"**Green-in-Three"**
IT Solutions Protecting Workers and the Environment – 12526

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ABSTRACT

The U.S. Department of Energy (DOE), Environmental Management (EM), DOE Richland Operations Office (RL), Mission Support Alliance (MSA), and Lockheed Martin Services, Inc. (LMSI), Information Technology partnered in an effort to reduce environmental impacts, energy use, and operating costs and improve worker safety through consolidation, centralization, and standardization of Information Technology (IT) assets on the Hanford Site. Green-in-Three is an IT Value strategy, which is moving Hanford from an inefficient, antiquated 20th Century IT architecture to a smart, green, flexible 21st Century IT architecture that delivers information anywhere at any time to Hanford Mission partners.

INTRODUCTION

Removal and/or repurposing of aged IT facilities and equipment to reduce the IT asset footprint at Hanford has been extremely successful. The Green-in-Three IT strategy depicted in Figure 1, went beyond typical IT industry partnerships (e.g., Microsoft, Cisco) to develop partnerships with outside organizations such as local power companies (e.g., Benton Public Utility District, Bonneville Power Administration [BPA], etc.), Transportation Security Administration, Nuclear Regulatory Commission (NRC), state and local governments, Tribes, and other DOE Sites. The outcome of these efforts contributes to EM's IT Strategic Plan Goal #2; "Implement Green IT solutions to reduce EM's carbon footprint and increase energy efficiency." The strong Green IT focus compliments and increases the value of IT to programs by delivering solutions that reduce Project operating costs, energy use, and environmental impacts.

Fig 1. IT Value Strategy.

METHODS

Data Center Consolidation

Two primary efforts related to consolidation involving data centers and infrastructure were completed. These efforts reduced IT facilities, space, and power use through the consolidation of legacy IT and telephone infrastructure. A total of 13 data centers were consolidated into 2, a primary and a disaster recovery data center allowing approximately 279 m^2 (3,000 ft^2) of space to be converted from dedicated IT use to general office space and substantially improving reliability, performance, and security. The difference between 20th-Century and 21st Century data centers is shown in Figure 2. Concurrently, the Site's carbon footprint diminished through the conversion to 208-volt power and the transition to virtualized servers, yielding a 50% reduction in

energy use at the primary data center and the excess of 9 metric tons (10 tons) of legacy server equipment. Across the Site, data center power use has fallen from 100 to 60 kW. In addition, upgraded energy-efficient network switches across the Site and new 10Gb links between the data centers offer Projects improved throughput network redundancy. The improved throughput has led to an 18% reduction in energy load in the primary data center.

Fig 2. Data Center Consolidation.

In 2011, The Green IT strategy included three heating, ventilation, and air conditioning units being replaced in the data centers. The project reduced grey water output by up to 227 L/hr (60 gal/hr), reduces maintenance costs by an estimated $40,000/yr, and will reduce power consumption by approximately 60,000 kWh/yr.

Infrastructure Consolidation

Major energy efficiency gains are forecast through the now completed Voice over Internet Protocol (VoIP) project, which consolidated voice and data traffic onto a single network. Projections indicate a reduction from a current use level of 1,000,000 kWh/yr for telecommunications equipment to 115,000 kWh/yr, as shown in Figure 3.
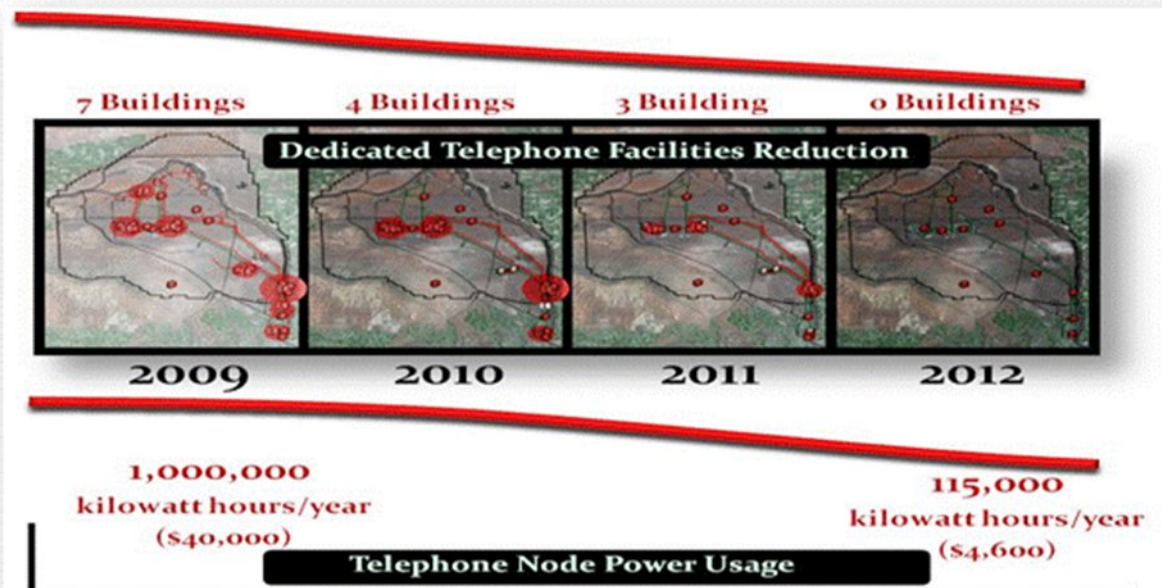
Fig 3. Telephone Facility Energy Reduction.

As a result of the VoIP project, approximately 586 m^2 (6,307 ft^2) of facility space was removed or repurposed, reducing the IT infrastructure footprint by 5 buildings.

Additionally, by leveraging VoIP technologies, the Site was able to remove 2871 kg (6,330 lb) of lead acid batteries. Of the 2871 kg (6,330lb), 2000 kg (4,410 lb) were recycled and 871 kg (1920 lb) were disposed of appropriately on Site.

Centralization

The creation of a robust wireless network allows the field forces to have Sitewide access to sufficient bandwidth for voice, data, and video requirements. The wireless network utilized 21st Century technology (WIMAX[1]) to provide high-speed wireless coverage to approximately 368 km^2 (335 mi^2) of the Hanford Site. The Green benefits of WIMAX are fourfold;

- Field personnel have access to information at the point of performance, reducing travel time to and from facilities when new information is required;

- Remote monitoring, telemetry and/or video can be conducted using the wireless network, reducing travel time for field inspections

- Emergency personnel have access to critical information at the incident site

- The cost to deploy voice, data, and video services to remote cleanup areas is faster, less disruptive to the environment, and less expensive.

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[1] WIMAX is a trademark of WiMAX Forum, San Diego, California.

Services to the field are delivered in days instead of months and information is being delivered to or sent from the point of performance. The outcome is the Projects have access to information when and where they need it, allowing them to be more efficient and effective. As a result, Projects are experiencing reduced work force time on their jobs with less travel, which in turn contributes to lowering the carbon footprint on the Site.

Using WIMAX for a wireless data transport and VoIP technology for voice and network connectivity, Hanford eliminated the need for installing costly fiber and/or copper cables to remote work sites saving as much as $300.000 per installation. As shown in Figure 4, The WIMAX/VoIP integrated solution is an environmentally and culturally friendly solution because it does not require trenching of cables and the equipment can be reused. In 2010 over $1,000,000 has been saved by using WIMAX and eliminating the need for outside plant cabling in support of *American Recovery and Reinvestment Act*-funded cleanup efforts. Because of WIMAX, the Projects had an additional $1,000,000 for cleanup, and they were able to deploy workers quickly.
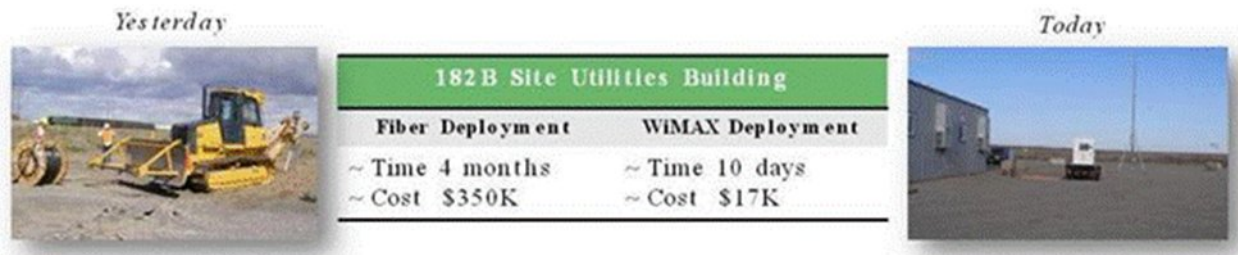

Fig 4. Typical WIMAX installation.

Standardization

Efforts toward standardization led to some of Hanford's most impactful innovations. In the Data Center, moving to an enterprise model based on VMWare[2] server virtualization has yielded tremendous cost savings (approximately 50%) and operational efficiencies. This standardization approach is a key factor to the 50% power reduction in the primary data center, and has led to a reduction from 19 server racks full of equipment to 8, yielding further space recovery, reduced heat loads, and system management improvements.

The Thin Client and Cloud Computing pilot project has been completed and has resulted in reducing the number and cost of refreshing or replacing approximately 9000 computers deployed across the HLAN today with approximately 700 Thin Clients deployed to date for MSA and DOE RL/Office of River Protection personnel. A Sitewide standard has been implemented and approximately 30% of the MSA computers have been tagged for refresh. The initial projections over the next 4 years indicate $4 to $6 million in total cost savings, a reduction of 1360777 kg (3 million lb) of CO_2 emissions, a

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[2]VMWare is a trademark of VMWare, Inc., Palo Alto, California.

reduction of 2 million kWh of power, 30% reduction in total cost of ownership, and 48% reduction in operating expenses.

Standardized applications such as Microsoft[3] Communicator and Live Meeting/Conference capabilities have been launched. These network capabilities enable electronic "in" or "out" of office status, text messaging, document collaboration, and expanded video teleconferencing capabilities. Projects will leverage these capabilities to conduct meetings and collaboration workshops, virtually eliminating the need for travel, again reducing the carbon footprint.

Conclusion

The "Green-in-three" efforts to date have had a significant impact on meeting and exceeding the overall IT Value Strategy to decrease IT maintenance and delivery costs and move Hanford into a smart, green, and flexible 21st Century IT architecture. Some of the results and impacts are as follows:

- Thirteen data centers were reduced to two, freeing up approximately 279 m^2 (3000 ft^2)) of space
- Reduced data center energy use 50%, from 120,000 to 60,000 kW
- Excessed 9 metric tons (10 tons) of server equipment
- Removed and properly disposed of 2871 kg (6,300 lb) lead acid batteries
- Projects saved over $1M in fiber and copper cable installation through 2011
- Developed or improved partnerships with local, state, and federal agencies, Tribes, and Site contractors
- Increased wireless coverage for improved access to remote areas.

Moving forward to 2012, the impact of these accomplishments will be realized in the years to come. IT services will be delivered in days instead of months. Field personnel will have access to information at the point of performance, reducing travel time. Remote monitoring, telemetry, and/or video can be conducted using the wireless network; reducing travel time for field inspections. Emergency personnel have access to critical information at the incident site, saving valuable time. Full deployment of the VoIP technologies will reduce power use by 1,000,000 kWh/yr for telecommunications equipment, driving home the IT Value Strategy of Green-in-Three.

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[3] Microsoft is a trademark of Microsoft Corporation, Redmond, Washington.