ICT-4010: Enterprise Architecture

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Executive Summary

The US Census Bureau has a Constitutional obligation to accurately and efficiently count the population every 10 years and is now relying on Enterprise Architecture (EA) systems to perform tasks previously done by hand. The EA has been developed and is nearing the end of TOGAF ADM iterations to the implementation phase. Budgetary constraints and inefficient appointment of leadership has caused a number of IT systems to have no established deadlines or deadlines that cannot be met. As a result the entire new EA system may need to go live without testing which could lead to dire consequences. The fate of our democracy hinges on the census to define our representation accurately.

Many of the issues stem from budget constraints and excitement that the EA architect's claims that the same work can be done for less money using the new IT infrastructure. This makes stakeholders reluctant to give out critical funding needed to test systems and train employees in how to use it. The responsibility to appoint leadership is that of the stakeholders. EA governance is lacking from proper leadership. Stakeholders are hampering progress in two important areas that could cause the entire initiative to fail but could be remedied if they made this a priority.

The Bureau needs to plead with stakeholders for the money needed to expedite training, hire consultants, and an EA Architect to lead the change initiative in lieu of proper direct leadership. The stakeholders hold the power to aggressively push the necessary tests and systems.

Background

The US Census started in 1790, as mandated by the Constitution, to provide data on populations across the growing country for the purposes of providing fair representation in government from each state. The Census is pivotal in ensuring a fair and just democracy in our country. The US Census Bureau (UCB), which began in 1880, collected data on populations using ever evolving techniques and technologies moving into the twenty-first century. The first census, done by hand counted 3.9 million people (UCB, 2000). Over 308 million were counted in the 2010 census using a variety of technology and IT infrastructure to compile a multitude of demographic data (UCB, 2010).

The UCB is a government bureaucracy and as such it is not able to radically and rapidly change to adopt new technologies (Coates 2016). The Government Accountability Office (GAO) is the entity charged with seeing that the UCB is meeting goals. The census is a complex undertaking and requires a huge amount of personnel, a complex enterprise data collection system (called the Census Enterprise Data Collection and Processing, or CEDCAP)(GAO 2016), effective leadership, and a well thought out EA framework. CEDCAP “is a complex modernization program intended to deliver a system-of-systems for the Bureau’s survey data collection and processing functions” (GAO 2016). As recently as August, 2016, data collection and data processing have not been able to coordinate schedules, requirements and risks and have not yet produced processes for interdependency management (GAO 2016).

As the 2020 census approaches, the UCB is rolling out new large scale technology changes (GAO 2016). With massive changes come problems. The GAO (2016) reports that security concerns, especially phishing attacks, are challenges with the coming census. Additional challenges include reaching deadlines for testing, development, and integration before major tests in 2018. Half of the 50 systems have no established deadline or are expected after the August 2017 start date (GAO 2016). The underlying problem appears to be with management and planning (GAO 2016).

Current Census EA

Until 2012, the UCB did not have an EA plan in place and the initial solution did not to follow a particular framework, but was 'fit-for-purpose' (Otto, 2014). The focus of the framework was a vetting process for software and governance standards (Otto, 2014). Before the framework was put into place, each division in UCB purchased Commercial-off-the-shelf (COTS) software which resulted in many copies of the same redundant software (Otto 2014). Though not mentioned specifically, the EA began with a good strategy, similar to the Phase A of the TOGAF ADM. This strategy phase looked at available technologies and how they could meet their goals. Before the EA began, there was a lot of duplication of efforts which needed to be remedied (Otto 2014).

The framework needed to be examined with the idea of the "survey life cycle" in mind (Otto 2014) which understands that the decennial census required special technologies and efforts. The EA architect, Necarisa McKinnon, had this to say, "The Census Bureau [is] a survey operation — we count people, we want to be a leader in providing data," McKinnon said. "The survey life cycle was a way to provide a common language that had to do with our overall mission, so that we can begin to transform the bureau from an organizational structure toward a more functional structure. Instead of

‘this division does this and that division does that,’ we build surveys and here are the functions. Despite what organization we have, we build surveys.” (Otto 2014).

The development shops in the UCB were the problem areas after EA implementation (Otto 2014). To alleviate the lack of opportunity of integration across mission applications, UCB employed the use of APIs to try and create better data flow and efficiency (Otto 2014).

As of 2015, the UCB has a formal EA and Infrastructure Transition Plan (CEAITP). This document was released to bring up current IT 2015 infrastructure state to handle the 2020 census and to address several tasks including, reengineering address canvassing, optimizing self-response, utilizing administrative records and third-party data, and reengineering field operations (UCS 2016). There have been 50 IT systems added to or will replace legacy systems in for the 2020 census including GIS systems that will save census workers from walking 11 million blocks (Thompson 2017).

A full review of every detail of the UCB EA would be out of scope for this analysis mainly because not every detail of the EA is publicly presented.

Identified Issues

- Organizational, Management, Strategy, Financial, People, Culture
    - Management is weak and is unable to coordinate schedules and deadlines for critical systems and tests. (GAO 2016)
    - Budget constraints from stakeholders are holding back progress.
    - Expecting new IT to be more effective and cost saving before implementation of EA – “cart before horse”.
    - Eliminating ‘bad habits’ and inefficient processes from bureaucratic culture is difficult.
- Data, Information & Knowledge
    - Data security challenges have been identified and need to be addressed. (GAO 2016)
- Information Technology, Other Technology
    - Infrastructure is not in place to handle more users through new technology. (GAO 2016)
- Architecture frameworks, reference models, patterns, Implementation
    - Need for a review of EA framework and Risk Management frameworks to ensure that all challenges are met. (GAO 2016)

Analysis

Management and Culture

There has been no deputy director of the UCB since January 2017 (Vinki 2017). On May 9, 2017, the UCB Director announced his resignation with last day in June with no clear reason as to why or if he was pushed out (Bahrampour 2017). Ken Prewitt suggests his stepping down was that the Director has lost confidence in the Commerce Secretary and needs to step aside (Vinik 2017). His appointment was expected to expire in December of 2016 but he was expected to remain in his position until 2017 (Bahrampour 2017). In a hearing a week prior the resignation, the director stated that the Bureau was underfunded by nearly 50 percent (Bahrampour 2017). The current administration has been lackadaisical in filling open positions throughout government so the replacement of the position "could take a while" (Bahrampour 2017). Compounding the issue of management, Congress decides the budget for UCB. Congress expects the 2020 census to cost as much as the 2010 census. A former Capitol Hill staffer stated, "They're not accounting for inflation; they're not accounting for the 30 million more Americans, for the fact that people don't have hard [telephone] lines anymore. And you're going to do the census for the same amount of money? That's not possible." (Bahrampour 2017). Politics plays a role in the Census which can cause abrupt changes in management at inopportune times.

Gap Analysis

As of May, 3 2017, the Enterprise Architecture (EA) architect hired in 2012 to implement the EA, Necarissa McKimmond, was not on the official employee list. It is unclear whether her role was as a contractor, consultant or full time employee. Either

way, the lead architect on the project is no longer with the team. The impact of this is difficult to gauge, but the reports of failures to implement projects in a timely manner could be a result. The EA suggests that Agile development methods are being used in the IT infrastructure component (UCB 2016 p18/119). Can the culture of a bureaucracy foster an effective Agile development environment? Agile development requires a series of sprints that break down tasks to be completed in specific time periods with detailed stakeholder feedback (Bente 2012). If management is not participating, or the vision of the projects are not clear, the stakeholders can lose control over the team and deadlines can be missed. Budget constraints can make Agile development fail if overtime is required to complete tasks. In addition, employees that are products of a bureaucratic environment may not translate well to the Agile format.

GAO (2016) reported that employees lacked the proper competence to complete the work of developing Cloud Computing, Security Integration, and Enterprise Engineering, Specifications Development, and Agile developers.

Data Security

Master Data Management (MDM) is an important part of managing an EA that is heavily into data and protecting privacy. One component of the MDM is the Base Services component with the Security and Privacy Domains (Godinez 2010). Security can be found in the Technology Layer for Information Services in the Operational Model Diagram. Security Management Services can be found in the IT Services & Compliance Management Services elements. This group encompasses all security features including firewalls, authentication, encryption, and access control (Godinez 2010).

Data security has been identified by GAO to be lacking in several respects (GAO 2016). GAO lists of the security challenges for UCB (GAO 2016):

- minimizing the threat of phishing aimed at stealing personal information, which could target 2020 Census respondents, as well as Census employees and contractors;
- ensuring that individuals gain only limited and appropriate access to 2020 Census data;
- adequately protecting approximately 300,000 mobile devices;
- ensuring adequate control of security performance requirements in a cloud environment, such as those related to data reliability, preservation, privacy, and access rights;
- adequately considering information security when making decisions about the IT solutions and infrastructure supporting the 2020 Census;
- making certain that key IT positions are filled and have appropriate information security knowledge and expertise;
- ensuring that contingency and incident response plans are in place that encompass all of the IT systems to be used to support the 2020 Census;
- adequately training Bureau employees, including its massive temporary workforce, in information security awareness;
- making certain that security assessments are completed in a timely manner and that risks are at an acceptable level; and
- properly configuring and patching systems supporting the 2020 Census.

Gap Analysis

Improved risk management is important to a successful EA. Benefits of improved risk management include reduced business risk, increased disaster tolerance, and reduced security breaches (Ross 2012). The goal of the census has the fate of

hundreds of billions of dollars at stake as well as the privacy concerns of potentially every person in America. A critical goal for the EA for the UCB is maintaining and establishing security frameworks.

It would appear that many of the security concerns are tied to the budget constraints and management inefficiency by not getting many of the project initiatives completed on time. The EA has plans to use SOA to implement an Enterprise Service Bus (ESB) system to reduce costs and avoid rewrites (UCB 2016 p19/119). The plan to implement COTS systems should help utilize SOA and can also be used for several of the security concerns.

TOGAF describes in several sections the importance of having properly trained employees, especially in Phase G, the Implementation Phase (TOGAF 2011). This phase involves testing and spinning up new systems. UCB is failing in this phase from a lack of proper employees.

Growing IT Challenges

Each decade the UCB is faced with a larger and more complex task. UCB needs to adapt to new types of data to be collected and the technology with which the data is collected. The population continues to grow which adds more data collection and the need for newer data collection methodologies and technologies. The UCB has been using computer technology to assist in data collection and analysis since the 1950s (UCB 2000). There have been many advancements in IT technology that were previously unavailable since the last census in 2010 due in part by Moore's Law and Kurzweil's Law of acceleration (Berman 2016). Being in the 'state of technology' that we

are in and because the census is taken every ten years, the UCB needs to reinvent itself with every iteration.

Preparing for the census is a very labor intensive task. In addition to the 12 primary regional UCB field offices in major cities, during the census collection period, there have been up to 500 offices and nearly 500,000 enumerators (Burke 2006). During the 2000 census, 95 percent of questionnaires were mailed. When they are not returned, enumerators visit individual homes to follow up by conducting in person interviews. Management of any enterprise at this scale is extremely challenging especially one that is cyclic like the census. The UCB also employs many contractors and sub-contractors for much of their work. As with the majority of government work, these contracts are often awarded to the lowest bidder.

Congress, the stakeholders for the UCB, expect the 2020 census to cost the same as it did in 2010 (UCB Strategic Plan 2013). Inflation of the dollar makes this request unreasonable in itself. The UCB suggested that the new systems could save 5 billion dollars over time (Gunter 2017). The EA plan outlines steps to implement major IT infrastructure upgrades to completely change how the primary methods of collecting data are performed. The 5 billion dollar cost savings could be possible in a typical EA in a business, but because of the type of business the UCB is, this may not be realistic. The management of the UCB should have never agreed to this budget. A request was recently made for a budget increase but was not received well (Gunter 2017).

Issues with scalability are not necessarily with the planned EA and the IT infrastructure. The problems that could arise are with the new systems. Many of the new systems rely on other systems that have not been implemented or tested. If these are not properly tested, this could cause several issues. Systems that are not tested may

not work correctly causing that method to be abandoned for other methods. This could cause other systems to be used excessively beyond their testing limits. The result could be more overtime and additional manpower being hired causing even larger budget overruns.

The UCB is in the Business Silos stage of EA maturity (UCB 2013), but it seems as though there is a move to rapidly transfer to Standardized Technology Stage. Based on the reports and information in the EA, it appears that there could be a lack of Foundation for Execution (FFE). There seems to be a disconnect between IT capabilities and business objectives. There could be a fine line between whether UCB is building IT capabilities or IT solutions. Because UCB is a cyclic organization with major projects every 10 years, this may be necessary to succeed. But because of the 10 year gaps and the need to keep budgets down between major census activities, building major IT capabilities needs to be done simultaneously with IT solutions. The UCB also conducts other surveys for measuring a variety of economic metrics.

Future year budget amounts for UCB were predicted using Monte Carlo model simulations (UCB Budget 2016). These simulations predicted that the total decennial census would save over 5 billion dollars compared to the 2010 census. With a constitutional obligation to count the population, the UCB, and Congress, are taking a big risk by implementing such radical changes in one enumeration cycle without having a contingency budget for handling unforeseen issues. Management has their hands tied because they are forced to focus on the budget and save money. The TOGAF ADM expresses the need for revisiting EA views and iteration until a refined system is developed. The timeline of the census EA is ambitious and doesn't allow the iterative process of refining the EA. The technologies being implemented are not proven ones.

The systems have not been previously tested under these conditions for this purpose. The budget is not padded to complete additional system enhancements to meet goals.

Architecture Framework Review

With the absence of the original EA architect, UCB needs to rely on the documentation they are left with to carry on the EA to completion. Documentation is a critical part of an EA. The documentation of the EA provided by UCB is lacking completeness. There are several architecture diagrams provided through documentation but they only show the incomplete right side of the diagrams. This could lead to a conclusion that other documentation is not tended to with care and detail. Lack of quality documentation is not a good way to manage risk.

The UCB identified that there were risks which needed to be minimized. Minimization of that risk would come with the proper appropriations in the budget (UCB budget 2016). Because the risk is linked directly to a yearly budget, IT tasks are considered on a lifecycle, rather than a yearly timespan. Additional capital expenses can be added to the budget as needed for these projects to come online and as the projects require. This gives stakeholders flexibility in distributing funds. The goal was to eliminate budget surpluses and overruns from year to year (UCB budget 2016). The cost savings of the new EA could potentially leave the UCB with a surplus of 5 billion dollars in 2021. This discretional spending adjustment cap is a new proposal for the UCB and has not been enacted until passed the midway point of the decade where this kind of discretionary spending is critical. While this new spending methodology is a positive way to reduce waste, it was enacted too late and budget constraints have caused problems with incomplete projects. This is a clear admission by the UCB (UCB budget 2016).

UCB has chosen Oracle SOA suite and Oracle Policy Automation as their SOA Management software solution. This solution seems to have a vast majority of the capabilities that are required for the EA. The solution chosen would score high in the criteria used to measure SOA by Forrester Wave (Heffner 2007). The information integration options in this system include the majority of methods required by UCB. The ease of use will be a great asset considering that there are not many highly skilled employees handling the IT systems.

Recommended Solutions

Culture Change

Recommended Solution

Bureaucracies, like the UCB, are very difficult to change, especially without leadership promoting changes. Many people get jobs in government because they expect them to be easy, the benefits to be good, and not much is expected of them. These kind of jobs are often held for long periods of time which leads to a lot of stagnant, unenthusiastic employees that clock in and clock out and do only the minimum.

Bureaucracies and EA are not impossible to meld,but as Kotter (2012) pointed out, there are many mistakes made when making change. Budget constraints are one key feature in bureaucracies and they can cripple progress. A change in culture is necessary to implement a successful EA. Employees can quickly lose momentum, and faith in vision, when short term wins are not realized by budget constraints. This can cause employees to have the EA vision blocked by obstacles faced by budgetary constraints (Kotter 2012). Challenges have already been seen in completing intermediate tests and a change of leadership is slated to occur. Many people worry that this could be a serious problem for reaching future test deadlines and implementing the remaining IT infrastructure.

Management is a core component of a successful EA. In the preliminary phase of the TOGAF ADM, it coordinates with Management Frameworks to enhance operational capabilities. A solid framework of Project Management Methods helps to manage change initiatives (TOGAF 2012). The huge workforce involved in the census and rapid growth that occurs before the decennial census can be a challenge for

management. Hiring a new EA Architect immediately to lead the team implementing the systems will help ensure that work is done properly and on time. Also if any changes are required, the EA Architect will be able to detect these and make informed recommendations. Morale could suffer without some short-term victories and placing a knowledgeable, hands-on leader into position can ensure that they can regain momentum.

Alternative

The UCB can rely on the current management structure and not hire an EA Architect. The current Director is leaving and there is no Deputy Director so the UCB is already without leadership from the top. Even if a new Director is appointed, they may not have the kind of knowledge required to quickly lead the operation. Most of the time these appointed positions lack depth of knowledge in the department they run. Not hiring an EA Architect immediately will leave the UCB without the guidance needed to complete critical tasks, but they will not need to pay a very expensive short-term position. UCB can instantiate a system of incentives for current employees that will attempt to expedite their competency and on-time testing. Studies have shown that incentive programs can promote positive results (Stolovich 2016).

Security

Recommended Solution

Many of the security issues can be solved by introducing more workers and more training. Current security risks are a result of systems not being implemented and tested on time. This is because employees are not adequately trained in the new systems. This is a result of the budget being too tightly controlled.

Budget has created quite a domino-effect within the organization. The damage has already been done. To control further damage, stakeholders need to be aggressive with spending to bring on qualified employees. Current employees need to be brought up to competency levels and those that are unable to must be replaced or reassigned to other departments.

The process of training employees is less expensive and time consuming. The benefit is to bring up competency of employees that are retained. Effectively, this is more efficient in the long term, but there are short term needs for critical testing. Because many employees will be occupied with training, some consultants will be hired to head critical tasks and lead non-training employees.

Alternative

Hiring a large team of consultants would be a quicker alternative but with a lot more cost. Consultants are highly trained with the skills needed to rapidly get systems up and running. Consultants are very expensive and may not be able to effectively train permanent employees while conducting tasks. This leaves the employees training concurrently with the consultants and unavailable to perform their normal duties. This is why a large team of consultants would be required.

This method would increase chances for success because more qualified people would be available to handle all tasks. Budget requirements are still an issue so this option would be the preferred option, but unlikely due to the stakeholders.

Management

Recommended Solution

Management will essentially be non-existent in the next few weeks when the director resigns. With no deputy director in place, the entire bureau will not have leadership and decisions will be made from the Commerce Department. With critical tests coming this year and next year, and the lag time the Administration is taking with appointments, the UCB cannot wait for leadership appointments. The UCB needs to hire an experienced EA Architect to take on the leadership role until formal leadership is appointed.

Alternative

Maintain leadership that exists at UCB. If a suitable person exists, and there is a person to spare, the Department of Commerce should send that person to take over as interim Director. UCB is in the process of major changes. Without a proper leader, the organization as a whole can lose morale, momentum and fail to meet their goals.

Architectural Review

Suggested Solution

The selected SOA Architectural Solution appears to be a good choice. The system allows much of the implementation to be done with less expertise and custom programming. It was known that the expertise of the employees would have been lacking and this system would make up for that deficiency. It has been indicated that the employees are still unable to operate the EA Solutions with their current competency. This could indicate that the solution is too complex and likely too expensive.

Work needs to be done on solidifying the Foundation for Execution. The EA should be revisited and adjusted to ensure that all systems are capable of performing their functions. Maintain using the current SOA Solution as is and utilize the brightest employees to continue the integration.

Alternative

In order to save money, switch to a cheaper SOA solution and hire consultants to perform the installation and integration. This will ensure that the integration work is completed quickly and on time by competent workers. The tradeoff is a solution that may not integrate all solutions as seamless as the original. Working toward saving money will be a popular choice as viewed from the stakeholders.

RoadMap

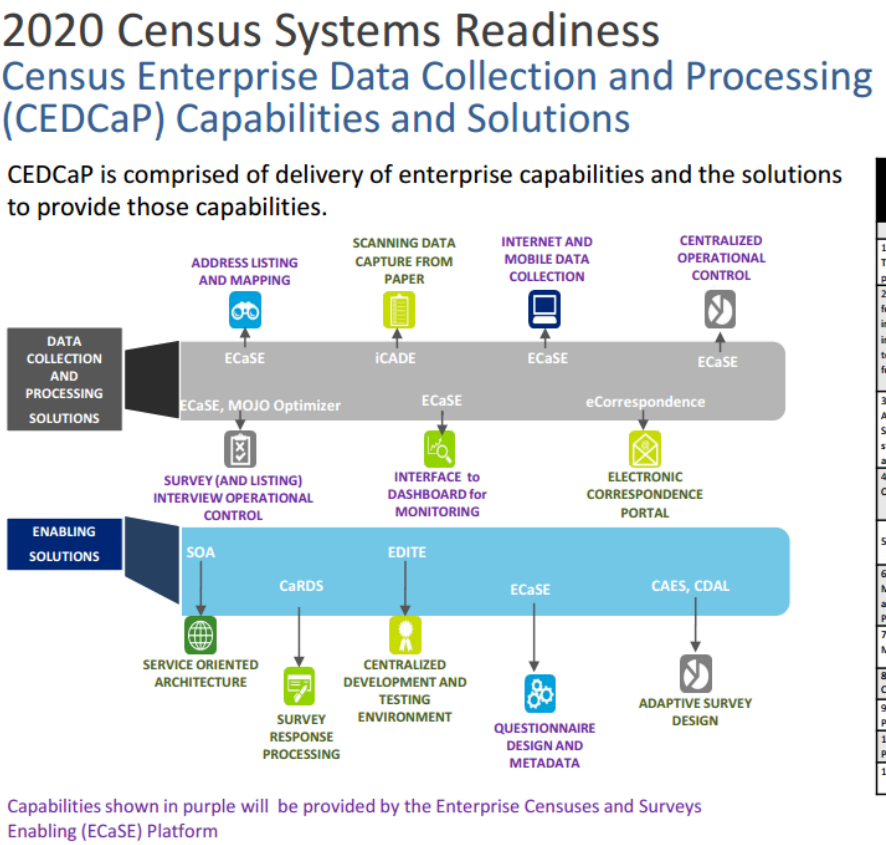
For the UCB to achieve their goals, they should follow the outlined steps to address their issues. Because the EA is in the Phase G TOGAF (implementation), the main obstacles are rapid funding and employment deficiencies.

Concurrent Progress	Prepare and conduct scheduled tests and system implementation	**Phase I. Approach Stakeholders for additional funds (ASAP- 2 months)**	1) Convince stakeholders that without funding, work cannot get done on time 2) Hire consultants to help conduct scheduled concurrent tests
		Phase II. Find Contractor EA Architect to oversee and refine Implementation (Concurrent with Phase I)	1) The EA Architect originally hired to design EA is no longer present. Find suitable manager to oversee implementation because leadership may be non-existent.
		Phase III. Line up intensive training and find highly qualified new employees. (3 months)	1) Find highly qualified new employees that can hit the ground running. 2) Line up phased training for current employees to bring up competency. 3) Enact bonus program for rapid competency and performance
		Phase IV. Complete scheduled tests (3 months)	1) Keep Consultants on as long as full time employees are not performing to full levels
		Phase V. Release Consultants (1 month)	1) As UCB employees gain confidence and competence, consultants are released. 2)Finally, release EA Architect

Conclusion

The US Census Bureau (UCB) has a Constitutional obligation to count the people of the United States every 10 years. The 2020 decennial census is occurring in a decade of technological advancements that make it a good decade to take advantage of technology for the heavy task. Through the decade, an EA has been developed and is now in Phase G of TOGAF, the implementation stage. There have been many problems encountered during this phase including many systems failing to be implemented on time, deadlines established or met, and a lack of clear leadership. Many of these issues have been carried on by budgetary constraints by stakeholders (US Congress). Because of lax leadership and budget shortcomings, architectural governance has fallen short of achieving their goals. The UCB needs to secure proper funding from stakeholders to hire competent and capable employees that can meet their goal of a successful decennial census. To accomplish this, UCB will need to hire the right balance of consultants while simultaneously conducting rigorous training of current employees. An experienced Enterprise Architect should be brought on to help evaluate EA integration and transition into TOGAF ADM Phase H, the evaluation and learning phase to determine if there needs to be changes to enhance the EA and bring it forward to the next decennial census.

Appendix



Census Enterprise Data Collection & Processing (CEDCaP)

CEDCaP Data Collection & Processing Capabilities and Solutions Delivered:	
CEDCaP Capability	CEDCaP Solution
1) Centralized Development and Testing Environment to CEDCaP projects	Enterprise Development, Integration, & Test Environment (EDITE)
2) Service Oriented Architecture for CEDCaP projects (i.e., common infrastructure and efficient system interfaces to allow IT applications to communicate without the need for costly system re-writes)	Application Programming Interface (API) Infrastructure (API-I)
3) Centralized Operational Analysis and Control and Adaptive Survey Design capability, including statistical modeling and administrative records	ECaSE Operational Control System Census–Data Access Layer (C-DAL) Concurrent Analysis and Estimation System (CAES)
4) Survey (and Listing) Interview Operational Control	ECaSE Operational Control System MOJO Optimizer
5) Address Listing and Mapping	ECaSE Address Listing Mapping
6) Interface to the Dashboard for Monitoring Survey Cost, Progress, and Quality and Enterprise Paradata Repository	ECaSE
7) Questionnaire Design and Metadata	ECaSE- Questionnaire Design Metadata
8) Internet and Mobile Data Collection	ECaSE Internet Self Response ECaSE – Enumeration
9) Electronic Correspondence Portal	eCorrespondence
10) Scanning Data Capture from Paper	Integrated Computer Assisted Data Entry (iCADE)
11) Survey Response Processing	CARDS (Pre-data collection, TBD (Post-data collection processing)

Figure 1. CEDCap System Diagram (UCB Sys Mgmt 2017)

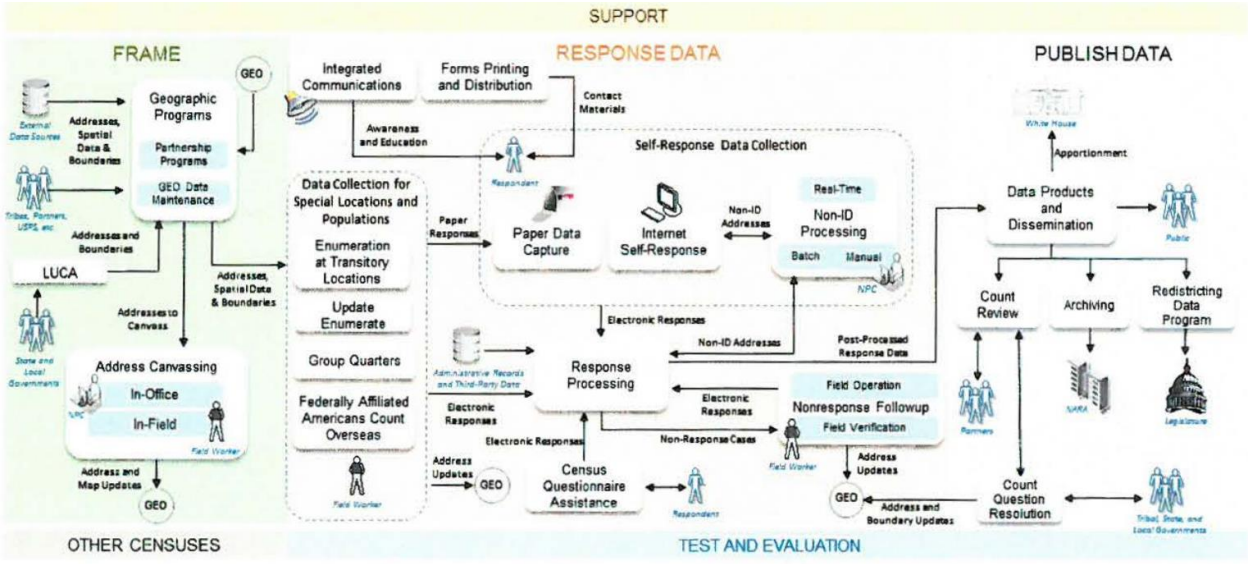


Figure 2. High Level Integration of Operations (UCB 2016)

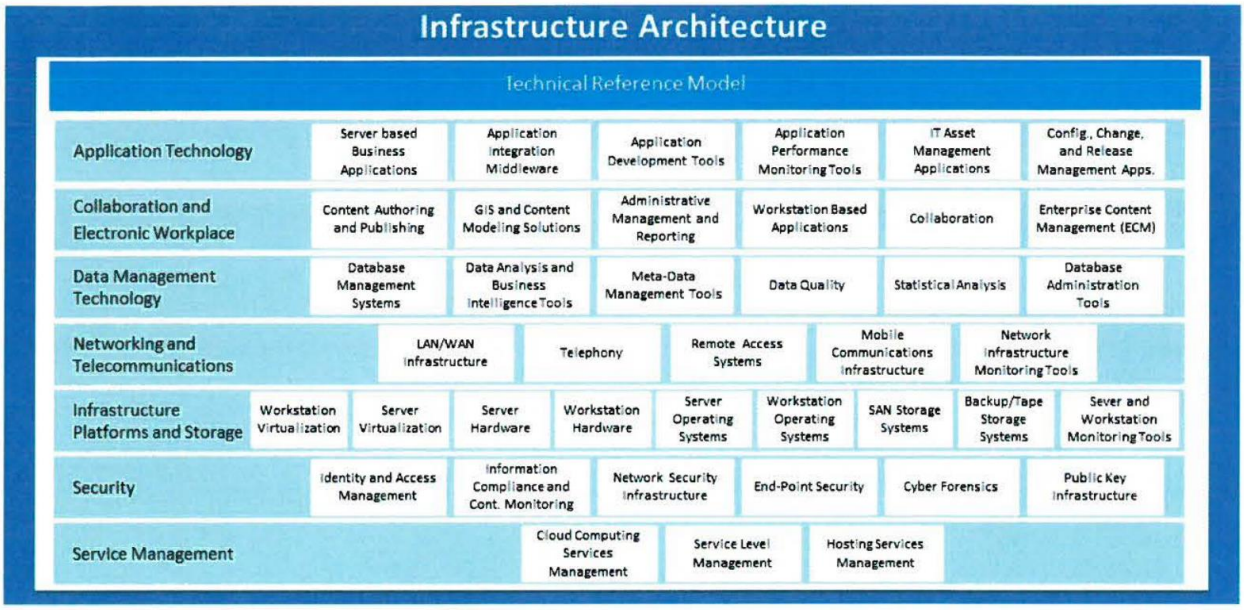


Figure 3. EA Technical Reference Model (UCB 2016)

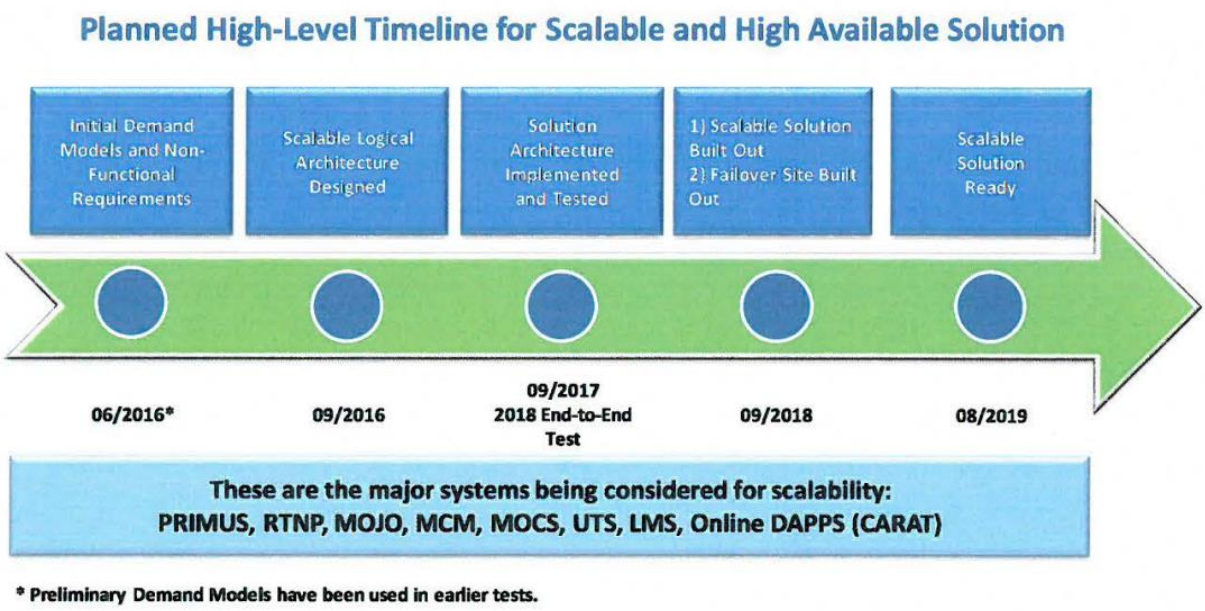


Figure 4. Planned High-Level Timeline for Scalable and High Available Solution (UCB 2016)

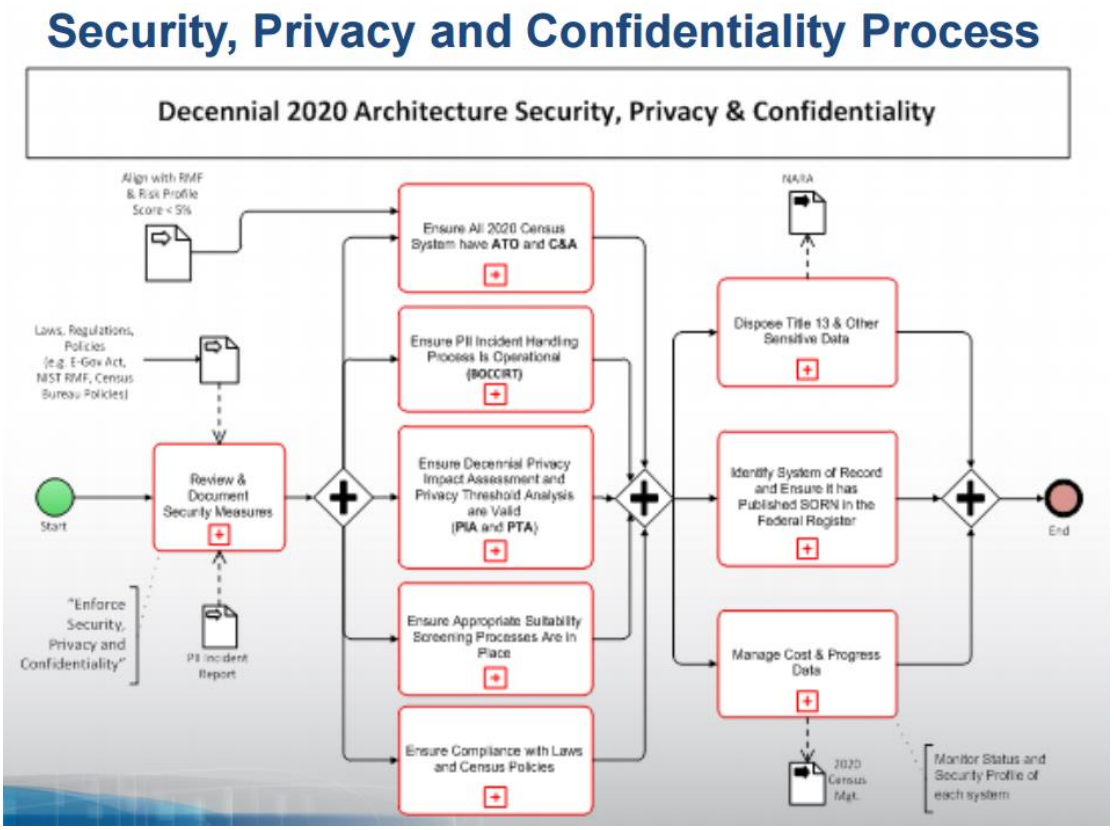


Figure 5. Security, Privacy and Confidentiality Process (Kalluri 2017)

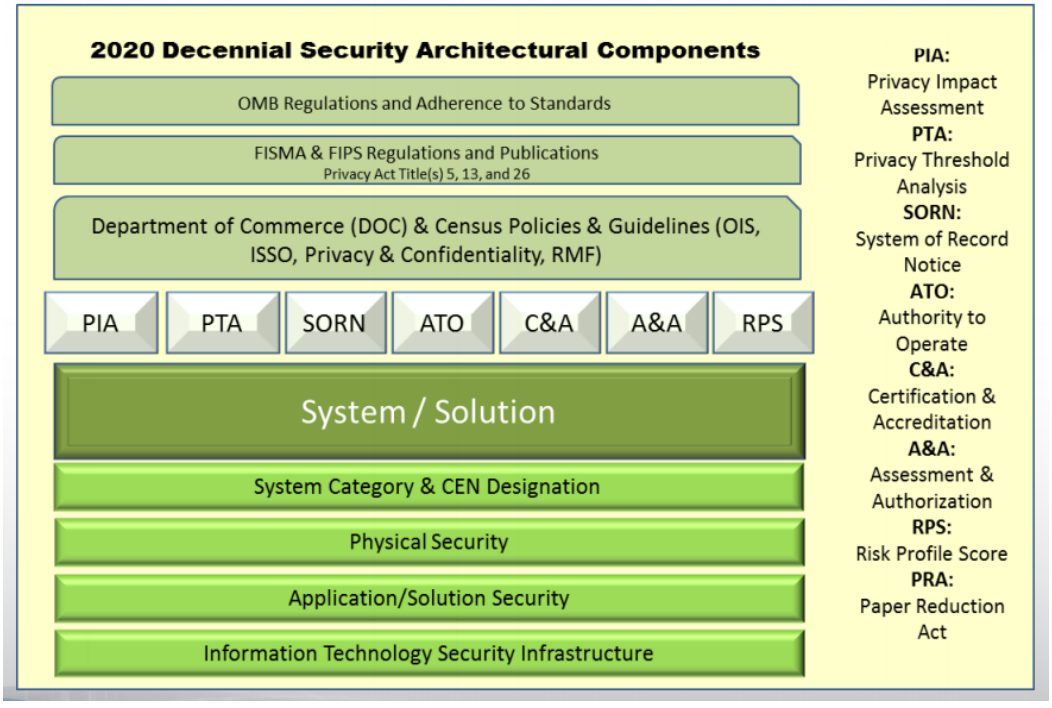


Figure 6. Security Architecture Components (Kalluri 2017)

References:

Bahrampour, Tara. "U.S. Census director resigns amid turmoil over funding of 2020 count." The Washington Post. May 09, 2017. Accessed May 11, 2017. https://www.washingtonpost.com/local/social-issues/us-census-director-resigns-amid-turmoil-over-funding-of-2020-count/2017/05/09/8f8657c6-34ea-11e7-b412-62beef8121f7_story.html?tid=ss_fb-bottom&utm_term=.c241e0c53568.

"US to use fingerprint technology in census." Biometric Technology Today 14, no. 6 (2006): 3. doi:10.1016/s0969-4765(06)70540-9.

Coates, Joseph F. "Moving the census into the 21st century." Technological Forecasting and Social Change 113 (2016): 44-46. doi:10.1016/j.techfore.2016.10.037.

Desouza, Kevin C., and Akshay Bhagwatwar. "Leveraging Technologies in Public Agencies: The Case of the U.S. Census Bureau and the 2010 Census." Public Administration Review 72, no. 4 (2012): 605-14. doi:10.1111/j.1540-6210.2012.02592.x.

"Federal Enterprise Architecture Framework Version 2." WhiteHouse Archives. January 29, 2013. Accessed April 27, 2017. https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/egov_docs/fea_v2.pdf.

Government Accountability Office (GAO). “Information Technology Management: Census Bureau Has Implemented Many Key Practices, but Additional Actions Are Needed” June 16, 2005. Accessed May 20, 2017. https://www.gpo.gov/fdsys/pkg/GAOREPORTS-GAO-05-661/html/GAOREPORTS-GAO-05-661.htm

Gunter, Chase. “Can the Census Bureau really deliver $5 billion in savings?” May 03, 2017. Accessed May 20, 2017. https://fcw.com/articles/2017/05/03/census-savings-billions-gunter.aspx?admgarea=TC_Management

Kalluri, Atri. “2020 Census” U.S. Census Bureau. October 2015. Accessed May 20, 2017. http://csrc.nist.gov/groups/SMA/ispab/documents/minutes/2015-10/oct23_kalluri_2020-census_nist_ispab.pdf

Kalluri, Atri, McGuire, Patricia, and Reece, Jason. U.S. Census Bureau. “2020 Census Systems Readiness”. January 1, 2017. Accessed May 20, 2017. https://www.census.gov/content/dam/Census/programs-surveys/decennial/2020-census/pmr-2017-01-27/pmr-slides-2017-01-27.pdf

Kotter, John P. Leading change. Boston, MA: Harvard Business Review Press, 2012.

Nguyen, Quyen, et. al. U.S. Census Bureau. “2020 Census Enterprise Architecture and Infrastructure Transition Plan” April 13, 2016. Accessed May 17, 2017. https://www2.census.gov/programs-surveys/decennial/2020/program-management/planning-docs/2020-enterprise-arch-infrastructure-plan_full-doc.pdf

Powner, David A. Government Accountability Office (GAO). “Uncertainty Remains about the Bureau’s Readiness for a Key Decennial Census Test”. November 16, 2016. Accessed May 17, 2017.

Ross, Jeanne W., Peter Weill, and David C. Robertson. Enterprise architecture as strategy: creating a foundation for business execution. Boston, MA: Harvard Business School Press.

Stolovich, Harold, PhD. "Incentives, Motivation and Workplace Performance: Research and Best Practices." Incentives, Motivation and Workplace Performance:

Research and Best Practices | Research | The Incentive Research Foundation. 2010. Accessed April 29, 2017. http://theirf.org/research/incentives-motivation-and-workplace-performance-research-and-best-practices/147/.

Turner, Marshall L. Jr. and LaMacchia, Robert A. “The U.S. Census, Redistricting, and Technology”. Social Sicence Computer Review, Vol. 17 No. 1. 1999. 16-26.

U.S. Census Bureau. “U.S. Census Bureau Strategic Plan FY 2013 – 2017” April 25, 2013. Accessed May 17, 2017. https://www.census.gov/content/dam/Census/about/about-the-bureau/PlansAndBudget/strategicplan.pdf

U.S. Census Bureau. “The Future of Census Bureau Operations” April 25, 2013. Accessed April 29, 2017. https://www.census.gov/content/dam/Census/about/about-the-bureau/PlansAndBudget/FutureofCensusBureauOperations_2013-04-25_v1.0_10ChangePrinciples.pdf

U.S. Census Bureau. “History and Organization”. Document CFF-4. May 2000. Accessed May 16, 2017. https://www.census.gov/history/pdf/cff4.pdf

U.S. Census Bureau. “U.S. Census Bureau’s Budget Fiscal Year 2017”. February 2016. Accessed May 19, 2017. https://www2.census.gov/about/budget/FY2017-census-budget.pdf

U.S. Census Bureau. “Prepared Statement: John H. Thompson, Director U.S. Census Bureau” February 15, 2017. Accessed May 18, 2017. https://www.census.gov/content/dam/Census/about/about-the-bureau/20170215_thompson_testimony.pdf

U.S. Census Bureau. “Prepared Statement: John H. Thompson, Director U.S. Census Bureau” May 3, 2017. Accessed May 18, 2017. https://www.census.gov/content/dam/Census/about/about-the-bureau/20170513-thompson-testimony.pdf

Vinik, Danny. "Is the census heading for a crisis?" The Agenda. May 13, 2017. Accessed May 14, 2017. http://www.politico.com/agenda/story/2017/05/13/head-of-census-bureau-resigns-2020-problems-000441.