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Welcome to BCNET 2019

**Enterprise Network Services: Collaboration on a Tight Rope
VIU Network Remediation Project (NRP)**



**VANCOUVER ISLAND
UNIVERSITY**

Agenda

- Project Overview and Triple Constraint
- Business Case Creation
(*A Case for MAEST*)
- Procurement, Contracts and Legal Considerations
(*Speed of Trust*)
- Infrastructure Design and Implementation
- Recap, Next Steps & Lessons Learned
- Q&A

Lemuel Mayona

Project Manager, NRP

Vancouver Island University



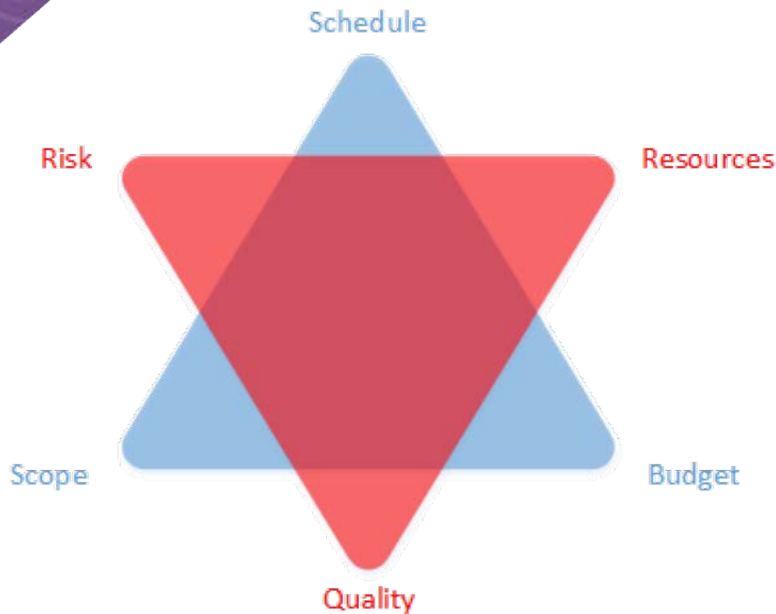
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Project Overview

- **Network Remediation Project (NRP)**
 - Scalable, secure, resilient, *cloud ready* network
 - Address over 20 years network infrastructure technical debt
 - Support teaching, learning and business units at VIU
- **3 Phase Project**
 - Phase 1 (2018-2019) – Core, Edge, Aggregate Layers
 - Phase 2 (2019-2020) – Distribution, Access Layers
 - Phase 3 (2020-2021) – Wireless

Triple Constraint



- **Time**

- Sept 2018 – \$1.25M from MAEST became available
- Oct 2018 – RFP for ENA/SNA
 - Enterprise Network Architect (ENA)
 - Senior Network Architect (SNA)
- Nov 2018 – Onboarding
- Mar 2019 – Phase 1 Commissioning

- **Cost**

- Requested Phase 1 budget of \$1.8M | Available \$1.455

- **Scope**

- Server Aggregation, Edge, Core Layers
- Add - Service Aggregation, Distribution, some Wireless
- Change - Direct Digital Controls / Emergency Call System

Procurement

- **VIU Purchasing**

- Worked with VIU Purchasing Manager, achieving fastest RFP in VIU history, to procure ENA/SNA

- **BCNet IT Professional Services Roster**

- Invited BCNet's 5 pre-qualified vendors for Network Services
- Max of \$250K per project (including any renewals and extensions)
- Received 3 submissions
- Compugen was successful after reviewing proposals and interviews with proposed ENA/SNA

- **Hardware and Software**

- Used BCNet's preferred value added reseller for higher education
- Best pricing and existing MSA

Contract and Legal Considerations

- Service Agreement from VIU, reviewed by vendor
- Statement of Work (clearly defined and detailed) from vendor
- Signed by both parties, quick turn around
- Purchase Order
- Consider sickness/vacation/emergencies/backup signatories
- Could get stuck in legalese

The Speed of Trust*

Summary

- Trust increases speed and lowers costs in business
- Trust = confidence = competence and character

↑ TRUST = ↑ SPEED + ↓ COST

↓ TRUST = ↓ SPEED + ↑ COST

Building and Accelerating Trust

1. Declare intent
2. Signal behaviour
3. Deliver

Nicholas Cumberbirch

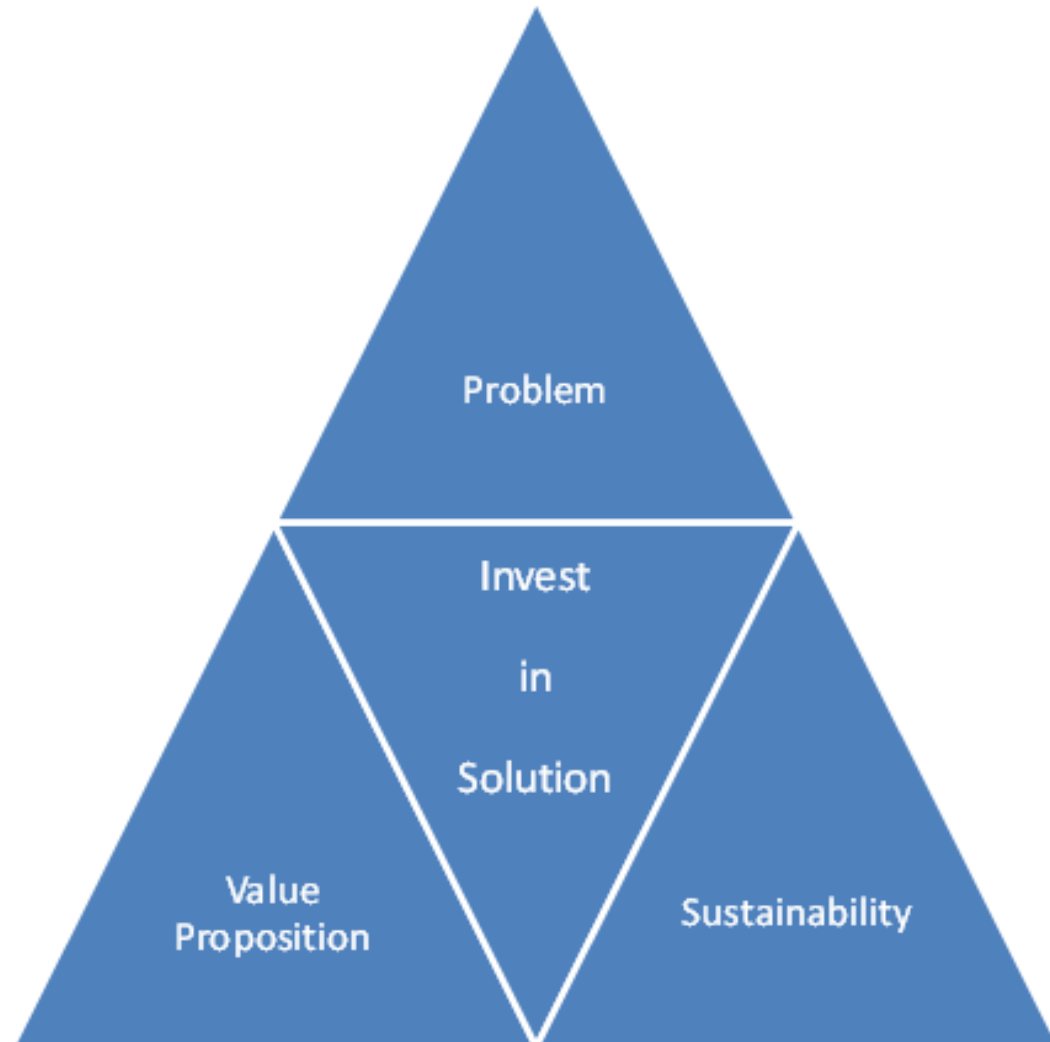
Managing Partner

innovations, inc



Business Case Creation

(A Case for MAEST)



1. Problem

Security: Breaches. Frequent and many
Resilience: Outages. Long durations of unscheduled outages
Scalability: No room for expansion

The ship was sinking!

All hands were pumping the bilges just to keep us afloat. No time to build a strategy into delivery.

Ministry Senior Executives met with us to discuss how they could help and support us to move away from being the single biggest security risk in the Province.

2. Proposition

We conducted an in depth assessment of where we were
Strategized our future vision

Developed GAPs, Road map, Bill of Material, resource
requirements, detailed implementation plans

Calculated our proposed Return on Investment

3. Sustainability

We planned

Sustainability: Next 5 years and included this as part of the proposal

- Resource certifications required
- Operational model
- Future technology replacement

4. Investment

We submitted our business case with a request for \$1.8M and received \$1.4M

5. The Solution

We have completed the first one year phase in 6-months; and are now embarking on the second year of this project; this time we have allowed the full 12-months.

Adam Jamieson

Senior Network Administrator

Vancouver Island University



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VIU Previous State

Organic Growth over the Years

Single Link to Buildings

100mb/s to Gigabit backbone

Media Converters, Multimode OM1,
Daisy-Chaining Bldgs.

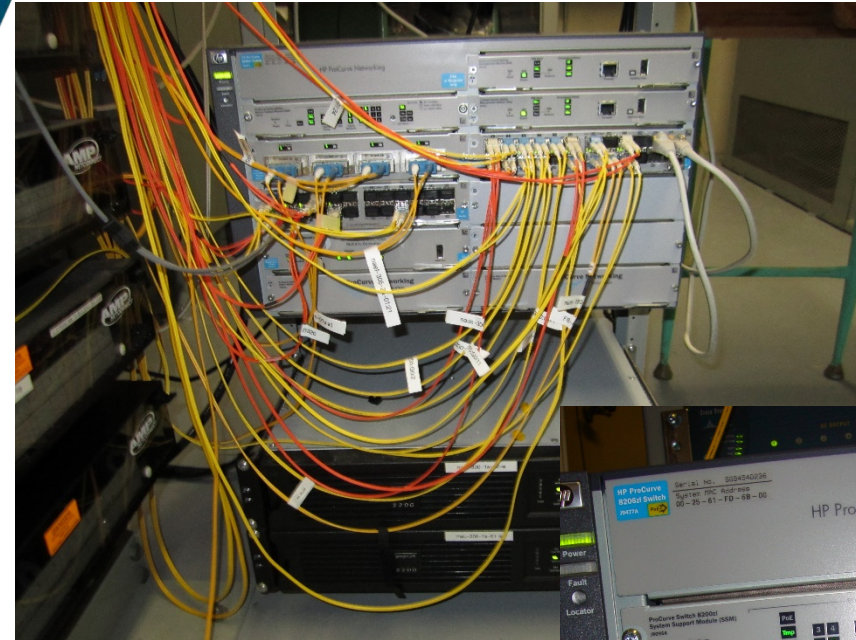
Layer 2 VLAN “Spiders Web”,
Spanning-Tree, BACNET, Legacy Stuff

Life Safety Systems, Door Controls,
HVAC

RIP, OSPF, Static.

Mixed Protocols

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Our Requirements

- Everything Layer 3
 - No more VLAN spanning between buildings
 - Limit Spanning Tree Protocol Domains
- 10Gigabit Backbone with 40Gig Upgradability
 - 10Gigabit Core to Building Requirement
 - 40Gigabit Datacenter to Core Requirement
 - 40Gigabit Service Aggregate Requirement
- Standardization of Network Routing/Switching Devices
 - Same 4 Models used everywhere
- Simple to Administer / Less Overhead (Change Points)

What did we do?

- Server Aggregation Layer
 - Re-built data center.
 - Shut down services for 2 days and rebuilt physical hardware, cabling, and new aggregation layer for server services.
- Building Distribution Layer
 - Added new Distribution switches to each building
 - 10Gigabit Connections
 - Dual Link
 - Standardized Programming / VLANS / Settings
- Core Layer
 - Removed 8406zl Cores
 - Added Brand New Aruba 8400 Cores
 - 40Gigabit to Server Aggregation Layer
- Edge Layer
 - Simplified Edge Connections
 - Replaced Edge Hardware with Devices Capable of 40Gigabit networking

Challenges & Solutions Designed in Project

- HVAC
 - BACNET Protocol
- Emergency Safety Poles
 - Initial Configuration Revisit
- Re-visit and Engage Vendors
 - Work Together on Layer 3 Solution
- VPN
 - VXLAN (Layer 2 over Layer 3 using Tunnels)
- Jumbo Frames
 - VPN / VXLAN

VIU Current State

40Gigabit Backbone

10Gigabit Connection to all Buildings

Dual Single mode Links to Buildings

Layer 3 Only, OSPF Only, Separate Areas

Spanning Tree Per Building

VLANs Standardized Per Building
(Same VLANs in Each Building)

Flexible for Future Growth

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José Perera

*Principal Consultant –
Communications and
Collaboration*

Compugen Inc.

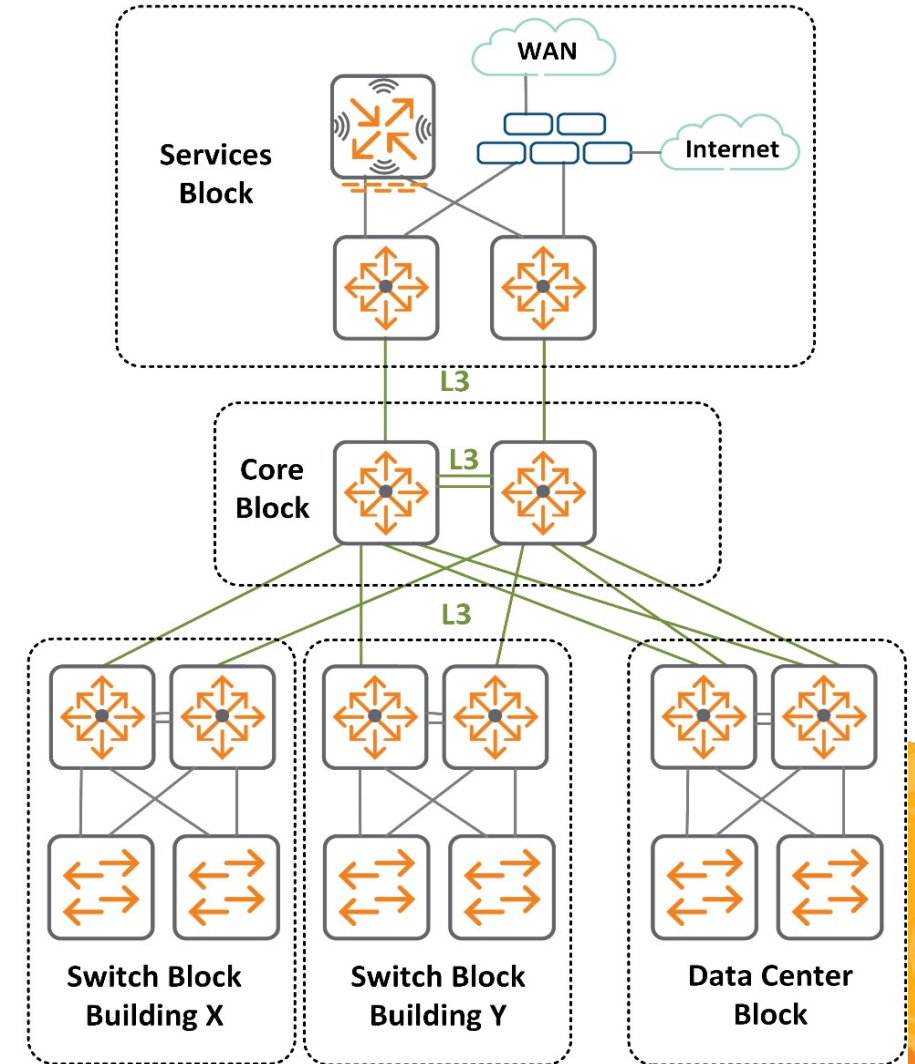
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Proposed Design

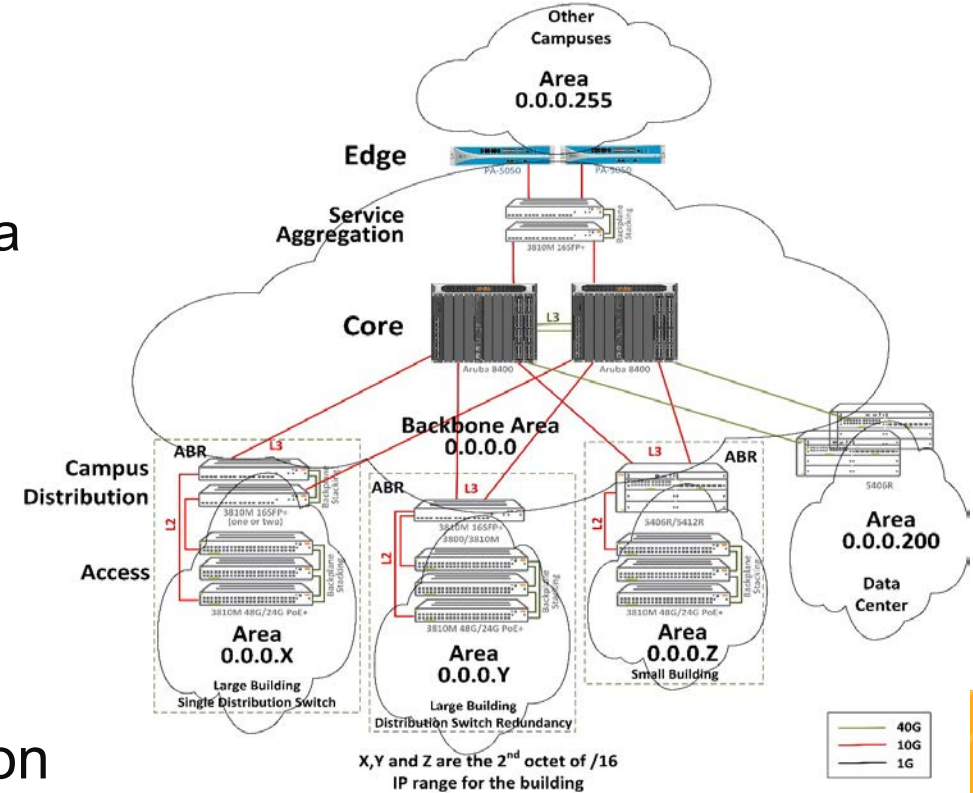
Modular Network Design

- Core Layer
 - Aruba 8400 switch
 - Only L3 running OSPF
 - Scalability / Automation
- Switch Layer
 - Aruba 540XR and 3810M switches
- Services Layer
 - Aruba 3810 switches
- Data Center Layer
 - Virtual Stacking (VSF) – Two Aruba 5406R switches
 - Backplane Stacking for ToR switches – Aruba 3810M switches



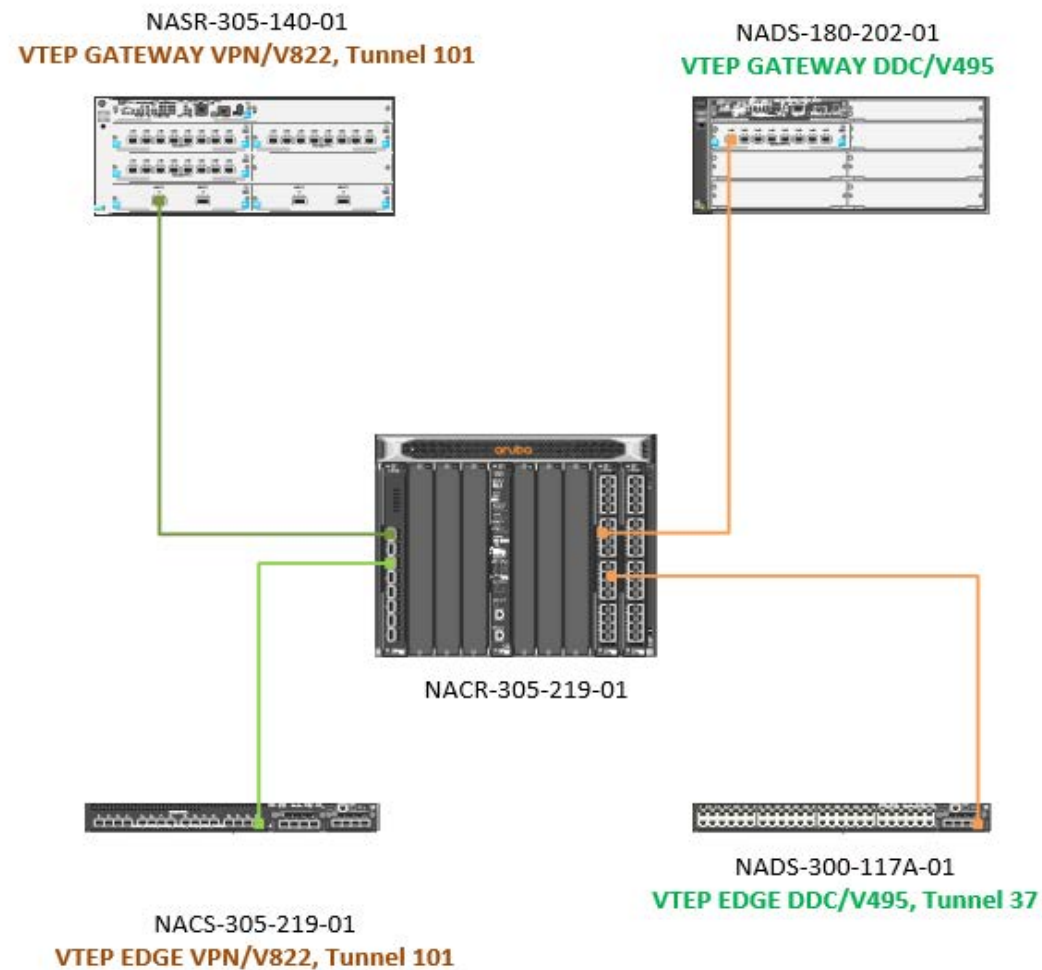
Logical Design

- Core
 - OSPF routing:
 - Point-to-Point Links between Core and Distribution switches using Equal Cost Multi-Path
 - Two OSPF areas: Backbone and Building area
 - Summarization at each Distribution switch
- Distribution/Aggregation Layer:
 - Can be replicated to add new buildings
 - Failure in one block should no or minimal impact on other switch or network blocks
- Redundancy / Resiliency
 - Two active-active cores switches
 - Redundant links between Core and Distribution switches
 - Backplane stacking with at least two switches for critical buildings



Logical Design

- L2 Overlay Design
 - Temporary solution
 - VXLAN design for DDC, Code Blue, VPN and ITAS



Implementation Plan

- First Step: Server Aggregation
 - POC environment
 - Install new switches in parallel when possible
- Second Step: Services (Edge)
 - One POC for Services, Wireless and Core
 - Split / share Internet connection between POC and production environments
- Third Step: Wireless WLCs migration
 - ArubaOS 8.X as requirement
 - Cluster WLCs for high availability
- Last Step: Core Layer
 - Gradual migration of distribution switches to new core
 - Replace distribution/aggregation switch(es), configure VXLAN and OSPF, and move to new Core
 - Minimize impact to users, and help with roll back procedure

Design and Implementation Challenges

- Possible Spanning Tree loops
- VXLAN (L2 Overlay)
 - Existing VPN solution using Public IP
 - Existing applications using L2/VLANs across the existing network (Code Blue, DDC)
- Wireless controllers connectivity
- Limited time during cutovers
 - Migration Schedules for each step of the implementation
 - Use of POC to stage switches in order to minimize time during migration



Jason Fernyc

Consulting Systems Engineer

**Aruba, a Hewlett Packard
Enterprise Company**

aruba

a Hewlett Packard
Enterprise company



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Infrastructure Design & Implementation

WIRED



Aruba 8400



Aruba 5400



Aruba 3810

WIRELESS



Aruba 7200

Infrastructure Design & Implementation

EDGE



CORE



AGG/DISTRIBUTION



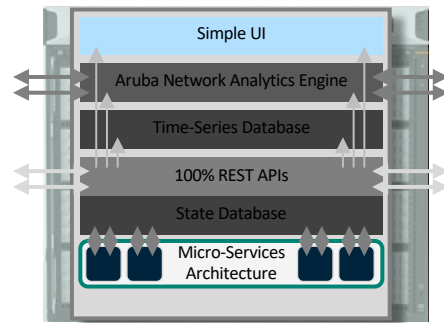
Aruba 8400 - Core

HARDWARE



Aruba 8400

SOFTWARE



AOS-CX 10

+

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- **Enhanced User Experience**

- Analytics
- User/Device Awareness
- Maximum Uptime
- Future Ready – 19+Tbps

- **Enhanced Operations**

- Live Upgrades
- SW + HW Modularity
- Automation Engine
- APIs
- License/Subscription Free

Aruba 5400 – Agg/Distribution

HARDWARE



Aruba 5400

SOFTWARE



AOS-SWITCH 16

+

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- **Enhanced User Experience**

- SmartRate Capable
- POE+
- User/Device Aware
- WIFI 6 Ready

- **Enhanced Operations**

- Easy Scalability
- Modularity
- Future Ready
- License/Subscription Free

Aruba 3810 – Edge & Agg/Distribution

HARDWARE



Aruba 3810

SOFTWARE



AOS-SWITCH 16

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- **Enhanced User Experience**

- SmartRate Capable
- POE+
- User/Device Aware
- WIFI 6 Ready

- **Enhanced Operations**

- Stackable / Easy Scalability
- Modularity
- Future Ready
- License/Subscription Free

Aruba 7200 – Wireless Core

HARDWARE

SOFTWARE



Aruba 7200

+



AOS 8

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- **Enhanced User Experience**

- Auto Load Balancing
- Zero Downtime

- **Enhance Operations**

- Logical Clustering
- Live Upgrades
- Easy Scalability

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Recap
Next Steps
Lessons Learned



Recap & Next Steps

- Network Remediation Project (NRP) is a 3 phase project to address network infrastructure technical debt at VIU
- Trust within VIU (IT teams, students, employees, various departments outside IT, admin), and out to funders, vendors and suppliers like MAEST, BCNet, Innovations, Inc., Compugen and Aruba enabled us to execute a 1 year project in 6 months, within budget
- Phase 2 RFP is ongoing
- Phase 3 still planned to commence April 2020

Lessons Learned - Technical

1. Continue to build future-proofed designs
2. Detailed Implementation Planning, with review and approval – Quality Assurance cycle
3. Perform peer reviews (outside of immediate project team) on plans, configurations, as-builts, SOPs, Transition docs, etc
4. Knowledge Transfer – include operations staff in project planning, activities/tasks, cutovers, documentation
5. Robust System and Integration Testing – continue to build in time for proof of concept and extensive testing

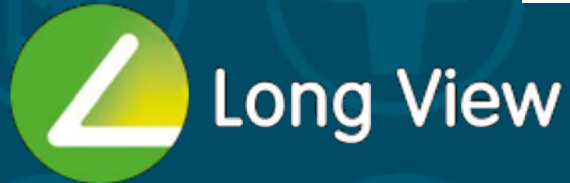
Lessons Learned - Project Management

1. Continue to develop well rounded business cases!
2. Have dedicated project workers—Project Manager, Support, Coordinator, instead of doing project management on the side
3. Importance of mentoring and certifications in achieving knowledge transfer and in the development of a project management culture
4. Procurement – fully utilize available knowledge, expertise and resources – VIU Purchasing, BCNet, vendors and suppliers – creating a circle of trust, without having to reinvent the wheel
5. Carry on a well-executed User Acceptance Testing and Implementation Command Centre

“We are in this together.”



NRP Collaborators



BCNET²⁰¹⁹

aruba

a Hewlett Packard
Enterprise company

BCNET³⁰ Years
Shared Services for Higher Education & Research

ESC
AUTOMATION

COMPUGEN
Simplifying the business of technology ... together

Ministry of Advanced Education, Skills & Training



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Q&A

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