6.1 PROGRAM: CONSOLIDATED INFRASTRUCTURE

Objective: Consolidate networking and computing infrastructure; enable a reliable statewide network; refresh and update desktop and mobile equipment; provide additional computing capacity via private partnerships; and develop the core infrastructure for departments' mission-critical applications.

Description: The consolidated infrastructure program encompasses several projects that will transform the State's IT infrastructure during the next 10 years into an integrated, state-of-the-art backbone for managing and using the information collected and/or generated by the State. From enhanced networks, to increased data capacity, to newer desktop computers and software for State employees — the consolidated infrastructure program is the cornerstone of the State's IT transformation.

Impact: The updated infrastructure environment will ensure that departments can efficiently run mission-critical applications and deliver services to Hawai'i residents, while Hawai'i's citizens will have increased access to government services such as Internet-accessible applications and business processes, and will benefit as well from improved communications infrastructure such as enhanced public safety radio systems.

Related Projects and Initiatives:

Network Upgrades

The existing State network is a shared network which:
- Provides secure and reliable connectivity between O'ahu and the Neighbor Islands

- Connects State departments together (email, document management, video conferencing, applications)
- Provides each department with access to enterprise applications, data center resources, cloud-based services, and Internet access

In 2012, the State was heavily reliant on legacy networks that were under-utilized by departments due to reliability issues, and which had low reliability rates, resulting in lags in system performance and application downtimes for departments. OIMT undertook a network assessment study to evaluate the current state of the network and identify weaknesses and critical improvement areas. The assessment identified all critical infrastructure related to the network, and a series of actions to be taken during the next two years that would result in improved reliability. Among the specific actions recommended were:
- Increase Internet bandwidth and establish connections to the Internet via multiple service providers.
- Add redundant interisland and O'ahu connections to increase reliability to 99.9%.
- Establish a separate fiber optic ring on O'ahu for State Government offices
- Upgrade connection speeds for a tenfold increase in bandwidth.

Because high-speed, reliable connectivity is fundamental to the State's IT transformation and operations, the State CIO made it a key priority in 2013 to improve the network — increasing reliability, enhancing speed and performance, and guaranteeing service levels. Additionally, OIMT began consolidating network circuits, resulting in huge savings statewide and more manageability of network services and performance metrics. The addition of redundant Internet and backbone network connections has been completed. The State achieved its goal of reaching 99.8% backbone network availability by the end of 2013.

In addition to the Executive Branch, the Judiciary and Legislative branches of the government have now joined the network, and several Executive departments have successfully consolidated onto the State network, saving significant funds which had previously been earmarked for maintaining their legacy networks. Finally,

plans for upgrading bandwidth to the data centers and to major State office buildings are currently under way.

As a result of the improved network, State employees can now take advantage of better-performing applications without downtime, increasing efficiency and productivity — resulting in employees finishing their work in less time. The improved network will also support the rollout of new enterprise applications including the State's new ERP and Tax systems, a plethora of Health IT systems and other strategic departmental and enterprise-level applications.

Departments have already begun to realize benefits from OIMT's consolidated infrastructure efforts. For example, the Department of Transportation notes, "On the networking side, OIMT has been helping us reduce our number of host circuits — reducing our costs and saving the Department money." Invested in the upgrade of the State's network backbone, increasing uptime from below 80% in 2011 to 95% in 2012 and 99.8% in 2013. Increased capacity from 100 Mbps to 10 Gbps (10X or 1000% increase) to all 15 major state government locations. Also upgraded the statewide backup network with disaster recovery capabilities.
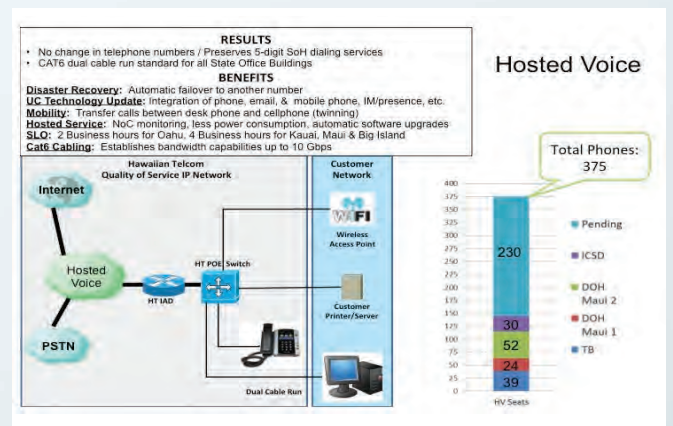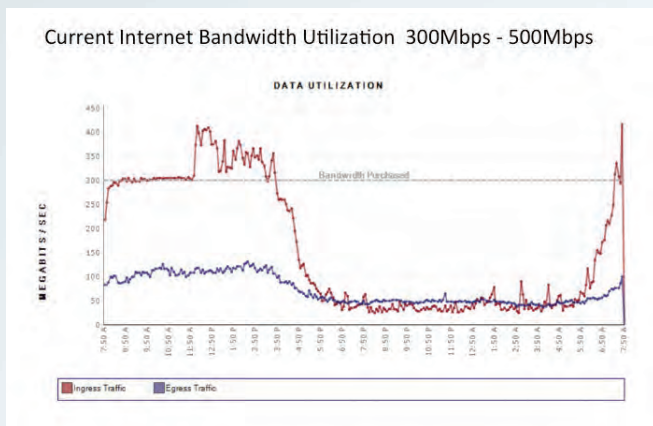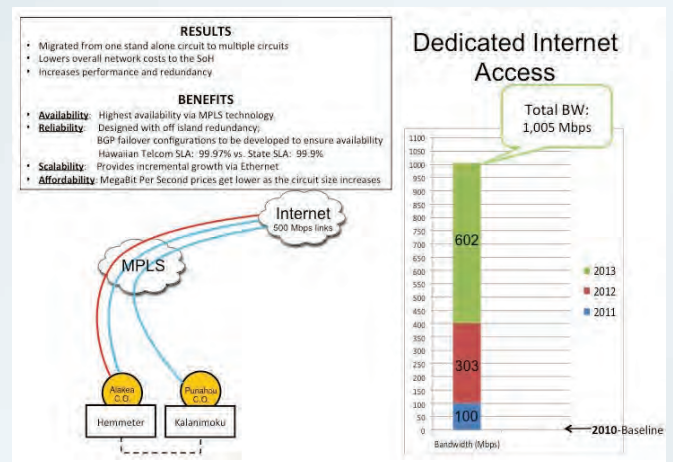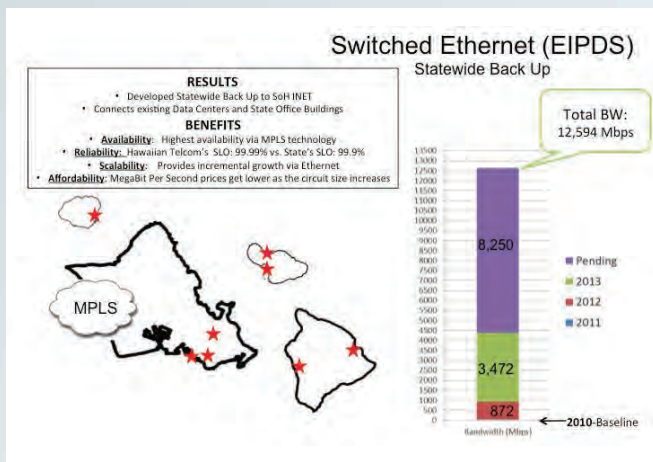
These figures illustrate significant infrastructure accomplishments across the State of Hawaii network.
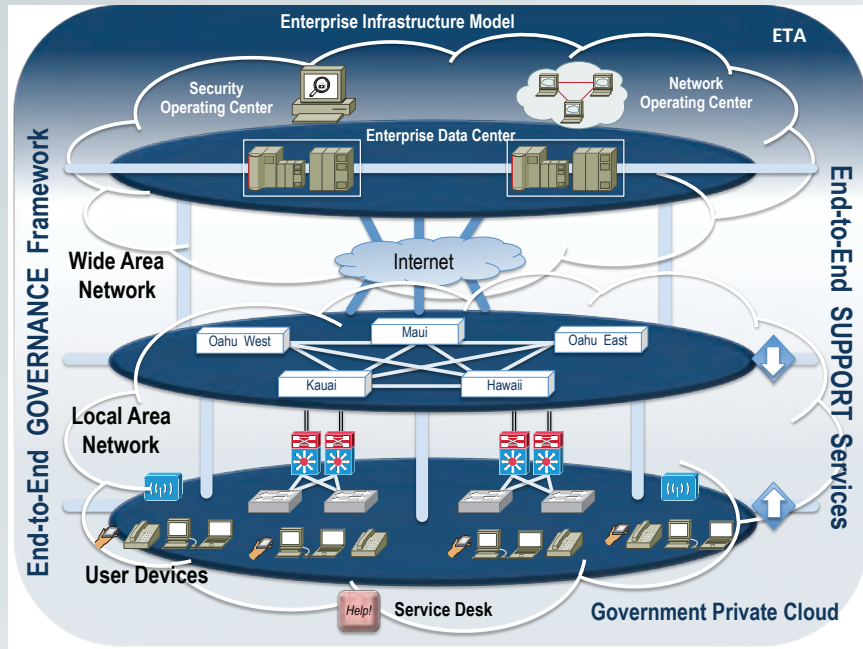
Data Center

Recognizing that modern, efficient data center operations are critical to State operations, the State CIO commissioned a Data Center Strategy in 2012. This effort found that the State's existing 25+ data centers expose the State to excessive risk and are inadequate to meet the State's expanding transformation needs.

Specifically, the Data Center Assessment found:

- Most data centers lack basic features such as generators to protect them from power outages. A significant power outage in Honolulu would significantly impact many critical State IT systems.

- Many data centers are located in or near flood/tsunami zones. Typically they are located in basements or on the first floor of State office buildings.

- The State's most critical data center is located in a basement near the water. Much of the power and cooling equipment in this facility, which was designed to last 15 years, has been in place for more than 30 years. In addition, the data center has almost reached full capacity.

- Data centers are not secured or monitored on 7x24x365 basis — leaving them vulnerable to prolonged outages and cyber-attacks.

- The State currently does not have a geographically separate disaster recovery center. A major Honolulu-centered disaster could expose the State to a potential shutdown of critical IT services for weeks, or even months. There is a chance that some systems and data might be unrecoverable.

While most states have established enterprise-level data centers and no longer house key systems in decentralized, departmental data centers, Hawai'i has more than 25 individual departmental and division data centers in operation that are hosting critical applications.

The current data center infrastructure cannot support new statewide applications, such as ERP and the new Tax system. In fact, the current data centers put these investments — and the State's existing IT assets, and the services that Hawai'i's residents rely on — at risk. The combination of new systems, more-integrated systems, and publicly accessible systems will create new demands on the underlying data center infrastructure that the current system cannot support. The inevitable results will be project delays, significant cost overruns, outages, and unacceptable exposure to disaster and other risks.

In 2012, OIMT developed and began executing against a three-part strategy for addressing the data center deficiencies.

PUBLIC CLOUD
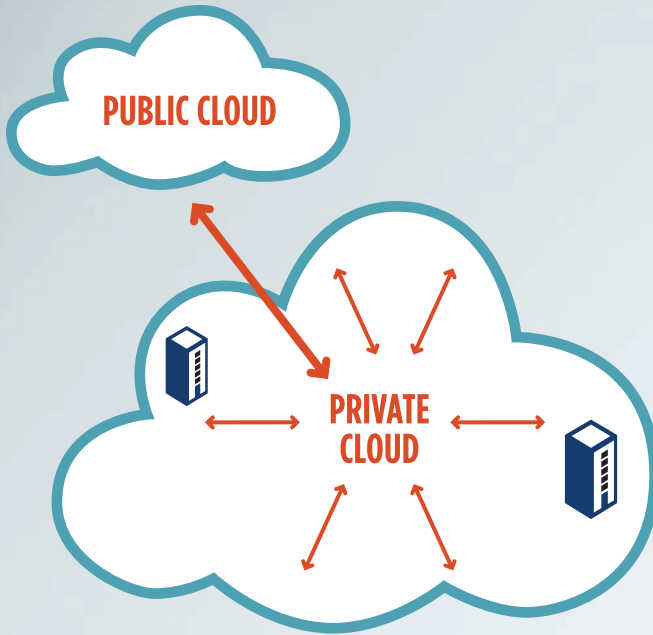
PRIVATE CLOUD

1. First, OIMT is developing a government private cloud solution which will enable departments to migrate much of the equipment located in their existing sub-standard data centers to a secure "cloud" solution which is secure, reliable, and maintained by State personnel at State facilities.

2. Second, OIMT has begun the process of acquiring a new enterprise-class data center on Oʻahu which will be designed for high availability and disaster survivability. OIMT plans to partner with the private sector to accelerate the acquisition of a Tier 3 data center and hopes to have it ready for occupancy within 36 to 40 months. Eventually this data center will be part of a five data center network (two on Oʻahu and one on each of the other three major islands).

3. Third, because the new data center strategy will take three years to put fully in place, OIMT has taken immediate steps to improve data center redundancy and resiliency. These steps include the following:
   • Establishing an operational mirror site on Maui where the State's critical data and applications will be replicated and can be run in the event of a major disaster on Oʻahu.

   • Establishing temporary data center facilities with commercial, on-island data center co-location providers, where new applications can be housed and existing departmental equipment can be consolidated.
   • Establishing limited backup capabilities in the University of Hawaiʻi's new state-of-the art data center in Mānoa.

Through server consolidation and virtualization, storage capacity increased tenfold, and select departments such as DHRD were able to begin moving their database information into cloud-based servers maintained by the Office of the CIO.

In addition to improving existing data center operations and deploying the government private cloud infrastructure solution, OIMT has begun the process of acquiring a new enterprise data center. This new facility will be highly energy-efficient and will provide the State with the capacity and level of reliability required to meet the needs of a leading digital state.

While consolidating from the more than 25 departmental data centers to an enterprise data center will allow the State to reduce costs through improved infrastructure sharing, leveraging staff, and increasing energy efficiency, the real benefit will be the added reliability and the mitigation of the State's current vulnerability to a concerted cyber-attack or a major Honolulu-based disaster. The State's investment in a Hawaiʻi-based data center will also prevent shifting jobs from Hawaiʻi to the Mainland, with an estimated 10-year positive economic impact of millions of dollars to the State.

In an effort to construct a state-of-the art data center for the lowest level of funding possible, OIMT recently conducted a Data Center Public-Private Partnership Study to assess the public-private option for building the State's shared data center. OIMT has submitted a Request for Information (RFI) to gather input from private sector organizations.

In addition to the outdated data center technology and operations, the State's 2012 assessment also found that the State was severely lacking in adequate backup and recovery systems and processes.

The Data Center Public Private Partnership Study assessed various models of public/private partnerships to determine the relative affordability and feasibility of each for the State.
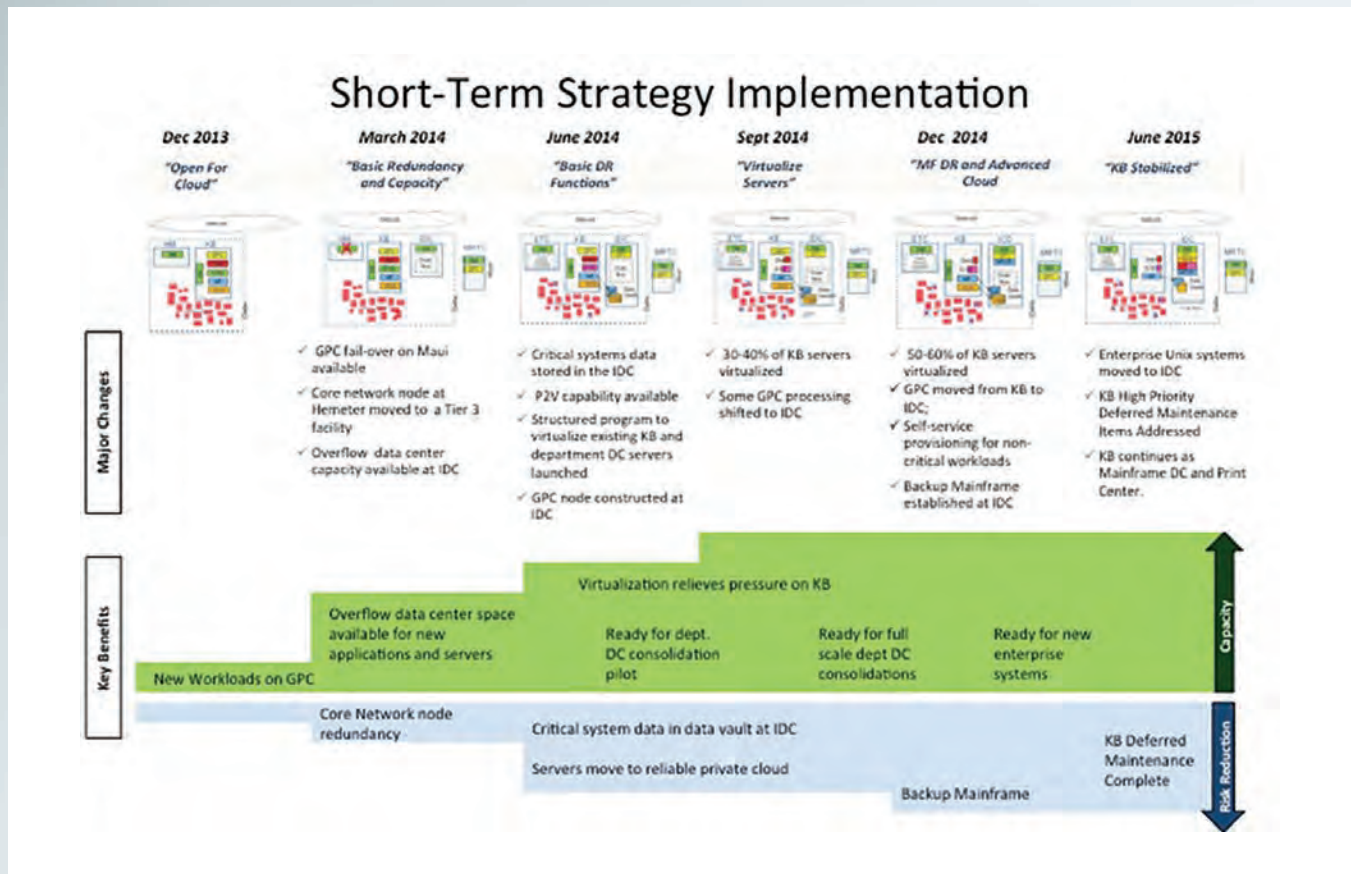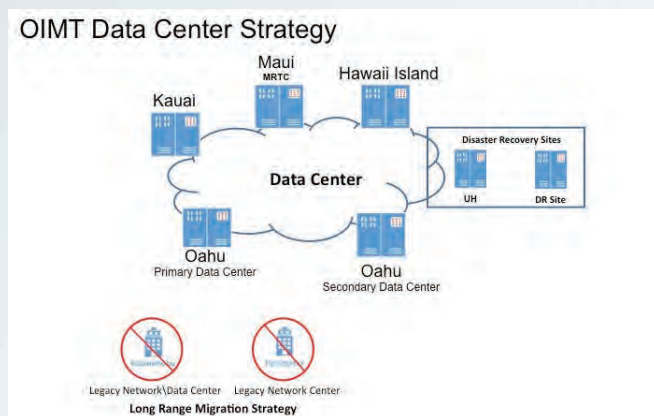
There was no central disaster recovery site for most critical State applications, and the State relied entirely on manual backup systems for disaster recovery protection. While some departments had limited continuity plans in place, most lacked comprehensive

IT disaster recovery plans — and where such plans did exist, the required infrastructure (e.g., facilities and equipment) had not yet been funded.

Realizing that a major Honolulu disaster could shut down State IT for months — and knowing that providing consistent and reliable access to State services when disaster strikes is essential to citizen confidence in government — the State CIO sought to improve backup and recovery operations within Hawai'i.

In 2013, OIMT began work on:

1) Providing Disaster Recovery Management (backups) for all servers/data on the core network (WAN).
2) Establishing network connections to other data centers for data replication, de-duplication, and disaster recovery management.

Public Safety Radio Communications

To ensure that first responders and government employees responsible for essential public safety operations have the communication tools necessary to carry out their missions, and ensure interoperability among and between agencies and partners, OIMT began improvements to the public safety radio network in 2013.

In an effort to embrace FirstNet (the national public safety broadcast network), the State made improvements including site and tower upgrades, air conditioning installation, electrical upgrades, and instituting interoperable standards and protocols. As a result of the improvements, the Office of the CIO was able to secure a FirstNet grant to help fund additional improvements and upgrades.

As an example of better managing all the State's communications and IT assets, OIMT is planning to leverage the interisland microwave network established to support public safety radio communications and to provide a backup network for the State's interisland data communications network. Currently this communications network is 100% dependent on interisland/undersea fiber optic connections. In the event of a widespread disaster, microwave may be the only form of high-speed data connectivity that the State can be assured is available. The graphic below is an example of how the Hawaiian Islands are connected via microwave connections.
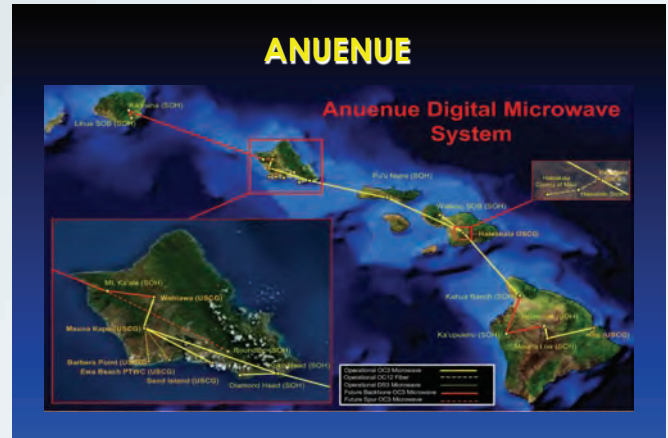
Ka'ūpūlehu Radio Tower

Kahuā Ranch Radio Tower
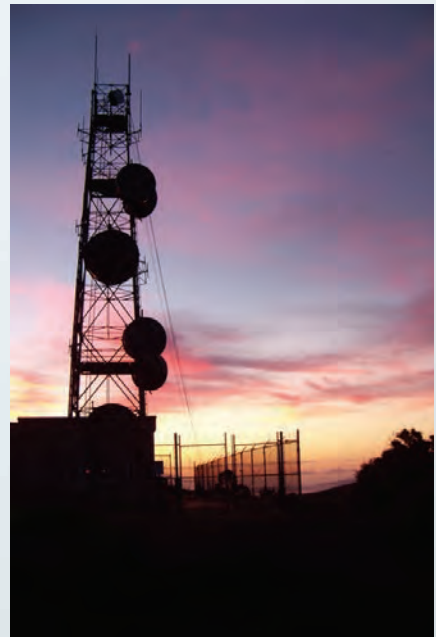
Puu Nana Radio Tower

Cloud Computing Vision

Government that Works

Closing the IT Performance Gap by leveraging cloud computing services, improving the management of major IT initiative and adopting shared services models while maintaining privacy and security

How To Get There

Current State

Efficiency
- Low asset utilization (Server utilization <25% typically)
- Fragmented demand and duplicative systems
- Difficult to manage systems

Agility
- Years required to build data centers for new services
- Months required to increase capacity of existing services

Innovation
- Burdened by asset management
- De-coupled from private section innovation engines
- Risk adverse culture

Cloud Framework for Migration
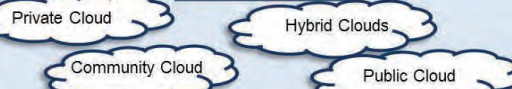
Select → Provision → Manage

Governance
CIO and Executive Leadership Councils

Cloud Deployment Characteristics
- On-demand self services
- Broad network access
- Resource pooling
- Measured service

Models
- Private Cloud
- Community Cloud
- Hybrid Clouds
- Public Cloud

Cloud Service for Use

Infrastructure-as-a-Service	Platform-as-a-Service	Software-as-a-Service
• CDN	• Developer Tools	• Government Productivity
• Storage	• Database	• Government Enterprise Applications
• Web Servers	• DBMS	• Resident Engagement
• Server Hosting	• Directory Services	
• Virtual Machines	• Testing Tools	

Future State

Efficiency
- Improved asset utilization (servicer utilization >70%)
- Aggregated demand and accelerated system consolidation
- Improved productivity in application development, application management and network and end user

Agility
- Purchase "as a service" from trusted cloud providers
- Near instantaneous increases and reductions in capacity
- More responsive to urgent State needs

Innovation
- Shift focus from asset ownership to service management
- Tap into private sector innovation
- Encourages entrepreneurial culture
- Linked effectively to emerging technologies (e.g., devices)

Operational Readiness Capability Overview

Target Existing

(Radial chart with scale markings: 0.3, 0.8, 1.3, 1.8, 2.3, 2.8, 3.3)

Axis labels:
IT Organization – Financial Mgmt
IT Organization – Service Mgmt
IT Organization – Operations Mgmt
IT Organization – Infrastructure Mgmt
Consumer Mgmt. & Reporting
Business Requirements Mgmt.
IT Financial Mgmt.
Accounting & Billing
Risk Mgmt.
IT Vendor Mgmt.
Service Catalog Mgmt.
Service Level Mgmt.
Service Portfolio Mgmt.
Service Development and Implementation Mgmt.
Demand Mgmt.
Chargeback and Metering
Service Desk
Event Mgmt.
Incident and Problem Mgmt.
Change and Configuration Mgmt.
Capacity and Availability Mgmt.
Continuity Mgmt.
Release Mgmt.
Integration & Automation Mgmt.
Provisioning Mgmt.
Performance Mgmt.
Architecture Services
Deployment Services
Infrastructure Provisioning Services
Integration and Automation Services
Infrastructure Capacity Mgmt.
Security and Compliance Mgmt.
Monitoring