



AIR FORCE CYBERWORX REPORT 18-008

Enterprise Architecture Repository

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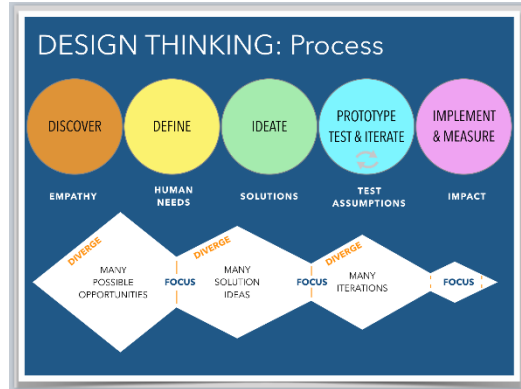
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Introduction to AF CyberWorx

CyberWorx is a dynamic, solution-oriented organization created to overcome barriers to efficient and effective cyber mission execution. By teaming with Air Force stakeholders, operators, academia, and industry, we provide the structure for advanced technological solutions that carry the warfighter and the nation into ever-increasing cyber dominance. As a full-service, human-centric design center, we drive cultural change that embraces failure and risk on the path to success. The CyberWorx process carries a solution from conception through prototyping and on to implementation.



Human-Centered Design at AF CyberWorx

CyberWorx draws its toolkit from industry best practices, offering engaging, collaborative *design services* to help create a better Air Force. Because each situation and challenge the Air Force brings is unique, CyberWorx tailors its approach to meet the specific needs of the client.



CyberWorx considers the human element first; then, organizational viability and technical feasibility.

Design begins by bringing together a diverse group of industry and military stakeholders for a multi-day “sprint” to understand a problem from the perspective of, “**who** needs a way to do **what** because of **why**?” Designing solutions that fit the needs of people shifts the problem from an organizational or technical one to the bottom line of what operators need to effectively produce the desired results. The technical and organizational factors become the means to achieve that end.

CyberWorx design sprints help refine the requirement by seeking the right problem to solve for and finding meaningful, forward-looking solutions that advance cyber in the hands of the warfighter. Participants are given the freedom necessary to create innovative solutions and discover unique perspectives and approaches to solving the problem.

The CyberWorx process does more than generate clever ideas. It takes ideas to prototype then tests, evaluates, and iterates until a viable solution is born. This process produces positive, timely results because it solves for a particular human need in pursuit of the warfighter mission.

Background & Participants

For years the USAF has operated in architecture silos to meet the needs of the respective Core Function Leads, Major Commands (MAJCOMs), Functional Areas (Functionals), and Components. The proliferation of systems, software services, and information led to a number of duplicative elements across the Air Force, as well as leaving some information gaps and shortfalls. With this realization and a better understanding of these opportunities, SAF/CIO A6 Enterprise Architecture Division (A6SA) is *seeking a way to enable an overarching enterprise view of USAF architectures, which will ultimately enable the USAF to analyze architecture data and architecture data analytics*. In turn, this will also provide USAF leaders with trusted information and a strategic advantage, ultimately empowering decision-makers to optimize planning and resourcing for the Air Force to effectively support readiness and warfighting goals. [AFEA Repository Concept, 2017]

Working with CyberWorx, stakeholders were brought together from a diverse group of units, professions, and industries to study and provide recommendations for an Air Force enterprise architecture (EA) repository. There were 22 participants present at the sprint including industry partners from the following organizations: Avolution, Inc., Braxton Technologies, LLC; AT&T; Microsoft; OE Data; SNIA; Planview; PatchPlus Consulting; and Tableau.

The diversity of the team led to a broadening of the design question and discovery of interconnected, overarching themes for exploration.

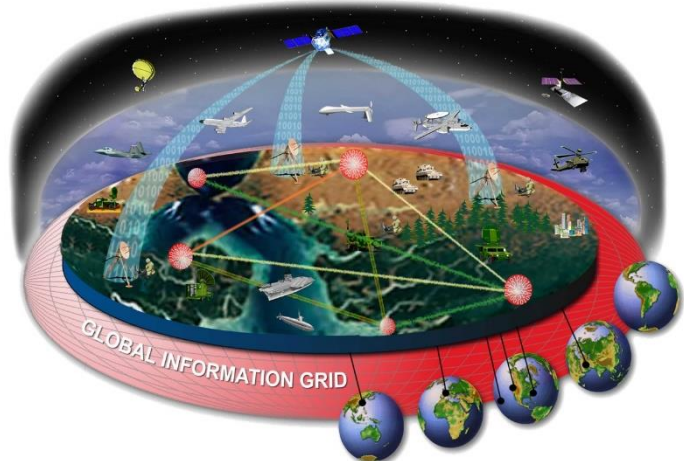
Personas

In a human-centered design approach to problem solving, each proposed solution articulates how it will address the core human need at the center of the problem. In other words, how will the solution improve the ability for specific individuals to perform the operations or make the decisions that will make war-fighting more effective? A complete solution must also account for organizational outcomes and technical needs but to be truly effective, must be centered on the needs of the humans who must take actions in the applicable situations and environments. Understanding and empathizing with the points of view, environments, motivations, wants, needs, and constraints of the people who are core to the problem area is the most valuable component to providing a solution that will fit their needs. In developing these “personas,” teams worked through various exercises to form a complete picture of the human needs. Each team developed personas based on how an enterprise architecture repository impacts the specific use cases they were tasked with analyzing – *capabilities assessment, cybersecurity, position navigation & timing (PNT), and application rationalization*.

Problem Statements

The overarching problem statement for the sprint was, “How might we leverage an architecture repository with analytic capabilities to help USAF leaders, customers, and stakeholders make more effective, efficient decisions that support today’s and future missions?” Teams established problem statements specific to the use cases and the personas they developed within them. These problem statements became the focus of the challenge to support an Air Force (AF) EA repository. The problem statements and current challenges the AF faces in these realms are as follows.

Capabilities Assessment - There is currently no means to identify, assess and determine impacts of any change across the enterprise. This includes any relevant capability, such as flying an airplane, recruiting airmen, or deploying a squadron.



Supporting today’s Air Force mission is more complicated than ever. Having an authoritative EA repository would enable data to be accurate, pedigreed and rapidly shared, which will ultimately improve the capability of the warfighter.

Persona: *Col Carly runs the Total Force Service Center, which serves about 7 million members and has more than 200 technicians employed there. MilPDS went down so her agents cannot perform any Human Resource (HR) functions because they can’t access member data.*

For hours, the phone lines ring and members make requests, such as getting a letter sent to a mortgage company so they can buy a home; wanting to finish their retirement process; and applying for a school board. But, all the requests are left unfulfilled until the system comes back up. Members are frustrated, technicians are frustrated and unproductive.

Col Carly is of course concerned that members are not receiving good service but also that the developer has no automation to help in pinning down the problem so it can be fixed. Additionally, since she has no tools to assist her in determining what secondary and tertiary systems are impacted by the failure, she cannot confidently or accurately notify other organizations of the problem’s scope.

Cybersecurity – Cybersecurity requirements and information are not integrated with the architecture information.

Persona - *Tom is a system engineer working on the Air Force Satellite Control Network (AFSCN) with the goal of using the commercial satellite network as leverage to significantly increase the AFSCN capability. When Tom uses the current cybersecurity guidance accessible in flat files to develop the software, he’s not confident his solution will meet both the current and evolving cyber threats. It takes a great deal of time to search for the correct requirements and integrate them into his work; so, he also queries his peers, but finds the requirements*

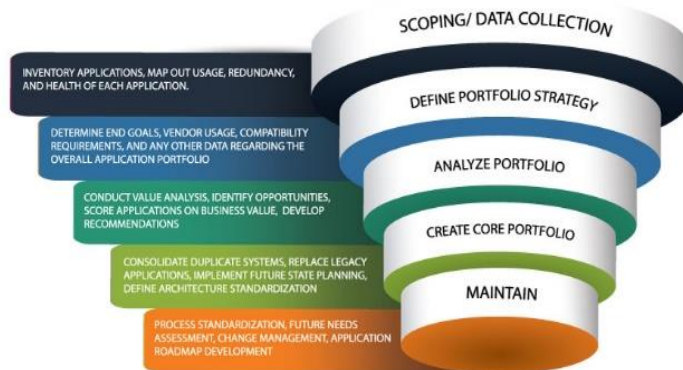
subject to interpretation and the data formats are inconsistent. He knows re-work will be required of him after he releases the capability but figures that's just part of the Air Force way of life.

Positioning, Navigation, & Timing (PNT) – Siloed efforts, organizations, and solutions, impact the user, operators, warfighter, and solutions from precisely executing PNT.

Personas: *Combat pilot Warren needs assured, timely, and accurate PNT data to accomplish his mission in the field, whether in times of peace or conflict. His main concern is with ongoing emerging cyber threats and that there is an increased risk of being attacked, jammed, or spoofed.*

Archibald is a solution/segment architect, who is tasked with building solutions to meet emerging capabilities and threats and ensuring the warfighter stays ahead of the cyber conflict. He has difficulty creating solutions because the data he needs is not readily accessible and, is largely in flat files. It is time-consuming to manually gather the information, and prone to errors. He has to verify its accuracy prior to creating a solution, which makes him less responsive to emerging threats and his solutions can be delayed or ineffective.

Application Rationalization - The inability to identify applications and systems that are unable to meet federal mandates, are redundant, broken, and obsolete.



Illustrates the scope of application rationalization.

Persona: *Joan is a portfolio manager who oversees 300 applications within the logistics functional area. Currently, 40 applications are located on a data center scheduled to be closed in the next two years. She's been directed to migrate these applications to the cloud*

and rationalize the data services supporting them. Over the next 5 years she is facing a 10% funding cut and must identify which systems to eliminate while maintaining the organization's capabilities and mission effectiveness. Leadership directed Joan to reduce the overall number of applications by 25% to streamline the organization and improve operational effectiveness.

Joan is concerned that she doesn't have the information she needs to effectively and confidently rationalize her portfolio to meet these challenges and directives and that there will be impacts to her organization's operational effectiveness, security, and associated costs. She is also concerned that she can't conduct an impact analysis, therefore there is the potential for loss

of capability. She can't develop an IT roadmap, so risk is heightened and resources are consumed on maintenance rather than innovation.

Themes & Solutions

Using personas involved in each use-case, teams ideated the needs and requirements for developing an enterprise architecture solution that would address the needs of the specific personas. The personas help illustrate and understand specific challenges faced by the AF because our enterprise architecture data is not widely accessible, current or integrated into key decisions.

Creating and maintaining a comprehensive enterprise architecture to meet all possible needs is neither practical nor affordable due to the size and complexity of systems and the dispersed nature of AF information. But an EA repository structure that is populated with artifacts to meet specific needs can begin to horizontally impact the AF's ability to rapidly inform technical and operational decisions and eliminate redundancies that exist when developing solutions and maintaining systems.

Three primary themes develop the case for an AFEAR, *business process automation (BPA)*, *data mining*, and *access/authority over data*.

1. **Business Process Automation** – The automation of human tasks such as workflows, auto populating data, and so forth improves delivery and reliability of information and substantially reduces costs associated with man hours. This is particularly relevant with cybersecurity requirements and decision making associated with capabilities and application rationalization.

BPA can be used to automatically flow data to supporting processes sustaining authority, and minimizing human data integration. This includes work flows for purchases and new capabilities requests, risk management framework assessments, R&D, and operational capability assessments.

Unlike before, when a significant system outage occurs or maintenance is planned, Col Carly can quickly mine the EA repository to get a clear understanding of the scope of services, customers, and missions affected. Armed with this information, the Total Force Service Center can quickly and accurately notify other organizations of outages and suggested work arounds. She can also minimize the impact to her technicians and members by making informed decisions about resource allocation and mitigation.

2. **Data Mining** - Interactive analysis, as in mining data from a repository, combined with comprehensive modeling, reveals dependencies between applications and systems in a specific context. Decision makers can then see impacts and choose the best options for meeting their organization's objectives. The EA repository provides the structure in which relationships between systems and organizations can be used operationally for PNT as well as technologically, as with capability assessment.

A new architecture design solution and paired with a data analysis application provides Archibald the ability to understand how his PNT designs fit into the existing enterprise. With this insight he can visualize cyber threat threads, redundancies and mission gaps. This allows him to develop solutions faster that are more resilient and better meets mission needs.

Warren is unaware of the process that happens behind the scenes but he notices a far more rapid and complete solution to the threats he's exposed to from the cockpit and he has increased confidence in the Air Force's ability to produce rapid, reliable capabilities.

3. **Access/Authority Over Data** - Data must be accessible to the right people across the AF. When looking at authorities over data, consideration must be granted across MAJCOMs, functionals, and components. EA will provide the necessary structure to ensure the data being added to the repository is relevant to those who are accessing it. If, for instance, cybersecurity protocols and requirements are baked into the process, countless man-hours will be saved over using flat files and duplicating work. BPA will work to ensure relevant, authoritative data and standards across the service and DoD. Establishing authority over data facilitates both BPA and data mining.

Tom is working on the Risk Management Framework (RMF) accreditation of a new system. While he is working in an RMF workflow the workflow is designed to rely on and draw directly from the authoritative EA data source. As a result the workflow directly downloads cybersecurity requirements met by the existing architecture so that he can clearly see the security requirements that are inherited and which ones he still has to design for. This saves him design time, prevents rework, and automatically fits into the AF EA and Space architecture. He is astounded at how much faster he can impact his mission, mitigate vulnerabilities and threats, and get new systems approved to connect to the AF networks.

Way Ahead

Developing and deploying an architecture repository to support an EA that maximizes the value to downstream AF and DOD processes and decision makers is conceptually easy but a longer process in practice. AF CyberWorx makes the following recommendations.

1. Choose an enterprise architecture data standard and structure that will maximize data sharing across systems.
2. Establish a data-sharing working group for integration into workflows of dependent process.
3. Adopt or develop a common lexicon to be used within all services.
4. Develop and implement initial test cases, then scale from there.

Summary

Building an enterprise architecture repository is not a new concept for the Air Force. In fact, it's been debated for decades; but, the sheer magnitude of its execution seems to have stifled its

progress. However, given today's cyber threats and the complexity of daily operations in the current technological environment, the AF acknowledges the necessity of the repository and is preparing to move forward in its development. This AF CyberWorx sprint provided a coalescence of ideas from across the Air Force and DoD in support of an EA repository.

Personas were developed to tell the story of individuals throughout the AF who face the challenges of not having a repository in today's environment. They then illustrate the end state of how a repository not only saves valuable time and money but also ensures requirements are thorough and consistent, and capabilities impact the mission, are non-redundant, and hit the intended mark.

The themes that developed out of this sprint represent the biggest game changers to an AF EA repository, *business process automation*, *data mining*, and *access/authority over data*. These three themes illustrate the horizontal impact the repository will have across the AF and provides the foundation to justify its existence.

As the EA repository concept moves forward, it is essential to cooperatively develop a common lexicon across the Department of Defense. Test cases need to be developed and the establishment of a data-sharing working group, will provide initial steps to the ultimate implementation of the repository. Even with the complexity and magnitude of the project, an EA repository will be embraced across the Air Force.

Appendix

See attachments.

