AARNet5

Packet Network Update Overview

12 November 2024

Agenda

- Customer Engagement

- Reference Architecture

- Technical Requirements

- The Tender Process

- What We Selected

Customer Engagement

- Completed 25 AARNet5 Customer Consultations
- Direct input to:
  1. AARNet5 Design
  2. Future product roadmap

How can AARNet5 help with your strategic objectives?

- What network requirements do you see coming in the next 3 to 5 years?
- Do you see emerging security requirements for network services?
- What network-related problems would you like to solve?

Customer responses:
four broad themes

1. Keep doing what you're doing
2. Help me move big research data flows
3. Help me better secure my network
4. Provide greater visibility of my services

What AARNet5 brings

Scale

Service bandwidths:
100Gbps -> 400Gbps

Resilience

Regional failover
New paths

Security

MacSec pass-through

Visibility

Service status & metrics

Capacity

Cloud connectivity
nx100Gbps -> 400Gbps

Quality

Service delivery
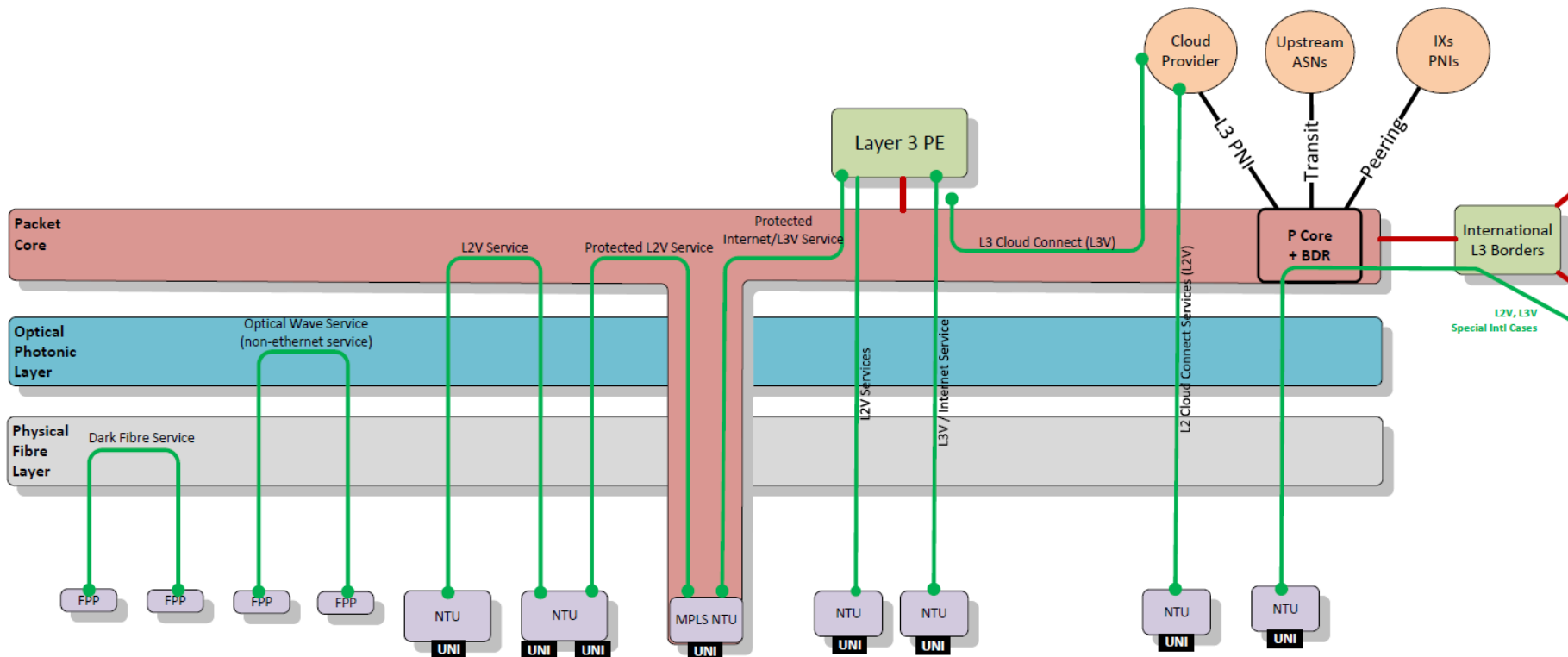*Process improvements*

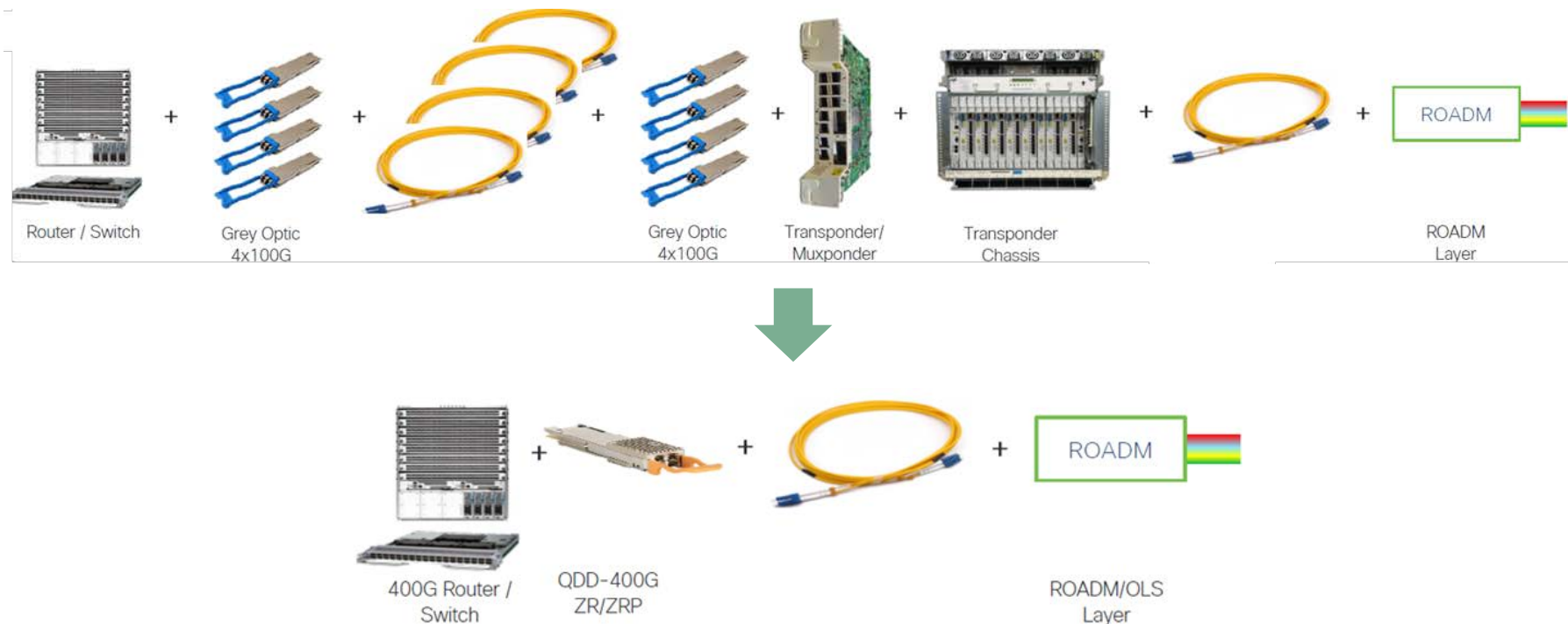**Trust**

BGP security enforced
Control plane security

Quality

In-service performance
monitoring

Reference Architecture

Optical & Packet Network Convergence

Router / Switch + Grey Optic 4x100G + [fiber cables] + Grey Optic 4x100G + Transponder/ Muxponder + Transponder Chassis + [fiber cable] + ROADM Layer

400G Router / Switch + QDD-400G ZR/ZRP + [fiber cable] + ROADM/OLS Layer

Optical & Packet Network Convergence

Save power, cost & space

Packet network closer to customers

400G Router / Switch   +   QDD-400G ZR/ZRP   +   [fiber cable]   +   ROADM   ROADM/OLS Layer
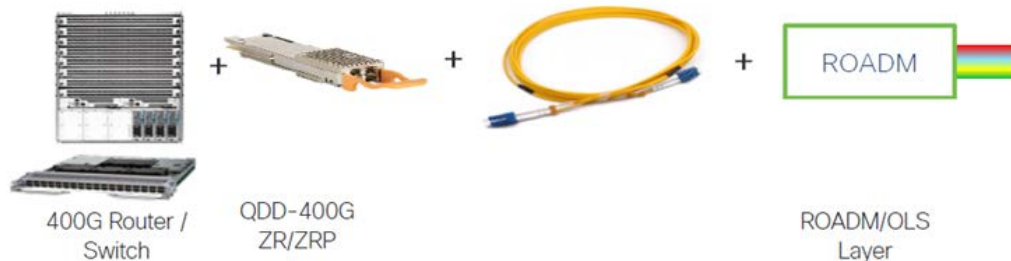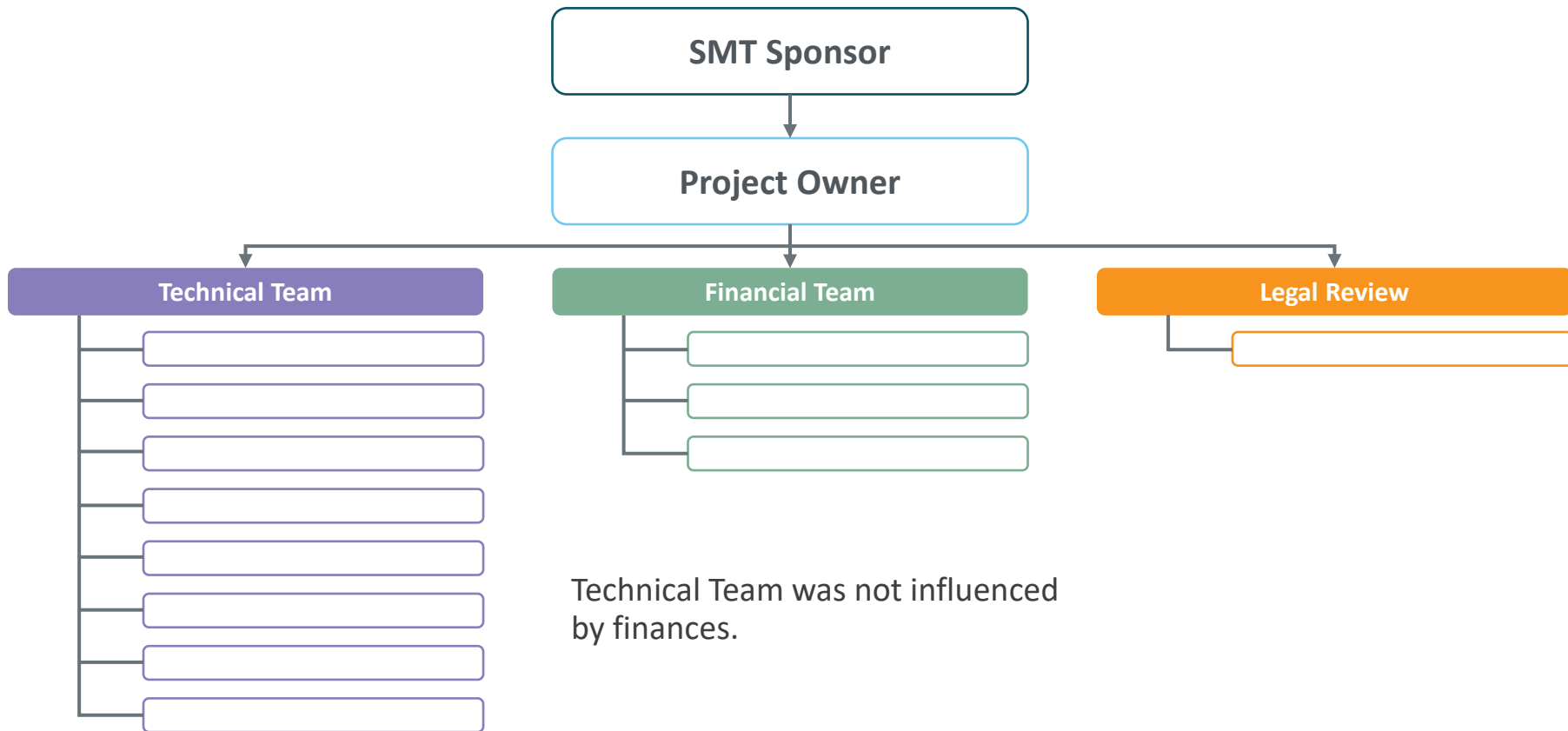
AARNet5 – So what happened in the Tender?

- Writing of the tender
  - Requirements
  - Legal framework
- Expression of Interest – who wants to bid?
- Request for Quotation
- Vendor response x 4
- Technical review and scoring
- Lab testing of two preferred responses
- Financial review
- Legal review
- Presentations to SteerCo and Board
- Best and Final Offer negotiations with selected vendors
- Legal contract negotiations
- Presentations to SteerCo and Board
- Signatures on agreements
- Purchase of initial equipment

Coffee meter

Evaluation – split into teams

SMT Sponsor

Project Owner

Technical Team

Financial Team

Legal Review

Technical Team was not influenced by finances.

Detailed Requirements & Scoring

NTU L2			L/M/H (or INFO)	Requirement Weighting (1 to 10)	Section Weighting (1 to 10)	% of overall score	Score (0 to 5) 0 = unacceptable, 3 = meets requirements, 5 = well exceeds requirements or NA	Red Flag? (Y)	Comment (Highlight any concerns, questions, our outstanding benefits)	Score x Weight	Section Score (calculated)	Weighted Section Score
		Selectable "Overhead Compensation" per frame configuration (in bytes), for correct calculation of L2 shapers using MEF frame definitions	L	2								
		Ingestion of customer frames and Layer-2 control packets without interaction			5	6.3%					score	
		The device shall not attempt to interact with customer's L2CP frames or Ether-types unless explicitly enabled	H	8								
		Protocols such as STP, LLDP, VTP, LACP, CDP, ILMI, MACSEC, etc.. are required to be ingested at a UNI without interaction or inspection	H	8								
		LLDP, LACP, or MACSEC **may** be enabled on the UNI or NNI in order to "peer" with our customer should they require it	H	8								
		Transport of customer frames and Layer-2 control packets without modification										
14	L2 Transparency	For MPLS based L2 services, the device shall accept and encapsulate all frames into the MPLS pseudowire by default	L	2								
		For L2 NTU based L2 services (using NTU switching/tagging/bridge domains), he device shall accept and tag (802.1q via 0x8100) all frames and pass them upstream by default	H	8								
		AARNet wishes to abide by MEF 3.0 CTB-2 L2CP handing, such that there shall be no DMAC translation of L2CP frames through the device	INFO									
		Translation of MEF 2.0 L2CP "tunnelled" frames as required	H	8								
		MEF 2.0 DMAC translation shall be supported on a per-UNI or per-service basis, translating to/from the original L2CP DMAC 01:80:00:xx to DMAC 01:cc:cc:dd:dd:d0	H	8								
		This will be specifically enabled on a per-UNI basis to comply with inter-op situations where the other end of the customer's EVC/OVC is employing MEF2.0 L2CP methodology	INFO									
		Injection of ethernet OAM packets into Layer-2 Services			5	6.3%					score	
		y.1564/y.1731/CFM into a customer's datastream for availability and end-to-end measurement of throughput, latency, jitter, and any loss.	H	8								
		Hardware time stamping of OAM frames for accurate measurement	H	8								
		Must be removed at far end UNI/eNNI as not to propagate past point of demarcation into customer's network	H	8								
		Must support unattended/periodic injection of monitoring frames on all services simultaneously	H	8								
		Unattended injection of periodic monitoring frames shall be configurable	H	8								
15	Ethernet OAM	On-demand testing of end-to-end throughput using	H	8								
		unidirectional methodology (active sender, active receiver)	H	8								
		bidirectional using remote loopback (sender only)	H	8								
		bidirectional using 2 x active UNIs (both actively sending/receiving)	H	8								
		Collection and exposure of results via below defined OAM Mechanisms (see below)	H	8								
		Scale to 500-1000 active OAM services per device, per service	H	8								
		Must support EPL(UNI), EVPL(multi-service UNI), and ENNI (High-Density Multi-Service) handoffs, on a per-service basis	H	8								

Proof of Concept Lab

Cisco and Juniper shipped us evaluation equipment to Melbourne.
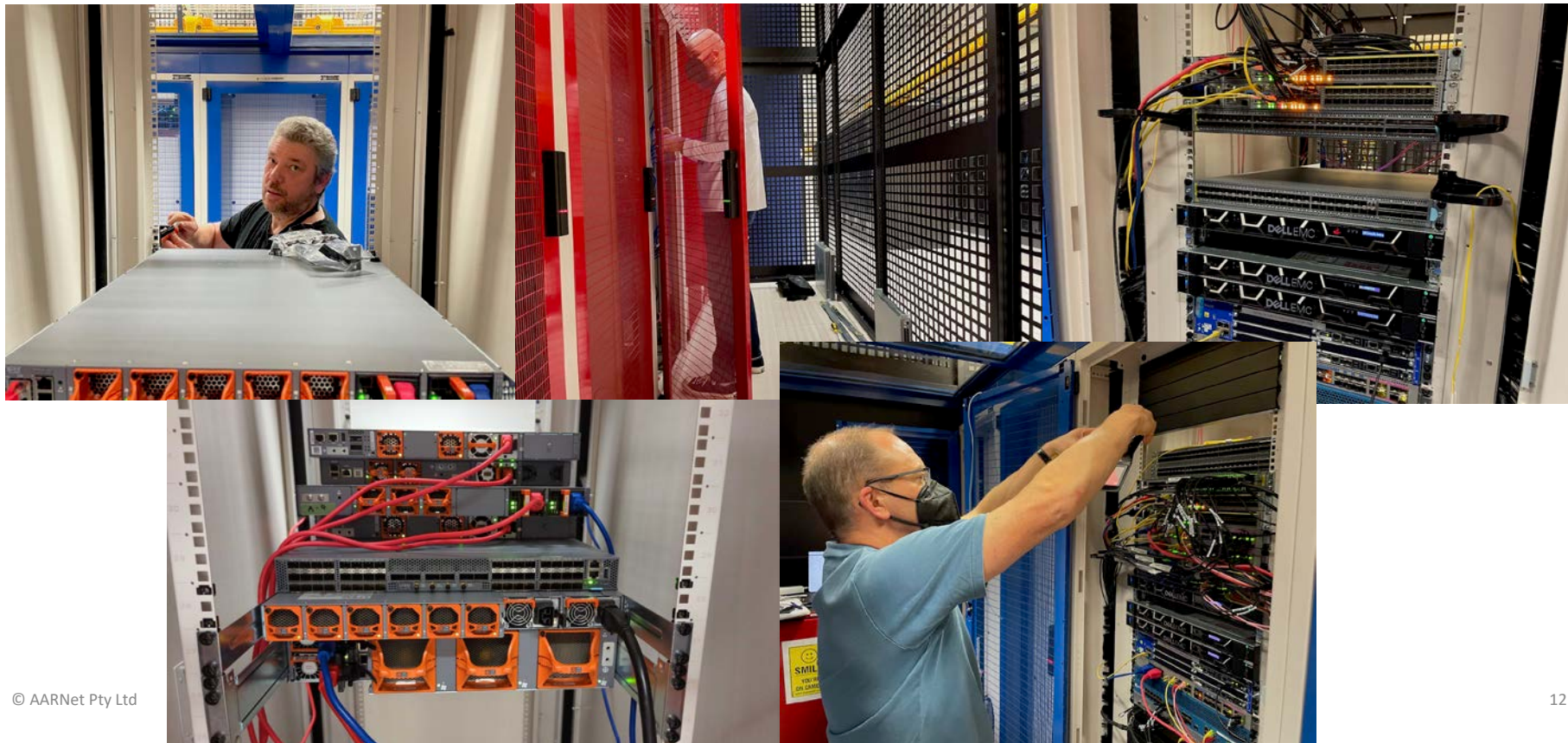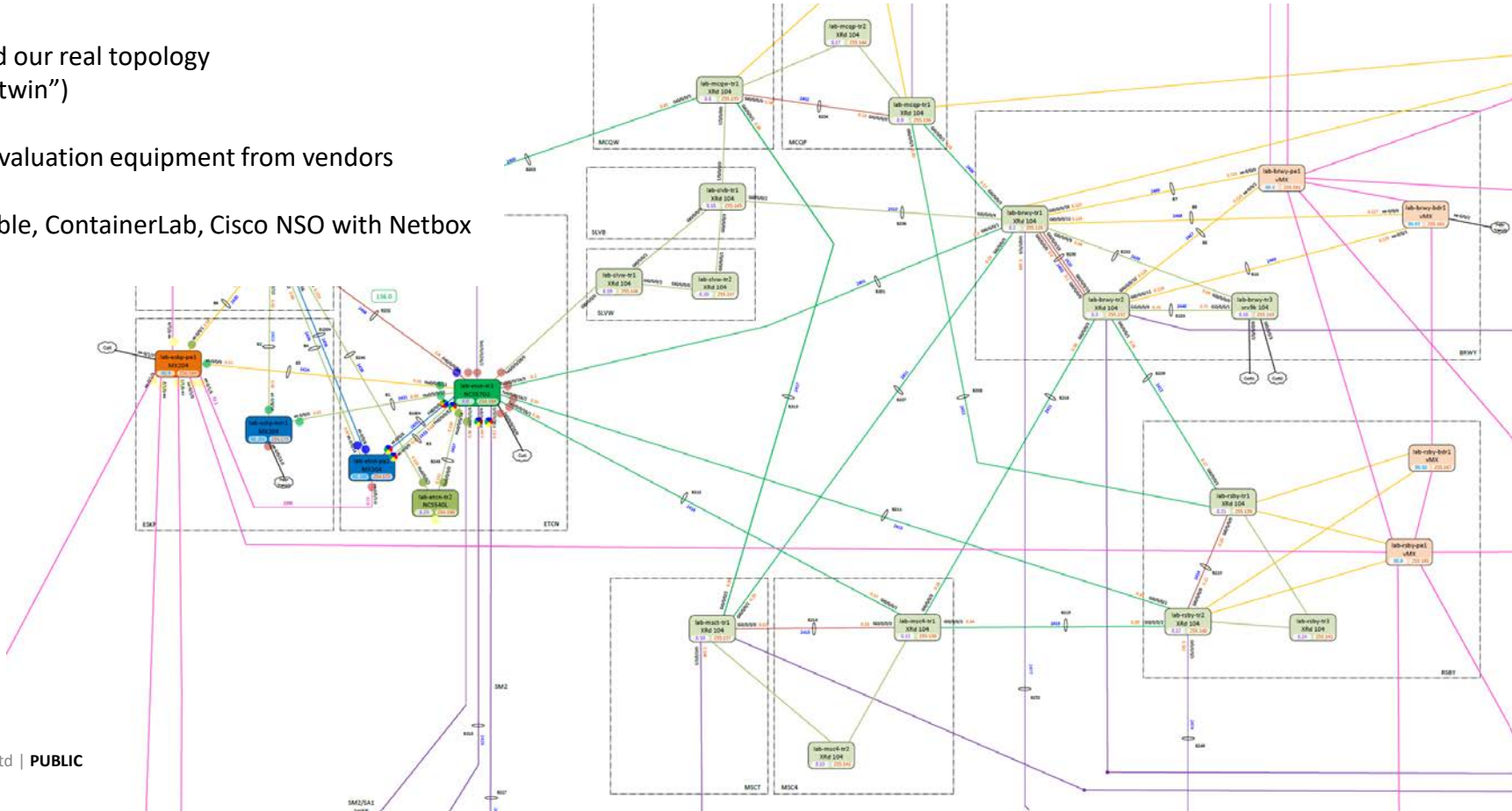
Lab

Physical and Virtual routers

Re-created our real topology
  ("digital twin")

Inserted evaluation equipment from vendors

Used Ansible, ContainerLab, Cisco NSO with Netbox

AARNet5 – Who we selected

CISCO

- Bulk of AARNet5 devices
- The Transmission Routed Layer
- Core Routers
- Aggregation Routers
- Network Termination Units

JUNIPER NETWORKS

- The Routed Edge Layer
- Border Routers
- Provider Edge Routers

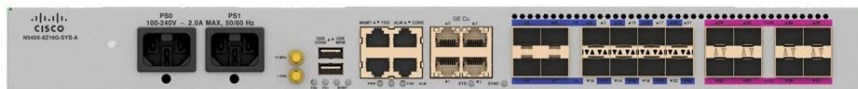# AARNet5 Equipment

Role

Cisco NCS57-D2-18DD
  Core Transmission Router
  400Gbps and 100Gbps ports

Cisco NCS57-C3
  In CEVs - Regional "Triversity" nodes
  Route up to 5 x 400Gbps optical paths

Cisco NCS540 Large
  In CEVs – Optical / Packet convergence
  Aggregation of 10Gbps for Core
  Customer site NTU for up to 400Gbps

Cisco NCS540
  Customer site NTU for nx10Gbps

AARNet5 Equipment

Role

Juniper MX304
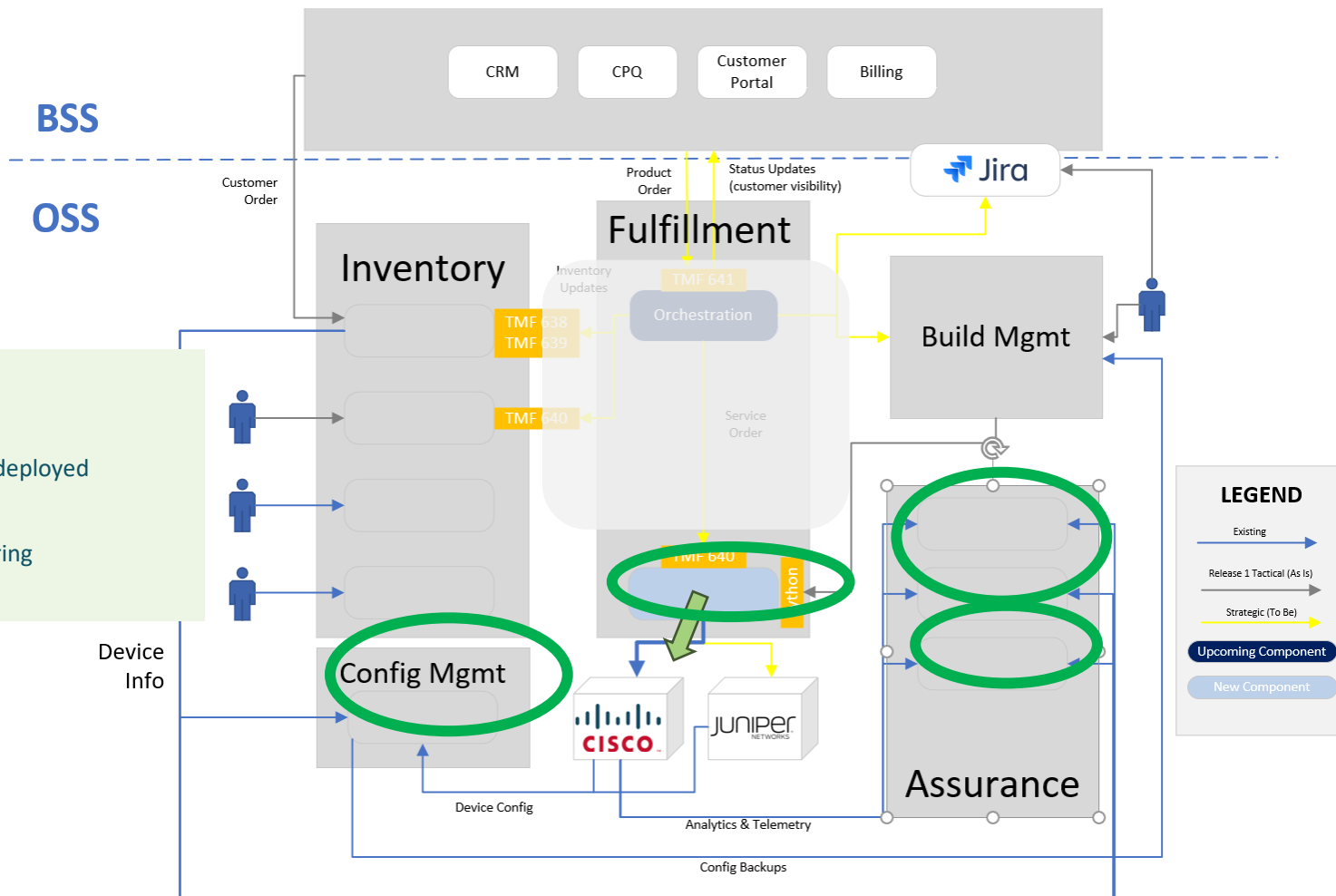 PE Router for Layer-3 VPN and Internet
  400 and 100Gbps ports

Juniper MX204
  Regional PE router (and small Border)
  for Layer-3 VPN and Internet

Automation from Day-1

BSS

OSS

Manual Design and Data entry

Then automation…

1. Cisco router config built
2. Customer Services built and deployed
3. Device config backup
4. Device and Interface Monitoring
5. Analytics Data collection