Information
and Communication
Networks

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Network Evolution towards profitable services

January 22, 2003

The road towards full convergence

Yesterday

- PSTN / ISDN
  - Voice-centric
  - Low bandwidth
  - Dial-in to data
- Data network
  - Different technologies (ATM, FR, X.25, IP)
  - Best effort Internet Access
- PLMN (GSM)
  - Voice, SMS
  - Terminal mobility
  - Low bandwidth

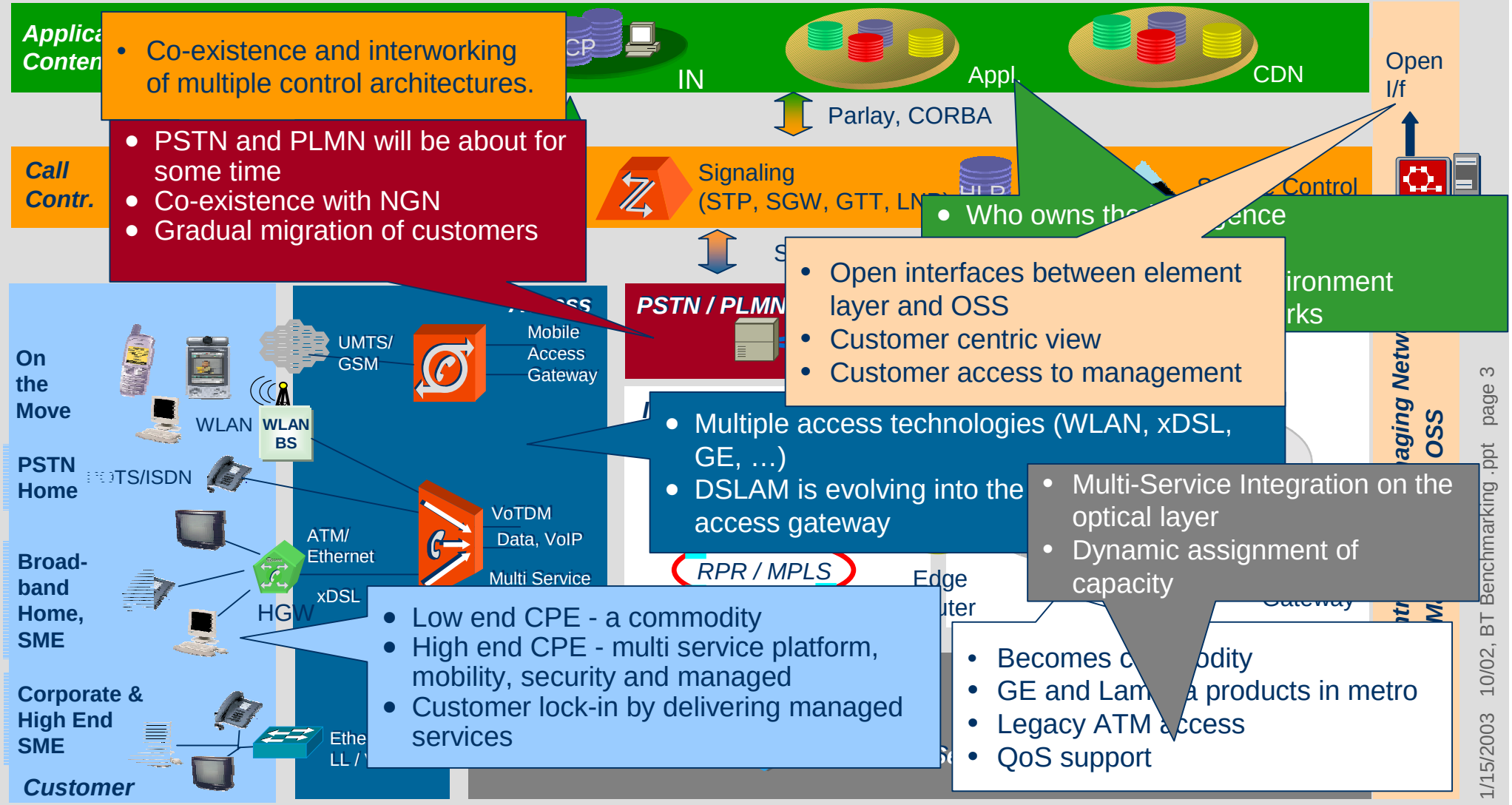
Today

- NGN fixed network
  - Voice / data
  - High bandwidth
  - QoS
- QoS data network
  - Pure IP
  - High bandwidth
  - Diffserv, Intserv, MPLS
- NGN PLMN (UMTS)
  - Terminal mobility
  - Voice / data
  - Broadband
  - QoS

Tomorrow

- Converged services and networks
  - QoS data network
  - High bandwidth
  - SS7, SIP, H.248
  - User mobility (mobile and fixed)
  - O&M

Siemens' vision of 21st Century network architecture



- Co-existence and interworking of multiple control architectures.
- PSTN and PLMN will be about for some time
- Co-existence with NGN
- Gradual migration of customers
- Who owns the
- Open interfaces between element layer and OSS
- Customer centric view
- Customer access to management
- Multiple access technologies (WLAN, xDSL, GE, …)
- DSLAM is evolving into the access gateway
- Multi-Service Integration on the optical layer
- Dynamic assignment of capacity
- Low end CPE - a commodity
- High end CPE - multi service platform, mobility, security and managed
- Customer lock-in by delivering managed services
- Becomes c odity
- GE and Lam a products in metro
- Legacy ATM ccess
- QoS support

Customer Premise Equipment

Evolution of CPE devices

Broadband Connectivity to One Device

Connectivity to Multiple devices on Home Network

Dynamic Delivery Of New Services

Remotely Managed & Upgradable

Internet Enabled devices

Mobility & Security

Support of different service quality

Networking Within the home

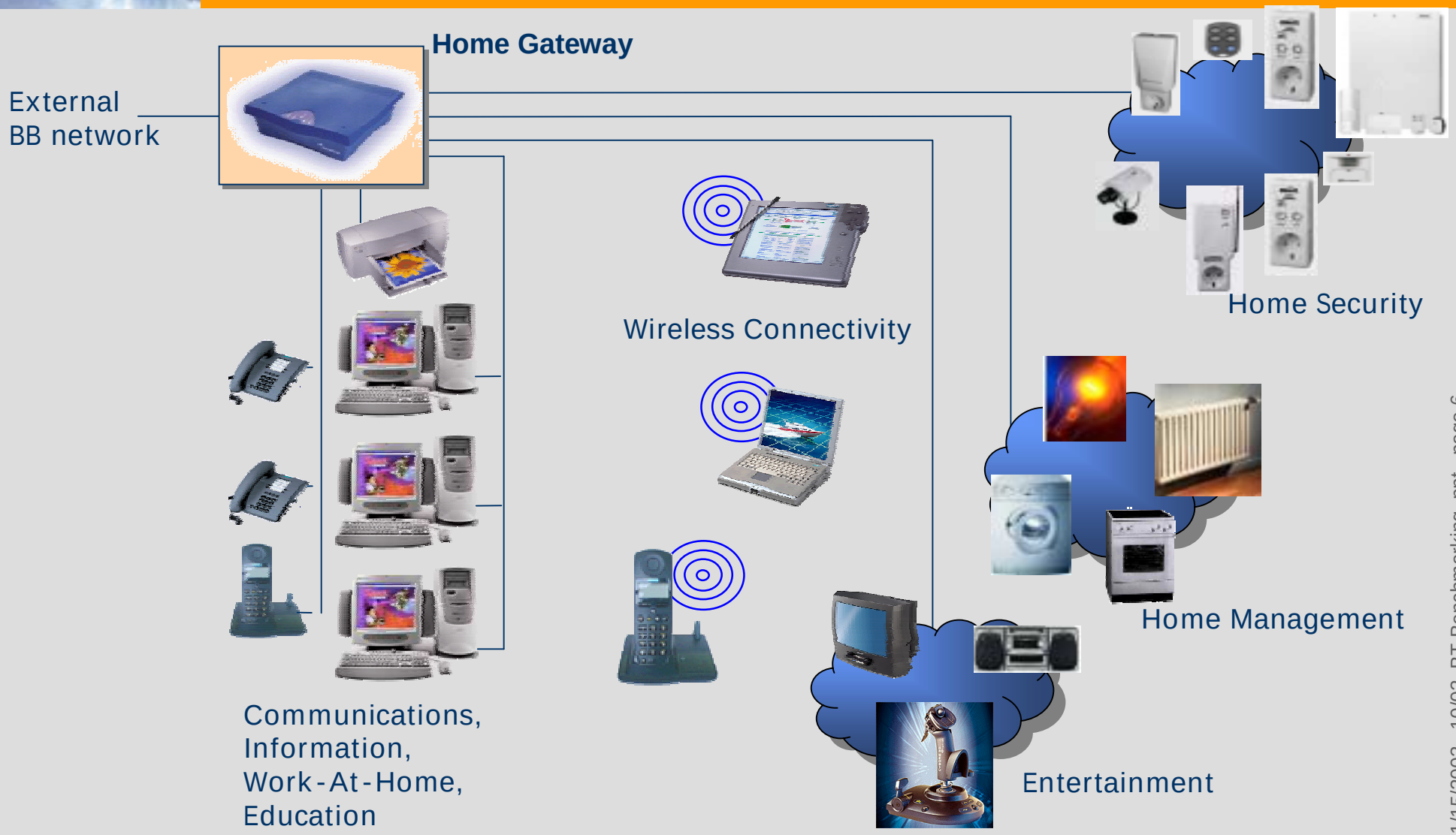
Modem

Router

Service gateways

1999 2000 2001 2002 2003

Intelligent Services Gateway
The Interface to different Application Domains



Access

Access networks
The evolution to broadband is the most demanding challenge

Investment is focused towards these access solutions

- Mass rollouts of ADSL
- SHDSL as LL replacement and with VoDSL (BLES) – OLOs, mainly
- VDSL field trials – central office and cabinet-based solutions
- Upgrade of Cable TV networks with cable modem technologies, mainly in US – however, signs of growth in Europe

Niche solutions

- Point-to-multi-point radio systems
- Fiber-to-the home / building evolves slowly, mainly due to high costs of civil works
- Power line systems
- Broadband satellite systems

Multiservice access
The DSLAM grows up!

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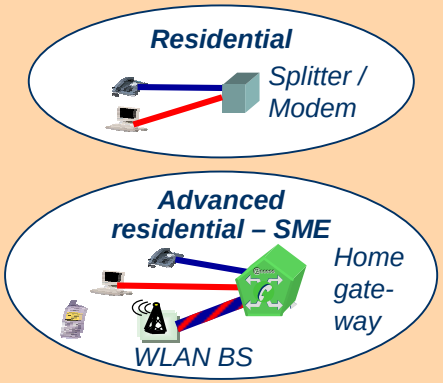
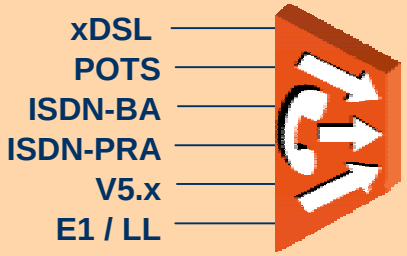
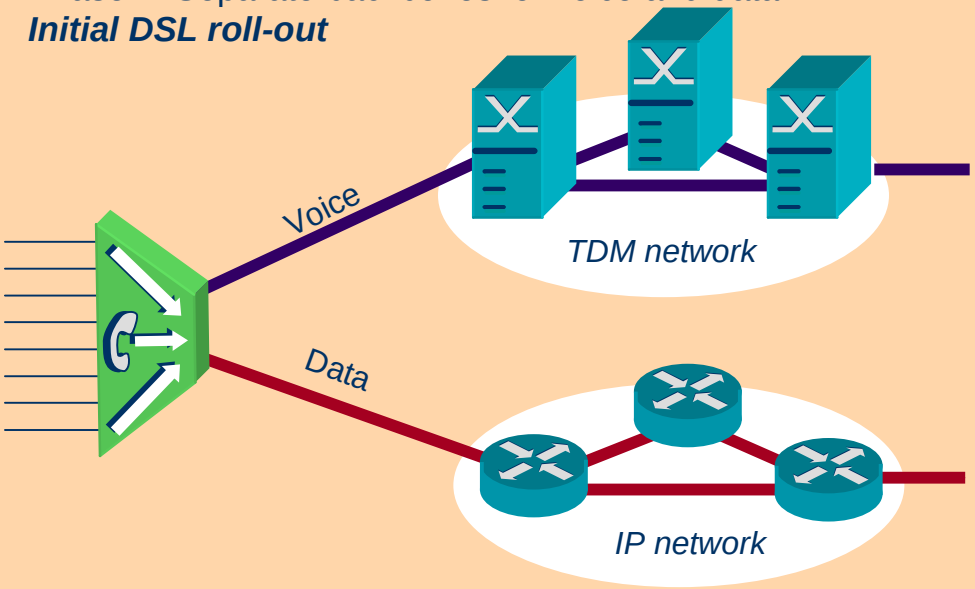




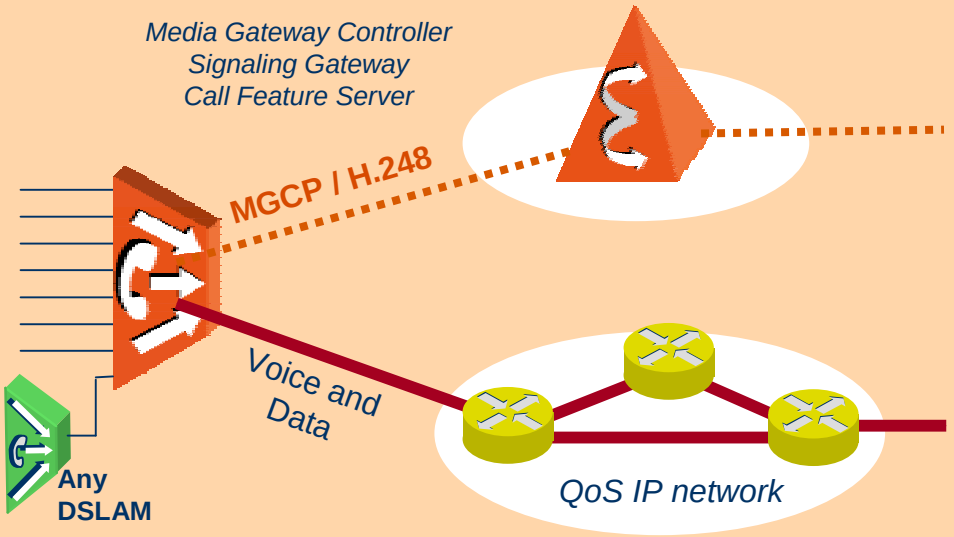
Multi-service access combines voice and data access capabilities in a single backbone

Bundle DSL with a new POTS proposition and get rid of legacy features!!!

Phase 1: Separate backbones for voice and data
Initial DSL roll-out



Phase 2: Packed-based backbone for voice and data
Evolution and gradual DLE replacement



Access - Extend the DSL footprint

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Challenges	*Our approach / solution*
• **Economically extending the footprint of DSL** • **Most cost-effective backhaul**	• **4 wire SHDSL** – **Twice the bandwidth 4.6 Mbps ~3 km reach** – **Enhance the reach at 2.3 Mbps ~5 km reach** • **ADSL+** • **Cabinet deployment** • **Scalable DSLAMs - micro DSLAM and pizza boxes** • **VDSL-CO and cabinet-based (geographical approach)** • **ATM and / or GE** – **ATM for assured services** – **Today, GE for best effort only**

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Control

PSTN evolution

- The classical PSTN market is stagnating
- Obsolescence is not key, but lack of flexibility within current PSTN network is a limiting factor
- Main threat for PSTN operators:

  Shift of telephony services to other infrastructure providers
- Main opportunity for PSTN operators:

  Migration of existing infrastructure towards broadband
- Voice drives the revenues of the telcos, but focus for investment is NGN
- Media gateways, call feature servers, and signaling gateways are the key building blocks of a multi-service architecture

The call control challenge

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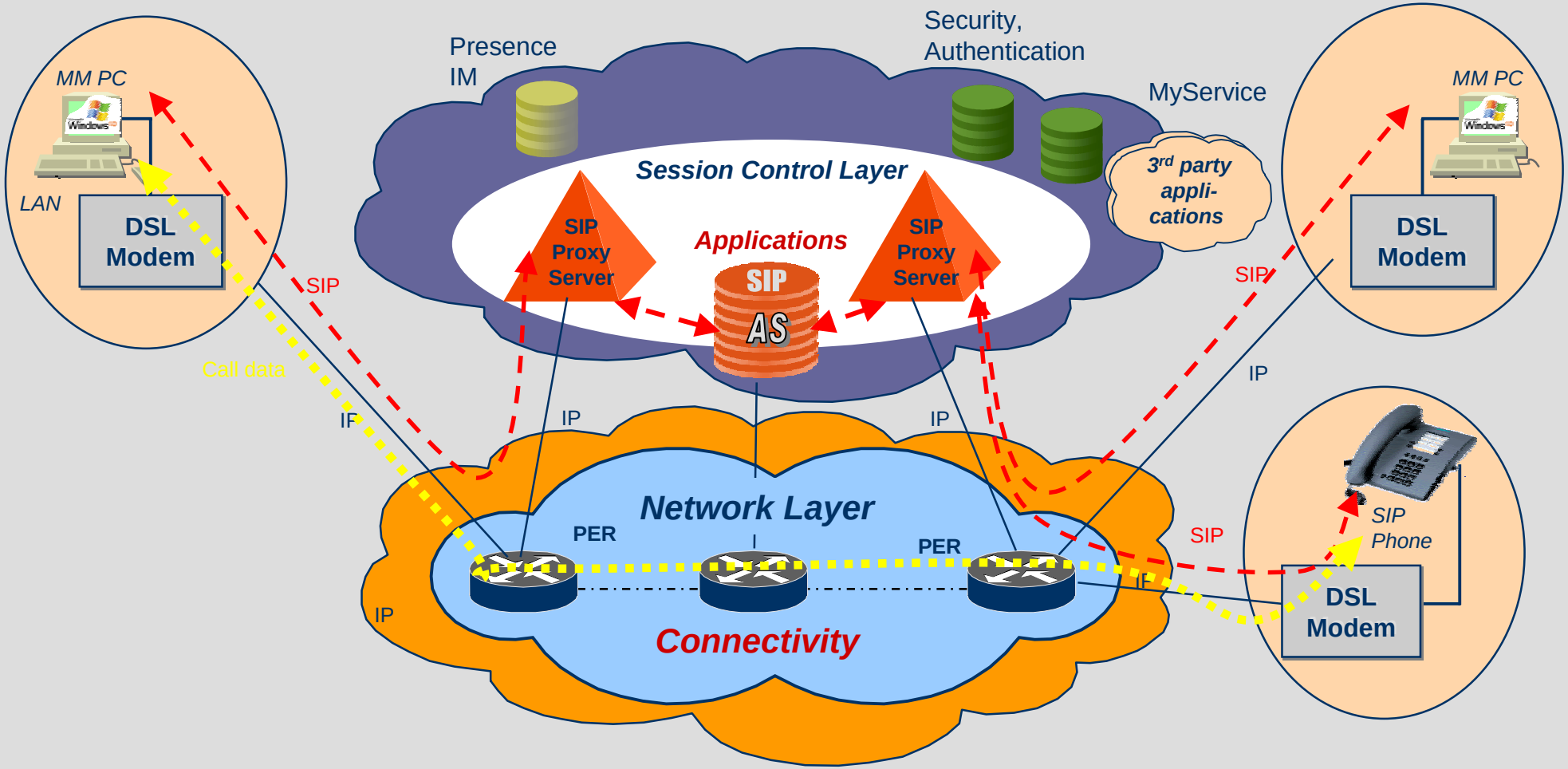
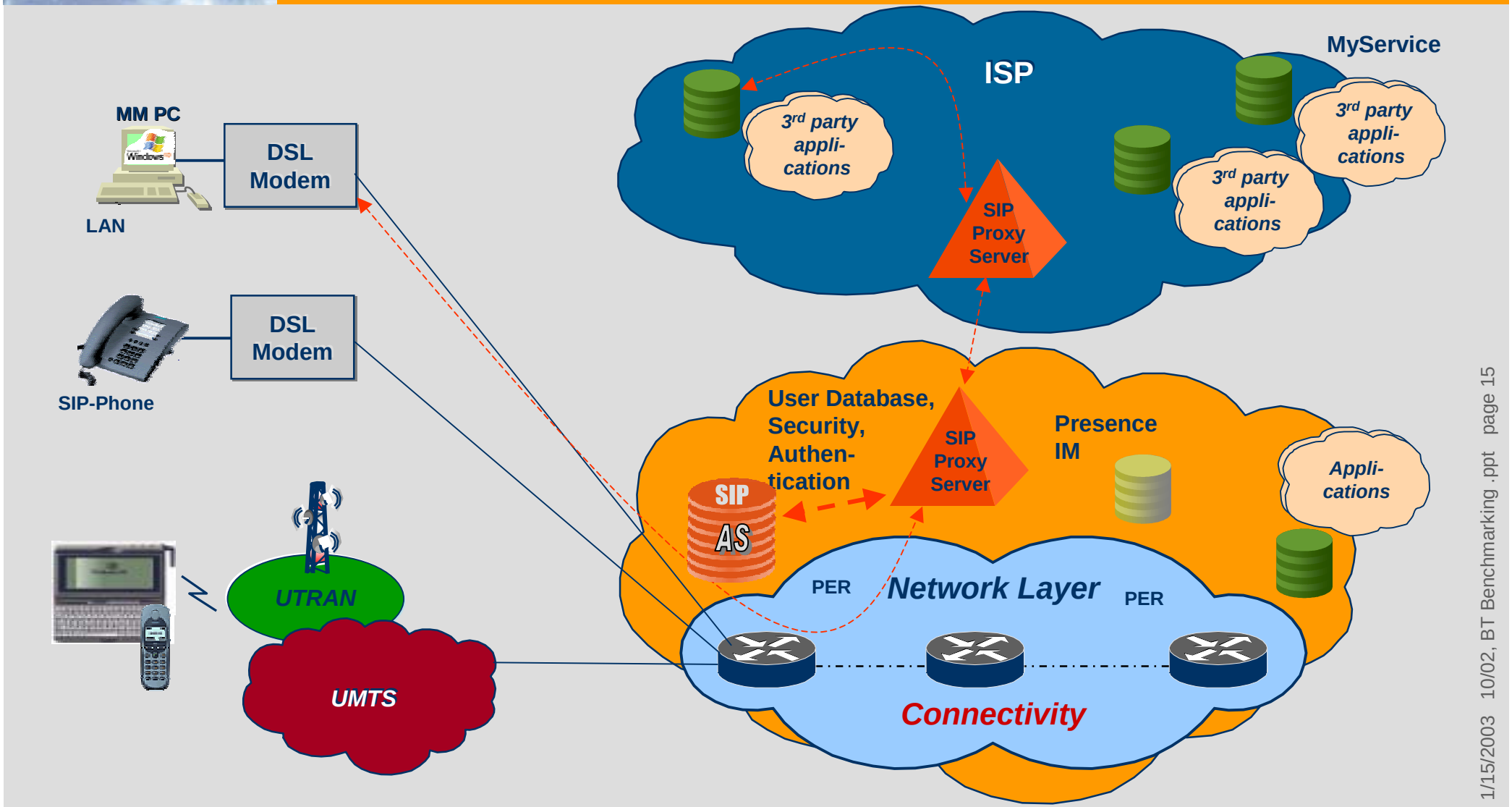
Challenges	*Our approach / solution*
• Network restructuring & simplification for cost effective NGN infrastructure • Dramatic growth of signaling entities (n^2 problem) • Migrate legacy network functionality • Bridge between traditional PSTN and NGN networks • Combine voice control domain (e.g. SIP) and data control domain	• Introduction of uniform signaling network • Underpin signaling network with full SG capability • Add network overload protection • Full carrier grade characteristics on call control • Evolution of Service Intelligence Domain Concept

The SIP challenge
Who's selling the services?

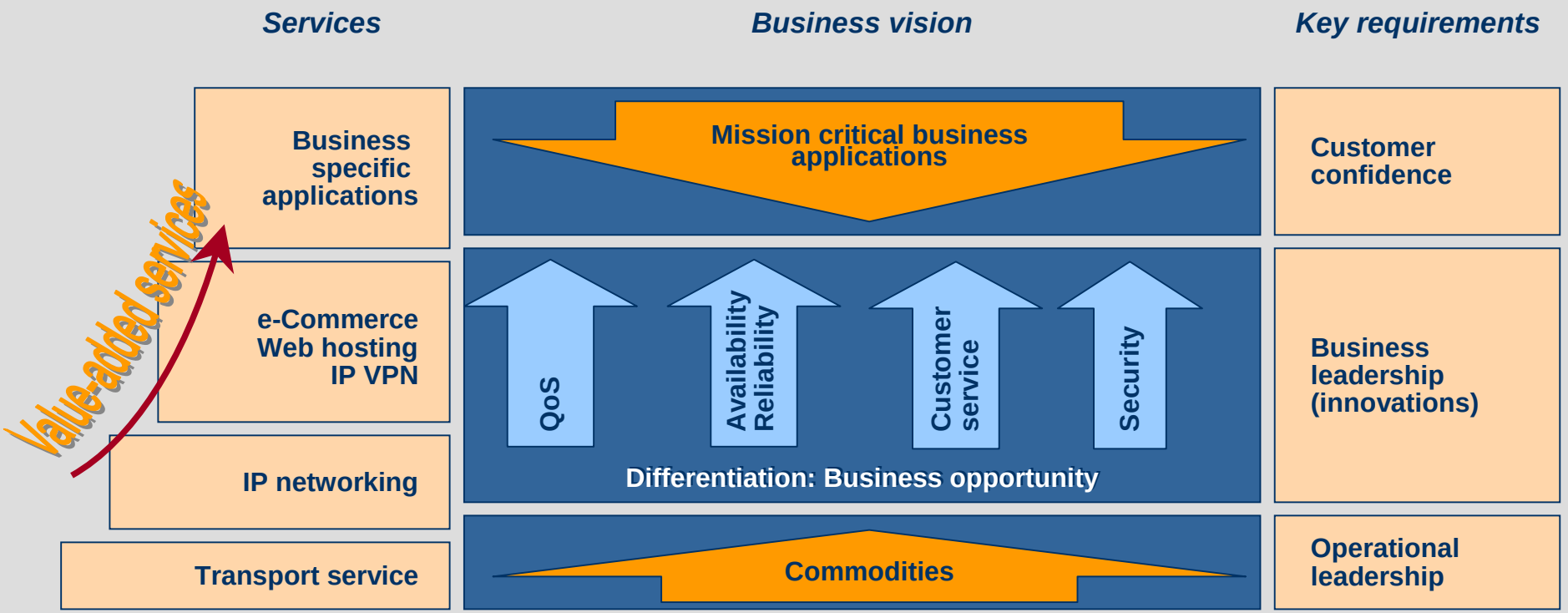


The SIP Challenge
Ownership of user data for solid business model



The move towards value-added services

- Value-added services will become the main differentiator
- Most added value services are based on voice, data, and mobility convergence and require support beyond best effort



The new service architecture

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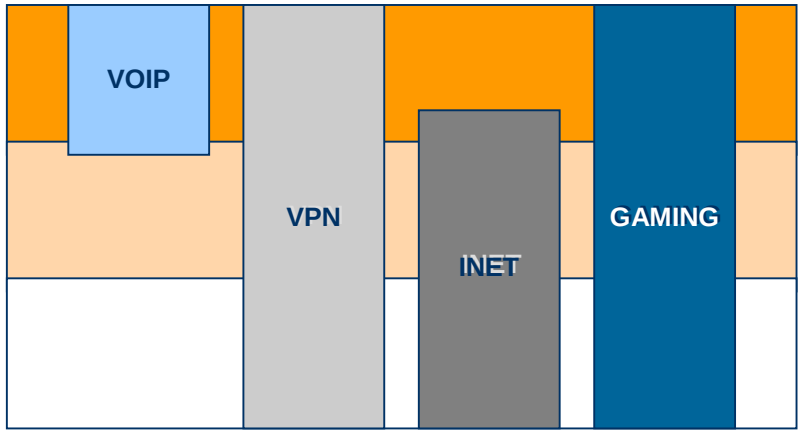
The service architecture delivers:

- Service models focusing on the experience, not the connection
- Business models that are flexible and easily adaptable
  - Different services for different markets with different billing
  - Simultaneously delivery of:
    - Low volume / high margin services
    - High volume / lower margin services
- Drive model from bits to experiences
- Product creation and definition for fast market trial

Service Models

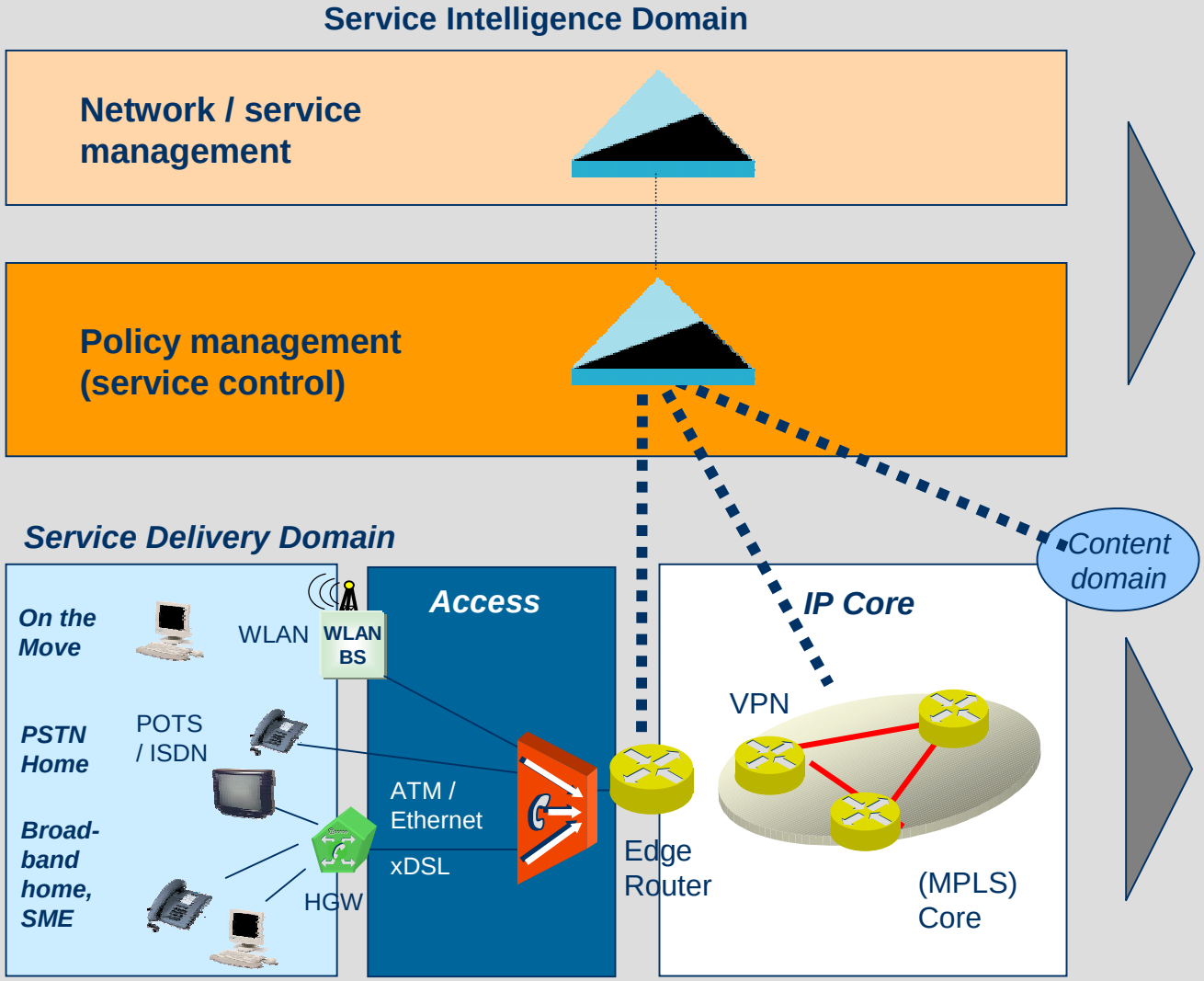


Assured experience

Better than best effort

Best effort

The New Broadband Service Control Architecture

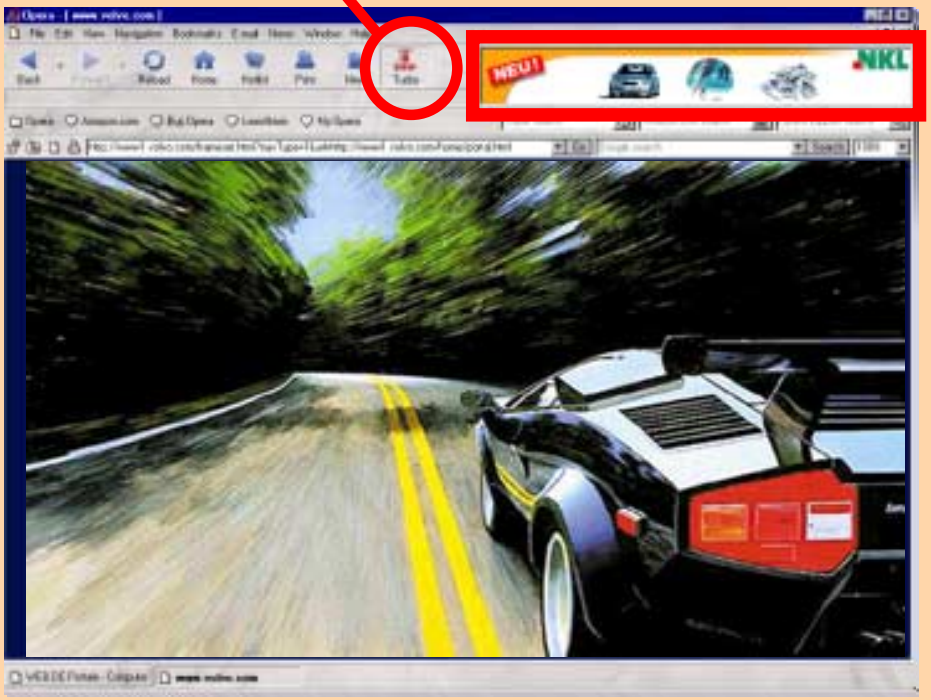


- The "IN" of the data network
- Virtualization of the service
  - Customer-centric view
- Manage services, not bits
- Real time changes to the connection between
  - Customer and content, or
  - Customer and customer

- Delivers scalability and reach
  - "Any Access"
  - DSL & WLAN
- Service Resiliency
- Carrier-, not enterprise-focused
- Performance for all traffic types
- Virtualization of the network
- Meditation of legacy systems
- Ease of management

Example: The Turbo Mode - Opera's ad based browser talks BRAS

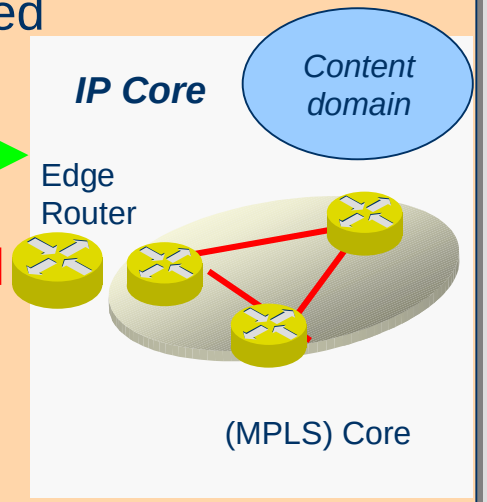
- Opens an Ad Window
- Demands Higher Speed from the Unisphere ERX Router
- Sends Unique User ID Data to the ISP
- ISP Allows more Speed and Sends Targeted Advertising



Opera Browser

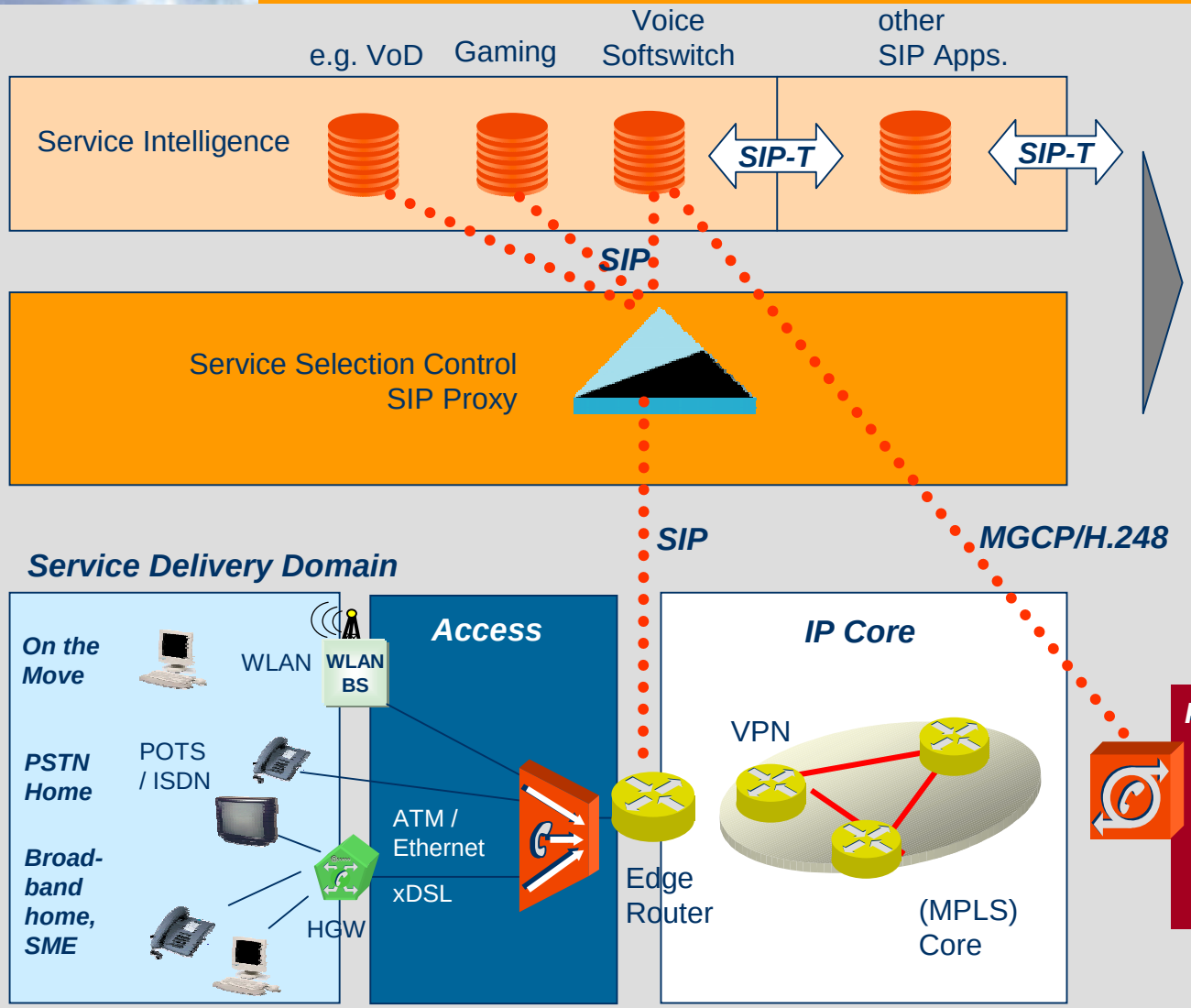
Demand for more Speed
+ User ID

Higher Bandwidth
+ Advertising



BRAS

The New Broadband Service Control Architecture (Session Control)



- Architecture allows separation of service selection and service interaction
- Service interaction most probably SIP based
- Architecture allows controlled access of independent service providers (e.g. gaming, VoD)
  - controlled access b/w
  - controlled QoS
  - billing/accounting possibilities

Challenge: IP-QoS & IP-Resilience

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Challenges

- **Guaranteed QoS**
  → Multimedia real time appl.
- **Service Differentiation**
  → Billing of QoS as service
  → Add. revenue
- **Subsecond network resilience**
  → Mission critical appl.
- **Efficient network operation**
  → Reduced OPEX & CAPEX

Our approach / solution

Different approaches for access / metro and core networks:

Access / Metro / Core QoS:

- Hierarchical and scalable resource management for access & core
- Access control at the edge – not stateful inside core
  → Adaptive and dynamic QoS management

→Research project **AQUILA**

Core QoS / Resilience:

- Admission control at edges – no statefull capacity reservation inside
- Multi path routing for advanced resilience
- Automated, adaptive, autonomous network control

→Research project **KING**

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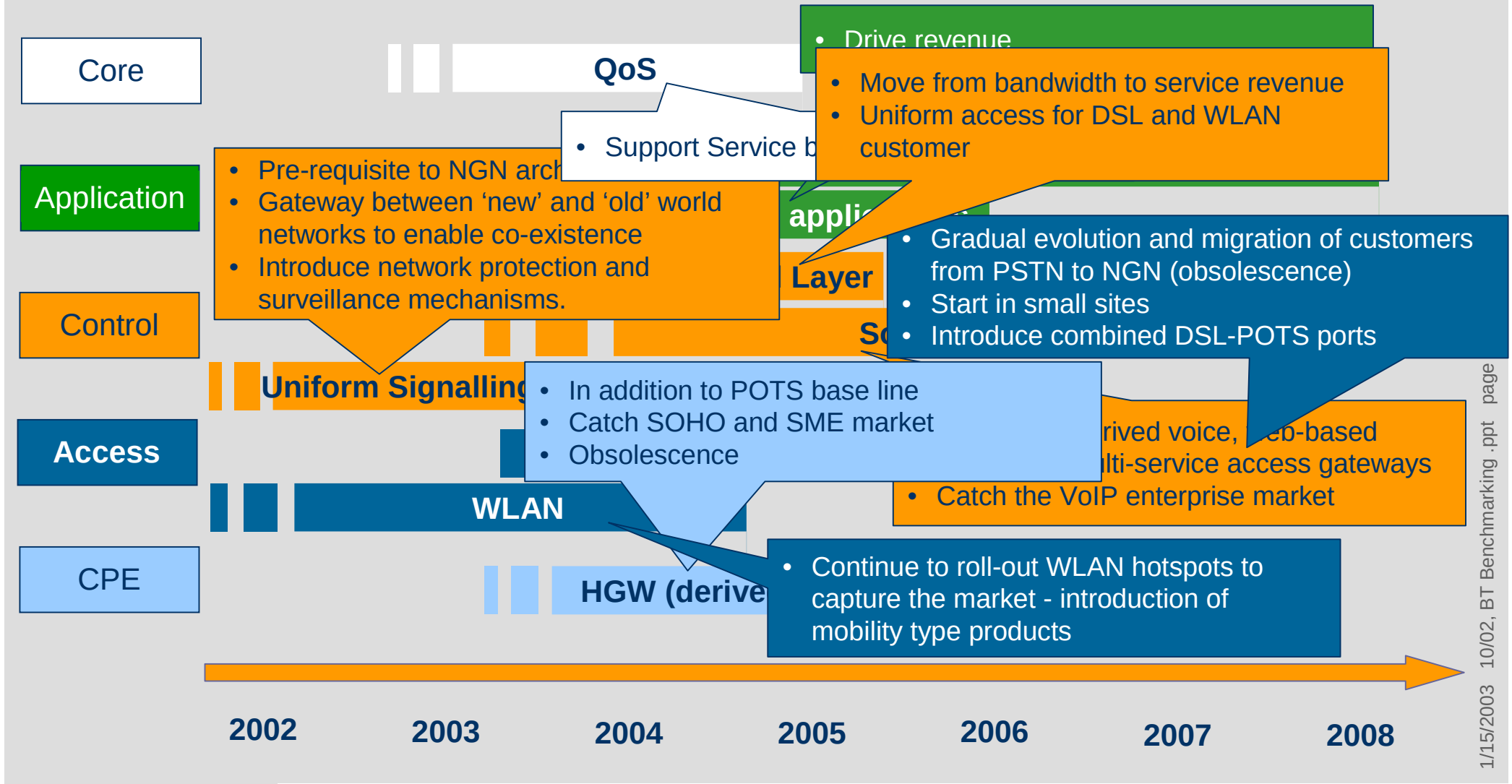
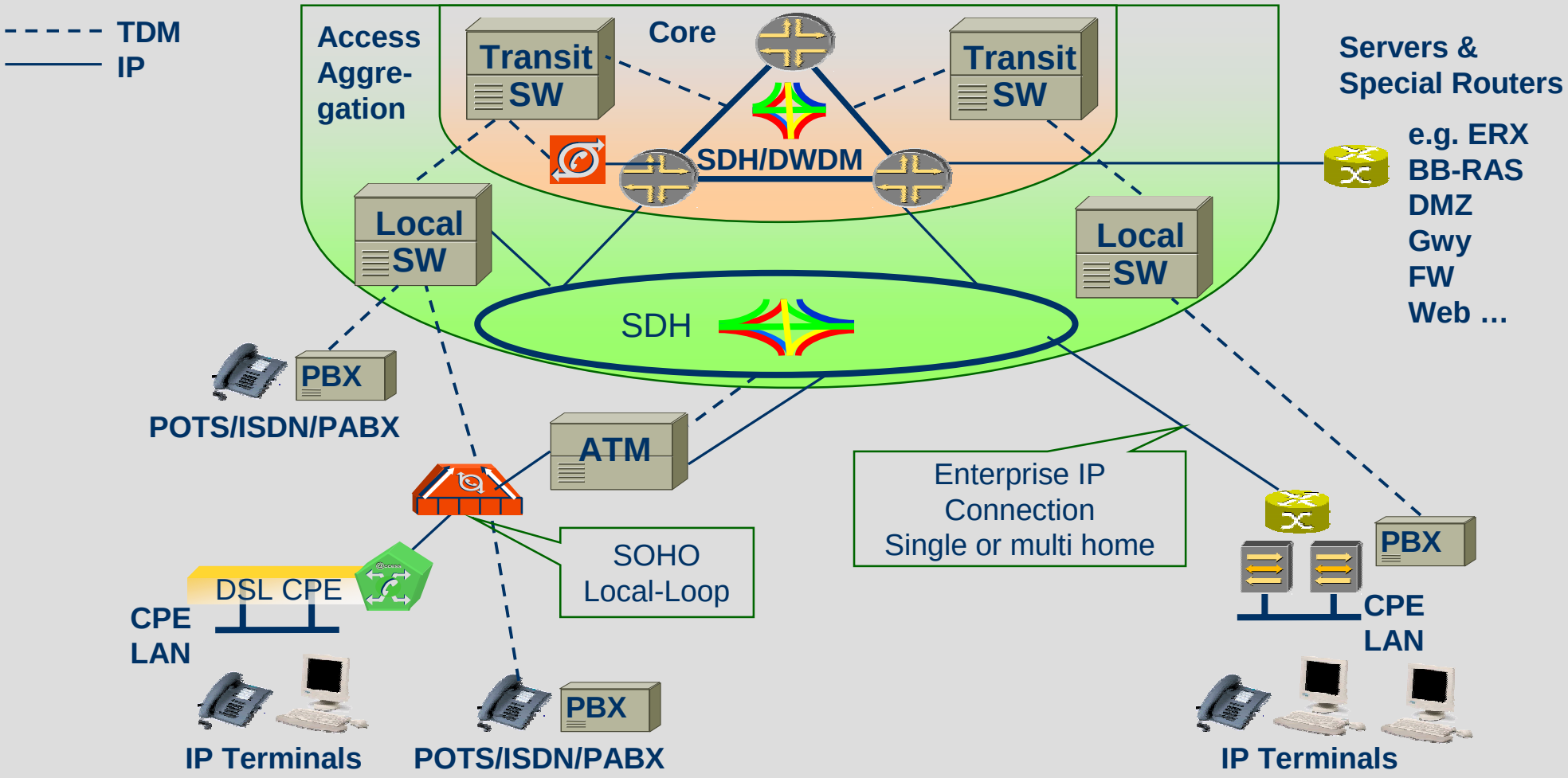
Migration

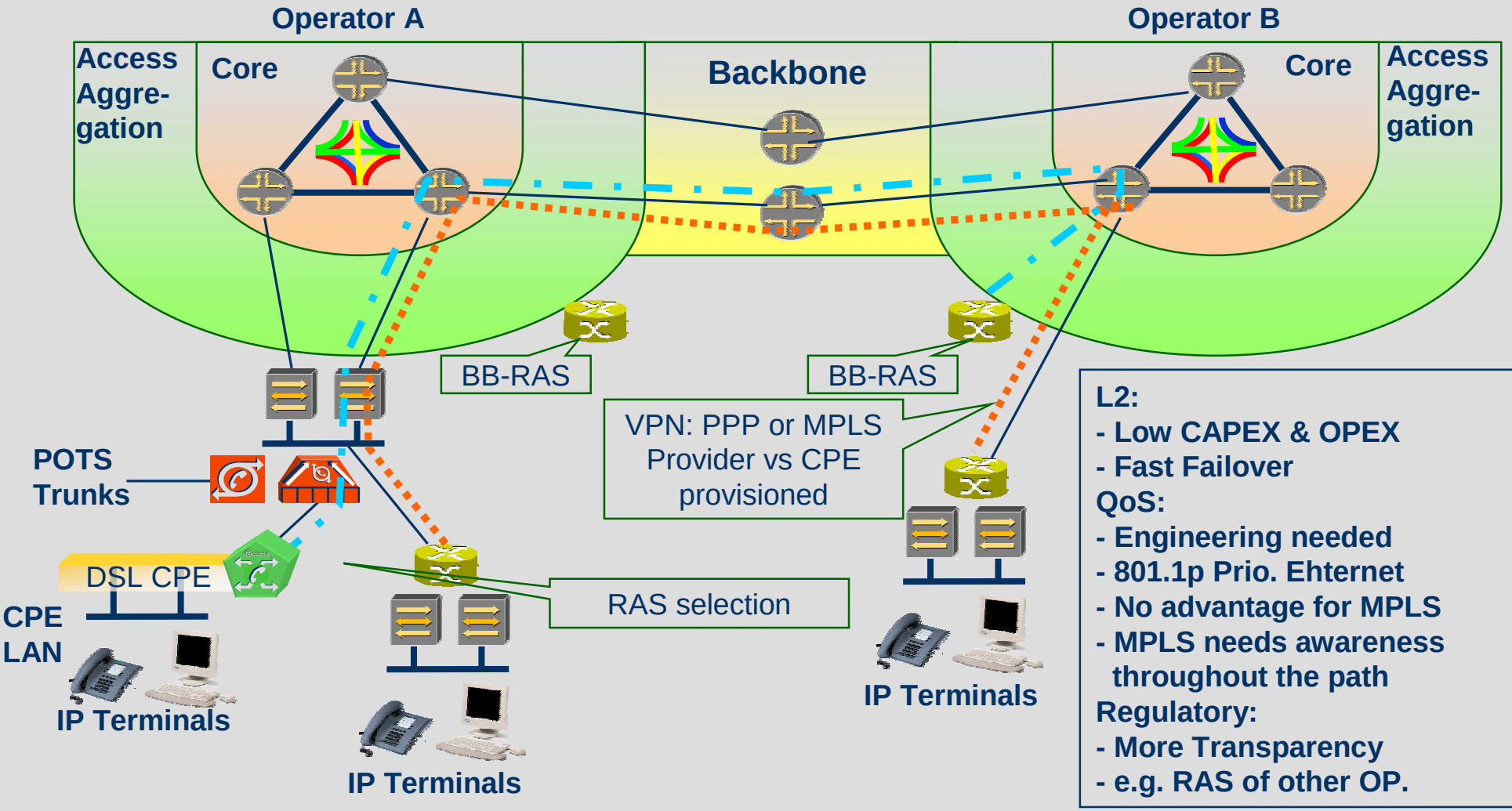
Migration Timeline - Our view



Today's Network Overview



All IP Network
Multi Operator Scenario



L2:
- **Low CAPEX & OPEX**
- **Fast Failover**

QoS:
- **Engineering needed**
- **801.1p Prio. Ehternet**
- **No advantage for MPLS**
- **MPLS needs awareness throughout the path**

Regulatory:
- **More Transparency**
- **e.g. RAS of other OP.**

All IP Network
L2 Switching / L3 Routing Tradeoff

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L2/L3 Costs

- Full wire speed routing with L3/L4 MPLS …
- L3 Routing only
- L2 Switching with resilience
- Simple L2 Switching

- Sophisticated routing functions increase OPEX and CAPEX
- MPLS solves special peering relations but is too expensive for the mainstream.
- Management is expensive for complex routing
- L2 provides enough resilience
- L2 is cheap to manage
- L2 has a limit on hosts in a given LAN. (Scalability limitations)

OPEX are often more important then the initial CAPEX.

There is no single solution for all deployment options L2/L3 and MPLS/Diffserv… will all exist in networks