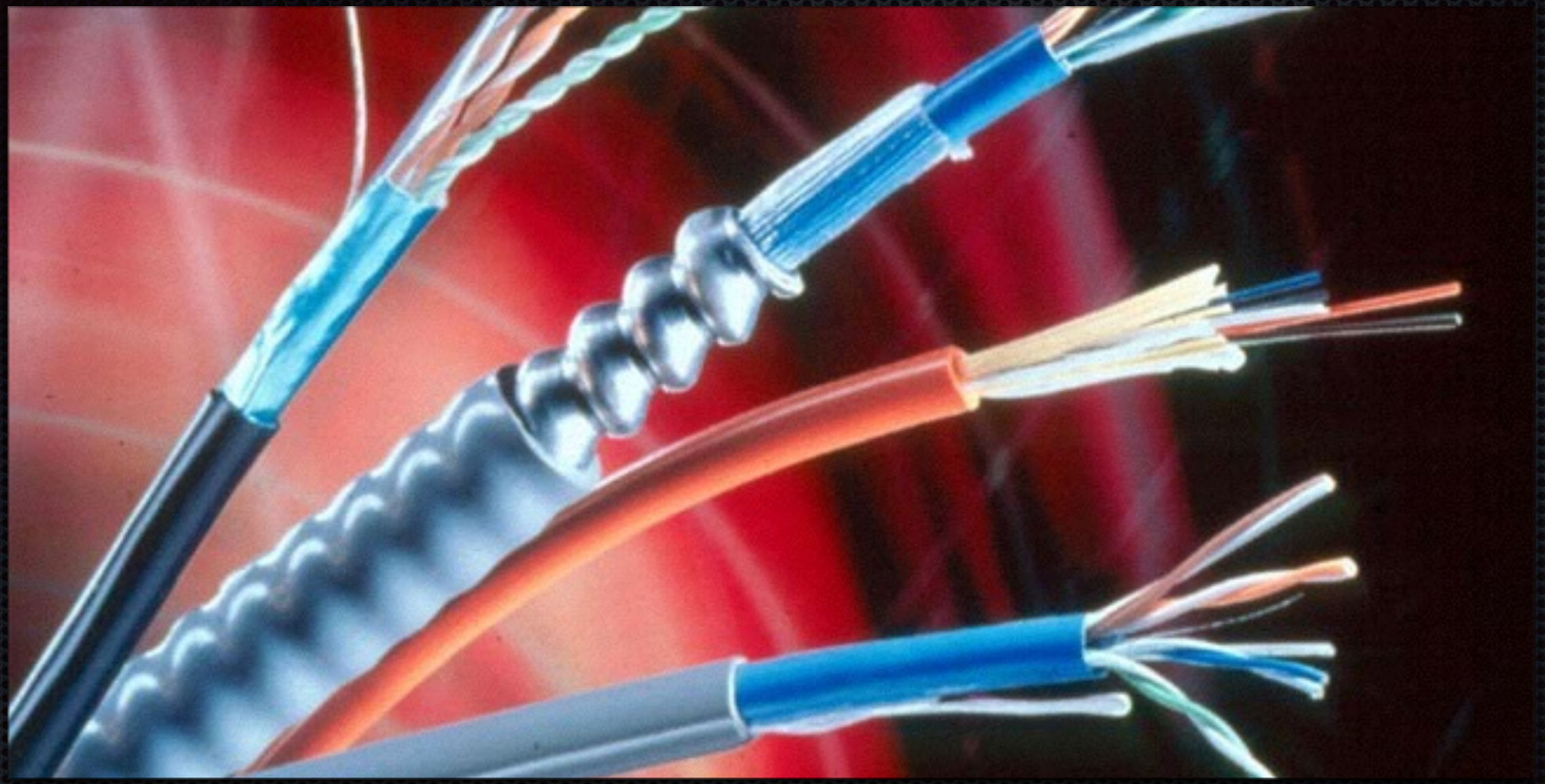

Achieving 2 Gbps with GPON

MikroTik User Meeting

Japan | 27th September 2015

Who am i?

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- Organiser of “MikroTik User Group Singapore” - MUG-SG (www.meetup.com/MikroTik-User-Group-Singapore-MUG-SG/)
- Works for ALAGAS NETWORK PTE. LTD., MikroTik distributor based in Singapore

Topics

- GPON in Singapore, Next Generation Nationwide Broadband Network
- MikroTik Hardware (CCR1009)
- Per Connection Classifier (PCC)
- Bonding (or SFP+)
- Bake them all to deliver 2Gbps to a single host

GPON in Singapore

IDA's Next Generation Nationwide Broadband Network

Next Generation Nationwide Broadband Network (Next Gen NBN)

- A project under Intelligent Nation 2015 (iN2015) master plan.
- Ultra high-speed optical fibre network
- Provide nationwide ultra-high speed broadband of 1Gbps and more
- Covering all physical addresses such as homes, schools, buildings, and NBAPs (Non Building Access Points).

NGNBN Industry Layers

- Network Company (NetCo), responsible for design, build and operation of passive infrastructure
- Operating Company (OpCo), commit to offering wholesale network service over the active infrastructure
- Retail Service Provider (RSP), sell services to end users and industry, fully competitive layer

Consumers

Services

Active Infrastructure

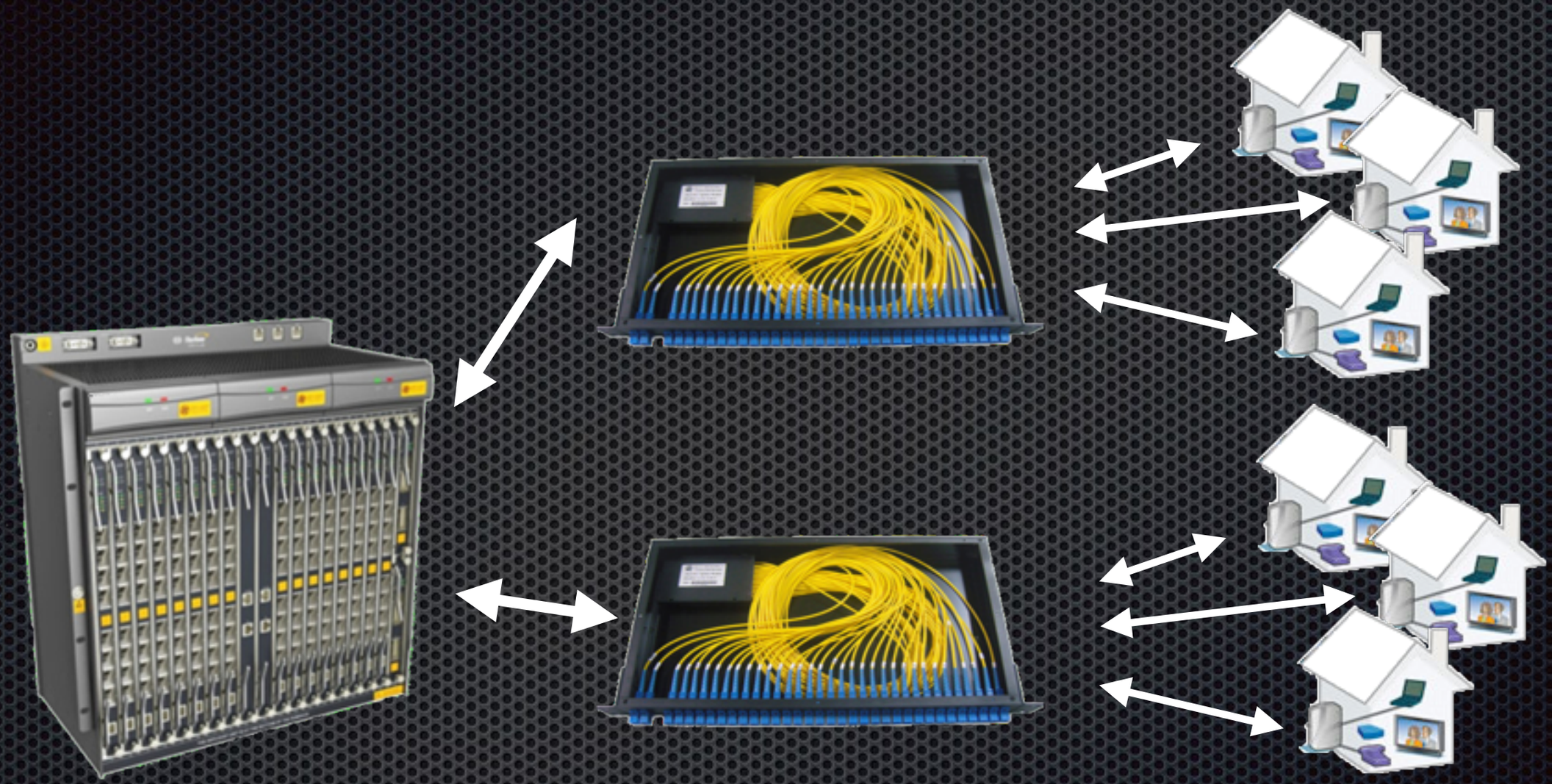
Passive Infrastructure

Retail
Service
Provider

Operating
Company

Network
Company

GPON Access Networks



Optical
Line
Terminal

Optical
Distribution
Network

Optical
Network
Terminal

Bandwidth

2.44 Gbps downlink, 1490nm (Broadcast)

Optical
Line
Terminal

Optical
Distribution
Network

Optical
Network
Terminal

Cloud Core Router 1009

- two models: low-cost CCR1009-8G-1S and full feature CCR1009-8G-1S-1S+
- Fanless CCR1009-8G-1S-1S+PC, passive cooling
- 9-cores Tilera Tile-Gx8009, 1.2Ghz per core
- up to 2GB RAM
- Eight 10/100/1000 Mbit/s Gigabit Ethernet with Auto-MDI/X, 1x SFP Cage, 1x SFP+ Cage

Per Connection Classifier (PCC)

- Takes selected fields from IP header, use hashing algorithm converts selected fields into 32-bit value
- The value then divided by a specified denominator and the remainder is compared to a specified remainder, if equaled then packet will be captured
- Selected Fields: src-address, dst-address, src-port and dst-port

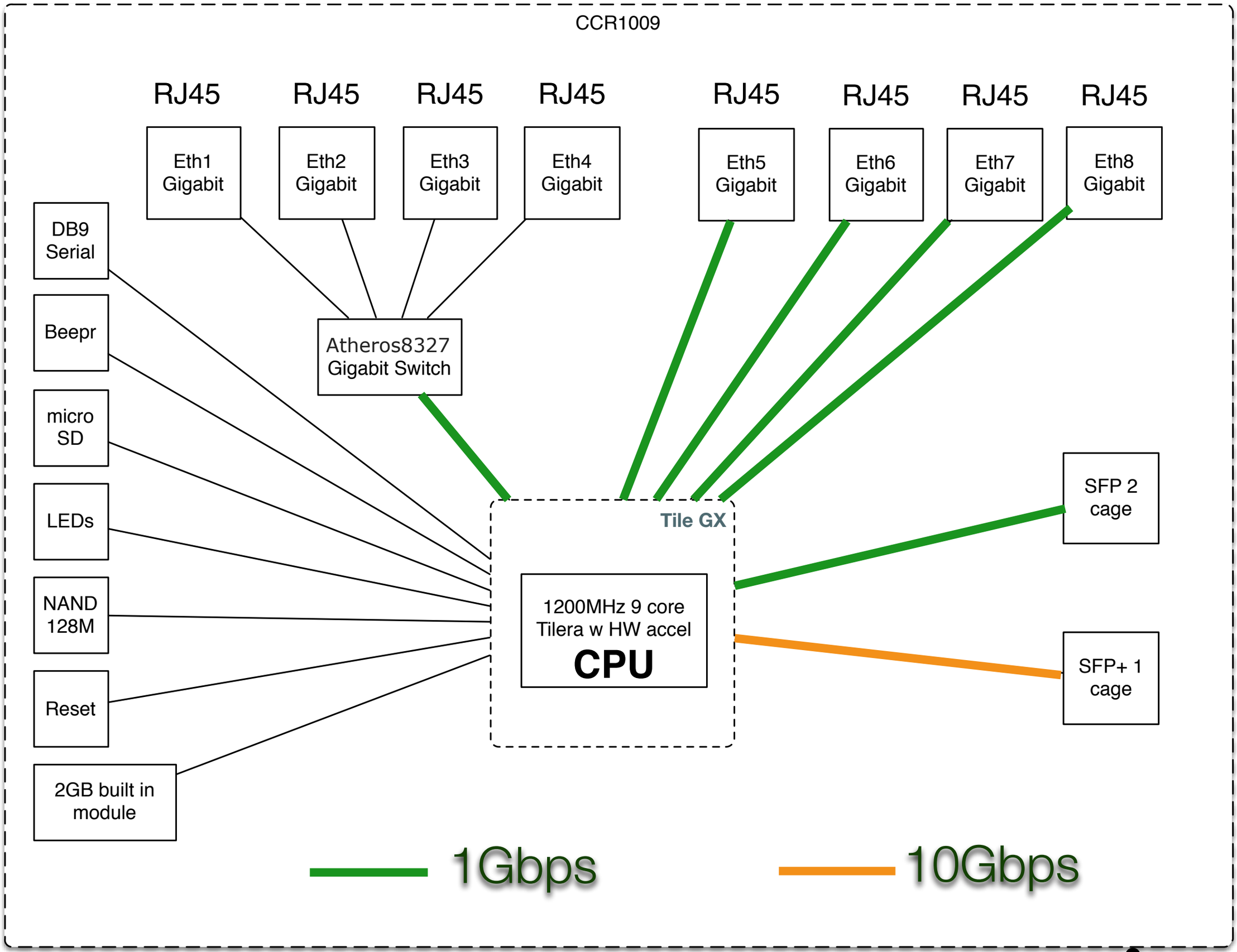
PCC Example

- A routing table for each WAN
- Mark connection of incoming traffic from each WAN
- Mark connection from LAN to WAN and put it into each routing tables

```
/ ip address
add address=192.168.0.1/24 network=192.168.0.0 broadcast=192.168.0.255 interface=LAN
add address=10.111.0.2/24 network=10.111.0.0 broadcast=10.111.0.255 interface=ISP1
add address=10.112.0.2/24 network=10.112.0.0 broadcast=10.112.0.255 interface=ISP2

/ ip firewall mangle
add chain=prerouting dst-address=10.111.0.0/24  action=accept in-interface=LAN
add chain=prerouting dst-address=10.112.0.0/24  action=accept in-interface=LAN
add chain=prerouting in-interface=ISP1 connection-mark=no-mark action=mark-connection \
    new-connection-mark=ISP1_conn
add chain=prerouting in-interface=ISP2 connection-mark=no-mark action=mark-connection \
    new-connection-mark=ISP2_conn
add chain=prerouting  in-interface=LAN connection-mark=no-mark dst-address-type=!local \
    per-connection-classifier=both-addresses:2/0 action=mark-connection new-connection-mark=ISP1_conn
add chain=prerouting  in-interface=LAN connection-mark=no-mark dst-address-type=!local \
    per-connection-classifier=both-addresses:2/1 action=mark-connection new-connection-mark=ISP2_conn
add chain=prerouting connection-mark=ISP1_conn in-interface=LAN action=mark-routing \
    new-routing-mark=to_ISP1
add chain=prerouting connection-mark=ISP2_conn in-interface=LAN action=mark-routing \
    new-routing-mark=to_ISP2
add chain=output connection-mark=ISP1_conn action=mark-routing new-routing-mark=to_ISP1
add chain=output connection-mark=ISP2_conn action=mark-routing new-routing-mark=to_ISP2

/ ip route
add dst-address=0.0.0.0/0 gateway=10.111.0.1 routing-mark=to_ISP1 check-gateway=ping
add dst-address=0.0.0.0/0 gateway=10.112.0.1 routing-mark=to_ISP2 check-gateway=ping
add dst-address=0.0.0.0/0 gateway=10.111.0.1 distance=1 check-gateway=ping
add dst-address=0.0.0.0/0 gateway=10.112.0.1 distance=2 check-gateway=ping

/ ip firewall nat
add chain=srcnat out-interface=ISP1 action=masquerade
add chain=srcnat out-interface=ISP2 action=masquerade
```

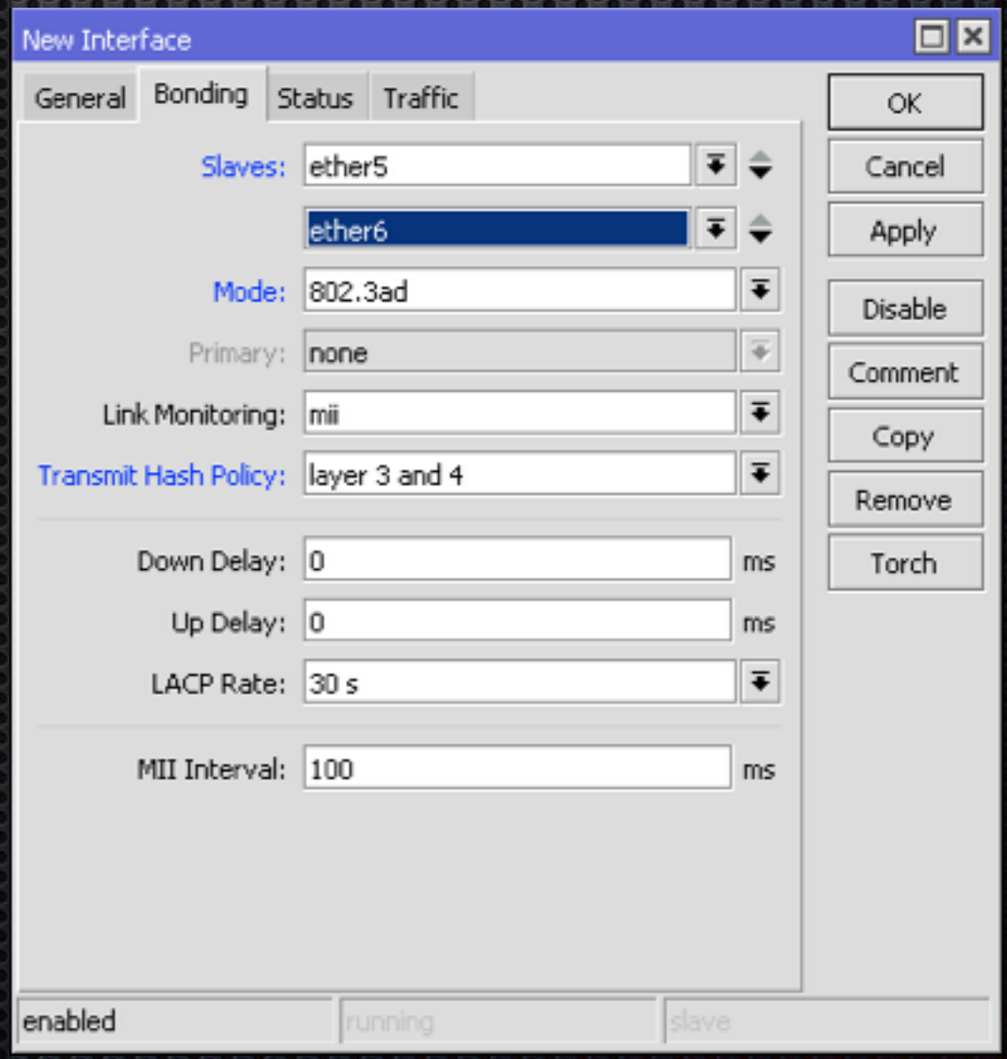
Cloud Core Router 1009

- Direct to CPU: Ether5, Ether6, Ether7, Ether8, Group1 (Ether1-4), SFP, SFP+
- Total: 6x 1Gbps dedicated, 1x 10Gbps dedicated
- By design: up to 3Gbps for basic model and up to 6Gbps for full feature model, WAN traffic


CCR1009
RJ45
RJ45
RJ45
RJ45
RJ45
RJ45
RJ45
RJ45
Eth1 Gigabit
Eth2 Gigabit
Eth3 Gigabit
Eth4 Gigabit
Eth5 Gigabit
Eth6 Gigabit
Eth7 Gigabit
Eth8 Gigabit
DB9 Serial
Beepr
micro SD
LEDs
NAND 128M
Reset
2GB built in module
Atheros8327 Gigabit Switch
Tile GX
1200MHz 9 core Tilera w HW accel
CPU
SFP 2 cage
SFP+ 1 cage
1Gbps
10Gbps
Up to 35W power consumption
110/220V
Integrated PSU
24V

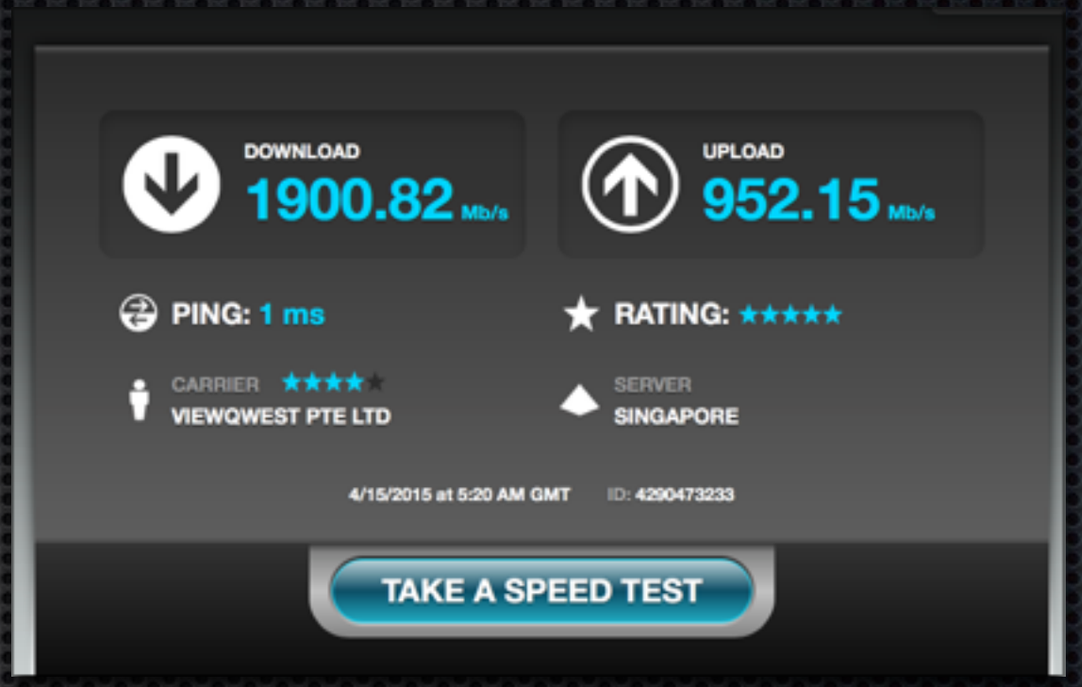
Interface Bonding / Link Aggregation

- Aggregation of multiple ethernet-like interfaces into a single virtual link
- Provides fail-over
- 802.3ad (LACP)



Layout of the setup

- Ether5, Ether6 to PC with dual gigabit port
- Ether7, Ether8 to WAN (ONT port 1&2), remember to do NAT on both interface.



Name	Type	L2 MTU	Tx	Rx
bonding1	Bonding		1905.4 Mbps	13.5 Mbp
bridge1	Bridge	1578	1820.5 Mbps	13.6 Mbp
ether1	Ethernet	1578	0 bps	0 bp
ether2	Ethernet	1578	0 bps	0 bp
ether3	Ethernet	1578	0 bps	0 bp
ether4	Ethernet	1578	0 bps	0 bp
;; 2Gbps to PC				
ether5	Ethernet	1580	949.7 Mbps	9.1 Mbp
;; 2Gbps to PC				
ether6	Ethernet	1580	955.7 Mbps	4.3 Mbp
;; Zhone GE1				
ether7	Ethernet	1580	6.9 Mbps	967.2 Mbp
;; Zhone GE2				
ether8	Ethernet	1580	6.5 Mbps	938.3 Mbp
sfp-sfpplus1	Ethernet	1580	0 bps	0 bp
sfp1	Ethernet	1580	0 bps	0 bp

Reference

- https://www.ida.gov.sg/images/content/Infrastructure/nbn/images/pdf/NextGenNBNFACTSHEET.pdf
- http://wiki.mikrotik.com/wiki/Manual:PCC
- http://wiki.mikrotik.com/wiki/Manual:Interface/Bonding
- http://i.mt.lv/routerboard/files/CCR1009-140630151432.pdf

Questions ?

Thank you