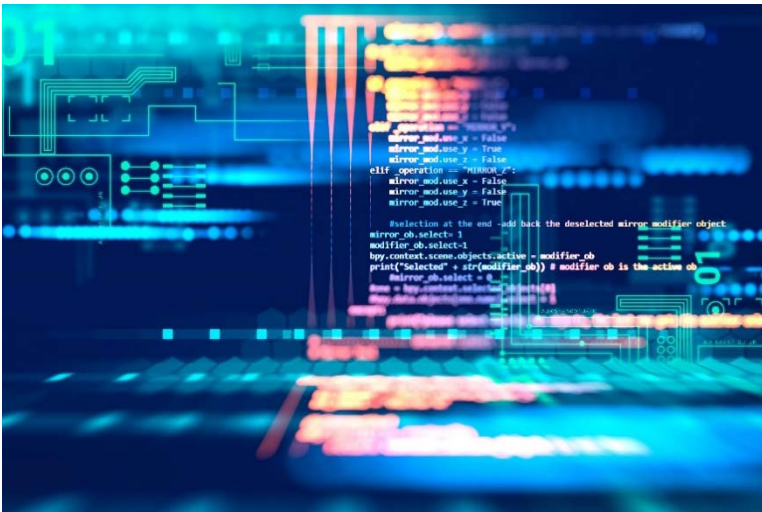# IT Modernization Plan:

A Business and IT Journey

Social Security Administration
October, 2017

Securing today
and tomorrow

Contents

Message from the Acting Commissioner

For SSA, information technology is vital to our mission and to the way we serve the public. We have applied technology effectively and creatively over the years to better serve the changing needs of the American people. Our systems have enhanced our own productivity and yielded numerous efficiencies to the way we work. And we have invested wisely over the years and sought prudently to derive the greatest value possible from these technology investments.

However, as we experience in our personal lives, technological change is accelerating at a relentless pace. New technologies offer us remarkable opportunities to change, transform and greatly improve the way we serve the public. Yet, these newer technologies can also be disruptive to legacy systems, business processes and, ultimately, to the way we work. As you will learn in this plan, many of SSA's core systems are over 30 years old. They have grown increasingly fragile and costlier to maintain.

We have painstakingly assessed the state of SSA's information technology. We conclude that IT modernization is now an imperative for this agency and it must start now. This agency plan describes our commitment to returning the agency to a healthy IT foundation, where the capacity and cost of change compare favorably to other modern enterprises. This agency plan describes our initiative and commitment to replace our core systems with modern systems that enhance the customer experience, better focus our IT workforce to future needs and reduce IT and other operating costs by adopting more modern technologies, such as artificial intelligence, predictive analytics, mobile and cloud. We will also use agile development to reengineer our business processes by optimizing end-to-end processing, redesigning workflows, reducing manual transactions, and using analytics to improve the effectiveness and efficiency of our programs.

In this major endeavor, I enlist your support, expertise, and steadfast commitment to joining us in creating an agile, 21st century enterprise. Mission Focus – Mission Driven.

Nancy A. Berryhill
Acting Commissioner

Message from the Chief Information Officer

Information technology supports every aspect of the Social Security mission, whether it's serving the public during an in-person interview or online, routing more than 37 million telephone calls on our 800 number, or posting 266 million earner wage reports annually; information technology is the enabler that allows us to service our many customers.

Yet, we place extraordinary demands on an installed base of technology that is increasingly showing its age. Most of our core systems are over 30 years old and some embedded software components are older. Over the years, newer technologies have been integrated with these legacy systems without a fundamental redesign of the system and enterprise environment within which it operates. Today, the cost of operating in this legacy environment is expensive. Front-line SSA employees are finding these systems increasingly difficult to use, and members of the public are not getting the self-service opportunities they have come to expect based on their experience with commercial enterprises. Furthermore, systems engineers with legacy system expertise are retiring from SSA at an increasing rate. Replacing them with similarly skilled staff is also increasingly difficult in the current job market.

IT modernization at SSA is a vital initiative that must begin now. Our vision in IT modernization is to deliver modern business process platforms that improve the agency's ability to respond to changing user needs rapidly and at manageable cost. Equally important, IT modernization intends to deliver an improved customer experience for millions of beneficiaries across all service channels in a cost effective and secure manner.

This IT Modernization Plan describes a thoughtful and deliberate, multi-year agency initiative to modernize SSA's enterprise IT using modern architectures, software engineering methods, cloud provisioning and shared services. SSA's IT modernization is an agency initiative involving all components. We welcome your support, oversight and your active engagement with us in this imperative undertaking.

Rajive Mathur
Chief Information Officer & Deputy Commissioner of Systems

IT Modernization Plan

Executive Summary

The Social Security Administration (SSA) Information Technology (IT) Modernization Plan reflects SSA's strong commitment to providing quality service to the public that is convenient to use across multiple channels while also emphasizing the use of efficient, affordable and secure IT solutions. This plan positions the agency to serve the public more efficiently and effectively, and provides for a modern technology foundation that eliminates legacy systems, reduces reliance on old mainframe architectures, allows for agile development, and enables us to be more responsive as an organization. SSA's information technology plays a critical role in support of the agency's mission of distributing benefits to more than 60 million people, ensuring access to information when and how the public needs it, and upholding our commitment to the protection of personal and financial information.

Equally important, the IT Modernization Plan represents SSA's approach for improvement of IT at a large federal agency with millions of individuals and thousands of employees, all working to navigate complex programs and policies. The "end state" of the organization will reflect the federal IT organization of the future, with the appropriate skill mix, organizational capabilities and processes to support the future needs of the public. IT is not just technology – it's the people, the customer experience, and, of course, the technical nuts and bolts.

We view this modernization as a way to keep our promise of quality service to the public.

We developed this Plan recognizing that our current technology infrastructure and existing business systems would not allow us to serve the public the way we wanted, or the way they expect us to. Today, our systems create inefficiencies that contribute to excessive backlogs and extend the time it takes for us to make critical determinations. We cannot respond quickly to changes that are driven by legislation, emerging cyber threats, or opportunities offered by new technologies.

The SSA IT Modernization Plan addresses the critical needs to be met. These challenges include:

- Increasing service expectations of the public for interactions with their government that reflect the efficiency and usability experienced in banking, insurance, shopping and other facets of their personal lives;

- Core business systems that are over 30 years old, expensive to maintain, and excessively complex;

- Large numbers of experienced and professional IT employees with legacy systems knowledge who are eligible for retirement;

- Attracting and retaining contemporary technology talent from outside and across government;

- Training staff in advances in technology that often require different platforms, processes and skill sets than currently in place; and

- Changes in legislation, regulations and policy.

The SSA IT Modernization Plan realistically lays out a roadmap that moves us toward achieving the following six goals:

1. **Improve Service to the Public** through increasing online services, real-time processing; and having a more service-centric organization, technical structure, and overall better customer experience.

2. **Increase the Value of IT for Business** by increasing IT and data reliability, security, and enabling faster claim and post-entitlement decisions.

3. **Improve IT Workforce Engagement** by enabling a quicker path to fielding new capabilities, modernizing the development environment to improve productivity, and building a culture to attract new and retain our current top technology talent.

4. **Improve Business Workforce Engagement** by enabling better service with enhanced user-centric tools and the ability to move routine work through the systems quickly, enabling our workforce to focus more on the most challenging service needs.

5. **Reduce IT and other Operating Costs** through expanding shared services, the cloud, and Commercial Off-The-Shelf (COTS) packages, increasing benefits available through disciplined approaches and reuse of code, and encouraging innovation to improve operational efficiency.

6. **Reduce Risk to Continuity of Operations** by increasing awareness of cyber threats and capacity to defend against these threats, and by replacing time-worn systems with maintainable technology.

Our IT Modernization Plan is a living document, established on the principles of agility and adaptation. We have established a path forward based on the analyses we have conducted to date and the gaps and risks we have identified. As we move forward, we will gain experience with the technologies we adopt, and we will fully engage our business partners in establishing the critical outcomes we are working toward. We will certainly adjust our Plan as we progress, reflecting applicable changes in this Plan and in the execution-level plans that support this work.

This Plan describes how we are leveraging modern technology and development tools to transform how we do business and, fundamentally, how we build our business systems. We intend to create a modern technology platform on which we can build streamlined workflow systems that can realize the innovations of our business partners. We will use modular construction and agile development methods so that our systems can share common elements, making development faster and more responsive. As we make our way through modernization, we will reduce the time it takes to collect the necessary information for our benefit programs. We are redesigning our databases to focus on the needs of the people with whom we interact, instead of being based on related cases and benefit programs. We are working to implement artificial intelligence systems to streamline the hearing process. Further, we are developing the capability to use advanced analytic techniques to assess medical evidence and help our technicians better utilize the increased electronic medical evidence we are receiving for more of our cases.

While we will always focus on providing the highest quality service to the public, our approach has been evolving for several years to provide an increasing number of service options. Several of our online services are already rated among the top in government and are as good as or better than some prominent private sector companies. As part of our modernization, however, we will focus on continuing to improve and expand the interactions available online. We are currently working to bring more of our services behind a unified and secure portal, so if a person wants to do business with us, he or she will come in through the same site and be able to view all of their available options. In addition, because our data will be aligned based on who the person is and the ways in which he or she interacts with us, our systems will be able to better determine if we have all the information we need to complete the interaction at that time. If there is additional information we need, we can automatically ask for it then. This saves the individual the inconvenience of multiple contacts and speeds necessary agency response. These expanded options provide the public with more convenient and secure service.

We are also working to create systems that are able to bring simple transactions to completion, so the people we work with don't have to wait, and we don't have to individually handle every request that comes to us. With the modernized technology foundation we are building, we will be able to implement these sorts of innovations faster than is possible now. Even where we cannot fully automate, the use of modern analytics and more accessible data across program areas will enable us to build systems to better support our front-line technicians, facilitating efficiency in their work and helping them to realize higher quality outcomes.

We can't make these advances with the core technology infrastructure we currently have. We have to transform our core systems to use the technologies described above and to be as responsive and efficient as we need to be to sustain those new capabilities. To make this transformation, we have already begun to use the new technologies and development tools that we describe in the balance of this Plan. We continue to grow our agile development approach where we work in tight collaboration with our business partners as we develop the vision for our new business capabilities. Agile methodology ensures that we build what the business needs, and it enables us to deliver discrete increments of capability quickly. We are also implementing automation and tools that enable us to test software early in the process so the applications and processes we produce will be of higher quality when initially released to the end users. Automation and new computing environments, like the cloud, will enable us to release new software without the weeks of preparation required now when we release new or changed legacy code on the mainframe.

Our new architecture will be modular and based on compact services – "chunks of functionality" that can be deployed efficiently and reused across many systems. Running systems in the cloud provides computing capacity on short notice. We have already begun to use these modern technologies, tools, architectures, and cloud infrastructure. Our Disability Case Processing System (DCPS2) uses modern programming languages, databases, and cloud technology. We have also completed the first phases of our new cloud-based Enterprise Data Warehouse (EDW) using modern database technology in the cloud. Retiring and replacing these outmoded systems will improve our readiness and adaptability.

To achieve our modernization goals, we will invest $677 million over five years in six transformational initiatives and the infrastructure to support them. In Fiscal Year 2018, our modernization will focus on high priority capabilities in the core business systems and enabling

infrastructure within the Communications, Disability Determination and Title II business domains. During this same time, we will continue to prepare for future transformation in the Title XVI, Enumeration, and Earnings domains.

We recognize this is a considerable investment, and any endeavor of this magnitude carries significant risks. We know that active and engaged leadership will be pivotal for our success. We appointed a Chief Program Officer (CPO) with end-to-end accountability (and associated decision authority) for delivering IT modernization. The CPO will be supported by a central program management office. Our executive Information Technology Investment Review Board (ITIRB), composed of the Chief Information Officer (CIO), Chief Financial Officer (CFO), and Deputy Commissioners, will provide the requisite engagement and consistent oversight. We also recognize that we will be held accountable throughout the execution of the Plan.

Our IT Modernization Plan is designed to assist our front-line employees to better serve the American public. Within the Office of Systems, we will work to adopt new IT development tools and techniques to gain efficiencies and advance our technological capabilities. While the specific IT Modernization projects are distinct, we will also be working to spread what we learn throughout the Office of Systems, leveraging our developing expertise wherever we find opportunities. In our business components, the modernized systems we build, and our emerging capability to bring new business functionality to SSA's front-line employees and the public will change how we are able to engage with the public. Our 360-degree view of a person will enable our front-line technicians to understand how best to serve the public, and as we automate more of the routine work, these employees can focus on providing excellent service.

Introduction

Few government agencies touch as many lives as the SSA. The programs we administer provide benefits to about one-fifth of the American population and serve as vital financial protection for beneficiaries and taxpayers. In addition, we maintain personally identifiable information (PII) on nearly every American and those working or attending school in the U.S. Since its inception, SSA has always adapted to change while providing crucial services. OMB memorandum, M-17-22[1], issued on April 12, 2017, instructs federal agencies to look for ways to increase efficiency and effectiveness and improve service to the public, including restructuring and streamlining our business processes. However, our stove-piped, monolithic systems make it difficult to change work processes without major engineering efforts, and legacy database designs interfere with linking work we are doing to connect individual members of the public to each of their cases/claims across programmatic areas. These conditions create extra work for our front-line technicians, requiring them to switch systems as they try to follow a single person's case through the myriad of processes, which sometimes results in multiple contacts with the applicant to get the required information of which we should have been aware we needed in the first place. The challenges that need to be addressed to resolve these system shortcomings include budgetary and resource pressures; changes in legislation, regulations and policy; changes in technology; and changing expectations of the public.

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[1] Access the memo at:
https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2017/M-17-22.pdf

We must embrace these challenges and effectively adapt our systems, policies, processes and organization to continue to meet SSA's business goals, and drive fundamental improvements in our ability to serve. This IT Modernization Plan is designed to put us in a position to respond quickly and effectively to all the drivers for change while mitigating other risk factors. We must take a long-term view; incremental modernization simply has not worked. Layers of repairs over old frameworks have resulted in less than fully modernized solutions and in security approaches that require awkwardly bridging many generations of applications. There are instances today where our front-line technicians move from modern graphical user interfaces to old-style green screen interfaces and back again to complete a single task. Getting rid of our green screens and designing our systems with a unified look and feel will enable our employees to focus on the business process and serving the public instead of learning obscure commands and using convoluted navigation as they switch systems. Throughout this transformation, modern cybersecurity and privacy solutions must be built in from the start to be fully effective and responsive. Our modernization must start now, before the remaining staff familiar with the legacy environment retires and we lose their expertise and knowledge as we transform our business systems to modern architectures and code bases.

This is an IT Modernization Plan, but the imperatives are creating efficient and effective business process change, producing stable and future-proofed business systems, and ensuring the security of our systems and data.

Our IT Modernization Plan focuses on replacing aging systems with more effective software and information, improving our development methods, adopting processes, and organizing to support innovation. This work will enable the agency to innovate its business processes to more effectively and efficiently serve the public.

In our Plan, we lay out the tools, technologies and methods that we are using to transform ourselves into an organization that benefits from harnessing modern IT. We describe how we are training our staff as we adopt new architectures and development approaches, and we explain the impact these transformations will have on our ability to quickly implement new business processes to enhance the public's experiences and to leverage the capabilities offered by new technologies. We also explain which of our core systems we are working on first to bring to bear the advantages of these efforts.

The balance of this Plan begins by laying out six goals of our modernization efforts. We explain the principles we will follow and the outcomes we expect to realize. We also describe risks we recognize and are mitigating, explain how we will oversee and manage our work, and lay out the critical work of building security into our systems. Next, in the Business Domain section, we describe the six major initiatives that we will undertake to transform our business systems. In that section, we lay out the specific objectives, high-level structure of the solution and near-term initiatives for each project. In the Technical Domain section of the Plan, we lay out additional work that supports or complements the major transformational work.

To be clear, while we describe work that we will undertake in the future, we have already initiated many aspects of this work. In later sections, we will describe efforts already underway that build the necessary infrastructure for tools and processes, and for an effective cloud operating environment. We have also been building expertise through training and the expanding application of modern tools and methods on existing projects. Our Modernization Plan is not a proposal; it is a map for the journey we have already commenced. It is a living

document, established on the principles of agility and adaptation, which we will use to guide the modernization of our systems. As we move forward, we will learn more about the technologies we have proposed to use, and we will fully engage our business partners in establishing the critical outcomes we are working toward. We will certainly adjust our Plan as we make headway, reflecting appropriate changes in this Plan and in the execution-level plans that support this work.

The Challenge: Rebuild the plane while it's flying

While our existing systems capably support SSA's mission, they are outdated and expensive to maintain. Our business partners in the agency annually request many more changes than we can deliver in a given year.   Most importantly, our operations staff finds that our systems are challenging to use, which affects their ability to serve the public, including our beneficiaries, their representatives, and external business partners.

Most of SSA's core systems are over 30 years old. Over that time, they have been subjected to constant change to incorporate changes in legislation, regulations, and policy. Through the years, new technologies and capabilities have been patched into the core systems without a fundamental redesign. With each patch and workaround, the systems become more fragile, and that makes the next change more expensive to deliver. The cycle of workarounds adds to our *technical debt* – the extra work that results from choosing easier solutions over more expensive redesigns.

Technical debt incurs interest payments, which come in the form of extra costs for future development and limited ability to respond to new requirements. Historically, SSA has chosen to pay that interest, rather than fully redesign legacy systems. After 30 to 40 years of change, SSA's core systems have reached the point where the cost of delivering any new capability is becoming exorbitantly expensive. Figure 1 below illustrates our current situation and how our modernization program will make a positive impact[2].

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[2] Concepts illustrated in chart are adapted from article *What is Technical Debt?* – Chris Cairns, Sarah Allen – GSA 18F, https://18f.gsa.gov/2015/09/04/what-is-technical-debt/.
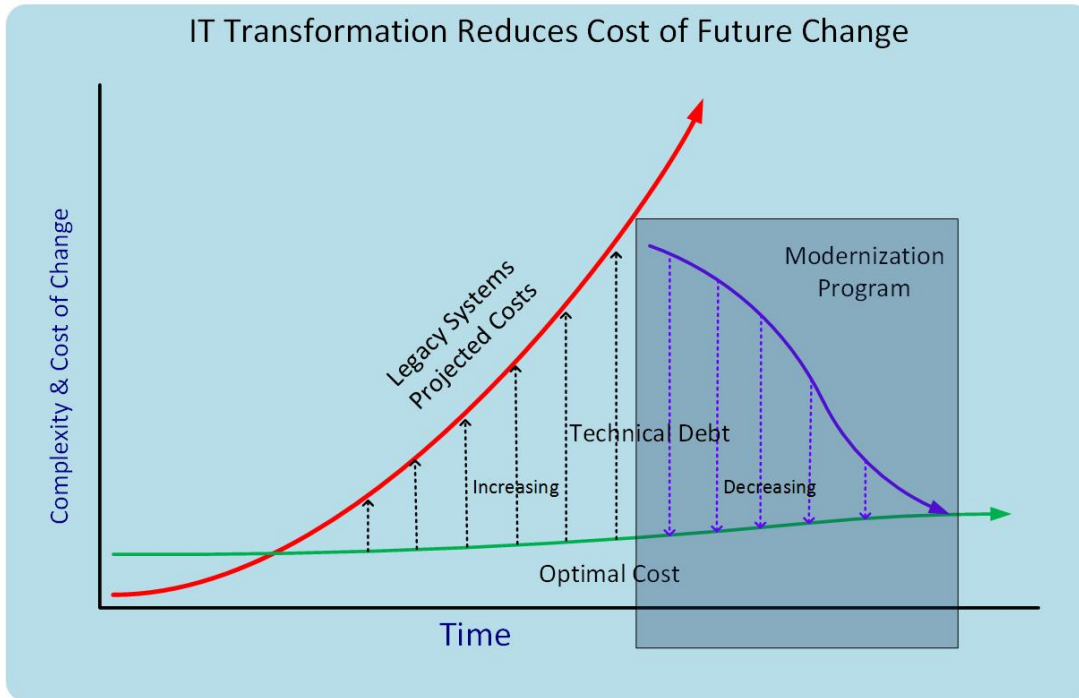
Figure 1: IT Transformation Reduces Cost

SSA's IT Modernization Plan describes the framework to return the agency to one having a healthy IT foundation, where the costs of change compare favorably to the rest of the IT industry and show positive cost benefits. Contrary to the incremental work of the last 30 to 40 years, IT Modernization is a plan to replace our core systems with new components and platforms, engineered for maximum usability, innate interoperability, and future adaptability.

In our IT modernization we will build transformed systems that will provide a business process platform to improve the agency's ability to respond to users' needs rapidly and with manageable cost. They will enable us to make technology changes to streamline business processes quickly at a cost that takes advantage of leading industry technology and practices. Security will be designed into our software so that we can respond to emerging threats as they are identified and implement new solutions as they become available. These are not just new business support systems; they enable the entire agency to function as a modern enterprise and to continue to do so into the future.

We recognize, of course, that we cannot ignore the ongoing investment required to keep our systems running and to respond to legislative directives and the small number of high-value/high-priority enhancements needed in the short term. We will evaluate our maintenance budgets to assess the necessity of continuing some of the work we have historically undertaken year in and year out, given that the systems will be retired in the foreseeable future. While we will not allow the risk of our existing systems failing to grow, we will consider whether "business as usual" makes sense in the short run. In addition, there is likely to be a small number of changes that will be driven by new statutes or the discovery of opportunities to make highly leveraged investments with short-term payoffs. These investments might be driven by business

process savings, the closing of security gaps, or the reduction of improper payments. In every case, the CIO will assess the investment decision, recognizing that we need to keep the plane flying while we are re-building it.

In the Technical Domain section, we describe investments that entail significant improvements of existing infrastructure platforms and ways of supporting our technology users. We designate these investments in the Technical Domain section simply as *modernization*, since they are generally not public-facing or have the direct transformational business process impact described earlier. However, these investments are designed to enable the technological and business process to leap forward as described in the transformational investments. Without the "Modernization" advances of the Technical Domain, we would not be able to fully leverage the new development and design approaches we intend to use in the "transformational" work of the Business Domains. For example, our transformed business systems will be built to run in the cloud, but capable of running on multiple platforms. We need to make advances in our computing infrastructure to support significantly expanded use of the cloud in order for our transformed business systems to fully realize their potential. When our transformed business processes run in "containers" in the cloud, we gain the ability to expand capacity quickly, so we can smoothly respond to peaks in public demand for our services. Our technology modernization is also necessary to enable the transformation in our systems development process. This work is fundamental to speeding the delivery of new user functionality and improving the quality of our software as we deliver it to our end users. We also describe efforts to make more of our existing major systems platform independent. In some cases, this will entail moving major systems off the z/OS-based mainframe and into a Linux-based operating system environment. The work described in this Plan will enable us to make substantial progress toward moving off the old z/OS-based mainframe systems.

IT Modernization Vision

The IT Modernization vision is to rebuild our systems using modern design techniques, unlocking possibilities that are not attainable with our legacy architecture. The benefits will be shared by members of the public, our operations staff, and our engineers. Figure 2 below illustrates the six goals to achieve the IT Modernization Vision.

IT Modernization Goals
Goal 1: Improve Service to the Public by:
- Moving towards a service design approach focused on the public - Increasing breadth, reliability and security of digital options while creating operational linkage to omni-channel service environment - Providing real-time processing of transactions, including transaction history - Building new systems with a customer experience focus to ensure we can meet the public's service expectations, regardless of service channel or point in the process
Goal 2: Increase Value of IT for Business by:
- Increasing user (e.g., public and employee) satisfaction with IT reliability, security, privacy, training and responsiveness - Reducing manual remediation of transactions (e.g., claims and post-entitlement actions) - Enabling faster, more accurate and better documented claims and post-entitlement decisions - Improving data reliability and consistency
Goal 3: Improve IT Workforce Engagement by:
- Reducing tangled systems, promoting reuse of code and enabling a quicker path to fielding new capabilities - Modernizing the development environment to improve productivity and enabling employees to work with modern tools - Developing tactics for employees to increase technology expertise with state-of-the-art technology - Building a culture to retain current and attract new technology talent - Changing the culture of the IT/business relationship by working in close collaboration
Goal 4: Improve Business Workforce Engagement by:
- Demonstrating investment in front-line employees - Establishing a broader view of customer service - Enabling better customer service by prioritizing development of tools to enhance the customer experience - Automating routine work enabling our employees to provide better service - Changing the culture of the business/IT relationship by working in close collaboration
Goal 5: Reduce IT and Other Operating Costs by:
- Increasing use of shared services and the Cloud - Increasing benefits available through more disciplined approaches to systems architecture, including reuse of components - Embracing a DevOps[3] mindset - Fostering innovation to improve operational efficiency
Goal 6: Reduce Risk to Continuity of Operations by:
- Increasing awareness of cyber threats and our capacity to defend against them - Replacing time-worn systems with maintainable technology - Building in security from the start of technology planning, design, and development

Figure 2: SSA's IT Modernization Goals

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[3] DevOps is a software development approach that integrates the development and operational teams, breaking down traditional silos and resulting in faster delivery of more innovative products.

Goal 1: Improve Service to the Public by**:**

- Moving towards a service design approach focused on the public

- Increasing breadth, reliability and security of digital options while creating operational linkage to an omni-channel service environment

- Providing real-time processing of transactions, including transaction history

- Building new systems with a customer experience focus to ensure we can meet the public's service expectations, regardless of service channel or point in the process

Moving Towards a Service Design Approach Focused on the Public

Our agency runs on the information it maintains. We have determined that one of the factors that inhibits our progress is the way our legacy information is organized. As a result, we have begun to modernize how we access our legacy data so that it more closely matches its intended use, and provides a coherent picture of the people with whom we interact. We have been working over the years to migrate our core data from antiquated storage schemes to relational containers. Older storage schemes are thus being retired.

We will retire single-purpose applications that monopolize information and replace them with interoperable services that make that information available wherever it is needed. Decoupling information from applications will allow us to build adaptable software that reflects the natural relationships between our lines of business. This means our front-line technicians will have the ability to move seamlessly between different types of claims within a single application. We have started this activity by deploying a data service that provides a common view of individuals across agency programs. The modernization program will build on this momentum, covering more lines of business and retiring legacy information silos.

As we leverage the opportunities presented by modernizing our data stores, we will use a service design approach built with the ultimate consumer of our services as the focus. While our former practices often focused on creating efficiencies for our front-line technicians and making incremental improvements in online access for the public, a service design orientation requires thinking through all the factors that, together, lead to whether the public is satisfied, or not, with our service, regardless of service channel selected. This will require us to move toward thinking of our provision of services from the public's perspective. We need to understand what members of the public have in mind as they come to us for support. We can use automated online or telephone support for actions that are simple, and build more sophisticated, intelligent support systems for actions that are more complex. Ultimately, we can put modernized tools, such as the common view of individuals described above, in the hands of our front-line technicians, so, whether face-to-face or over the phone, they can assess the support that is required and provide it efficiently.

The broader implication of this shift, which is already being seen in the private sector, is that the public will begin to rely on automated and self-service channels for simple transactions and will

reach out for face-to-face or interactive channels for more complex needs. Our future provision of services will take these public expectations and technology solutions into account.

Increasing Breadth, Reliability and Security of Digital Options while Creating Operational Linkage to an Omni-Channel Service Environment

We will develop online service options to best fit the specific individual and situation. This approach allows users to get accurate and timely information, while receiving more convenient, safe, and secure service. The public will also have the ability to view their entire correspondence and claims history to facilitate greater understanding of their relationship with the agency. Expanding self-service options provides a more convenient way for the public to complete their transactions. Providing additional self-service opportunities increases certain security and privacy concerns for the agency; therefore, integration of cybersecurity and privacy requirements will be a key element of modernization activities.

SSA delivers services to the public via an omni-channel environment including by phone, mail, web, and in-person interactions. The public may utilize any and all methods to interact with us in order to conduct their business. Certain types of interactions may be better suited to certain channels. For example, getting a simple status on whether a medical evaluation has been received could be a digital transaction, while actions associated with an administrative appeals process may require a face-to-face live transaction. By introducing more digital interactions, end-to-end services becomes reality. Having real-time access to accurate information will assist these self-service options, presenting choices for the individual to consider and select, and will allow SSA front-line technicians to devote their time and expertise to solving complex issues. Our plans to modernize will enable SSA to better segment and categorize the public's needs and then develop business processes and technology to serve those needs, more flexibly and timely.

To enable secure access to our services, we continue to improve our authentication for the millions of people who work or receive benefits. Our focus is to implement security measures to safeguard personal information while providing solutions that are also easy to use. With higher levels of authentication we are able to allow two-way communication through the *my* Social Security portal, which is necessary to provide many of the services we describe in this Plan.

Providing Real-Time Processing of Transactions, Including Transaction History

When new information enters our legacy systems throughout the day, including all transactions taken through our internet portal, the systems store the information, and then process the transactions during an overnight batch operation. As a result, we are not able to complete these transactions in real time while the beneficiary is available to provide additional information we might need, and we are unable to provide a timely summary of the decisions made based on the information provided.

In addition, our internet applications, accessible at socialsecurity.gov, such as iClaim, are not completed in real time and do not go through an overnight process. For example, when a person submits a claim online, we are not able to fully evaluate whether all of the necessary information is provided. Instead, the claim is placed into a queue until it is pulled into the Modernized Claim System (MCS) where it is manually evaluated for completeness. If information is missing, the claimant is contacted for follow-up. If we were better able to assess

the application for completeness at the initial contact, the claimant would not have to be bothered with a follow-up contact, and we would not have to expend resources on work that could have been avoided.

The public expects to complete transactions with us instantaneously as they do with banks, insurance companies, and even online shopping. We need to build systems that enable us to collect all the information we need at first contact, so that repeated contact is not required, even if final determination of benefits may take some time. While batch processing continues to be appropriate for many kinds of workloads, SSA needs to build in the flexibility to handle more of its processing in real time.

Our transformed systems will seamlessly process certain types of events with minimum human interactions. Examples include automatically handling age attainments, earnings reports, death reports, and other reports that result in changes to a beneficiary's status.

Improving the integration of our systems will also yield other efficiencies for the public and for our front-line technicians. For example, if an individual begins to submit a new claim with us, we will be able to recognize whether the individual has provided the necessary information in the past, and we may be able to prepopulate the data that we already have in our repository. Then that person can just verify the information that is still correct and change what needs to be changed, saving time and reducing the possibility of errors.

Building New Systems with a Customer Experience Focus to Ensure We Can Meet the Public's Service Expectations, Regardless of Service Channel or Point in the Process

As we modernize our business processes and systems, we will focus on the customer experience. We have come to understand that, while we administer distinct programs to the public, the public's view is customer-centric, and ours should be as well. We will design our modernized systems with a focus on providing an improved customer experience. To accomplish this, we will establish a stronger integration of technology and business perspectives in our development teams. Each of our major initiatives will have both technology and business leadership, and we will employ modern design techniques, such as journey mapping, that will enable us to understand better how the public engages with us for specific services, as well as across a broad range of services. While internally, we might think of our business processes as oriented along statutory programmatic lines (e.g., retirement, disability, and supplemental security income programs), we want the public to be able to request services from us knowing only what they need to accomplish without having to know what program it is part of or what form they need to use. We will design our business processes and systems keeping in mind the view of the public and their experience as they conduct their business with us. When a life event brings a person to us, we want to be able to provide the service they need as smoothly as possible through the channel they prefer.

In order to achieve this level of service, we will need to provide online services that are more complete than those we provide now and that are built to take full advantage of the technology platform on which the service channel is based. Most of our underlying business processes were developed in a time when we provided services to the public face-to-face through our field offices or through the U.S. Mail. These processes are very detailed with many specific manual checks and edits and were built to support our trained employees. As we began to deploy more services online, we provided entry points for the public into these complex processes. While

this level of access made it easier for the public to avoid trips to the local field office to provide basic information, and it was faster than the mail, it did not provide them with any insight into the process or much ability to contribute to the process online after the initial application. If we need additional information, we have to follow up through some channel other than online. In addition, our systems are stove-piped. If an applicant or beneficiary contacts us with questions or an issue, our current systems are not designed to provide easy access to full information about the individual – we have to work across multiple systems to provide information about eligibility or discover the underlying issue. Currently, our online services provide a good customer experience for those individuals with whom we can complete the transaction in a single contact, but a less refined experience for others.

Our modernized systems will take full advantage of the advanced technology and business processes that were created with a service design approach and public-focused approach. That is, we will design our business processes with the specific end user in mind (e.g., employee or the public), focusing on their unique requirements and expectations. Front-line employees will have a 360-degree view of the individuals they serve, using applications designed to integrate information from across SSA programs. Our systems will retain a full history of events and interactions for each person, regardless of channel, and make it available wherever it is needed so that the public can understand their benefits and identify specific issues more easily, and our front-line technicians can troubleshoot more effectively. In addition, as described above, we will use more real-time processing of transactional interactions so that any missing information or clarifications can be handled during the initial contact, thus reducing confusion and delay. Processing Center workloads will be automated as a result of the lower volume of system processing exceptions requiring additional interventions. For example, employees will be able to automatically convert Medicare-only claims to retirement in an online environment. In addition, our modern systems will be designed to be able to provide the information that the public tends to be most interested in. For example, when a beneficiary or applicant contacts the agency, he/she is often interested in the decisions the agency has made or will make regarding benefits, but the basis for our decisions is often buried in isolated systems or behind automated decisions that are not evident to our front-line technicians. For every program decision, agency systems will capture and preserve the evidence used to arrive at that decision. This mapping of decisions to evidence is a key element to providing real-time answers.

Goal 2: Increase Value of IT for Business by:

- Increasing user (e.g., public and employee) satisfaction with IT reliability, security, privacy, training and responsiveness

- Reducing manual remediation of transactions (e.g., claims and post-entitlement actions)

- Enabling faster, more accurate and better documented claims and post-entitlement decisions

- Improving data reliability and consistency

Increasing User (e.g., Public and Employee) Satisfaction with IT Reliability, Security, Privacy, Training and Responsiveness

SSA's current systems were built to support new programs and policies as legislation evolved over the years. Because of this, most of our systems are designed to do one job. SSA systems are generally independent of each other, with separate data stores or independent access to a shared data store. As a result, our systems are functional silos servicing independent lines of business. For example, even though a beneficiary may be entitled to both Title II and Title XVI benefits, the systems used for filing each kind of claim are separate. This separation is a characteristic of the organizational structure of the original development teams and the fact that the programs emerged at different times; it does not accurately reflect statutes and policies that require information exchanges between those business lines.

Not only do functional silos impact the public, but they also affect our front-line technicians who must be trained in an ever-increasing number of systems. Because of these silos, these technicians must become proficient in navigating between the various systems to accomplish a single business outcome. Further, often they must copy information about a beneficiary between systems. As data is copied it becomes more complex to manage, more expensive to maintain, and can get out of sync. Our systems are challenging to use because there are separate applications for each of our business lines, which directly affects our ability to serve the public without extensive systems training.

To achieve its modernization vision, SSA needs to become more responsive to the public's service expectations, delivering more capability in less time using fewer resources. Historically, SSA's IT organizational structure evolved to reflect the "waterfall" model, in which systems were conceived, designed, implemented, tested, and released in a strict sequence, with responsibility moving from organization to organization as phases were completed.

We have begun to incorporate agile methods in our engineering practices, moving from a rigid, handoff-driven development cycle to a more conversational approach with day-to-day involvement from our business experts. Our agile methodology encourages a Minimum Viable Product (MVP) approach, where we focus first on the smallest increment that can be deployed into production that provides meaningful value to our users, internal and external. Additional features are delivered in future product increments. We employ short development sprints with

frequent checkpoints to respond quickly to changing user priorities, ensuring that useful products will be in the hands of our users faster. This new collaboration between agency business organizations and systems developers ensures the right capabilities are delivered to the right people at the right time. By shifting focus from "Big Design Up-Front" to a conversational and collaborative approach based on short cycles of building, demonstrating, and improving actual software, developers spend more of their time on high-value work, and less time producing artifacts needed for organizational handovers. SSA has already delivered several major software projects that followed agile methods. We have conducted seminars and other training to familiarize our developers with this way of working. Our IT Modernization Plan emphasizes agile development and a product-oriented view of the software we produce.

Reducing Manual Remediation of Transactions (e.g., Claims and Post-Entitlement Actions)

While our legacy systems have a significant amount of automation based on transactions, they are not able to fully process certain types of cases, resulting in an unsustainable backlog of manual remedial actions. This backlog comprises not only claims, but also actions related to recipient's whose circumstances have changed after they apply or become eligible for benefits, known as post-entitlement actions. Our systems currently generate very large numbers of manual transactions for the Processing Centers, and that impacts our ability to efficiently serve the public. With modernization, we will also be able to use information we already have in our records to propagate the information that is required for subsequent actions, eliminating additional actions by the beneficiary or fallout to our processing centers. For example, currently we are not able to convert Medicare-only claims to retirement, disability, or auxiliary claims within the automated system. When a person who is receiving Medicare-only benefits retires, that action requires the generation of a form and subsequent manual action by the processing center to facilitate that person's retirement benefits. This shortcoming generates over 100,000 manual interventions for the Processing Centers every year. Our modernized systems will be designed to eliminate the need for manual intervention when we already have all the information we need to complete the action automatically. Our goal is to automate the majority of our claims and post-entitlement workloads to provide better service.

We can also reduce unnecessary workloads in our field offices by redesigning our processing systems to close gaps that exist today. As an example, when certain circumstances of a Title XVI beneficiary change we have to terminate the existing claim, using a paper form, and then re-establish the claim. With modernization, we will be able be able to edit claims without closing and re-establishing them and without the generation of paper forms.

Enabling Faster, More Accurate and Better Documented Claims and Post-Entitlement Decisions

Our legacy systems do not (for the most part) store information so that decisions can be linked to the evidence used to reach them. While a skilled front-line technician will often know where to look based on his or her training and experience, our current systems do not store this connection directly. In many cases, our systems do not retain a historical record of how decisions were made, which is needed in case of challenges and questions.

Our goal in this area is to benefit from the new person-centric data and 360-degree view of the people we serve combined with advancements in artificial intelligence and machine learning that

we are currently exploring. These technologies will enable us to review medical evidence faster, process claims and post-entitlement more accurately, and to store key data for historical purposes.

Improving Data Reliability and Consistency

The architecture of SSA's core programmatic systems has not changed substantially since the early 1980s when the decision was made to develop an in-house, batch-oriented database system known as MADAM (Master Data Access Method), coded in COBOL and Assembler. Although it fulfilled its original design objectives, MADAM is now technologically obsolete and functionally primitive compared to commercial relational database products available today.

The agency's core data systems were designed around the limitations of tape storage, prevalent in the 1980s. Because tape technology does not permit random data access, all updates were managed via periodic merging of updates queued in temporary staging stores. The nightly merge model persists today even though tape storage has been retired and more advanced capabilities are available. In the following paragraphs, we describe the steps the agency has taken to meet this challenge.

Over the years, our data stores have grown in ways that have led to similar data being captured in more than one place and with a slightly nuanced meaning. This occurred because, as our legacy systems evolved, the agency often duplicated data to attain better performance. At this point in time, our analysts and developers repeatedly need to conduct extensive analysis to understand exactly what data sources to use in a particular application and how to reconcile that data with other data sources. Developing new functionality that should be quick to bring about requires extensive analysis by systems analysts, developers, and policy experts to make sure that the changes are correct. This adds to our project timelines and makes development more expensive. When we want to create management reports or conduct business analysis using our extensive data, we find that the nuances among similar data create ambiguity in the analytic results. That means we can get answers that are inconsistent.

We have begun modernizing our data design and access methods to enable our systems to more efficiently and effectively utilize our extensive data stores in achieving our mission. This initiative, simply entitled, Enterprise Data Modernization, will utilize state-of-the-art approaches from building structured data access services to reformatting and organizing the underlying data into views that are more consistent with how the data will be utilized in our modernized systems. Retiring legacy data sources and formats will allow us to use modern tools and techniques to efficiently access and process our data, to accelerate our development cycles, and to provide the capability of servicing high volumes of online transactions. Early results from this initiative have provided information about the people we interact with from separate sources within our siloed systems and we have begun to integrate it into a central location supported by a data service. Moving forward, we will enhance the information about the nature of each type of relationship with the agency (e.g., beneficiary, representative payee, etc.).

The modernization program will further evolve the Enterprise Data Modernization initiative to encompass even more agency program information. It will support an increasing number of business software components, providing a service-oriented, API-driven (Application Programming Interface) gateway to the information it contains. Other subject areas we will be developing include claims and post-entitlement actions, benefits, workload management, and

the kinds of contacts that members of the public have with the agency. By refactoring our data into subject-focused domains, it becomes easier to build relationships among the data to support our business processes. This advantage, and the use of common API-based interfaces, will speed the time it takes for us to add new data elements. It also reduces the need for deep knowledge of the data design in order to work with it. As the agency begins its IT modernization, we will investigate new data storage solutions and techniques to keep pace with the rapidly evolving business while minimizing risk to the agency.

The agency has established an Enterprise Data Warehouse (EDW) to provide an integrated source of historical data for business intelligence and predictive analytics initiatives across the agency. The EDW is designed to replace SSA's existing legacy management information database networks and provide modern reports more efficiently with higher data integrity. As it evolves, it will consolidate existing operational data store report marts into the more cost-effective, flexible and integrated EDW platform, saving money and reducing complexity. We are identifying time-intensive batch processes and replacing them with real-time or near real-time data integration processing to realize operational efficiencies. Consolidating our analytic databases makes cross-cutting analytics more accessible. For example, we will be able to view all of an individual's interactions with the agency more easily, even as we work to break down the siloed processing systems that produce the data.

The EDW will empower the business community to perform self-service business intelligence analysis in support of data-driven decision-making. It will also support predictive analytics to help drive new business intelligence capabilities to enhance the claims and post-entitlement processes. Since the major analytic data resource will be housed in a single repository for the first time, data governance will be improved and the identification of data anomalies will be facilitated, improving data quality.

Our modernization will continue the EDW work and establish flows that regularly acquire data from production systems. That information will be reformatted as needed and loaded into the warehouse. As modernization proceeds, we will retire legacy management information and business intelligence capabilities scattered throughout the agency.

Much of the data that fuel SSA's programs were compiled before the value of data quality was well understood by the IT industry. In the early days, the computer was treated like an electronic ledger, used mainly to store and quickly recall large amounts of information for human interpretation. The assumption was that our technicians could and would examine, interpret, and manually correct information on an as-needed basis. Legacy software performed some basic syntax and consistency checks, but on the whole, a great deal of trust was placed on the person entering information into a system to do it correctly. Because of this, SSA's data stores have accumulated pockets of information that produce incorrect results or prevent automated systems from working without manual intervention.

To prepare itself for full automation, SSA will undertake a comprehensive assessment of the quality of information contained in its internal data stores. When possible, data problems will be automatically corrected in place. At a minimum, the scope and sources of data quality problems will be identified and corrected, so that quality problems remain solved.

SSA's legacy systems reflect the design tradeoffs of the 1980s, when the economics of IT were entirely different than they are today.   In that early era, designers prioritized the conservation of

processing power and memory, which were extremely expensive. Integration, maintainability, and adaptability were secondary considerations. Today we find just the opposite – processors and memory are commodities, available for pennies on the dollar, especially on cloud platforms. The agency is paying the price for legacy software that is hard to adapt and expensive to integrate. Today, it takes an inordinate amount of resources to deliver even a small systems change.

Our legacy systems are the final limiting factor on the agency's ability to economically create applications that provide the needed levels of service to the public. Year after year, the size and complexity of our legacy systems consumes a greater proportion of our available resources, just to maintain their current operational state. Adding new capabilities atop the legacy systems is increasingly expensive, as their complexity grows. Replacing those systems with systems that are less expensive to maintain and that provide the opportunity to streamline business processes will reduce our costs to sustainable levels.

Goal 3: Improve IT Workforce Engagement by:

- Reducing tangled systems, promoting reuse of code and enabling a path to fielding new capabilities

- Modernizing the development environment to improve productivity and enabling employees to work with modern tools

- Developing tactics for employees to increase technology expertise with state-of-the-art technology

- Building a culture to retain current and attract new technology talent

- Changing the culture of the IT/business relationship by working in close collaboration

Reducing Tangled Systems, Promoting Reuse of Code, and Enabling a Path to Fielding New Capabilities

As new functionality was needed over the years, SSA found it necessary to integrate systems that were not originally designed to be interoperable. As most projects needed to be completed within an annual funding cycle in order to respond to legislation, correct a newly-discovered operational issue, or realize short term operational workforce savings, the agency often chose the most economical way to fulfill that requirement, through a variety of ad hoc techniques. While our projects focused on meeting an immediate need, we created a culture of quick fixes versus a commitment towards strategic design. We layered patches onto older patches and even older frameworks, so our systems have remained operationally intact, but have become less stable and flexible than they need to be to satisfy modern requirements.

Our systems developed dependencies on the content and format of each other's data, making it very difficult to predict which systems would need changes if that data were to change. The result is that reasonable changes to data formats were avoided, and the effort to make such changes was multiplied.

Software developers will find their productivity boosted as entangled systems are retired and replaced by modular components that are easy to revise and extend. We will be able to add new capabilities more economically and bring them to value faster building on a base designed for extensibility.

Our transformation emphasizes smaller, simpler software components developed by small, self-managed teams comprised of business and IT resources using agile methods. Our investments in automation for all aspects of the development phases will eliminate time-consuming and error-prone manual actions. We expect our development teams to deliver new features and fixes routinely in regularly scheduled deployments. Cloud platforms and automated build pipelines will make it economical to deploy and scale our software in production. Modern security solutions and federal programs for agencies to share security services enable us to make headway in technologies that we might have struggled with in the past. We are already using several shared security services and are looking for additional opportunities to leverage government wide technology offerings.

Modernizing the Development Environment to Improve Productivity and Enabling Employees to Work with Modern Tools

SSA's current software engineering style is based substantially on the practices of the 1970s and 1980s, when the economics of IT were vastly different. In that era, code development, testing, and rework required dedicated mainframe computing resources, which were scarce and extremely expensive. Development practices evolved, therefore, to do as much manual work as possible away from the computer. Software functionality was specified in minute detail, and designs were completely modeled on paper before any coding was allowed to begin. This up-front work, expensive in human terms, was aimed at minimizing rework in an attempt to conserve even more expensive computer time. The business consequences of those practices were that requirements were locked in early in the conceptualization of the business process, and the time between the business's identification of their needs and the delivery of the system could be measured in years.

To build its modern systems, the agency is adopting an agile approach that emphasizes short release cycles adding incremental value over time, increased automation, and continuous delivery to production. We will make technology do more so that our developers can better utilize their skills, increasing our productivity all around.

Working closely with our business partners, we will organize our software development to support product lines that evolve according to business-driven roadmaps of new functionality with long-term time horizons. We will incrementally release new functionality for our products to production as soon as they demonstrate sufficient value to make them useful. These Minimum Viable Products will be enhanced over time to add more useful functionality, following the product roadmap. Maintaining a long view of agency products improves our ability to plan for their steady evolution.

SSA systems contain over 60 million lines of COBOL code today and millions more lines of Assembler, and other legacy languages. To maintain and extend our legacy systems, skills in those legacy languages are needed and they are in short supply. New graduates are needed to replace retiring programmers, but few of them arrive with knowledge of those languages. Staff with first-hand knowledge of our legacy systems continue to retire from the agency and are

not easily replaced. We discuss our approach to mitigating this risk in our Workforce Development section later in this Plan.

SSA will also reexamine the way it organizes its people to produce value. Agile development calls into question rigid divisions between organizations and arms-length communications. Projects will be staffed by small cross-functional teams, including business experts, working together daily from inception to product delivery. Dissolving organizational walls between development and operations staff will foster continuous delivery of value when and where it is needed. These new talented teams comprised of engineers and business owners centered around evolving products will foster a culture of trust that will improve products and our ability to serve the public well.

Automated testing is becoming a cornerstone of SSA's modern development style, and that trend will accelerate during the modernization program. Our teams will set aside appropriate time and invest effort for the construction of automated test suites, and we will ensure that more testing is done earlier in the development cycle. The advantages of automated tests are abundant - they provide daily assurance that software is working correctly after changes are introduced. This gives our developers the confidence to refactor their software courageously, knowing that any regressions will be detected immediately. We will also build test environments that better reflect the production environment in which the code will be deployed, so that issues with interactions between applications and the operating environment can be discovered and resolved before final release. By refactoring software and focusing on necessary improvements to the quality of the code base and architecture when needed, the overall quality of agency software will improve and technical debt will be kept low.

Developing Tactics for Employees to Increase Technology Expertise with State-of-the-Art Technology

Over the past two years we have introduced a number of new strategies for exposing our workforce to the newest innovations in the technology industry. We have introduced a practical and rigorous incubation capability to explore the latest technologies and related processes at the least cost, risk and obligation to the agency. Incubation candidates are identified via key trends in industry, best practices, business needs, executive requests and employee suggestions. Incubation teams are created with key personnel from the Offices of Systems, Operations, and other components to ensure technical and business domain expertise. Using a "learn fast, fail fast, iterate" mindset, the incubation team explores the likelihood of the candidate to be successful in production while providing expected business benefits. If the candidate is successful, the incubation team integrates with the target operational environment to ensure an effective transfer of the needed skills and knowledge to successfully implement the technical innovation. Through incubation, we not only introduce new, exciting and powerful solutions, but we also provide additional hands-on training for our employees on the latest technologies that are applicable to the agency.

We also bring new knowledge and skills in industry leading technology through informal discussions, such as our monthly Tech Talks. These events bring insights into new areas we are hoping to explore, as well as exposure for all interested employees to the incubation activities being conducted. Our Tech Talks are very popular and have covered all of our incubation efforts including cloud infrastructure, agile, Modern Development Environment (MDE) and new development methodologies. The feedback from these sessions indicates that our

employees truly appreciate our efforts to bring these topics and insights to them. The Office of Software Engineering, Project Management Community of Practice, and Agile Resource Center all offer similar periodic informal presentations and discussions.

Lastly, our new 10-Day Challenge initiative is another example of how we are engaging our employees with creative learning opportunities to acquire technical expertise. This initiative offers employees the opportunity to challenge themselves to learn about selected market-leading technologies within a tightly-scripted 10-day mini-curriculum. The participants follow a plan that includes brief daily learning tasks such as reading industry articles, watching YouTube videos, performing hands-on activities and working with in-house subject-matter experts in the specific topic they've selected. Within 10 days the participants gain valuable knowledge and skills that they can begin to apply immediately. This initiative has proven to be very popular, doubling the number of employee participants in just its second offering. Feedback from participants has been excellent and we are planning to expand this initiative moving forward.

Building a Culture to Retain Current and Attract New Technology Talent

We have described above how we need to train employees and ensure that all of our employees are engaged in the modernization effort, whether or not they are directly supporting the work. Beyond that, we recognize that we have to develop and execute a plan to evolve how we address IT work across the board. We intend for the changes we are making in the Office of Systems to support the IT Modernization effort to become our new normal. SSA is building a culture where we are able to attract top talent and support employees through active and continuous engagement. We empower them to make decisions that best serve the people we serve, and offer developmental opportunities that span the government. We also use contractors to fill critical skills gaps in our IT workforce.

Attracting new talent and retaining and further developing our existing workforce is a core issue, and a key success factor for SSA to meet our intended modernization goals. We recognize that SSA carries a significant risk if IT modernization is delayed due to the increasing numbers of legacy system experts that are retiring. Later, in our Workforce Development section, we describe how we will attract and retain the necessary talent to be successful in our IT Modernization efforts.

Beyond the fundamental talent, we will also bring additional focus to building a culture of innovation and adoption of modern technologies and design methods that will enable us to service the public better. This work has just begun. It will require that our employees become comfortable with more rapid technological change than they have encountered in the past, with more flexible teaming arrangements than has been our practice. This, too, will be discussed further in the Workforce Development section.

Changing the Culture of the IT/Business Relationship by Working in Close Collaboration

One of the fundamental cultural changes we are making as we plan for modernization is ensuring a close collaboration between the business and IT organizations as we define, design, and build new business systems. In order to hold the customer experience as a critical design element, and to effectively implement a service design approach, the business and IT organizations have to work together to design and implement systems that optimize users' experiences as they interact with our business processes through whatever channel they

choose. Traditional IT development approaches often create a chasm between users and developers through the development process where experts at each stage — analysts, architects, developers, testers, infrastructure engineers, and so on — all enter and leave the process, handing off their piece of the work as they come and go. The operating model we are implementing for our IT Modernization effort involves all team members at all stages, and ensures that business experts are full team members. The agile development process we are adopting relies on multiple small teams with business experts constantly involved with design decisions, ensuring that our system designs always reflect the needs of the user and that the business process is designed to optimize the user experience, not some technology preference. Furthermore, by adopting a service design approach as we re-examine our business processes, we will ensure that we deliver an improved customer experience meeting needs holistically, recognizing that whatever system we build, whatever technology we implement, we do it to provide the best possible service to the public.

Goal 4: Improve Business Workforce Engagement by:

- Demonstrating investment in front-line employees

- Establishing a broader view of customer service

- Enabling better customer service by prioritizing development of tools to enhance the customer experience

- Automating routine work enabling our employees to provide better service

- Changing the culture of the business/IT relationship by working in close collaboration

Demonstrating Investment in Front-Line Employees

Our IT modernization effort is truly a business process and system modernization effort. Our IT and business organizations are partnering to create a new IT foundation that will enable the agency to provide services to the public across several channels and to meet the expectations of the public. Ultimately, we are undertaking this modernization effort to put better tools in the hands of our front-line employees, so that they can provide improved service to the public.

Over the years, we have regularly updated the tools our employees use to achieve our mission. Occasionally, we make large technology steps, like the move to workstations on everyone's desk and moving to electronic rather than paper folders. But the progress has been incremental, always building off the existing business process, and often inhibited by the challenges of making transformational business process changes with the available technology.

Under this IT Modernization Plan, working with our business partners, we will create new opportunities for fundamental changes in our business processes. We will use service design approaches to ensure that we are anticipating the public's expectations and needs appropriately, that we are designing a customer experience that meets those expectations, and that we provide our front-line technicians with the capabilities for delivering excellent customer service.

Demonstrating investment in our front-line employees explicitly recognizes the fundamental role they play in providing service to the public and in achieving the agency's mission. Front-line technician participation in the service design process will ensure optimization of their contribution to the customer's experience. In addition, it will demonstrate to our employees our commitment to maximizing their ability to serve the public in the future.

Establishing a Broader View of Customer Service

Outstanding public service has always been a fundamental objective for SSA. For most of our existence, our primary method of providing service has been direct public contact through our field offices. We still provide face-to-face service at sites across the country and in several foreign countries, and we remain committed to providing the best possible service to everyone who needs our services. However, our notion of providing excellent service has to evolve to include a broader view of delivery channels. Using a service design approach, we can better understand what services are best performed through which channels (e.g., in-person, video, phone, or online). We are moving to an understanding that we can actually improve the customer experience by providing a thoughtfully designed array of services provided over multiple channels.

Along with a broader view of how we can most effectively provide service, we will bring a singular focus to the end user of our services. While we build systems for our front-line technician to use, they are only intermediary users. As we continue to build systems for our employees we will also prioritize design of our modernized business systems with the public in mind.

Enabling Better Customer Service by Prioritizing Development of Tools to Enhance the Customer Experience

Here we reiterate that it is the customer experience that drives our IT modernization. The modernization of our technology will be undertaken with the objective of improving the customer experience. While the underlying technical work may address challenges of stability, agility, flexibility, and security, the reason behind that work is to bring us to the point where we can realize improved customer experience. Every business process and technology decision we make will be evaluated in light of its contribution to the customer experience.

The close working relationship between IT and the business organizations in SSA will ensure that the specific design of our modernized systems will include tools that enhance the customer experience. Our governance model for execution of the IT Modernization Plan establishes an imperative for a focus on the needs of the public, and reinforces that imperative at every level. Organizing the work around execution teams with both business and IT participation will also help to sustain customer experience focus throughout the effort.

Automating Routine Work Enabling Our Employees to Provide Better Service

Inherent in our approach to redesigning our business systems is leveraging technology to take advantage of its capabilities to facilitate, and relying on the knowledge and inherent competencies of our front-line technicians to address those processes/cases that are too complex or ambiguous for technology to handle. We have already exercised this principle as we have been implementing new online services. For example, it is possible to file an initial claim, change an address, or request a Social Security number replacement card online – all

actions that individuals can take with information they have available to them. As we implement this plan, we will expand on our use of technology by automating more actions and applying intelligent navigation in our online applications to ensure we collect all necessary information before the automated process executes the request. Within the automated process, we will build systems to handle increased ambiguity and to process security checks, ensuring accuracy and completeness of the desired action. Essential to these advances will be the ability of our automated systems to notify the public when actions are completed and to include confirmation of the outcome. To accomplish this, we will expand our online communications capabilities to include all of our programs and business processes.

The challenges inherent in this objective are significant, but success in providing for straight-through processing of a large portion of our less complex business actions will enable our technicians to focus on providing support to the public for their most complex interactions with us.

Changing the Culture of the Business/IT Relationship by Working in Close Collaboration

This objective is repeated from Goal 3, since it is as important to the front-line organizations as it is to IT. The business organizations and IT must become partners in the design and implementations of modernized business systems, using service design as an underlying principle with a focus on providing an outstanding customer experience. Neither the front-line organizations nor IT alone can achieve the desired outcome. Historically, the dominant culture was one where the front-line organizations told IT what they wanted to make their operation more efficient, and then had IT deliver it. While we have begun the necessary shift, the front-line organizations and IT must become partners in all of our efforts.

The design of our IT modernization operating model, where the business and IT serve together to bring focus to critical design, planning and execution is fundamental to success in the modernization efforts described in this Plan. Promulgating the culture change throughout the agency, to activities outside the IT Modernization Plan, will be supported by communicating the nature and criticality of the change in how we operate.

Goal 5: Reduce IT and Other Operating Costs by:

- Increasing use of shared services and the cloud

- Increasing benefits available through more disciplined approaches to systems architecture, including reuse of components

- Embracing a DevOps mindset

- Fostering innovation to improve operational efficiency

Increasing Use of Shared Services and the Cloud

The agency's modernization program will position SSA to take advantage of shared services provided by federal agencies. By modularizing our capabilities, and accessing them through well-defined APIs, our software can take advantage of new shared services as they become available.

For example, we currently obtain payroll services from the Department of Interior's National Business Center, and we procure a travel system through GSA. Leveraging these opportunities enables us to take advantage of economies of scale, and we can focus our attention on the critical IT development and operation of the core services we provide as part of our mission.

Another way to leverage publically available resources is through the use of "open-source" code. Open source software is computer software that is made available with a license that allows users to change and use the software for any purpose. Often this software is developed and supported by a broad community of users. The industry has embraced open source development for virtually all modern frameworks and code libraries. SSA is taking full advantage of the value provided by the open source community and will continue to incorporate that capability into the software we build. Our modernization will include building and maintaining a secure, stable repository that makes verified copies of open source modules available to our developers. Where appropriate we will make our code available for use by other federal agencies and the public. This work supports OMB's Federal Source Code Policy[4].

Agency Cloud Infrastructure (ACI) is our preferred platform for software deployment and for provisioning our development projects. Our plan is for our modernization projects to use our cloud platform to develop, run, and manage applications without the complexity of building and maintaining infrastructure, customized for individual projects. The ACI emphasizes commercial cloud services, supplemented with a private data center-based cloud platform for hosting components that have special requirements. Our goal is to increase our developer productivity, beginning with flexible infrastructure and self-service provisioning. Our existing off-premise private cloud has an Authority to Operate from the CIO and uses a GSA-approved, and FedRAMP-assessed, public cloud provider.

Cloud computing is significantly more economical, scalable, and flexible than traditional host-based computing. While SSA will continue to support applications running in its data centers, the agency is committed to deploying its modern software components in the cloud whenever possible.

Modernized software components will be optimized to run on a cloud platform that can scale by dynamically and transparently adjusting the number of servers dedicated to running a software component, based on demand for its services. The cloud platform operating system allows software developers to concentrate more on software development and less on scalability. Running software on a cloud platform is remarkably simple because the platform takes care of almost every infrastructure concern associated with traditional data center deployment. To work properly in this environment, agency software will adhere to widely accepted design factors for cloud-based operation.

Modernized software modules are self-contained and self-hosted — capable of servicing network requests autonomously, without the need to monitor them and respond to changing conditions manually. Modules are deployed directly to a cloud platform, which assumes the responsibility for creating new instances to meet demand and load balancing between them.

Adopting the cloud as our platform of preference will require us to develop new expertise in both operating and maintaining a cloud environment for our purposes, as well as developing

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[4] Find OMB's Federal Source Code Policy at: https://sourcecode.cio.gov/.

expertise in the tools and techniques that fully leverage the cloud's capabilities. In the Workforce section of this Plan, we describe the training we have already begun to bring our staff up-to-speed in building for and maintaining a cloud computing capability.

Recognizing that cloud computing holds the key to economical processing power and virtually unlimited scaling, the agency has designed its newest system, the Disability Case Processing System especially for the cloud platform. It uses a modern technology stack that takes full advantage of cloud scalability. Scalability can enable us to deploy new systems more quickly, by simplifying the procurement process for new computing capacity. We can also leverage the extraordinary capacity that major commercial cloud providers offer to carry us over temporary spikes in demand due to cyclical processing peaks or the release of new online services and the accompanying public interest.

Increasing Benefits Available Through More Disciplined Approaches to Systems Architecture, Including Reuse of Components

As described earlier in the Plan, SSA's current systems were built as its programs and policies evolved over the years. As a result, most of our systems are designed and function independently of one another, creating functional silos across lines of business. Navigating these silos places a burden on the public, the front-line employee, and our IT employees.

The agency's modernization program will steadily replace legacy software with new components that follow a consistent architecture. SSA will migrate away from monolithic software that performs one job and toward more granular, narrowly focused components that can be combined in different ways to accomplish a variety of purposes. Reuse of smaller components will allow agency software to produce more consistent results, and better manage development projects. The aggregated outcome of these changes will be a fundamentally revamped architecture that takes advantage of the flexibilities and efficiencies offered by modern technology.

In order to achieve the technological and business advances described in this Plan, we must consistently apply the tools and methods we have described. Our Enterprise Architecture (EA) Program provides a framework for maturing and promulgating those software engineering practices that we will rely on to modernize our IT applications. As depicted in Figure 3, our Chief Architect has established a federated organization of individuals with responsibility for each of several practice areas. While these individuals work in a range of organizational components (e.g., data and database design, infrastructure design, etc.), these Reference Architects, led by the Enterprise Architect, provide the operational foundation for implementing the practices that will support our modernization effort. The Enterprise Architect will work with the domain business and technology leaders, who have responsibility for overall domain strategy, to provide leadership expertise in the use of emerging technologies to improve our business process, and he or she ensures that systems across the agency follow design and data frameworks that will enable us to overcome the existing stove-pipes. For example, our *my* Social Security portal has been used since its inception to provide secure access for individuals to their SSA accounts. The Enterprise Architect, working with multiple business owners and IT development teams, is developing a design through which *my* Social Security can provide secure access for all individuals interacting with the agency whether on their own behalf, on behalf of a beneficiary, or as an agency business partner. The Enterprise Architect also works

with the Reference Architects to ensure that all domains are using those practices that will move us forward. The Enterprise Data Architects and Solution Architects play critical roles in ensuring that the appropriate data and software designs are leveraged by project teams so that our business processes will be integrated to provide the best possible service to the public and maintain the necessary agility to respond to changing requirements and expectations quickly.
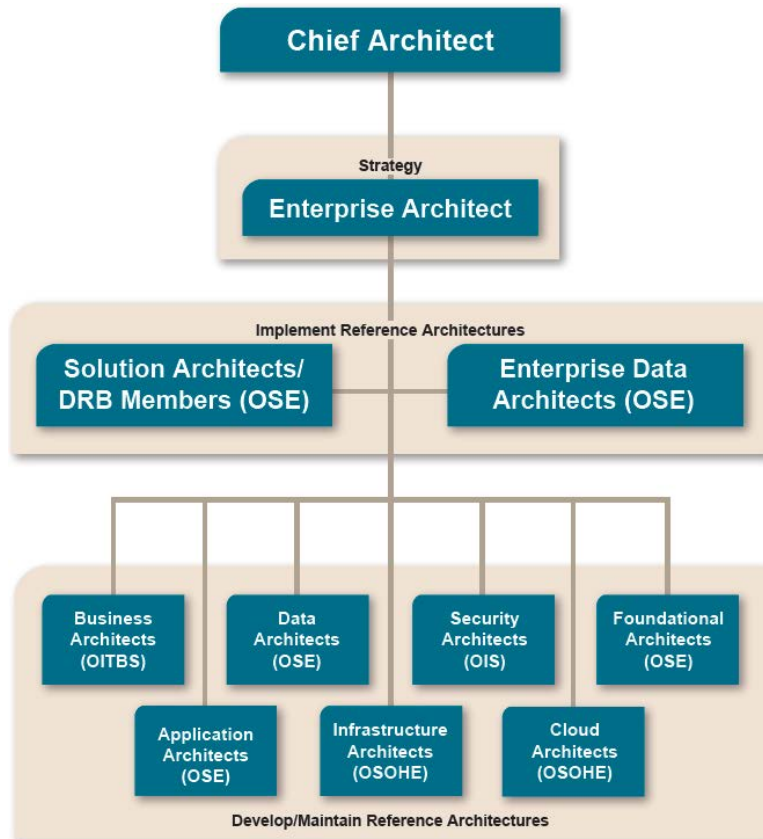

Figure 3: Enterprise Architecture Framework

Our existing software architecture is at the core of many of the technology challenges we face. At this time, most SSA systems have a monolithic architecture. In a software monolith, concerns such as user interface, business logic, and data access are interwoven into a single code base. That code base tends to be large and requires a large development team to manage it. Monolithic software releases are time and labor intensive. Since the code base is so intertwined, all aspects of the application must undergo testing for every release, slowing our release of new functionality. Our monolithic, siloed systems served us well for many years, but they cannot respond to modern demands for streamlining business processes and deploying new functionality rapidly.

To avoid these drawbacks, SSA's modern software architecture will rely on modular components, each breaking the monolith into modular components. These components will be the building blocks of our modern systems. These components can be reused and combined in different ways to accomplish any number of business purposes requiring the same underlying actions. This approach speeds development and reduces the effort to maintain our systems.

Agency experience has shown that addressing software integration as an afterthought results in tangled systems with hidden dependencies. Our modernized systems will be designed with interoperability as a primary consideration. Our modern architecture requires that every business service, as described above, support a network-accessible, language-neutral API that provides access to its capabilities. This allows our developers to use the programming language that best suits their needs while ensuring that components can communicate freely. We are instituting API-First development practices that enable the agency to integrate new technologies into the environment fostering innovation while preserving compatibility. Utilizing an API-First development methodology requires new approaches to architecting applications and managing the services and APIs across applications. Furthermore, to avoid system entanglements, all new components will have exclusive control of the information they use. In this way, hidden entanglements between software components are eliminated. Enclosing information behind an established, recognized API will allow components to be engineered and deployed independently of each other. Loose coupling via well-defined APIs keeps component interdependencies to a minimum, allowing the most efficient development and testing processes.

Many of our legacy systems were designed to recognize when transactions have taken place by observing when data has changed, rather than when the transaction, itself, has occurred. This design necessitates our using overnight batch processes, rather than the real-time processes that will enable us to complete interactions with the public with one contact. We intend to design our modernized systems to process user interactions in real time across all relevant systems.

Event-driven components can integrate their operation without being tied to a single, stove-piped business process, eliminating entanglements, and leading to enormous productivity improvements for developers. When an event occurs, it requires no knowledge of the components that will act as a result. Business logic in the services described above can act independently when the event is detected. In this way, changing the mix of components that respond to an event becomes more straight-forward.

Furthermore, the reuse of software services across systems will help us ensure that the business rules we build into our systems are applied consistently, and that data is accessed and shared appropriately. When we change the rules that support new policies, we will know all the places where they are used. We make the change just in the common software service, anticipate the impact everywhere the service is used, and we use automated tests to ensure the resulting impact is what we expect. These methods enable us to roll out new business functionality faster and with fewer issues in the field.

We are gaining critical experience as we roll out new services in many of our current releases. At the same time, we are modernizing the tools we have in place to provide for the security of modern services and to catalogue them so that they can be shared among all developers.

Embracing a DevOps Mindset

DevOps is a way of working together, where all of the resources involved in building a software product break down traditional silos to innovate and produce products faster. The advent of agile methodologies laid the groundwork for this collaboration to occur. In traditional waterfall development, business resources, analysts and developers produce software that is then

handed off to a separate group responsible for tasks such as final testing, security, deployment and monitoring, often referred to in industry as "operations". In DevOps, the development team is integrated with the operational team, hence the term DevOps. A key aspect of this integration is having the operational team deeply involved from the start of the development life cycle. In waterfall the operational team is typically positioned near the latter part of the software life cycle, so it agile, they "shift left" in the process. Having all key resources involved early provides the team with insights into downstream testing, security and the production environment that can inform initial design decisions in ways that would not otherwise happen, or that would happen later in the process at greater cost.

Implementing DevOps provides game-changing benefits, including immediate cross-team communication, the ability to respond quickly to changing requirements, saving time by building aspects of testing and security into the product from the start, and delivering better software, faster.

Our DevOps initiative is bolstered by our MDE, which is a suite of tools providing automated code management, testing, packaging, and deployment. New engineering practices are being implemented to enable the effective use of the MDE.

At its core, DevOps is not really about tools or technologies, it's about culture. Teams work and think differently by adopting a DevOps mindset that positively affects all aspects of their collaborative project work.

Fostering Innovation to Improve Operational Efficiency

Our Chief Technology Officer (CTO) has the role of identifying and piloting innovative and relevant technologies to modernize SSA's code, data, and IT infrastructure. The CTO collaborates with business partners across the agency, incubating new technologies and innovations to determine whether they can solve SSA business problems. By applying new technologies to real business challenges in a controlled environment, we are able to assess the technology's potential at a minimum cost, risk, and obligation to the organization. The CTO transitions successful technologies for use across the enterprise, and quickly abandons technologies deemed unsuccessful in incubation.

Goal 6: Reduce Risk to Continuity of Operations by:

- Increasing awareness of cyber threats and our capacity to defend against them

- Replacing time-worn systems with maintainable technology

- Building in security from the start of technology planning, design, and development

Increasing Awareness of Cyber Threats and Our Capacity to Defend Against Them

The information entrusted to us by the American public must be protected against unauthorized access and disclosure. Our modernized IT systems will strive to use the latest technologies and best practices to safeguard our data. We will implement strong security and privacy controls, technology, processes and training to prevent unauthorized access from both external sources

and insider threats. We will integrate security and privacy capabilities in our IT systems as well as automate security testing as part of our agile development.

Cyber security risks and the digital threat environment have changed dramatically since the time our legacy systems were deployed. Legacy systems employ technology that resists modern security best practices such as data encryption and multi-factor authentication. Operational risks arise when these systems cannot adapt to current or expected mission requirements, user needs, operating environments, or are no longer cost justifiable. In these cases, modernization will improve the ability of these systems to deliver the necessary levels of functionality to securely satisfy the needs of agency users, users from outside the agency, and the American public more broadly.

The agency's cybersecurity program performs a vital role in protecting, enabling, assuring and securing IT assets, network, and data. As we upgrade our software architecture and our engineering methods, our cybersecurity practices must also be upgraded to keep pace. By building security into our automation, analytics, and agile development processes, we will reduce the risk of deploying unstable legacy applications. We will incorporate security into the design of our IT environments and systems by providing a modern security architecture that supports our cloud-based, API-driven modern software architecture. We will strengthen the security services we provide to the agency in the areas of data encryption, Identity and Credential Access Management (ICAM), and secure application design.

Replacing Time-Worn Systems with Maintainable Technology

A candid examination of the agency's current systems demonstrates the need for their replacement. Our conclusion is that legacy limitations cannot be overcome by incremental upgrades – their deep structure is resistant to superficial workarounds. It is our experience that the cycle of workarounds adds to our total technical debt – the amount of extra work that we must do to cope with increased complexity. The complexity of our systems impacts our ability to deliver new capabilities. To break the cycle of technical debt, a fundamental, system-wide replacement of code, data, and infrastructure is required. Our transformation program is intended to replace time-worn systems with new ones that are simpler and cheaper to maintain. A build vs. buy analysis and subsequent decision is an important component of that program.

Building in Security from the Start of Technology Planning, Design, and Development

Protecting the personal information of the public and the integrity of our data stores and business processes is a fundamental requirement of any service we provide through any channel. Over the years, as we have implemented more online services, we have instituted additional security measures, both technological and business process-based. While we work hard to protect the data and business processes, these security measures can diminish the customer experience. In addition, over the years, with the mix of very old and newer technologies and designs in our computing environment, effectively protecting our technology investments has become more and more challenging.

As we conduct our analysis and design of our modernized business processes using a service design approach focused on the public, we will design security measures that will inhibit delivering our services as little as possible. For example, over the years we have built secure online services for several different purposes, including a retirement estimator, the ability to request a Social Security number replacement card, and providing access to electronic records

to appointed representative. Each of these online services uses a different portal and employs a different method to control access to our systems. The differences are driven by the era when the applications were implemented and the level of security required. Going forward, we will design and implement, to the extent possible, a single portal and security framework with the capability to identify individuals and the access to which they are entitled based on the business they have with us. This will ease access and any unnecessary interference with the customer experience without compromising the security and integrity of our computing environment or business processes.

Benefits of IT Modernization

The following table details the benefits of our proposed modernization.

Transformation Opportunity	Benefit to SSA and the People We Serve
Product View	Enables continuous delivery of new capabilities to the public and our employees, with a minimum of disruption.
Comprehensive Self-Service	The public can complete its business using the channel of their choice.
360 Degree Customer View	Front-line technicians have one place to go for information about a person, including a complete history of agency contacts. Satisfaction rises because our employees have a better understanding of the public's relationship with the agency.
Transactional Processing	By processing new information as it arrives, our systems will deliver immediate and accurate results to external users and SSA staff. Problems can be addressed in real time, eliminating the need for follow-on notices and other communications. Security will be built-in from the start for both the public-facing and back-end transactions.
Data Quality	Improving data quality ensures that our systems run smoothly without generating exceptions that require manual correction. Operational workloads are reduced, improving service to the public. Analytics will be implemented to ensure that the high-quality data we are collecting can be used in a practical manner by users throughout the organization to monitor and measure our performance.
Event-Driven Processing	All parts of the system receive information about life-events and react in near- real time. In this way, self-service external users and our employees always have access to the most current information.

The benefits above will allow SSA to:

- Accelerate the pace of innovation and delivery;
- Manage enterprise risk to core services;
- Govern, prioritize, and fund service improvements;
- Use industry best practices, or at least, industry current practices;
- Enable the business to contribute directly during service design and build;

- Change the IT-Business model to deliver faster, and hire/train tomorrow's workforce of IT experts;

- Conduct cross-channel analytics and inform service innovation;

- Avoid building a large new silo to deliver new services and products; and

- Clarify the migration approach and transition of ownership once services are launched.

Modernization Transformation Risk Summary

SSA recognizes that large-scale transformation must be approached carefully, given the many risks that such an effort introduces. We have confidence that these risks can be addressed and overcome using the approaches outlined in this Plan.

Hybrid Environment Risk: Execution risk while operating dual (new and old) systems simultaneously

Complete replacement of our systems will take years to accomplish. During that time, we expect to run a mix of modern and legacy components in production. As we build modern software to replace legacy functionality, we will be challenged to maintain results that are correct and consistent, to ensure a high level of performance, and to protect the security of our systems. We plan to meet these challenges through a number of mechanisms, many of which we are already implementing as we gain experience with our modern tools and technologies.

Maintaining hybrid systems will be more complex than maintaining a single system. We need to ensure that our workforce is able to effectively support both old and new systems during the transition period. Our staff will have to be aware of the interfaces between the two, and the temporary methods we adopt to bridge them. We address this risk with early and abundant training and oversight by the architects and engineers to design and implement robust bridges between the multiple generations of systems. We have extraordinary experience working with our existing systems, and we will bring that expertise to bear as we learn and gain experience with the new systems. Documentation and mentoring will provide a foundation as we learn the new way.

Data Integrity Risk: Execution risk of using old and new data sources simultaneously

To investigate the risk for data and data-transforming processes, particularly those driven by batch processes, we will generally run both old and new processes in parallel for some period of time. This enables us to compare the results of the newly-coded services against the old and ensure data integrity. Running both code bases is easily accomplished by building a branch into the code that drives the process, and the testing that compares the results is easily automated. The period of co-processing can run from weeks to months, depending on the complexity of the code and whether monthly or annual processes might cause anomalies only seen during those particular processes.

Code Quality Risk: Ensuring that we are able to roll back to previous versions of software in the event of deployment issues

For new front-end code, or what the end user sees, we will rely heavily on testing throughout the development process, beginning with developers' unit and functional testing, continuing through

more production-like validation and integration testing (including load testing), including comprehensive user acceptance testing before new software is deployed to end users. Once code is deployed, emerging issues are carefully monitored. We make additional adjustments to the production environment and corrections to the code, as needed. A significant advantage of the modern architectures and development methods we will be using is that errors in the code can be isolated to specific services, and corrections can be developed, tested, and deployed quickly. If significant issues make their way past testing and into our production environment, we will have partial or full roll-back procedures in place to quickly fall back to a prior version.

Back-End Processes Risk: Integrating across old and new architectures while realizing good performance

One risk we are encountering and developing solutions to already is the challenge of designing the back-end processes, such as API calls to services, for systems that include both modern and legacy components. We have created several techniques to enable us to reach across technologies. Several recent deployments of new software have given us opportunities to learn how to tune the operating systems and reduce the load of the new architectural components on the legacy systems. We are capturing the lessons we learn in these initial efforts and we will establish mechanisms to convey this knowledge to developers as they work on new systems.

Security Risk: Ensuring that we are continually building, testing, and deploying innovative cybersecurity measures to counter evolving external and internal threats

Security is key to our transformation effort and new risks surface every day. Our business partners need greater access to sensitive information to meet the expectations of the public. To manage and reduce that risk, we continue to implement a strong cybersecurity infrastructure. We are committed to integrating security into the software development process right from the start to ensure that products are as safe and secure as possible. Security across old and new systems also brings additional risk, initially, as we work through ways to efficiently secure transactions as they travel between old and new environments. We have the necessary infrastructure in place now to ensure that transactions and data are secure, but as transaction volumes increase, we will have to ascertain that existing approaches continue to be adequate. Our security organization is continually exploring options to prepare us for adoption of the changes described in this Plan. Cybersecurity-specific risks and mitigation is covered more fully in the "Cybersecurity and Privacy Program Enhancements" section of this document.

Workforce Risk: Ability to retain current and attract new IT employees with state-of-the-art technical skills while ensuring existing employees gain similar skills and opportunities

This transformation effort poses a risk on a number of fronts related to our IT workforce. Our ability to attract the best talent is more important now than in the past as we move from waterfall processes to agile and as we continue to move into new technologies at a faster rate. We plan to implement effective recruiting strategies and market SSA as an employer of choice.

Our current training approaches have seen great success by providing knowledge and skills development in key new technologies via engaging delivery strategies such as Boot Camps, Tech Talks and our 10-Day Challenge initiative. Skills in Agile, DevOps, cloud and other state-of-the-art technologies are rapidly being acquired and put into practice by our IT workforce. Our hybrid environment will pose unique challenges as business users work their way through

business processes that contain aspects of both old and new systems. User interactions will shift between new and old, and the business processes will change as we take advantage of the capabilities of new technologies. We will address these unique needs by continuing to expand our curriculum and our training delivery strategies.

All of this change, even when applied to a well-trained workforce, can put pressure on our culture. Transforming our culture from its previous stance to one where we deliver products faster based on a more collaborative commitment between systems and business, and one that is supported by new development/deployment technologies, is well underway.   We have been dedicated to delivering a clear message on why change is necessary at the agency to meet the ever-growing, and changing needs of the public we serve. Additional details on these workforce-related topics can be found in the section entitled "IT Modernization Workforce Development".

Funding Risk: Ensuring that adequate incremental funding for transformation is available while existing IT needs are also funded to maintain core operations

Governance is key to effectively managing risk and this Plan proposes the establishment of a new Chief Program Officer (CPO) with accountability for delivering the solution. The CPO will operate under executive oversight from the Commissioner of Social Security (COSS), Principal Deputy Commissioner, and other key leaders in the agency.

IT modernization is a top priority for the agency. We will continue to pursue additional IT modernization funds through additional requests in subsequent years, and through every other available opportunity, such as the Modernizing Government Technology (MGT) Act. We will also leverage the American Technology Council (ATC) for efficiency and support opportunities. The section later in this document entitled "IT Modernization Cost, Benefits, and Avoidance" offers further explanation into all aspects of the risks associated with this topic.

IT Modernization Roadmap

This IT Modernization Plan proposes a number of key initiatives that need to be carefully planned, managed and monitored to ensure success. We propose a strategic approach to planning these initiatives that focuses on our top business domains first, while making incremental advancements in the other domains to prepare for phasing them in over time. In addition, new systems will be designed from the start to ultimately turn off the older systems that they replace. The commitment to shut down older systems ensures a far better user experience that provides all needed functionality and data in a single-system solution, while significantly reducing the costs associated with the maintenance of those older systems and the infrastructure on which they run. Data and infrastructure modernization are critical underpinnings for the modernization of the programmatic systems described in detail later in this document. Our work to restructure our data assets to facilitate business systems modernization is ongoing and will continue throughout the duration of the Plan. Likewise, the work to provide additional computing platforms is underway — the first few applications already in place in the cloud and more are on the way.

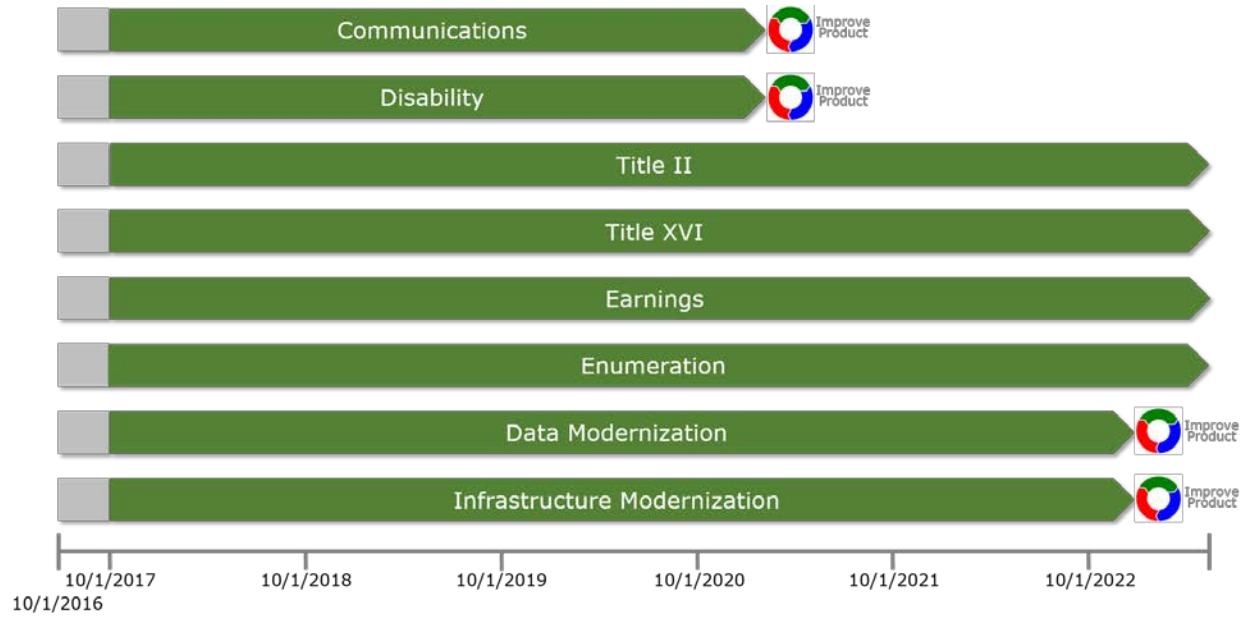The roadmap in Figure 4 depicts the timing of our proposed IT Modernization initiatives.

Figure 4: IT Modernization Roadmap

Business Domains

Introduction

This section describes the investments we are making to transform our business systems, leveraging the technology and modern design elements described in the previous sections. We use the term "business" to describe activities related to our core mission - public service. This part of our Plan is divided into six Business Domains, which represent the systems and processes we use to communicate with the public, determine eligibility for benefits, process claims and post-entitlement actions, maintain earnings records, and assign Social Security Numbers (SSN).

Our new core systems will support critical business processes more efficiently and effectively than the systems they replace. Beyond these operational advances, their modern design, and our ongoing utilization of modern development tools and computing platforms, means that in the future these systems can be adapted to leverage technology advances in a more flexible manner and at less expense.

While the work we have already begun has provided initial advances in the modernization of our technology and IT development methods, going forward we will bring focus to modernizing our business processes as well as the technology that supports them. Our business domain leadership will establish a vision and roadmap for how we can leverage technological innovation to improve operational efficiency and, most importantly, service to the public. As we fully engage in this work, we will continue to examine how we provide service to the public, refine and streamline our methods, and apply modern IT technologies to the refined process.

In this section we provide summaries of each of the business domains: Communications, Disability, Title II, Title XVI, Earnings, and Enumeration. Each section includes a brief summary of our current state and how our efforts will transform our operations, the benefits to the public and the agency, and specifically what we expect to accomplish in FY 18. As previously mentioned, this Plan is a roadmap that will guide us through a multi-year effort, but we will continue to evaluate our progress and adjust the Plan and our activities under each domain to maximize our outcomes. The IT Modernization Plan is a living document that we will revise as we make adjustments, and it will be supplemented by more detailed planning and reporting documents and reports as we move forward.

Communications

The Communications domain centers on developing a more global approach to how we connect with the public and respond to their needs through multiple channels. Today, SSA engages with the public primarily through face-to-face field office visits, call centers, and by mail. Use of our socialsecurity.gov website is ever-increasing, but this is currently almost exclusively a one-way communication channel. As we embark on using a service design orientation throughout our IT modernization effort, the ability to seamlessly communicate with the public across all service channels becomes critical. Initially, we will focus on how we deliver notices that communicate agency decisions and updates that affect applicants and current beneficiaries.

SSA mails over 250 million paper notices a year that address every aspect of our business processes and are produced by several major notice generation systems. Maintaining these diverse systems is labor intensive and inefficient. Our current notice systems and infrastructure are not able to easily adapt to policy changes, internal and external user needs, or service channels. Making changes to notices is a difficult and lengthy process, largely because of the tight integration with legacy programmatic systems. This domain begins to create a messaging "backbone" that allows for the right content and data to be delivered to the right individual in a secure and efficient manner using the channel of choice.

We must first evolve the notion of "notices" from that of strictly a mailed paper notice to a more modern view of communicating important content using the recipient's preferred mode of communication. In addition to addressing communication systems and infrastructure, we will transform our business processes and related policies to provide clear, concise communication to the public. By modernizing the notice generation and delivery systems and transforming the underlying business processes, we will reduce both the burden on the public and our operating costs.

We are already working on this effort and have made significant headway in rethinking how we deliver notices. When complete, our work in this domain will enable us to retire a significant portion of some of our oldest code base. By moving much of this work to the cloud, our notice platform will be much more responsive to future modernization efforts.

Benefits

Public	SSA
• Faster communication than currently possible • Stay in the same service channel for all communications • Additional communication channels including email, text messaging, and chat • Communications that are written in plain language • Communications that provide direct links to relevant supporting information and online services	• Streamlined approval processes for communications • Decouples notice system from legacy systems so that changes can be made more quickly • Easy to access customer history to help reduce redundant mailings and limit manual intervention • Reduced operating costs

Key FY 18 Outcomes

In this first year, we will build the framework for transformation of our notices process. We will establish a flexible architecture to modernize notice delivery and build a simplified format for managing and updating notices. We will also select certain notices for modernization in the current year and evaluate, categorize, and prioritize notices for future inclusion in the modernized system.

In preparation for future work, we will begin building the mechanism for content management including editor, management, generation, rendering, and delivery. Included in this effort will be the development of individual content/communication history.

Disability

The Disability domain focuses on replacing our current disability systems to provide us with a coherent system that streamlines workflow and leverages modern technology to expedite processing of disability claims, better supports our front-line employees, and provides faster responses to the public. Our existing disability systems are a collection of inter-related subsystems designed to support the full scope of disability processing including intake of disability applications, claim development, medical and vocational assessment, adjudication, hearings, and appeals. The systems serve internal users throughout the disability process, as well as external users, such as disability applicants and beneficiaries.

Under the Disability domain, we will develop a modern and cohesive end-to-end disability claims processing infrastructure that supports the full life-cycle of a disability claim. This national platform will drive greater efficiency, provide maximum flexibility, and improve service delivery in our disability programs. These improvements will also support our strategy to improve in-line quality and eliminate paper forms.

Our work will enable us to better utilize both the unstructured data files that comprise a large portion of medical records and the structured Health IT (HIT) files that form a growing portion of the data available to us. Developing these new tools and expertise will enable us to use advanced data analytics and high-level automation techniques to streamline the business processes. Expanding the use of data analytics is also critical to our ability to detect fraud and reduce or prevent improper payments.

As we begin the effort to modernize the disability process, we expect to benefit from DCPS2 by building on its already successful codebase, and leveraging what we have learned from DCPS2 regarding agile processes and the construction of agile teams.

Benefits

Public	SSA
• Faster application process • Eliminates need to provide basic information already known by SSA • Faster and more consistent decisions • Better claimant and appointed representative insight into application progress	• Streamlined medical evidence request and acquisition process • Automated review process that identifies key evidence and removes duplicate data from case files • Consistent decision support rules • Improved adjudication and documentation support tools • Elimination of manual requests for medical evidence files • Reduced errors and enhanced detection of fraudulent claims • More balanced workloads by leveraging and managing available resources in locations nationwide

During this first year, we will make significant strides in streamlining our disability workloads and processes and realizing improvements across all levels of the disability adjudication process. We will deploy the Duplicate Identification Process (DIP), which uses machine-learning to identify and flag duplicates within case files to alleviate the need to manually search through lengthy records. We will use INSIGHT to extract data from the disability decision and other documents for quality analysis, data, and policy analysis. We will also complete development of our case processing system. For our existing Document Management Architecture (DMA), we will begin to move document storage off of the mainframe for maximum scalability. We will also seek to contract with industry partner(s) to support the acquisition of medical evidence.

Specifically, for our disability determination workloads, we will deploy Intelligent Medical-language Analysis GENeration (IMAGEN), which applies machine-learning technologies to increase efficiency and accuracy. We will also modernize the hearings process to support balanced workload sharing.

Title II

Modernizing our Title II systems, which supports the Old Age, Survivors and Disability Insurance (OASDI) program, will improve the way we process initial claims and post-entitlement actions so we are focused more on the events that happen to our clients — the American public — throughout their lives. We can enhance the public's contact with the agency as well as boost efficiency. Our efforts will also support SSA technicians in processing workloads in an online and "real-time" environment.

We have already made strides in modernizing our Title II systems with new internet applications and services. These applications and services have been designed to take advantage of enterprise Service Oriented Architecture (SOA) technology and will be implemented using modern software languages. In addition, we have been adopting agile methods to deliver products faster and to manage technical debt.

Our work will focus on reducing operational and maintenance costs while moving toward more public-focused systems for processing Title II workloads in an online, real-time environment. This approach offers greater capability to process work at the public's first contact with the agency, reducing the inconvenience and inefficiency of re-contacts to obtain additional information, while also improving the efficiency and effectiveness of non-user initiated activities. Our modernization effort will also provide additional safe, secure, and convenient services for both initial claims filing as well as post-entitlement actions. By building additional analytics into the system, we can also better respond to specific life events, such as marriage or the death of a family member, with targeted services.

While our current legacy software supports high volume transaction processing with high availability, the continued attrition of staff skilled in older technologies is adding to the need for modernization. As Title II modernization activities continue, we will build the staff's technology and business system knowledge with a focus on modern tools and design. In addition, we will leverage modern technologies to better capture business knowledge in formal business rules so

that our systems remain more flexible and the knowledge more accessible for future modification.

Benefits

Public	SSA
• Life events trigger targeted outreach • Faster benefit computation • More people will be able to complete their application online • Improved communications to support the application and post-entitlement processes	• More consistent processing and reduced fallout to the processing centers • More efficient computations • More claims flow straight through to award without manual intervention • Ability to review expected results in real-time before finalizing the transaction • Reduced operating and maintenance costs • Better feedback mechanisms to provide more properly targeted solutions and content • Easy access to customer history to help reduce redundant mailings and provide better follow-up service • Improved subject matter expert knowledge management

Key FY 18 Outcomes

In this early phase of this initiative, we plan to complete the preliminary work to construct a new Title II, person-centric database and more efficient computational services. The new database and services provide the foundation for new processing capabilities that integrate data collection and claims development, enabling interactions based on the individual's life events, resulting in faster claims and post-entitlement actions. This work will also enable the provision of additional on-line services, and the ability to more effectively obtain all the necessary information at the first contact.

Title XVI

The Title XVI domain modernization supports the Supplemental Security Income (SSI) program that provides benefits to the aged, blind, and disabled who have little or no income. Work accomplished over several years of incremental modernization has already resulted in moving a substantial portion of the Title XVI systems away from old technologies, improving processing flexibility and adding useful tools for reducing improper payments. The IT modernization work will leverage that progress to include more time-saving processing automation and tools to reduce improper payments that may necessitate recovering funds from beneficiaries.

Currently, SSA collects detailed information from the recipients to determine initial and continued eligibility for SSI benefits. We receive this information in person, by telephone, and via the internet on multiple platforms (e.g., desktops and hand-held devices), and from internal

and external interface methods. The SSI Systems are comprised of over a dozen small applications to collect information, make payments, and communicate with our clients.

As part of our ongoing incremental modernization approach we have updated our database to a modern, relational database platform that leverages the person-centric data structure that's part of the IT modernization effort. We have retired legacy code languages in favor of web-enabled applications and enterprise services. However, we must accelerate and increase our modernization efforts to fully transform our Title XVI Systems.

We will accomplish this by completing the streamlined web-enabled input and screen flow, increasing automated capture of eligibility data, and reducing the need for manual intervention as described earlier. These improvements will reduce improper payments, and improve front-line productivity and SSA's service to the public.

Benefits

Public	SSA
• Faster claim and post-entitlement decisions • Reduced overpayments and underpayments • More responsive and efficient claim processing	• More efficient claims through a streamlined browser-based application • Better access to complete income and asset data • Reduced manual data entry • Reduced improper payments • Lower operating costs

Key FY 18 Outcomes

In our first year, we will modernize processing of 800# Leads including a direct process for establishing the correct Application Filing date on the Claim. Time-saving features will enable front-line employees to use information already in our systems to speed processing and reduce the potential for errors. We will also streamline system navigation and ease of use by implementing browser-based screens at the start of the work flow that establishes the new claim, completing the person-centric user experience on the web platform. New electronic wage data exchanges with a third party Payroll Data Provider will enable applicants/claimants to avoid having to report on their monthly income as they do today.

Earnings

The Earnings domain modernization will be focused on improving the speed of processing the millions of W-2s and W-3s that we receive each year, and improving the public's access to the submission and correction features. SSA's Earnings applications are part of a larger IT system called the Earnings Record Management System (ERMS). ERMS processes annual W3 and W2 data for employers, third-party wage providers and self-employed individuals who submit through the Internal Revenue Service (IRS). This system also processes corrected data and updates information on SSA's master database of earnings records, also known as the Master Earnings File (MEF).

The current system is a combination of web-based interactive screens and batch systems. Parts of the Earnings system are very old, but recent modernization efforts included the implementation of the Electronic Wage Reporting (EWR) and the Annual Wage Reporting (AWR) Earnings redesign. Since the implementation of the AWR Earnings Redesign improvements, various initiatives involving business process changes, code modernization, database modernization, and infrastructure modernization have continued at a fluctuating scope and pace due to funding. We recently deployed a change that enables the agency to process wage reports earlier in the tax year. As we continue to modernize, we will leverage common enterprise architecture and data and services. We will take advantage of new technologies to reduce maintenance costs, increase flexibility, and accelerate our development and deployment process.

The Earnings domain will support current and new initiatives that will evaluate and streamline earnings systems processes, earnings business processes, and earnings policy. We will transform the entire earnings process including the following actions:

- Collecting W-2 and W-3 earnings information from employers

- Providing IRS earnings information for the IRS tax filing processes

- Supporting SSA benefit computations for Title II and Title XVI

- Supporting the Office of the Actuary for Trust Fund projections and the Average Wage Index reported to Congress

- Providing earnings information to the public to help plan for retirement

Benefits

Public	SSA
- User-friendly electronic submission of earnings data - Faster processing of electronic wage data submitted to SSA - Simplified access to the individual's comprehensive earnings information	- Reduced effort required to support evolving business needs and legislative changes - Enable newer technologies and establish a foundation for near real-time earnings record establishment and reinstatement - Increased timeliness and accuracy of earnings data available to calculate benefits and minimize improper payments - Support IRS tax liability determinations and anti-fraud initiatives - Reduced training needs for new employees - Reduced operating costs

Key FY 18 Outcomes

During the first year under this domain, we will modernize and streamline the earnings processing that updates the agency's master earnings repositories to ensure timely and

accurate wage data to support SSA benefit computations and IRS tax filing processes. We will also modernize earnings query systems that support the agency's earnings and claims workloads. A modernized and streamlined external employer wage reporting capability will encourage electronic filing by the public and reduce manual, paper-based workloads required to process paper submissions. All of these efforts will enable us to retire the standalone Accuwage system and legacy self-employment and reconciliation systems.

Enumeration

The Enumeration domain modernization is focused on improving access to, and the infrastructure behind, the Numerical Identification Master Database (Numident) and associated business processes. The Numident, a numerically-ordered master file of assigned Social Security Numbers (SSN), is the foundation of all SSA business. The current system that assigns numbers and houses associated data is a combination of web-based interactive screens and a batch system that processes data from multiple internal and external sources. Parts of the Enumeration System are over 35 years old, but other portions have recently been modernized, including the web-based intranet Social Security Number Application Process (SSNAP) in 2009.

Since the implementation of SSNAP, various initiatives involving business process changes, code modernization, database modernization and infrastructure modernization have continued. The newest Enumeration application is the Internet Social Security Number Replacement Card (iSSNRC) service. As we continue to modernize, we leverage common enterprise architecture, data and services, and take advantage of new technologies to reduce maintenance costs, increase flexibility and accelerate our development and deployment process.

Under the Enumeration domain, we will improve access to Numident information, modernize user interfaces, update and automate business processes, and replace out-of-date technologies with a more robust infrastructure. We will further improve our death reporting processes and systems to establish an authoritative source of death data across all applications, reducing errors in payments and inconvenience to the public. Our Enumeration systems will be transformed into a modern service-based architecture to better serve the public and improve processes for front-line employees.

Benefits

Public	SSA
• Receive SSN faster	• Eliminate manual paper verification workload
• Improved notification of the status of original SSN application process	• Same day retrieval of enumeration history data
• Improved accuracy of online verification process	• Reduced errors in alien verifications through automation

Key FY 18 Outcomes

In this initial phase, we will make a number of tangible improvements to our enumeration process. We will modernize SSNAP and automated alien status verification software to eliminate paper verifications. We will move enumeration history data to the more robust EDW to enable faster and more flexible data access. We will also incrementally change the overnight

enumeration batch process to eliminate obsolete workflows and modernize programming languages where appropriate.

We will also begin the analysis to define and design new capabilities for future modernization. We will create a service model that enables real-time submission of applications for an original SSN. In addition, we will design a modern internal data service that will provide access to the Numident and the ability to display this information in a modern web browser.

Technical Domains

Introduction

In the previous sections of this Plan, we describe the transformational efforts we are undertaking to fundamentally change the way we design and develop the core business systems on which the agency runs. These transformed business systems will carry us into the future, providing economies and flexibilities that will enable us to respond more quickly and efficiently to emerging business and technology drivers. However, there are many aspects of our infrastructure that must be also modernized to support what we have described and to keep the agency's operating environment healthy. Some of that work is incremental, such as moving to an Omni channel to allow the public to seamlessly move between channels, but other work involves more game-changing elements, such as the evolution of our data center computing environment to support the rapid incremental releases of new code driven by our adoption of agile development methods.

Even the incremental work can be very significant, though less transformational. For example, our Next Generation Telephony Project will provide a single unified communication platform to improve business and public services through multi-channel telecommunications access. Likewise, our Quantum Leap project is designed to support the increased bandwidth requirements of many of the expanded capabilities we are implementing across our technology environment, including enhanced public services like increased video hearings and enabling the public in our busier field offices to obtain services from staff in our less busy offices through video conferencing.

Technical Direction

As discussed earlier in this Plan, we are modernizing on a number of technical fronts. Our client applications are moving from old-style green screens to modern, web browser-based applications, and we have a growing number of applications that can be used on mobile devices to support the needs of the public.

On the code front, we are moving away from our monolithic legacy writing in COBOL, Assembler, and similar languages to multi-tiered designs that benefit from APIs and services that provide a layer of abstraction between the front-end view layer and back-end processing. That process layer is already moving from batch to event-based processing that not only more closely maps to real-life events, but also breaks us free from the rigid, limited and expensive situation of locked-in, overnight processing. Further, our growing DevOps capabilities allow us to provide better, higher-quality solutions to our users faster, with any needed updates being delivered quickly and continually on the heels of the initial deployment. Our newly established cloud infrastructure further extends our ability to respond faster, more reliably and with the ability to scale to whatever our users need.

On the data front, we continue to move away from a batch-merging approach in favor of using our newly implemented modern data access methods and the EDW, both of which use data transformation methods such as ETL (Extract Transfer Load) to provide access to data that our employees need to better serve the public.

Figure 5 illustrates the transformation we are making from green screens to browser-based and mobile-enabled applications, from monolithic codebases written for the mainframe to modular service-oriented functionality at the code level, and from stove piped application-oriented to normalized subject-oriented data. This is the foundation of our transformation.
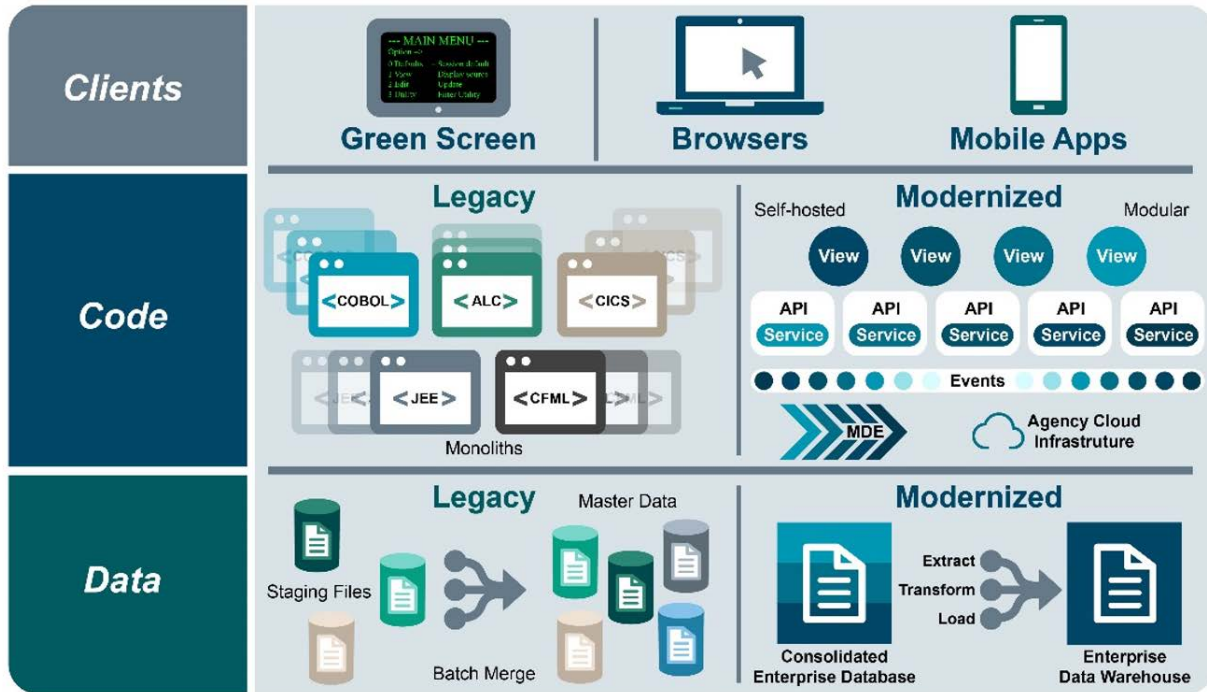

Figure 5: Transformation of Clients, Code and Data

The sections that follow further explore the specifics of our technical direction. They describe the infrastructure that needs to be in place for the rest of the transformation to succeed, the data modernization efforts we are undertaking to enable the business processes advances we have described, and the cybersecurity and privacy work we are doing to ensure that the data and business processes remain safe and secure.

Infrastructure Domain

The infrastructure domain brings focus to modernizing the underlying technology and processes to enable the business process innovations described earlier. Achieving the agility and other benefits promised by the business domains requires advances in our computing environment and how we support the work of the developers and front-line business units. The following section briefly describes this work.

Enabling DevOps and Modern Software Release Process

> *"DevOps is the practice of operations and development engineers participating together in the entire service lifecycle, from design through the development process to production support." Ernest Mueller*

Today, SSA IT Systems teams are working together across multiple technology and subject matter disciplines to support the agency's adoption of modern software engineering practices. While infrastructure processes for traditional data center operations are mature, as demand for non-traditional services grows, it will quickly exceed our capacity to respond. Future modernization requires the transformation of traditional operational functions. Testing, validation, and operational monitoring controls will occur earlier in the life cycle, and be responsive to the team. This capability is known as "shifting left."

Shifting left permits active engagement and efficiency, improved iterative processes for certification of production readiness, and the introduction of operations monitoring capabilities into the software development process. The benefit is faster time-to-market and less re-work for agency applications, without compromising testing for environment and performance requirements. Shifting left requires modernization of both the software development and release processes.

The rapid incremental release of new functionality that is a primary advantage of the agile development approach requires a modern software release process that is tightly integrated with the development process advances described earlier. That process is being implemented using a collection of tools that allows for the automation of what are now manual processes. Among the many new features is a modern release process that will automatically log all activity to support the ability to quickly roll back releases and to reduce the burden of manually creating artifacts of the development process simply for audit purposes. The capability also enables visibility into all development efforts, the work performed on them, and the current state of each. Our Modern Development Environment (MDE) will provide these capabilities.

As we implement DevOps in the software release process, we will simplify and link disparate systems and software in such a way that they become self-acting or self-regulating. This increases efficiency, lowers costs and is a better value. Automation will eliminate steps in the pipeline and replace "middlemen" with direct results. It reduces the amount of logistics and workforce required in the movement of code from programmer to end user.

In support of our DevOps strategy, we have created a DevOps model to support the DCPS2 project; it uses a cloud-based, modern, software architecture. An Ops team with full authority over the complete stack of hardware and software, as well as the release process management (including deployment, testing, automation, and support), has merged into the DCPS2 product team. SSA will continue to analyze and evaluate this new support model as the DCPS2 product matures.

Implementing the Agency Cloud Initiative

We are continuing to extend our infrastructure with cloud technologies based on our strategy to enable relevant hybrid cloud-based services. By the end of FY 18, SSA's traditional infrastructure will be augmented with on-premise cloud services, hosted in our two co-processing data centers, and off-premise cloud services for availability, flexibility and cost efficiency. The strategic deployment and management of this broader enterprise enables us to leverage the cloud-computing model as an IT services broker. In such a capacity, we will:

- Enable the implementation of solutions that are cloud-based with the appropriate infrastructure, personnel and support methodologies, processes and tools

- Provide on- and off-premise cloud-based and cloud-enabled infrastructures, platforms and applications/services to meet the service delivery and business operations requirements of the agency

- Host the MDE, our suite of tools and practices aimed at modernizing SSA's application development practices using agile principles

- Consolidate and standardize SSA's IT infrastructure systems (compute, storage and networks) to reduce costs, simplify management and administration requirements

- Enable SSA to cost-effectively test and validate ongoing technology developments to enhance the delivery of mission-related services, business operations and processes

- Simplify the migration of legacy applications and services to the cloud based platform

Our off-premise private cloud has an Authority to Operate (ATO) from the CIO and utilizes a GSA-approved, and FedRAMP-assessed, public cloud provider. We currently host DCPS2, EDW, and a number of smaller applications and tools in our external cloud.

An acquisition vehicle for competitive access to qualified cloud service providers has been established, and the network design for seamless access to multiple cloud service providers is underway.

Platform Transition

The goal of platform transition is to provide multiple alternative computing platforms for each modernized system (e.g. on-premise cloud, off-premise cloud, distributed servers, etc.), enabling us to select the optimal platform for each situation. Inherent in this approach is our utilization of cloud-based Platform-as-a-Service (PaaS) architectures, which eases the movement of systems between cloud platforms. To support this work, we are establishing criteria for assessing applications and workloads that can operate efficiently on modern platforms.

As a first effort to move a major legacy system onto an alternative platform, we are working to pilot the redeployment of the agency's Document Management Architecture (DMA) from the mainframe to a distributed platform. DMA is the SSA's key repository for beneficiary health information, consisting of millions of documents containing medical evidence and other information. This information is in the form of images and faxes, organized but unstructured, and growing at 100,000-Gigabytes a year. As part of our modernization, we will transition DMA from its current mainframe hosting platform to a modern platform consisting of a large distributed cluster of economical servers.

The modernized systems we will build as part of our IT modernization effort will be designed to take full advantage of PaaS and the economic and performance advantages of being able to select among multiple computing platforms.

Back Office Modernization

Our back office support includes office applications, including email, office productivity, and collaboration tools. While a majority of the hardware and software infrastructure is centrally located and managed, there are some critical elements that are local to offices outside headquarters. By moving major elements of our back office to the vendor-supported facilities in

the cloud, we can focus our attention on SSA-specific applications where our internal expertise is most critical, leaving the support of industry-standard to cloud-based commercial service providers.

Specifically, for office productivity tools, we will be completing implementation of SharePoint 2016 in the cloud in FY 18. This will provide both improved reliability and lower total cost of ownership because system updates are easy to make and efficiencies are significantly improved. We have also initiated planning and analysis for the implementation of Office 365 in the cloud, which we will begin our implementation in FY 18. At the same time, we are initiating planning for evaluating email in the cloud. The extent of integration of email with our applications, as well as the size of our enterprise, makes the move of email to the cloud a particularly challenging migration, so our planning is especially deliberate as we manage the risks inherent in such a move.

To benefit our field office users, we are evaluating technologies and operations strategies for centralizing field office servers. Our goal is to leave the smallest possible server footprint in the field offices to allow field office employees to focus on public service elements rather than infrastructure maintenance. We are engaging in similar dialogue with other SSA components that may have local infrastructure to identify opportunities for centralization and associated efficiencies.

Data Domain

The data domain is designed to consolidate our data, utilizing state-of-the-art approaches to simplify, organize and provide data and services to fully support how modernized systems are able to more effectively utilize data. Retiring legacy data sources and formats in favor of modern tools and techniques will optimize the way we store and process data, and result in improved quality of the agency's data. Moreover, it will provide an integrated source of historical data for business intelligence and predictive analytics across the agency.

Consolidated Enterprise Data

This initiative will simplify the data and provide the capability to build relationships amongst the agency's data to better support our modernized business processes. It will also provide a much more intuitive gateway within the agency to interact with data. This effort pursues both restructuring data and providing more modern access methods to existing databases, in order to achieve the benefits of modern data access without disadvantaging systems that have not been modernized yet. Beginning with the Numident, it will simplify the internal structure of the database to provide more efficient and effective usage of person-oriented data. It will also provide improved structure and entry into the data contained in the Master Beneficiary Record master file for internal users and other SSA systems.

Person Information

The person Information project is modernizing how we manage the data SSA collects and maintains about a person. SSA has over a petabyte of information on over half a billion enumerated individuals ranging from data that we collected on paper forms back in the late 1930s to today's electronic submissions. This data modernization initiative will move us towards an enterprise-level, authoritative data source for client-related information while eliminating the

redundancy and inconsistency in the collection and storage of this data. Bringing the data together will enable us to provide our customers with a clear picture of their information through our electronic services portals such as *my* Social Security, and it will establish the foundation for a 360-degree view of our customers, so we can provide better service. We have already deployed the first versions of the person information services, and several systems are utilizing them. We will continue to work to improve its performance and integrate it with new systems. In addition, we are developing design specifications for the inclusion of data covering family relationships, criminal information, and customer interactions.

Enterprise Data Warehouse (EDW) Modernization

The EDW provides an integrated source of data to service Management Information (MI), Business Intelligence (BI), and predictive analytics initiatives across SSA. Specifically, the EDW Modernization will ultimately replace SSA's existing legacy management information database systems and provide modern reports more efficiently and with higher data integrity. It is one of our first systems being run in the cloud, and we are working to implement the capability to update EDW throughout the day with the most recent transactions, potentially eliminating overnight batch processes and enabling near real-time access to transaction data for MI, BI and anti-fraud processing. We are now working to identify and conduct Proofs of Concept (POCs) to facilitate formulating the best plan for migrating legacy MI/Operational Data Stores and data warehouse database(s) to the EDW.

Integrated Database Management System (IDMS) Database Retirement

The IDMS Database Retirement will retire the agency's use of IDMS databases along with the technology used to access the data. Maintaining and supporting IDMS databases translates to a significant technical debt. It is extremely costly to maintain the infrastructure, and it is difficult to secure resources with the necessary skills and abilities to support its maintenance.

Cybersecurity and Privacy Program Enhancements

Security is one of SSA's core organizational competencies. Our Cybersecurity Program applies to all of the modernization efforts described in this Plan, as well as the rest of our IT environment.

The Cybersecurity Program performs a vital role in protecting, enabling, assuring and securing our IT assets, network and data. We use knowledge of the threat landscape, advanced technologies, and skilled cyber professionals to make information and resources secure across the broad spectrum of threats facing the SSA. We continually improve our cybersecurity controls to deal effectively with the increasing volatility of business, technology, and threat environments that put the agency at a substantial risk of security incidents.

SSA has a strong history of successfully meeting or exceeding federal cybersecurity performance measures. The continued modernization of our Cybersecurity Program is vital to addressing ongoing cyber threats and continuing to enable our mission and operations through the modernization effort. The introduction of innovative and modern IT environments and the evolution of business expectations mean that the extent of connectivity and demand for access to sensitive data through a variety of technologies are growing. This leads to both greater business opportunities as well as greater cybersecurity and privacy risks and challenges. A

strong and flexible cybersecurity infrastructure is a critical success factor in facilitating the transition to a modern and secure IT environment. We are dedicated to ensuring that as our systems modernize, security and privacy controls are "baked" into our applications and the design of our IT environments and systems from the beginning. In addition, by taking greater advantage of automation, analytics and agile development processes, we will address the risks that were inherent in legacy applications and "bolt on" security controls.

Cybersecurity modernization will focus on seven key areas:

Strengthen Identity Credential and Access Management (ICAM) Capabilities

Technology expansion and modernization has changed the way agency personnel and the public access SSA information and systems. The ICAM program addresses the mission-critical need to ensure appropriate access to resources across multiple operating environments and devices. Continued improvement to this program will automate previously paper-based processes, provide stronger protections for privileged accounts, increase cooperation with federal agencies, and integrate and centralize onboarding, off-boarding and reporting.

Expand Continuous Diagnostic and Mitigation (CDM) Program Capabilities

CDM is a collaborative program with the DHS that automates critical aspects of federal agency cybersecurity programs to provide a continuous monitoring function. SSA is deploying advanced technology solutions through our participation in DHS' Continuous Monitoring as a Service (CMaaS) program. CDM Phase 1 provides agencies with automated capabilities to improve their management of IT assets, and detect and mitigate vulnerabilities while Phase 2 will support the ICAM program.

Modernize Integrity Review Processes

In addition to deploying strong security and privacy controls designed to protect against external cyber threats, SSA has implemented integrity review processes designed to examine user behavior for potential fraudulent activity. Modernization of this program will automate multiple new business processes using data analytics and workflow modeling and streamline and reduce the management burden needed to investigate potentially fraudulent activity.

Implement a Cyber Defense Operations Center (CDOC)

The SSA Agency Security Operation Center (SOC) provides essential threat identification, mitigation, and incident response capabilities 24X7 to protect agency infrastructure and data. Our vision is to mature our SOC into a next generation Cyber Defense Operations Center (CDOC) that will improve our ability to manage cyber threats across our modernized IT environments. The CDOC will combine advanced technology solutions, infrastructure and highly skilled staff in a state-of-the-art facility dedicated to ensuring the secure configuration and operation of our network and systems. It will provide the facilities, infrastructure and services needed to deploy advanced modern threat and risk management capabilities across the agency. Specifically, the CDOC will strengthen our ability to detect security events by expanding our log collection across all our environments and platforms. Once identified, CDOC analysts will utilize advanced tools and business processes including big data analytics to prioritize, respond, contain and remediate vulnerabilities. The CDOC will leverage federal information sharing forums for real-time threat intelligence to identify and block bad actors and

maintain our strong security posture. Most importantly, the CDOC will recruit, develop and retain a highly effective cybersecurity workforce.

Adopt a Flexible Approach for Protecting Expanding Boundaries

Similar to ICAM challenges, modern technology has changed the definition of our agency's boundary and how information can be protected while being accessed from devices outside the traditional boundary. Because of this, the Zero-Trust[5] model was designed as a flexible approach to protecting information no matter where users are accessing it.

Enhance Automated Security and Privacy Testing

We will provide automated code testing tools so that developers will be able to dynamically test and mitigate security vulnerabilities in code during the development process. In addition, modernization will integrate dynamic code scanning capabilities and other "real-world" testing scenarios to better simulate cyber-attacks to test the cyber resiliency and security controls of the SSA applications and infrastructure.

Maintain Continuous Cybersecurity Risk Management and Governance

To support ongoing cybersecurity risk management, SSA will transition to an ongoing security authorization model. In contrast to traditional three-year security authorization, this model provides Authorizing Officials and Risk Executives a near real-time view of a system's security posture along with integration of cybersecurity risk into the enterprise risk management program.

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[5] A Zero-Trust model approaches security through segmentation, providing broad network access layered with targeted data access that is granted based on how data is being used.

IT Modernization Cost, Benefits, and Avoidance

Introduction

SSA's IT modernization must be executed in a fiscally responsible manner and yield maximum cost benefits. Modernized IT reduces risk and increases capabilities and performance, but comes at a cost. It is incumbent on SSA to not only spend smartly, but also in a manner optimizing the cost benefits IT modernization initiatives yield.

This section describes:

- Cost and benefit assumptions
- Major categories of cost benefits and ranges of achievable benefits
- Conclusion and estimated payback period

Our cost benefits conclusions are based on agency data and research collaboration with Forrester, a major research and advisory firm, which analyzed IT modernization efforts either concluded or underway at comparable (in terms of mission, size and complexity) entities, and adapted its findings to SSA's current environment and plan to modernize. Forrester's analysis is available in Appendix A.

Assumptions and Risks in Forecasting Costs and Benefits

As we conducted the financial analysis described in this document, we developed several assumptions to help provide a context for the analysis. We also recognized several risks that we accepted throughout the analysis and accommodated them as appropriate. These assumptions and risks are:

- Projected cost benefits are a supporting, rather than a primary compelling reason for IT modernization at SSA. Financial benefits are not the primary driver for modernizing our IT.

- Achieving cost benefits depends on sufficient and sustained funding. Deferring development due to budget austerity increases the risk that systems will not be properly integrated, causing increased expenditures in the future to integrate systems that would have been more easily integrated when all the co-dependent systems were in similar stages of development. Deferring development also increases the risks associated with uncertainty of future costs.

- It is imperative to start modernizing now while the staff who developed the current systems are still available to help. Otherwise, the contractor engagements needed to replace those lost skills come with an increased cost and risk due to limited availability. The average age of an SSA IT staffer is 49 years old, and each year another significant percentage of the staff becomes eligible to retire.

- Modernization will generate *cost benefits* – not *cost savings* – for SSA. These cost benefits will allow SSA to be more efficient and increase our capacity and ability to

address currently unfunded requirements, including continuing modernization. Thus, technical debt will be reduced because investment in the modernization program, which employs more efficient methodologies such as agile and cloud-based infrastructure, will deliver new and more complex capabilities at a lower overall life cycle cost when compared to projected costs of legacy systems.

- In many cases, we will not realize substantial benefits until legacy systems are completely retired. This co-processing period of old applications and the applicable modern replacement may extend beyond one year. We will likely find issues in both the new and old versions which will take time to correct. So, although our core IT modernization is a five-year development initiative, additional IT deployment and retirement may be necessary beyond that time. Up to the point of legacy system retirement, we will experience both the costs of modernization and the cost of maintaining the related legacy systems.

- We will not get off to a 'clean' start. In many cases, older systems are poorly documented and not well understood. Most of our applications have hooks and tentacles in many other applications – some are necessary, others are not; still others are not understood. Parsing applications into executable modernization chunks will take time and must be factored into schedules, costs and benefits. In other cases, systems that should be integrated are not. This means front-line technicians must become experts in navigating among the various systems to accomplish a single business outcome.

- Another benefit category to consider is cost avoidance. Cost avoidance is most effectively estimated in terms of systems downtime. Complete systems failure would cost the agency $25 million per day. Partial unavailability is more likely – the impact in dollars depends on the number and specific down systems.

- Gaining material benefits from modernizing our IT infrastructure is longer term. Our major reliance on mainframe will likely continue for the next five years, or so. Migrating to the cloud and shared services have been identified as the highest cost benefit infrastructure modernization initiatives.

- There are many post-modernization benefits where numbers will not reflect significant benefits realized. For example – better security and reduced risk of systems failure. The modernization addresses four main areas of risk: cybersecurity, system failure, personnel retirements, and programming code obsolescence. Benefits begin to manifest upon the initiation of risk mitigation for these four risk areas, meaning taking steps toward mitigating future risks reflects favorably on our credibility in the areas of budgeting and IT modernization. The likelihood of modernization success increases with each positive-outcome development iteration as risk mitigation picks up momentum.

- During IT modernization, the agency will dedicate development resources to IT modernization-specific initiatives. We will defer any unnecessary improvements or updates to legacy IT applications and processes.

- Costs represent preliminary estimates, which will be further developed and refined during the 2019 budget preparation processes.

Major Categories of Cost Benefits and Ranges of Achievable Benefits

We have identified four major IT modernization areas with opportunities for cost benefits, three of which have quantifiable benefits calculated in the return on investment (ROI).

Data

SSA has collected data over decades for a variety of reasons, and by a variety of applications and tools. The results are:

- Data is being stored in a variety of formats and media. To get better use of this data, it is critical to transform it using consistent standards and storage

- There are silos of data, which results in duplication and inconsistency

- Unstructured data. It is important to convert from unstructured data (such as images) to structured data

- Semi-structured data. Data that is used today, but which requires a lot of effort to find, store and use

We assume data modernization initiatives should ultimately result in a range of annual cost benefits of 10 – 25 percent. Additional assumptions and analysis for range determination can be found in the Forrester Report.

SSA plans to achieve the upper end of the range, but in the nearer term will accomplish the lower end of the range. SSA will incrementally consolidate our databases, modernize our database technology and tools, structure our data, de-duplicate data, and streamline and automate data management.

Applications

SSA was an early investor in automation and applications dating back several decades. At the time, what were modern application development standards and coding methods have now become dated. In addition, each new initiative resulted in a new set of applications, built on top of, or linked to, previous applications. This resulted in:

- A hugely complex interrelationship of applications and data (sometimes poorly documented) – with many dependencies not well understood without the help of systems forensics experts. The opposite case exists as well.

- Over 60 million lines of unstructured or less-structured COBOL code supporting a range of functionality from "Business Critical" to "Unused".

- Duplication of functionality or applications.

- Dependence on an outdated, batch-processing architecture. This will become progressively more difficult to maintain, and will stop meeting the demands of our constituents for accurate and timely processing of SSA activities.

We assume application modernization initiatives should result in a range of annual cost benefits of 10 – 30 percent.

Again, SSA plans to gain momentum, efficiencies and resulting benefits over time. We are confident we can achieve the lower range of the scale given experiences learned on the DCPS2 program, but also realize that tackling 1,300 legacy applications developed over 30 to 40 years is a daunting task that will only gain execution velocity over time. Modernizing our applications entails teasing apart millions of lines of "spaghetti code," eliminating useless and redundant code, connecting applications where automation is needed, structuring code and rewriting it into modern language segments, and identifying and employing useful open source code.

Infrastructure

We rely heavily on mainframe and other centralized processing technologies. While it is possible to continue for some time operating on these stable and reliable technologies, the maintenance costs and the limited productivity inherent in these technologies make them increasingly expensive. Migrating to newer cloud-based, shared and open platform technologies will lower our software and operations and maintenance costs, allowing for more critical development, modernization and enhancement work to take place.

We assume infrastructure modernization initiatives should result in a range of annual cost benefits of 10 – 30 percent.

Though SSA will continue relying on mainframe computing for the foreseeable future, there are several infrastructure initiatives which can realize cost benefits at the lower end of the scale. Examples include: establishing an on-premise cloud; back-office modernization including server optimization and Linux modernization; moving to DevOps; platform independence; and improving IT service management.

Workforce

As IT is modernized at SSA, three significant workforce impacts will occur:

- New technologies require different skills. It is more expensive to maintain outdated skills than to train or hire people with relevant skills. Resources with modern IT skills are more abundant in the marketplace than those with dated skills (e.g., COBOL programmers).

- Consolidation of systems will unite and streamline the teams that manage them, thus resulting in workforce efficiencies.

- Automation will reduce reliance on employees, although it will require different skills to define and manage the automation measures.

Quantifying post-IT modernization workforce efficiencies is difficult based on several factors including but not limited to: hiring restrictions, retirement rates, market conditions five or more years out. We can confidently state that we are developing a future-ready workforce that will be the catalyst for driving the efficiencies and cost benefits attained in data, application, and infrastructure modernization at SSA. By employing methodologies such as agile, we expect a more productive workforce when compared to traditional approaches, thus developing higher quality applications leading to better service to the public.

Return on Investment and Estimated Breakeven Period

SSA is committed to attaining the following expected annual cost benefits upon completion of our IT modernization initiative in the three modernization areas listed below:

- Data – SSA will achieve an assumed 10 to 25 percent cost benefits

- Applications – SSA will achieve an assumed 10 to 30 percent cost benefits

- Infrastructure – SSA will achieve an assumed 10 to 30 percent cost benefits

We can roughly estimate the IT modernization investment payback period using the following assumptions.

- Given that the ranges are similar among the three measured areas; we can assume they hold true when combined

- In our first year after initial systems are in production for IT modernization, we can assume we'll be 10 percent more efficient

- In the second two years, we can assume we'll achieve 15 percent efficiency

- Thereafter we can assume a peak at 20 percent increased efficiency

An average annual SSA IT budget is around $1.6 billion including government labor and IT purchases. Certain elements are not expected to be impacted by our modernization efforts. If we subtract these elements (e.g., telecommunications usage, end user equipment, management and governance), we are left with about $1.0 billion. This remaining amount is used as the basis for calculating the yearly benefit efficiency percentages assumed above, for a total of $787 million in benefits through FY 28.

Considering roughly a $677 million investment in SSA IT modernization and based on the assumptions above, the breakeven period is about nine years. Additionally, preliminary estimates yield an approximate 10 percent discounted return on investment.

Executing the IT Modernization Plan

The SSA IT Modernization Plan is the foundation for achieving SSA's vision. As shown in Figure 6 below, the Plan is informed by a number of critically-important inputs, including the Agency Strategic Plan, which sets the stage for all subsequent inputs by providing the vision that guides the agency.
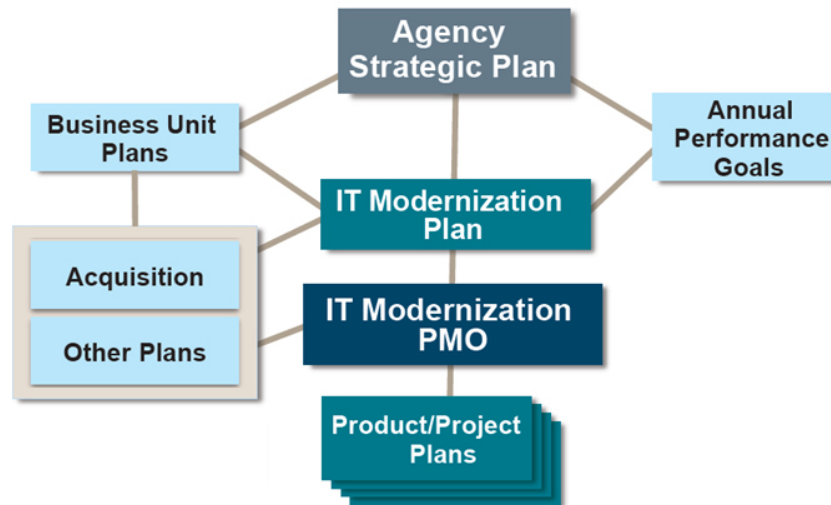

Figure 6: IT Modernization Inputs and Components

The successful execution of the IT Modernization plan will depend on four key components that will create the right environment for long-term sustainability of information technology delivery.

1. Program Management Office (PMO)
2. Governance
3. PMO Operating Model
4. IT Modernization Workforce Development

An important consideration for the IT Modernization Plan is to embrace the positive aspects of the existing IT and business environment while seeking opportunities to improve other aspects. This Plan seeks to infuse new ideas and approaches to product delivery by creating efficient processes and appropriate governance that allows empowered, integrated systems/business teams to deliver.

Program Management Office

Central to the execution of the IT Modernization Plan is the proposed IT Modernization PMO comprised of business and systems personnel providing the leadership, guidance and support to ensure the success of this initiative. The plan and the PMO will receive input from Business Unit Plans that define how we will achieve the vision from an operational perspective, and Annual Performance Goals that are the benchmark by which we can determine the degree to

which we have achieved the vision. Acquisition and other plans provide additional inputs that will be put into action by the PMO and that will guide the product areas and projects.

Governance

Throughout the life cycle of the IT Modernization Plan, many factors may influence or shift the direction or implementation. We expect and anticipate these changes, and are prepared to address them with sound governance practices as they occur.

SSA has a comprehensive set of governance processes that provide oversight and direction for all information technology initiatives across the agency. At the highest level, our governance model comprises:

- Agency Oversight
- IT Modernization Program Management Office
- Supporting Organizations
- Product/Project Governance

Program Management Office

Program Management will be key for us to ensure controls and processes are in place to manage, review and elevate risks or issues as appropriate. The IT Modernization effort will be managed by a central Program Management Office (PMO) and led by the Chief Program Officer (CPO), supported by a Deputy CPO. The CPO will have end-to-end accountability and associated decision authority for delivering IT modernization. The CPO will build a lean PMO team with key resources from systems and business to oversee the functions required to execute the plan. The intent is to make sure the decisions and direction of the IT Modernization effort, along with potential impacts on other programmatic areas, are well coordinated and communicated throughout execution.

Investment Prioritization

Stewardship of the investment process will be accomplished through SSA's Information Technology Investment Process (ITIP). The ITIP is a discipline that coordinates and integrates investment planning, selection, management and evaluation of IT investments. SSA uses a holistic approach when considering each investment, which includes, but is not limited to determining return on investment, benefits to the agency, bundling "like" investments, and leveraging reusable capabilities and components along with shared services.

IT investments are reviewed by an executive Information Technology Investment Review Board (ITIRB) composed of the CIO, CFO, and other Deputy Commissioners as part of SSA's existing investment selection and oversight mechanism - the ITIP. It provides a way to plan, select, manage, and evaluate IT investments. Within ITIP, the ITIRB ensures transparency, strategic alignment and executive oversight.

Domain Governance

At the domain and project levels, our governance model calls for effective integration with the PMO. At the head of each domain we will have a business lead and an IT lead that ensure the

integration of applicable agile process, design, development, testing and implementation governance on a day-to-day basis and provide a direct link back to the PMO to ensure that top-level guidance is conveyed to the operational levels.

Policy and Regulatory Compliance

The Federal Technology Acquisition Reform Act (FITARA) requires that agencies implement adequate incremental software development techniques, such as agile development. SSA has an agile policy in place and a mechanism whereby the CIO can certify compliance when applicable. To further ensure compliance, we will focus on taking full advantage of suitable open source code, shared services and government-wide applications.

The agency will also ensure compliance with Capital Planning and Investment Control (CPIC) requirements, including adoption of Technology Business Management (TBM) and responding to Budget Data Requests (BDR). The SSA IT modernization effort will transparently report progress not only through internal reporting mechanisms but also through mechanisms such as PortfolioStats, TechStats, the quarterly Integrated Data Collection (IDC), President's Management Agenda Benchmarking, and the Federal IT Dashboard (FITDB).

We recognize the significance of the IT Modernization Plan to the agency's ability to meet its mission over the long term and to its success in meeting Administration and Congressional initiatives (such as the Comprehensive Plan for Reforming the Federal Government and Reducing the Federal Civilian Workforce, OMB M-17-22). We will have in place the management systems necessary to track IT Modernization Plan progress, including benefits realization.

Adhering to technical standards and methodologies will be a responsibility that starts with the PMO, and extends into each project team working within the IT Modernization effort. This will include ensuring standards are met for agile process, software engineering, security, audit compliance and quality assurance. Our MDE development pipeline and supporting DevOps methodology are already in place to help ensure compliance to standards.

PMO Operating Model

The operating model for the PMO shown below in Figure 7, aligns resources in a productive manner and creates a structure and process that empowers teams and aligns decision-making at the appropriate level of the organization ensuring that decisions are within the confines of SSA's risk and operating framework. The operating model also provides development opportunities for business and systems personnel, introducing a framework that can scale to effectively and efficiently handle changing enterprise workloads.

Key features of the operating model are as follows:

- Lean, matrix teams that operate as one

- Business and systems joint leadership, beginning with executive/senior level Domain leadership and laddering down to every level of the organization

- Co-location of business and IT teams

- Shared objectives across business and systems

- Deliberate fusion of existing and new expertise across disciplines, as needed

- Projects and people enter and exit the matrix organizations, while balancing continuity with delivery

- Finite-duration personnel assignments which allow for cross-pollination of skills, ideas, process within the operating model
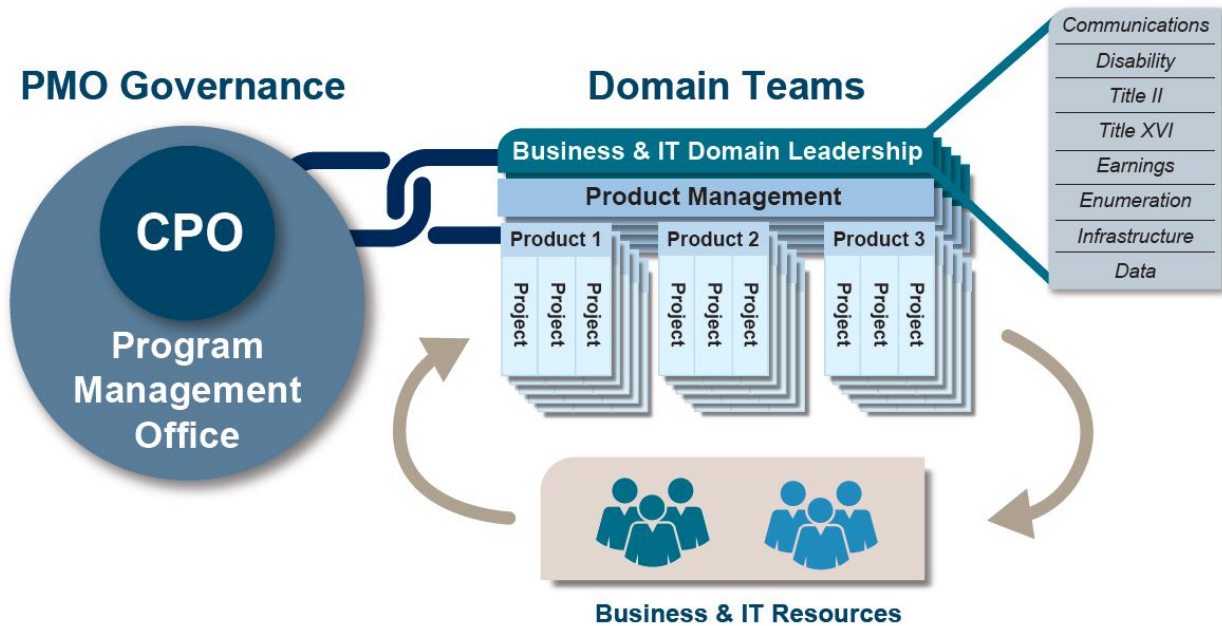

Figure 7: PMO Operating Model

In the operating model, the PMO provides governance to all domain teams in a number of key areas. Each domain team is comprised of one or more products with a Product Management team and domain leadership providing direct guidance and support. Those products are, in turn, comprised of one or more projects staffed by agile teams that will pull work from their product backlogs and sprint towards incremental product deliveries. These agile teams are responsible for learning and discovery, developing, testing, pivoting, and iterating to get their products to completion.

The Product Management team has resources that specialize in business/operations, product management, service design, enterprise architecture, security, DevOps, enterprise data, and user experience design. These resources work across projects to ensure that each project team gets the guidance and support they need to ensure maximum productivity, consistency and governance rigor. This approach subscribes to the fundamentals of scaled agile methodology.

We will configure each project team to meet the needs of the specific product being developed as defined by the Chief Product Manager working with their teams. Each team will include, at a minimum, the essential roles of Product Owner and Project Manager along with the requisite mix of analyst, architect, security, developer, tester, database and DevOps roles.

Many of the resources within IT Modernization, at every level from the PMO to the project teams, will be on rotation, within matrix teams from their original business and system areas as detailed in the following section on IT Modernization Workforce Development. For project team members, knowledge and skills training in agile and DevOps will be provided to those resources that need it prior to beginning their project work. When the projects are completed, these resources will be assigned to other IT Modernization efforts or they may be returned to their original business and system areas. This matrix approach serves us well in two ways: those transferring to new IT Modernization efforts will bring substantial agile and DevOps knowledge and skills to bear on their new projects, and those that return to their original areas will bring the same knowledge and skills to share with others, positively influencing our overall move to a new development mindset across the organization.

IT Modernization Workforce Development

Introduction

SSA's IT workforce comprised of both business and systems personnel is critical to maintaining and modernizing our IT systems. Attracting, continuously developing, and retaining this talent is a critical element and a key success factor for this IT Modernization Plan. This approach includes both bringing in new employees, as well as training existing staff on new technologies, tools, and processes while we maintain expertise in our legacy systems at the same time we transition and phase out those systems. We also recognize the importance of a fungible workforce, where our employees are flexible and able to work across systems and business boundaries.

As we execute our IT Modernization Plan, we continue to design training opportunities that will enable our employees to work effectively in SSA's transforming environment. This includes preparing our employees for the introduction of new technologies and methods that require new skills, as well as modernized systems that require a new approach to organizing work.

Throughout this section, we define our IT modernization workforce plan. In support of this plan, we also provide examples of how we:

- Prepare for and encourage a culture change related to both the new environment and the ability for our workforce to work across system and business boundaries

- Engage with staff in ways that encourage collaboration

- Creatively train and develop the skills of employees to prepare them for transformation

- Promote self-learning to encourage employees to learn new methods and stay up-to-date with external IT practices

- Capitalize on our innovative and talented employees by encouraging them to think outside the box, helping us advance in our modernization

Staffing Strategy and Forecasting

The IT Modernization effort is the highest priority in the agency. Business and Systems will contribute the necessary resources with specific expertise and will allow reach-back as required for additional staffing and support. As previously mentioned in the Governance section, the

Chief Program Officer (CPO) will have accountability and decision authority for executing the IT Modernization Plan. The CPO will have oversight of the initiatives and the infrastructure efforts supporting the initiatives, and will be responsible for tracking and monitoring IT modernization performance. The CPO will ensure that appropriate staffing plans are in place, as each domain must be fully staffed with all skill requirements addressed for the IT Modernization Plan to be successful.

IT Modernization Workforce Requirements (What We Need)

IT modernization will use our talented and skilled employees. We will encourage them to be more proactive and data-driven, and to leverage new technology and practices in the way we work. The IT modernization workforce will be organized to support this initiative. Their skillsets will be refined to better address our modernized environment. This will allow the agency to be flexible and responsive as our environment grows and changes over time.

SSA is committed to a future-ready, agile, and adaptable IT workforce equipped with the modern tools and technologies needed to serve the American people effectively. Some of the skills identified for our employees include: agile, Java, modern development tools and methods as well as other new skills that arise because of evolving technology trends.

Workforce Retention

We are confronted with the challenge of retaining our talented employees in a highly competitive IT environment. The private sector, as well as other federal, state, and local governments compete for our employees who have the IT skills needed to support their respective missions. In relation to IT, employees are seeking to be part of innovative technology and at the forefront of new technology. IT modernization will provide our employees the opportunity for technological innovation, an environment for creative IT collaboration, and the support to be engaged in development and execution of new advancements.

Conclusion

SSA is resolved to improve its ability to provide excellent service to the public across multiple channels using flexible and efficient IT solutions. In this IT Modernization Plan, we described our current state and the tools, techniques, and technologies we will use to reach that desired outcome. We laid out how replacing older systems with proven new technologies and processes will reduce operating costs and improve service on many fronts, including providing new ways for the public to transact with SSA, providing new online services to meet expectations of the public, and protecting critically important data.

We have begun the journey to develop modern systems and business processes in order to keep our service promise to the taxpayer and our beneficiaries. Our continued diligence and prioritized commitment to these efforts will enable us to deliver systems and services that provide the best possible customer experience.

Appendix

Appendix A: Forrester IT Modernization Benefits Report

The Forrester/SSA IT Modernization Efficiencies report analyzed IT modernization efforts concluded or underway at comparable (in terms of mission, size and complexity) entities, and determined ranges of expected efficiencies in a modernized SSA environment.

Introduction

The SSA is embarking on an IT Modernization program that will improve how the Administration uses and manages technology. Improvements in speed, accuracy and efficiency - and the ability to roll out new programs – depend on investment to update or replace systems that are aging to a point where they cannot be sustained.

On the one hand, modernization will bring about much needed change; on the other hand, modernization must be done in a fiscally responsible manner. Benefits that increase the Administration's capabilities and performance will come at a cost, which must be offset by greater efficiencies.

This document focuses on how the Administration can achieve cost efficiencies that will offset the investment in modernization. These are referred to in this document as cost benefits.

This document outlines:

- A perspective on how to measure the success of the program

- Four major categories of cost benefits

- The range of cost benefits that can be achieved for three major initiatives (IT Benefits)

- The conditions that will influence whether the benefit achieved is at the higher or lower end of the range

- Other benefits that should be considered

- Examples of organizations where cost benefits were achieved

Disclaimer

This appendix is based on data relating to the industry and parameters provided by the SSA. The purpose of this document is to provide information on which areas would be candidates for potential cost benefits and to identify how these cost benefits might be achieved. This will be used as input for a more detailed evaluation in the IT Modernization program itself.

A more detailed evaluation would include the following actions:

- Baseline current costs by category

- Identify constraints (policies, contracts, etc.) that will limit cost benefits

- Define cost benefit options and perform cost modeling for each option

Cost Behavior

Cost behavior during an IT Modernization program is complex, and takes the following into account:

- Legacy systems will continue to operate throughout the program:
  - Partly to keep available those systems that will be transitioned later in the program
  - Party to run in parallel with new systems until they are performing reliably

- Any time a new environment is set up, the organization will go through learning experiences that may cause rework or even failure. These are unavoidable because of all the unknowns in the new environment, and the fact that the existing resources are geared to the way the old environment works. Although care should be taken to test assumptions, train resources, and minimize disruption, they will occur and should be allowed for as part of the program costs.

- New systems will ramp up at the same time as legacy systems are ramping down – which means that there will be a period of parallel operation

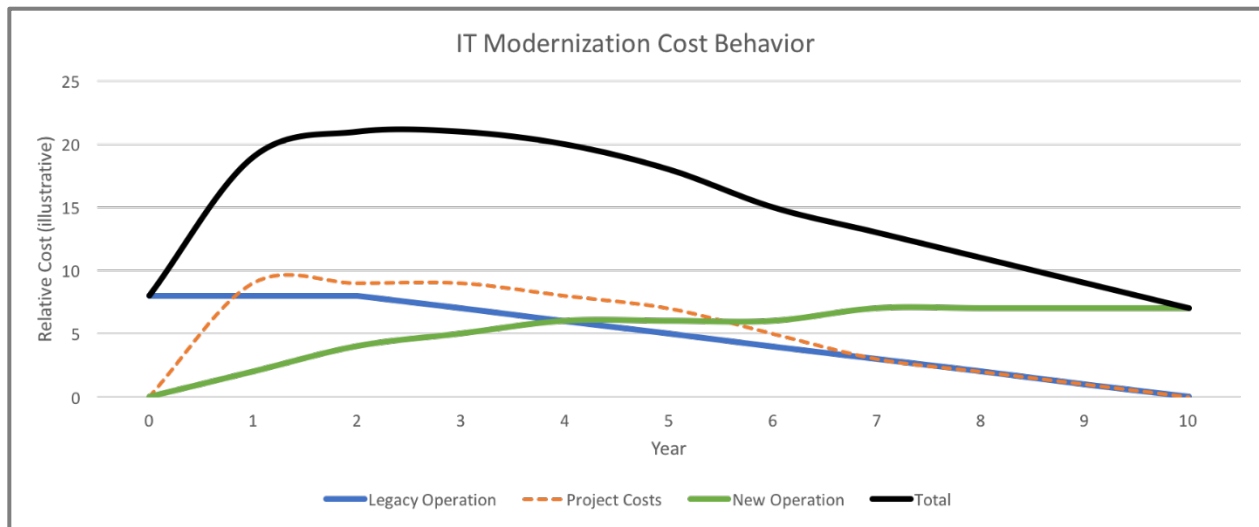These factors are illustrated in the following chart:

Figure 4: Cost Behavior for IT Modernization

In the above chart, the new operation replaces legacy operation and increases efficiency over a 10-year period (purely for illustrative purposes – the actual period could be longer or shorter). However, to get to this point there is a significant increase in total spend during the 10-year period.

Even without investment costs, the cost of maintaining two operational environments are significant. This is shown in the following chart:
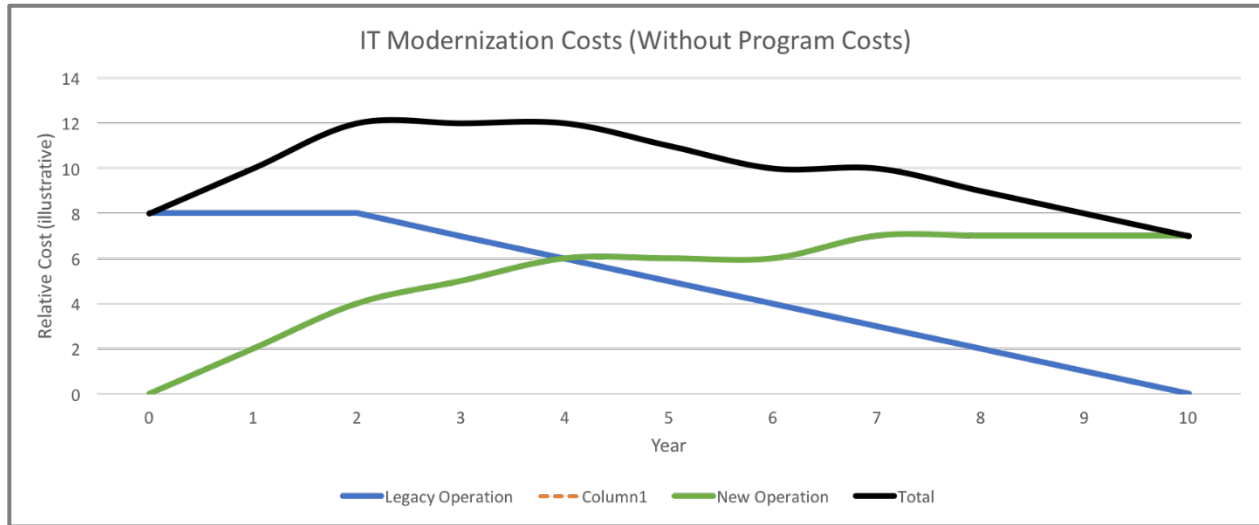
IT Modernization Costs (Without Program Costs)

Figure 5: Cost Behavior for IT Modernization Without Program Costs

Challenge

IT modernization is an expensive and lengthy program. Although efficiencies will be achieved by the time the legacy systems have been transitioned to the new environment, the SSA must decide how to account for the program costs and parallel operation. This cannot be done on a project-by-project basis as the efficiencies achieved in these projects will be consumed many times over by the initial investment.

Suggested Approach: Maintain Focus on the Key Purpose of IT Modernization

Although modern IT is more efficient, no organizations to our knowledge have embarked on this journey expressly to save money. Rather, the purpose of modernization is to replace unsustainable technology and thus increase enterprise effectiveness, accuracy, speed and relevance.

Every project should therefore be measured using the following types of metric:

- Has it solved an existing problem that could not be solved (in a cost-effective manner) in the old environment?

- Has it moved the enterprise closer to its strategic objectives?

- Has it achieved improvements in speed, accuracy and efficiency?

- Has it selected the most efficient option(s) to achieve the desired outcome?

- Did we learn anything about how we should do things differently in future?

- Has the new environment been properly documented and instrumented to track value and ongoing returns on investment?
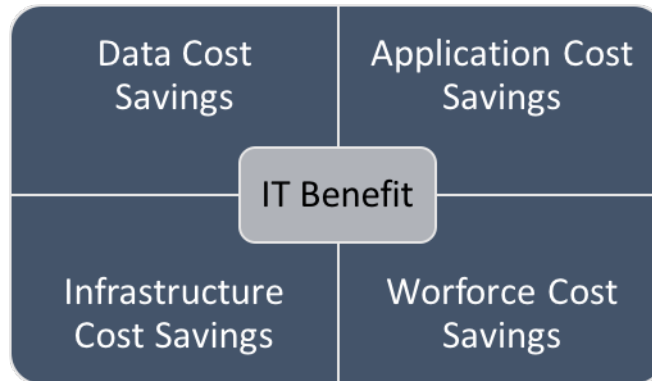
Four Major Sources of Cost Benefit

Figure 6: Cost Benefit Sources

This document identifies four major areas of cost benefit. While each of these brings its own benefit, the combined effect will be greater – since changes in one area will impact how effective the others are:

Data

The SSA has collected data over decades for a variety of reasons, and by a variety of applications. The results are:

- Data is being stored in a variety of formats and media. To get better use of this data it is critical to transform it using consistent standards and storage

- There are silos of data, which results in duplication and inconsistency

- Unstructured data. It is important to convert from unstructured data (such as images) to structured data

- Semi-structured data. Data that is used today, but which requires a lot of effort to find, store and use

Applications

SSA was an early investor in automation and applications date back several decades. What, at the time, were modern application development standards and coding methods have now become dated. In addition, each new initiative resulted in a new set of applications, built on top of, or linked to, previous applications. This resulted in:

- A hugely complex interrelationship of applications and data – with many dependencies not well understood

- Over 60m lines of COBOL code supporting a range of functionality from "Business Critical" to "Unused"

- Duplication of functionality or applications

- Dependence on an outdated, batch-processing architecture. This will become progressively more difficult to maintain, and will stop meeting the demands of Congress and citizens for accurate and timely processing of SSA activities

In addition, there is an unknown number of applications and databases that have been developed by users throughout the organization. The potential duplication and maintenance of these applications is a candidate for significant cost benefits, although it might not initially reflect against the IT budget.

Infrastructure

In line with the SSA's early automation strategy there is a huge investment in mainframe and other centralized processing technologies. While it is theoretically possible to continue operating on this technology, the costs of maintaining aging hardware and the limits to productivity make it increasingly expensive.

The cost of migrating from these technologies has been very high, but the cost of sustaining this technology is increasing, while newer technologies with more open platforms are making migration more feasible.

In addition, many infrastructure cost benefits will result from Data and Application modernization initiatives.

Workforce

Workforce costs are dependent on the nature of the application, data and infrastructures that are used in the SSA. As IT is modernized, three things will happen:

- New technologies require different skills. While this might initially imply an increase in cost, it is more expensive to maintain outdated skills than to train or hire people with relevant skills

- Consolidation of systems will consolidate the teams that manage them, thus resulting in a net reduction in workforce

- Automation will reduce reliance on employees, although it will require different skills to define and manage the automation measures

IT Benefit: Data Modernization

The costs of data are incurred in three major areas:

- Storage, which is made more expensive by:
  - Duplication of data (resulting in double, or more, the amount of required storage)
  - Backup policies
  - Indiscriminate redundancy measures (e.g. providing failover for data that is not often used)
  - Outdated storage equipment that is expensive to maintain and operate
- Preparation for use, where data is collected, collated and staged for use. This is made more expensive by:
  - Inefficiencies in application coding

- The number of applications involved in using and preparing data for a single purpose
- The number of sources where the data must be found
- The amount of processing required to eliminate duplication
- The number of steps data must go through before it can be used

- Processing and analysis, which are made more expensive by:
  - The quantity of data being processed in any single step and the number of steps required to perform the analysis
  - The accessibility of data
  - The amount of processing required to validate and de-duplicate data
  - Outdated or inefficient architecture

Range

Data modernization initiatives should result in a range of efficiencies of 10 – 25 percent.

The upper end of the range represents the savings that an outsourcing company would have to achieve to make the contract profitable. They achieve these savings through standardized architecture and operation, replacing expensive solutions, economies of scale and multi-tenancy.

The lower end of the range is based on an organization that is unable to achieve economies of scale, and relies purely on replacing expensive solutions with cheaper ones.

Cost Benefits

Cost Benefits	
Data	- Database Consolidation - Modernize database technology - Move unstructured data into a lower cost environment - Archive old, unused or unknown data - De-duplicate data - Define and automate data governance to ensure the appropriate level of management for each level of data
Applications	Reduce the need for dedicated, application-based data stores, this saving development time and operational cycles
Infrastructure	- Save MIPS cost with Content Manager - Consolidate file servers - Align storage options to data priority (e.g. only store high priority data in hot failover, fast retrieve infrastructure and move low priority data to offline storage) - Reduce the amount of processing that needs to be done to stage, analyze and report data - Reduction of storage due to indiscriminate backup practices
Workforce	- Reduced data management activities through automation and focusing attention on high priority data management activity - Reduced database administration workload

Additional benefits

Data modernization will have these additional benefits:

- Data governance: a clearer understanding of who is responsible for what data, and how it contributes to the administration's objective, resulting in:
  - Better quality business decisions (since stakeholders know what data they have and how accurate it is)
  - Avoiding projects that create duplicate data
  - Better decisions about what data is kept, where, for how long and at what level of responsiveness
  - Better management of data. In the absence of governance, the IT group will tend to manage data at the highest feasible levels. When governance is in place, these decisions and funding are specified by the person accountable for the data – and IT becomes its steward.

- The ability to automate and use data sources that are not currently available online (e.g. data contained in paper documents). This increases the availability of data and the speed of processing business activities. It also increases the accuracy of those activities.

Spending Required

- Data management and governance tools

- Storage infrastructure. Although the overall cost will be reduced, investment must be made in modern, multi-tier storage technology

- Tools to source, analyze and report data, regardless of where it originated

- Transformation of unstructured data (e.g. images) into structured data

Influencing Factors

- Data Governance: Duplication and unnecessary storage are often the result of data being generated for a specific purpose or application, without the responsibilities and decision rights of that data being assigned for ongoing operation. In the absence of data governance, all data is deemed to be important unless specifically shown otherwise, and is stored at similar levels of availability and responsiveness. To overcome this issue, all projects must identify who is accountable and responsible for resulting data, and what circumstances will alter the meaning, use and priority of that data. This information must become a formal part of operational processes and policies. The following need to be recorded as part of the service models in the service portfolio – or at the very least, in the application portfolio:
  - Intended use of data
  - Decision rights (who has the authority to make decisions and policies about data – especially after the forecast lifespan of the solution?)
  - Retention policies
  - Backup policies

- Policies for unstructured data (including how this will be stored, who will cover the cost, what tools will be used to stage, process and analyze it)

- Tools:
  - Storage management, including de-duplication tools
  - Policy management / enforcement
  - Analysis tools – especially for unstructured data or for using data from disparate sources

Example

A large health insurance company had to organize and store data that had been collected or generated over 25 years, and which was in multiple formats (dedicated application databases, digital documents, physical documents, data from third parties, etc.). The effort took five years and relied on:

- Establishing a data governance approach

- Defining a common architecture approach for all groups in the enterprise

- Using Big Data approaches and tools (Data Warehousing, Data Mining and Data Lakes – along with tools to mine, analyze and use data)

- Data deduplication tools

- A close alignment with business units to identify how data was being used and improving how critical data was accessed, while moving less important data (e.g. historical records) to less expensive storage

The cost benefits in this case were not easy to quantify, for three reasons:

- The improvements were made because of the rising complexity of data and the resulting reduction in application and infrastructure performance – as well as the amount of additional work to define new functionality that used existing data

- The costs of data were not specifically known at the outset of the project, since much of the data was incorporated into applications or was in disparate forms

- The success of the program was measured in IT's ability to be more agile in responding to business needs, and to speed up the performance of applications and data analysis. Therefore, there was more focus on how much investment was needed, than on how much money was saved.

Nevertheless, it was possible for the organization to quantify:

- Time saved in development projects

- A reduction in physical storage by digitizing physical documents

- A reduction in the use of more expensive storage options through archiving and "slower" storage options

- Instead of trying to identify and organize all data, the organization depended on tools (like data lakes) to aggregate and use data. This was especially useful for "orphan" data (where the application was no longer in use, or where the original use was no longer

known or valid, or where data had been procured from a third party). The cost benefit here was measured in terms of cost avoidance, but this was only valid insofar as the organization thought the data was valuable – otherwise a far cheaper option would have been to discard the data completely.

Research References

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- Weigh The Economic Factors of Your Data Center Ecosystem Transformation: https://www.forrester.com/report/Weigh+The+Economic+Factors+Of+Your+Data+Center+Ecosystem+Transformation/-/E-RES119565

IT Benefit: Application Rationalization and modernization

The costs of applications fall into five main categories:

- Development, which is made more expensive by:
  - Requests for duplicate functionality
  - Outdated design and development methodology (including language, tools, testing methods)
  - Diverse development environments, which require investment in disparate architectures and skills
  - Dependence on proprietary components (e.g. databases)
  - Long, cumbersome development and testing cycles
  - Un-economical coding, which increases application complexity, infrastructure investment and maintenance activities
  - Rework

- Licensing, which is made more expensive by:
  - Requests for duplicate functionality
  - Dependence on proprietary components (e.g. databases)
  - Uncoordinated purchasing (e.g. licenses are purchased under several different contracts, which do not qualify for bulk discounts)

- Maintenance, which is made more expensive by:
  - System complexity
  - Architectural flaws, which increase the amount of work to keep systems performing optimally. This has an additional cost of lost productivity when systems must be brought down for maintenance just to achieve acceptable performance levels
  - The need for manual versus automated maintenance activities

- Operation, which is made more expensive by:
  - Manually intensive management activity (e.g. database administration, access control)

- High failure rates (staff are deployed to fix incidents and problems rather than spending time in better design and business support)

- Latent Functionality. These are applications, or parts of applications, which are no longer used or where the value has diminished. They are kept operational because of some dependency or because another component is still necessary. This is made more expensive by:

  - Continuing to pay for licenses, support and infrastructure even though the original business case is no longer entirely valid (including diminished returns on investment)

Range

Application modernization initiatives should result in a range of efficiencies of 10 – 30 percent.

The upper end of the range represents the savings that an outsourcing company would have to achieve to make the contract profitable. They achieve these savings through application rationalization, standardized architecture and operation, replacing expensive solutions, economies of scale and multi-tenancy.

The lower end of the range is based on an organization that is unable to achieve economies of scale, and relies purely on replacing expensive solutions with cheaper ones.

Cost Benefits

Cost Benefits	
Data	- Reduction in duplicate data because of fewer applications and less overlap of functionality - Data governance measures and automation built into applications – result in better managed data, and more targeted storage mechanisms where lower priority data is stored in lower cost options
Applications	- Rationalization will reduce the number of applications, resulting in: - Reduction in overall maintenance efficiency - More cost effective to enhance/update applications - Reduced cost for new applications (less tentacles) - Reduced license costs - Standardization increases efficiency through: - Quicker and lower cost projects because resources are more fungible - Greater interoperability means less cost for integration and interfaces – and less need for duplicate applications in different groups
Infrastructure	- Reduced hosting costs, mainly due to use of virtualization technologies - Reduced storage costs due to better database design and the consolidation of data into fewer applications

	• Reduced compute costs due to the reduction in number of applications performing similar tasks, and also due to simplified functionality architecture (i.e. number of routines required to perform a single transaction) • Virtualization reduces the need for dedicated infrastructure with spare capacity • Testing and release environments using modern development and delivery methods use virtualized devices that are quick and easy to provision and decommission
Workforce	• Expertise for maintenance of obsolete applications no longer needed • Use of modern development and delivery methods reduces time spent waiting for resource availability • Reduced rate for coding in modern language vs. legacy code • Moving from GS-14 step 10 legacy software archeologists to GS-12 working in modern development • Software archeology incurs high contractor costs

Additional Benefits

Application rationalization and standardization will have additional benefits, including:

- Less complex application development, testing and operational environments, thus improving time from request to production
- Using modern application development methods, key functionality can be released quickly and improved incrementally
- Applications themselves require fewer expensive integration utilities or interfaces
- Support is less complex, resulting in quicker maintenance and repair times
- Development staff is more versatile, since they are able to work across multiple applications

Spending Required

- Establishing an integrated build/run cycle
- Selecting a standard methodology
- Training resources in how to use it
- Tools that automate build, test and release
- Functionality mapping
- Standard creation and compliance management (tools and processes that validate that applications have been developed using agreed standards)
- Investment in open frameworks and tools. Although "Open" seems to imply "freely available" this is not the case. Open refers more to the interoperability of systems. Costs include:

   – Licensing

   – Education and training on how to use and manage the frameworks chosen

   – Maintenance

   – Note: Open systems vendors tend to layer services and functionality into the open components to lock their customers in. When investing in open frameworks, it is advisable to choose the most "vanilla" option, or to select a vendor whose strategy most closely aligns to yours

Influencing Factors

- Integration of the Service, Application and Project Portfolios: Separately, these portfolios only cover parts of the ecosystem, at different stages of the service life cycle. Understanding all investment at all stages of the life cycle can only be done when these portfolios are integrated. Of special value is the cost analysis that can be performed when the original use cases, investment models and operations requirements are analyzed consistently at all stages of the life cycle. The cost benefit of performing this step alone is significant since it reduces waste, prioritizes investment and identifies where value is most easily achieved.

- Tight linkage with business strategy processes: Significant costs are incurred when strategy is updated without tracking the decision back to technology components that were originally created to support that strategy. Spending on "business as usual" IT operations activities that are no longer business critical can account for up to 15 percent of cost.

- Agile development methodology: There are both cost benefits and improvements in productivity to be achieved here. Teams use modern technology and design/build methods to reduce release time and use of expensive, dedicated equipment. In addition, the team are multifunctional so the solution is more likely to work reliably from the first release – and is easier to resolve if it does. Cost benefits here come from reduced project durations and workloads, together with more efficient technology usage. Also, the business can get critical functionality faster – which is a boost to productivity.

- Standardization: The more standardized the environment, the easier it is to manage, integrate and build. The workforce requires fewer diverse skillsets, which makes them more efficient, and the tools required to manage the environment are simpler, fewer and easier to use.

- Open architecture: The benefits here are like those of standardization, with the added benefit of being able to integrate between different types of application more easily – especially applications that are external to the Administration. Vendor management becomes easier and more effective. Architecture becomes easier to track and manage – especially where applications must change frequently to meet changes in business, infrastructure capability and vendor.

- Education: Unless the employees (business and IT), contractors and vendors are all aligned on how to use and manage these areas effectively, cost benefits will be restricted to those that allow us to do the same things with cheaper technology. However, even that argument is questionable, since cheaper technologies often end up costing more (e.g. Costs of storage by GB has plunged over the past 10 years, but all that happens is that

organizations store more – resulting in an ever-increasing spiral of storage costs. Another example is that latest generations of programming language and techniques are less efficient and can result in waste if a more disciplined approach is not taken).

Example

A large technology company (300,000 employees) completed an application rationalization and standardization program in 3 years. During this time, they reduced the number of applications by 60 percent and reduced costs by an estimated 30 percent.

The reason that the percentage of cost reduction is not the same as the percentage of application reduction is because many of the decommissioned applications were small and relatively low cost whereas those retained were large, enterprise-wide applications.

The cost benefits came from:

- Reduction in license costs for applications no longer used

- Reduction in maintenance and support costs

- License costs for retained applications grew because users were centralized. This enabled a better discounting structure

- Reduction in infrastructure costs due to lower hosting requirements; and standardized equipment and operations

It should be noted, though, that this was an aggressive program – driven by the CEO, CIO and CFO jointly with a zero-tolerance policy for deviation. Business units were forced to change their way of working, and those that did not were terminated. It should also be considered that much of the duplication was the result of acquisitions – and a large part of the project included standardizing working practices and procedures.

Research References

- Justify Your Hybrid Cloud Future With A Solid Business Case: https://www.forrester.com/report/Justify+Your+Hybrid+Cloud+Future+With+A+Solid+Business+Case/-/E-RES61608

- Vendor Landscape: Hosted Private Cloud, Q3 2016: https://www.forrester.com/report/Vendor+Landscape+Hosted+Private+Cloud+Q3+2016/-/E-RES135733

- Adoption Profile: Hosted Private Cloud in North America And Europe, Q1 2017: https://www.forrester.com/report/Adoption+Profile+Hosted+Private+Cloud+In+North+America+And+Europe+Q1+2017/-/E-RES136826

IT Benefit: Infrastructure Modernization

The costs of infrastructure fall into five main categories:

- Hardware, which is made more expensive by:
  - Inefficiencies in development and design (e.g. specifying dedicated new equipment for each new application developed, instead of using existing infrastructure and virtualized architecture)

- Designing for performance and availability:
  - Designing for continuous availability when lower levels are sufficient
  - Designing for high performance at peak workloads when there are alternatives
  - Failure to understand workloads and designing inappropriately. This increases expenses in both over-design (more capacity is purchased), and under-design (constant attention is required to keep the system functioning at higher levels).

- Facilities, which are made more expensive by:
  - Investment in infrastructure that is not energy efficient
  - Building data centers at the highest tier possible, even when a relatively small percentage of the infrastructure requires it (consider investing in hybrid data center design)
  - Spare space in data centers (which incur power and cooling costs, even when not being used, as well as losing potential to obtain funding from co-location arrangements)

- Operation, which is made more expensive by:
  - Manually intensive operational activities (e.g., server performance tuning, patch management)
  - High failure rates (staff are deployed to fix incidents and problems rather than spending time in better design and business support)

- Latent Capacity
  - During design, it is common for development teams to engineer the solution to anticipate future demand – thus increasing the initial investment on the understanding that heavier use at the end of the life cycle will cover that investment. However, current architectures (such as private cloud) mean that it is possible to gear supply and demand more effectively so that infrastructure is provisioned closer to demand. If design does not take this into account, it is possible to significantly overspend on projects.
  - Note: Some components must be designed to provide supply that is significantly ahead of the demand curve (e.g. network bandwidth). This is a legitimate response to the dynamic nature of demand, and is usually based on past performance, which is projected forward. However, a better understanding of workloads will ensure that the gap between supply and demand is not over-provisioned.

Range

Infrastructure modernization initiatives should result in a range of efficiencies of 10 – 30 percent.

The upper end of the range represents the savings that an outsourcing company would have to achieve to make the contract profitable. They achieve these savings through standardized architecture and operation, replacing expensive solutions, economies of scale and multi-tenancy.

The lower end of the range is based on an organization that is unable to achieve economies of scale, and relies purely on replacing expensive solutions with cheaper ones.

This section includes the potential cost benefits of changing to a private cloud strategy.

Cost Benefits

Cost Benefits	

Data	• The cost of storage per GB is steadily reducing. However, to achieve benefits, the amount of data must remain constant or be reduced – this is covered in the section on Data Modernization
	
	• Direct cost benefits include:
	
	  − Using lower cost storage architecture
	
	  − Differentiating between different levels of data priority and hosting lower priorities of data on lower cost data storage solutions

Applications	• Open source usage: reduced development cost, and quicker time to production • More efficient development through virtualized infrastructure and tools that support modern development and delivery methods • Reduced maintenance cost for more modern applications and hosting environments
Infrastructure	• CA, BMC, IBM tools on the mainframe: won't be paying MIPS charges on x86 • Reduced mainframe cost (assume % of applications that will run on mainframe) • Consolidation of servers and better resource utilization delays purchasing • Just in time provisioning • More efficient hardware reduces the cost of facilities, power and cooling
Workforce	• Operations automation reduces reliance on operators and physical operations activities • Monitoring and control integrated into applications and operations allows for smart responses and automated operations • Skills are more effectively redeployed to higher order service provision activities

Additional Benefits

Infrastructure modernization produces other benefits, including:

- A less complex, more homogenous, environment that is easier to manage through automation

- Fewer specialization required to manage and support the infrastructure

- Modern infrastructure architectures are inherently more stable and easier to recover from failures

- Hardware provisioning and configuration is much quicker and more accurate, resulting in the ability to deploy new or changed solutions faster

- The ability to map business and technology dependencies using tools that are available in modern infrastructures – resulting in more proactive maintenance and support activities

- A workforce that can focus more on higher-level (business support) activities because much of the routine, mundane activities have been automated

- The ability to adjust workloads to meet changing business demand – thus reducing the need for expensive capacity over-design

- More versatile, simpler vendor contracts with clear performance metrics

Spending Required

- New infrastructure (servers, network, storage, etc.)

- Operations management tools

- Monitoring and response tools

- Training and tools for modern development and delivery methods

- Service modeling and portfolio management tools and processes

- Workload management tools

Influencing Factors

- Virtualization: Virtualization on its own does not necessarily save costs, but using the technology to reduce the number of physical servers will result in a reduction of hardware, maintenance and power costs. Combined with other management tools, it also reduces the time to configure and provision servers, and allows the building of more resilient environments (thus reducing the need for redundant infrastructure – although it cannot be a replacement for full physical redundancy).

- Standardization: As with Applications, the more standardized the environment, the easier it is to manage, integrate and build. The workforce requires fewer diverse skillsets, which makes them more efficient, and the tools required to manage the environment are simpler, fewer and easier to use.

- Agile development methodology – where operations-focused engineering and instrumentation are built during the development cycle. Having operations and

infrastructure staff engage in design and build activities results in more reliable systems that operate more efficiently, with a minimum amount of rework.

- Updated operational processes: Technology itself might reduce in cost, but the techniques and skills to manage it will change. It is important to continue to update standard operating procedures, skills, policies and monitoring to ensure that efficiencies continue to be achieved at the higher level.

- Infrastructure components are mapped in the Service Portfolio (service models): A significant amount of time is spent on discovering what components are involved whenever a system is changed, maintained or needs to be repaired. Keeping the service models up to date will be key to keep the cost of the workforce low and productivity high. Note: NO SYSTEM EXISTS TODAY (regardless of vendor claims) that can self-determine linkages between infrastructure, application and business outcome.

- Better understanding of workloads and why, how, when and where they are processed. This will enable better demand forecasting and shorter procurement cycles where the right amount of money is spent at the right time. As pointed out in the Application Initiative, the increase in processing power combined with a reduction in cost does not automatically result in cost benefits. We are in a perfect storm between Moore's Law (processer power doubles every two years) and Say's Law (Supply generates demand).

- Automation: Automating operational activities and workload balancing is key to achieving economies, but setting up automation requires a solid understanding of what is being automated. Again, the Service Portfolio with its service models, combined with clearly documented standard operating procedures is key.

Example

Examples of infrastructure cost benefits are more common. Three examples are:

- A federal agency which has been dealing with budget cuts, which will continue to worsen (initial cost benefits have been in the region of 20 percent, but this is an ongoing project)

- A vendor which consolidated eight data centers to 2 (cost benefits were in the region of 40 percent - mainly because of a reduction in facilities costs)

- A bank which moved from mainframe to server-based technology (initially the cost benefits offset the investment, but over time they expect to save in the region of 15 percent)

All three achieved cost benefits from the same areas:

- Reduction in facilities costs

- Standardizing the architecture for all applications and operations (resulting in savings to licenses, maintenance and staff training and recruiting)

- Automating operational activities

- Reduction in power and cooling costs

In the case of the federal agency, additional cost benefits were achieved by:

- Consolidating activities of multiple programs using shared services

- Standardizing business processes

- Moving maintenance and support activities to a single group per region – instead of having the programs invest in these skills individually

In the case of the vendor, further cost benefits were achieved by:

- Standardizing on systems management software that they produced and marketed themselves

In the case of the bank:

- They used the same facilities, so there were no cost benefits there, although power and cooling were reduced by about 10 percent

- Maintenance costs were reduced

- Investment was required to migrate applications to the new infrastructure, and rewriting of the applications is ongoing

Research References

- Strategic Benchmarks 2013 IT Infrastructure: IT Complexity And Growing Business Demands Orient Infrastructure Priorities Toward Increasing Hardware and Cost Efficiency: https://www.forrester.com/report/Strategic+Benchmarks+2013+IT+Infrastructure/-/E-RES89422

- Five Data Center and IT Infrastructure Lessons From The Cloud Giants: https://www.forrester.com/report/Five+Data+Center+And+IT+Infrastructure+Lessons+From+The+Cloud+Giants/-/E-RES101601

One Further Cost Benefit to Consider

So far, this document has identified the significant program costs and the costs of running parallel systems; and then focused on how these costs can be offset over time by the efficiencies achieved in Data, Application and Infrastructure modernization.

However, the SSA is investing in technologies that position it to offset the costs more directly using external funding. The rationale is as follows:

- The SSA is using a modern, open (cloud based) architecture to modernize IT. Effectively the SSA is becoming a cloud service provider in its own right

- The efficiencies created, and the nature of the architecture, will result in spare capacity in two areas:
  - Facilities: The new technology will not require as much physical space to run, but the SSA data centers already exist. Reducing the hardware footprint will result in spare data center space.
  - Infrastructure: The nature of the infrastructure being deployed makes it very easy and cost effective to provision and de-provision additional equipment as needed

- There are many federal agencies or offices that are facing similar challenges to the SSA, but which are not big enough to embark on as ambitious a project as the SSA's IT modernization initiative

- The SSA is well positioned to be able to provide a range of services to these groups, for example:
  - Co-location: where spare data center space is provided for other entities to set up and manage their own IT environment
  - Cloud services: Initially these are likely to be Infrastructure or Platform as a Service (IaaS or PaaS), although it is possible that certain functionality may be provided on a SaaS basis in future). In a commercial cloud service provider, these would represent significant revenue streams achieved through "economies of scale". For SSA, these could represent significant funding to offset IT modernization investment.

Conclusion

IT modernization is an unavoidable and necessary initiative for the SSA. Although this initiative will require significant funding, it is clear that SSA intends to use this initiative to drive:

- Less complexity, resulting in systems that are easier to develop, manage and (if appropriate) decommission

- The use of open, versatile technologies. These will encourage simplicity, make interoperability easier to achieve, and reduce the amount of specialization required to keep the administration running.

- Standardization of key technologies wherever possible, to achieve ease of management, ease of use, and higher levels of agility

- Better governance that allows all stakeholders to be involved in decisions that balance investment and outcomes, without sacrificing functionality and performance

The three initiatives outlined in this document (Data Modernization, Application Rationalization and Standardization, and Infrastructure Modernization) will help the SSA to:

- Improve the performance of all mandated functions due to increased accuracy and speed of the new technology

- Achieve greater accuracy and speed for all standard transactions

- Initiate new programs more quickly and cost effectively

Appendix B: Legislative and Executive Authorities

For the purpose of this appendix, "authorities" is an all-inclusive term for laws, regulations, guidance, mandates, and any other governing document or statement issued by the Legislative, Executive, and Judicial branches of the government of the United States of America. Authorities are presented in chronological order.

Legislative Authorities

- The Social Security Act of 1935 (Public Law 74-271, codified as Title 42 United States Code Chapter 7) establishes the Social Security Administration and authorizes its activities.

- The Privacy Act of 1974 (Public Law 93-579) establishes a Code of Fair Information Practice that governs the collection, maintenance, use, and dissemination of personally identifiable information about individuals that is maintained in systems of records by federal agencies. The Privacy Act requires that agencies give the public notice of their systems of records by publication in the Federal Register. The Privacy Act prohibits the disclosure of information from a system of records absent the written consent of the subject individual, unless the disclosure is pursuant to one of twelve statutory exceptions.

- The Paperwork Reduction Act (PRA) of 1980 (Public Law 96-511), amended by the Paperwork Reduction Act of 1995 [44 U.S.C. Chapter 35]), is designed to reduce the total amount of paperwork burden the federal government imposes on private businesses and citizens. OMB review considerations range from policy issues to statistical design and methodology.

- The Federal Managers' Financial Integrity Act (FMFIA) of 1982, Public Law 97-255, requires agencies to evaluate the ability of internal controls to protect federal programs against fraud, waste, abuse, and mismanagement. Agencies must report annually to the President and the Congress on the effectiveness of internal controls and any identified material weaknesses.

- The Government Performance and Results Act (GPRA) of 1993 (Public Law 103-62) is a series of laws designed to improve government performance. GPRA requires agencies to set goals, measure results, and report their progress. In order to comply with GPRA, agencies create strategic plans, performance plans, and conduct gap analyses of projects.

- The Clinger-Cohen Act (CCA) of 1996 (Public Law 104-106, Division E) is a part of the FY 96 National Defense Authorization Act (NDAA) and was formerly known as the Information Technology Management Reform Act (ITMRA) of 1996. The CCA is designed to improve the way the federal government acquires, uses and disposes of information technology.

- The Electronic Government (e-Gov) Act of 2002 (Public Law 107-347) was created to improve the management and promotion of electronic government services and processes by establishing a Federal CIO within OMB as well as a framework to improve citizen access to government information.

- The Federal Information Security Management Act (FISMA) of 2002 (Public Law 107-347) was signed into law as a statute within the Electronic Government (e-Gov) Act of 2002. FISMA is a comprehensive framework that defines specific measures to mitigate

cybersecurity risks. The act requires each federal agency to develop, document, and implement an agency-wide program to provide information security for the information and information systems that support the operations and assets of the agency, including those provided or managed by other agency, contractor, or other source. FISMA assigns specific responsibilities to agencies, the National Institute of Standards and Technology (NIST) and the Office of Management and Budget (OMB) in order to strengthen information security systems.

- Openness Promotes Effectiveness in our National (OPEN) Government Act of 2007 (Public Law 110-175) To promote accessibility, accountability, and openness in Government by strengthening section 552 of title 5, United States Code (commonly referred to as the Freedom of Information Act).

- The GPRA Modernization Act (GPRAMA) of 2010 (Public Law 111-352) requires agencies to publish their strategic and performance plans and reports in machine-readable formats. GPRAMA also provides enhanced performance planning, management, and reporting tools that can help inform congressional and executive branch decision making to address significant challenges facing our nation. If effectively implemented, GPRAMA is designed improve information sharing and coordination among federal agencies while helping address issues that hinder the government's ability to address fragmentation, overlap, and duplication.

- The Digital Accountability and Transparency Act (DATA) of 2014 (Public Law 113-101) is a law that aims to make information on federal expenditures more easily accessible and transparent. The law requires the U.S. Department of the Treasury to establish common standards for financial data provided by all government agencies and expand the amount of data that agencies must provide to the government website, USASpending.gov. The law is to improve the ability of Americans to track and understand how the government is spending their tax dollars.

- The Federal Information Technology Acquisition Reform Act (FITARA) for fiscal year 2015 (Public Law 113-291) gives chief information officers (CIOs) greater authority over IT investments. FITARA requires the heads of the following agencies to ensure that their respective chief information officers (CIOs) have a significant role in IT decisions, including annual and multi-year planning, programming, budgeting, execution, reporting, management, governance, and oversight functions.

Executive Authorities

- The 25 Point Implementation Plan to Reform Federal Information Technology Management[1] (also referred to as the 25 Point IT Reform Plan), issued on Dec. 9, 2010, outlines 25 areas Federal Agencies need to address in producing greater return for the government's investment in IT.

- The National Institute of Standards and Technology (NIST) is responsible for developing standards and guidelines, including minimum requirements, for providing adequate information security for all agency operations and assets; but such standards and guidelines shall not apply to national security systems. For example, NIST issued guidelines for Cloud Computing and applying the Risk Management Framework:

- NIST SP 800-145, The NIST Definition of Cloud Computing[2], September 2011, errata amendments on 27 April 2012.

- NIST SP 500-292, NIST Cloud Computing Reference Architecture[3], September 2011.

- NIST Special Publication 800-37 Revision 1, Guide for Applying the Risk Management Framework to Federal Information Systems[4], 5 June 2014.

- Executive Order 13589, Promoting Efficient Spending, 9 November 2011, advises that, to promote further efficiencies in IT, agencies should consider the implementation of appropriate agency-wide IT solutions that consolidate activities such as desktop services, email, and collaboration tools.

- Executive Order 13610, Identifying and Reducing Regulatory Burdens, 10 May 2012, requires agencies to conduct retrospective reviews of regulations to identify and eliminate waste. In implementing and improving their retrospective review plans, and in considering retrospective review suggestions from the public, agencies shall give priority, consistent with law, to those initiatives that will produce significant quantifiable monetary savings or significant quantifiable reductions in paperwork burdens while protecting public health, welfare, safety, and our environment. To the extent practicable and permitted by law, agencies shall also give special consideration to initiatives that would reduce unjustified regulatory burdens or simplify or harmonize regulatory requirements imposed on small businesses.

- Executive Order 13642, Making Open and Machine Readable the New Default for Government Information, 9 May 2013, advises that, to promote continued job growth, Government efficiency, and the social good that can be gained from opening Government data to the public, the default state of new and modernized Government information resources shall be open and machine readable. Government information shall be managed as an asset throughout its life cycle to promote interoperability and openness, and, wherever possible and legally permissible, to ensure that data are released to the public in ways that make the data easy to find, accessible, and usable. In making this the new default state, executive departments and agencies (agencies) shall ensure that they safeguard individual privacy, confidentiality, and national security.

- Executive Order 13681, Improving the Security of Consumer Financial Transactions, 17 October 2014, requires agencies to protect consumer data through: secure government payments, identity theft remediation, securing federal transactions online, and other personal data protection as appropriate.

- OMB Circular A-11[5], titled "Preparation, Submission, and Execution of the Budget," November 2014, provides guidance on preparing the next United States federal budget and instructions on budget execution.

  - Part 1 provides an overview of the budget process. It outlines the basic laws that regulate the budget process and the terms and concepts you need to know to understand the budget process and this Circular. (Sections 10 through 22)

  - Part 2 covers development of the President's Budget and tells you how to prepare and submit materials required for OMB and Presidential review of agency requests and for formulation of the next budget, including development and submission of performance budgets. A significant portion of Part 2 focuses on the preparation of the Budget

Appendix and the related database. Detailed instructions for a number of requirements not directly related to the preparation and production of the budget are accessible through electronic links that are provided in section 25. (Sections 25 through 95)

– Part 3 discusses sequestration, budgetary supplementals and amendments, deferrals and Presidential proposals to rescind or cancel funds, and investments. (Sections 100 through 113)

– Part 4 provides instructions on budget execution, including guidance on the apportionment and reapportionment process, a report on budget execution and budgetary resources (SF 133), and a checklist for fund control regulations. (Sections 120 through 150)

– Part 5 covers federal credit programs, including requirements related to the preparation of budget estimates and to budget execution. (Section 185)

– Part 6 describes requirements under the GPRA Modernization Act (GPRAMA) and the Administration's approach to performance management including: a) requirements for agency strategic plans, annual performance plans and reports on a central website; b) Agency Priority Goals and Cross-Agency Priority Goals; c) reviews of agency performance; d) Federal Program Inventory; and e) elimination of unnecessary agency plans and reports. (Sections 200 through 290)

– Part 7 contains supplementary materials. (Appendices A through K and the Capital Programming guide)

• Executive Order 13702, Creating a National Strategic Computing Initiative, 29 July 2015, establishes the initiative among agencies to conduct research and development and a national coordinated effort to advance the science of high performance computing (HPC) for the betterment of the nation.

• Executive Order 13707[6], Using Behavioral Science Insights to Better Serve the American People, 15 November 2015, encourages agencies to leverage modern insights into behavioral science to improve government interactions with the People.

– A growing body of evidence demonstrates that behavioral science insights -- research findings from fields such as behavioral economics and psychology about how people make decisions and act on them -- can be used to design government policies to better serve the American people.

– Where Federal policies have been designed to reflect behavioral science insights, they have substantially improved outcomes for the individuals, families, communities, and businesses those policies serve. For example, automatic enrollment and automatic escalation in retirement savings plans have made it easier to save for the future, and have helped Americans accumulate billions of dollars in additional retirement savings. Similarly, streamlining the application process for Federal financial aid has made college more financially accessible for millions of students.

– To more fully realize the benefits of behavioral insights and deliver better results at a lower cost for the American people, the Federal Government should design its policies and programs to reflect our best understanding of how people engage with, participate in, use, and respond to those policies and programs. By improving the effectiveness and efficiency of Government, behavioral science insights can support a range of

national priorities, including helping workers to find better jobs; enabling Americans to lead longer, healthier lives; improving access to educational opportunities and support for success in school; and accelerating the transition to a low-carbon economy.

- Executive Order 13718, Commission on Enhancing National Cybersecurity, 9 February 2016, establishes within the Department of Commerce a commission to study and coordinate planning across agencies to enhance the nation's cybersecurity practices.

- OMB Circular A-123[7], M-16-17, Management's Responsibility for Enterprise Risk Management and Internal Control, 15 July 2016, requires agencies to develop, maintain, and assess the effectiveness of internal controls to prevent fraud, waste, abuse, and mismanagement. Revisions in 2016 introduced the concept of managing risks with Enterprise Risk Management. (See, related, NIST 800-37, Guide for Applying the Risk Management Framework to Federal Information Systems, 5 June 2014).

- OMB Circular A-130[8], Managing Information as a Strategic Resource, 17 July 2016, establishes general policy for the planning, budgeting, governance, acquisition, and management of Federal information, personnel, equipment, funds, IT resources and supporting infrastructure and services. Circular A-130 was first issued in December 1985 to meet information resource management requirements that were included in the PRA of 1980 (Public Law 96-511).

- M-16-21, Federal Source Code Policy, 8 August 2016, ensures that new custom-developed Federal source code be made broadly available for reuse across the Federal Government.

- Executive Order 13765, Minimizing the Economic Burden of the Patient Protection and Affordable Care Act Pending Repeal, 20 January 2017, requires agencies with responsibility under the PPACA to "exercise all authorities under the law" to minimize actions that execute the provisions of the PPACA. The order requires agencies to "waive, defer, grant exemptions from, or delay the implementation of any provision or requirement of the Act that would impose a fiscal burden on any State or a cost, fee, tax, penalty, or regulatory burden on individuals, families, healthcare providers, health insurers, patients, recipients of healthcare services, purchasers of health insurance, or makers of medical devices, products, or medications".

- Presidential Memorandum, Regulatory Freeze Pending Review, 20 January 2017, requires agencies to halt action on new and pending federal regulations to allow time for administration leadership to thoroughly review and understand the regulations. Agencies have been discussing pending regulations with administration leadership using summaries in the forms of fact sheets and briefings.

- Executive Order 13771, Reducing Regulation and Controlling Regulatory Costs, 30 January 2017, is an executive action to "manage the costs associated with the governmental imposition of private expenditures required to comply with Federal regulations. Toward that end, it is important that for every one new regulation issued, at least two prior regulations be identified for elimination, and that the cost of planned regulations be prudently managed and controlled through a budgeting process."

- Executive Order 13777, Enforcing the Regulatory Reform Agenda, 24 February 2017, mandates agencies have a Regulatory Reform Officer to "oversee the implementation of

regulatory reform initiatives and policies to ensure that agencies effectively carry out regulatory reforms, consistent with applicable law". Enforces Executive Order 13771.

- Executive Order 13781, Comprehensive Plan for Reorganizing the Executive Branch, 13 March 2017, requires the Director of OMB to submit, no later than 9 September 2017, a plan "to reorganize governmental functions and eliminate unnecessary agencies (as defined in section 551(1) of title 5, United States Code), components of agencies, and agency programs".

- OMB Budgetary Impact Analysis for Executive Order 13781, 14 March, 2017, discusses the expected budgetary impact of reorganizing the executive branch.

- M-16-NN, Information Technology Modernization Initiative[9], no date, public comment period closed, OFCIO is currently adjudicating feedback. This memorandum provides guidance to agencies on planning for the modernization of at-risk information technology (IT) systems. It establishes a series of actions for agencies to implement to support the modernization of inefficient and insecure IT systems.

[1] Find the 25 Point Implementation Plan to Reform Federal Information Technology Management here: https://www.dhs.gov/sites/default/files/publications/digital-strategy/25-point-implementation-plan-to-reform-federal-it.pdf

[2] Find the NIST Definition of Cloud Computing here: http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf

[3] Find the NIST Cloud Computing Reference Architecture here: https://bigdatawg.nist.gov/_uploadfiles/M0008_v1_7256814129.pdf

[4] Find the Guide for Applying the Risk Management Framework to Federal Information Systems here: http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-37r1.pdf

[5] Find OMB Circular A-11 here: https://www.whitehouse.gov/sites/default/files/omb/assets/a11_current_year/a11_2015.pdf

[6] Find Executive Order 13707, Using Behavioral Science Insights to Better Serve the American People, here: https://obamawhitehouse.archives.gov/the-press-office/2015/09/15/executive-order-using-behavioral-science-insights-better-serve-american

[7] Find OMB Circular A-123 here: https://obamawhitehouse.archives.gov/sites/default/files/omb/memoranda/2016/m-16-17.pdf

[8] Find OMB Circular A-130 here: https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/OMB/circulars/a130/a130revised.pdf

[9] Find M-16-NN, Information Technology Modernization Initiative here: https://policy.cio.gov/it-modernization/