• **T1: Implementing a Reliable Infrastructure Environment**

• **“Operational Excellence”**
  – Creating a world-class technology environment that is highly available, resilient, and scalable with a Service Level Guarantee of 99.9% availability.
  – Supporting Continuity of Government Services

• **State Transformation Plan**
  – Technology Modernization Track
    • Consolidated Infrastructure
    • Enterprise Shared Services
• Session Focus

– What will the future bring to our data center and its interfaces? As we continue to upgrade the infrastructure, what new technologies should be considered? This session takes a look at the technologies that will lead the way including what is the future of the Consolidated Infrastructure, Advanced Computing Environment, Data Centers and what exciting new trends are coming in virtualization, mobility, storage, cloud computing, green technology, maintenance, cost control and overall security.
• Agenda
  – Presentations by Panelists
  – Facilitated Q & A

Sharon Wong - Acting Administrator, Information and Communication Services Division, Department of Accounting and General Services, State of Hawaii

Shaun Sweeney - Regional IT Lead, Cisco

David Wu - Chief Information Officer, Department of Education, State of Hawaii

Keone Kali - Deputy Chief Information Officer - Operations, State of Hawaii

T1: Implementing a Reliable Infrastructure Environment
• **T1: Implementing a Reliable Infrastructure Environment**

• **Problem Statement**
  – Cisco IT wanted to increase the company’s business agility by automating the ordering and provisioning of IT infrastructure and making it available as a standardized, cost-effective service.

• **Alignment with State Transformation Plan**
  – Technology Transformation
    • Enterprise Resource Planning (ERP)
    • Shared Services Center
• CITEIS
  – Cisco IT Elastic Infrastructure Service

• Cisco on Cisco
  – Utilize Cisco’s product offerings to deliver best in class services to our internal users
    • Unified Fabric
    • Unified Computing
    • Unified Management
Cisco IT Journey: Automated Self-Service Provisioning

FROM 8 WEEKS TO 15 MINUTES

T1: Implementing a Reliable Infrastructure Environment
Data Center Transformation – Infrastructure TCO Over the Years

**Legacy Bare Metals based Data Center**
- UCS Adoption
- All Virtualization on UCS

**Q4 CY11**
- E2E = 17 days
- CITEIS/Compute = 15 mins.
- Fully Self Provisioned
- 5%
- -24%

**Q4 CY12**
- E2E = 5 days
- -21%

**Q2 CY13**
- -45%

**Virtualization**
- 95%

**TCO ($/Qtr.)**
- TCO ($ Per Qtr)

**Source:** Cisco IT GIS–September 2012
• **Key Accomplishments**
  
  – 170,000 CITEIS requests provisioned in a little more than two years
  
  – CITEIS users can order the service through an easy web portal
  
  – 90 percent of virtual machines provisioned by users are self-managed, which reduces the support burden on Cisco IT
  
  – CITEIS eliminates reasons for users to turn to external cloud services, with their associated costs and security risks
• Summary
  – Architecture, Architecture, Architecture
  – Virtualize
  – Standardize
  – Automate

T1: Implementing a Reliable Infrastructure Environment
DOE Now
Active-Passive Site

MOST of the data on disaster recovery site is used on failure
(Outage to move applications)

Other Common Approaches
Server Clusters
Host Mirroring
Remote Replication

Traditional challenges
→ Server cycles required to mirror or cluster
→ Application restart required after failover
→ Remote replication RTO/RPO impact
→ Network routing and different L2/L3 per site
→ Pay for expensive DR equipment that isn’t used
Site A - Active

Site B - Active

Active-Active Data Access

Federated AccessAnywhere

DOE Future RAD Design

Keep Applications Running
Utilize Resources at Both Sites
Move & Share Data Non-Disruptively

Advantages

- Enables stretched clusters with zero RPO
- Automated recovery with near-zero RTO
- High availability within and across VPLEX Metro data centers
- MOST importantly DR equipment is used

“RAD” Advantages

11/27/13

Example of RAD Value—Evolution of Oracle Storage toward VPLEX Design

Typical configuration:
Oracle RAC with array-based replication for disaster recovery

Areas for Enhancement
• Requires full failover and restart at remote site
• Recovery time objective (RTO) is long
• Complex DR testing

Typical configuration:
Oracle RAC over distance with Oracle ASM (Host-Based Mirroring)

Areas for Enhancement
• Valuable CPU cycles spent on host mirroring
• Error-prone management of host mirroring, groups, paths
• Complex cross-connect SAN networking

VPLEX configuration:
VPLEX simplifies deployment of Oracle RAC over distance

VPLEX Delivers:
• High availability
• Configuration & Management SIMPLICITY
• High-performance replication (no server CPU cycles)

** Requires Oracle Cloud File System License **

Consolidated Infrastructure

10Gbps Backbone Network

Unified Communications

Internet Services
OIMT Data Center Strategy

Kauai

Maui MRTC

Hawaii Island

Data Center

Primary Data Center

Secondary Data Center

Disaster Recovery Sites

UH
DR Site

Oahu

Long Range Migration Strategy

Legacy Network\Data Center

Legacy Network Center
RESULTS

- Developed Statewide Back Up to SoH INET
- Connects existing Data Centers and State Office Buildings

BENEFITS

- **Availability**: Highest availability via MPLS technology
- **Reliability**: Hawaiian Telcom’s SLO: 99.99% vs. State’s SLO: 99.9%
- **Scalability**: Provides incremental growth via Ethernet
- **Affordability**: MegaBit Per Second prices get lower as the circuit size increases

Total BW: 12,594 Mbps
RESULTS
• No change in telephone numbers / Preserves 5-digit SoH dialing services
• CAT6 dual cable run standard for all State Office Buildings

BENEFITS
Disaster Recovery: Automatic failover to another number
UC Technology Update: Integration of phone, email, & mobile phone, IM/presence, etc.
Mobility: Transfer calls between desk phone and cellphone (twinning)
Hosted Service: NoC monitoring, less power consumption, automatic software upgrades
SLO: 2 Business hours for Oahu, 4 Business hours for Kauai, Maui & Big Island
Cat6 Cabling: Establishes bandwidth capabilities up to 10 Gbps

Total Phones: 375
RESULTS
- Migrated from one stand alone circuit to multiple circuits
- Lowers overall network costs to the SoH
- Increases performance and redundancy

BENEFITS
- **Availability**: Highest availability via MPLS technology
- **Reliability**: Designed with off island redundancy; BGP failover configurations to be developed to ensure availability
  Hawaiian Telcom SLA: 99.97% vs. State SLA: 99.9%
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Current Internet Bandwidth Utilization  300Mbps - 500Mbps
### Consolidated Infrastructure

- Network Managed Services
- Security Managed Services
Network and Security Operations Center (NSOC)

- Global Monitoring
- All IT Assets
- All Ingress/Egress Points
- All Network Nodes
• Critical Infrastructure Protection
• Cyber Hazard Monitoring

• Natural Hazard Monitoring
• Man-Made Hazard Monitoring
• Detailed IP Security Forensics
• Near Real-Time Response and Mitigation
• Video Surveillance
IP/VPN (RNS)
Frame Relay Migration to MPLS

RESULTS
• Migrated more than 100 circuits from legacy Frame Relay to Next Gen IP VPN
• Lowers overall network costs to the SoH

BENEFITS
• Availability: Highest availability via MPLS technology
• Reliability: Designed with off-island redundancy; Hawaiian Telcom SLA: 99.99% vs. State SLA: 99.9%
• Scalability: Provides incremental growth via Ethernet
• Affordability: MegaBit Per Second prices get lower as the circuit size increases

Remotes Access To ICSD
MRTC

Total BW: 3,935 Mbps
2010 - Baseline

Consolidated Infrastructure
Data Center Managed Services
State of Hawaii’s Long Term Data Center Journey

**Current State**
- State IT assets spread across 27+ departmental and ICSD data centers on Oahu
- Primary state data center at Kalanimoku houses many critical applications
  - Decaying DC infrastructure susceptible to outages
  - Limited expansion capability; current data center is almost “full”
  - Vulnerable to natural disasters (fire, flooding, etc.)
- Limited and inadequate disaster recovery capability for major applications housed at Kalanimoku
- Loss of Kalanimoku data center could cause state backbone network failure affecting all departments and sites

**Short Term- Future State (2-3 years)**
- Interim Data Center (IDC) established at a world class, co-location facility on Oahu
  - Reliable, Tier 3 DC infrastructure
  - Sufficient capacity to support new applications/ workloads and some departmental consolidation
  - All critical state applications except those on the mainframe migrated to this facility
- Kalanimoku Dependency significantly reduced
  - KB role reduced to mainframe data center, print center and server room for legacy, non-critical applications
- Disaster Recovery (DR) and failover capabilities established for new and existing applications
  - Real-time Data Vaulting of all legacy applications housed at KB established at IDC
  - Failover for Unix and Windows applications provided through GPC infrastructure on Maui
  - Mainframe “warm site” disaster recovery capability established in this facility

**Long Term- Future State (4-5 years)**
- Most existing State or departmental data centers retired as part of an overall consolidation program.
- Most State system housed in highly robust Tier 3 data center located away from likely disaster zones.
- Full DR capability for all critical State systems housed in a separate Tier 2 data center on Maui or Oahu
- Satellite data centers established on Neighboring Islands to support island-centric computing needs.

ETC- Enterprise Telecom Center
KB- Kalanimoku Data Center
HM- Hemeter Building
IDC- Interim Data Center
MRTC- Maui Research & Tech Center
GPC- Government Private Cloud
NET- Core State Network Node
OCS- Other Critical Systems (Unix)
Short-Term Future State: Six Key Aspects

1. Major statewide network node at Hemmeter is migrated to the ETC which will be located at major co-location center on Oahu.

2. Primary State data center is the Interim Data Center (IDC) at a major co-location center on Oahu. All future systems to be located here.

3. Disaster recovery capabilities are provided through a data vault located at the IDF for legacy mainframe systems remaining at KB and at the State’s primary Disaster Recovery site at the MRTC on Maui for all other systems.

4. Kalanimoku remains the State’s primary data center for Mainframe Systems and a primary network location (but fully redundant with the IDC). It also remains print center, staff location (help desk, etc.) and legacy server room.

5. Most x86 servers at KB are migrated to the government private cloud (GPC) infrastructure which located at the IDC and the MRTC.

6. Critical Unix systems are migrated to the IDC as part of their hardware refresh process.

Note: UH is not depicted here as it would be a telecom center only. Initially, this would be a minimal footprint, perhaps including of the State’s Internet connections. This role will be more important once the Oahu INET ring is split.

Legend:
- Legacy Departmental X86 Servers
- Legacy ICSD X86 Servers
- Major Telecom Nodes
- Enterprise Unix Systems
- ETC- Enterprise Telecom Center
- KB- Kalanimoku Data Center
- HM- Hemmeter Building
- IDC- Interim Data Center
- MRTC- Maui Research & Tech Center
- GPC- Government Private Cloud
- NET- Core State Network Node
- OCS- Other Critical Systems (Unix)
**Short-Term Strategy Implementation**

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<tr>
<td>“Open For Cloud”</td>
<td>“Basic Redundancy and Capacity”</td>
<td>“Basic DR Functions”</td>
<td>“Virtualize Servers”</td>
<td>“MF DR and Advanced Cloud”</td>
<td>“KB Stabilized”</td>
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- **Major Changes**
  - GPC fail-over on Maui available
  - Core network node at Hemeter moved to a Tier 3 facility
  - Overflow data center capacity available at IDC
  - Critical systems data stored in the IDC
  - P2V capability available
  - Structured program to virtualize existing KB and department DC servers launched
  - GPC node constructed at IDC
  - 30-40% of KB servers virtualized
  - Some GPC processing shifted to IDC
  - 50-60% of KB servers virtualized
  - GPC moved from KB to IDC;
  - Self-service provisioning for non-critical workloads
  - Backup Mainframe established at IDC
  - Enterprise Unix systems moved to IDC
  - KB High Priority Deferred Maintenance Items Addressed
  - KB continues as Mainframe DC and Print Center.

- **Key Benefits**
  - Overflow data center space available for new applications and servers
  - Critical system data in data vault at IDC
  - Servers move to reliable private cloud
  - GPC Deferred Maintenance Complete

**Virtualization relieves pressure on KB**

- Ready for dept. DC consolidation pilot
- Ready for full scale dept DC consolidations
- Ready for new enterprise systems

**New Workloads on GPC**

**Core Network node redundancy**
Enterprise Shared Services

Government Private Cloud Services (GPC)
Virtual Desktop Infrastructure (VDI)
Geospatial Information Systems (GIS)
Enterprise License Agreements
Accelerate Transformation Services leverage ITIL v. 3 to define a service as “A means of delivering value to the Customers by facilitating outcomes the Customers want to achieve clear ownership; reduction of specific Costs and mitigation of Risks”.

Accelerate Transformation Services build and align the service life-cycle with core areas of people, process, and technology to align with business needs.

Accelerate Transformation Services build executable processes aligned to VMware Products to accelerate Customer value.
Drivers:

- State of Hawaii Innovation Economy initiative
- Data center consolidation, scattered “IT” brought together
- Economies of Scale
- Enterprise Shared Services
- Network / Technology Upgrade and Stability – 99.9% uptime goal
- Security 60+ projects under way
- Network 50+ projects under way
• Virtualization Initiatives:
  – Operational Capability Assessment
    • Assessment completed
    • Recommendations & roadmap delivered

– Private cloud technology implementation
  • Hardware & software configured
  • Self-service selection(s) via portal
  • Automated infrastructure deployable < 5 minutes
New Operating Model for the Cloud Era

Reactive
“Standardize”

Proactive
“Service Broker”

Innovative
“Strategic Partner”

HOW DO I OPERATIONALIZE CLOUD SERVICES?

HOW DO I MAKE THE TECHNOLOGY MEET THE BUSINESS NEED?

IT Business Management
People, Culture & Organization
Processes & Control
Software Technology & Architecture
Cloud Operations Leadership Team

Sample: ITaaS Operations Leadership Team

Lead Architect(s) Analyst(s) Administrator(s) Developer(s)

Executive Leader

Enterprise Architect
OS Specialist(s)
Physical Networking
Physical Storage
Physical Systems
Security

IT Governance
ITaaS Operations Management
Traditional Operations Management Teams
NOC
Service Desk
Operational Readiness Capability Overview
State of Hawaii – Private Cloud Maturity Targets
Key Recommendations

- **Establish IPC Infrastructure & VMware software**
  - IaaS 24 hr. SLA
  - Disaster Recovery in 72 hrs.
  - Convert to “Cloud First” policy

- **Implement Cloud Operations Leadership Team**
  - COLT structure & function training
  - Execution Excellence Training
  - Converge ICSD & OIMT teams

- **Implement Best-practice ITSM Structure**
  - SaaS or On-premise
  - Best-practice ITIL core processes
  - Predictive Dashboard for Growth

- **Manage IT Financials**
  - IT Show-back in 2014
  - Chargeback on Customer services
  - Budgeting based on show-back data
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Government Private Cloud – on Demand Provisioning of Servers
Virtualize desktops into a Centralized Service

**Transform:** Simplify desktops and apps into the datacenter with virtualization

**Broker:** Manage and secure virtual desktops from a single admin console while removing data off endpoints

**Deliver:** Empower your workforce with secure, roaming access to your same desktop across devices

**IT Benefits:**
- Simplify and Streamline Desktop Management
- Drive Down Costs
- Enhance Security & Compliance
- BYOD Security Compliance

**End User Benefits:**
- Enhanced User Access & Mobility
- Optimize usability & productivity
- Customize & personalize desktops
Online GeoPlatform: http://gis.hawaii.gov
Solar Exposure and Rainfall Runoff Applications

A collection of web applications and 3D web scenes showing potential solar roof exposure and rainfall runoff for various buildings in Honolulu, Hawaii.

Search maps

Rainfall Runoff

Aia Moana

Downtown Honolulu

Kaimuki (East)

Mallino

Solar Exposure

About the Data

2D and 3D GIS building models and applications showing potential solar and rainfall renewable energy for buildings in Honolulu, Hawaii. Rainfall volume is the number of gallons of runoff expected from 1" of rain on the calculated roof surface area of the building. Solar values were based upon calculated roof area and orientation of roof relative to North, in degrees: 0: North Orientation; 0-80 degrees, 281-360 degrees 1: East Orientation: 81-160 degrees; West Orientation: 201-280 degrees 2: South Orientation: 161-200 degrees Data developed for Hawaii Office of Information Management and Technology (OIMT) by CyberCity 3D, March, 2013. For more information, contact Hawaii Statewide GIS Program, Office of Planning, State of Hawaii.
• Panel Questions
  – What are the trends around Consolidated Infrastructure and deploying Shared Services Models?
  – Key Lesson(s) Learned and Best Practice(s)
  – Next Steps
  – How can you help?
  – Who do you contact?
    • Sharon Wong