DE-CIX Apollon

Heutige Situation und künftige Herausforderungen für den Internet-Betrieb am Beispiel des DE-CIX

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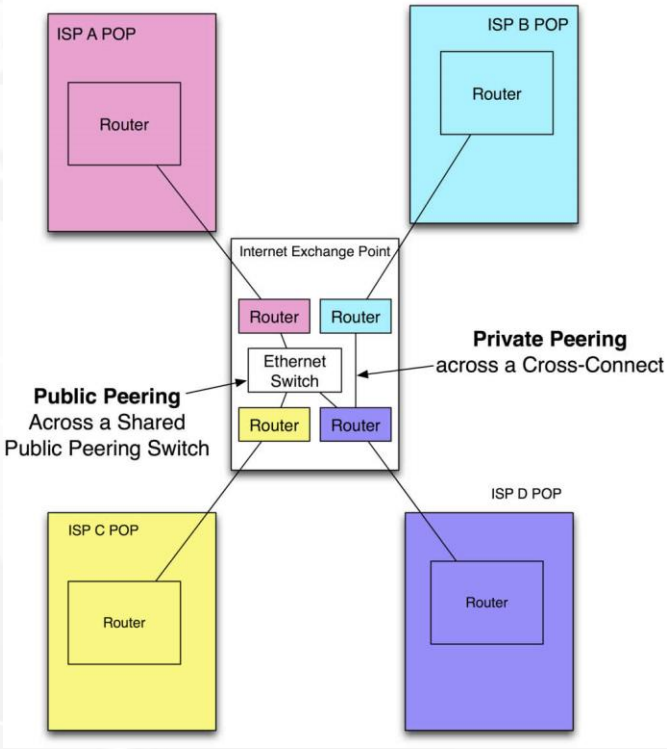
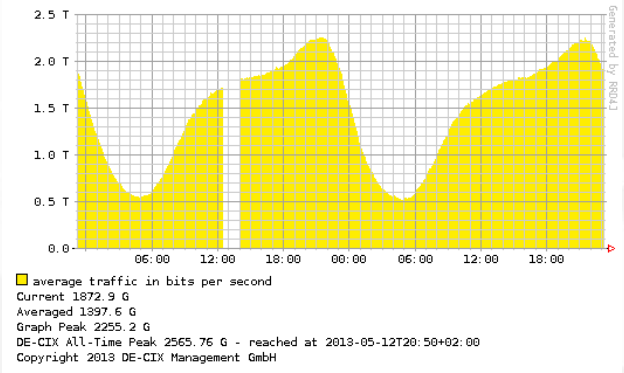
- Internet Exchange (IXP)
  - An Internet Exchange Point (IXP) is a place (or series of interconnected places) where many different organisations (each with their own autonomous system number or numbers) can come together to interconnect their networks.
  - An IXP provides a network infrastructure within the place or places for the purpose of facilitating the neutral exchange of Internet traffic between different network autonomous systems
  - An IXP has a minimum of three connected members/customers.
  - The network infrastructure is operating below Layer 3 of the ISO/OSI model



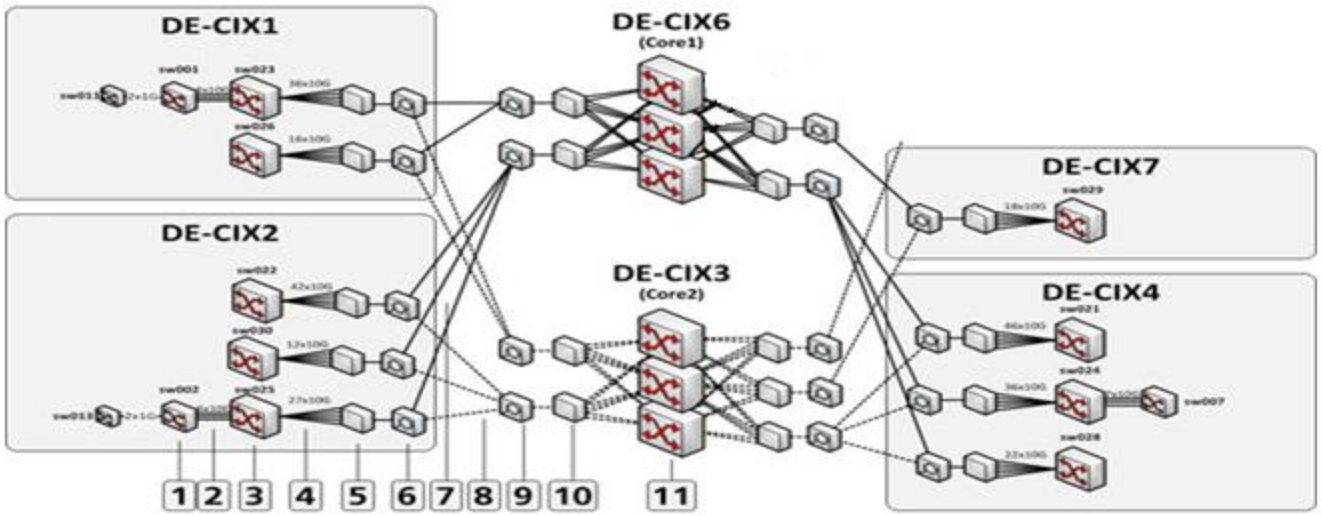
From: http://drpeering.net/FAQ/What-is-an-Internet-Exchange-Point.php

- DE-CIX
  - was founded May 1995
  - is the world‘s largest Internet Exchange with more than 2.5 terabit per second peak traffic
  - serves and connects 500+ networks
  - keeps 70,000+ active peering sessions stable
  - has 770+ 10GE switch ports connected
  - is the most valuable IXP with more than 4,7 Gbit/s per customer
  - has been a 100 percent uptime since 2007



- Metropolitan Area - Frankfurt
  - is the strongest economic region of Germany and the most productive in Europe with a population of 5+ million
  - accounts for over 8 percent of GDP in Germany and has a purchasing power far above national average
  - is the biggest hub for Voice and IP traffic in Central Europe, Telegeography ranked Frankfurt the No. 1 Internet traffic hub in Europe
  - less than 8 milliseconds to other European metropolitan areas
  - has 14+ colo operators with 400,000 square meters of space with reliable power capacity, single sites having 500+ carriers / ISPs connected
  - And by the way … Germany is the 4th largest economy worldwide & largest within the EU

- Status Quo DE-CIX Network Topology



1 Force10 Terascale E1200
2 Multiple 10G-Connections
3 Force10 Exascale E1200i
4 Multiple 10G-Connections
5 DWDM MUX 32 Channel
6 Lynx LightLeader Master Unit
7 Dark Fiber Working Line
8 Dark Fiber Protection Line
9 Lynx LightLeader Slave Unit
10 DWDM MUX 32 Channel
11 2xBrocade MLX32 and 1xForce10 Exascale 1200i per Core

- Platform – Status Quo
  - Current access-switches (F10 ExaScale E1200i) allow max. ~80 customer ports (10GE), no100GE possible
  - No LACP for backbone connections, no link monitoring BFD
  - MAC learning issues on the core switches
  - 1:1 redundancy in the core – 3 core switches doing nothing at the time
  - No multipathing via multiple core switches
  - In case of failover about 400 x 10GE connections are switched simultaneously and need to work immediately – testing beforehand not possible
  - Monitoring of backup links also not possible
  - 5% light on backup links via LightLeader has unwanted side effects on bacukp cores
  - Reseller ports only via hardware looping

- Goals
  - DE-CIX Apollon will provide cutting edge interconnection on a 100GE level by choosing and implementing new infrastructure for both the optical layer and the switching layer.
  - Apollon needs to support traffic and customer port growth for the next 3-5 years. This includes scalable capacity in the core of up to 20Tbps in 2016 and 45 Tbps in 2018.
  - Replace 1:1 redundancy in the core with n+1 redundancy.
  - Keep local traffic local (switch and site).
  - Core links must be 100GE to reduce the number of links, to better utilize bandwidth, and to be able to accommodate larger flows.
  - Redundancy and multipathing on upper protocol layers.

- Technology selection
  - We need an optical platform and a switching platform
  - Gather information
  - Make a decision matrix
  - Output: Short list – 3 vendors for optical, 3 vendors for switching
  - Do extensive Lab tests with shorlisted parties

ADVA Optical Networking

Alcatel-Lucent

- Technology selection: Optical Platform
  - 100G! 100G! 100G!
  - 80 DWDM Channels, 28G each (4 = 100G)
  - Fiber protection
  - Fast (< 100ms) protection switching
  - Scalability
  - Compact size (rack mountable)
- ADVA System

ADVA Optical Networking

- Technology selection: Switching Platform
  - 100G capable
  - High port density (for 10G and 100G)
  - 3rd party transceivers possible
  - Multipathing (via MPLS)
  - Port security at the edge
  - VLAN translations functionality

- Lab tests
  - Up to 4 cores (2 minimum)
  - 2 “new” access switches
  - 2 “old” access switches (to emulate migration scenario)
  - Devices to emulate customers, 100G interconnections etc.
  - Simulate all scenarios we could think of
  - Simulate the migration from old to new

- Decision matrix

Basiskategorie	Gewichtung	Maxwert	Subkategorie	Maxwert	Gewichtung	Subfaktor	Maxwert	Gewichtung			
Kosten	20%	200	Anschaffungskosten Nominalsetup [€]	100	50%						
			Betriebskosten Nominalsetup [W]	100	50%						
					Summe:						
Funktionalität	50%	700									
			Chassis	800	12%	Chassisbasierte Lösung (*)	100	12	100,00%	100,00%	100,00%
						redundante Lüfter, hot swap (*)	100	12	100,00%	100,00%	100,00%
						redundante Mgmt-Karten, hot swap (*)	100	12	100,00%	100,00%	100,00%
						redundante SFM, hot swap (*)	100	12	100,00%	100,00%	100,00%
						redundante Netzteile (2xN), hot swap (*)	100	12	100,00%	100,00%	100,00%
						AC	100	12	0,00%	100,00%	100,00%
						Front-to-Back Airflow (*)	100	12	100,00%	100,00%	100,00%
						Linecards vertikal eingebaut	100	12	100,00%	100,00%	100,00%
								Summe:	*84,0*	*96,0*	*96,0*
			Linecards	500	12%						
						Portdichte > 500 x 10G per Chassis (*)	100	20	100,00%	100,00%	100,00%
						10GE-Linecards (SFP+) (*)	100	20	100,00%	100,00%	100,00%
						100GE-Linecards (CFP) (*)	100	20	100,00%	100,00%	100,00%
						Roadmap für höhere 100G-Portdichte (2013) (*)	100	20	100,00%	100,00%	0,00%
						3rd-Party Transceiver nutzbar	100	20	100,00%	100,00%	100,00%
								Summe:	*100,0*	*100,0*	*80,0*
			Features	2500	12%	[redacted]					
			Management	1100	12%	Dedizierte Ports für Management (*)	100	9			
						IPv4 und IPv6 für Management (*)	100	9			
						NTP (*)	100	9			
						Remote Logging (syslog) (*)	100	9			
						SNMPv2c und SNMPv3 (*)	100	9			
						Lokale User (*)	100	9			
						TACACS+ und/oder Radius (*)	100	9			
						TFTP und/oder FTP (*)	100	9			
						Zugang via SSHv2 (*)	100	9			
						SSH Authentication via Key	100	9			
						OOB, seriell RS232 (*)	100	9			
								Summe:			
			Service	300	12%						
						Softwareupgrades (*)	100	33			
						4hr-Austauschservice (*)	100	33			
						TAC-Zugriff 24x7 (*)	100	33			
								Summe:			
			Testcases [%]	100	20%						
			Subjektives Vertrauen [%]	100	20%						
					Summe:						
Handling/Support	30%	200									
			Subjektives Handling [%]	100	50%						
			Support [%]	100	50%						

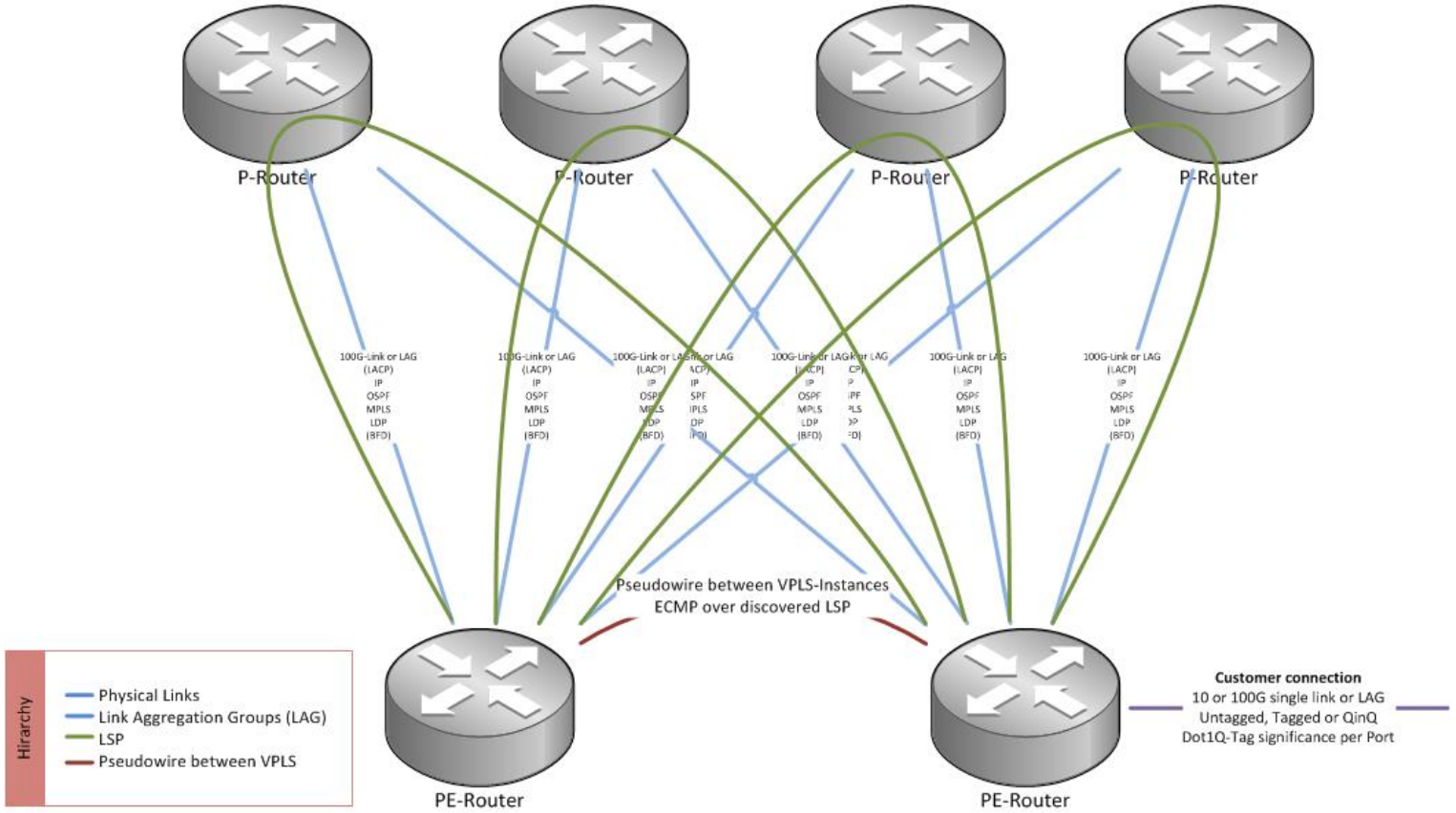
- Technology: And the winner is….
  - Optical Layer
    - ADVA FSP 3000 DWDM
    - Up to 80 x 28GBit/s (=2TBit/s per fiber pair)
  - Switching Layer
    - Alcatel-Lucent („ALU“) 7950 XRS-20
    - Up to 80 x 100GE or 800 10GE per chassis
    - 10 chassis in total incl. 4 x Apollon Supernodes (core) in 4 secure locations

ADVA Optical Networking

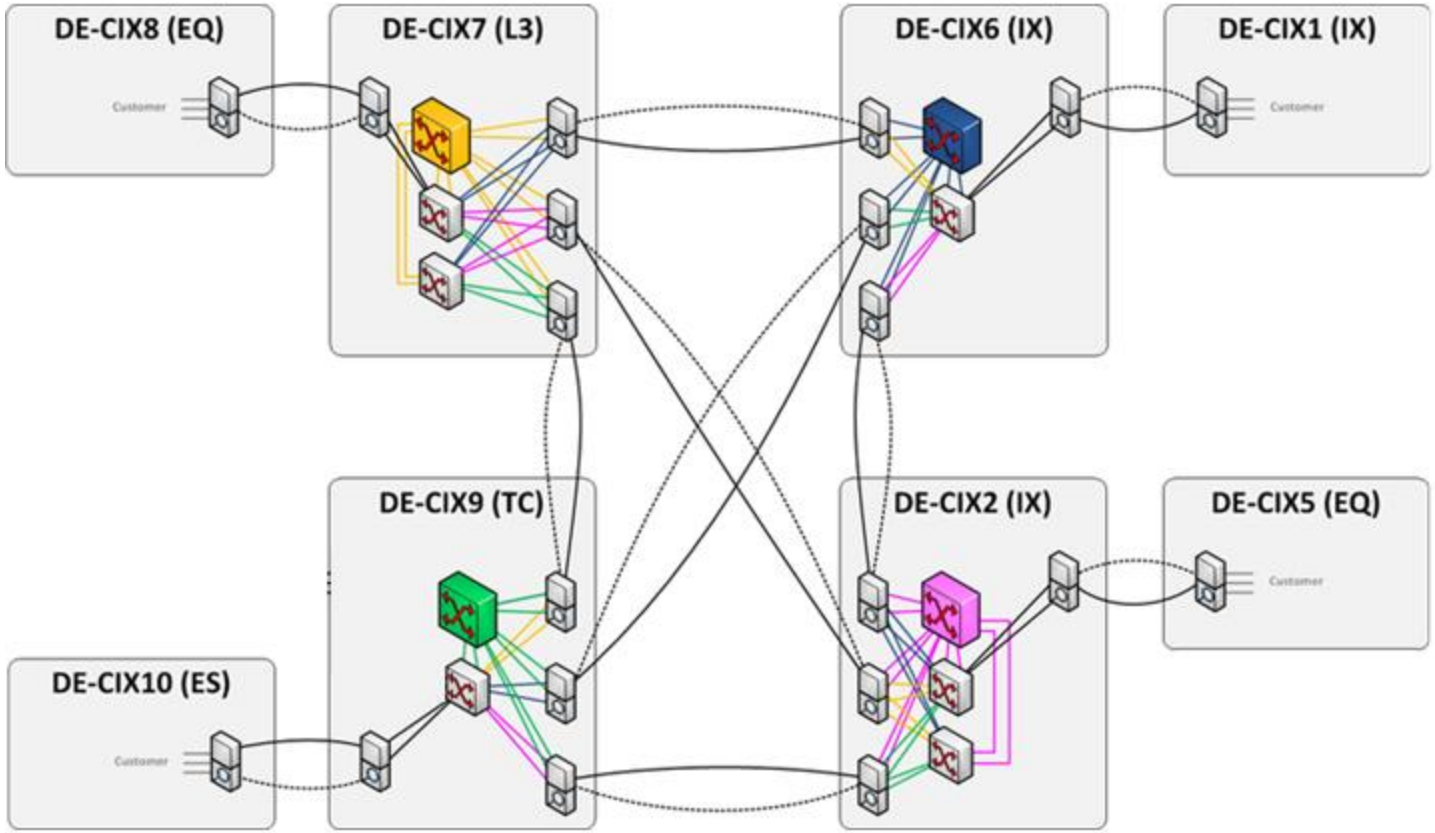
Alcatel-Lucent

- Alcatel-Lucent 7950 XRS-20
  - Pro
    - Ready for multi chassis
    - Best implementation of required features
    - Excellent hardware performance
    - Migration scenario possible
  - Con
    - Only DC chassis (needs external rectifiers)
    - No sflow (counter & samples; implementation necessary)

- VPLS / MPLS Design

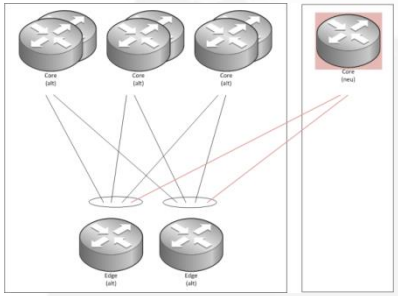


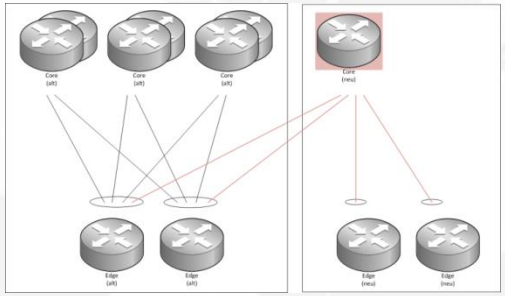
- New Topology (snapshot)

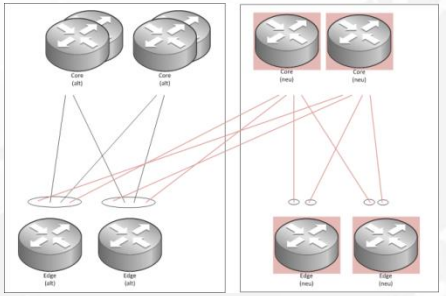


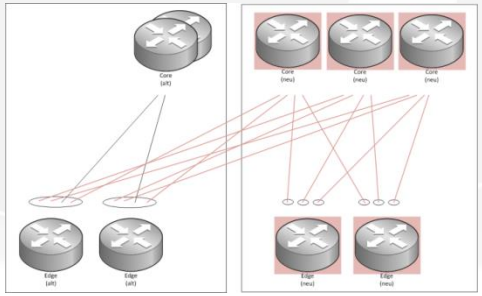
- Migration
  - Should be as painless for the customers as possible.
  - No impact on daily ops
  - **Decision: Hire a dedicated project manager**
  - **Involve every department**
    - Sales: Make customers and prospects aware of the upcoming migration
    - Support: Handle customer requests before, during and after migration
    - Engineering: Do most of the actual work
    - Marketing: Create Apollon branding, visual messaging, PR

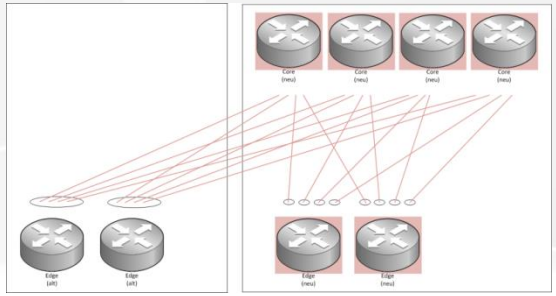
- Migration (core)





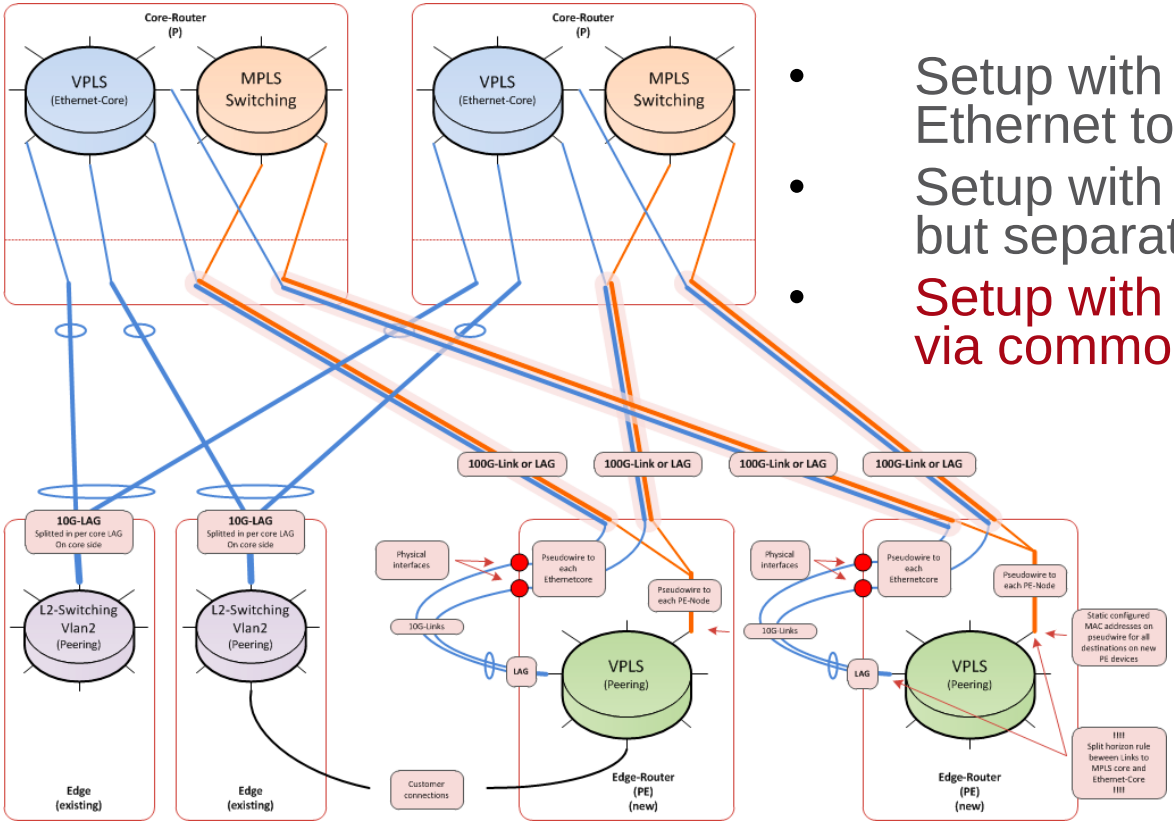






DE·CIX Where networks meet

- Migration Setup



- Setup with hard switch from Ethernet to MPLS
- Setup with both Ethernet/MPLS, but separated Edge/Core links
- Setup with both Ethernet/MPLS via common link

- Migration Steps
  - Replace the core first
    - Add one new core switch
    - Remove one old core switch
    - Continue until all cores are replaced and 4 new cores are active
  - Replace the edge switches one by one
  - Lots of getting up early in the morning for customer support and engineering

- Edge migration
  - Connect new edge routers to the new core
  - Keep old edge switch running
  - Move customers fibre by fibre
  - Test each customer after moving
  - Try to keep individual downtime as short as possible
  - During each migration customer support will also be in the office to handle customer requests and questions.

- Summary
  - DE-CIX Apollon will provide a larger spectrum of Ethernet based interconnection services incl. Internet Exchange and Layer 2 data link functionality.
  - Yes – there will be new products. We will keep you posted.
  - DE-CIX is a one-stop shop for interconnection in an all Ethernet and all IP environment. All backed by industry leading SLAs.

Questions?

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