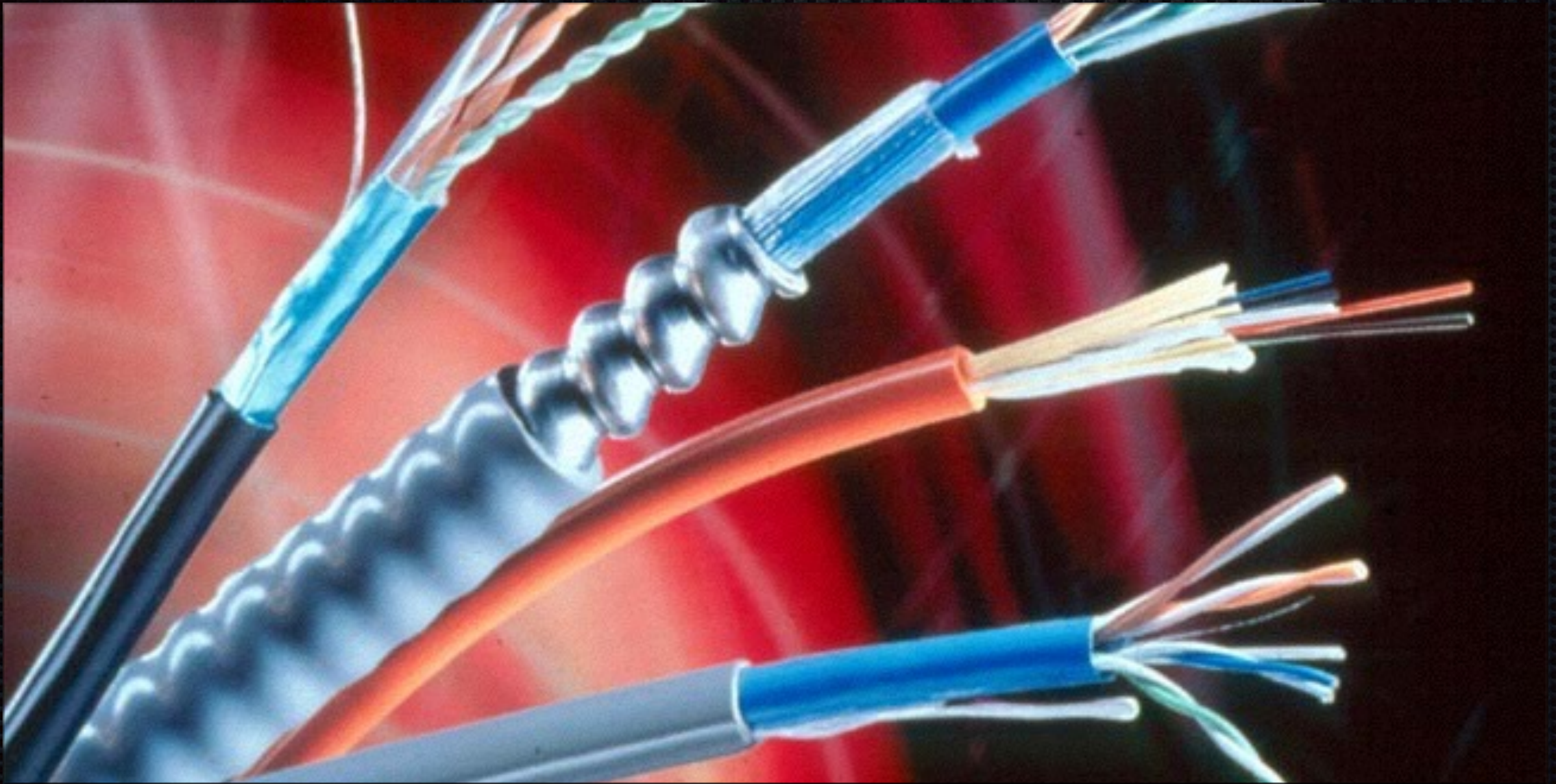




Achieving 2 Gbps with GPON

MikroTik User Meeting

Japan | 27th September 2015

Who am i?

- ✦ Soragan Ong
- ✦ Email: soragan.ong@alagasnetwork.com
- ✦ 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

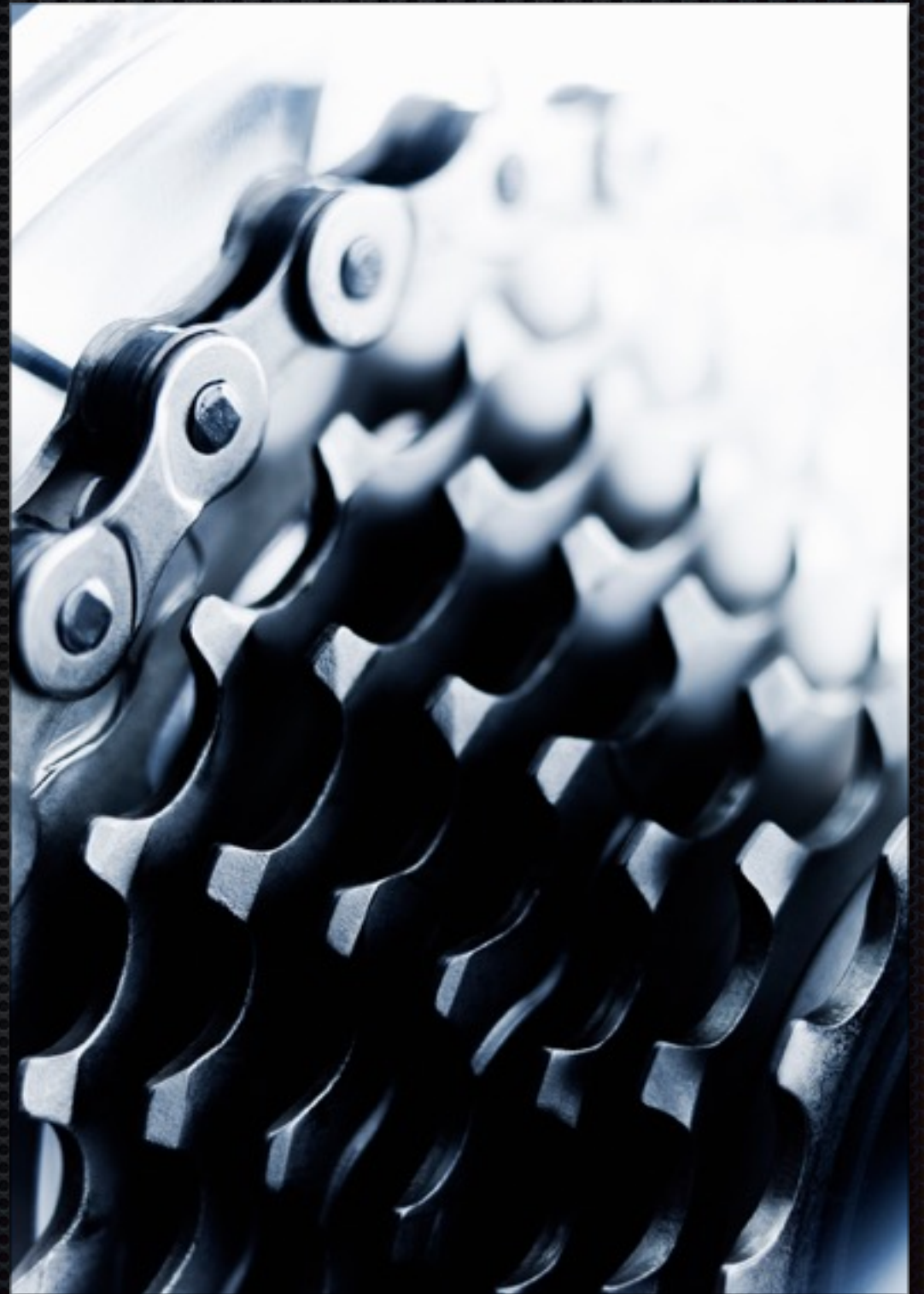


Topics

- ✦ 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

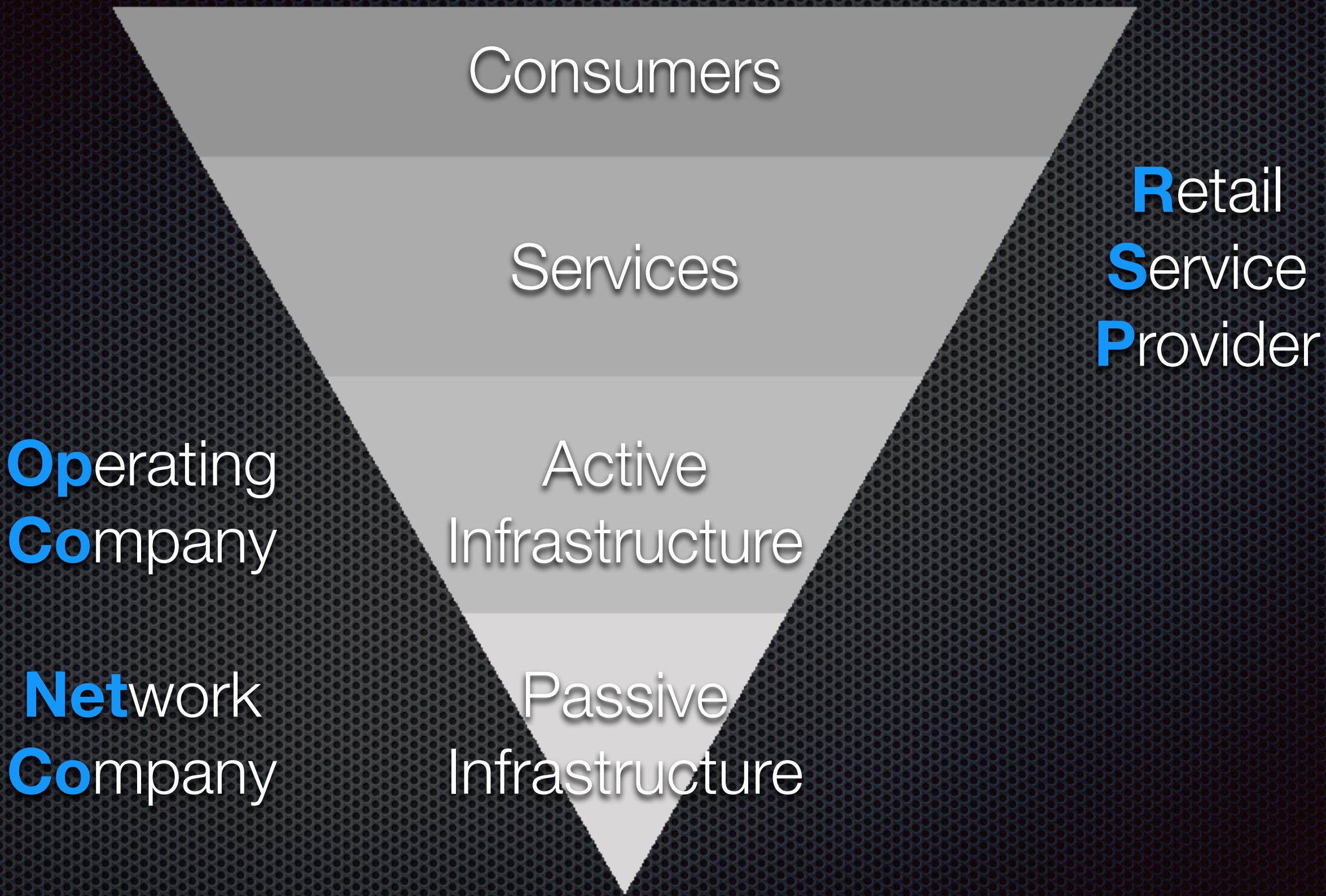


Next Generation Nationwide Broadband Network (Next Gen NBN)

- ✦ 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

Retail
Service
Provider

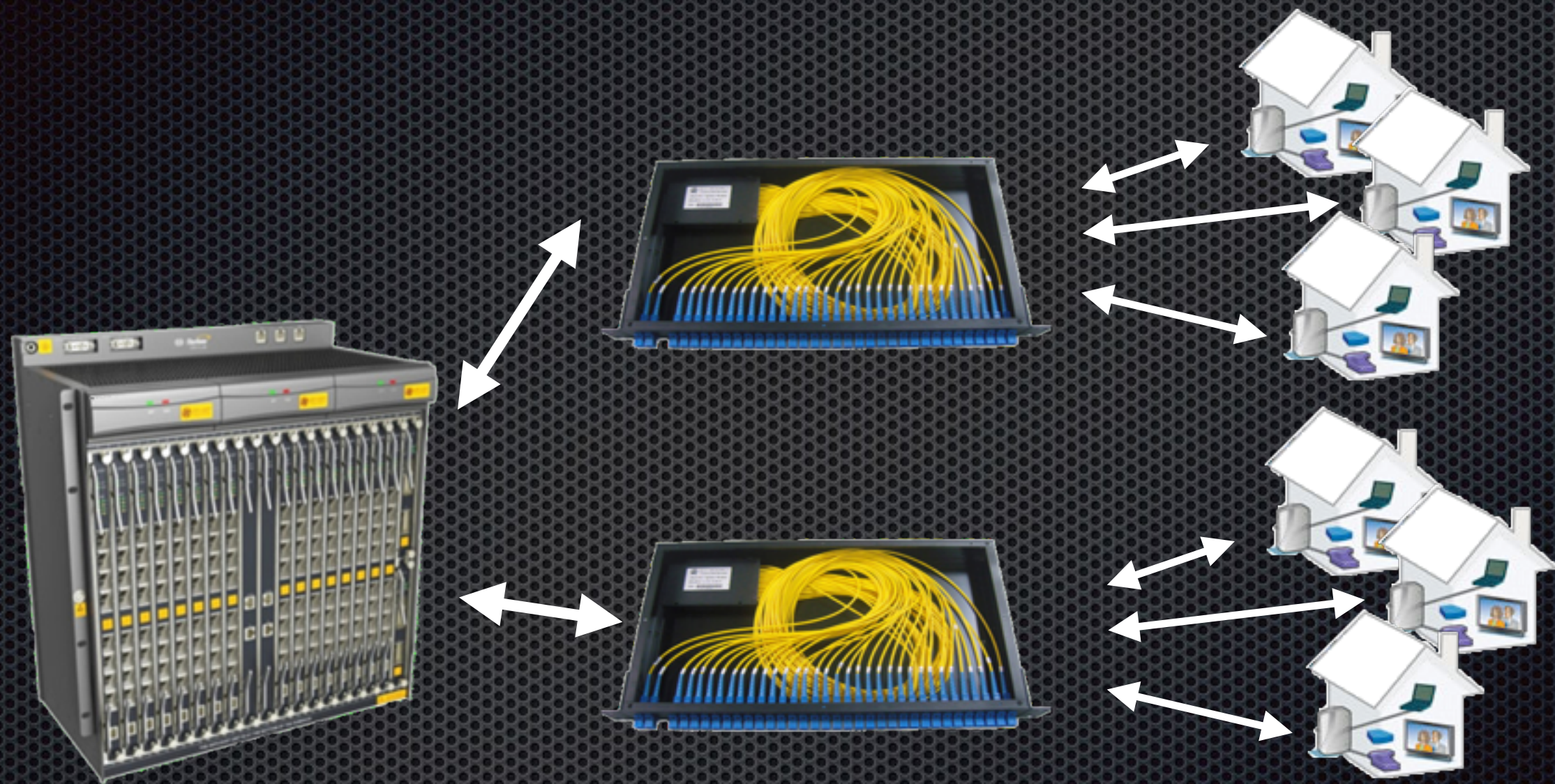
Operating
Company

Active
Infrastructure

Network
Company

Passive
Infrastructure

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 Tiler 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

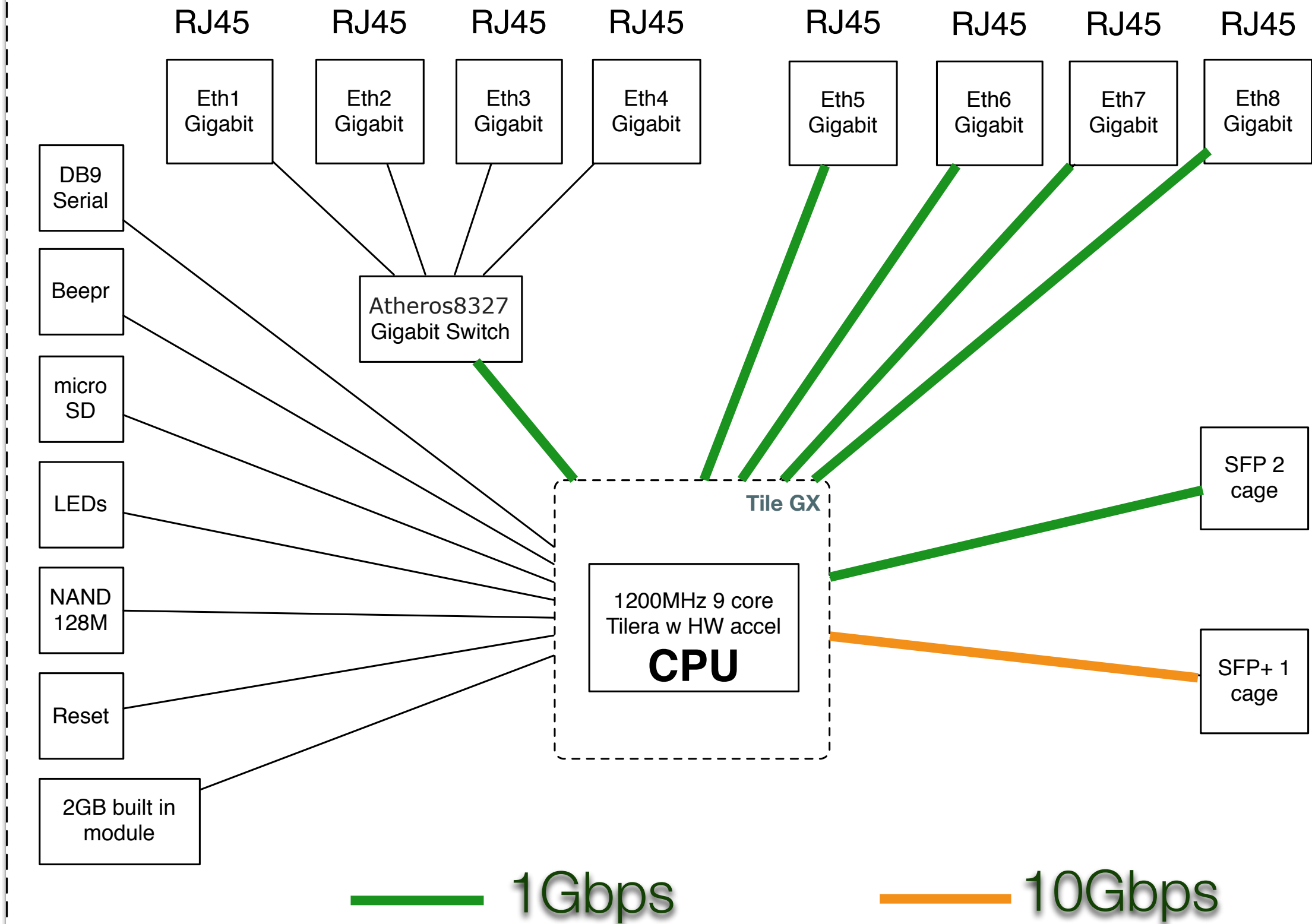
/ ip route
add dst-address=0.0.0.0/0 gateway=10.111.0.1 routing-mark=to_ISP1 check-gateway=ping
add dst-address=0.0.0.0/0 gateway=10.112.0.1 routing-mark=to_ISP2 check-gateway=ping
add dst-address=0.0.0.0/0 gateway=10.111.0.1 distance=1 check-gateway=ping
add dst-address=0.0.0.0/0 gateway=10.112.0.1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



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)

The screenshot shows the 'New Interface' configuration window with the 'Bonding' tab selected. The window has four tabs: 'General', 'Bonding', 'Status', and 'Traffic'. The 'Bonding' tab contains the following settings:

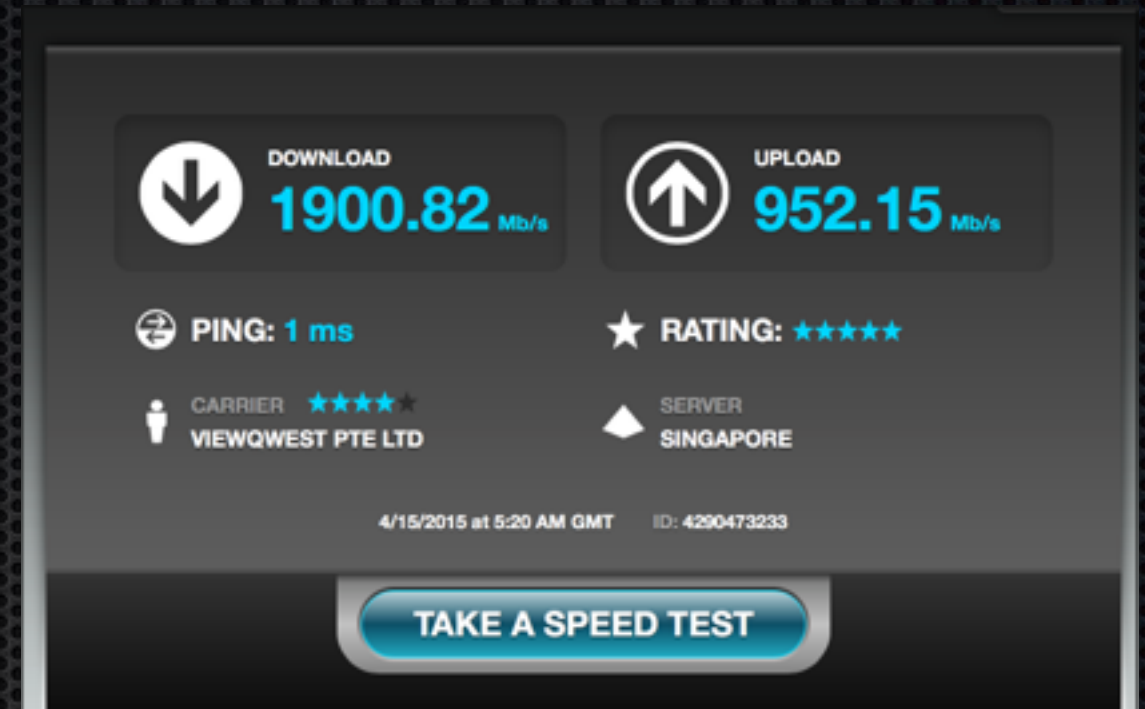
- Slaves:** A list box containing 'ether5' and 'ether6'. 'ether6' is currently selected.
- Mode:** A dropdown menu set to '802.3ad'.
- Primary:** A dropdown menu set to 'none'.
- Link Monitoring:** A dropdown menu set to 'mii'.
- Transmit Hash Policy:** A dropdown menu set to 'layer 3 and 4'.
- Down Delay:** A text box with '0' and a unit of 'ms'.
- Up Delay:** A text box with '0' and a unit of 'ms'.
- LACP Rate:** A dropdown menu set to '30 s'.
- MII Interval:** A text box with '100' and a unit of 'ms'.

On the right side of the window, there is a vertical stack of buttons: 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', 'Remove', and 'Torch'.

At the bottom of the window, there are three status indicators: 'enabled', 'running', and 'slave'.

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 Mbps
bridge1	Bridge	1578	1820.5 Mbps	13.6 Mbps
ether1	Ethernet	1578	0 bps	0 bps
ether2	Ethernet	1578	0 bps	0 bps
ether3	Ethernet	1578	0 bps	0 bps
ether4	Ethernet	1578	0 bps	0 bps
; 2Gbps to PC				
ether5	Ethernet	1580	949.7 Mbps	9.1 Mbps
; 2Gbps to PC				
ether6	Ethernet	1580	955.7 Mbps	4.3 Mbps
; Zhong GE1				
ether7	Ethernet	1580	6.9 Mbps	967.2 Mbps
; Zhong GE2				
ether8	Ethernet	1580	6.5 Mbps	938.3 Mbps
sfp-sfpplus1	Ethernet	1580	0 bps	0 bps
sfp1	Ethernet	1580	0 bps	0 bps

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