



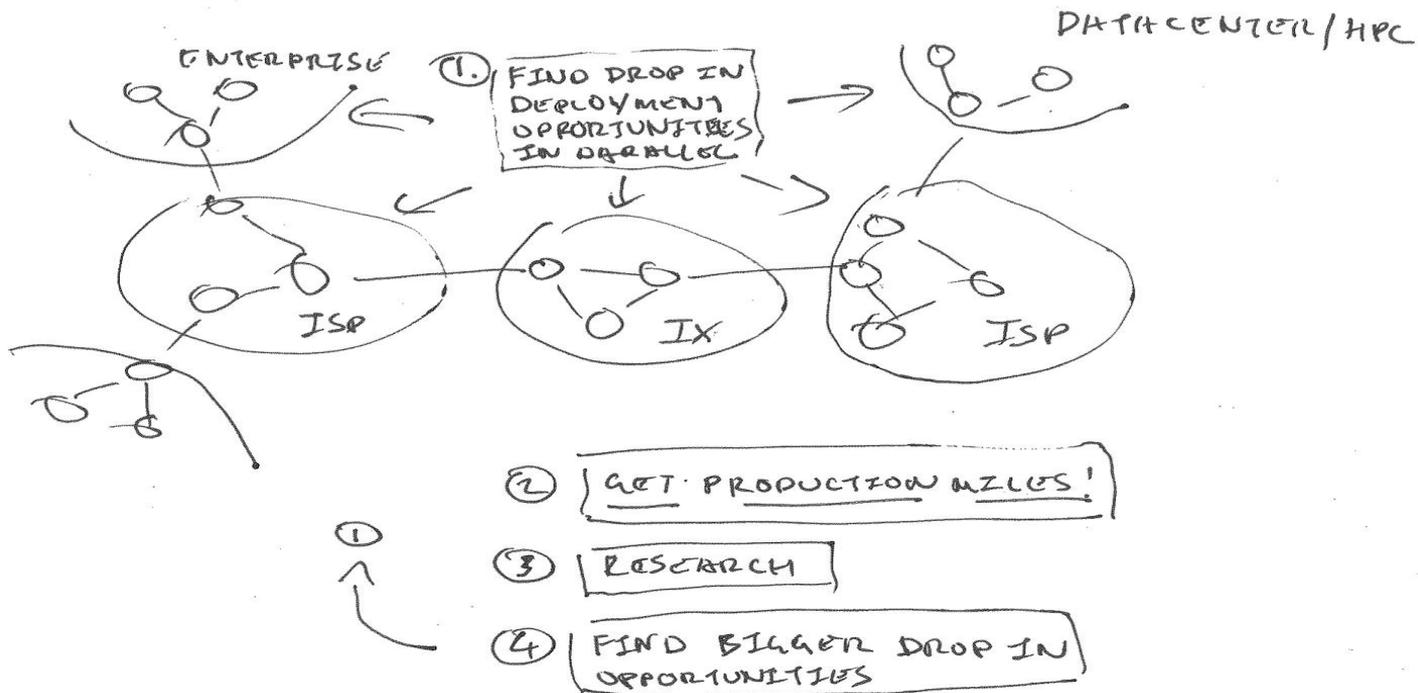
SDN research: in production

joshb@google.com

Production is the way forward

- Plenty of controllers, prototypes and demos
- Not that many SDN-based networks with production miles
- Vendor SDN software still very basic
- Winning the hearts of operations staff is key
- Showing vendors what they need to build for the future is key
- Take informed risks/go for production deployment, solve some of today's problems
- Solve migration (from non-SDN to SDN) and interoperability (SDN-to-SDN or non-SDN to SDN) cases
- Solid platform for ongoing research

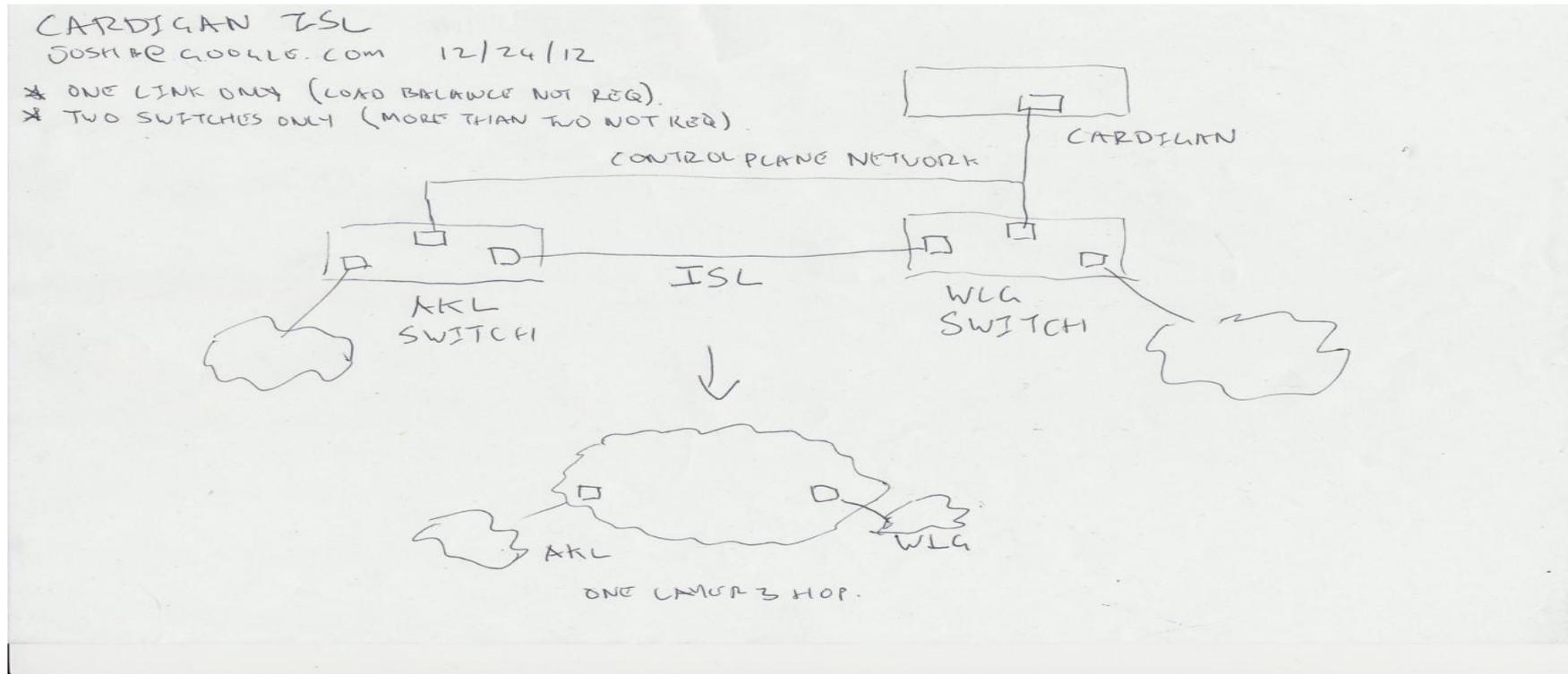
SDN IN PRODUCTION STRATEGY



Standard approach to introducing new technology

- Innovate at core push to edge (though edge doesn't have to wait)
- You solve interoperability along the way (old->new and new<->new)
- Start getting the benefits earlier (Eg logical centralization, lower cost per port - see following)

Examples from NZ #1: CARDIGAN



Examples from NZ #1: CARDIGAN continued

- Simple (2 node) distributed router
- In production at REANNZ for 6+ months
- Connected to live Internet/actual IX serving production traffic
- Operations staff gain confidence with platform
- Many vendor OF1.3 bugs fixed
- Platform suggests new research (Eg, automated fabric fault mitigation)
- Platform suggests new vendor opportunities (requirements for OF1.3/IPv6, larger TCAMs, etc)

Examples from NZ #2: SDX



12 November 2013

CityLink and NoviFlow sign agreement to create the first SDN Based Internet Exchange in the World

CityLink and NoviFlow today announced their agreement for the supply of Software Defined Networking (SDN) equipment, which will be deployed in New Zealand's Internet Exchange Points (IXPs) around the country.

Group Chief Technology Officer Jamie Baddeley said that "...the agreement is the conclusion of an exhaustive set of tests of key SDN switching vendors that has taken place at CityLink over the last 12 months. We have very exacting requirements when it comes to SDN and the IXPs. NoviFlow clearly demonstrated their capability and commitment to very high performance Software Defined Networking and because of that we're innovating the future architecture of Internet Exchange Points with them."

Examples from NZ #2: SDX continued

- Use SDN to solve problem of today: lack of control in IX fabrics (enforce L3 policy at L2)
- SDN fabric gets in production
 - gain operator confidence (and train operations staff)
 - vendor driven to provide production quality system
 - platform for further deployments/research

SDN & IXP's in NZ

APRICOT 2013

Jamie Baddeley

Chief Technology Officer

Regional Peculiarities



- oRelatively small number of “traditional” IXP participants (i.e. ISP’s)
- oVolume pricing for Transit is pervasive
- oAs a result there’s a reasonable number of “non ISP” participants at main IXP’s in Auckland and Wellington
- oSmall, Medium and Large Enterprise are peers in NZ IXP’s to side step volume charging (amongst other things).
- oWhich means BCP not necessarily followed as well as it could be.
- oWIX and APE are distributed Metro Exchanges (i.e. >20 sites)



Observations

- There are some known security issues associated with current Internet Exchange Architectures.
 - As highlighted by Mike Jager at APNIC34.
(ref <http://bit.ly/13wzAHW>)
 - NZ peers fail (and will continue to) at BCP Router Hygiene i.e.
 - <https://www.ams-ix.net/config-guide>

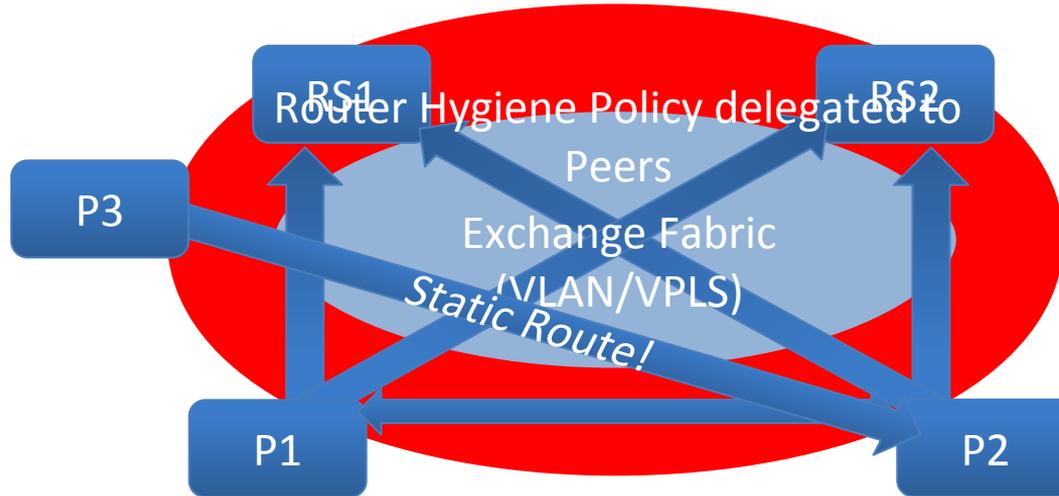
Observations

- Peers leaking IGP, CDP etc etc.
- Peers carrying full tables or default at their peering border.
- Other Peers pointing statics or default at a peer carrying a full table or default route.
- We're all spending a lot of time trying to stop things from happening and not enough time making things happen.
- Exchange Architecture has not been reviewed for some time.

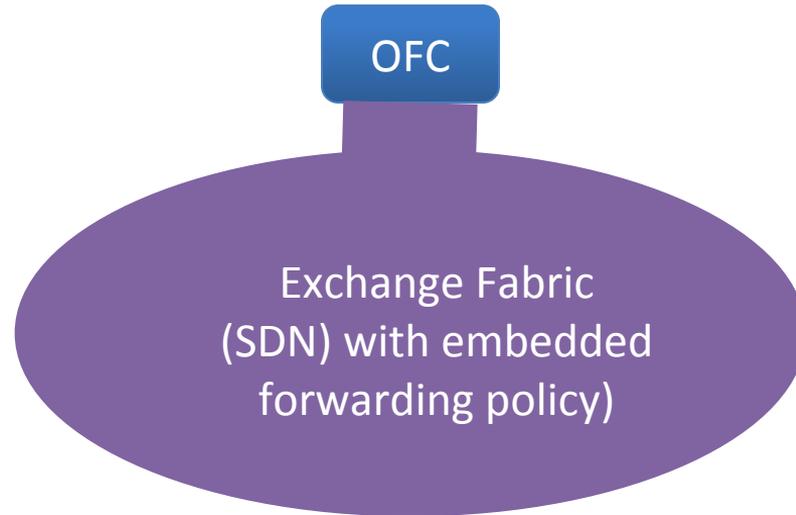
SDN & NZ IXP's

- New initiative within Citylink to take another look at how the IXP works.
- We are actively exploring the use of SDN/Openflow technology to:
 - Deal with Router hygiene issues (default deny instead of default allow).
 - Deal with “Capacity Theft” issues (as well as “noise” traffic)
 - Information interchange between the Route-server and the OF controller.
 - Lends itself well to the distributed nature of the APE & WIX in particular

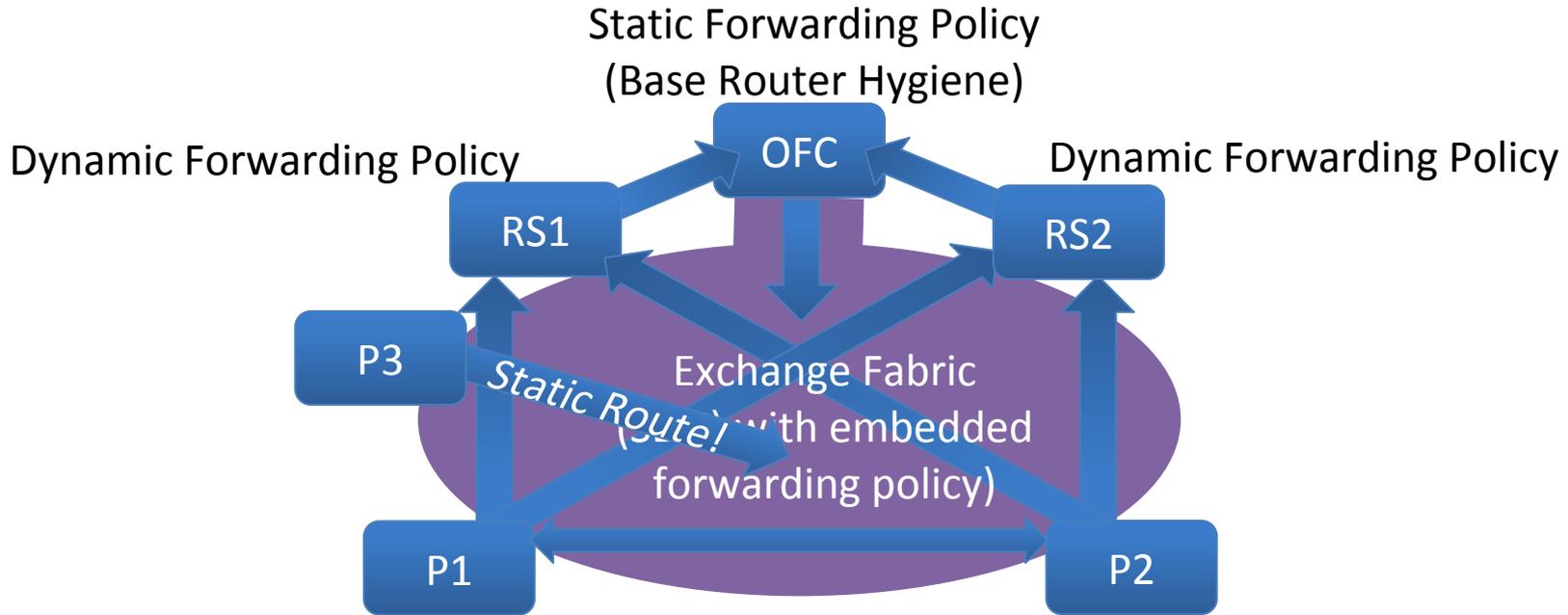
Current IXP



SDN & The IXP



SDN & The IXP



Other Aspects

- Regional Situation makes policing BCP by peers difficult.
- Peer Driven Portal to communicate desired “dynamic” forwarding policy essential. Enhanced Tools and Instrumentation comes with that.
- Database Driven IXP
- Peering Participant Reviewed base IXP characteristics essential
- Collaboration needed due to relatively small talent base but we’re busy improving that.