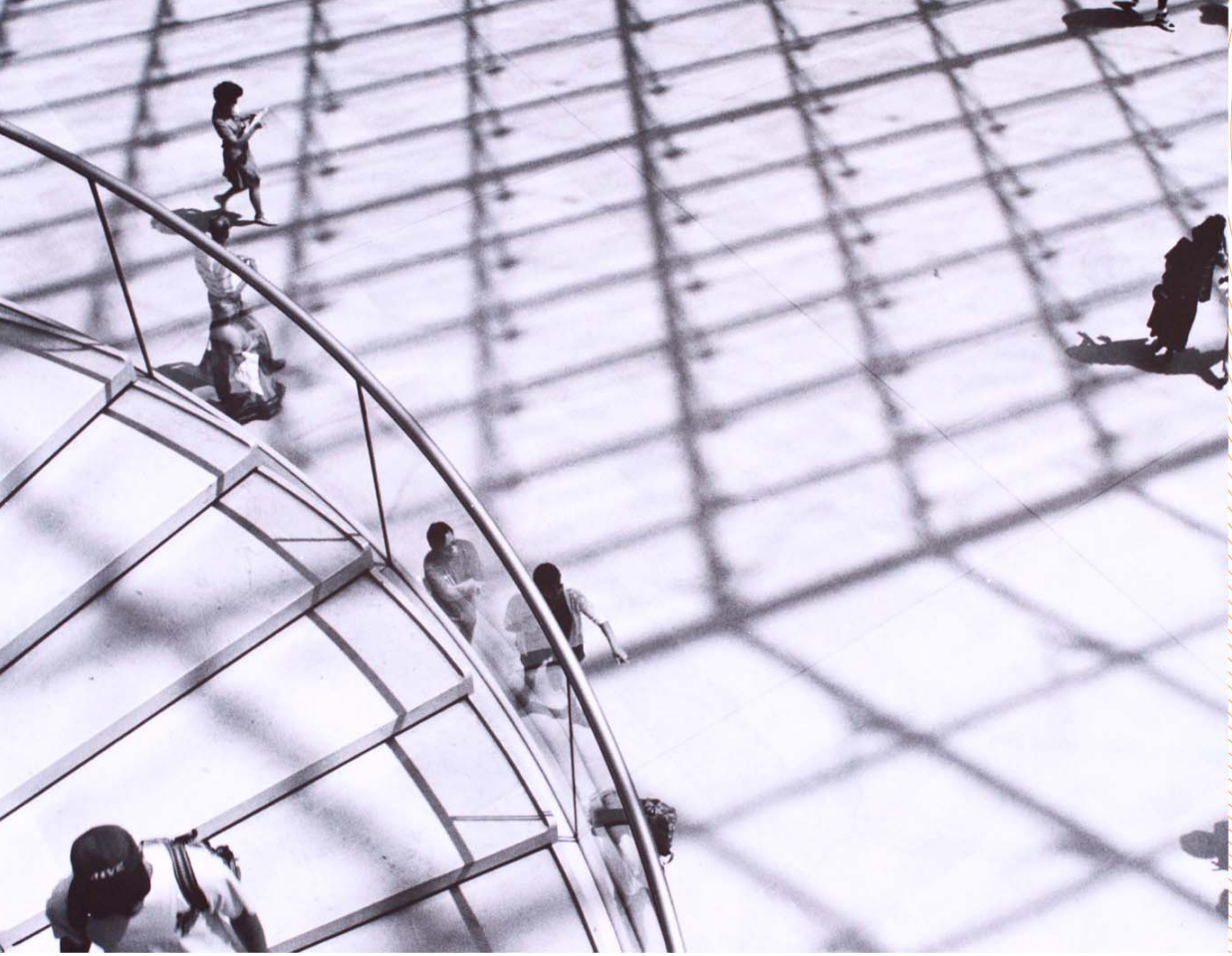


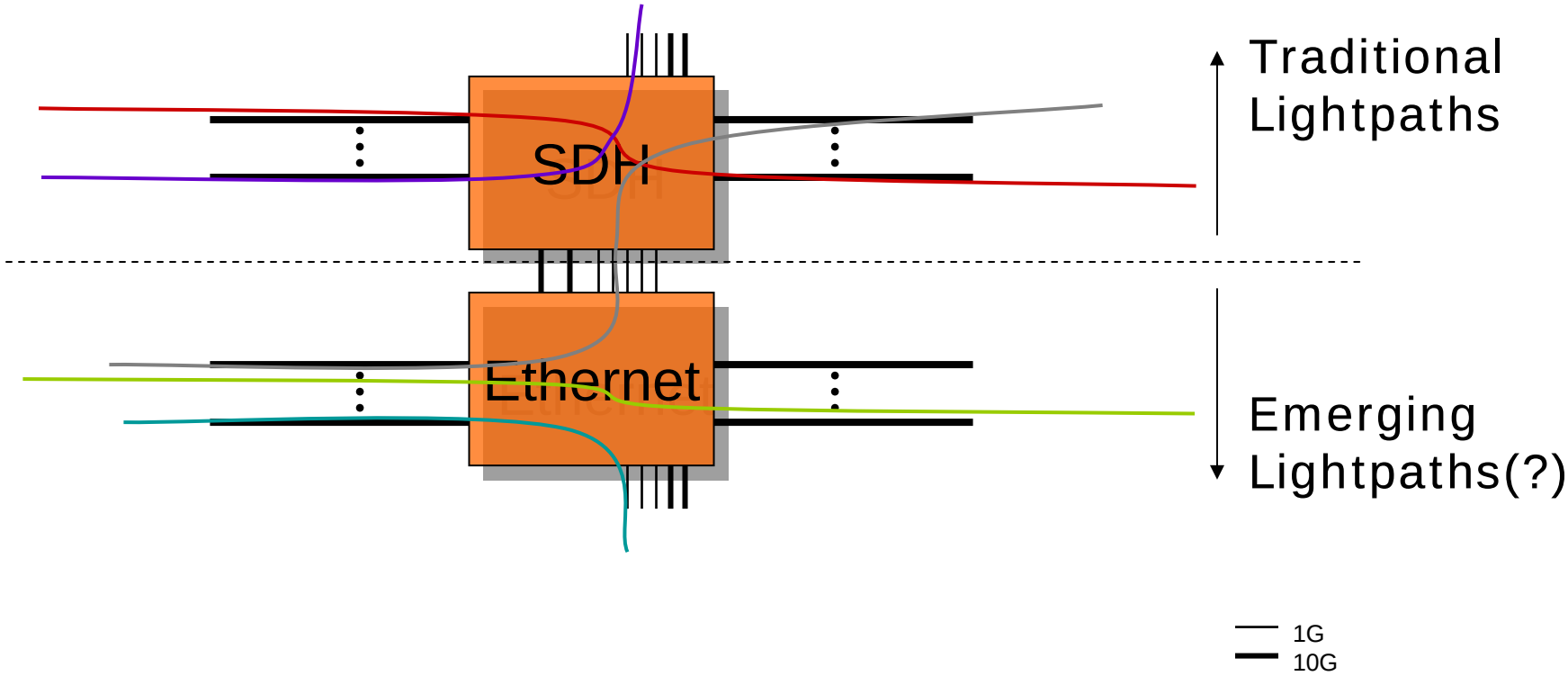
802.1ah in NetherLight

Wouter Huisman and Ronald van der Pol

October 2008

NetherLight Services

- Lightpath using SONET/SDH transport layer
- VLAN based connections using Ethernet layer 2
- Or combined service



Why Ethernet as Transport layer

- All services on NetherLight are Ethernet, no GFP/LEX mapping
- Projects in temporary hibernation mode don’t consume bandwidth, minimal effort for GOLE operations
- Benefit from statistical multiplexing, providing better utilisation on transatlantic links (scarce bandwidth)
- Multiple services per client interface (eg. GE port)
- Mesh is allowed, not limited to point-to-point
- Market trend: “Ethernet is more cost efficient”

Emerging Ethernet Technologies

- New Connection Oriented Ethernet technologies are defined to find a cost efficient replacement for SDH/SONET, like PBB-TE / PBT, T-MPLS, MPLS-TP, IP-MPLS, etc

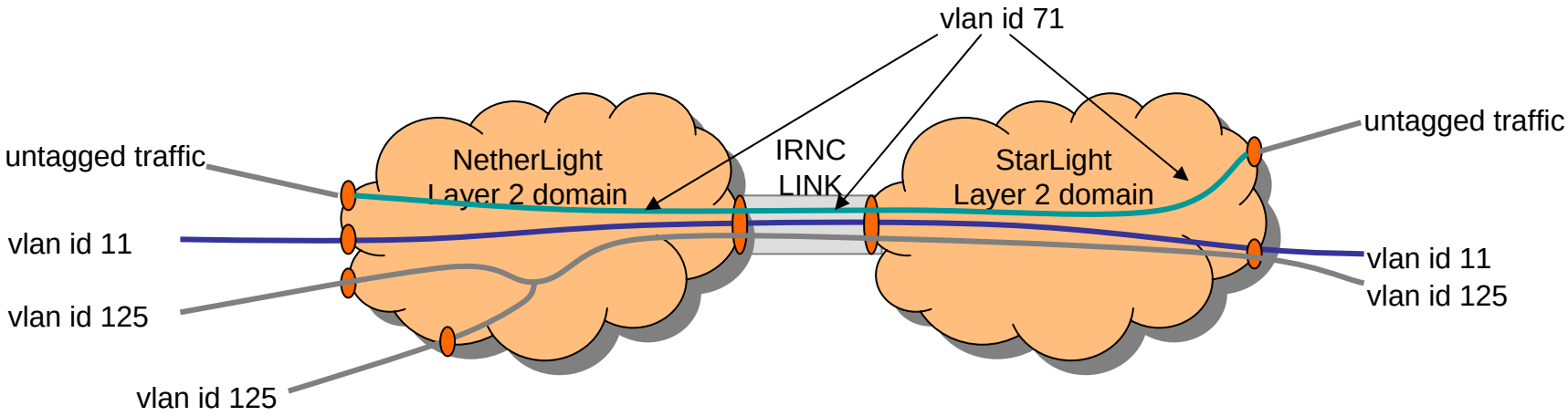
These are not covered in this presentation

Current Ethernet services

- Two connection models apply based on VLAN tagging (802.1Q):
  - Tagged traffic originating from an Ethernet network is passed on using the same VLAN tag
  - Untagged traffic originating from a directly connected host, data is mapped to a new VLAN ID.

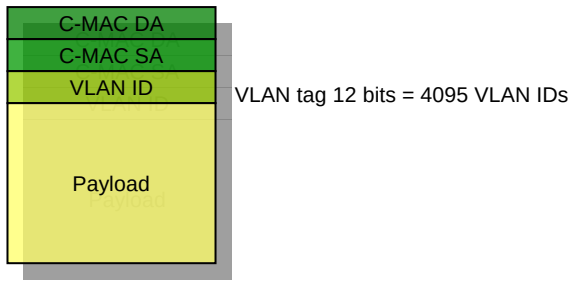
Best effort services, ideally with no overprovisioning to guarantee performance

Ethernet services current practise



VLAN tagging - 802.1Q

- Multiple services per interfaces possible; trunking
- One broadcast domain, all MAC addresses for connected networks are learnt
- Max 4095 VLAN IDs



Limitations 802.1Q

- Max number of 4095 VLAN Ids may result in stranded VLAN Ids for connected GOLEs
- Finding an available VLAN ID is time consuming since many parties are involved (eg Arecibo – JIVE)
- No clear separation between customer network and provider network
- Backbone MAC table contains all customer MAC addresses
  - Flooding of MAC table

Alternatives for 802.1Q

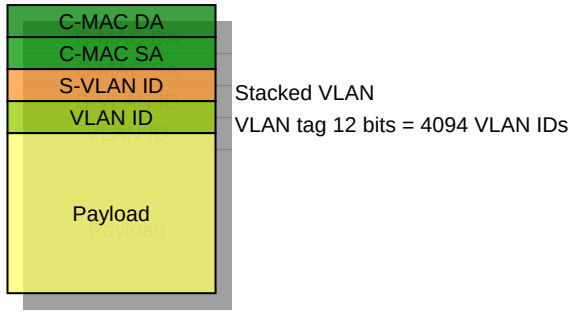
Instead of VLAN tagging, two encapsulation methods could be used:

- QinQ, 802.1ad
- PBB / Mac-in-Mac, 802.1ah

802.1ad Q-in-Q

Q-in-Q is an Ethernet standard defining an aggregating function for multiple VLANs into 1 provider VLAN

- transparently maps any VLAN to a provider VLAN ID
- Customer VLANs are separated from Provider VLANs



Limitations 802.1ad

- Separation between customer network and provider network only on VLAN ID
- Backbone MAC table contains all customer MAC addresses
  - Flooding of MAC table

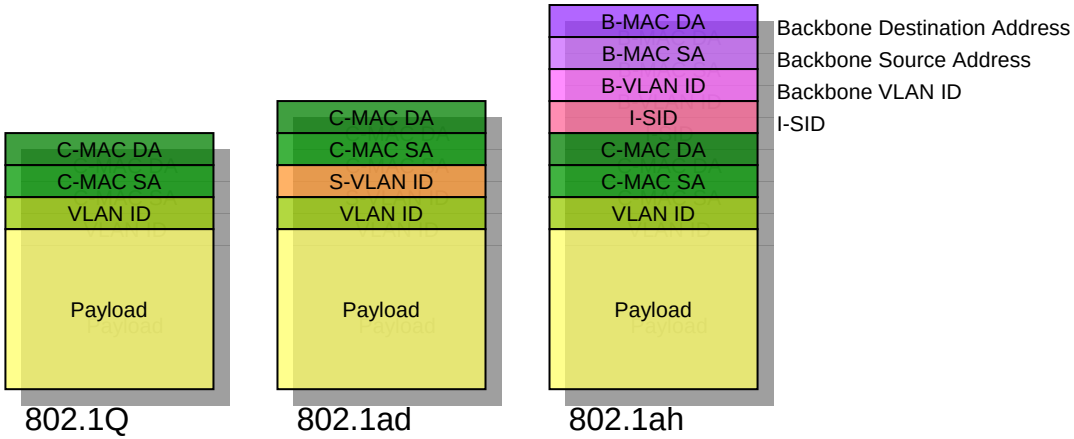
- Aggregation only:

  No flexible switching, since all incoming traffic is mapped to 1 provider vlan → not suitable for NetherLight.

802.1ah / PBB / Mac-in-Mac

Ethernet standard allowing mapping of VLAN IDs to I-SID

- Scalable to 16M services
- Clear separation between customer and provider network
- MAC addresses separation
- Similar feature set as VLAN tagging + more



Limitations 802.1ah

- Slightly larger overhead (22 bytes)
- Bit more configuration work to set up a service
- Not too many vendors support 802.1ah

Implementations

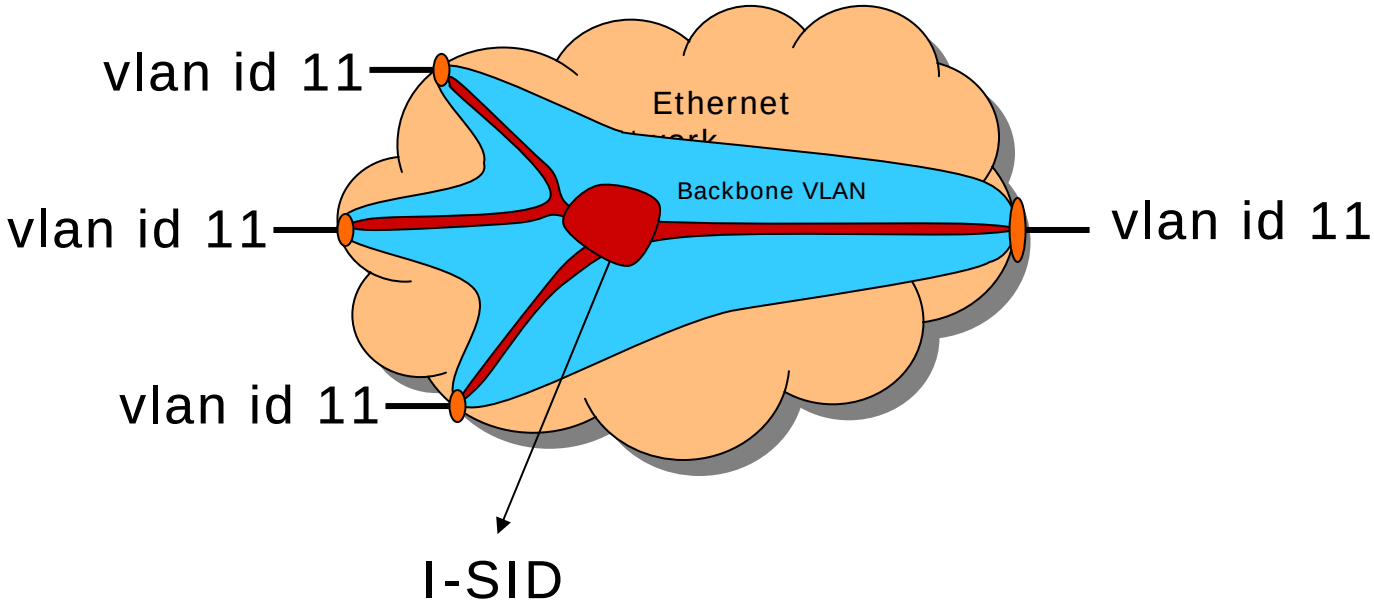
- 802.1ah can be run in parallel to 802.1Q
  - Smooth introduction
- No interop issue to customer interfaces:
  - The UNI of the PBB domain can be 802.1Q (VLAN tagging), 802.1ad (Provider Bridge, aka QinQ)
- No special hardware required for PBB, just SW upgrade

Setting up Mac-in-Mac

1 - Define Backbone VLAN (one per network)

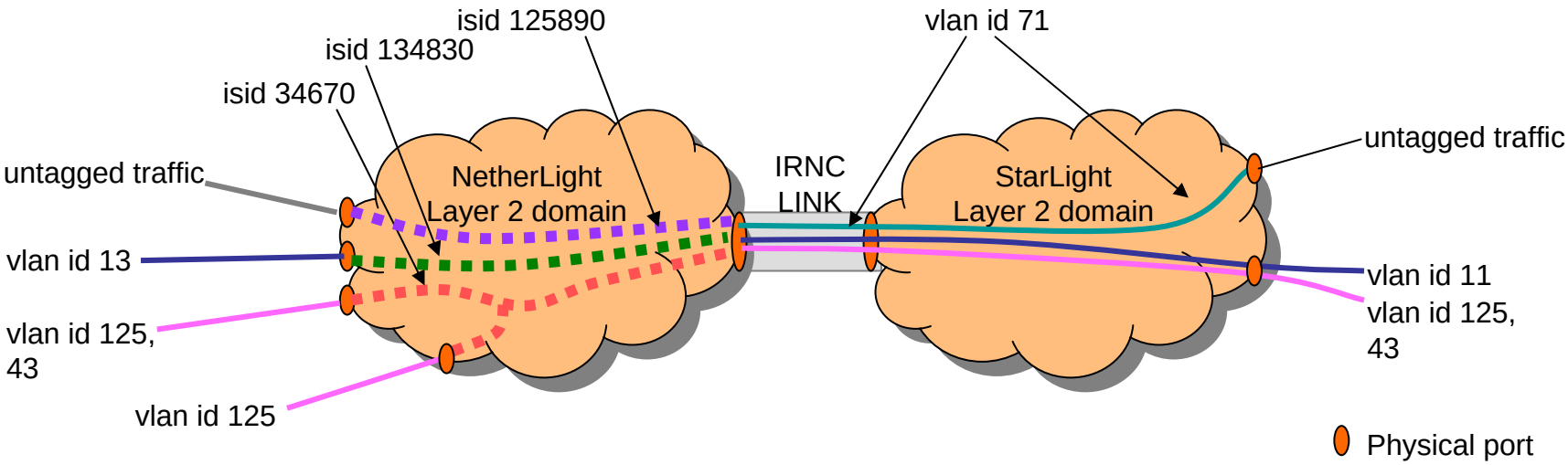
2 - Add I-SID per service instance

3 - Create endpoints for I-SIDs (mapping VLANs) to I-SID



Tested solutions

- Untagged traffic → VLAN
- Transparent VLAN
- VLAN retagging
- Trunk VLANs



PBB support by

- Foundry NetIron MLX series
- Nortel MERS8600
- …

- Which vendors are used by the GOLE, and is PBB supported?

Next steps

- Upgrade NetherLight ERS8600 to MERS8600 R5.0
- Migrate services from VLAN to I-SID instances
  - Service interuption

- Study on connection oriented Ethernet for GOLEs / Global implementation possible
  - Like PBB-TE (PBT), MPLS-TP, etc
  - Is a replacement for traditional SDH lightpaths possible/preferable?

Conclusions

802.1ah / PBB brings value to NetherLight

- Secure
  - MAC address separation
- Flexibility
  - VLAN retagging
  - Customer VLAN agnostic
- Scalable
  - 16M services
  - No VLANID stranding

But:

- No replacement for SDH or SONET services