The University of the South Pacific
Campus Network Expectations and Challenges

PACNOG 25 - Fiji

Welcome
Edwin Sandys
IT Services
Agenda

• About USP
• LAN & WAN Infrastructure
• Systems & Networks Infrastructure
• Cloud Services
• Challenges
• Future
About USP

• USP established 1968 to serve 12 member countries.
  – Fiji, Samoa, Vanuatu, Solomons, Tonga, Kiribati, Tuvalu, Nauru, Marshalls, Niue, Cooks, Tokelau.

• Unique Regional Scope;
  – Covering thousands of islands over 33 million square km of ocean
  – Around 2 million people and hundreds of distinct cultures
  – 25,000+ students; 5-8% growth p.a. & 1500 Staff

• Connectivity
  – 26 Active Sites over 12 Countries
  – Satellite C & Ku Band (16 Sites – 28 Mbps)
  – Undersea & Terrestrial Fiber (Fiji Sub Sites, Tonga, Marshalls, Vanuatu & Samoa)
  – Upstream via Research & Education Network (AARNet)
Connectivity Cont....

- Fiji eXchange Point (IXP) Peering (Early 2018)
  - Better service access for Students & Staff
  - Better VPN Access (Work from Home)
  - Planning Stages: Livestream lectures for Fiji

- Future for IXP – Later Slide!
LAN & WAN Infrastructure

Roads & Bridges
Satellite Platform Revamp

• C Band Dishes Installed 1999 - 20 Years Old
  – EOL 15 to 20 Years
• Regional Dishes
  – 7 New Installs: 2 Non Penetrating & 5 Penetrating Mounts
  – 3 Refurbished plus non penetrating mount dishes
• Fiji Hub
  – Refurbish current
  – Build new antenna
• Enhanced IP Satellite System (iDirect)
  – 32% efficiency gains of current outbound Mbps
  – Better enhancements (DVBS-2X with ACM)
  – Enhanced Modem performance (32APSK Modcods)
Fiber Ring Journey

• Business Case Approved - 2008
  – Fiber Purchased Approved
• Trenching Works Completed - 2009
• Cabinet Cleanup & Auditing Completed - 2011
  – 70+ cabinets
  – 35 fiber terminals
• Fiber Pulling and Termination Completed - 2013
  – Documentation Update & As-Builds
• Cabinet Electrical Wiring & Grounding - 2015
• Fiber Ring Switches Purchase Approved - 2017
• Fiber ring Online & Operational - Oct 2018
Comms Fire Fiber Redirection
Systems & Networks Infrastructure

Layering on equipment!
General Networking

• Scale
  – 10 / 40 / 100 Gig

• Reduced Footprint
  – Less racks = Less Power
  – Smaller rooms
  – Less cooling

• Wireless Services
  – Centralized Management
  – No Cabling No Problems (Mesh)
    • 15000 Feet = 4572m
  – Over 350 AP’s
  – 2000+ Connected Users

• Design is Essential
  – Redundancy & Resiliency
  – NSRC Engagement
Design - Wireless

- **Wired Devices**
- **Wireless Devices**
- **Users**
  - Register & Authenticate
- **SSO, Certificates, Policy Servers**
- **NAC Server, MDM Server, Provisioning Services**
- **Push Services & Policies**
- **Send**
- **Enforce**
- **ALL SERVICES**
  - Office 365
- **Monitoring & Control**
  - Management & Monitor
Design – Layered Approach

- Reference Point
- Endorsed Direction
- Easy Equipment Choices
- Application Provision
  - Business Critical
  - Faculty / Departmental
  - IT Services
  - Development
- QoS Tagging
  - End to End

AARNet ISP
- 10 G Fiber
- 2 x 40 G Fiber

HA cluster

TFL Fiber Suva
Primary AARNet Link

TFL Fiber Vatuwaqa
Secondary AARNet Link

USP Fiber

Internal BGP Equipment

Cisco ASR 1002-X

FAN

USB CONSOLE AUX MGMT ETHERNET CRIT MAJ MINTAT WR

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

Data Center Central Core

CISCO NEXUS N 9K-C92160YC-X

BCN

STS

ENV

N9K-C92160YC-X

Cisco ASR 1002-X

FAN

USB CONSOLE AUX MGMT ETHERNET CRIT MAJ MINTAT WR

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

ISP Sites (External)

ISP Peering

IXP Peering

USP Fiber Interconnect

USP Campus WAN Sites (Trusted)

Federated Peering

USP Affiliated Sites (Semi-Trusted)

USP Sites (External)

NGO Peering

ISP Peering

USP Satellite Interconnect

Business Critical

Faculty / Departmental

IT Services

Development

QoS
Server Hyper Converge Infrastructure (HCI)

- Technology
  - Smaller
  - Faster
  - Compact

- Reduced Footprint
  - Less power
  - Less racks
  - Smaller rooms
  - Smaller cooling
  - Better Electrical
Server Room Cleanup
## HCI Server Compute

- **HCI Node Failover N+1**

<table>
<thead>
<tr>
<th>#</th>
<th>Technology</th>
<th>Number of Nodes</th>
<th>Cores</th>
<th>Total Cores</th>
<th>HyperThread</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dell VX Rail G410 (6 Nodes)</td>
<td>6</td>
<td>14</td>
<td>140</td>
<td>280</td>
<td>65 TB Effective (All Flash)</td>
</tr>
<tr>
<td>2</td>
<td>Cisco HyperFlex HX240c (3 Nodes)</td>
<td>3</td>
<td>20</td>
<td>80</td>
<td>160</td>
<td>120 TB Effective (All Flash)</td>
</tr>
<tr>
<td>3</td>
<td>IBM ThinkAgile HX552x (8 Nodes)</td>
<td>8</td>
<td>20</td>
<td>280</td>
<td>560</td>
<td>480 TB Raw (Hybrid) 250 TB Effective</td>
</tr>
</tbody>
</table>

### VM Efficiency

- **Overprovisioned**
  - Dell VX Rail: 78
  - Cisco HyperFlex: 9
- **Inactive**
  - Cisco HyperFlex: 4
  - IBM ThinkAgile: 0
- **Constrained**
  - Dell VX Rail: 0
  - IBM ThinkAgile: 9
- **Bully**
  - Dell VX Rail: 0
  - IBM ThinkAgile: 0

[View All Inefficient VMs](#)
Cloud Services

Determine services that should be placed in the Cloud.
Student Gmail

- **On Premise**
  - Google Cloud Directory Sync
  - Users & Groups
- **Cloud Security**
  - Anti-SPAM
  - AV
  - IPS
- **Students**
  - 15 Gig mailbox per user
  - Unlimited Cloud Storage
  - 30,000 active users
  - 450 Terabytes of Data
<table>
<thead>
<tr>
<th>#</th>
<th>Service Classification</th>
<th>Backup Frequency</th>
<th>Recovery Testing Frequency</th>
<th>Retention Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Business Critical (includes development)</td>
<td>Every 6 Hours</td>
<td>Every 3 Months</td>
<td>7 Years</td>
</tr>
<tr>
<td>2</td>
<td>Departmental &amp; Faculty</td>
<td>Weekly</td>
<td>Every 6 Months</td>
<td>3 Years</td>
</tr>
<tr>
<td>3</td>
<td>IT Managed</td>
<td>Weekly</td>
<td>Every 6 Months</td>
<td>3 Years</td>
</tr>
<tr>
<td>4</td>
<td>Development</td>
<td>None</td>
<td>None</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Recovery

- 3rd Backup Repository
  - Cloud storage services.
  - Amazon AWS / MS Azure / Google / USP
  - Cost vs Features vs Ease

- Service Recovery
  - Spins services on the cloud
  - Business disaster options
  - No need for secondary data center
Challenges

What keep the cogs turning!
Challenges for Team

- **Documentation**
  - Maintaining records (meticulous)

- **Standard Operating Procedures (SOP)**
  - Process driven
  - Flow of events

- **Automation & Central Management**
  - 4 Systems Engineers
  - 5 Network Engineers
  - 3 Infrastructure Techs

- **Infrastructure Patching vs Application Updates**
  - Patching security platforms, networking gear, etc.
  - Updating application code and open source development.

- **Testing Tools**
  - Fiber & UTP
  - Wireless
Challenges Cont....

- **Construction / Landscaping**
  - Fiber Cuts & Pit Damage
  - Redesign of contractor plans

- **Technical Expertise**
  - Constant training renewal
  - Recruiting appropriate personnel
  - Internal recruitment process
  - Maintaining market value

- **Security**
  - Securing people (Trust but Verify)
  - Securing infrastructure
  - Securing services

- **Weather** – No Control!
Bridging the Gaps

• NOC Monitoring
  – Interns with supervisory staff.
  – Weekday operations from 7am to 10pm
  – Weekend operations from 10am to 6pm
  – Other Hours: Automated Notifications

• Detailed Provisioning
  – Network Operations Center (NOC) – iCinga
  – Bandwidth Validation – Perfsonar
  – Network Provisioning – Cisco Prime
  – Systems Provisioning – vCenter & Prism
  – Security Monitoring – Firewall Analyzer
Future

What's next on the roadmap?
Future

• Connectivity
  – Regional Fiber Connects (join Fiji eXchange Point)
  – Eduroam – Under Technical Trials
  – Additional Satellite Providers
  – Extend 10 Gig (Office Uplink) – 30% Complete
  – Reduce Firewalls

• Cloud
  – Office 365 & Disaster Recovery

• Infrastructure
  – Small is better so consolidate
  – Localise Content to remote sites (caching)

• Technology Trends
  – Keep track on current technologies
  – Extensive Automation & API Integration
Regional Designs - Wireless
Thank You & Questions

We do things right, our people stay connected!

Email: Edwin.sandys@usp.ac.fj