

The challenges of building to 121 nbnTM POIs.

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Why we did it.

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Having our own national network to the nbn™ puts us in control of our own destiny.

The situation – September 2016.

- _ Connected to 12 nbn™ POIs with ~10,000 connections
- _ Using Optus to connect to remaining ones through a national aggregation agreement
- _ Optus delays and congestion meant two customers: 'on-net' (very happy) and 'off-net' (increasingly unhappy).

The decision

- _ Build our own network to all 121 nbn™ POIs
- _ Use Telstra Wholesale as backhaul provider, supplying 1G and 10G wavelengths.
- _ Puts us in control of our own network.

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The rollout took 6 months longer than we expected.

- _ We placed our backhaul orders in October 2016
- _ Our first links were delivered in March 2017
- _ The bulk of the links were delivered between April and June 2017 at around 30 links per month
- _ As at today, 118 are fully connected and operational
- _ The final 3 will be completed in September 2017

It had plenty of challenges.

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There were no shortage of issues!

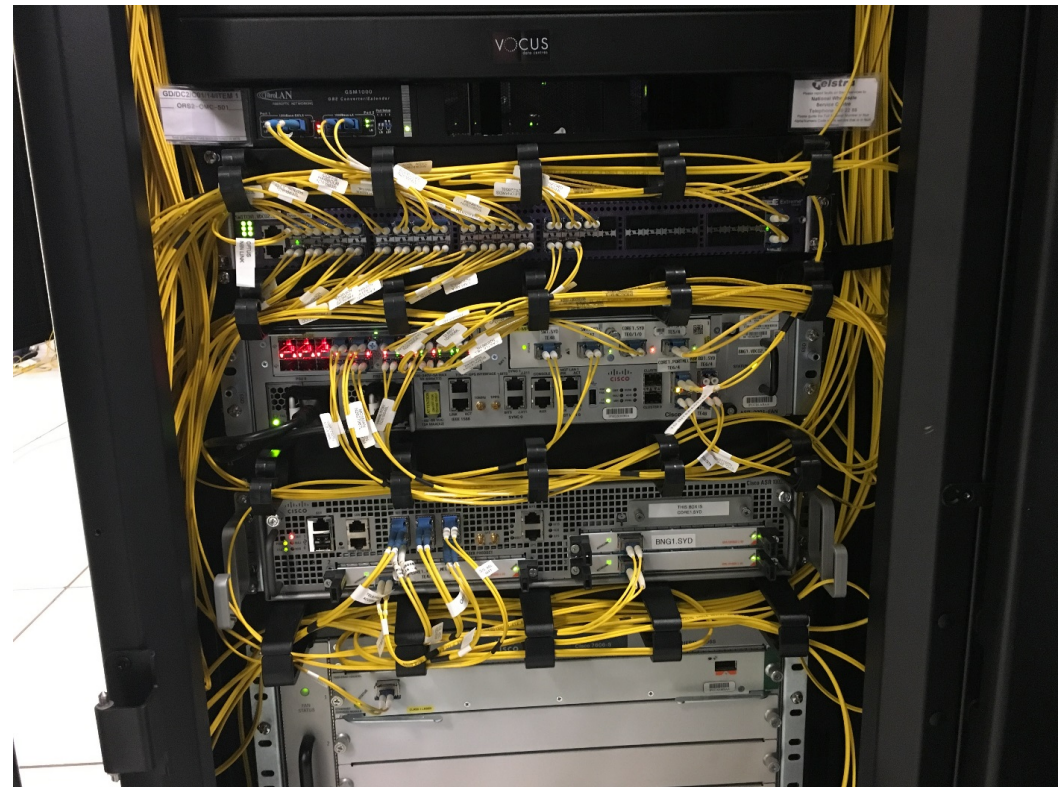
Whilst rolling out the network we encountered:

- _ 52 of 114 services didn't work straight out of the box
- _ Frequent issues with TX & RX being reversed at the POI end (on Telstra's side)
- _ Needed to establish strong relationships with both Telstra and nbn to ensure finger pointing didn't become an issue
- _ Getting accurate information about FTP handoff locations was sometimes difficult
- _ Delays in order completion processing
- _ Gaining access to NNI hand off racks was difficult at times to test where a fault may lie
- _ Needed to have conference calls with all parties and all parties on site to ensure quick fault resolution
- _ Having auto speed/duplex on 1G interfaces would not link up in some locations even when both ends were configured that way. Needed to have fixed speed/duplex on the nbn™ and Telstra hand off ends. Was difficult to diagnose initially as Telstra was using different equipment types for hand off.

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Our Sydney POP.

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More than just the network.

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Whilst there's lots of links to make our national network, it's our software that makes it perform.

Automation is the key

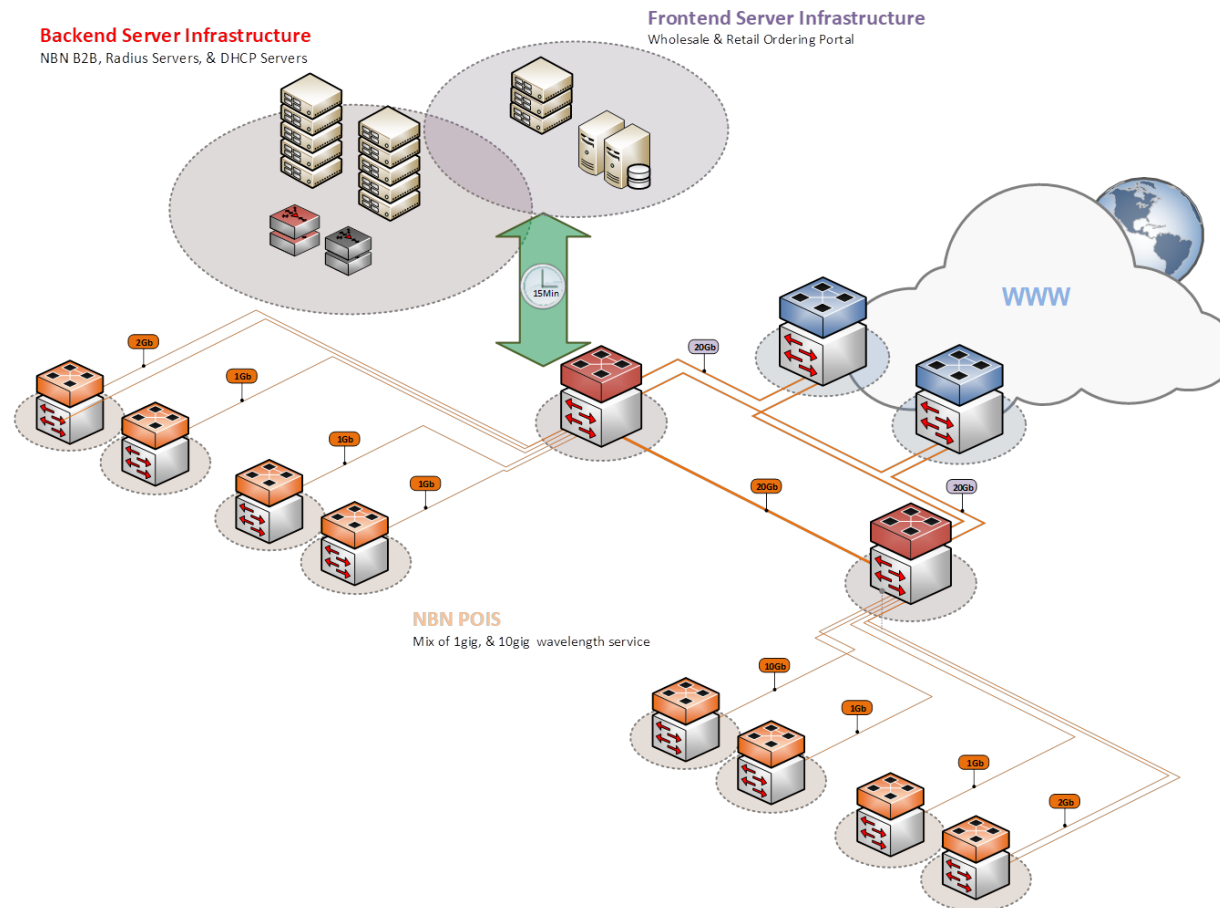
We've developed industry leading software systems:

- _ Our tightly integrated software is allowing us to take nbn™ orders from website to fully provisioned in under 15 minutes with no human intervention
- _ Our internally developed software fully integrates with nbn™ b2b systems and the Cisco 9K platform
- _ Has allowed us to scale to significant order volumes with minimum staff increase

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Architectural Overview.

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Policing is evil

- _ Need to have multiple levels of shaping to ensure customers don't hit nbn™ policers, primary reason why we purchased the Cisco 9K platform
- _ Three separate levels of shaper
 - _ Backhaul level
 - _ CVC level
 - _ AVC level, per customer based on link speed
- _ All of our shaping is controlled out of radius or using the API functions of the 9K
- _ Policing has a considerably higher effect on nbn™ Fixed Wireless due to increased latency

Ongoing Challenges.

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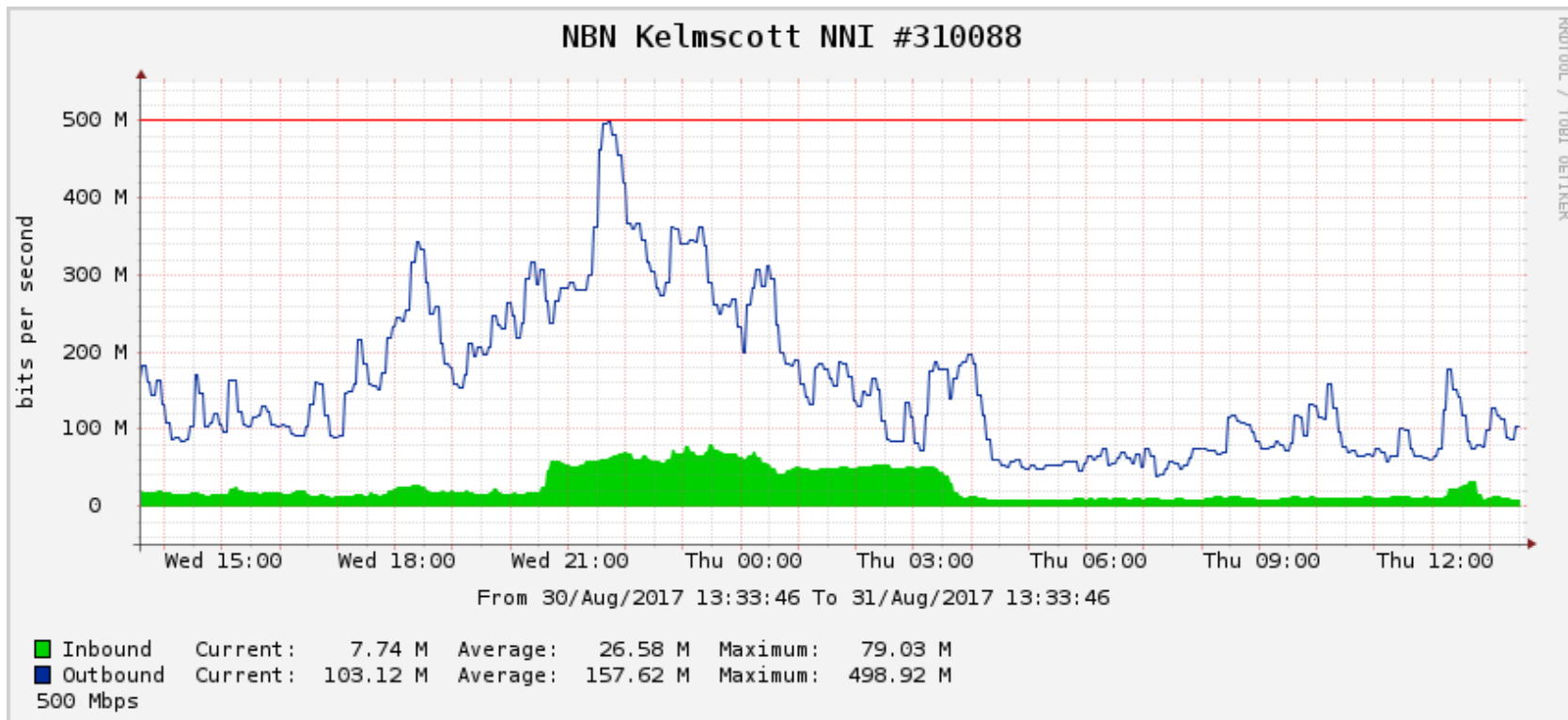
Now the network is almost complete we are dealing with the daily operational challenges.

Our commitment is to a congestion free network:

- _ Daily management of CVC bandwidth levels
- _ Forecasting and ordering 6-9 months ahead for additional backhaul wavelengths
- _ Ensuring peering and transit capacity is keeping up with user demand - we add about 1.5 Gbits a week
- _ Continuing to add more local state based hand offs as customer expectations are their traffic will always stay local
- _ Fault management of individual backhaul link failures

Lightly loaded POIs.

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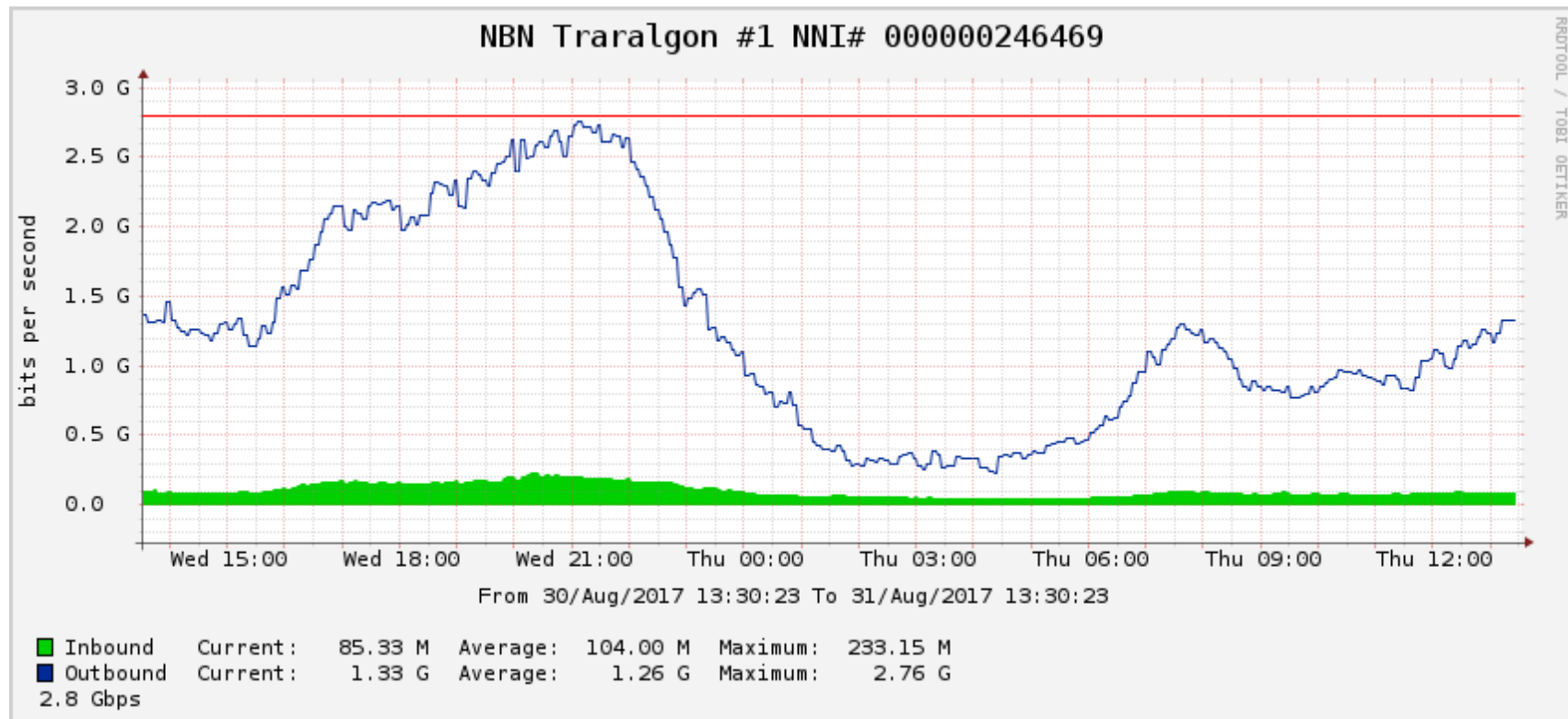


180 customers utilising 500 Mbits / \$42.36 CVC per user

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Mature POI.

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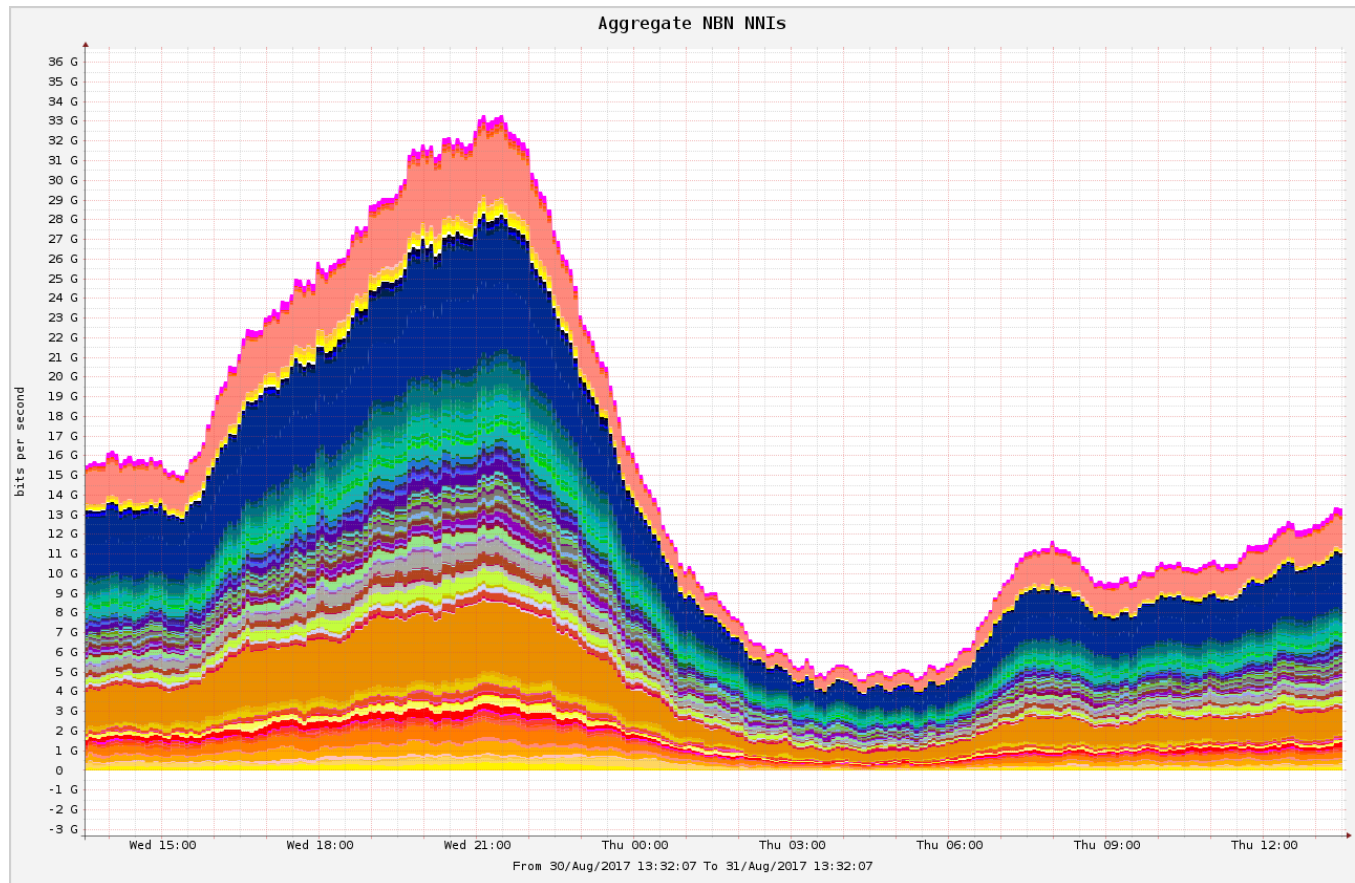


3643 customers utilising 2.8 Gbits / \$11.72 CVC per user

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All POIs Stacked.

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35 Gbits of CVC being utilised across 118 POIs but 48.3 Gbits of CVC being purchased to ensure each POI has enough capacity for peak time throughput.

13.3 Gbits of CVC sitting idle costing approx \$202,000 a month

An alternative CVC model.

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We have an opportunity through the latest nbn™ PDF discussion papers to propose a new model

Our view:

- _ As an option to the existing CVC charging model let providers stay on the existing model or move to 95th percentile model where the CVC is open and unrestricted
- _ Measure capacity used across all POIs rather than an individual an POI basis
- _ Allows smaller operators to enter the market, whilst still maintaining the 121 POI model to protect existing investments
- _ In our case, this would save around 13.3 Gbits in CVC charging compared with the current model today

What's next for us?

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**We still have some way to go,
and many challenges ahead.**

We're not quite finished yet.

There's still a number of challenges ahead:

- _ Complete the network rollout with one POI to go on the mainland and the two Tasmania POIs
- _ Manage the network (without going crazy)
 - _ Build more automation into our systems
 - _ Develop further quality control (e.g. stop sell policy)
 - _ Build redundancy for a more robust network
- _ Continue to grow bigger and better

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