Evolution of Data Networks of BTC

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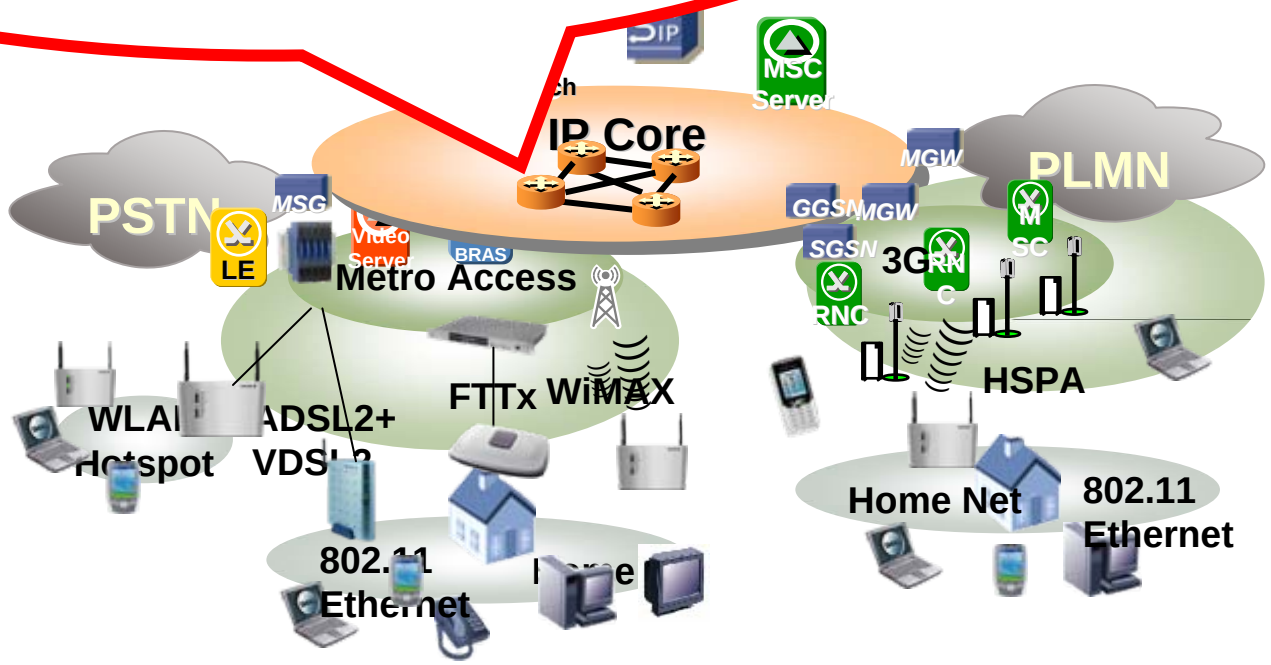
Data Networks evolution

Development of network driven by market requirements and utilizing available technology in efficient way for optimization of TCO



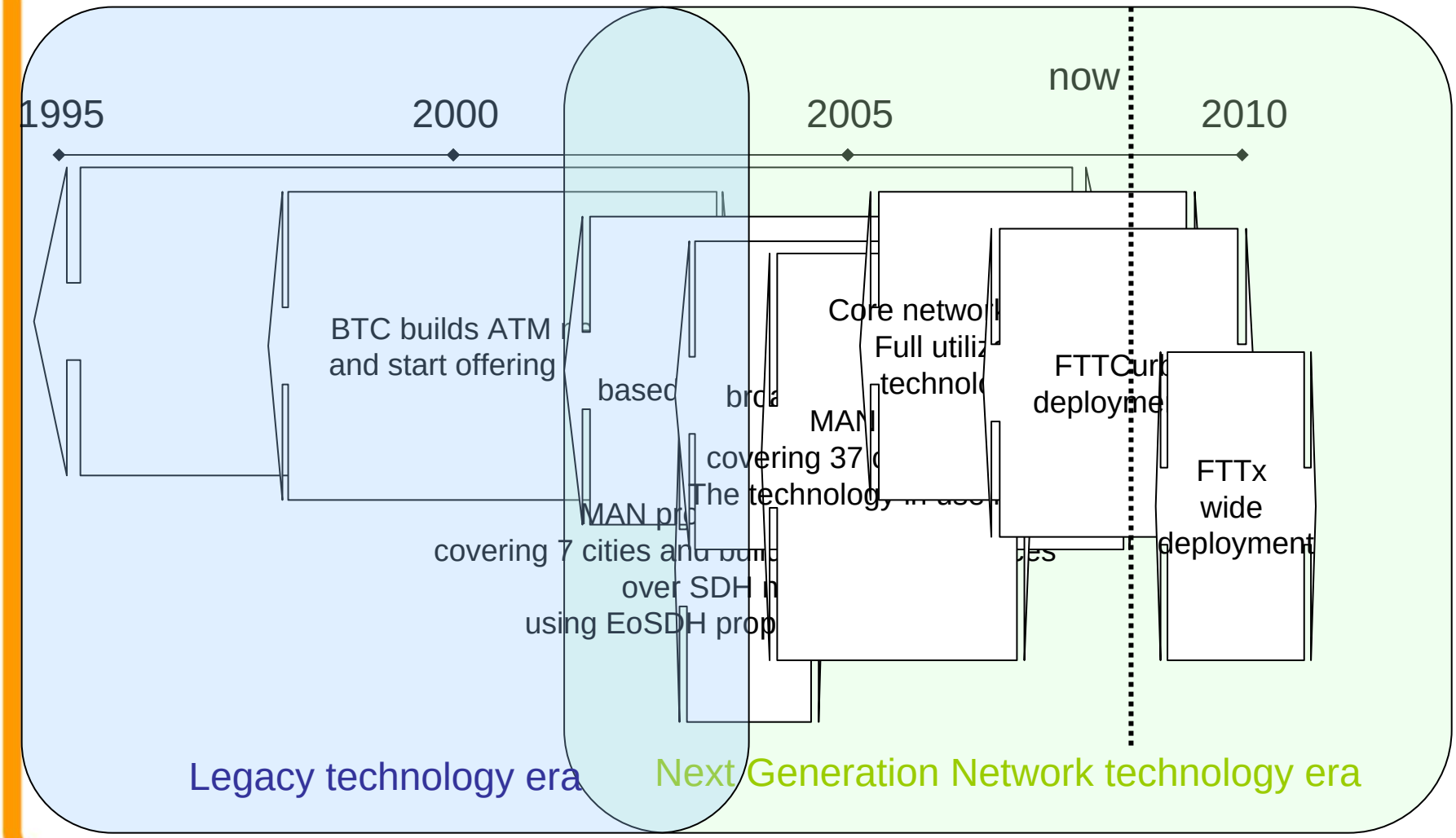
Data Networks evolution

Why we discuss the networks evolution?

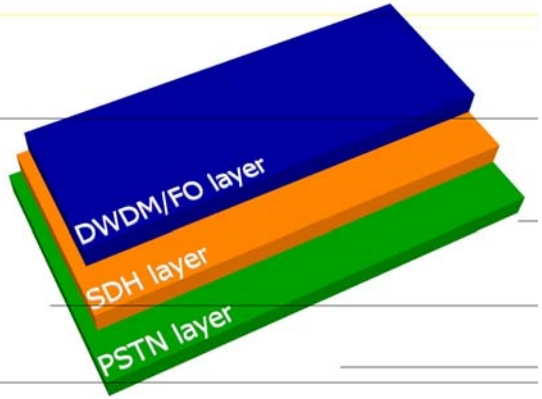
Drivers for data network evolution

- Scalability – capacity growth driven by Internet services
- Reliability – requirement driven from service standards based on TDM technology
- QoS – requirement driven from service standards based on ATM technology
- Flexibility – build a network upon a technology that opens opportunities for deployment of new services
- Security – requirement driven from service standards based on ATM and FR technologies

Data Networks evolution



Data Networks Architecture



Legacy Network Architecture

Complex and Flexible

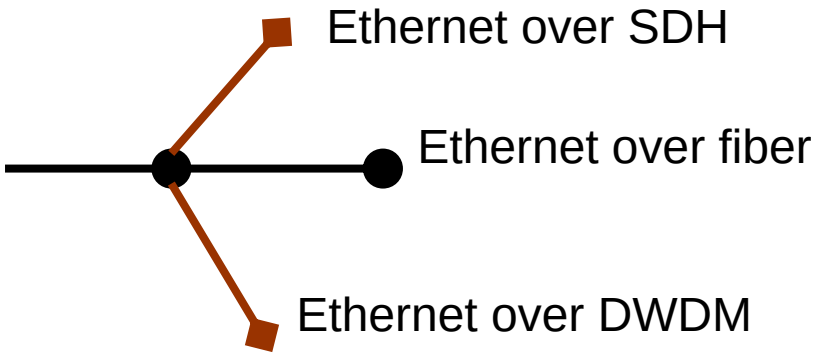
Many choices to make

NGN Architecture

Data Networks Architecture

- Next Generation network layer groups
  - Next Generation Transport
    - Fiber optical infrastructure
    - DWDM transmission
  - Next Generation Core
    - MPLS Core
    - MPLS Service Edge
    - Carrier Ethernet aggregation
  - Next Generation Access
    - xDSL (ADSL, ADSL2+, VDSL, SHDSL)
    - FTTx (Node, Curb, Building, Home)

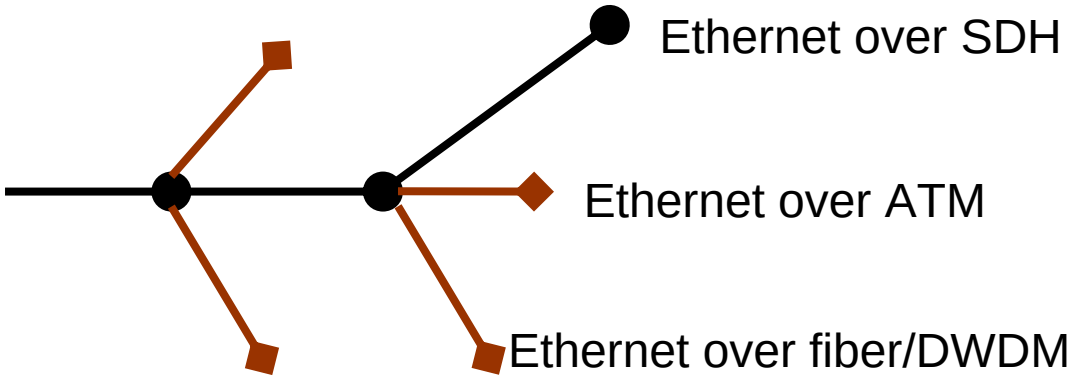
Network Evolution
MAN pilot



- Challenges for pilot MAN networks
  - marketing demand for data LAN-to-LAN services
  - technical solutions options
    - Ethernet over DWDM
    - Ethernet over SDH
    - Ethernet over fiber

- Implemented network layers – Ethernet over fiber
- Network footprint – about 20 sites in Sofia
- Implemented topology – ring
- Protection mechanism – RSTP
- Services – 802.1q VLAN
- QoS – no QoS. Bandwidth planning

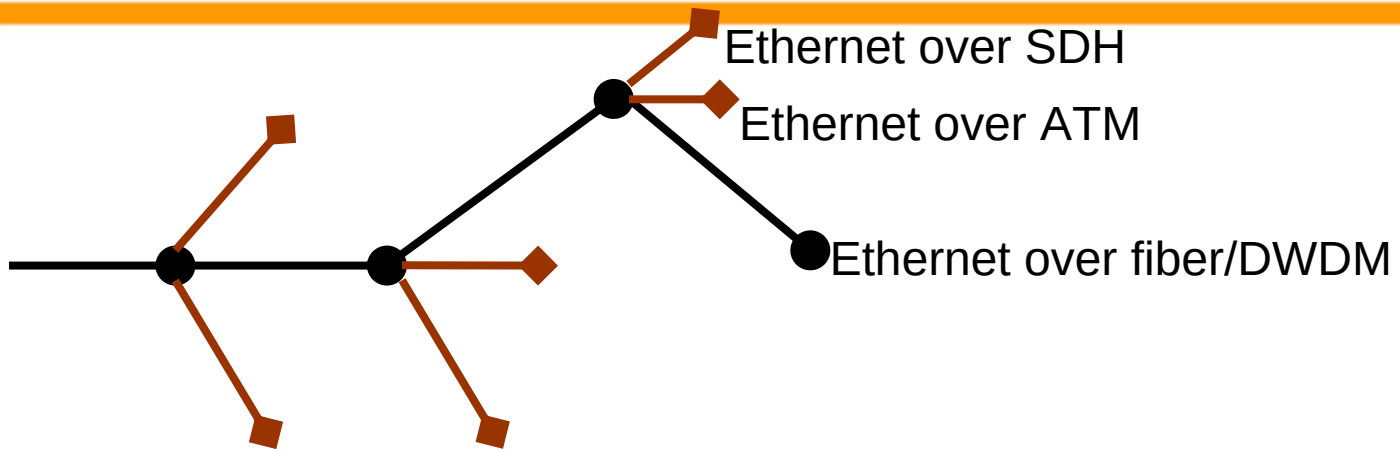
Network Evolution
MAN Intercity



- Challenges for intercity MAN
  - marketing demand for Pseudo Wire services national wide
  - technical solutions options
    - Ethernet over SDH
    - Ethernet over ATM
    - Ethernet over fiber/DWDM

- Implemented network layers – Ethernet over SDH
- Network footprint – 7 cities
- Implemented topology – star
- Protection mechanism – SDH protection
- Services – 802-1q VLAN
- QoS – no QoS. Bandwidth planning

Network Evolution
MAN Intercity



- Challenges for intercity MAN wide deployment
  - marketing demand for Pseudo Wire services national wide
  - technical solutions options
    - Ethernet over ATM
    - Ethernet over SDH
    - Ethernet over fiber/DWDM

- Implemented network layers – Ethernet over fiber/DWDM
- Network footprint – 37 cities
- Implemented topology – ring, partial mesh
- Protection mechanism – MPLS fast convergence
- Services – 802-1q VLAN
- QoS –QoS for voice, business data and best effort traffic.

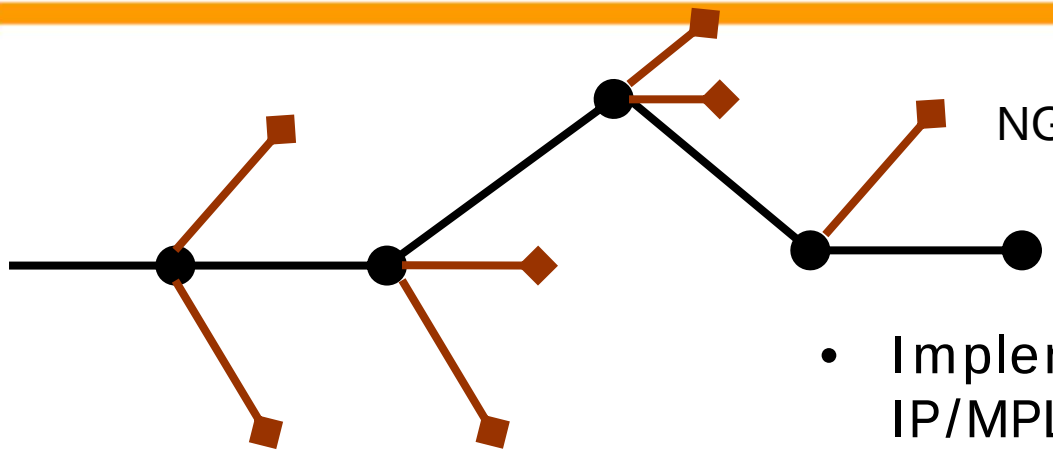
Network Evolution
MPLS Core network

- Services challenges – capability for multi-play services

	Services	technology challenge
Data	Internet access	Best effort, high capacity
Voice	VoIP applications	QoS for ensuring low delay, low jitter
Video	IPTV and VoD	Multicast, QoS ensuring low packet loss

- Core network challenges driven from tight requirements of Next Generation Network
- QoS
- Convergence and resilience
  - MPLS FRR
- MPLS-TE
  - efficient utilization of bandwidth
  - Per service TE

Network Evolution
MPLS Core network



- Technology challenges for Core network
  - NG-SDH
  - IPoDWDM

- Implemented network layers – IP/MPLS over DWDM
- Network footprint – 28 cities
- Implemented topology – full mesh in core, partial mesh in edge
- Protection mechanism – MPLS FRR and fast convergence
- Services – all MPLS VPN services (L3 VPN, L2 VPN, multicast VPN, VPLS)
- QoS –QoS for voice, business data and best effort traffic.

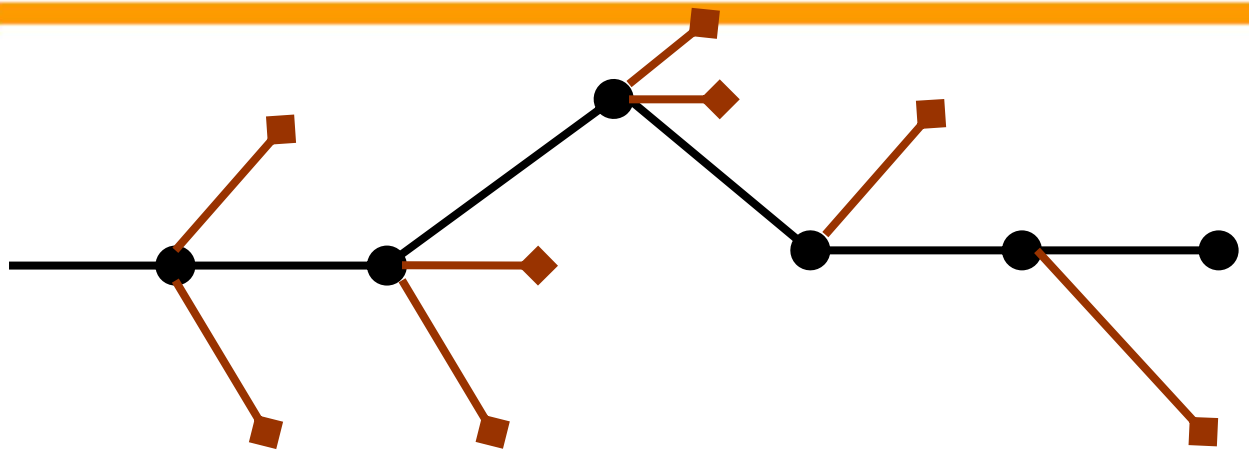
Network Evolution
MPLS Core network

- Services challenges
  - Transport for Next Generation Voice platform
  - Transport services for Video applications
  - Transport services for BTC Mobile (Vivatel) 3G network (CsC)
  - Services – L2 and L3 VPN services
  - Transport services for high capacity Internet services (wholesale)
  - Transport for broadband services

- High requirements for
  - High Reliability
  - QoS for realtime
  - QoS for low packet loss
  - Fast Convergence
  - multicast efficiency

- Scalability
- Cost effective future upgrades
- Reduction of TCO per Gbps

Network Evolution
MPLS Core network



- Technology challenges for Core network
  - Integrated DWDM
  - IPoDWDM
- Implemented network layers – IP/MPLS over DWDM. Integration of transmission network in MPLS core routers

- Implemented topology – full mesh in core, partial mesh in edge
- Protection mechanism – MPLS FRR and fast convergence
- Services –MPLS VPN services (L3 VPN, L2 VPN)
- QoS –QoS for voice, business data and best effort traffic.

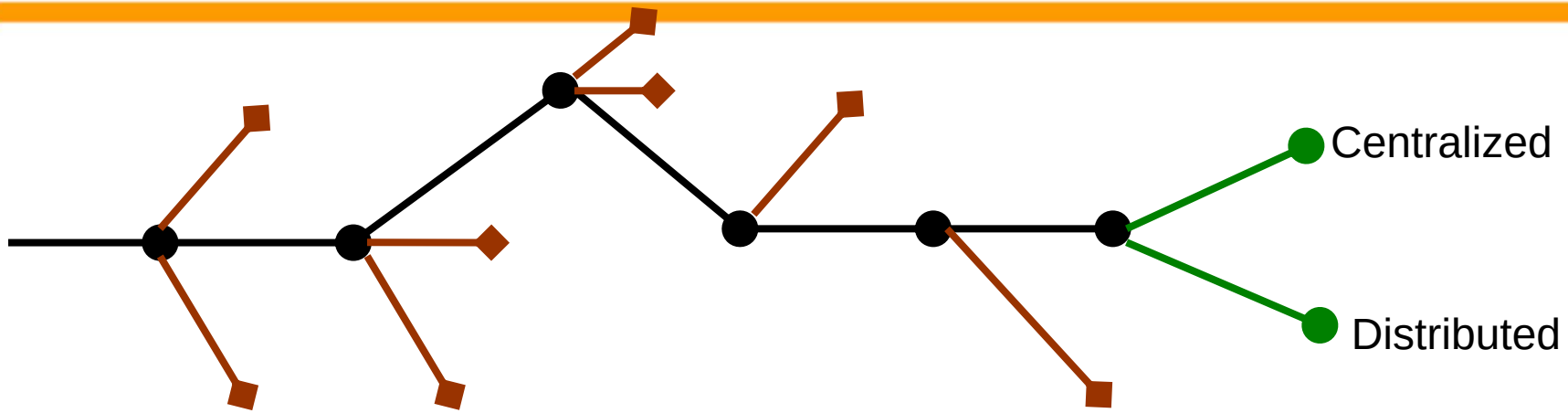
Network Evolution
Broadband aggregation

- Services challenges – capability for multi-play services

	Services	technology challenge
Data	Internet access	Best effort, high capacity
Voice	VoIP applications	QoS for ensuring low delay, low jitter
Video	IPTV and VoD	Multicast, QoS ensuring low packet loss

Same challenges –
Different approaches to solve

Network Evolution
Broadband aggregation



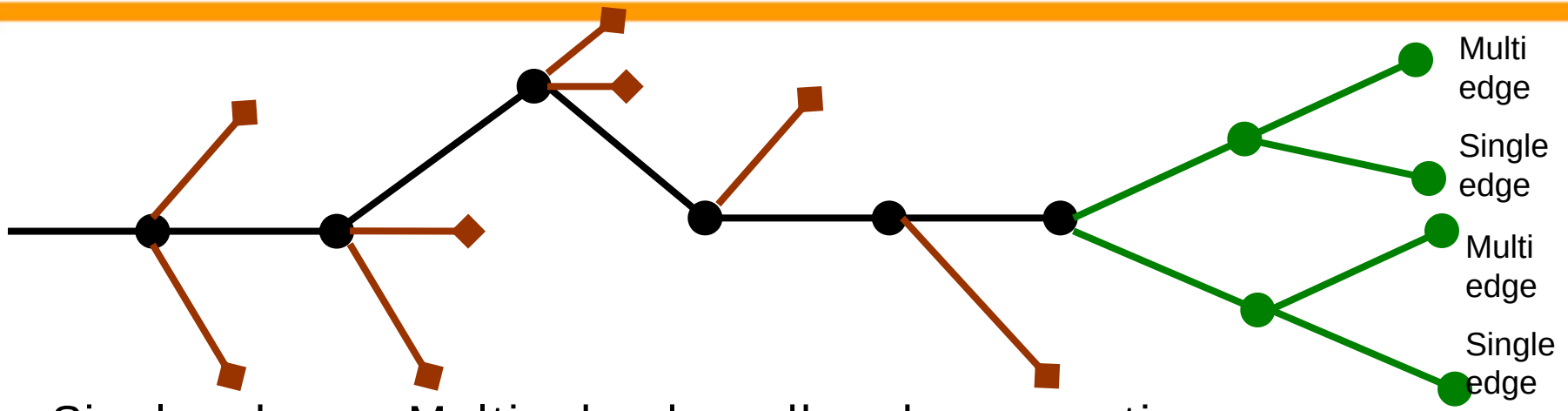
Centralized vs Distributed broadband aggregation

- Drivers for centralized broadband aggregation:
  - ATM network aggregation
  - Small and strongly distributed subscriber base

None of the above is valid today

- Centralized edge architecture is promoted mainly by BRAS and edge router vendors
- Distributed edge architecture is promoted mainly by suppliers of Carrier Ethernet equipment

Network Evolution
Broadband aggregation

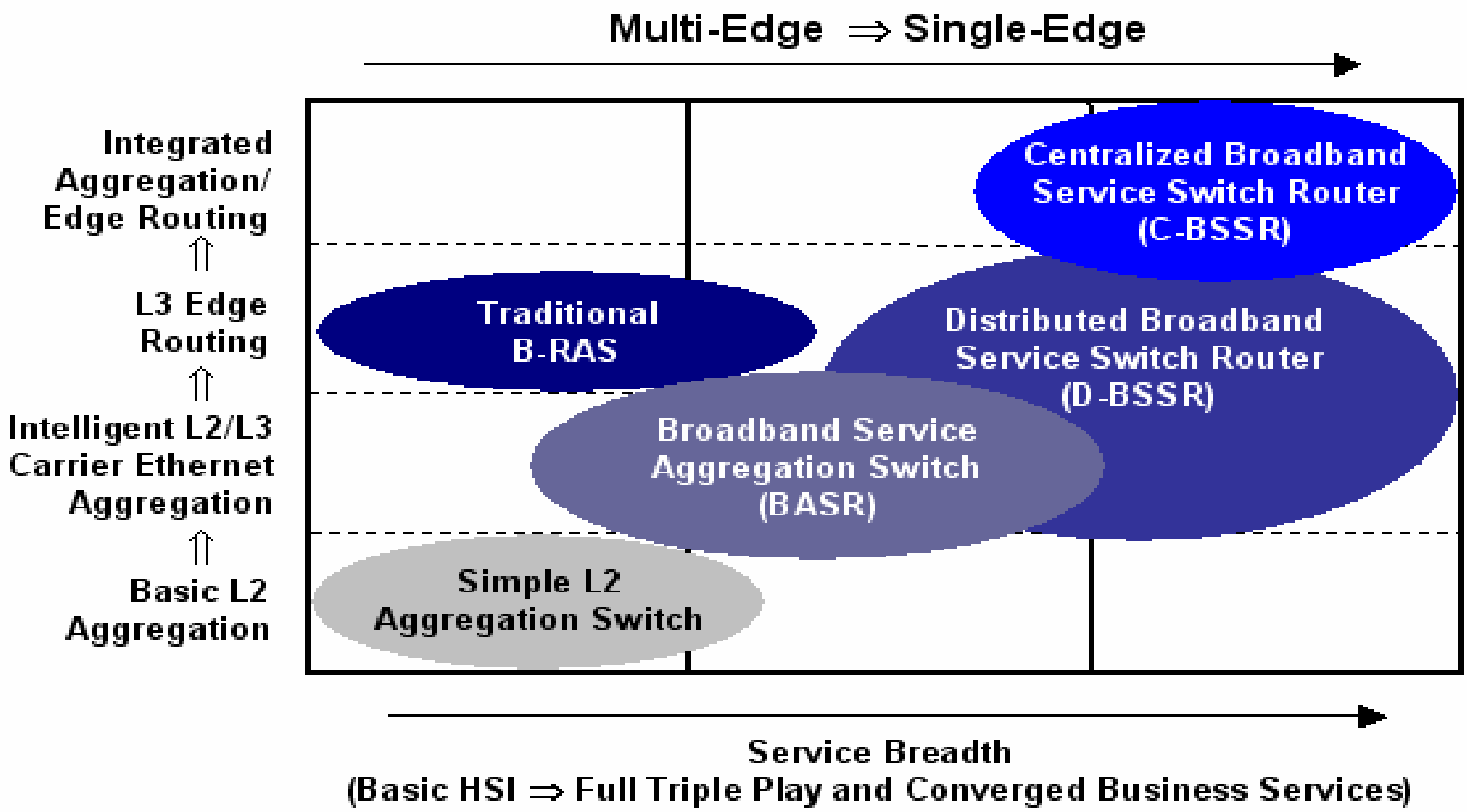


Single edge vs Multi edge broadband aggregation

- Single edge architecture consolidates all services in a single node
  - Single control point for all services
- Multi edge architecture uses separate nodes for separate service
  - Multiple control points

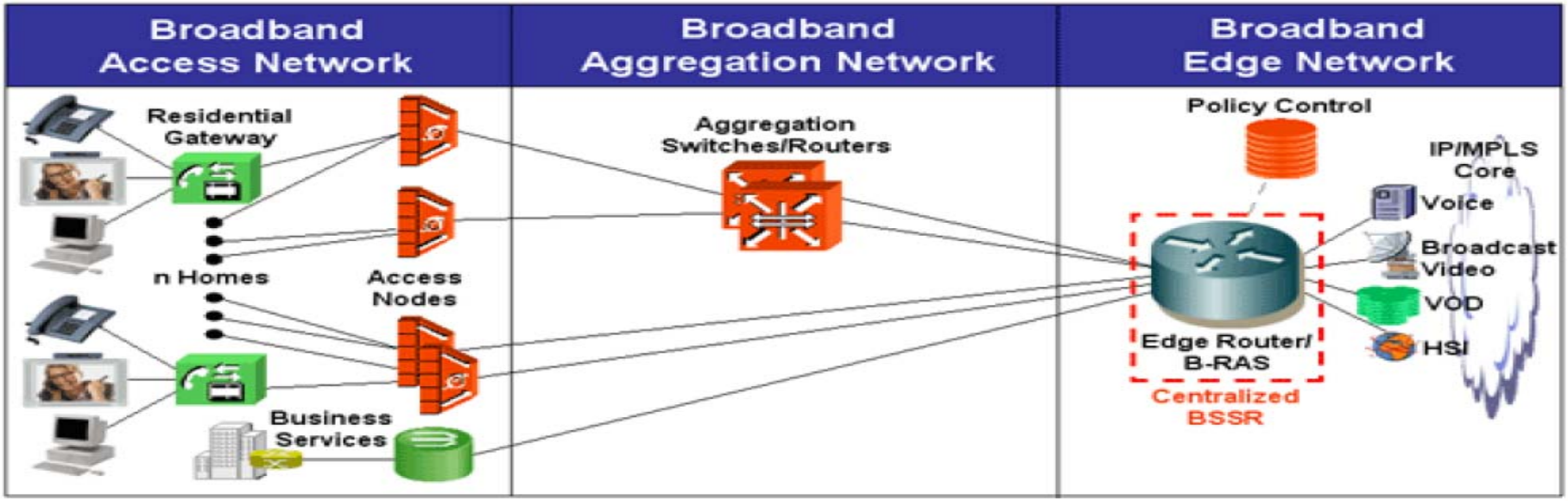
Multi edge provides specialized solution for more specific services – business services.

Network Evolution
Broadband Edge Taxonomy



Source: Heavy Reading

Network Evolution
Broadband aggregation

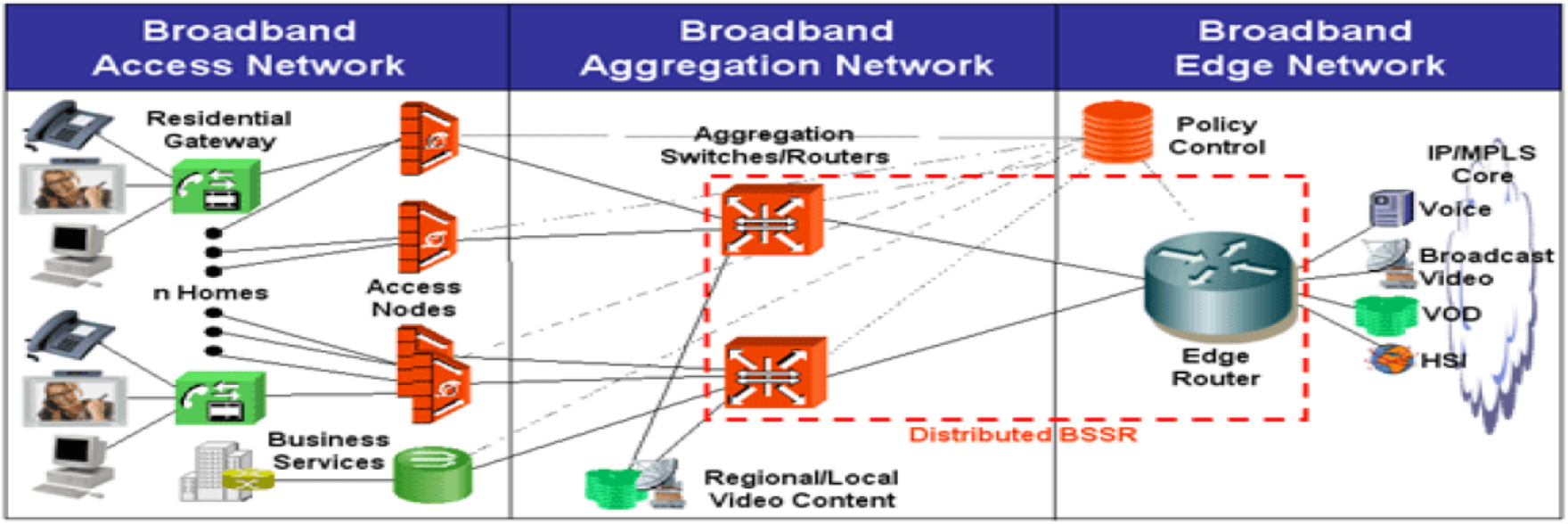


Source: Heavy Reading

Centralized Single Edge broadband aggregation

- Similar to legacy (ATM) edge architecture
- Enforce QoS for all services
- Capable for multiple service – Internet, residential voice, video, data and convergent enterprise services

Network Evolution
Broadband aggregation

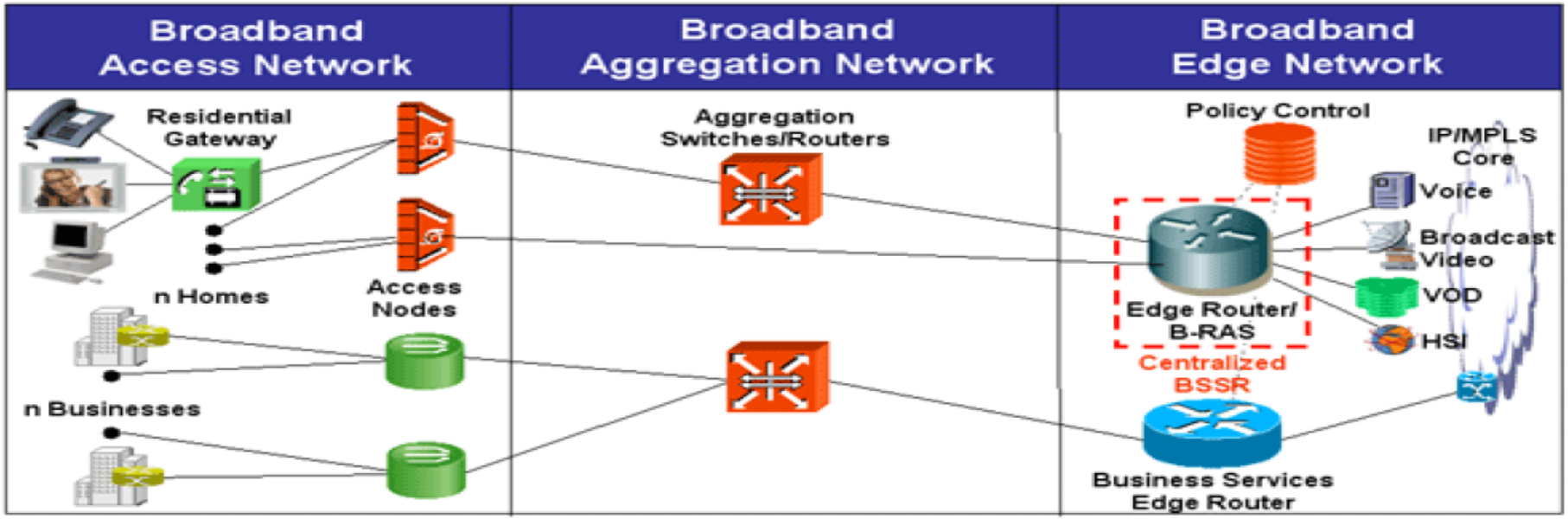


Distributed Single Edge broadband aggregation

Source: Heavy Reading

- Distributed control points between IP edge router and Gigabit Ethernet aggregation switch
- Evolution from traditional service architecture – intelligent and scalable managed services
- QoS is enforced in distributed manner and managed by policy management system
- Optimized for new services as IPTV

Network Evolution
Broadband aggregation



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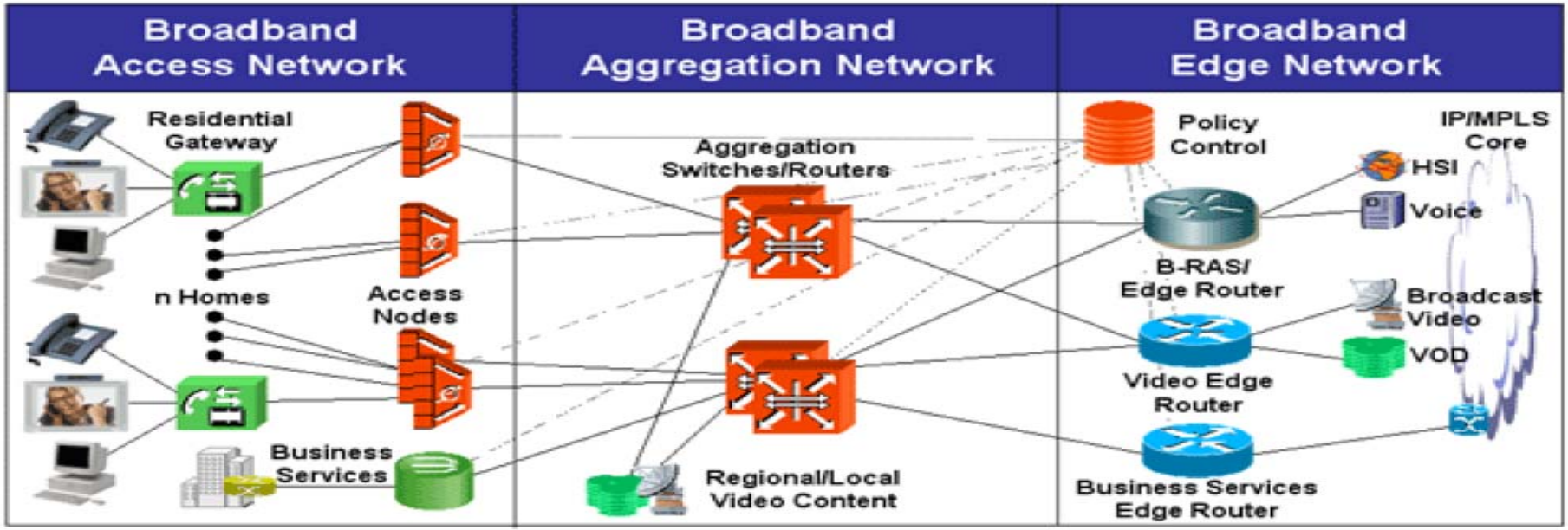
Centralized Multi Edge broadband aggregation

- similar to centralized single edge
- better support for business services – dedicated boxes for different services
- overcome vendor limitations by deploying optimized equipment

Network Evolution
Broadband aggregation



Source: Heavy Reading

Distributed Multi Edge broadband aggregation

- similar to centralized multi edge
- better support for business services – dedicated boxes for different services
- overcome vendor limitations by deploying optimized equipment
- more hybrid variants are possible

Next Generation Access

Broadband access – outline evolution challenges

- xDSL evolution to FTT(Node/Curb/Building/Home) – when?
- FTTx regulation uncertainty
- FTTx technology – PON or Active Ethernet?
- WiMAX and HSPA/LTE – convergence or coexistence?
- CPE – Distributed or Integrated?
- CPE – Managed or Unmanaged?

Q & A