DOE Hanford Network Upgrades and Disaster Recovery Exercise Support the Cleanup Mission Now and Into the Future – 14303

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ABSTRACT

In 2013, the U.S. Department of Energy's (DOE) Hanford Site, located in Washington State, funded an update to the critical network infrastructure supporting the Hanford Federal Cloud (HFC). The project, called ET-50, was the final step in a plan that was initiated five years ago called "Hanford's IT Vision, 2015 and Beyond." The ET-50 project upgraded Hanford's core data center switches and routers along with a majority of the distribution layer switches. The upgrades allowed HFC the network intelligence to provide Hanford with a more reliable and resilient network architecture. The culmination of the five year plan improved network intelligence and high performance computing as well as helped to provide 10Gbps capable links between core backbone devices (10 times the previous bandwidth). These improvements allow Hanford the ability to further support bandwidth intense applications, such as video teleconferencing. The ET-50 switch upgrade, along with other upgrades implemented from the five year plan, have prepared Hanford's network for the next evolution of technology in voice, video, and data.

Hand-in-hand with ET-50's major data center outage, Mission Support Alliance's (MSA) Information Management (IM) organization executed a disaster recovery (DR) exercise to perform a true integration test and capability study. The DR scope was planned within the constraints of ET-50's 14 hour datacenter outage window. This DR exercise tested Hanford's Continuity of Operations (COOP) capability and failover plans for safety and business critical Hanford Federal Cloud applications. The planned suite of services to be tested was identified prior to the outage and plans were prepared to test the services ability to failover from the primary Hanford datacenter to the backup datacenter. The services tested were:

- Core Network (backbone, firewall, load balancers)
- Voicemail,
- Voice over IP (VoIP)
- Emergency Notification
- Virtual desktops and;
- Select set of production applications and data.

The primary objective of the exercise was to test COOP around the emergency operations at Hanford to provide information on capabilities and dependencies of the current system to insure improved focus of emergency, safety and security capacity in a disaster situation. The integration of the DR test into the ET-50 project allowed the testing of COOP at Hanford and allowed the lessons learned to be defined. These lessons learned have helped improve the understanding of Hanford's COOP capabilities and will be critical for future planning.

With the completion of the Hanford Federal Cloud network upgrades and the disaster recovery exercise, the MSA has a clearer path forward for future technology implementations as well as network improvements to help shape the usability and reliability of the Hanford network in support of the cleanup mission.

INTRODUCTION

On August 3, 2013 a 46-member team gathered at the DOE Hanford Site to participate in the network upgrade at Hanford's primary datacenter. During the upgrade a DR exercise was held. The DR exercise took advantage of the full datacenter and network outage that spanned a 14-hour window. The objective of the exercise was to perform a COOP test of a well-defined group of HFC services.

The planned outage of Hanford's main datacenter was ET-50's fifth and most impactful outage. Since the core backbone routers, switches and network supervisors at Hanford's datacenter were replaced the outage impacted all of Hanford's computing. The installation completed Hanford's upgraded network design, a design that provided increased bandwidth between backbone devices, improved intelligent routing and increased processing capabilities.

The disaster recovery test, which included COOP testing, took place during ET-50's outage window. The COOP test was an integration test of the Hanford's uninterrupted service functionality for a cloud configuration. The DR exercise focused on the recovery ability of following primary services:

- Core network (backbone firewall load balancer)
- External routing (ISP, DMC)
- Network services (DNS, DHCP, Proxy, Wireless)
- Authentication services (Domain, RSA and ACS)
- Voice Services (VoIP)
- Emergency messaging services (AtHOC)
- Collaborative services (Exchange, Blackberry, Lync)
- Hosted desktop services (VDI/Thin Client, U drives)
- Application Services - (Storage area Network (SAN))

The HLAN had operated without a planned datacenter outage for over three years. In that time, comprehensive change to the HLAN had provided increased capacity and speed and had also helped to centralize equipment, especially in the two primary datacenter locations. The HLAN supports over 600 servers, 2,000 applications and 7,000 users with an average of 3,000 users active during business hours. Because of this, network outages must be planned well in advance with extensive efforts paid to minimize the timeframe of the outage.

On the day of the datacenter outage, the team assembled at 5:30 a.m. and began the initial shutdown process of key applications and infrastructure. Using the plans that were prepared prior to the outage, the DR team started the failover of the major network services from the primary Hanford datacenter to Hanford's backup datacenter. The datacenters are geographically located six miles apart from each other. The shutdown process would take three hours, and likewise, an organized startup an additional four hours. This would leave a precious work window of seven hours to complete the ET-50 upgrades, test DR anomalies and resolve any issues.

Every plan, test plan, and man-hour was used to bring success for both projects. From the beginning of the outage, the plans, backup plans, and technical teams were fully utilized. And as planned, not all went as expected or advertised, starting with a main conference bridge used for integrated communications not working. However, because procedures, roles and responsibilities were defined, all of the issues were overcome in a timely manner allowing the outage to end ahead of schedule at 7:15 p.m.

What led Hanford IM to this successful DR/COOP exercise was not a coincidence. In 2009, Hanford's IT operated with multiple single points of failure, lacked COOP capabilities, had facilities in differing states of maintenance, and operated on a legacy telephone and emergency notification systems. In 2009, MSA IM worked with DOE and its Hanford customer base to institute an integrated planning discipline that produced a long term IM plan that integrated with Hanford Site Cleanup Plans. The planning focused on the 2015 Hanford Site Cleanup Vision established by DOE in 2008. The DOE vision set a scope of work that would be potentially accomplished by 2015. The vision provided the basis to support focused planning and was central for all Hanford cleanup participants. Specifically, it was essential for IM to build and track to an integrated comprehensive plan for the Hanford Site Information Technology and telecommunications infrastructure (IT).

Through the deliberate focus and continual updating of the vision, goals, budget and plans, Hanford's IT team has been able to develop an environment that has allowed MSA IM to advance IT technologies at Hanford and plan, implement and deliver a reliable and resilient network architecture.

DESCRIPTION

The Hanford Site IT is required to support the movement and management of voice, data, and imaging information over wired and wireless infrastructures. The IT Infrastructure consists of four major components:

- Facilities (buildings, enclosures, towers, huts, and the associated uninterrupted power supplies, backup generators, and heating, ventilation, and air conditioning [HVAC] systems)
- Outside plant (fiber and copper cabling systems)
- Wireless transport systems (radio, cellular, and wireless voice, data, and imaging transports)
- Network and telecommunication systems (equipment, operating software, and management tools to maintain performance).

Technology and cyber security requirements continue to change and mature annually. Therefore, maintaining an IT Infrastructure in a steady state would make the system obsolete within a few years. An outdated network increases the vulnerability to security threats, risk of prolonged outages, promotes single points of failure, and limits flexibility, change and computing mobility. To ensure Hanford's Information Management remains reliable and meets the demands of cleanup activities, the site’s IT infrastructure requires adherence to deliberate plans for maintenance, upgrades, modernization, and enhancement.

In 2009, just one month after contract performance began on the Mission Support Contract, kickoff sessions were held for the ”Infrastructure Services and Alignment Plan” (ISAP), of which, IT is a subsection. The IT portion of this plan was called the “IR/CM Infrastructure Scalability Solution and Implementation Plan (ISSIP)”. The approach of this planning effort was to:

- Engaged the customer (DOE, CHPRC, WRPS) upfront and throughout the process.
- Focus development of a six-page brochure and then write the plan around it.
- Develop the frame work for IM to achieve, the following was the base framework:
    - Foster & Leverage Partnerships
    - Enhance Information Services
    - Align & Optimize IT Portfolio
    - Attract & Retain Highly Skilled Professionals

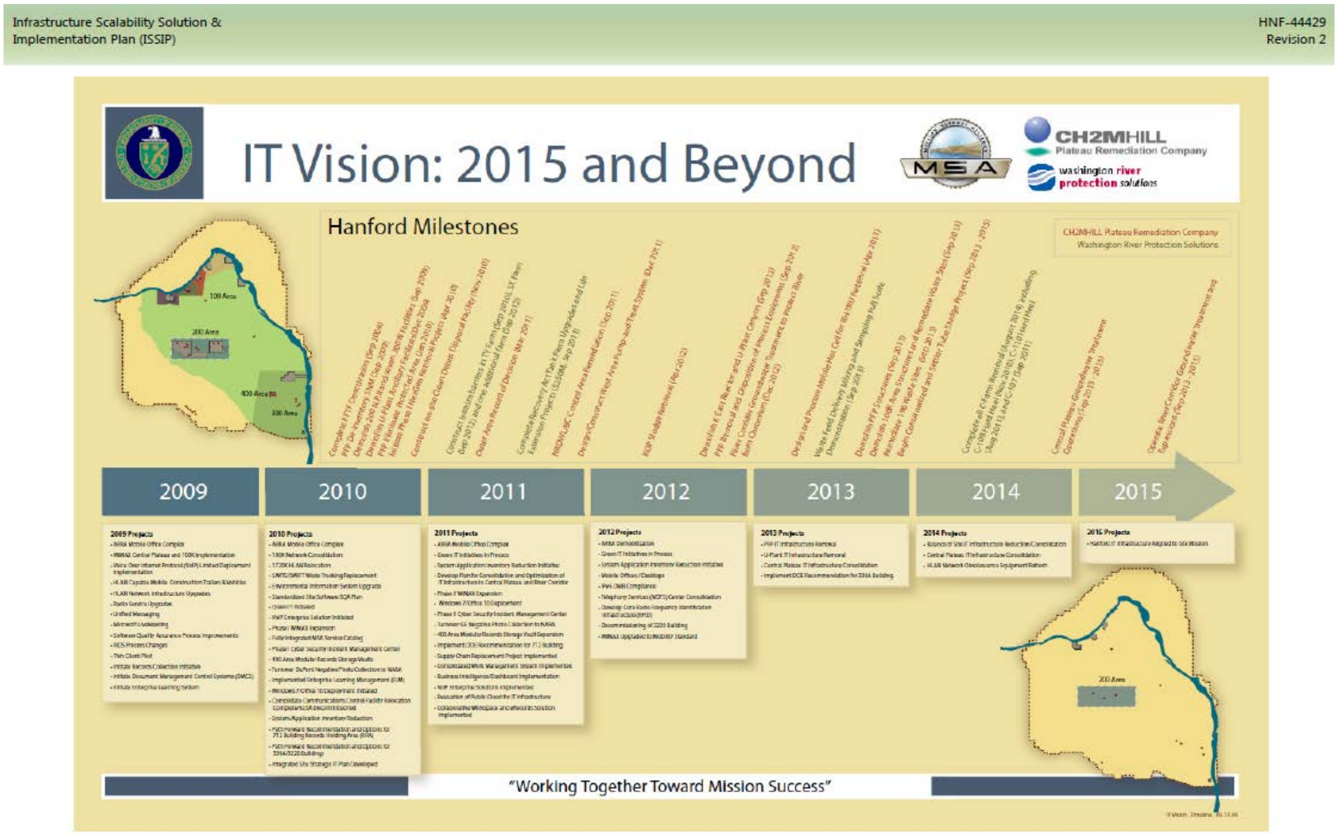
The ISSIP was completed with buy-in by the customer and the plan was submitted with the Infrastructure Services and Alignment Plan (ISAP) dated March 1, 2010. DOE-RL approved the plan with praise associated with its content and presentation form.

The ISSIP and the ISAP have been used faithfully to track and update any changes in mission needs and new technology strategies that benefit the customer’s mission and projects. Additionally, the customer buy-in and participation provided an environment where systems engineers and system architects were able to propose and implement network innovation and improvements by providing a working environment that put reality into a vision document.

While collaboration and customer participation were critical to making the ISAP relevant, special attention was also paid to world events and lessons learned. For example, the events of 9/11 in New York City brought attention to Hanford’s antiquated telephone system, which although reliable, could not be expected to survive a major disaster. The system could have taken weeks or months to recover. In several cases during 9/11 Internet service was the only mode of communication. With this insight, MSA took a close look at how phone services were delivered at Hanford. In 2011 the phone system had multiple single points of failure, and while reliable, was not considered resilient.

This insight helped to shed light on the importance of a Voice over Internet Protocol (VoIP) implementation project and decisions were made to converge the standalone telephone system into the HLAN by implementing a VoIP and Unified Communications platform. VoIP changed the delivery of telephone services (i.e., phone, voicemail, conferencing, and faxing) through the HLAN and reduced cost by eliminating end-of-life technologies, facilities, and streamlined engineering resources. More importantly, the move to VoIP improved the overall performance and resilience of the communications system since investment dollars and network knowledge that had been distributed between two infrastructures was concentrated into one.

Figure 1 is a core visual of the original ISSIP. Working with the customers and the ISSIP, functional plans associated with Infrastructure Services, Records and Content Management and Information Systems were developed and aligned appropriately and in a timely fashion. Figure 1 provides a framework to communicate planned projects to implement the IT Vision. From this vision, plans and projects were executed. With communications implemented between customers and the ISAP, plans were able to evolve, adjusting to technology, funding and innovations.



Infrastructure Scalability Solution & Implementation Plan (ISSIP)

HNF-44429
Revision 2

IT Vision: 2015 and Beyond

Hanford Milestones

CH2MHILL Plateau Remediation Company
Washington River Protection Solutions

- Complete FFTF Deactivation (Sep 2009)
- PFP De-inventory SNM (Sep 2009)
- Demolish 200 N, P and seven 300W Facilities (Sep 2009)
- Demolish U-Plant Ancillary Facilities (Dec 2009)
- PFP Eliminate Protected Area (Jan 2010)
- Initiate Phase I NexGen Retrieval Project (Apr 2010)
- Construct on-site Clean Debris Disposal Facility (Nov 2010)
- Construct Interim barriers in TY Farm (Sep 2010), SX Farm (Sep 2012) and one additional farm (Sep 2012)
- Outer Area Record of Decision (Mar 2011)
- Complete Recovery Act Tank Farm Upgrades and Life Extension Projects ($250M, Sep 2011)
- HRDW/USC Central Area Remediation (Sep 2011)
- Design/Construct West Area Pump-and-Treat System (Dec 2011)
- KOP Sludge Retrieval (Apr 2012)
- Demolish K East Reactor and U-Plant Canyon (Sep 2012)
- PFP Removal and Disposition of Process Equipment (Sep 2012)
- River Corridor Groundwater Treatment to Protect River from Chromium (Dec 2012)
- Design and Procure Mobile Hot Cell for the TRU Retrieval (Apr 2013)
- Waste Feed Delivery Mixing and Sampling Full Scale Demonstration (Sep 2013)
- Demolish PFP Structures (Sep 2013)
- Demolish 100K Area Structures and Remediate Waste Sites (Sep 2013)
- Remediate 118 Waste Sites (Sep 2013)
- Begin Containerized and Settler Tube Sludge Project (Sep 2013 - 2015)
- Complete all C-Farm Retrieval (August 2014) including C-108 Hard Heel (Nov 2010), C-110 Hard Heel (Aug 2011), and C-107 (Sep 2011)
- Central Plateau Groundwater Treatment Operations (Sep 2013 - 2015)
- Operate River Corridor Groundwater Treatment and Expansions (Sep 2013 - 2015)

2009

2009 Projects
- ARRA Mobile Office Complex
- WiMAX Central Plateau and 100K Implementation
- Voice Over Internet Protocol (VoIP) Limited Deployment Implementation
- HLAN Capable Mobile Construction Trailers & Vehicles
- HLAN Network Infrastructure Upgrades
- Radio Service Upgrades
- Unified Messaging
- Microsoft Livemeeting
- Software Quality Assurance Process Improvements
- RIDS Process Changes
- Thin Client Pilot
- Initiate Records Collection Initiative
- Initiate Document Management Control Systems (DMCS)
- Initiate Enterprise Learning System

2010

2010 Projects
- ARRA Mobile Office Complex
- 100K Network Consolidation
- 1720K HLAN Relocation
- SWITS/SWIFT Waste Tracking Replacement
- Environmental Information System Upgrade
- Standardized Site Software SQA Plan
- DMCS/IT Initiated
- VoIP Enterprise Solution Initiated
- Phase I WiMAX Expansion
- Fully Integrated MSA Service Catalog
- Phase I Cyber Security Incident Management Center
- 400 Area Modular Records Storage Vaults
- Turnover DuPont Negative Photo Collection to NARA
- Implemented Enterprise Learning Management (ELM)
- Windows 7/Office 10 Deployment Initiated
- Consolidate Communications Control Facility Relocation Complete/615A Decommissioned
- System/Application Inventory Reduction
- Path Forward Recommendation and Options for 712 Building Records Holding Area (RHA)
- Path Forward Recommendation and Options for 3316A/3220 Buildings
- Integrated Site Strategic IT Plan Developed

2011

2011 Projects
- ARRA Mobile Office Complex
- Green IT Initiatives in Process
- System Application Inventory Reduction Initiative
- Develop Plan for Consolidation and Optimization of IT Infrastructure in Central Plateau and River Corridor
- Phase II WiMAX Expansion
- Windows 7/Office 10 Deployment
- Phase II Cyber Security Incident Management Center
- Turnover GE Negative Photo Collection to NARA
- 400 Area Modular Records Storage Vault Expansion
- Implement DOE Recommendation for 712 Building
- Supply Chain Replacement Project Implemented
- Consolidated Work Management System Implemented
- Business Intelligence/Dashboard Implementation
- VoIP Enterprise Solutions Implemented
- Evaluation of Public Cloud for IT Infrastructure
- Collaborative Workspace and eRecords Solution Implemented

2012

2012 Projects
- ARRA Demobilization
- Green IT Initiatives in Process
- System Application Inventory Reduction Initiatives
- Mobile Offices / Desktops
- IPv6 OMB Compliance
- Telephony Services (NCFS) Center Consolidation
- Develop Core Radio Frequency Identification Infrastructure (RFID)
- Decommissioning of 2220 Building
- WiMAX Upgraded to 802.16e Standard

2013

2013 Projects
- PFP IT Infrastructure Removal
- U-Plant IT Infrastructure Removal
- Central Plateau IT Infrastructure Consolidation
- Implement DOE Recommendation for 3316A Building

2014

2014 Projects
- Balance of Site IT Infrastructure Reduction/Consolidation
- Central Plateau IT Infrastructure Consolidation
- HLAN Network Obsolescence Equipment Refresh

2015

2015 Projects
- Hanford IT Infrastructure Aligned to Site Mission

"Working Together Toward Mission Success"

MSA
CH2MHILL
Plateau Remediation Company
washington river protection solutions
100 Area
200 Area
400 Area
300 Area
200 Area

Figure 1. IT Vision: 2015 and Beyond

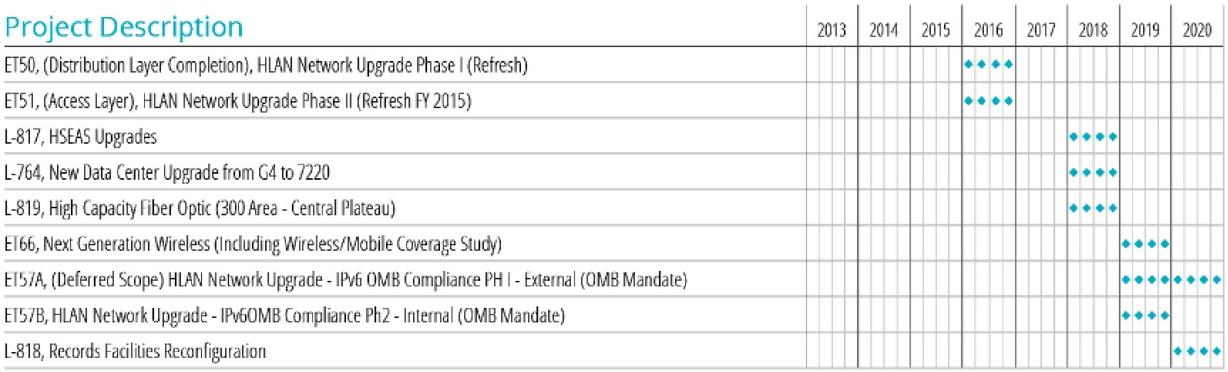
The ISAP provides a structure to ensure customer communications are maintained and investment plans are updated to reflect adjustments needed due to innovations, technology and funding. The ISAP goes through a yearly planning cycle to validate infrastructure to the Hanford Mission. Driven from these plans, key network and communications infrastructure projects are planned and tracked with a site wide integrated approach.

For example, in September 2010, the ISAP provided visibility and priority to the following Network and Communications Infrastructure projects to be completed over a five year planning cycle.

- HLAN Network Upgrade Phase 1 (five year required refresh cycle for all network infrastructure)
- HLAN Network Upgrade Phase 2 (next five year refresh begins)
- Complete transition from Legacy 5ESS Telephone to Enterprise VoIP (ET59/60) voice service in FY 2011
- Special Circuit transition completed in FY 2012
- Communication towers and supporting infrastructure renovations
- UPS upgrade for telecommunication and data network facilities
- Next Generation WiMAX implemented
- HVAC upgrade to datacenters and network-hub facilities
- HLAN IPv6 upgrade

All of these projects have been initiated and/or completed as of this writing. The facility upgrades (HVAC, UPS and Communications towers) have been important for overall IT stability and energy savings, but the Refresh Cycle for HLAN Network Upgrades (Phase 1 and 2) provided the basis that allowed the dramatic and innovative change which transformed the Hanford network (Hanford Local Area Network (HLAN)) into the Hanford Cloud (Hanford Federal Cloud (HFC)) and thus provided a framework for the COOP solution.

The tactical implementation of the HLAN Network Upgrades broke down the upgrades into specific reliability projects. The projects are monitored within the Mission Support Alliance management framework to insure visibility and integration to the site vision and mission at the site infrastructure level. The following table contains the names, generic scope and current schedule of the tactical implementation HLAN IT Network Upgrade Projects from the 2013 ISAP.



Project Description	2013	2014	2015	2016	2017	2018	2019	2020
ET50, (Distribution Layer Completion), HLAN Network Upgrade Phase I (Refresh)				◆◆◆◆				
ET51, (Access Layer), HLAN Network Upgrade Phase II (Refresh FY 2015)				◆◆◆◆				
L-817, HSEAS Upgrades						◆◆◆◆		
L-764, New Data Center Upgrade from G4 to 7220						◆◆◆◆		
L-819, High Capacity Fiber Optic (300 Area - Central Plateau)						◆◆◆◆		
ET66, Next Generation Wireless (Including Wireless/Mobile Coverage Study)							◆◆◆◆	
ET57A, (Deferred Scope) HLAN Network Upgrade - IPv6 OMB Compliance PH I - External (OMB Mandate)							◆◆◆◆	◆◆◆◆
ET57B, HLAN Network Upgrade - IPv6OMB Compliance Ph2 - Internal (OMB Mandate)							◆◆◆◆	
L-818, Records Facilities Reconfiguration								◆◆◆◆

Table 1. 2013 ISAP Project Descriptions

The ET-50 and ET-51 projects identified above are the HLAN Network Upgrades that are scheduled to occur every five years. As a vital infrastructure system, IT components must be maintained for physical maintenance, replacements, and software upgrades. Unlike electrical, roads and water with 30 to 50 year normal service lifespans, IT infrastructure components have a much shorter normal lifecycle, usually three to six years. Not being able to maintain a funded technology refresh program on this critical infrastructure puts essential services that projects depend on at risk.

The ET-50 project defined in this presentation relates to the project description above. The work performed on August 3, 2013 is the completion and installation of the major distribution functionality for the 2009 - 2013 refresh. By comparing the 2010 and 2013 ISAP IT Infrastructure projects, one can notice the change in priority and funding by the extension of ET-50 and ET-51 refresh from completion in 2013, based on 2010 ISAP, to 2016 based on the 2013 ISAP revision.

Within this planning framework and fully implementing the technologies used for the 2009-20013 refresh of the ET-50 and ET51 projects, major innovation opportunities have been identified and implemented at Hanford leading to implementation of the Hanford Federal Cloud. Only because of the planning framework at Hanford, providing for open communication and resource management, could innovations to a "normal" network upgrade be leveraged with major innovations. This allowed a dramatic progression from an all physical system computing infrastructure (system-server(s) to a Virtual Computing Infrastructure (Cloud) by maximizing the capability of existing technologies and maximizing the benefit from attracting and utilizing highly skilled IT professionals.

DISCUSSION

Cyber threats are a growing reality in computing and Hanford is no exception. The innovations that are advertised giving capability for work, productivity and information management are of no avail if implemented without adherence to changing and evolving cyber security requirements. In 2012, Hanford was faced with a need to implement network intrusion monitoring devices throughout the infrastructure. This need was a focus based on cyber and network analysis, independent system audits and maintaining adherence to the National Institute of Standards and Technology (NIST) Special

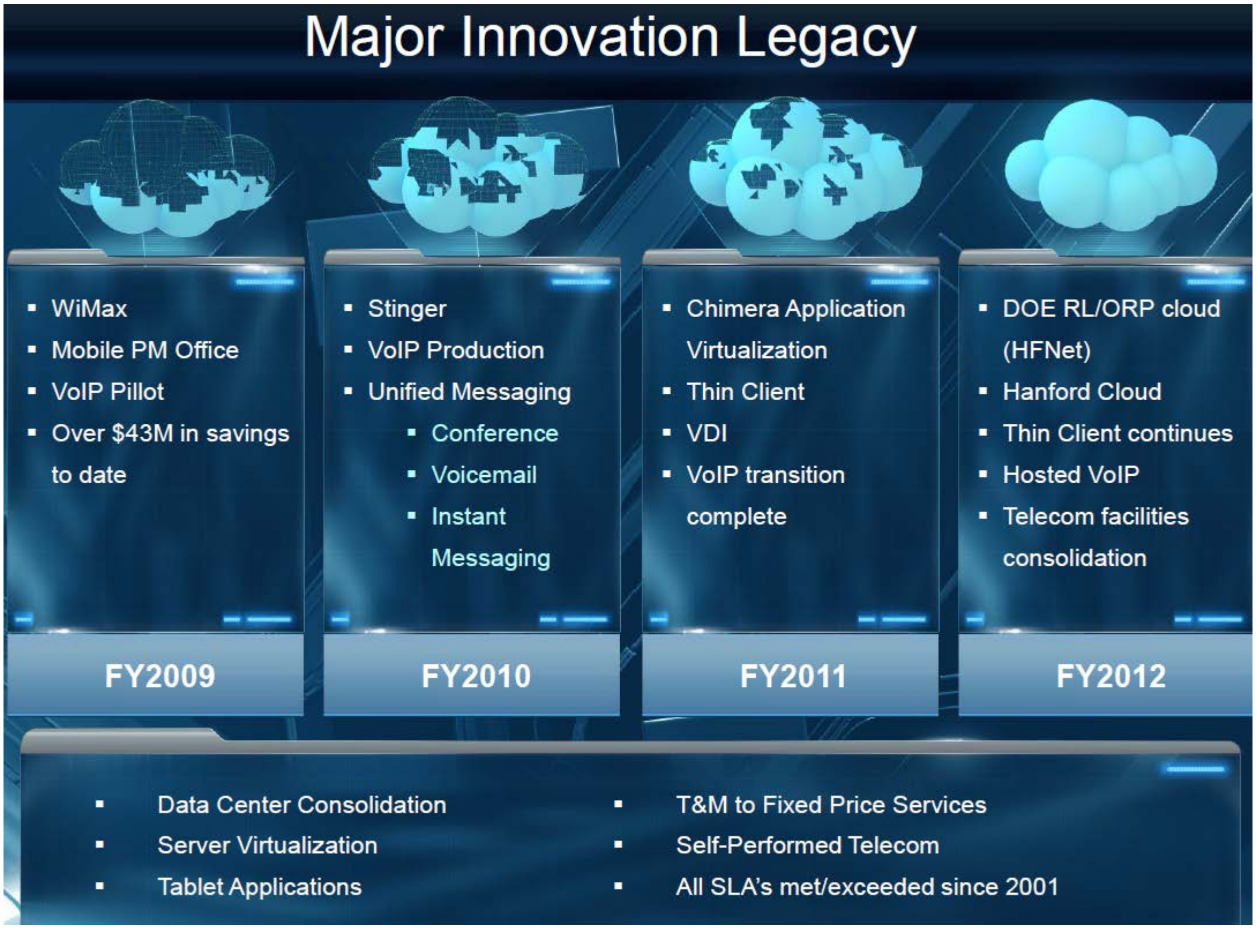
Publication (SP) 800-53, Rev. 3, Recommended Security Controls for Federal Information Systems and Organizations.

To address the network detection needs from two separate management perspectives, that is cyber or network, would have made the cost of the cyber intrusion monitoring devices implementation cost and technically prohibitive. It was this security issue that was viewed by the management and technical team at Hanford that brought together the needs of security to the needs of Hanford's growing dependence on information and drove the funding and projects to bring network segmentation across the entire campus and datacenter along software network intrusion monitoring devices that drove Hanford to a cost effective and secure network referred to as "Cloud Infrastructure and Management System" or CIMS, or more often referred to as the Hanford Cloud.

As cyber security and overall dependency on Information systems have increased, Hanford's Leadership, through collaboration and focused planning, continue to provide a work environment to support innovations to implement technologies providing the following site benefits:

- Increase operational efficiency through cost-effective sharing of expensive infrastructure
- Achieve economies of scale by leveraging shared resources
- Continually improve security posture in the Cyber environment
- Rapid and agile deployment of customer environments and applications
- Rapid allocation of capacity when there are sudden changes in demand
- Improve service quality and accelerate delivery through standardization
- Promote green objectives maximizing efficient use of shared resources and lowering energy consumption

However this major innovation (see Figure 2) which has driven the benefits above, has also driven the dependency on a centralized set of IT resources, facilities, computing and software. The impact of a disaster (which is now defined by the customer as any service interruption to phone, mail, Internet, systems or mobile device) must be prepared for as the impact of IT downtime at Hanford has progressed as much as the technology.



Major Innovation Legacy

- WiMax
- Mobile PM Office
- VoIP Pillot
- Over $43M in savings to date

FY2009

- Stinger
- VoIP Production
- Unified Messaging
    - Conference
    - Voicemail
    - Instant Messaging

FY2010

- Chimera Application Virtualization
- Thin Client
- VDI
- VoIP transition complete

FY2011

- DOE RL/ORP cloud (HFNet)
- Hanford Cloud
- Thin Client continues
- Hosted VoIP
- Telecom facilities consolidation

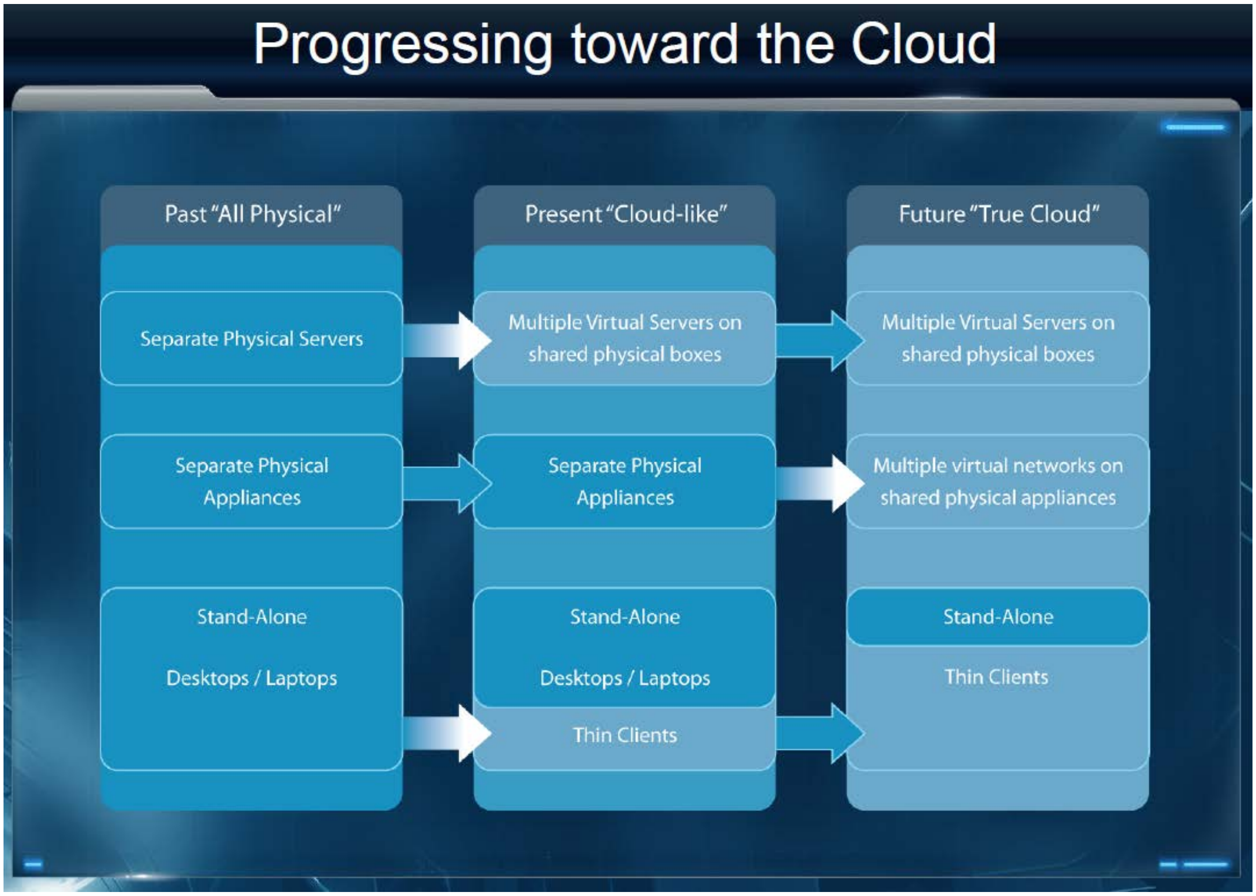
FY2012

- Data Center Consolidation
- Server Virtualization
- Tablet Applications
- T&M to Fixed Price Services
- Self-Performed Telecom
- All SLA's met/exceeded since 2001

Fig. 2 Major Innovation Legacy

The final and major driver that brought focus to the need of continual, measured improvement for Hanford COOP and DR services was the HLAN outage which occurred on March 29, 2011. This outage happened at on onset of planning for the Hanford Network and the Hanford Cloud. Mission Support Alliance Occurrence Report, EM-RL-MSC-General-2001-0003, detailed the lessons learned and informed Hanford leadership on the dependency of the Hanford work force on HLAN. This outage and its impact on stability planning for future of the Hanford cloud cannot be adequately measured as safety and stability were made even more of a reality for many with that March 29, 2011 incident.

Since 2011, Hanford COOP and DR services have been designed and implemented into the Hanford Network while the network has continued operating. COOP and DR services were unit and lab tested then placed into production without integration testing because integration testing of DR/COOP is not feasible due to uptime and resource requirements. The 2013 DR was needed to allow an integration test and status of COOP and DR services that had been implemented as innovations progressed toward the Cloud (see Figure 3).



Progressing toward the Cloud

Past "All Physical"	Present "Cloud-like"	Future "True Cloud"
Separate Physical Servers	Multiple Virtual Servers on shared physical boxes	Multiple Virtual Servers on shared physical boxes
Separate Physical Appliances	Separate Physical Appliances	Multiple virtual networks on shared physical appliances
Stand-Alone Desktops / Laptops	Stand-Alone Desktops / Laptops Thin Clients	Stand-Alone Thin Clients

Fig. 3: Progressing Toward the Cloud

HANFORD COOP PYRAMID

The HLAN COOP design and implementation was planned, reviewed and tracked using a diagram called the "Hanford COOP Pyramid". Over time, the Hanford COOP Pyramid became the tool to use when communicating technical direction, the concept of COOP and the priority scale for acquisitions to move technology into a configuration that minimized risk while maximizing technology availability at Hanford.

The “Hanford COOP Pyramid” is being incorporated formally in the 2013 update to the HNF-9247, Post-Disaster Recovery Plan (PDRP). This plan identifies essential missions, business functions, and contingency requirements at Hanford, and explains what “Key Critical” systems must have recovery within 24 hours, and what “Key Essential” systems must have recovery within 48-72 hours. Hanford’s PDRP is consistent with NIST SP 800-34.

To access the need and impact of the 2013 DR, it is important to be able to use and understand the Hanford Coop Pyramid as the services and tests directly correlate to the Critical Infrastructure services identified by the Pyramid.

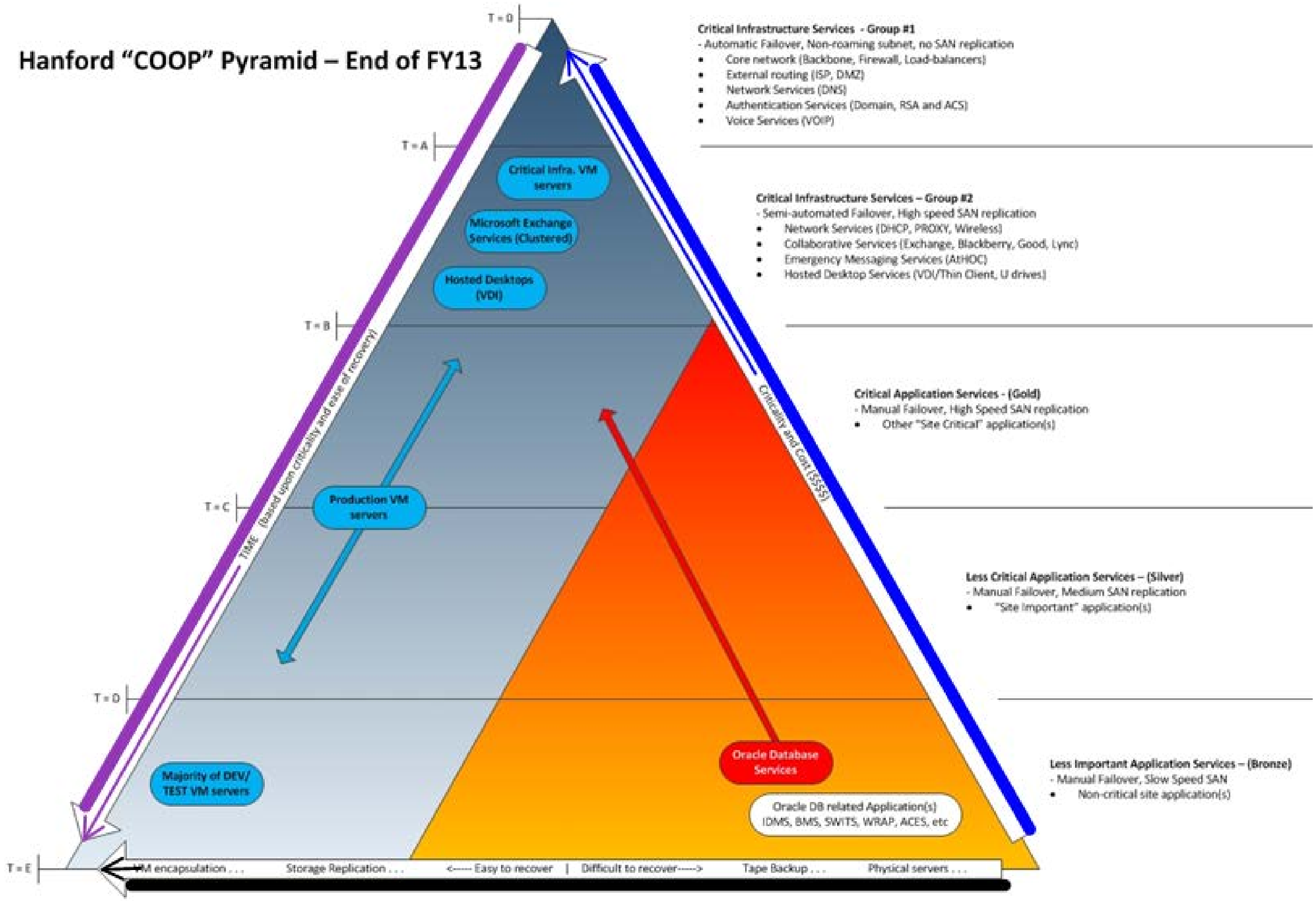

Hanford "COOP" Pyramid – End of FY13
T = 0
T = A
T = B
T = C
T = D
T = E
TIME (Based upon criticality and ease of recovery)
Criticality and Cost ($$$$)
Critical Infra. VM servers
Microsoft Exchange Services (Clustered)
Hosted Desktops (VDI)
Production VM servers
Majority of DEV/ TEST VM servers
Oracle Database Services
Oracle DB related Application(s) IDMS, BMS, SWITS, WRAP, ACES, etc
VM encapsulation . . .
Storage Replication . . .
<----- Easy to recover | Difficult to recover----->
Tape Backup . . .
Physical servers . . .
Critical Infrastructure Services - Group #1
- Automatic Failover, Non-roaming subnet, no SAN replication
• Core network (Backbone, Firewall, Load-balancers)
• External routing (ISP, DMZ)
• Network Services (DNS)
• Authentication Services (Domain, RSA and ACS)
• Voice Services (VOIP)
Critical Infrastructure Services – Group #2
- Semi-automated Failover, High speed SAN replication
• Network Services (DHCP, PROXY, Wireless)
• Collaborative Services (Exchange, Blackberry, Good, Lync)
• Emergency Messaging Services (AtHOC)
• Hosted Desktop Services (VDI/Thin Client, U drives)
Critical Application Services - (Gold)
- Manual Failover, High Speed SAN replication
• Other "Site Critical" application(s)
Less Critical Application Services – (Silver)
- Manual Failover, Medium SAN replication
• "Site Important" application(s)
Less Important Application Services – (Bronze)
- Manual Failover, Slow Speed SAN
• Non-critical site application(s)

Fig. 4: Hanford COOP Pyramid

The 2013 revision of the Hanford COOP Pyramid is shown in Figure 4. The following describes elements of pyramid to explain how the diagram shows status.

> The bubbles within the pyramid represent the major server services that are a DR planning concern. The bubbles show the as-is status of services while the attached arrows show the desired improvements.
>
> The bolded black line and arrow on the bottom of the pyramid highlight the location of services in relation to their evolution of DR capability. The flow of technology along the direction of the arrow shows the technology of the major server services. Within the pyramid, services identified within the color of orange are dependent on older recovery technologies while services identified within and blue for operate with newer recovery technologies.
>
> The bolded purple line and arrow on the left of the pyramid highlight the location of services in relation to their Relative Time of Recovery (RTR). RTR is signified by the symbols to the left T=0 or T=(A-E). Where the T represents time and 0 represents COOP ready or A-E representing the RTR (an RTR of with A

representing less time with B-E representing increments of increasing recovery time) due to priority, labor and resource needs.

The bolded blue line and arrow on the pyramid's right represent the increased criticality of the services and increased cost of downtime as services move toward an RTR of T=0.

The services identified on the immediate right of the pyramid, in plain text, are the Critical Infrastructure Services Groups (CISG). CISG are the HLAN Infrastructure services designed and categorized into groups based on the expected RTR for the service. Currently CISG for the HLAN infrastructure is divided by 5 RTR increments. The definition of the 5 CISG's are described below:

CISG-1: Critical Infrastructure Services - Group 1
The services identified in CISG-1 (Group-1) are COOP ready. At Hanford, this equates to services that are designed to operate within the two data centers and an outage of the service in the primary datacenter will initiate an automatic failover to the service in the backup datacenter. The backup does not require human intervention, Storage Area Network (SAN) replication or network adjustment.

CISG-2: Critical Infrastructure Services - Group 2
The services identified in CISG-2 (Group-2) have nearly fully automated failover. These are services that are designed to operate within the two data centers with minimum intervention such as a network command, high speed SAN replication. The failover requires minimum human intervention to complete change of service from the primary datacenter to the service in the backup datacenter.

CISG-3: Critical Application Services - (Gold)
The services identified in CISG-3 (Gold) are Applications on Servers identified as "Site Critical" and require manual failover with high speed SAN replication. All application owners at Hanford must register their applications in Hanford Information System Inventory (HISI) and complete the Software Grading Checklist. Answers to the HISI Software Determination Checklist generate a graded Software Level/Risk used to determine the priority and order of application recoveries. Site Critical applications identified as Group 3 (Gold) have predominately determined to be identified as "Key Critical Application" in HISI. These systems require immediate attention (within 24 hours) due to the critical, safety, security or business need. The criteria of predominate is due to infrastructure applications that are site critical for the infrastructure and recovery but not a part of the HISI process. “Site Critical" failover requires planned intervention involving the customer.

CISG-4: Less Critical Application Services - (Silver)
The services identified in CISG-4 (Silver) are Applications on Servers identified as "Less Critical" and require manual failover with medium speed SAN replication. Less critical applications identified as Group 4 (Silver) have predominately determined to be identified as a "Key Essential Application" in HISI. These systems

require attention (within 48 hours) because of the dependency to mission and programmatic goals and deliverables. The criteria of less critical is an infrastructure term due to the priority and intervention required by infrastructure, application developers, customer contacts and disaster recovery teams for restoration priorities.

CISG-5: Less Important Application Services - (Bronze)
The services identified in CISG-5 (Bronze) are Applications on Servers identified as "Less Important" and require manual failover with slow speed SAN replication. Less important applications identified as Group 5 (Bronze) have predominately determined to be identified as "Non-Key Applications" in HISI. These systems are needed for the recovery of normal business operations; however, restoration can be deferred for an extended period and are low priority for recovery. The criteria of less important is an infrastructure term due to the prioritization process of recovery and the interface to application developers, customer contacts and disaster recovery teams.

The main objective of the 2013 Disaster Recover Exercise was to test as many of the services defined in Group 1 and Group 2 of the Hanford COOP Pyramid. Only one application, EOCWEB, was tested as a CISG (Gold) application. It is important to note that applications are categorized as gold, silver, or bronze based almost entirely on the HISI administrative procedure. Future plans will further categorize the hundreds of Hanford applications based on capability, HISI and an improved Business Impact Analysis (BIA) and further delineate the CISG grouping because of the ability to plan DR with greater accuracy.

The following diagram shows the results and status of the 2013 DR tests. The tests are identified as services within the CISG groups of the Hanford COOP Pyramid.

DIAGRAM TO BE COMPLETED

CONCLUSIONS

The 2013 DR was completed and has been recognized as a success. The ET-50 implementation went into place without issue giving time to do a DR Exercise. Both projects and project managers were implementing another building block onto a long term plan. A plan that is another of a long line of projects that have been implemented at Hanford with minimal impact to the customer, all pointing to a common vision.

For the activities connected with ET-50 and the DR, The primary success criteria was the integration of the 2013 DR into the ET50 Project's 14 hour downtime window. Within that window, project success was the execution of test plans to measure the COOP capability at Hanford and allowing the corrective actions to be defined that will stabilize Hanford COOP capability and network infrastructure. While many issues with the configuration were discovered, the DR exercise has allowed the problems to be resolved.

Having a unified vision, building long IT vision, and implementing plans built on goals to:

- Foster and Leverage Partnerships
- Enhance Information Management
- Align and Optimize to Project Requirements
- Attract and Retain Highly Skilled Labor

Allow projects such as ET-50 and Disaster recovery be able to support continued integration, and validation of an environment that will support Hanford's vision "Working together Toward Mission Success"

As Hanford's Site footprint shrinks, as the site is cleaned up…….Information needs will expand and the work population will grow and move into a smaller area. But as far as Hanford IT is concerned, the effort put into every small and large project are on a defined path to keep Hanford's IT on track and or ahead of schedule to support the DOE 2020 Vision and beyond.