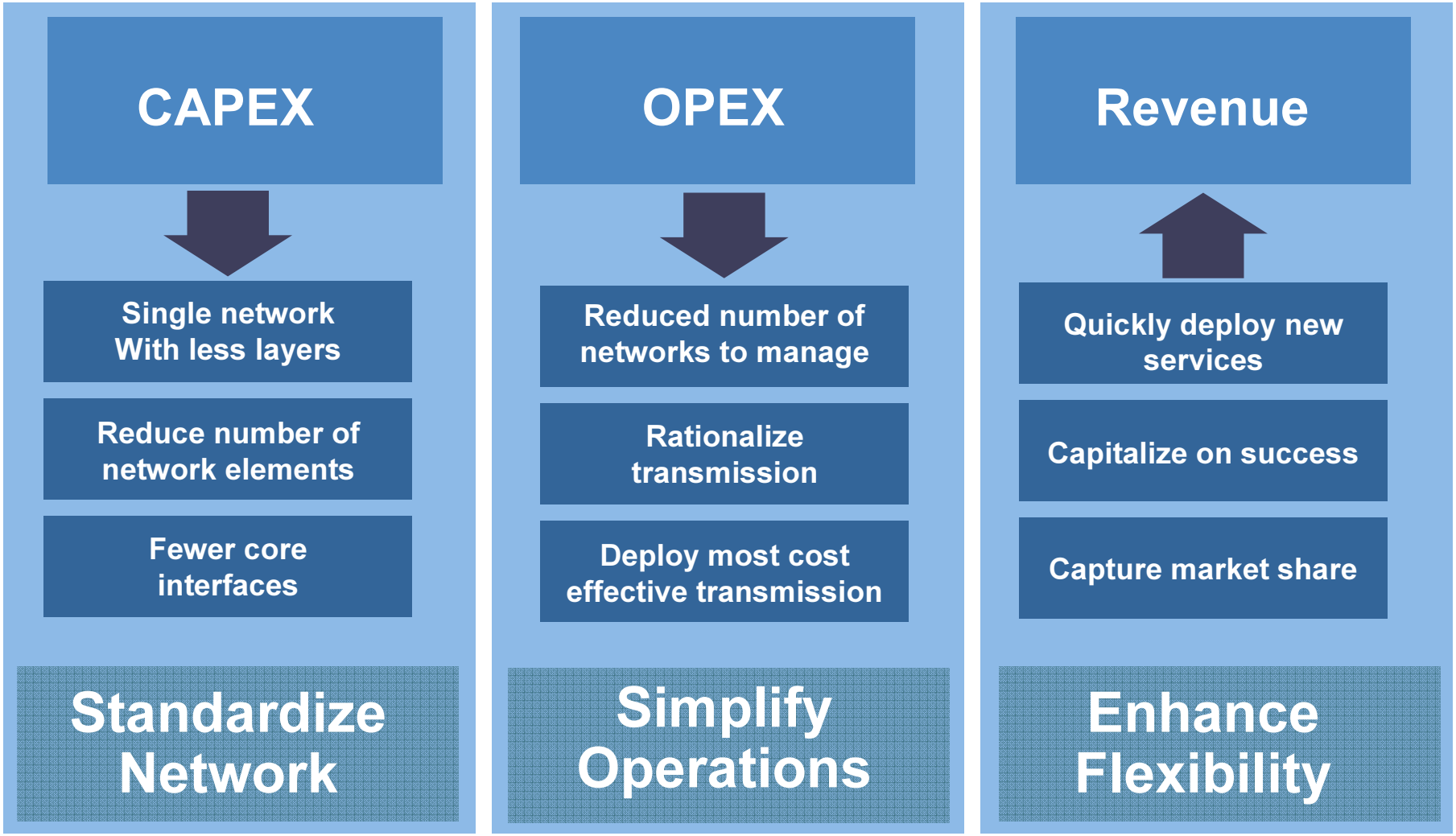
SP HA/Flexibility/Agility, eller IP NGN om du vil….

Arne Martin Skyrud
askyrud@cisco.com

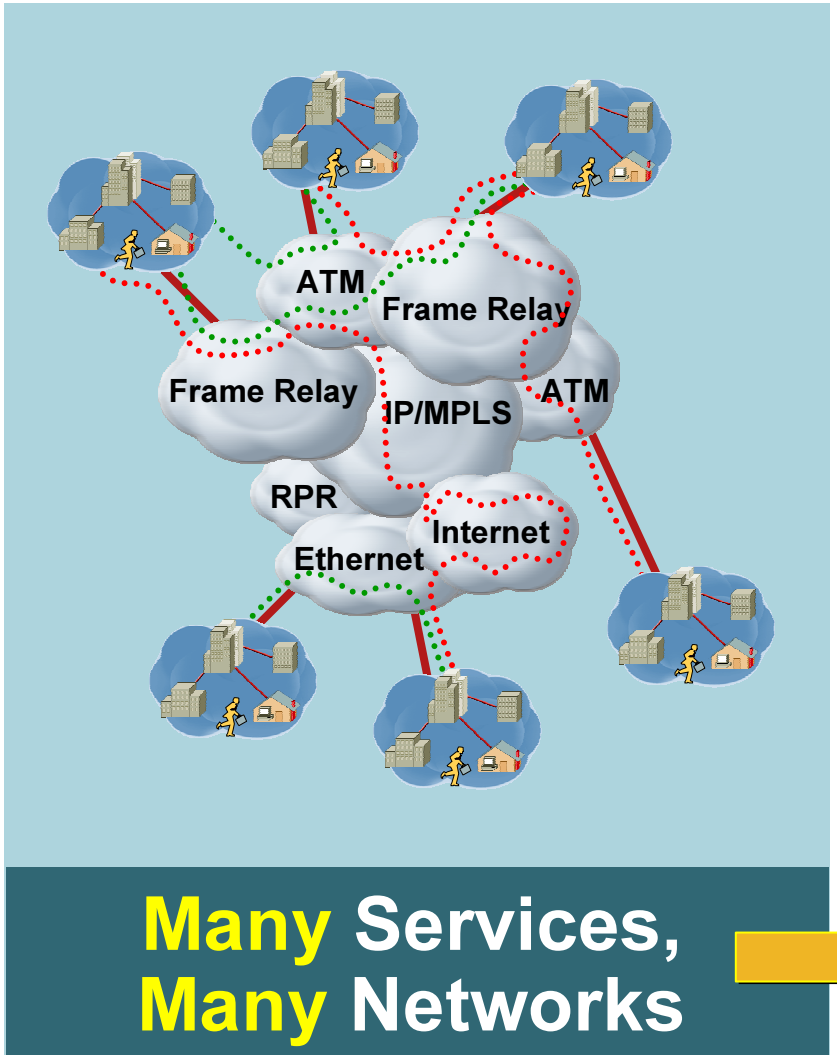
Key Messages

- General industry acknowledgement on benefits of carrying data, voice and video over converged IP/MPLS backbone
- Growing IP/MPLS adoption among wireline, wireless and cable operators
- Innovations in QoS, security, resiliency and management are accelerating core-edge convergence
  - Cisco's standards-based Traffic Engineering, Fast Re-Route, RSVP-TE, L2TPv3, IPSec, embedded management, Dynamic Multipoint VPN, multicast VPN
- Convergence enables new service revenue, simplifies operations and reduces costs
- Cisco is delivering industry-leading IP/MPLS technologies and driving standards to enable transport convergence

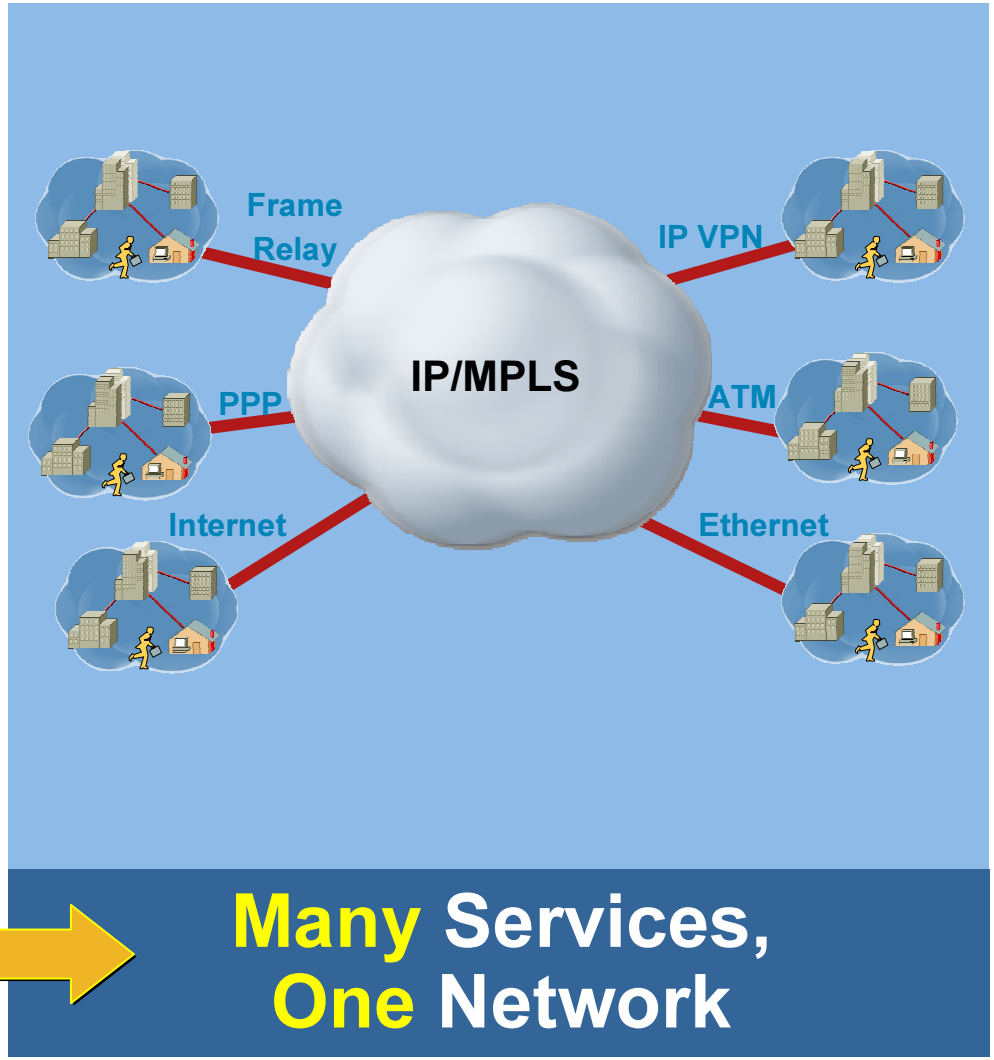
Drivers for Convergence



IP/MPLS Enables Core-Edge Convergence



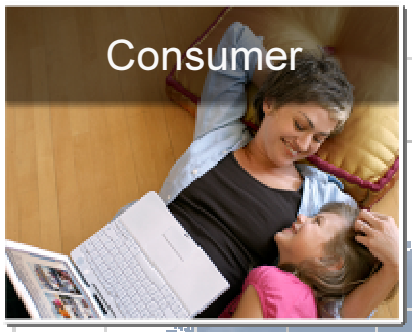
Many Services, Many Networks



Many Services, One Network

Cisco Service Provider Vision

Connecting Customers with Services,
Services with Networks,
and Networks with Each Other



IP Next-Generation Network

VPNs | Content | Transport | Mobility | Internet | Voice & Video

The Connected Life

Personalized Experiences to Many Screens

Four Key Connected Life Enablers

Internet Protocol

Information becomes

Agnostic to Content

Bandwidth

Information becomes

Agnostic to Time

Connectivity

Information becomes

Agnostic to Space

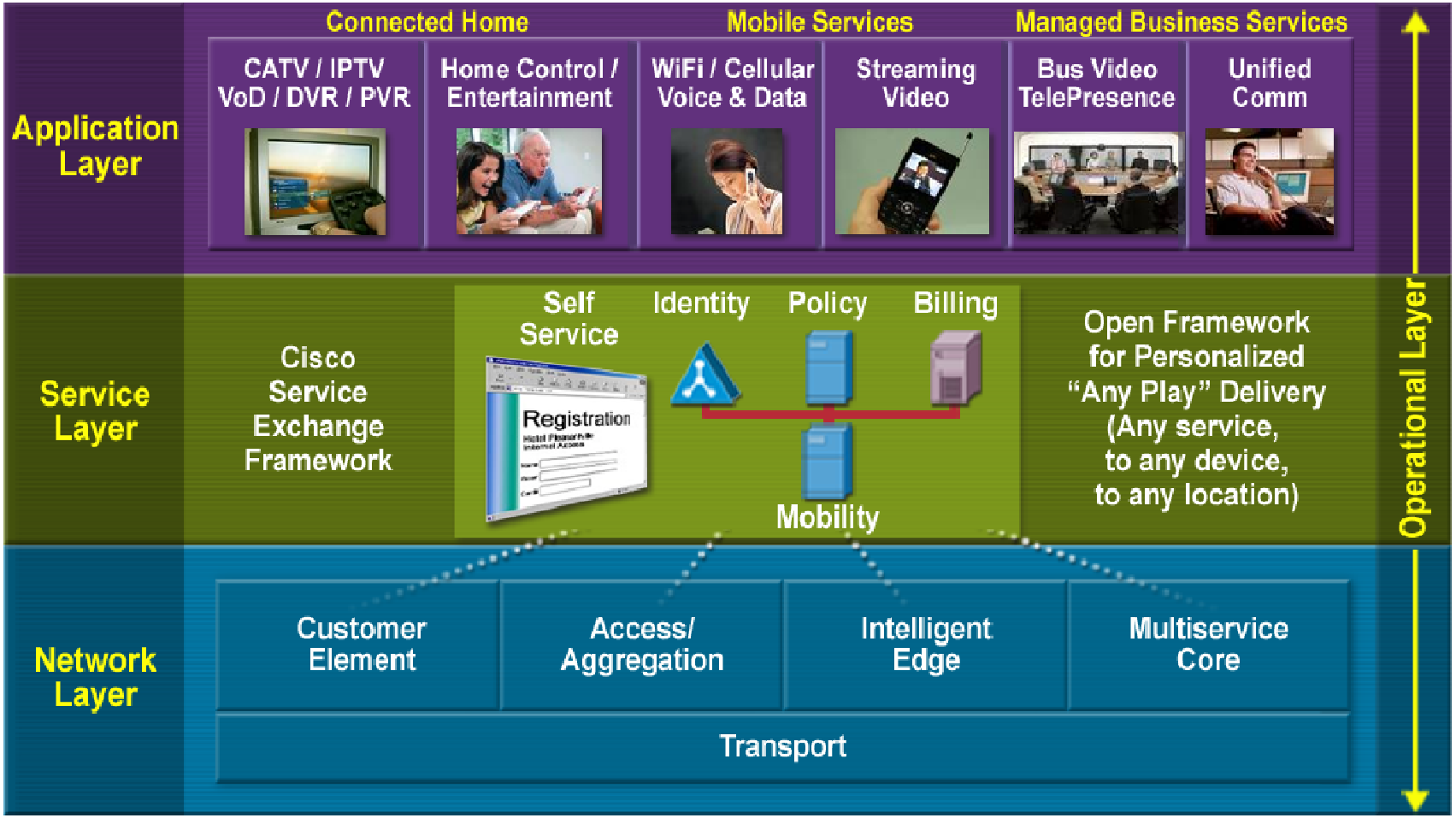
Quality of Experience

Information becomes

Agnostic to Form

Cisco IP NGN Framework

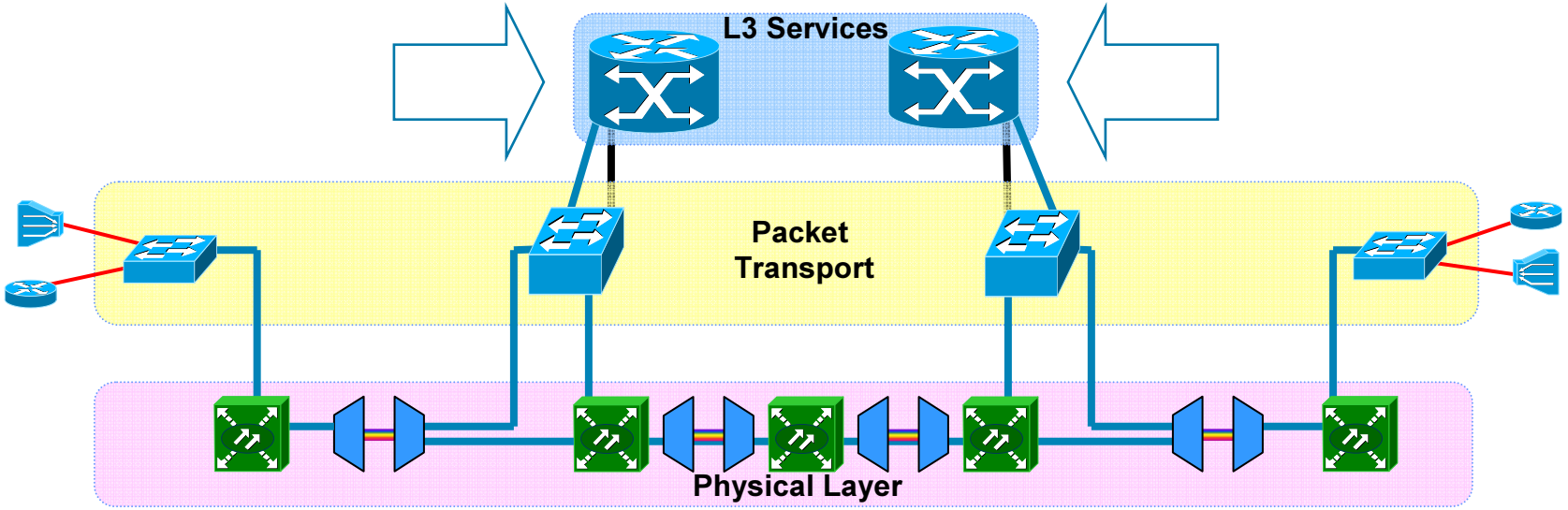
Cisco is The Leader in IP Networking

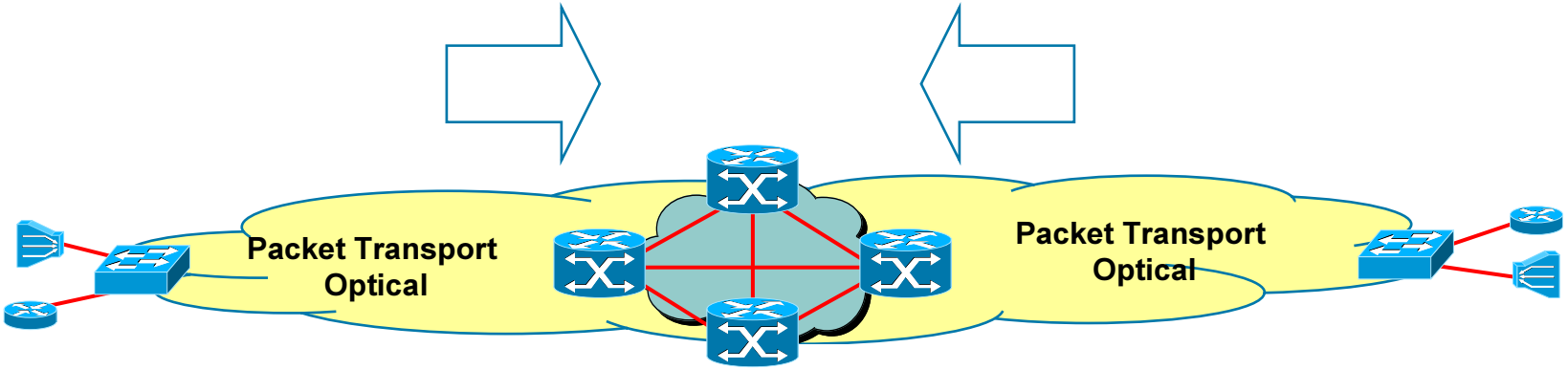


Intelligent Networking

Next Generation Packet / Ethernet Transport

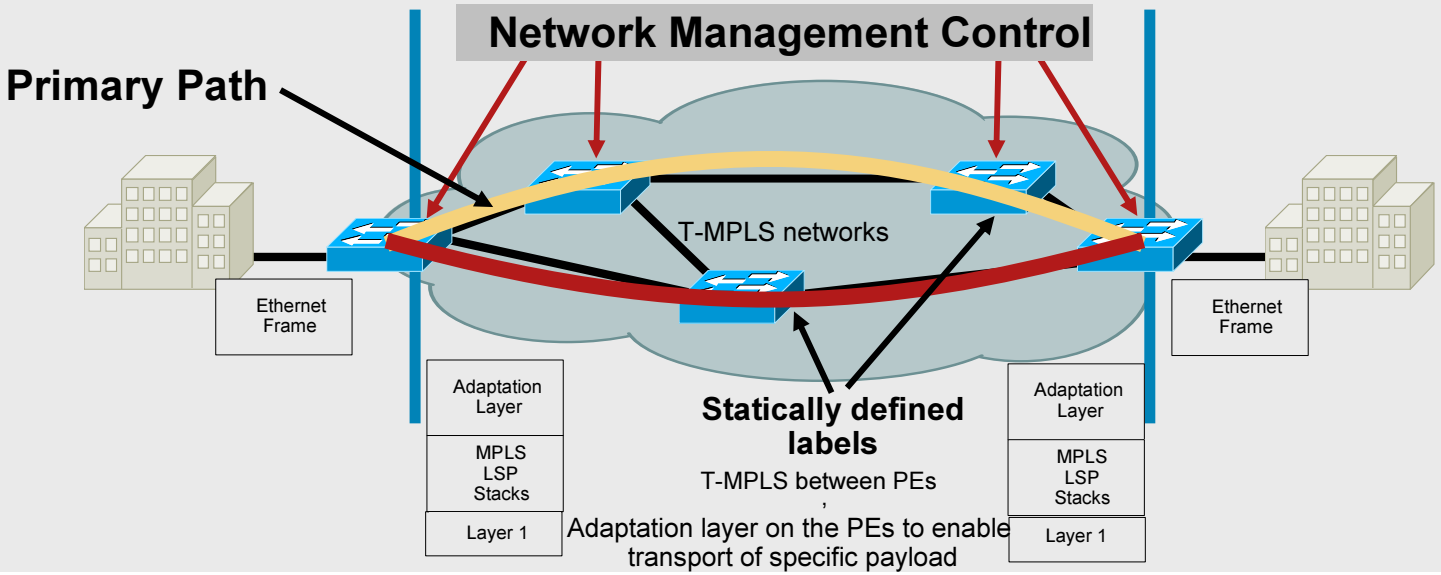
Transport orientated view
Rationalise





L3 Services
Fully meshed at transport level

What is T-MPLS ?

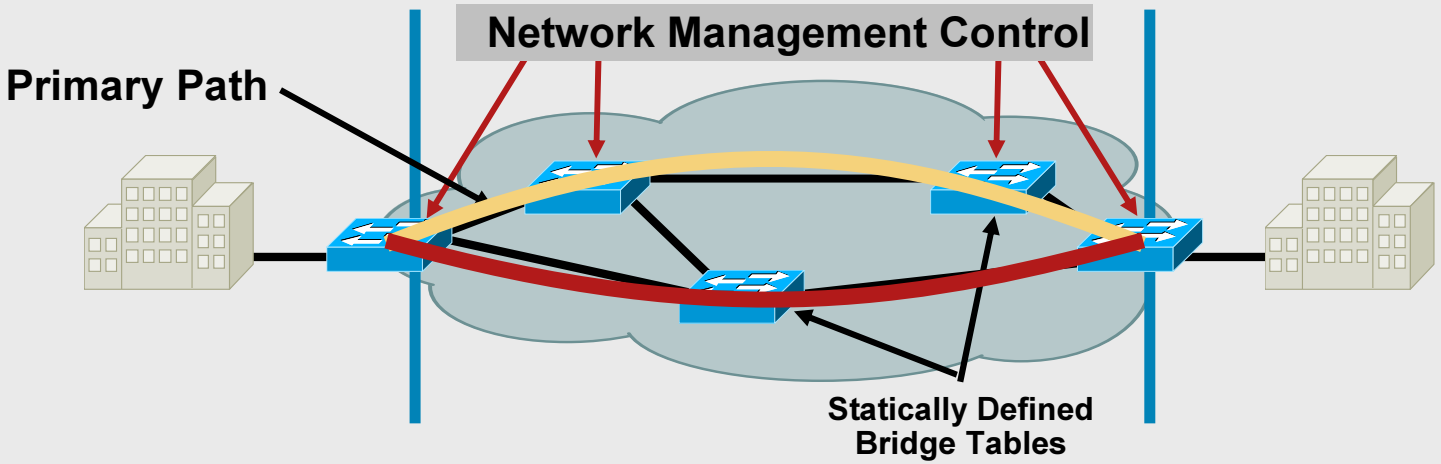


- Definition: Transport MPLS
  - Forwarding Plane: MPLS labels with simplifications (bidirectional LSPs)
  - Control Plane: Phase 1: static provisioning of labels using OSS/NMS
  - OAM based on Y.1711
- Services: Phase 1 : P2P connection orientated services only
- Standards:
  - ITU-T based set of standards

How is it Positioned?

- Next Generation SONET/SDH with tight integration to Metro Ethernet and Access: Transport Ethernet frames over point-to-point VCs
- Offers a transition path to SPs/Carriers who have a huge SONET/SDH infrastructure and moving toward packet
  - Re-usability of OTN networks without expensive upgrade (e.g. Introduction of control plane might require more memory or device forklift)
- Next Generation Packet Transport: Layer 2 hollow core
  - Claim: cheaper OPEX, easier to operate and deploy

What is PBT ?

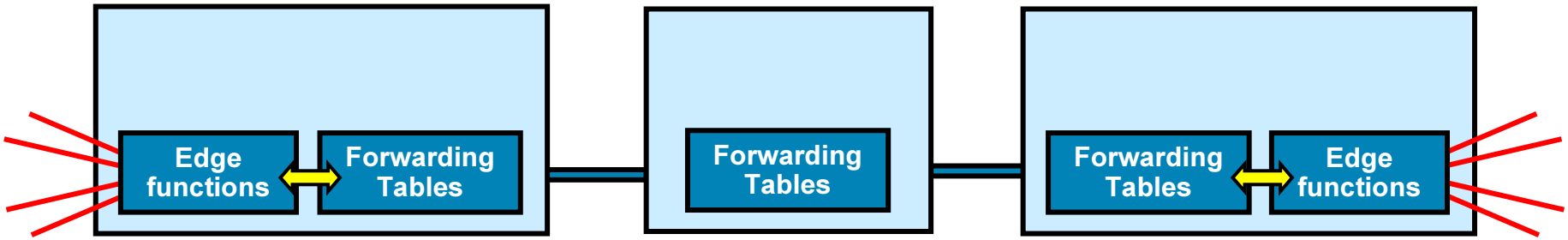


- Definition: Provider Backbone Transport (PBT)
  - Forwarding Plane: 802.1ah encapsulation from Provider Backbone Bridging
  - Control Plane: An OSS/NMS replaces IEEE control plane elements
  - OAM based on 802.1ag (with modifications)
- Services: P2P connection orientated services only
- Standards:
  - PBT is proprietary
  - PBB-TE in project approval request (PAR), has just entered the standards
    - Does not assume PBT as a base line
    - Aspiring to be more than PBT, address MP2MP services

Who are the Target Customers?

- A PRIMARY target for PBT are customers with legacy SONET/SDH switching and NMS solutions
- Operators who want to offer Ethernet services over Ethernet Infrastructure
- Existing operators who currently deploy IEEE 802.1ad (QinQ) Metro Ethernet network and want to evolve to IEEE 802.1ah/PBT network

Forwarding plane Comparison

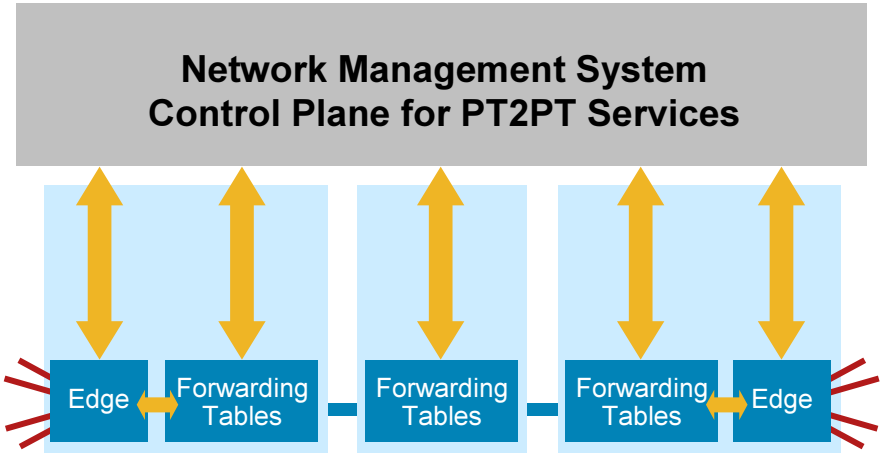


- IP/MPLS
  - Customer packet encapsulated in an MPLS label stack
  - Forwarding based on a label switch
- T-MPLS
  - Customer packet encapsulated in MPLS label
  - Forwarding based on a label switch
- PBT
  - Customer packet encapsulated in 802.1ah
  - Forwarding with modified Ethernet switching

Strong similarities

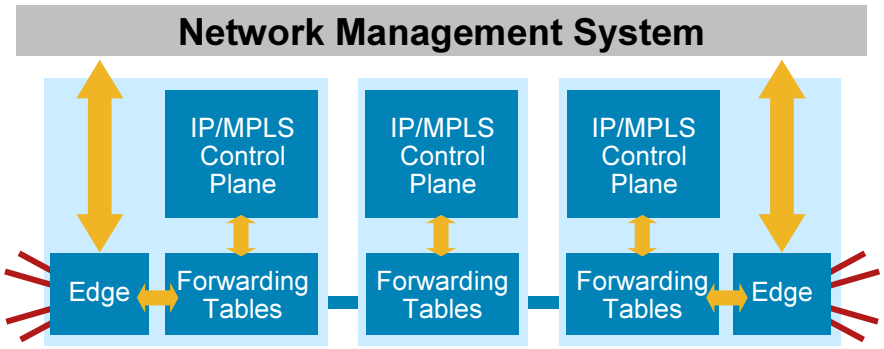
Control Plane Comparison

PBT and T-MPLS



- NMS based Control Plane
- Long term support integrated control plane?
  - PBT and T-MPLS → G-MPLS
  - G-MPLS – Link state Protocol, RSVP etc
- Single Service Control Plane
  - Pt2Pt Only

IP/MPLS

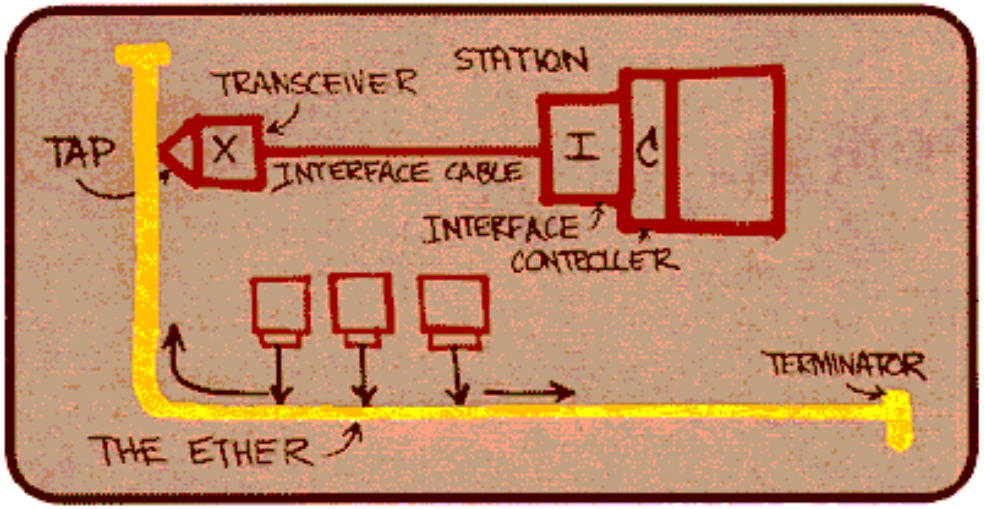


- Integrated Control Plane
- Multi-service Control Plane
  - L1, L2, L3
  - Pt2Pt, Multipoint

PBT / T-MPLS : Simply moves complexity to the Network Management layer

Once Upon a Long Ago…

- 1972 Robert Metcalfe implemented Alto Aloha Network at Xerox Parc

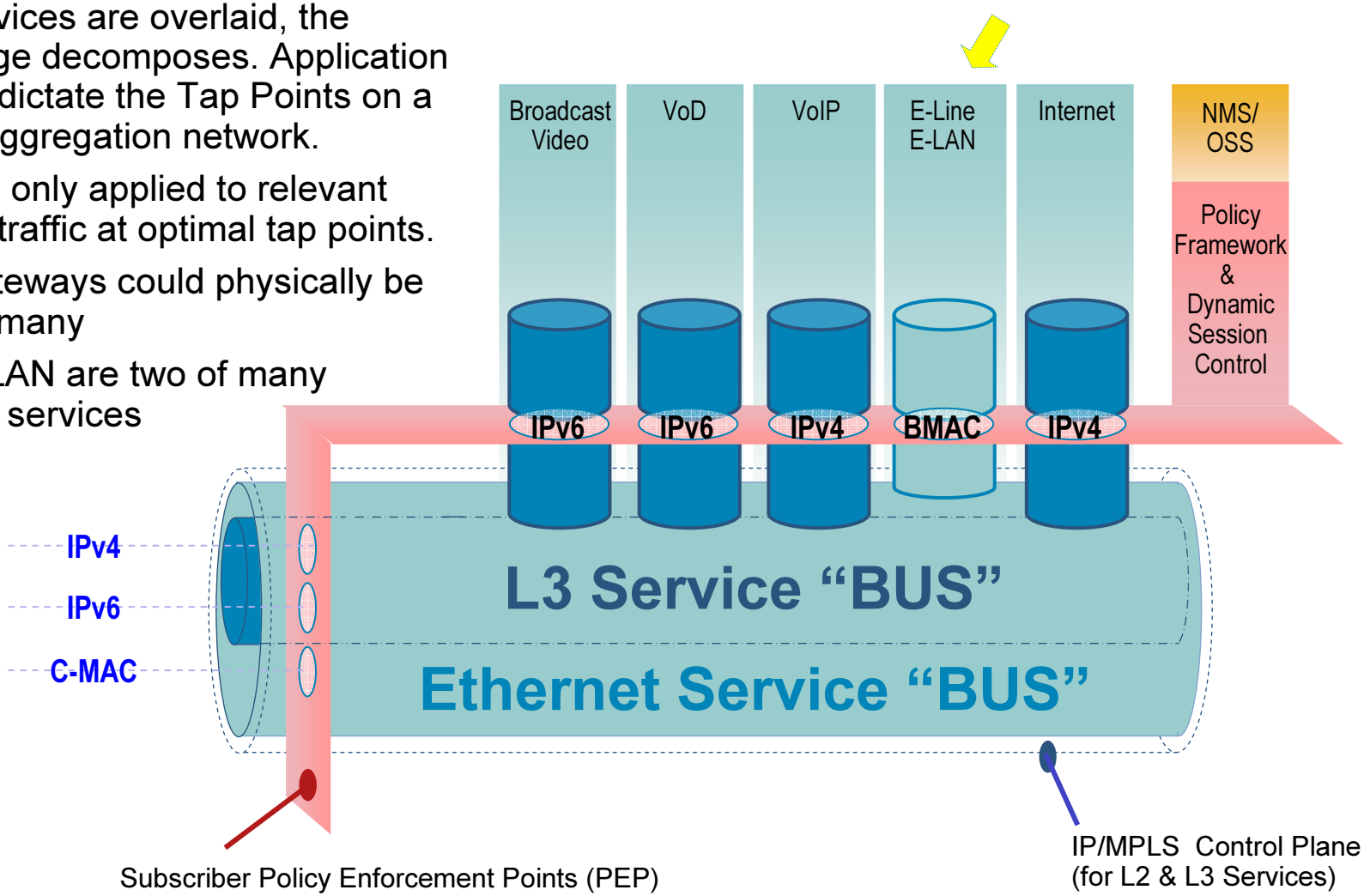


- 1976 name *Ethernet* coined
- Heritage is inherently *Multipoint* (i.e., multiple tap points on shared media.)

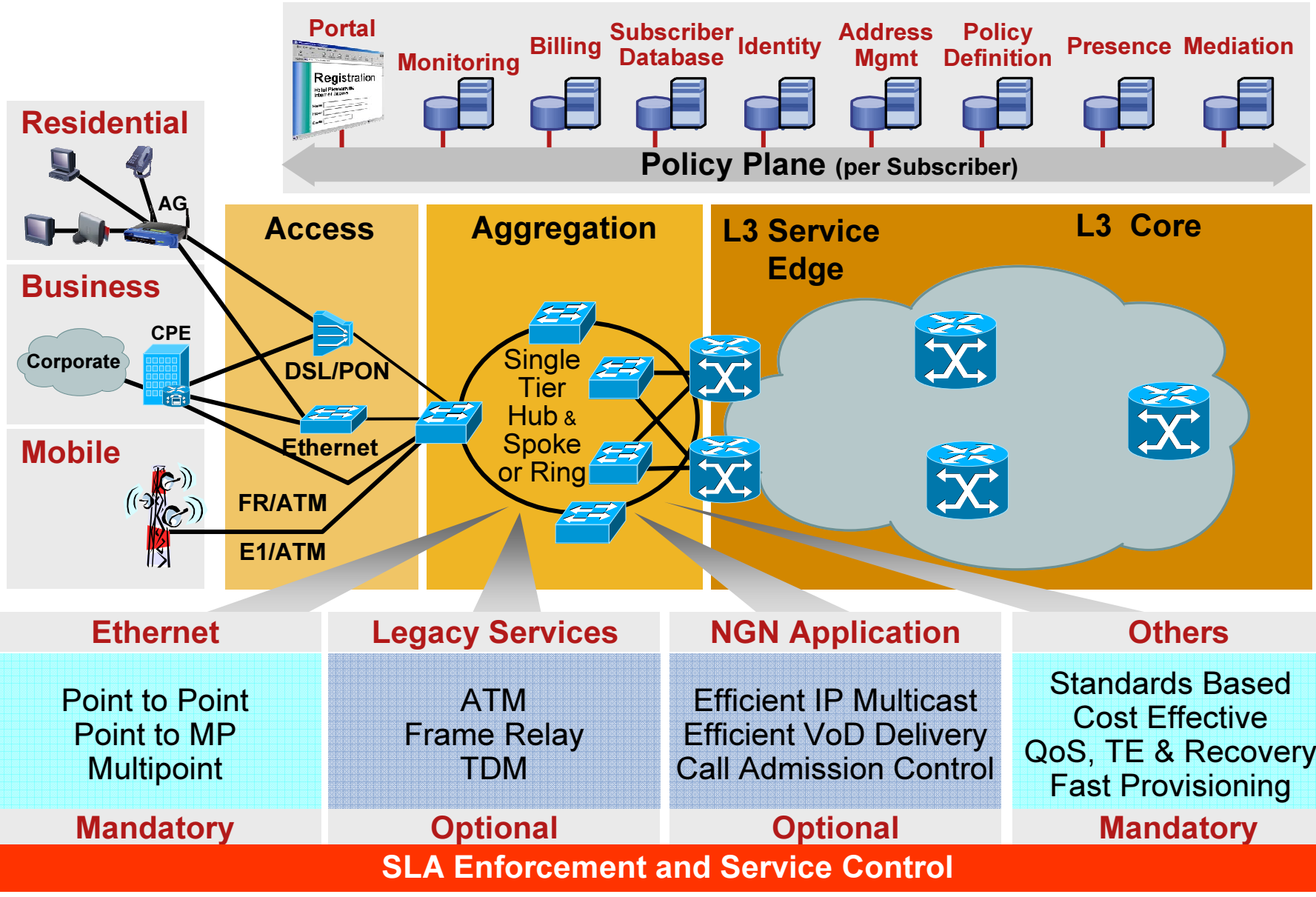
Now… SP Ethernet Aggregation Vision

From: Network per Service *To:* IP/Ethernet Convergence

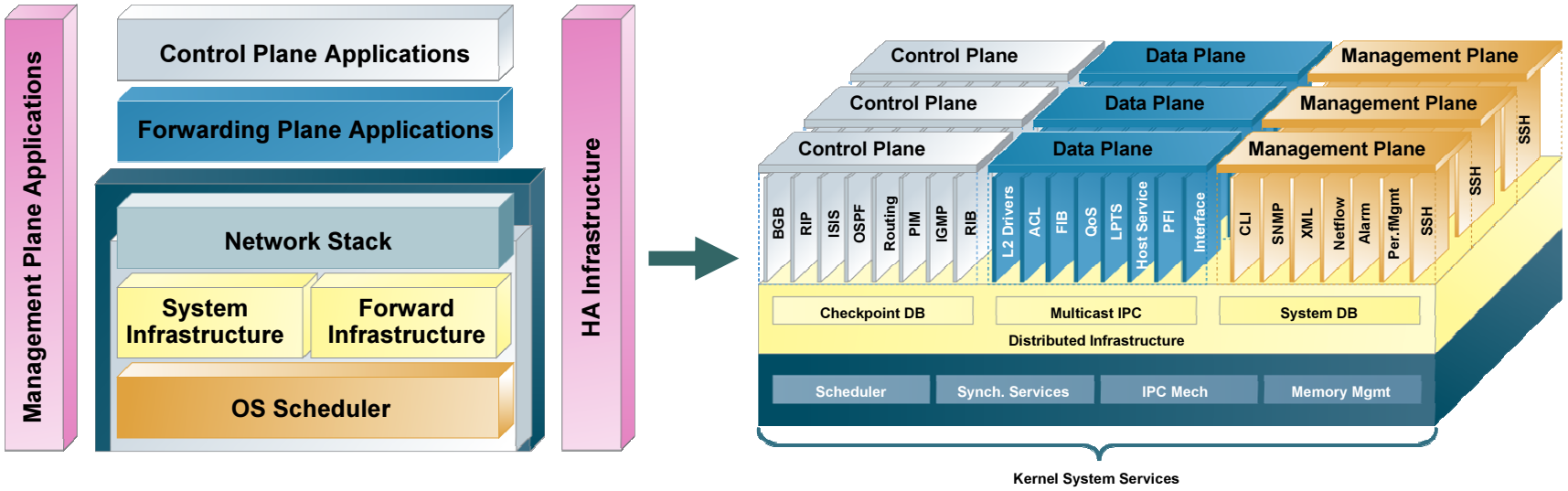
- As new services are overlaid, the network edge decomposes. Application economics dictate the Tap Points on a multipoint aggregation network.
- Policies are only applied to relevant application traffic at optimal tap points.
- Service Gateways could physically be one box or many
- E-Line / E-LAN are two of many aggregated services



Next-Generation Network Requirements



What about HA ?
Router OS Evolution



New Router OS Architecture is required to deliver:

- Monolithic Kernel
- Centralized Infrastructure
- Integrated Network stack
- Centralized applications

- Continuous system operation
- Unparalleled scalability
- Flexible service delivery
- Single unified system view

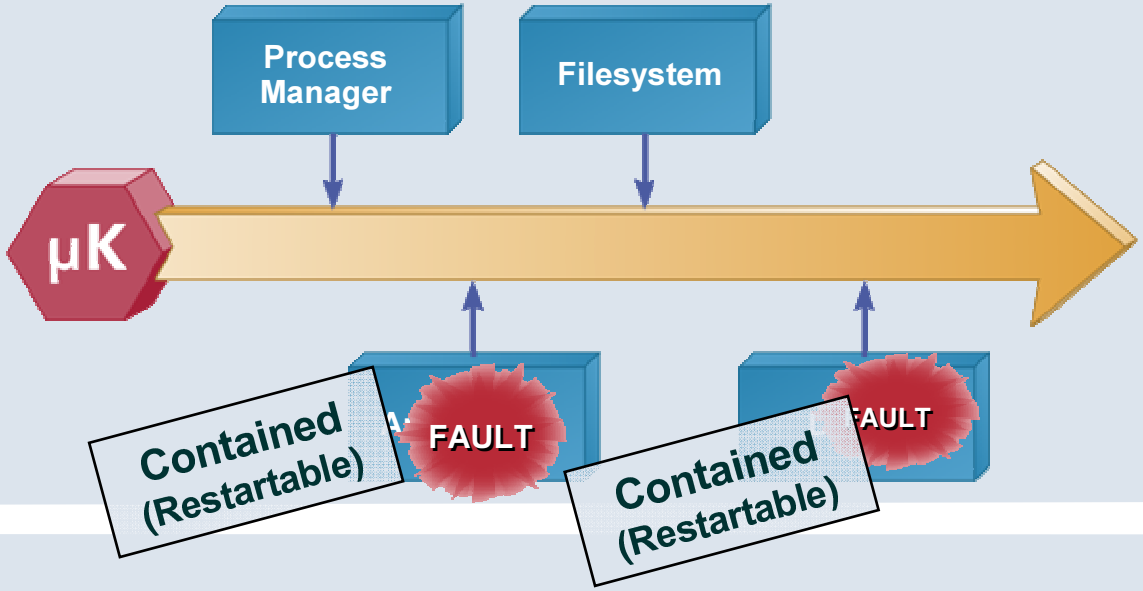
- Micro Kernel
- Distributed Infrastructure
- Independent Network stack
- Distributed applications

IOS XR Software Architecture Overview

Picking The Correct OS To Meet CRS Software Requirements

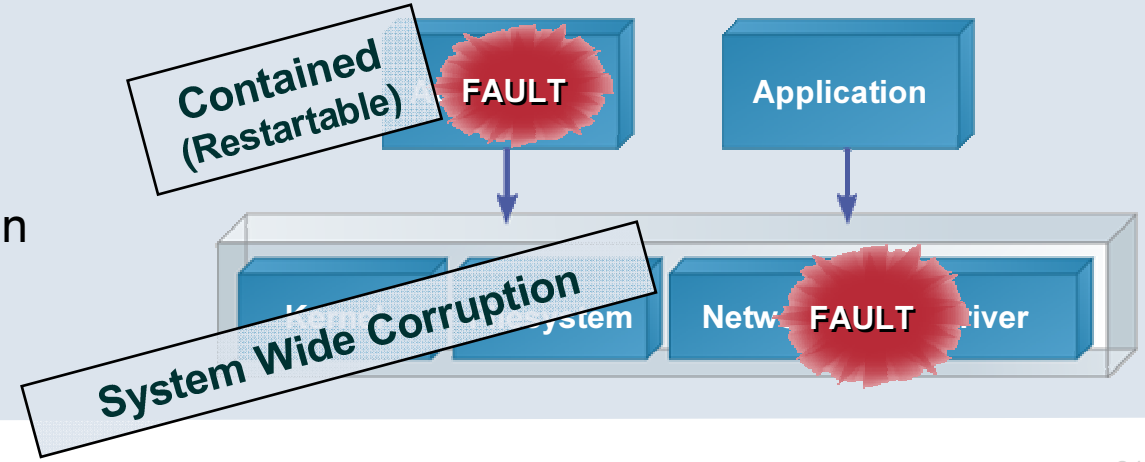
TRUE Microkernel (Mach, QNX)

- –MMU (Memory Management Unit) with full protection
- –Applications, drivers, and protocols are protected

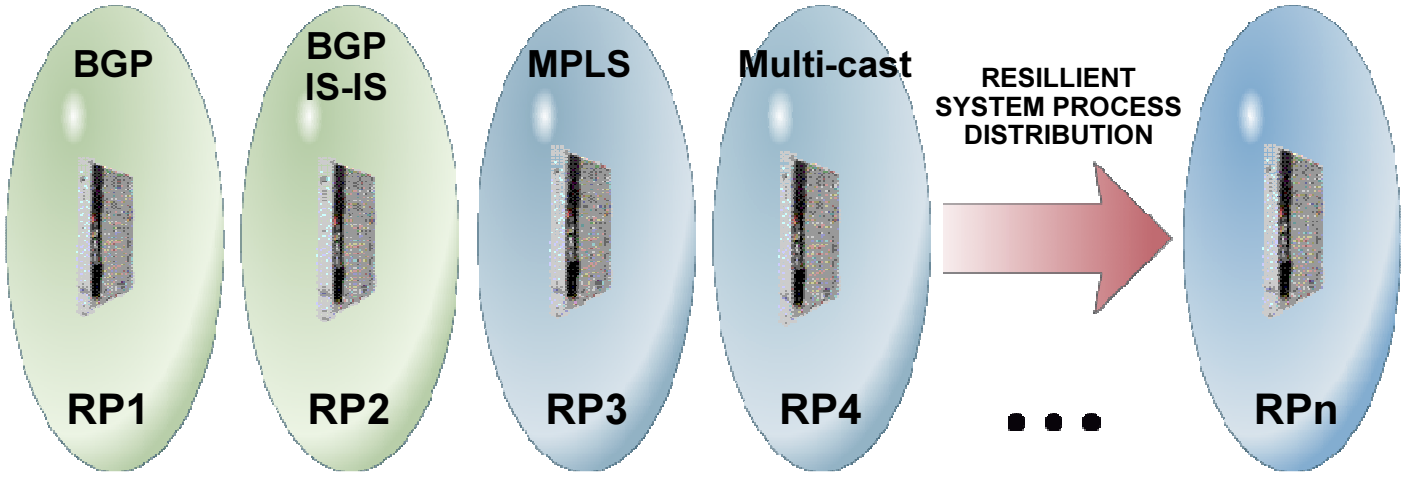


Monolithic Kernel (BSD/Linux, NT)

- –MMU with partial protection
- –Applications are protected



Distributed Control Plane



- Routing protocols and signaling protocols can run in one or more (D)RP
- Each (D)RP can have redundancy support with standby (D)RP
- Out of resources handling for proactive planning

IOS XR Summary

- Longevity
  - –Scale to 92Tbps
  - –Programmable Hardware
- Continuous System Operation
  - –No single point of failure
  - –Non Stop Forwarding
  - –In Service SW Upgrade
- Flexible Service Creation Architecture
  - –Logical Routers
  - –Virtual Routers
  - –VRF
- Single Unified System View