Carrier Ethernet Service, Release 4
Swinog #18

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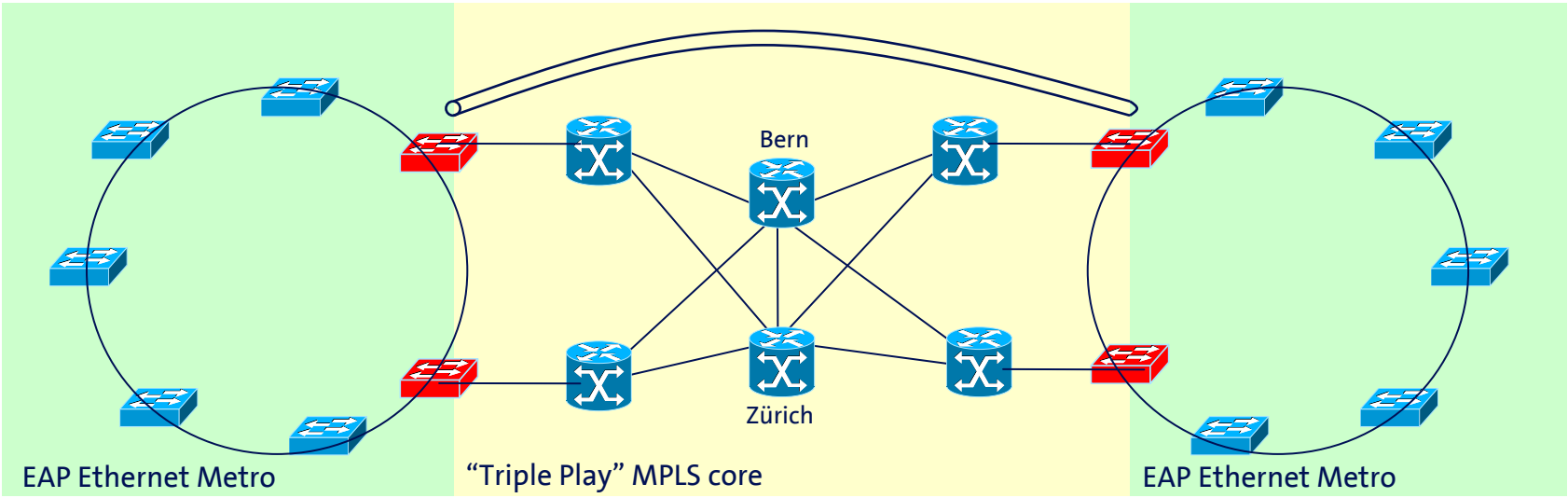
Agenda

- Core and metro network overview
- Carrier Ethernet Service -- CES
- New features with CES Release 4

CES uses both EAP and 3P-core for an end-to-end service: VPLS tunnels across core, native Ethernet in the access

- Ethernet Aggregation Platform (EAP):
  A native Ethernet platform, forming metro rings
- IP Standard Services (3P-) core:
  MPLS core network with a dual star topology




```
ipc-zhh790-m-ds-01#sh mpls l2transport vc vcid 16910

Local intf     Local circuit         Dest address    VC ID      Status
-------------  --------------------- --------------- ---------- ----------
VFI VFI-16910  VFI                   138.187.63.33   16910      UP
VFI VFI-16910  VFI                   138.187.63.93   16910      UP
```

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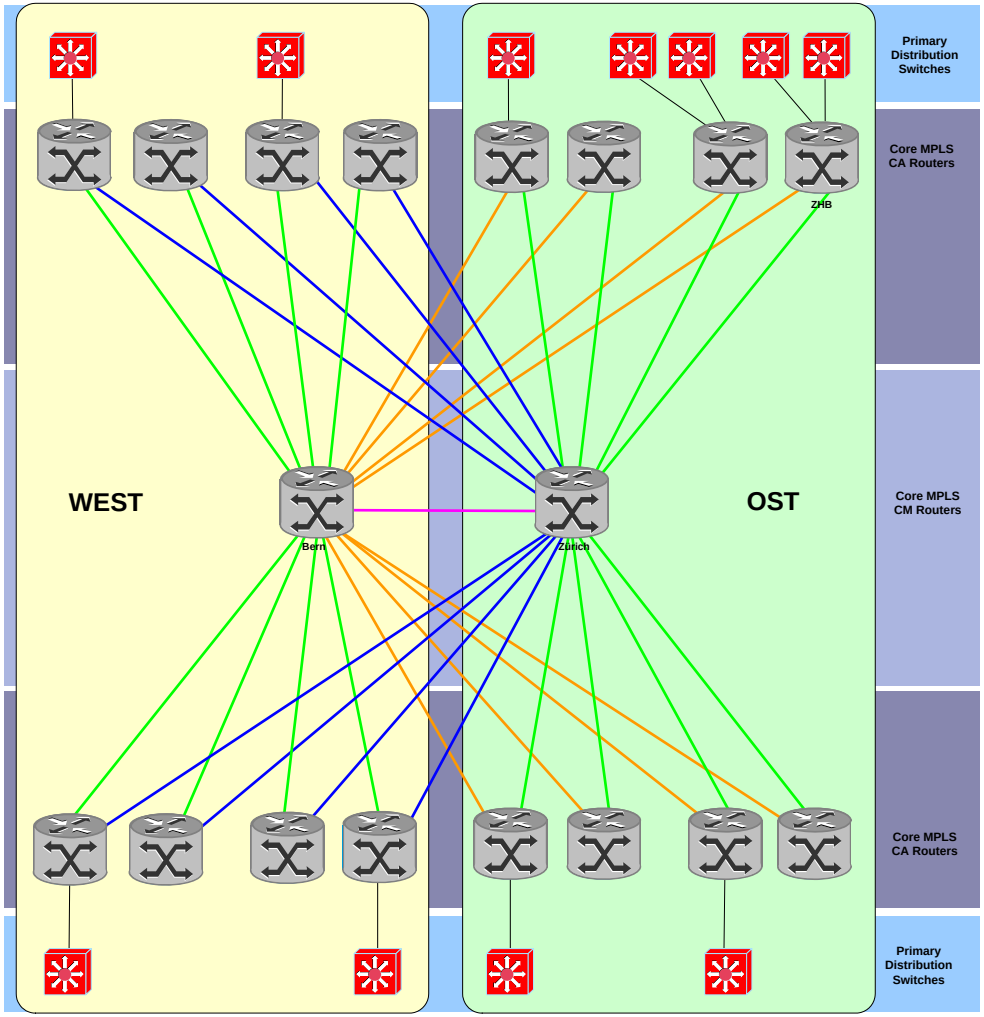
IPSS Core network

MPLS-based multi-service core



- Based on the Cisco CRS1-8/16 platform.
- 2 CRS1-16 as Core Main routers, one in Zürich, one in Bern.
- Core Aggregation routers with 10 or 20 Gb/s to each Core Main. Act as P or PE
- IS-IS as IGP.
- Native multicast (PIM-SM) for IPTV.
- Used for CES, CIS/LAN-I, BBCS, Mobile Voice and data...

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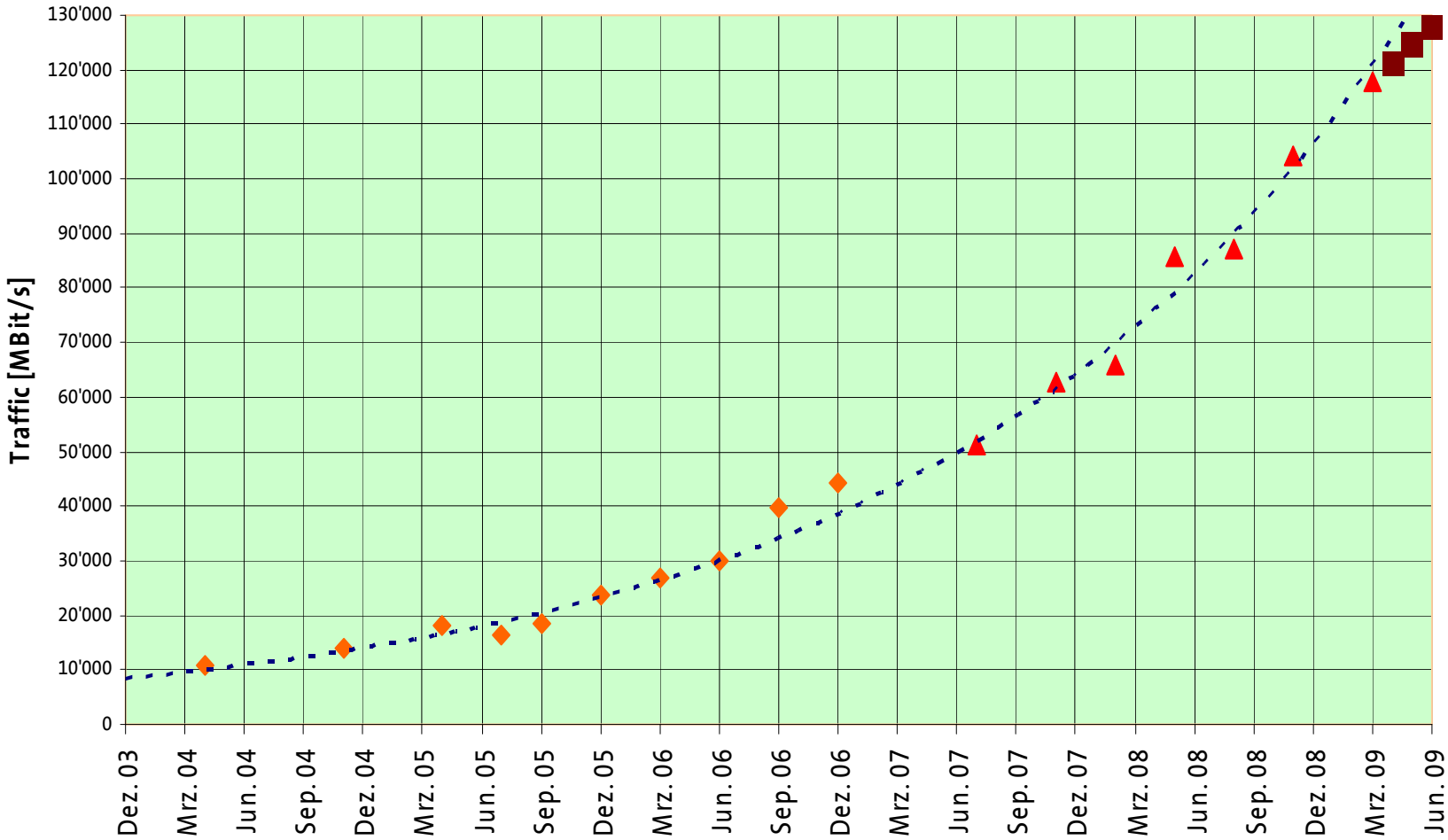
Continuing exponential growth:

Core traffic evolution, taking into account Internet, IPTV, CES inter metro, VoIP



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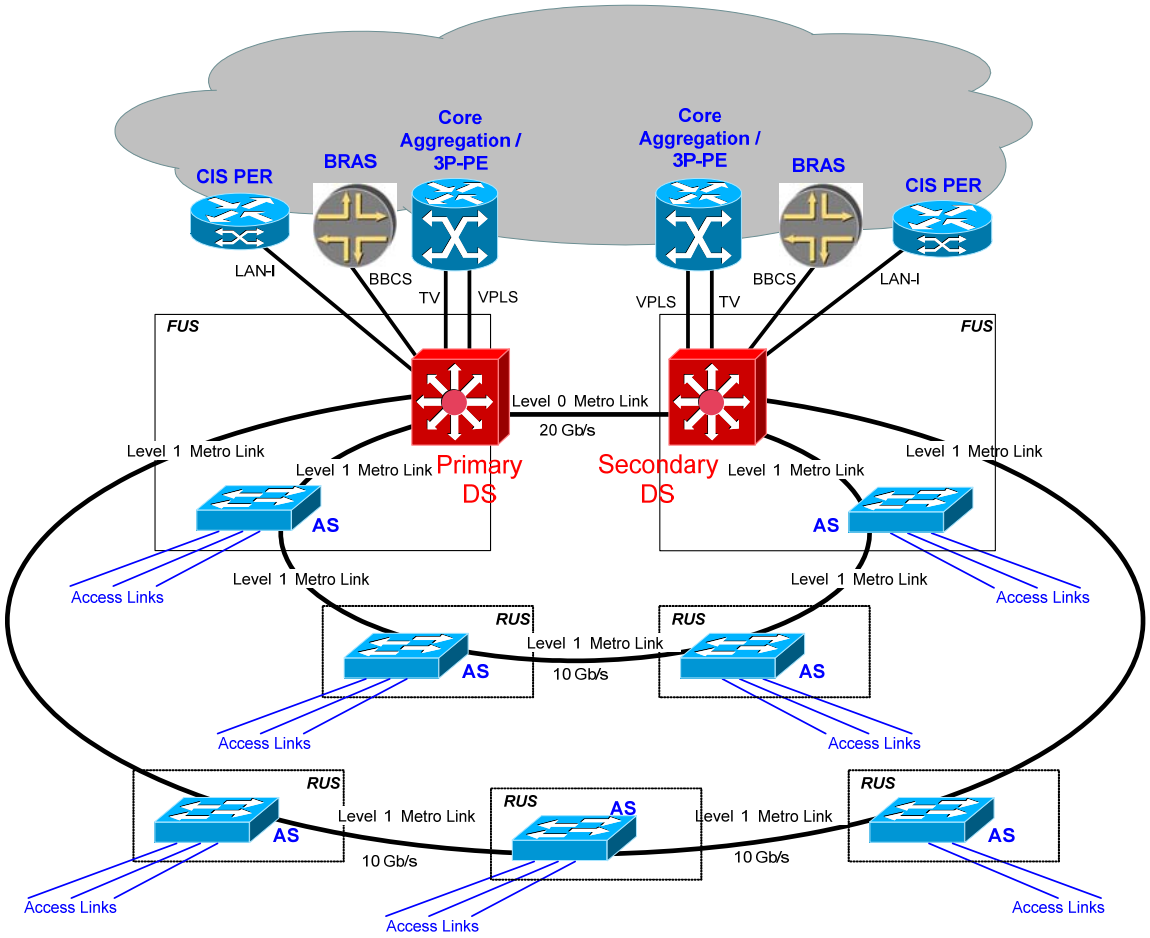
EAP metro aggregation:
Facts and figures



- docents of independent metro networks
- Cisco 7609 as Distribution Switches. Act as PE for VPLS.
- hundreds of Cisco 4510R as Access Switches

- BBCS and IPTV
- CES as layer 2 service
- CIS/LAN-I as layer 3 service
- QoS protects high-value services

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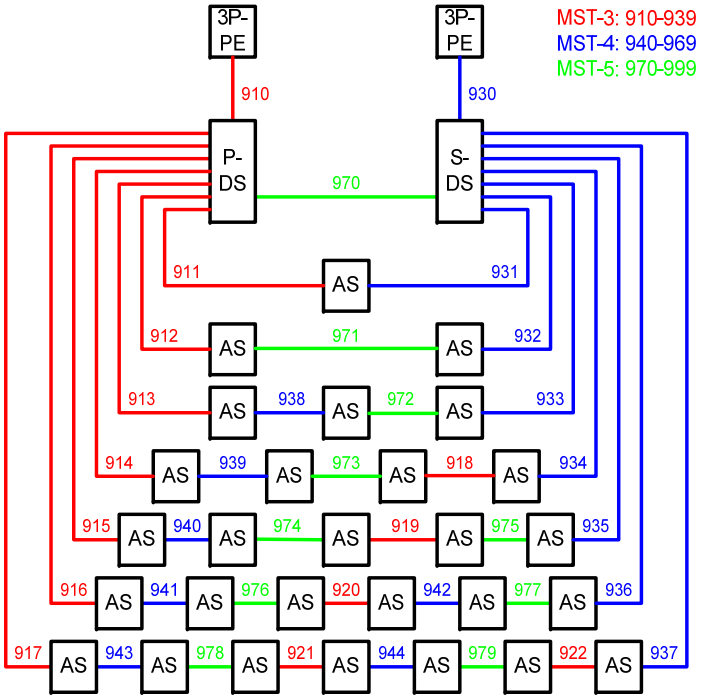
EAP is also used for IPTV distribution:
Layer 3 multicast on an – otherwise – L2 platform

- Challenge: Decouple MST for switched traffic from routed multicast
- Idea: Eliminate need for STP by using a P2P VLAN for each ring segment
  → convergence for MC traffic becomes independent of STP
- Disabling STP in an MST environment not supported per VLAN
  – → workaround: 3 MST instances, alternate MST instances on ring segments
    STP still runs, but no port can ever be blocking



- Unique VLAN ID for each ring segment
- Alternate VLAN instances on ring segment
- Mapping to MST instances
  – MST-3: 910-939
  – MST-4: 940-969
  – MST-5: 970-999

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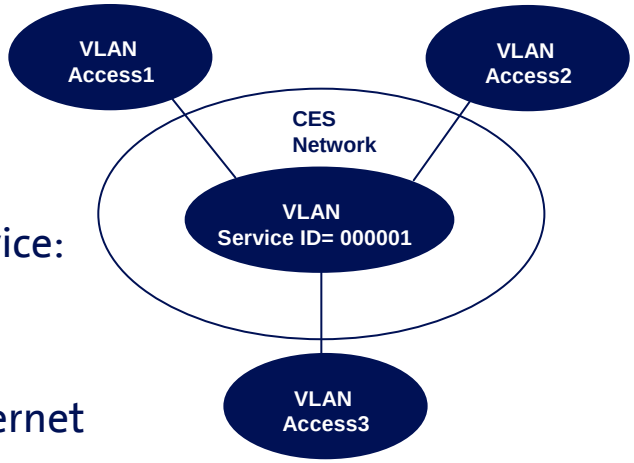
Carrier Ethernet Service (CES):
L2-VPN wholesale service offering

Swisscom Corporate Business (CBU) sells CES as Swisscom Ethernet Service (SES) to end customers

- CES is a **Layer 2** Ethernet (802.3) VLAN service.
  - Delivers unconditionally unicast, multicast and broadcast Ethernet frames.
  - Offers a L2 **VPN** service: VLAN Service ID
- CES is a **multiplexed multipoint-to-multipoint** service:
  - Multiple VLANs can be configured on a SAP, all having any-to-any connectivity.
- CES is an **ELAN** service as defined of the Metro Ethernet Forum:
  - When a new VLAN access is added to the service, no new Ethernet Virtual Circuits need to be created.



CES service properties and options

Intended use

- CES is a L2 network to run a L3 service. The first customer equipment should be a router!

Bandwidths

- Ranging from 2 Mb/s to 1000 Mb/s, 10 Gb/s on request

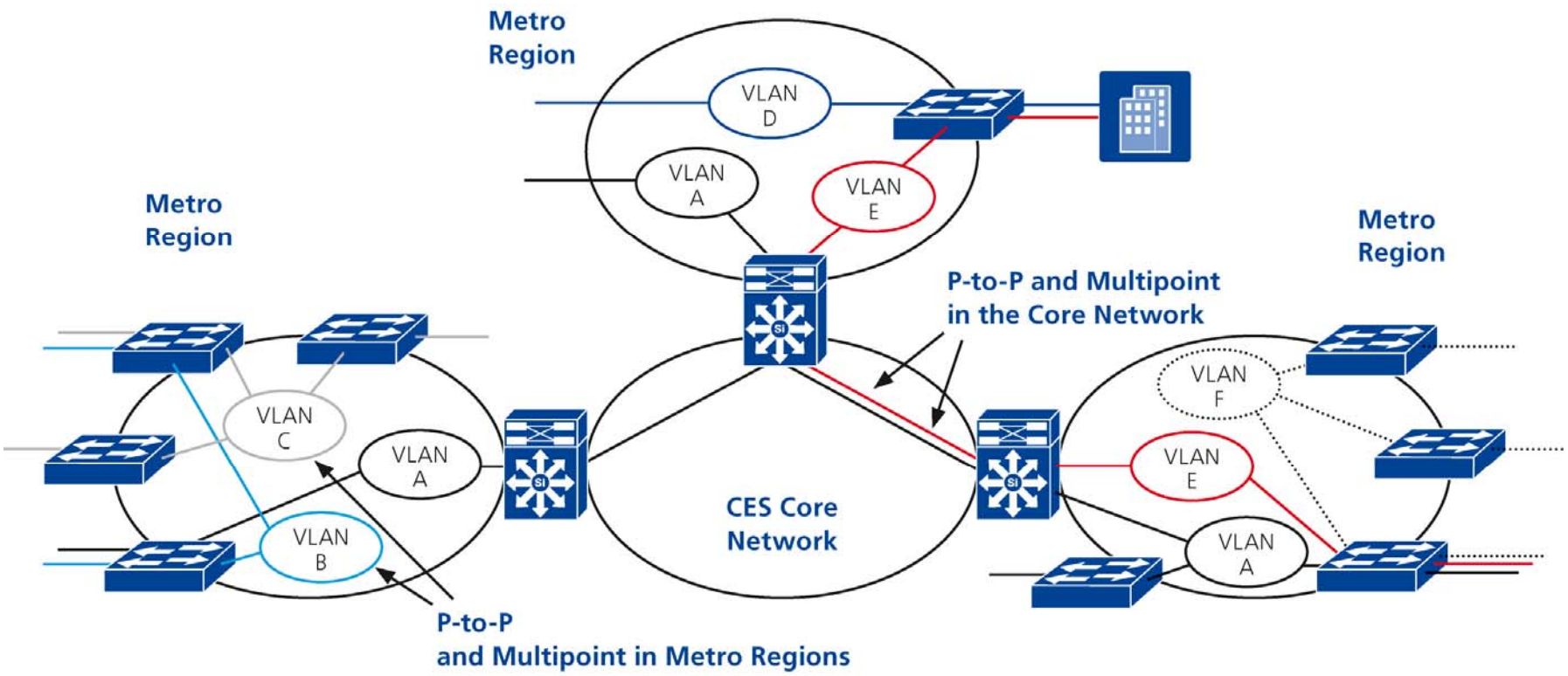
Service access point

- Optional managed CPE (3400 or 3750-ME)
- Single access or dual homed (platinum). Typical SLAs apply.
- „Platinum light“: Dual homed with a shared fiber path in the last mile.
- Trunk / access / tunnel port
- 100 BASE-TX, 1000 BASE-[S|L|Z]X

Transparency

- MAC addresses limited to 5 per SAP and VLAN, extendable to 25 MACs.
- Not transparent to L2 signalling, except STP, VTP, CDP on EPL access

CES Any-to-any Connectivity



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Access Switch customer facing port: Policing & remarking, CoS, MAC limiting


```
interface GigabitEthernet3/6
   description cstm-zhb-001:Gi1/1/1, Zurich IP 9999, ces-cstm-ch-zhb-s-001
   switchport trunk encapsulation dot1q
   switchport trunk allowed vlan 402,3023,3057,3084
   switchport mode trunk
   switchport nonegotiate
   switchport port-security
   switchport port-security maximum 16
   switchport port-security aging time 5
   switchport port-security aging type inactivity
   mtu 4470
   qos trust cos
   flowcontrol receive off
   vlan-range 402
     service-policy input MGMT-RATELIMIT-PM
   vlan-range 3023,3057,3084
     service-policy input CES-03-10.0:0:0:0-STD-PM
     service-policy output CES-03-10.0:0:0:0-STD-PM
     port-security maximum 5
   tx-queue 1
     bandwidth percent 2
   tx-queue 2
     bandwidth percent 48
   tx-queue 3
     bandwidth percent 100
     priority high
   tx-queue 4
     bandwidth percent 50
```

```
policy-map CES-03-10.0:0:0:0-STD-PM
  class class-default
    police 10000000 bps 1000000 byte
    conform-action transmit exceed-action drop
   set dscp cs1
```

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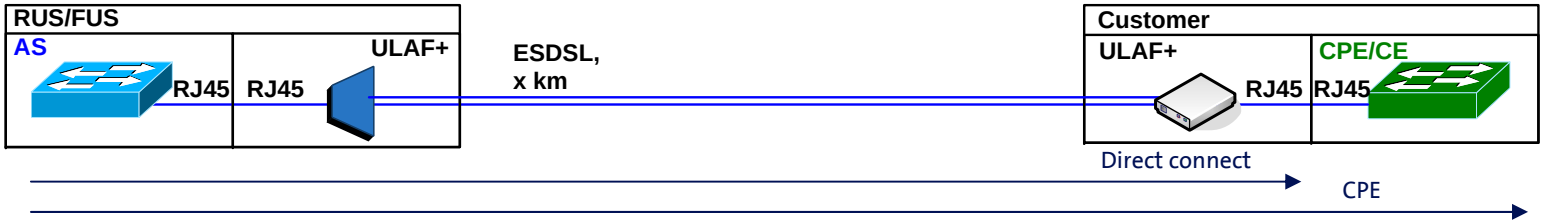
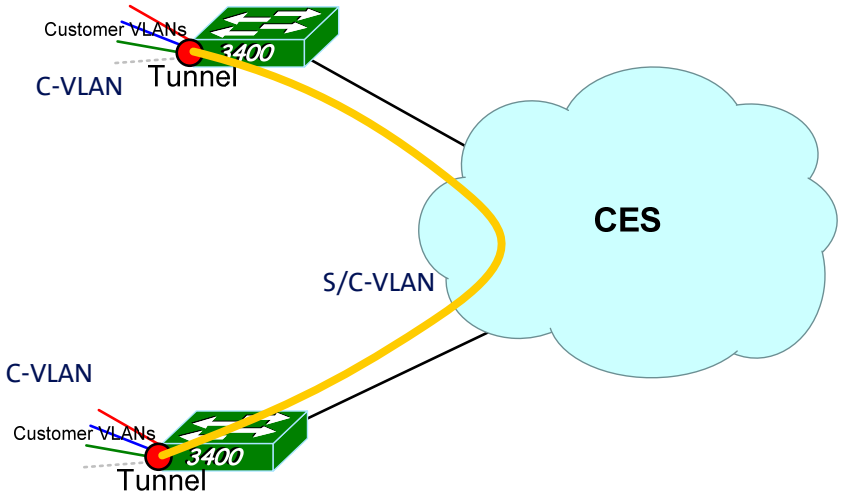
New feature #1: “CES over copper“
Enhanced SDSL as last mile technology



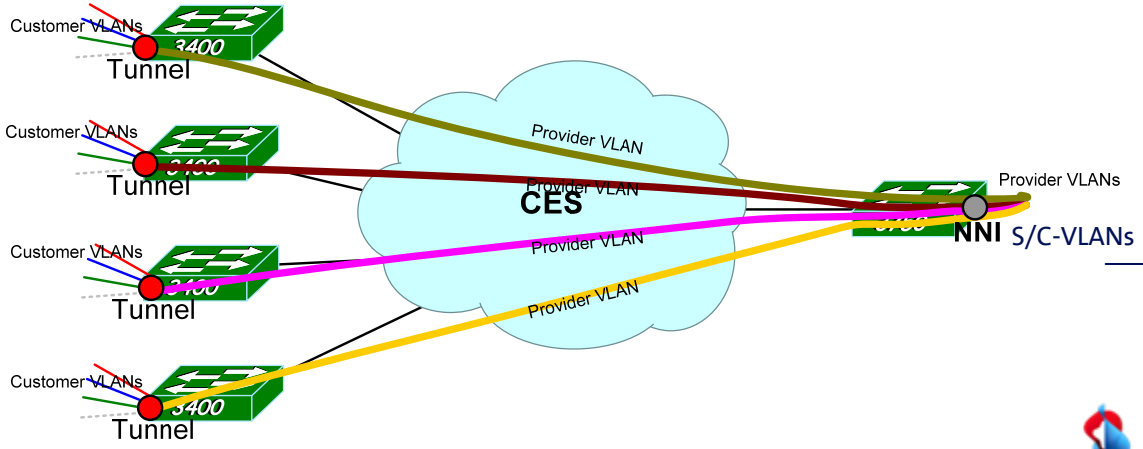
- ESDSL as last mile technology, using the Albis Technologies ULAF+ platform
- Speed vs distance:
  - 5.7 Mb/s symmetrical at short distances
  - Reach of ~6500 m for lower speeds
  - ESDSL has two modulation types, PAM-16 and PAM-32. CES uses only PAM-16
  - PAM-32 could reach higher speeds, but is less robust to noise and interference than PAM-16.
- Bonding of copper pairs
  - Up to four copper pairs can be used in parallel to provide higher speeds
  - Max. CES profile speed: 14 Mb/s, in steps of 2 Mb/s
- Available with CPE, or as Direct Connect with an NTU (ESDSL modem)
- No redundant copper access

New feature #2: „transparent“ service
Ethernet Private Line

- Tunnel – Tunnel
- This combination can be used for transparent point to point, leased lines substitution, no aggregation.



- Tunnel – NNI
- NNI ports aggregate and multiplex all provider‘s VLANs. Each Provider VLAN contains multiple customers‘ VLANs



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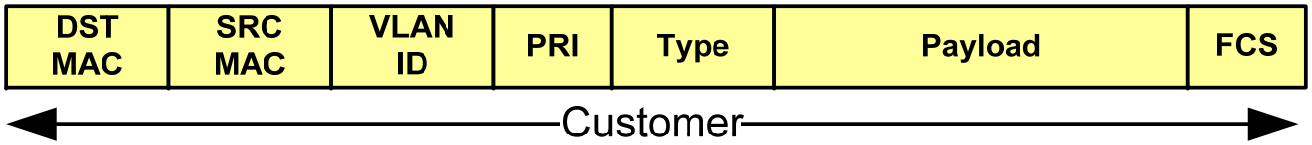
CoS concept for EPL:
Static traffic class for S-VLAN

- End customers' frames .1p-bit must be transported unmodified: This is given by how a Cisco tunnel port works. C-VLAN tags are not changed
- The service should look like a leased line, where a fix static service class is associated.

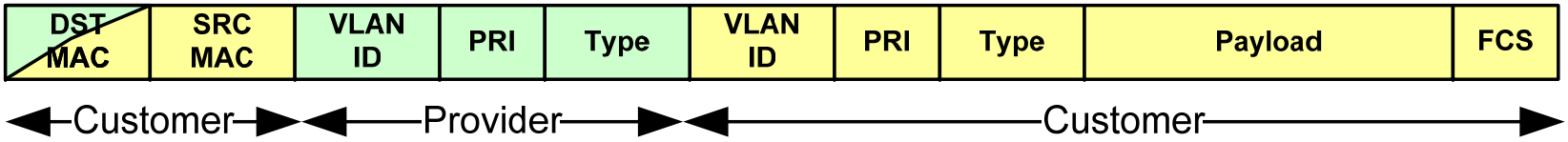
  → The S-VLAN .1p-bit are marked to either Best Effort*, Control (AF2), or Real Time traffic. All customer traffic is transported using this fixed priority.

  * BE queue, but with different WRED parameters than BBCS best effort traffic

Customer original .1Q Ethernet frame



Ethernet frame after the tunnelling operation



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Thank you. Questions?

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