

# Layer 1, 2 and 3 Integration

Highlighting the business and technical drivers and detailing the practical steps to its realisation

Javier Benítez, Network Strategy and Architecture

**colt**

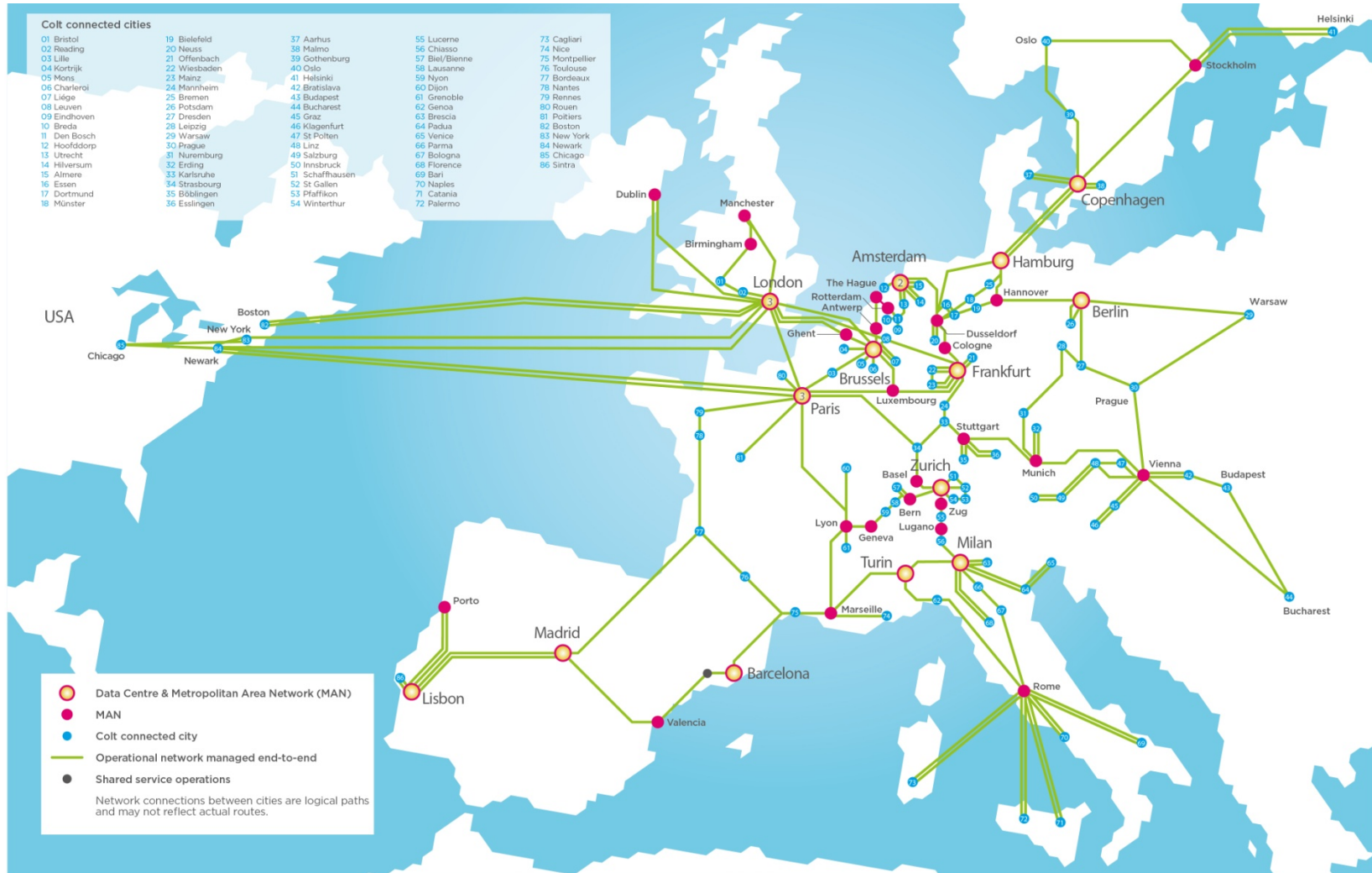
smarter / faster / further



# Contents

- 1** Colt today: 3 separate layers for L2 & L3 services
- 2** Making the case for collapsing L1 & L2 & L3 onto one integrated network – detailing the technical and business benefits
- 3** Examining Phase 1 – L2 & L3 integration phases and challenges: access (CPE), edge and core
- 4** Phase 2: packet optical integration
- 5** Highlighting what Colt needs from packet optical

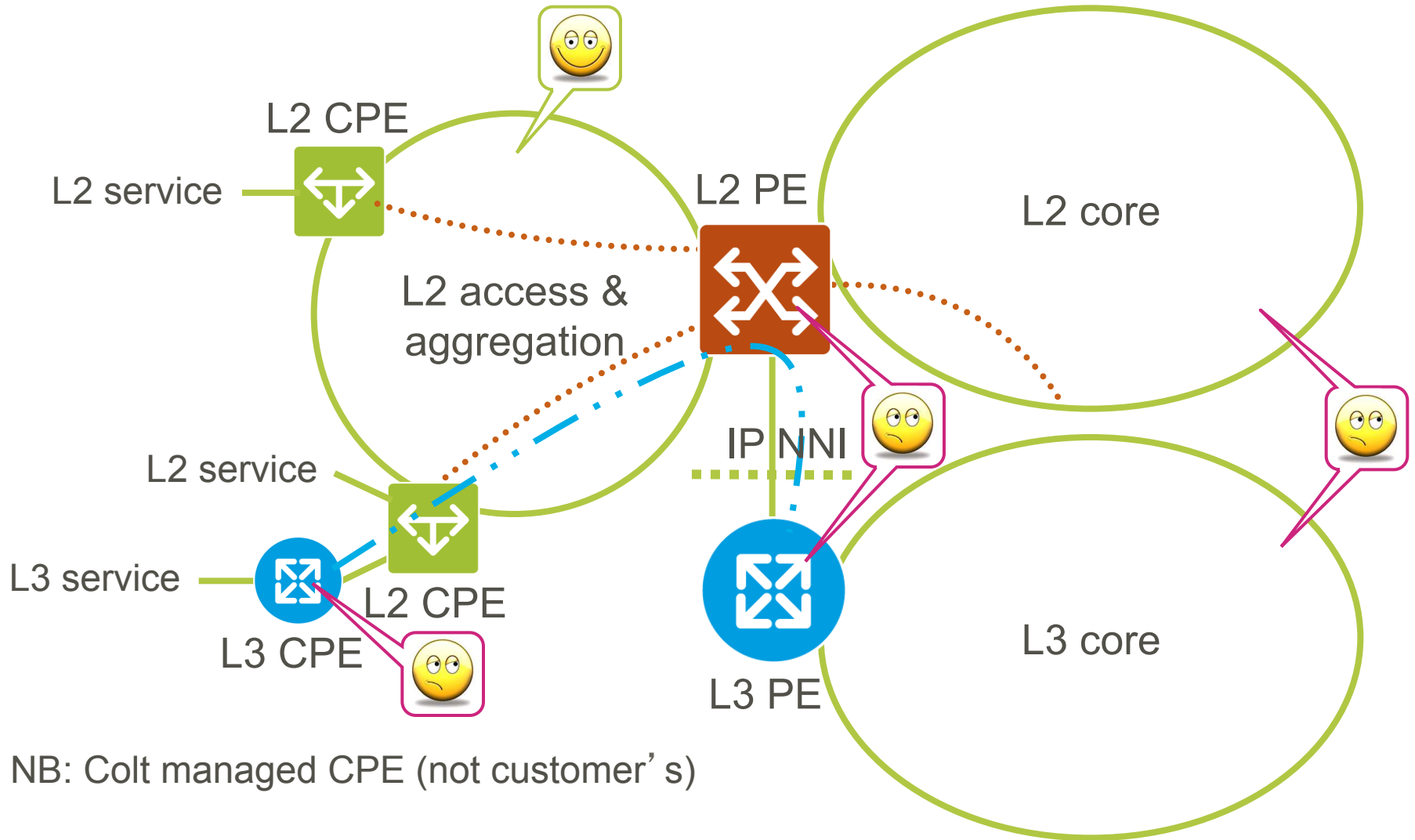
# Colt's information delivery platform



## L2 & L3 product requirements

Characteristics	L2	L3
Service type	E-Line, E-LAN, E-Tree	Internet, VPN, mVPN
Protection	Sub50ms	100s of ms (~10x)
QoS	3 classes (user)	5 classes (user)
Bandwidth model	Hard QoS & CAC for CIR in the access & core	Hard QoS & CAC for CIR in the access only
Latency	Static explicit routing (ERO from NMS or IGP) critical for all “Fastnet Ultra” services	IGP-driven acceptable

# Historical situation



NB: Colt managed CPE (not customer' s)

- . . . IP services over Ethernet access (metro)
- . . . . . Ethernet services (metro & inter-metro)

# Background to the L2 & L3 separation

Characteristics	L2 requirements	Gaps (in 2007)
Protection	Sub50ms	BFD, FRR, etc. not supported in the L3 core
QoS	Hard QoS & dual colour rates	None supported in the L3 core
Provisioning	End-to-end point & click	More complex with the transport PW infrastructure
Bandwidth scaling	Hard QoS for CIR in the core (per service instance)	L3 core « too small » to serve the L2 traffic forecasts
Price point	Focus on service unit costs	L3 PE/P far more pricey

# Technical and business benefits

## Simplification

Operations, architecture, service nodes (PEs)

## Cost

Reduced CAPEX (less devices per service, “pay as you grow” core) and OPEX (simplified delivery & assurance)

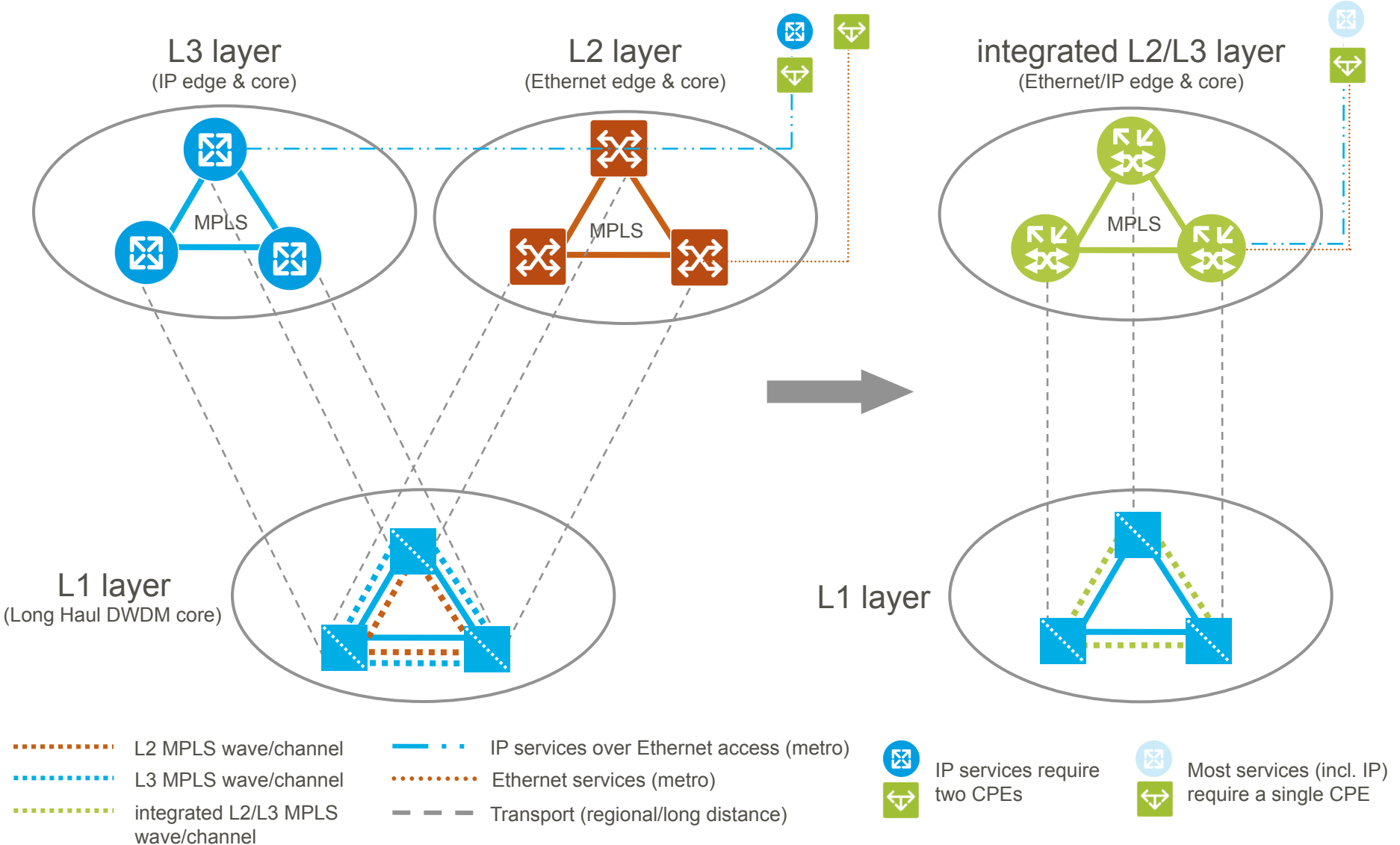
## Technical

Statistical multiplexing gain in the core, also for L2 with EIR

## Product

Improved service unit costs (CAPEX/OPEX reduction, statistical multiplexing), better delivery lead time and TTR, L2 & L3 service blending (Integrated Routing & Bridging on PE)

# Phase 1 – L2 and L3 network integration

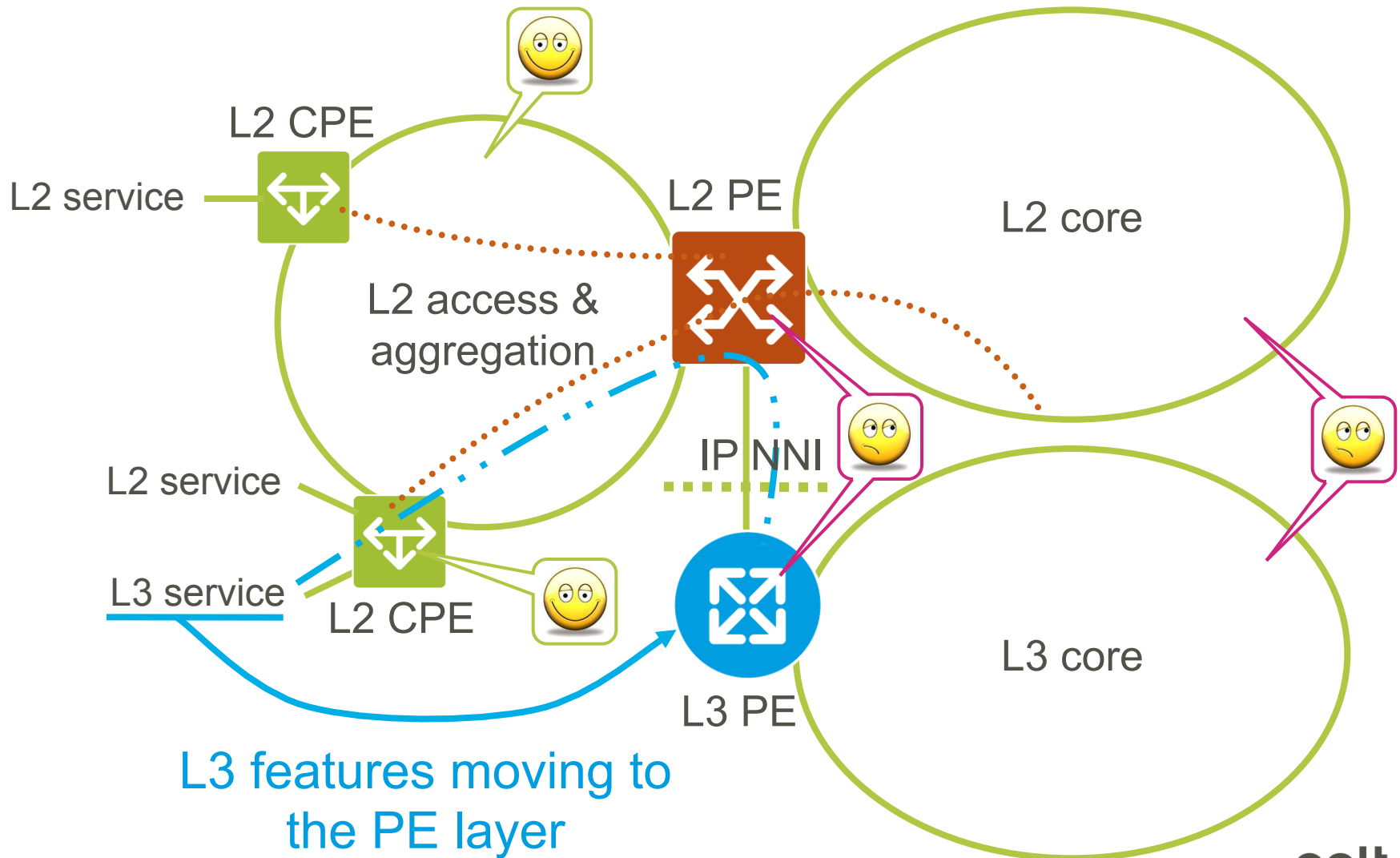




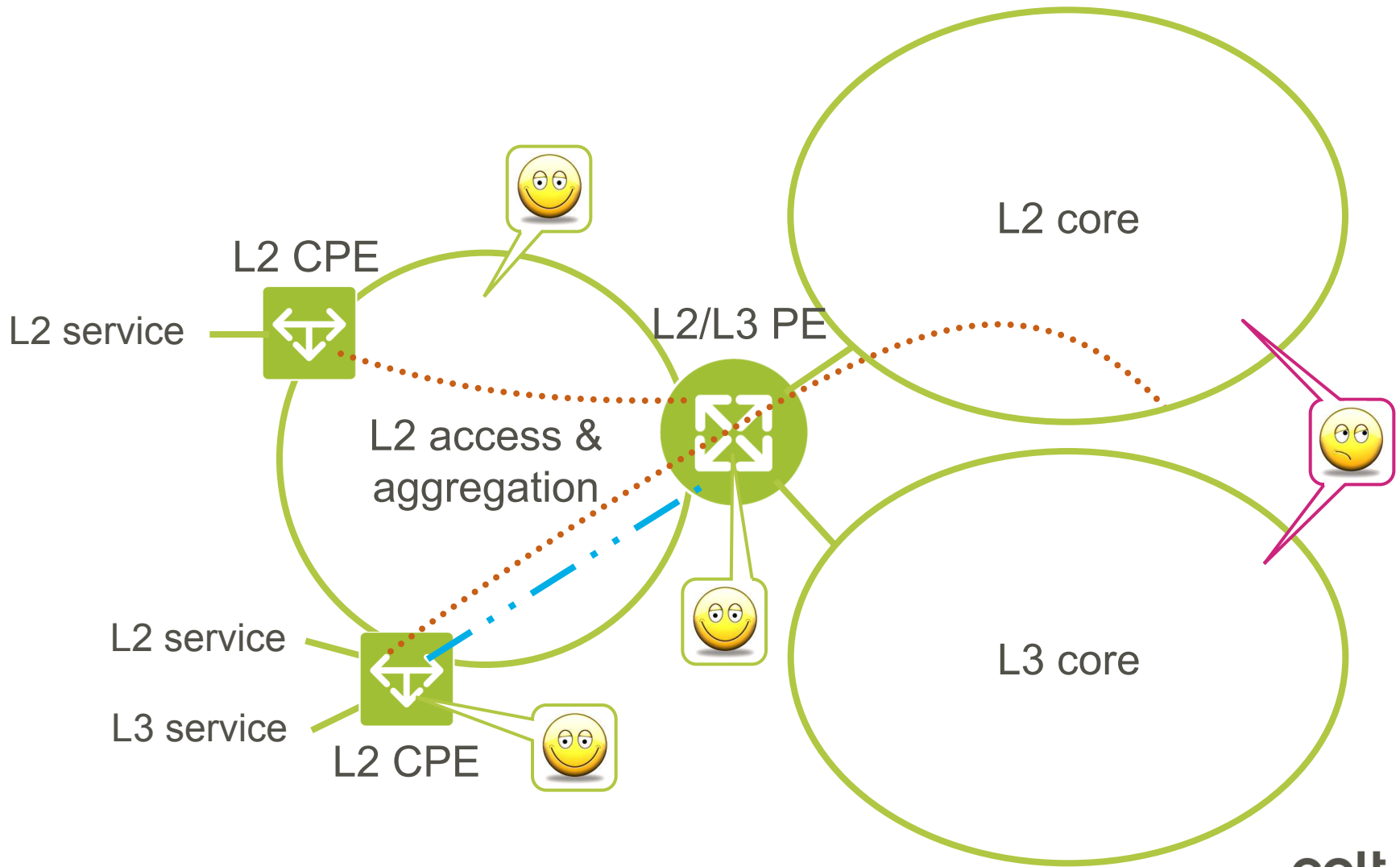
# L2 & L3 integration phases

- Phase 1: Access layer (CPE actually)
  - Immediate start
- Phase 2: Edge layer
  - Vendor roadmap dependency (future release required for edge integration)
- Phase 3: Core layer
  - Vendor roadmap dependency (same future release required for core integration)
  - Higher L2 product exposure and general development effort
- Alternative phasing
  - No strict dependency between the phases

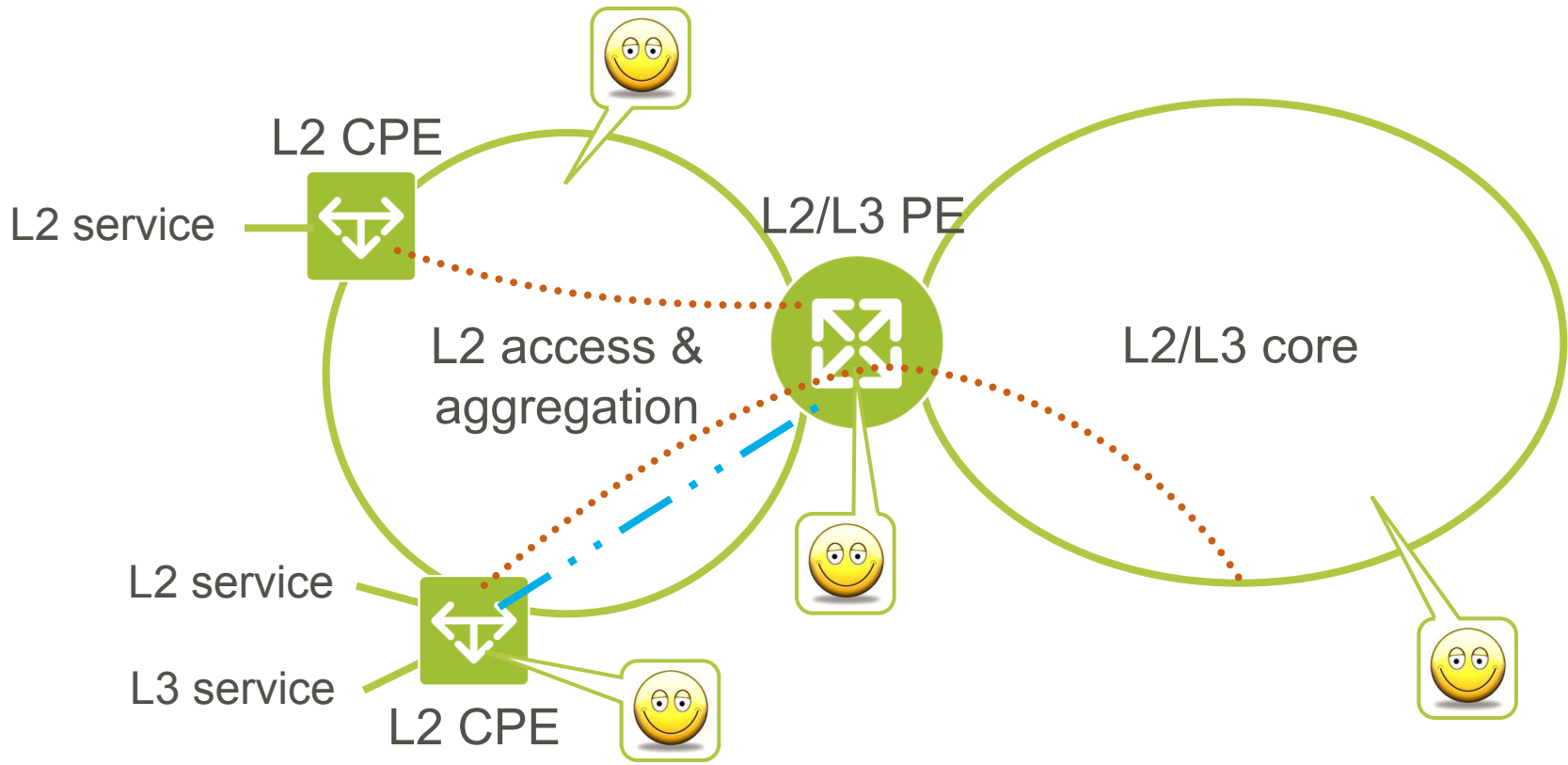
# Phase 1 – Access (CPE) integration



# Phase 2 – Edge integration



# Phase 3 – Core integration



# L2 & L3 integration phases and challenges

## General challenges for hybrid networking

- Organizational
- High-end L2 service definition
- Security

## Access

- Quick win phase to save the L3 CPE
- Eligible L3 product feature set
  - Options still requiring a L3 CPE (backup, resilience, remote access)
  - Strong dependency on L2 CPE capabilities

## Edge

- Optimisation of the service node architecture (shared PE)
- L2 product requirements, scalability and security

## Core

- Most complex phase planned after the edge integration
- L2 product requirements, QoS & control plane architecture, test

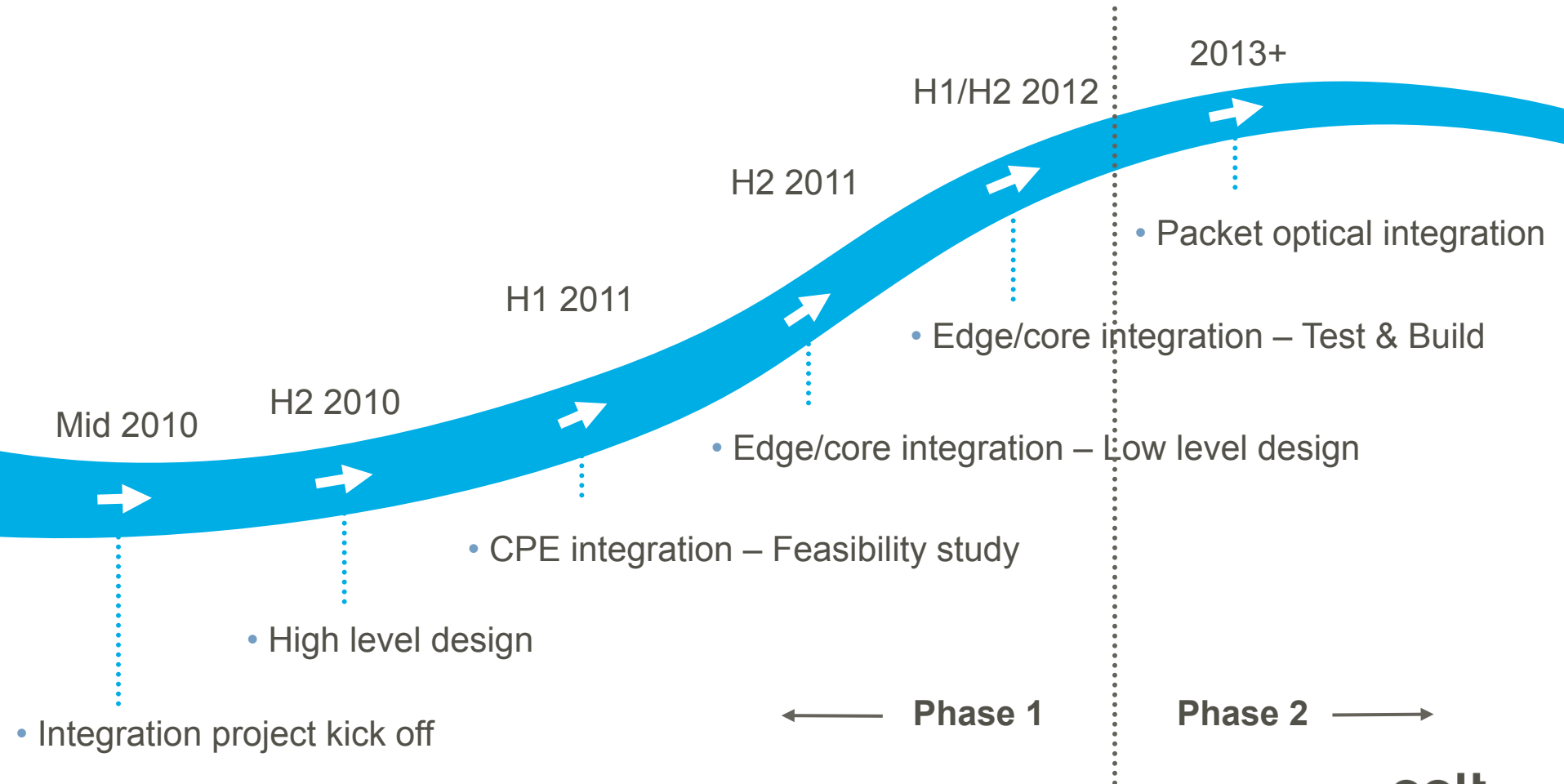
# Progress review of the Colt project

## Where we are now

- On the company roadmap with divisional resources already engaged
  - Colt-wide integration work kicked off
- High level design done without major development required from the main vendors
  - Various development pieces to come from the general roadmap
- Areas under work in progress
  - Strategy for the historical L2 & L3 edge and core: cap and grow, natural decline over time (ceases), migrate
  - PE architecture: shared PE for L2 & L3
  - Dual vendor environment execution: tactical, mass production

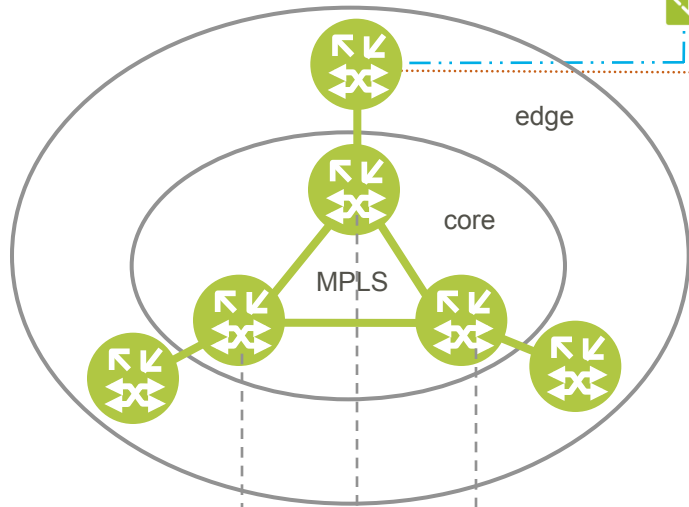
# Progress review of the Colt project

## Where we are going

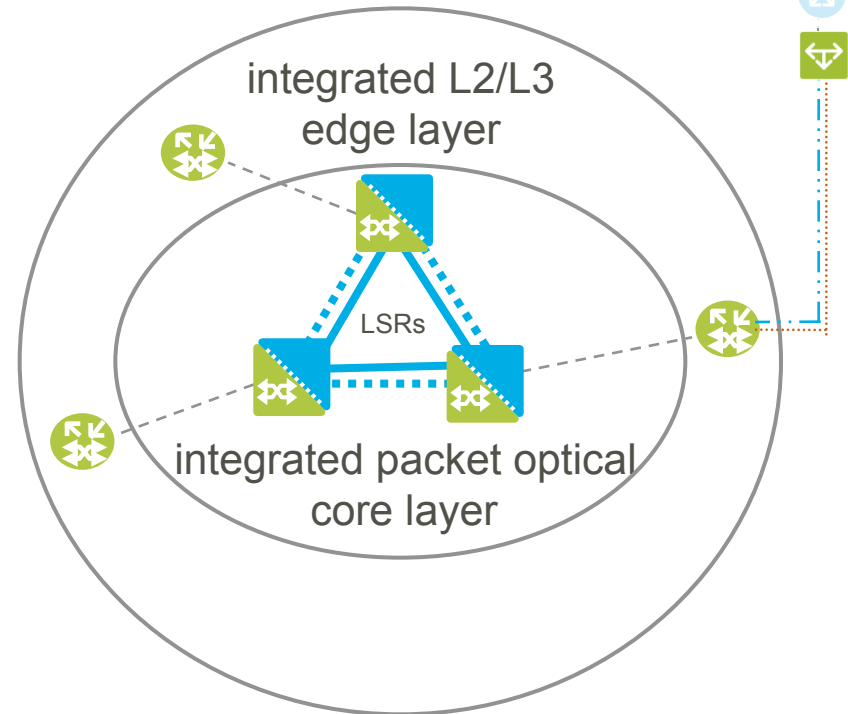


# Phase 2 – Adding packet optical integration

integrated L2/L3 layer  
(Ethernet/IP edge & core)




integrated L2/L3  
edge layer



L1 layer  
(Long Haul DWDM core)

-  DWDM wave/channel
-  MPLS LSPs
-  Hybrid LSR / optical core
-  IP services over Ethernet access (metro)
-  Ethernet services (metro)
-  Transport (regional/long distance)

 Most services (incl. IP) require a single CPE



# Highlighting what Colt needs from packet optical

- Meet all characteristics of Colt packet products (L2 and L3)
  - Don't forget circuits!
- Deliver the expected benefits
  - Core optimization
  - Router bypass where it makes sense
- Functionalities
  - MPLS packet switching (LSR role)
  - OTN switching (grooming role, also for transit)
  - Wavelength switching (ROADM role)
- Standard-based implementation

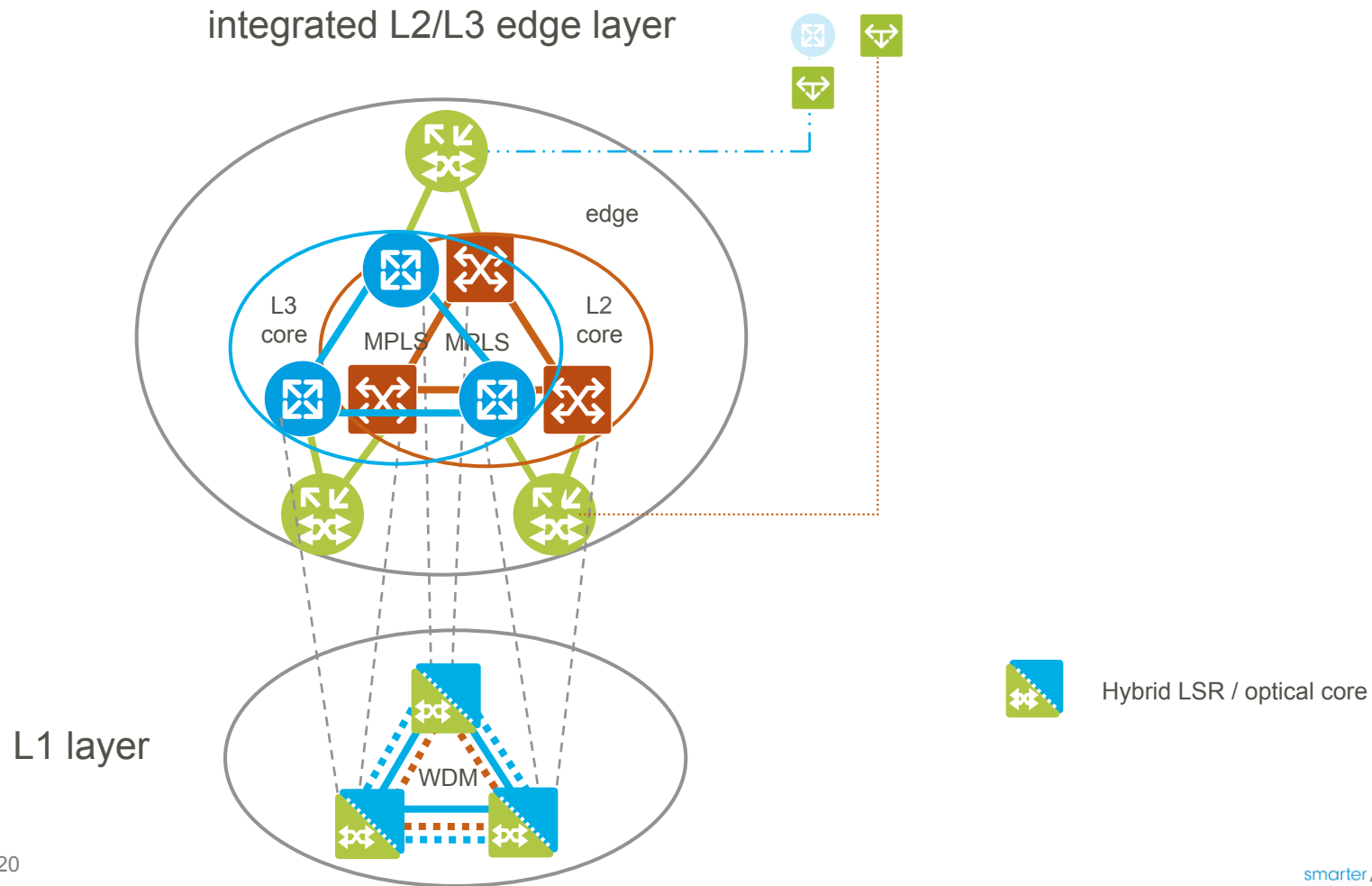
# Challenges with packet optical

- Similar to L2/L3 integration risks
- Fully integrated multivendor environment
  - As opposed to overlay
- Overall operating model
  - MPLS-TP evaluation
  - NMS/OSS centric; more network signaling protocols; mixed
  - Resiliency
  - Product scope
  - Multi-segment
- Dual vendor
  - Complete rethink of the OSS layer
- Deployment alignment of two integration trains
  - L2 with L3 and L1 with L2/L3



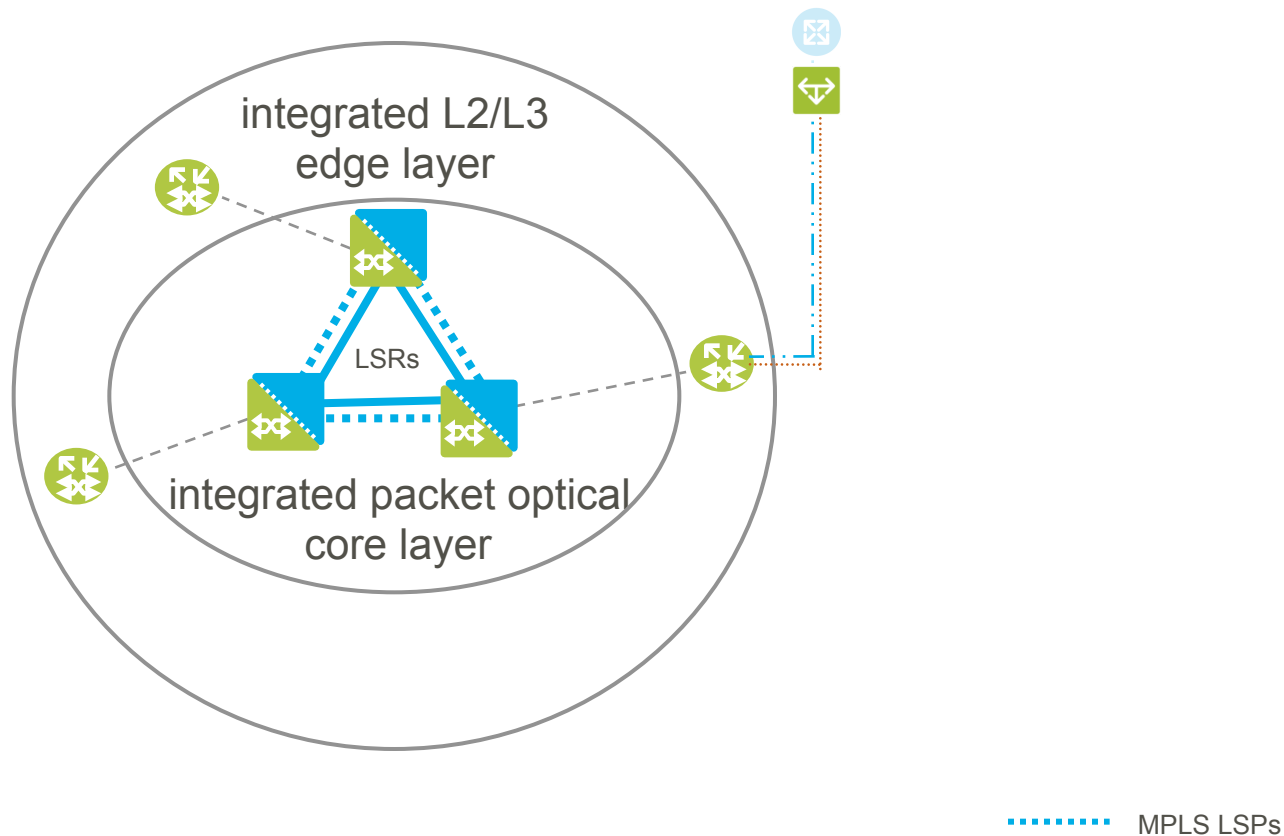
# Deployment alignment – Second step

- Packet optical infrastructure roll-out and packet fabric activation



# Deployment alignment – Last step

- Phasing out of L2 & L3 cores to packet optical



# Summary

- Carrier Ethernet continuity as an absolute requirement for Colt L2 products
- Fully approved L2/L3 integrated solution in 1 year time
- Infrastructure ready for product evolution
  - e.g. hybrid L2 & L3 VPN services with collapsed PE
- Next step with packet optical in the core

A smarter integrated platform,  
easier to operate,  
cloud friendly,  
and benefiting customers.

# Thank you. Questions?

[Javier.benitez@colt.net](mailto:Javier.benitez@colt.net)

[www.colt.net](http://www.colt.net)

**colt**

smarter / faster / further

