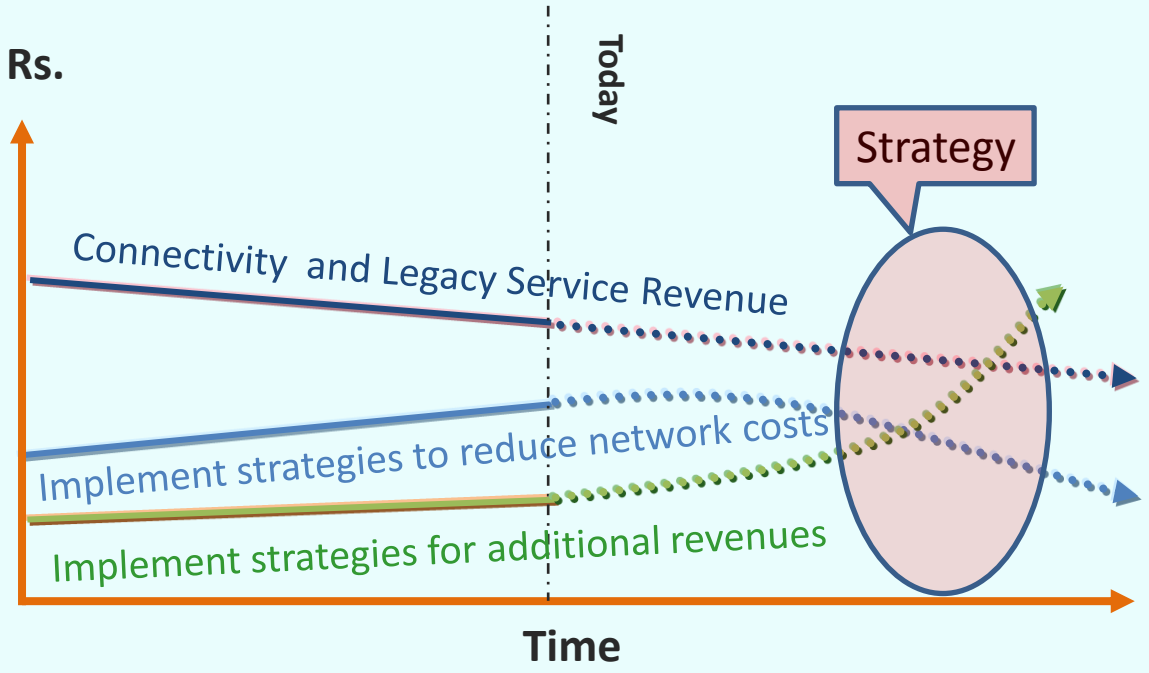
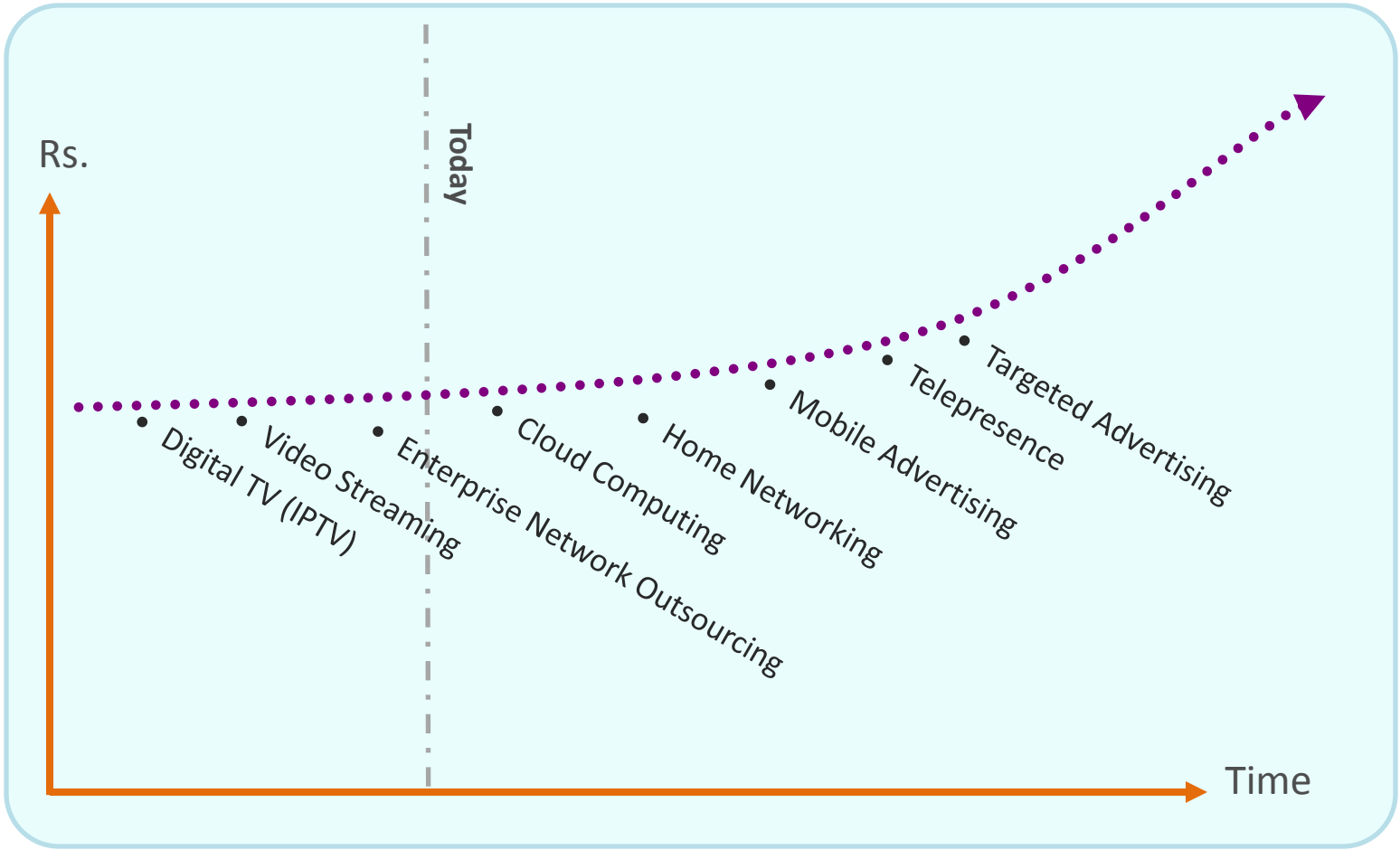
NGN framework – Part II

Corporate Planning & Monitoring Cell, BSNL

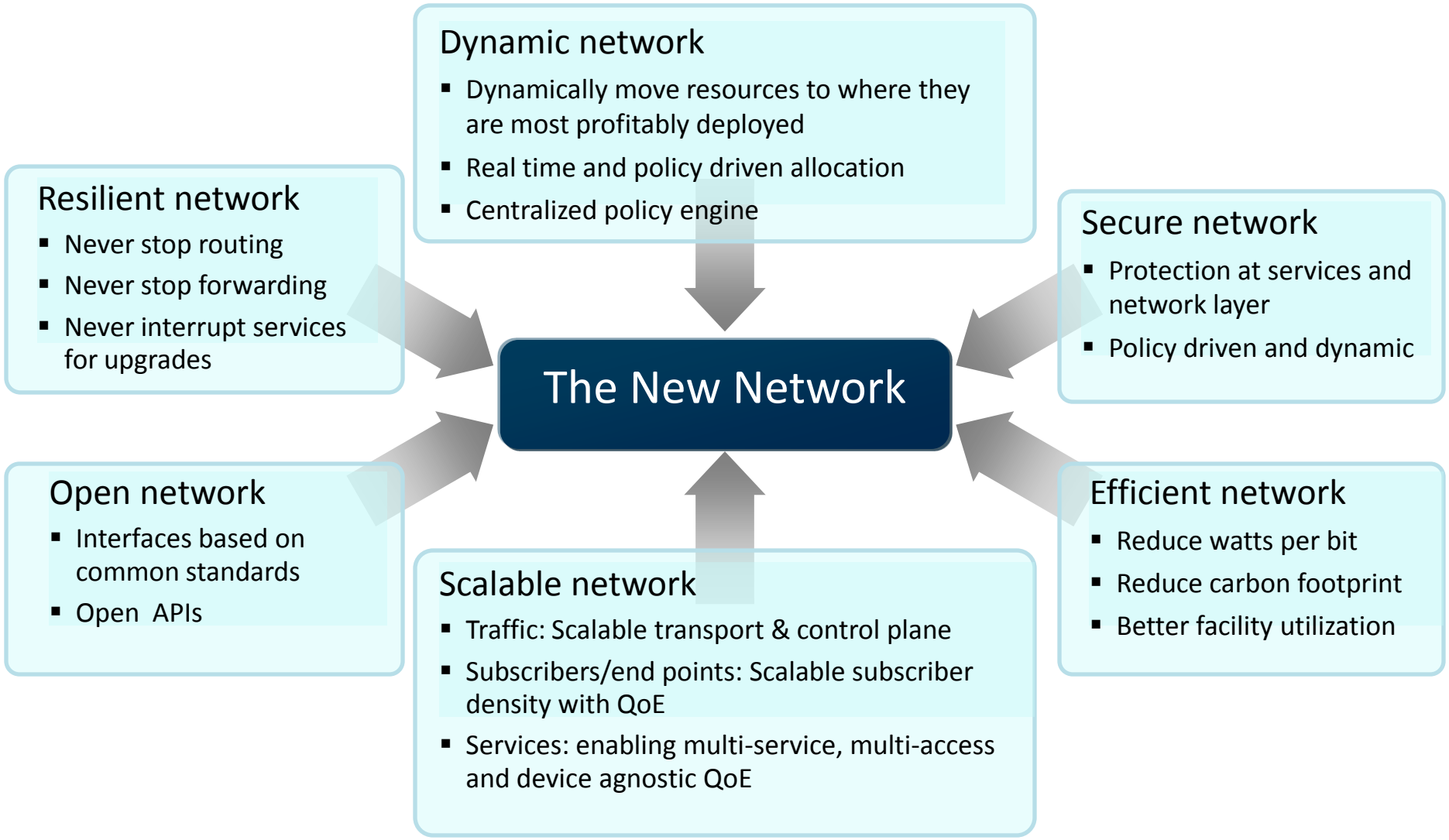
What options? What strategy?



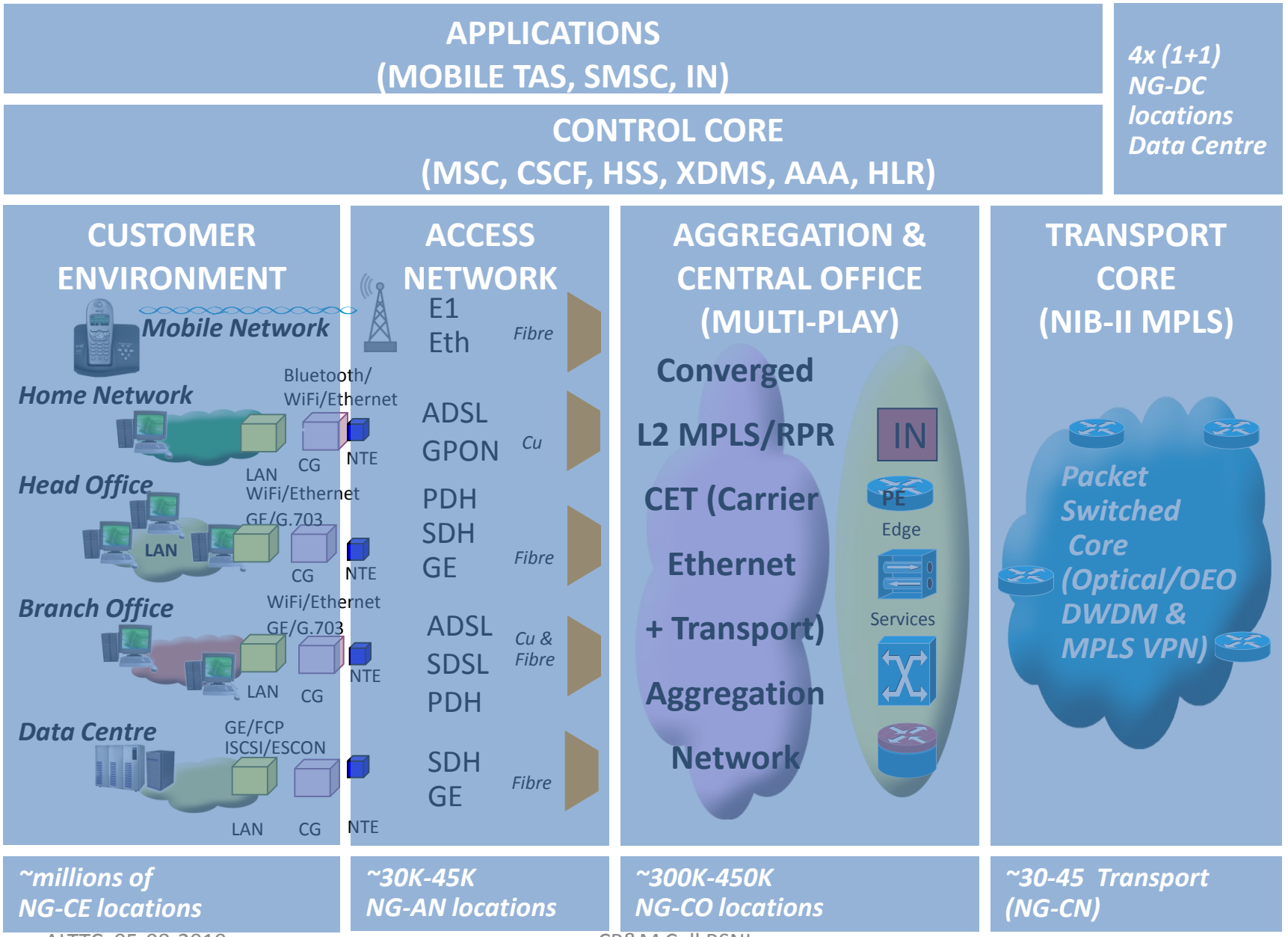
An NGN framework architecture alone can support enablement of newer services



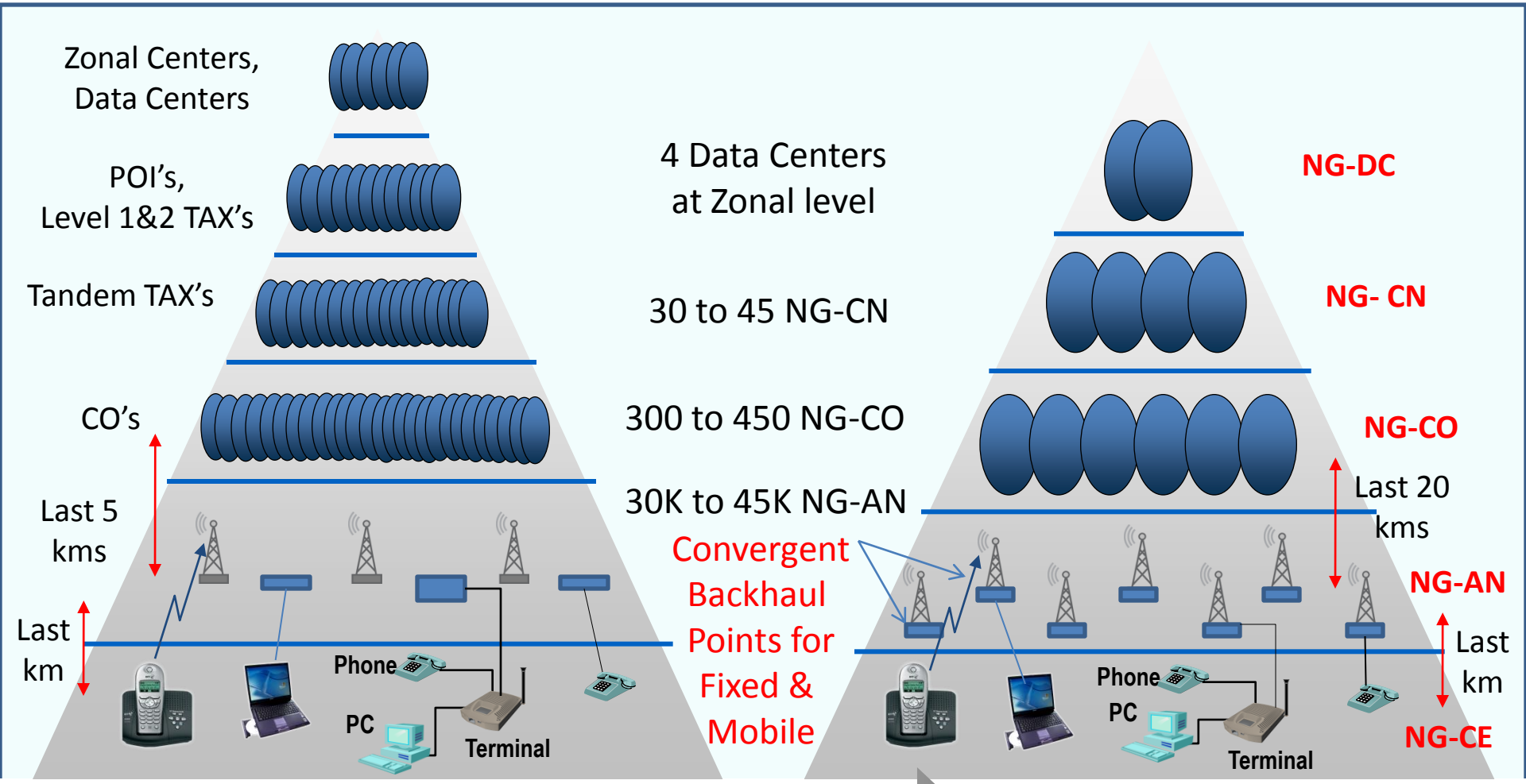
Requirements of an NGN framework architecture



NGN framework high level network node architecture

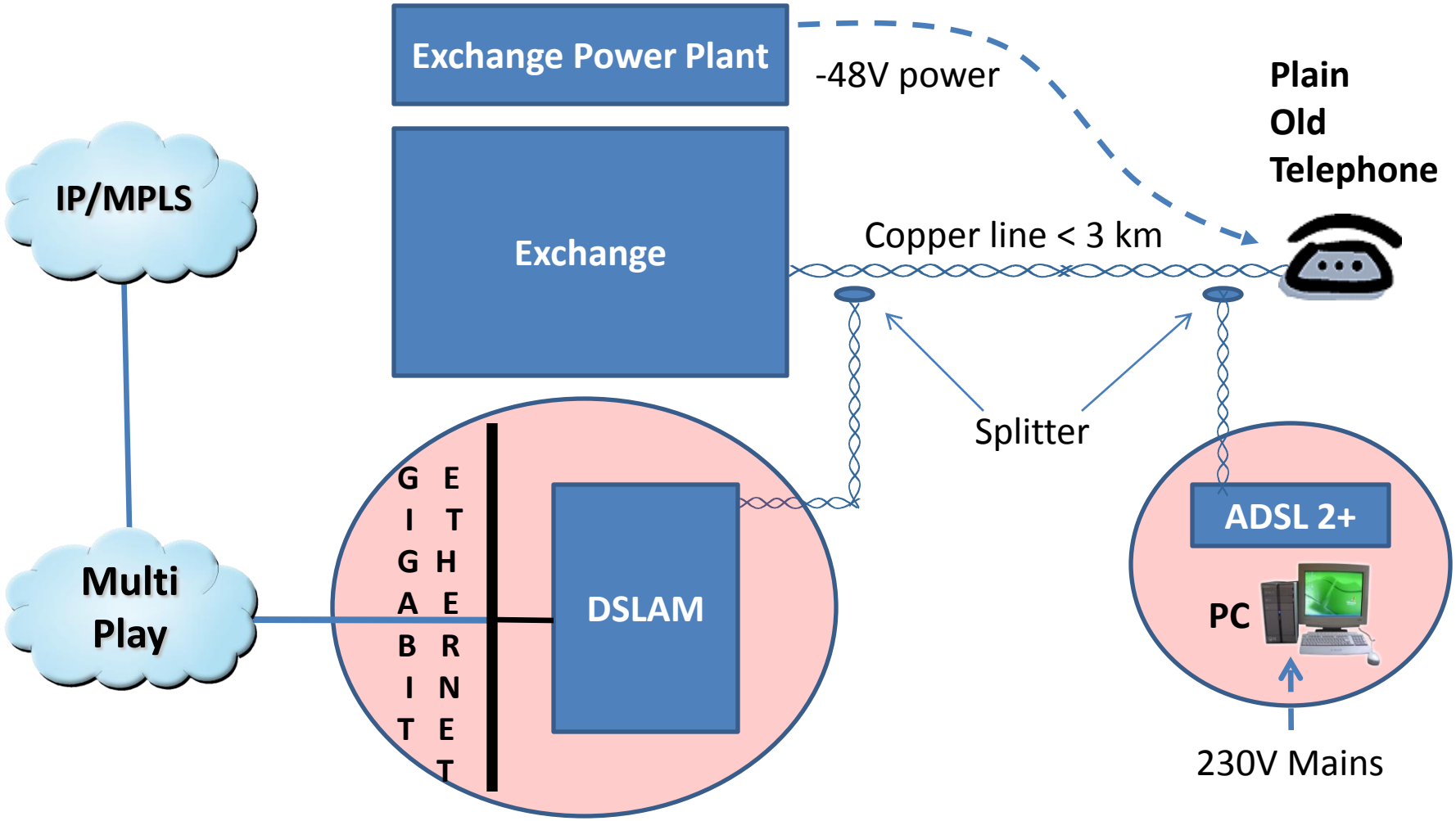


FACILITIES CONSOLIDATION



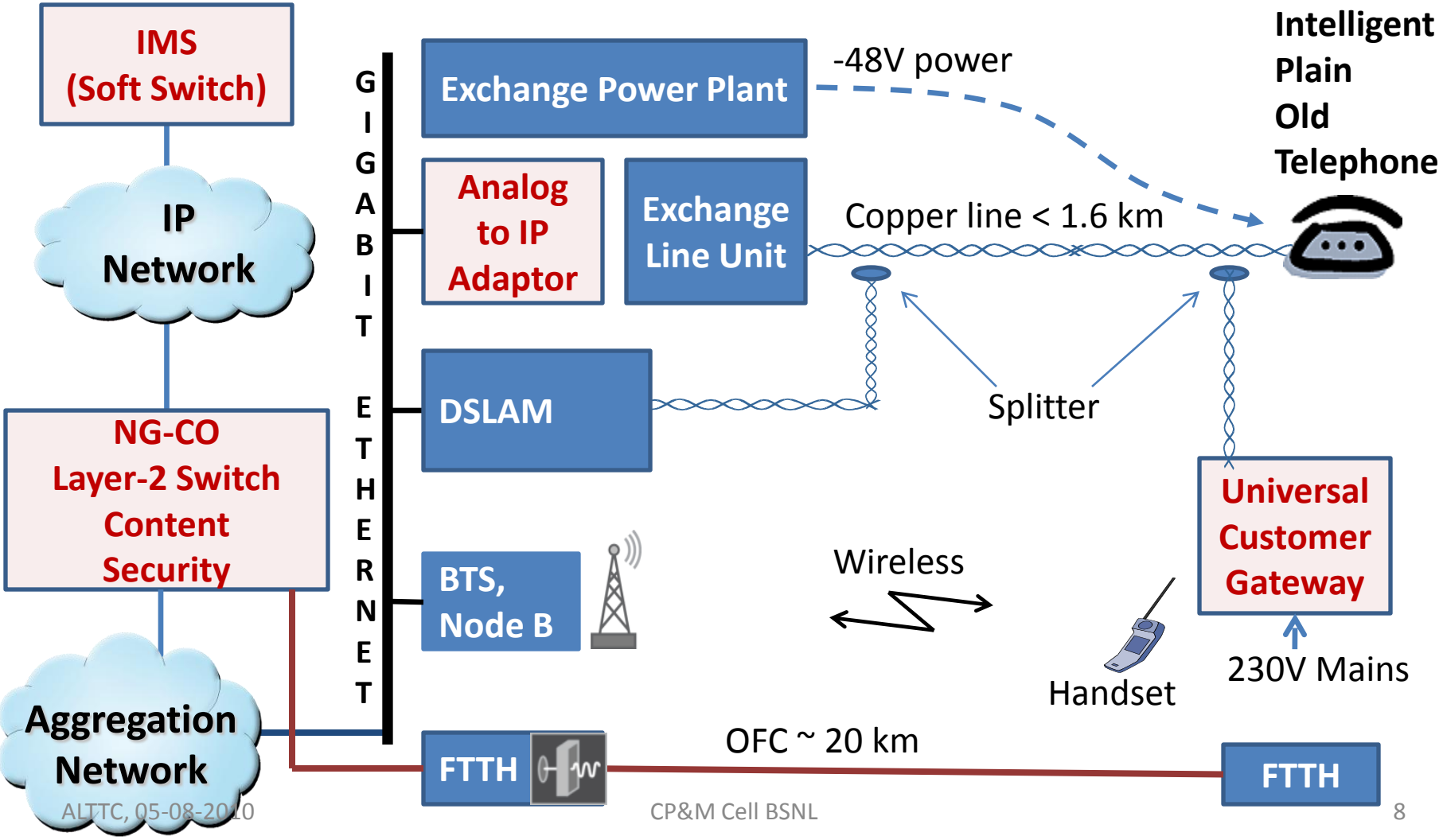
Economies of scale and service enablement through Central Office consolidation

Fixed Access network - **today**



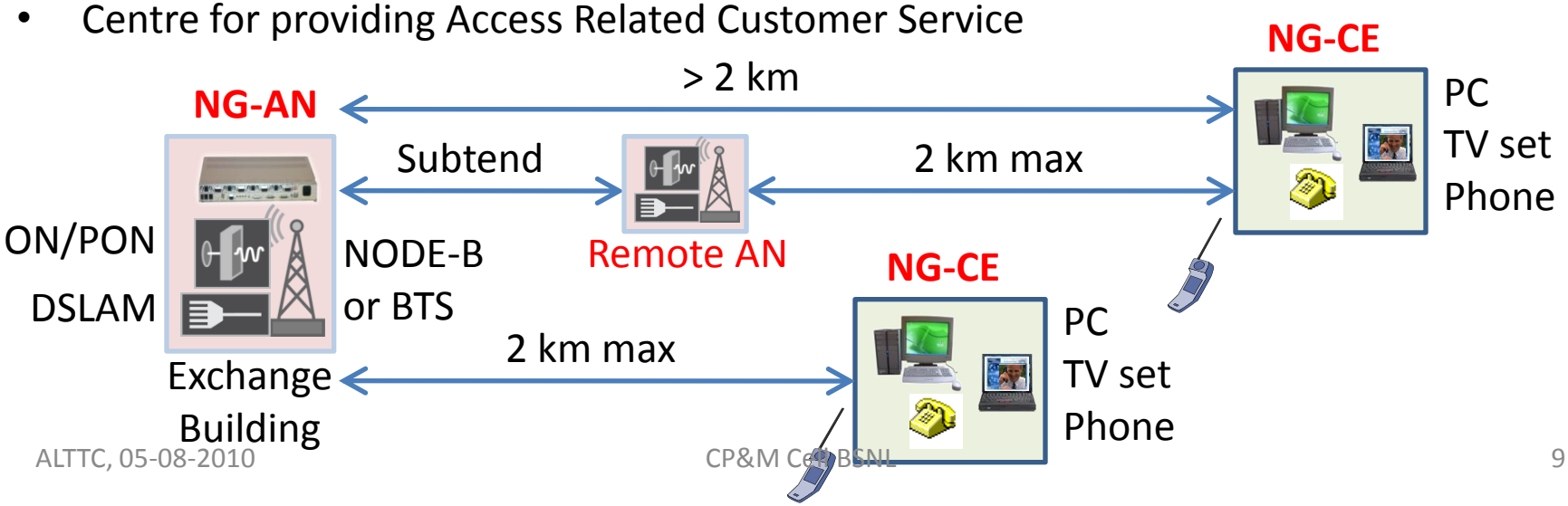
Converged Access network - tomorrow

Local Exchange becomes an NG-Access Node



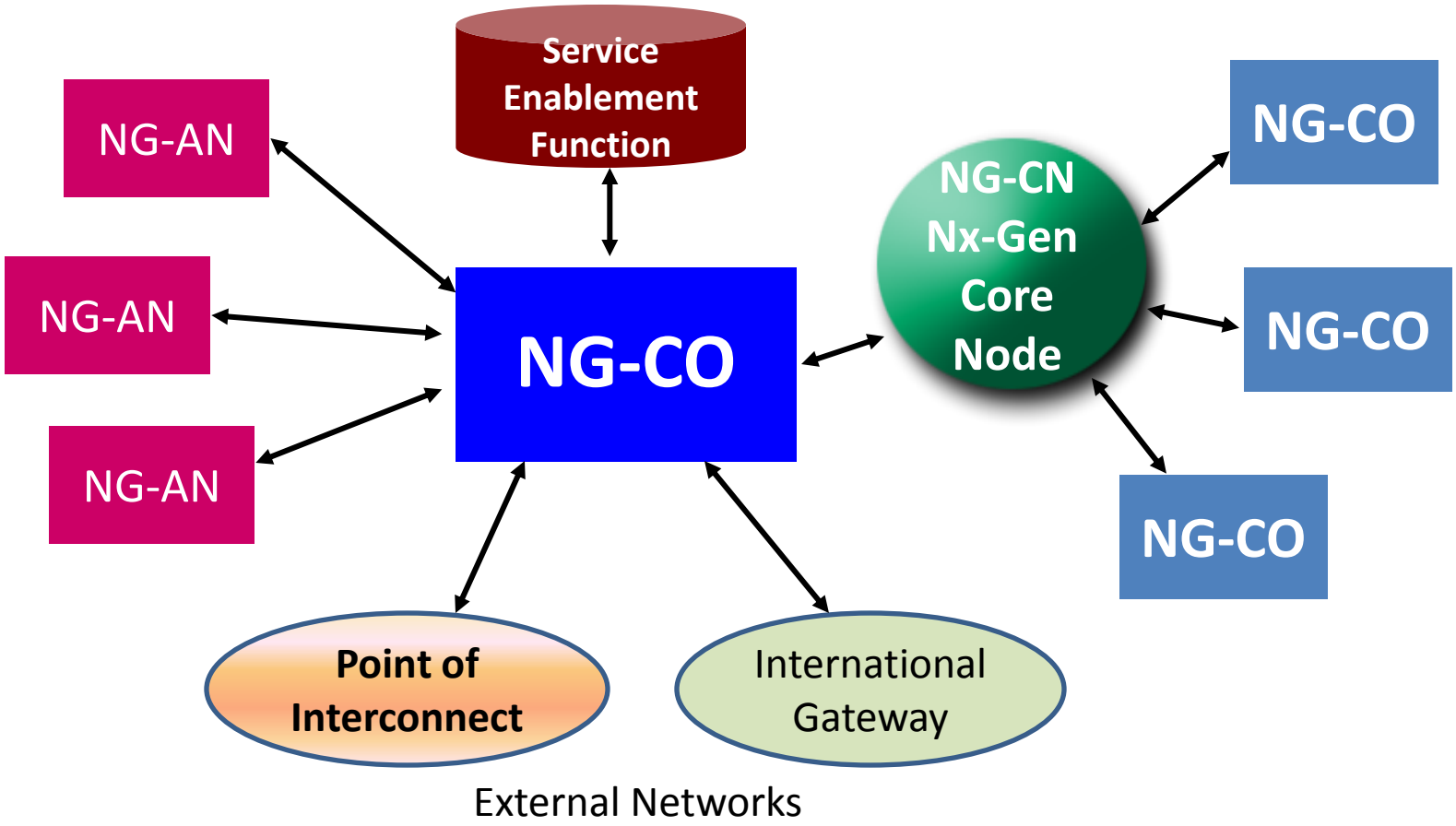
NG-AN functions

- Erstwhile Telephone Exchange Building
- Re-christened as NG-AN, it serves as Aggregation point for all access technologies:
  - Node-B
  - DSLAM serving up to 2 km coverage area from exchange
  - GPON
  - OLT
  - MSAN, ADM, PDH mux
- Subtends Layer-2 services to remotely located Access Node (Remote AN) to serve coverage area beyond 2 km (up to ~5 km)
- Provides a breakout point for Optical Network / Passive Optical Network
- Provides backhaul for both mobile and land line aggregation over converged MPLS/RPR/CE
- Centre for providing Access Related Customer Service

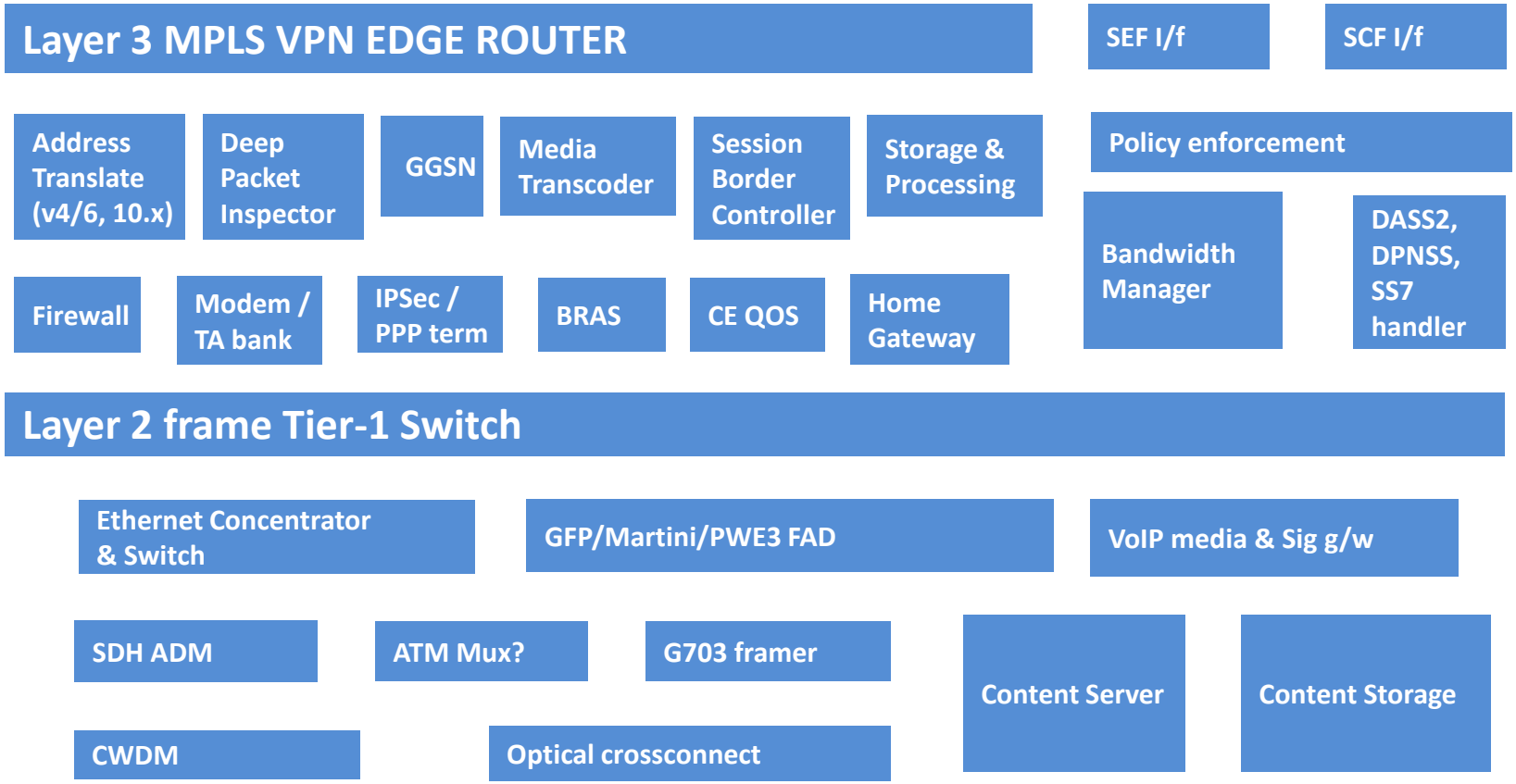


The NG-CO or Metro node

…converts data streams into services

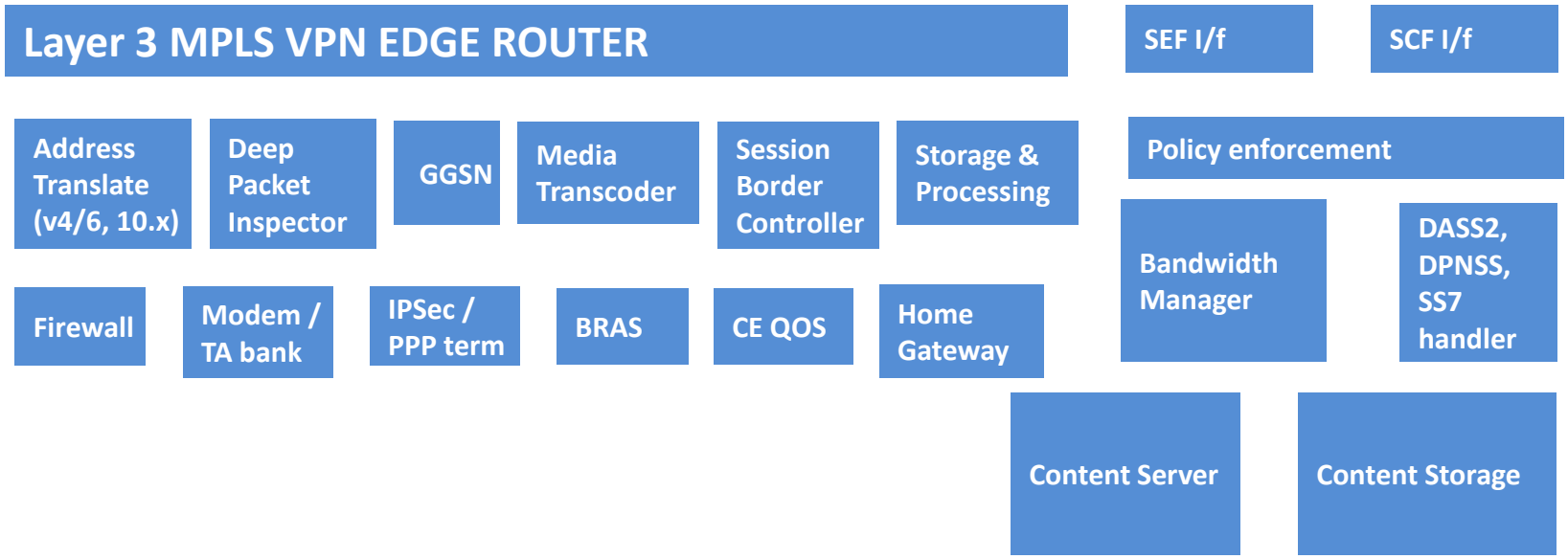


Metro node **today**



Multiple switching technologies at metro node

Metro node **tomorrow** (Next-Gen Central Office or **NG-CO**)



Multi-service aggregation done at NG-AN
At NG-CO, Tier-1 switch is fully packetized

Next Gen - Central Office has 5 network functions

Aggregates
~ 400K subs
Scalable to 4mn.

Routing & Transport
- Scale control plane
- IP/MPLS and Optical Integration
- 100GE Support
- Non-stop operations

Packet handling & Security
- Multi-layer security protecting apps/services and infrastructure
- Scale subscribers, sessions and bandwidth

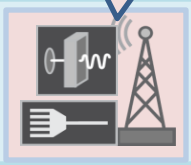
Non-blocking Switch Fabric
Interconnect supporting standards based interfaces to connect both networking and IT resources

Content Servers & Storage
- Caching & delivery of popular content/application
- Dynamic & network aware content delivery

Subscriber/Enterprise Service
- Consolidate business, residential, fixed and mobile access in Unified Edge
- Scale subs, traffic & services

Fixed Mobile Convergence

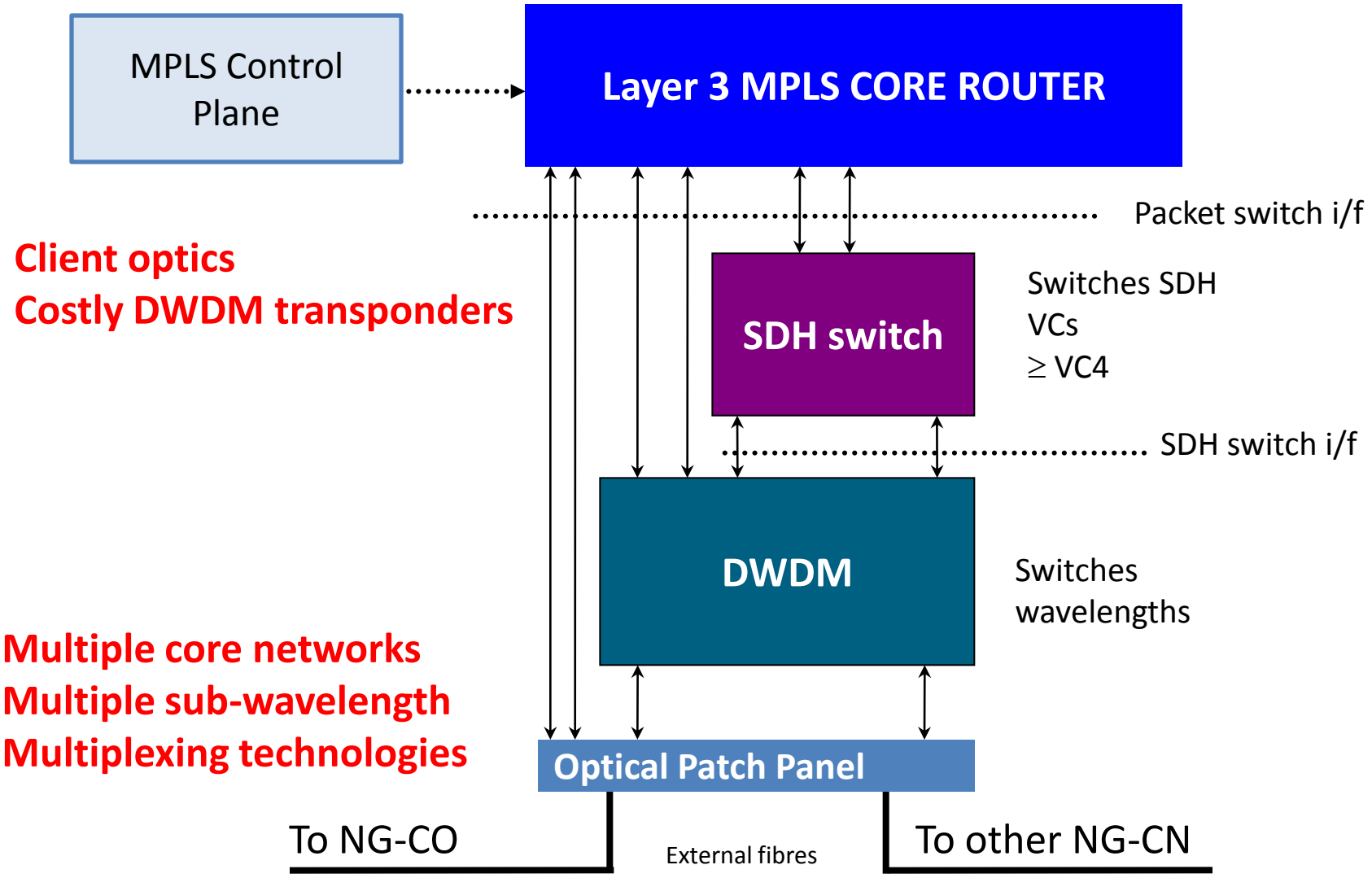
ON/PON
DSLAM



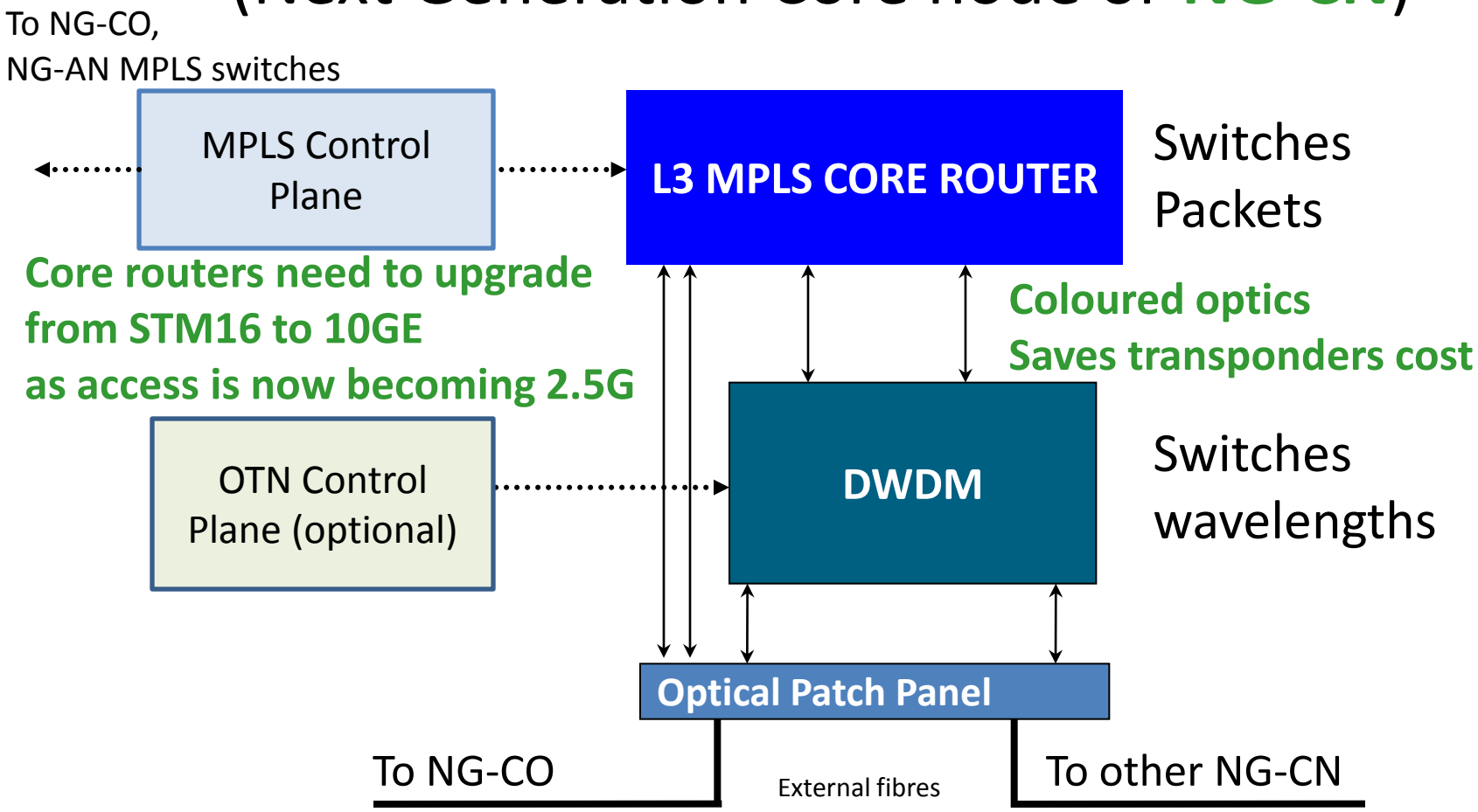
NODE-B
or BTS

Next Gen - Access Nodes

Transport Core node **today**

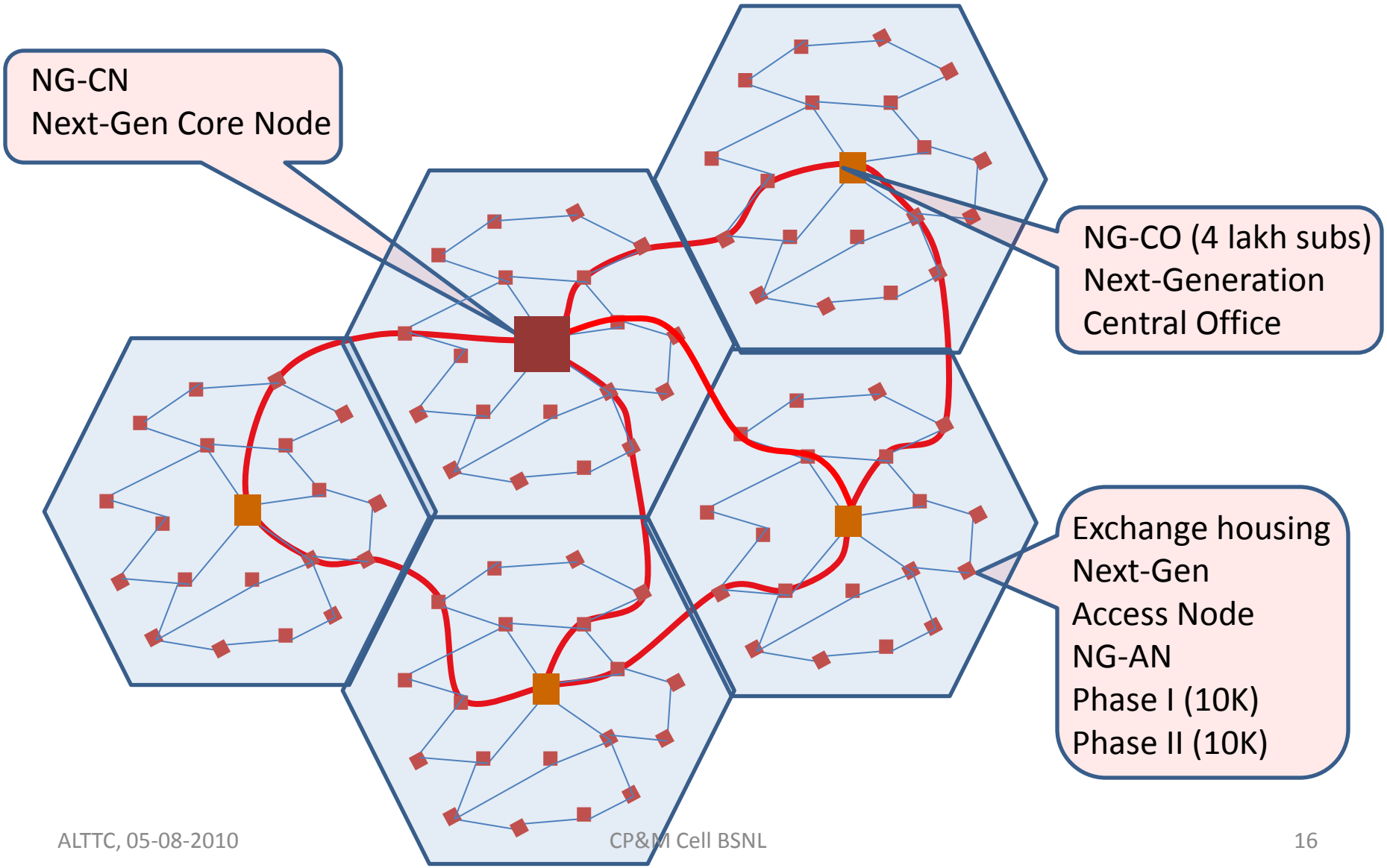


Transport Core node **tomorrow** (Next Generation Core node or **NG-CN**)

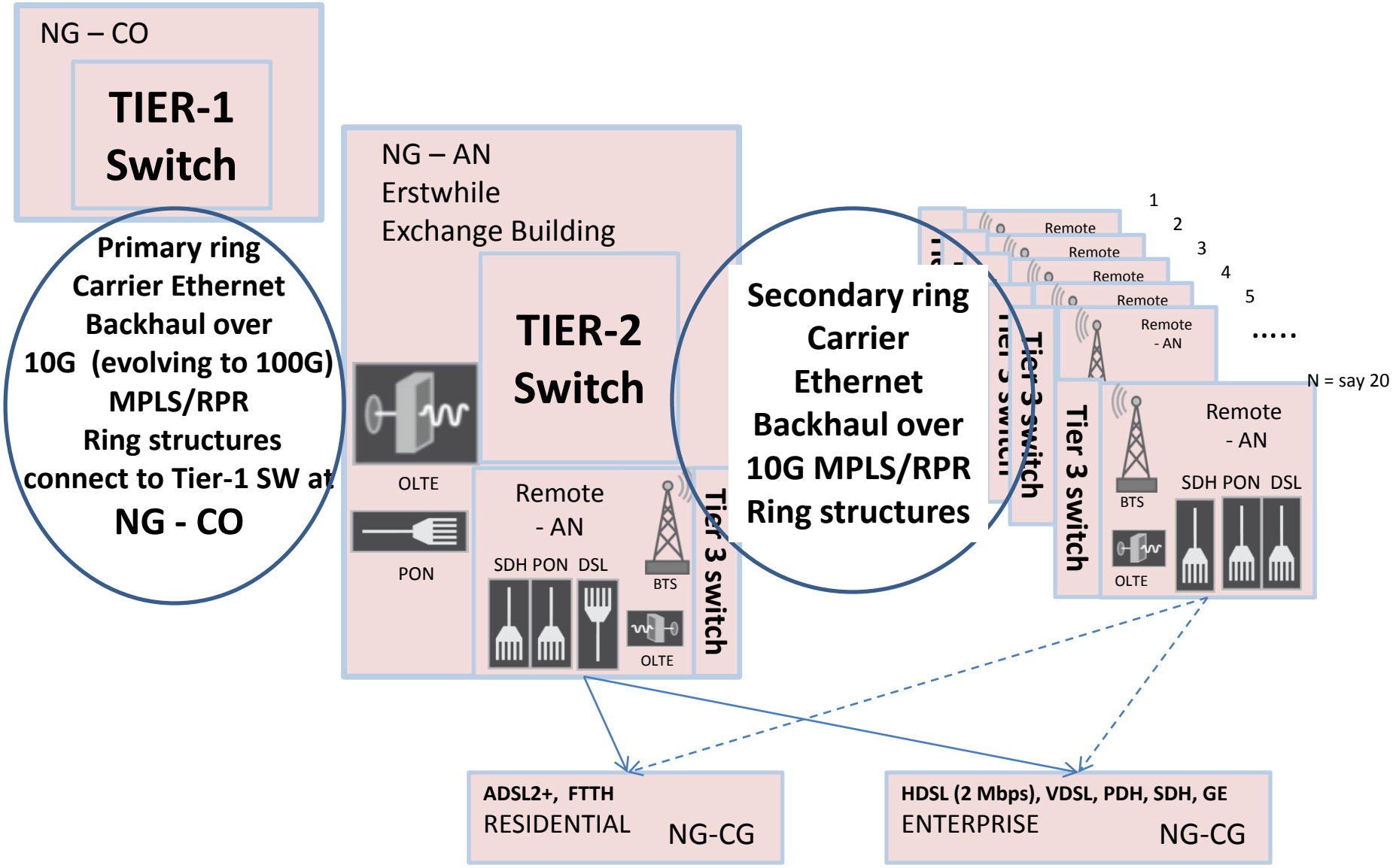


Multi-service aggregation done at NG-AN
NG-CN has only packet and wavelength switching

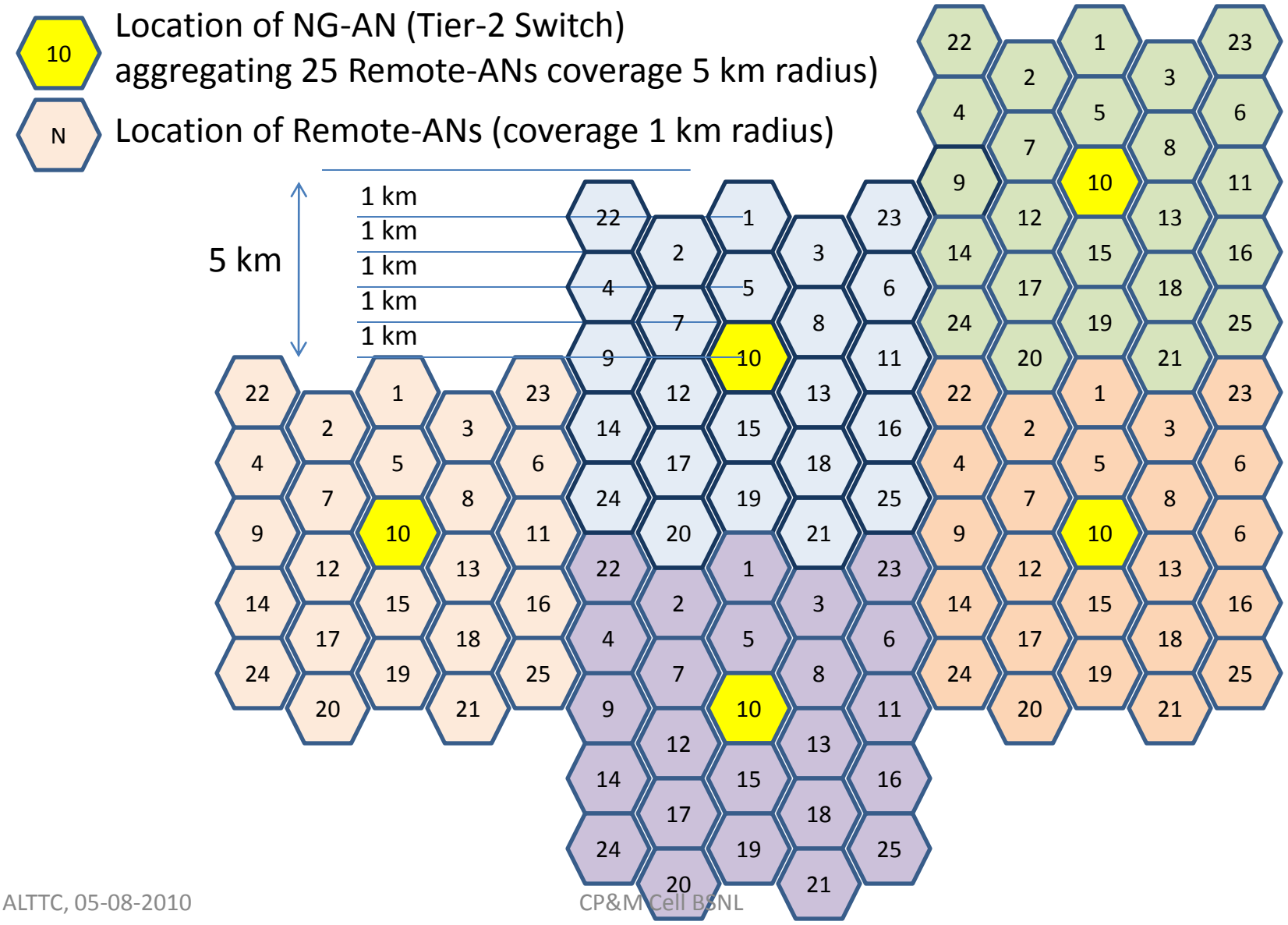
Interconnection model for NxGen-Nodes



Aggregation of “Remote – ANs”



Aggregation of Remote-ANs at NG-AN



NxGen Unified Transport Architecture

- Converged Layer-2 aggregation network
- Extend MPLS up to NG-AN
- Circuit Emulation over Packets:
  - SDH over MPLS using CEP (RFC 4842)
  - PDH over MPLS using SAToP (RFC 4553)
- Mobile backhauling over MPLS
  - 2G using SAToP, 3G/WiMax/LTE using Ethernet
- MPLS control plane
  - Multi-vendor interoperability
  - End to end MPLS tunnels from L2-MPLS and L3PE
    - NG-AN → NG-CO → NG-CN → NG-CO → NG-AN

Transport Core requirements

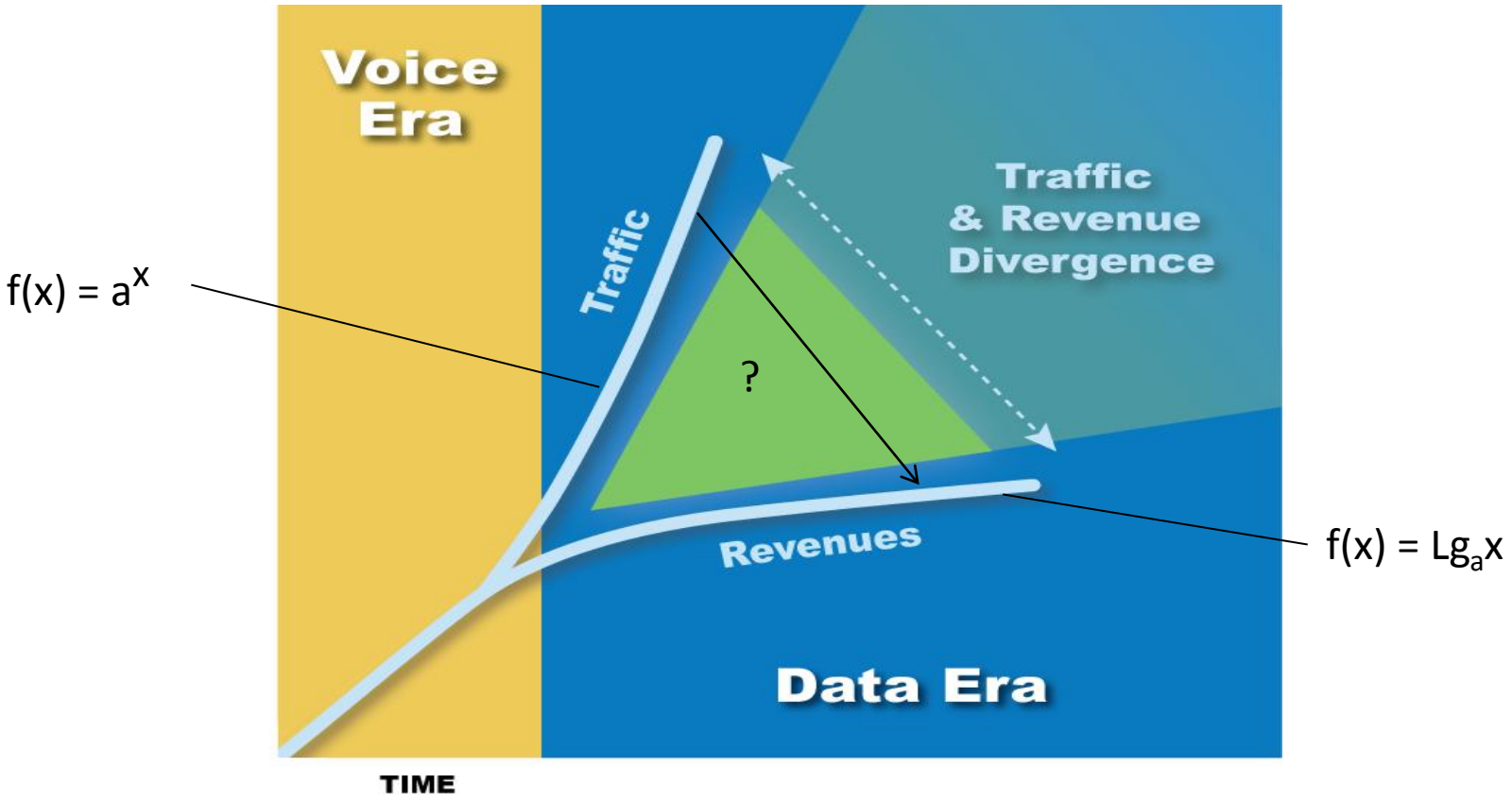
- Optical Control Plane
  - Restoration:
    - Fast protection schemes using ITU-T G.841,
    - Control plane protocols as defined in ITU-T G.771x series.
    - Crank back, prioritised restoration
    - Resilient to both node and complete duct failure
  - No SDH switching – SDH transported over MPLS
  - Optical core only switches wavelengths
  - Sub-wavelength multiplexing is fully packetized
  - Jitter & Wander as per G.8251 (defines hops/SSU)
- MPLS
  - Core routers must be carrier class & operationally stable
    - 1 for n redundancy, modular software, hardware reliability, scalable
  - High Performance Packet Switch
    - Targets: 425us latency, 62 us jitter, max per hop
    - Supports ATM CBR SLAs, ETSI compliant circuit emulation & PSTN
    - 2.5 Gbps to10 Gbps interfaces
  - Must support connection oriented services

Key attributes of optical transport & MPLS core

- Optical Core
  - Use G.652 fibre
  - The same control plane & restoration requirements as SDH
  - Initially OEO moving to OOO
  - Initial clients are SDH switches & Routers
  - **With colored interfaces on routers, optical core can become OOO**

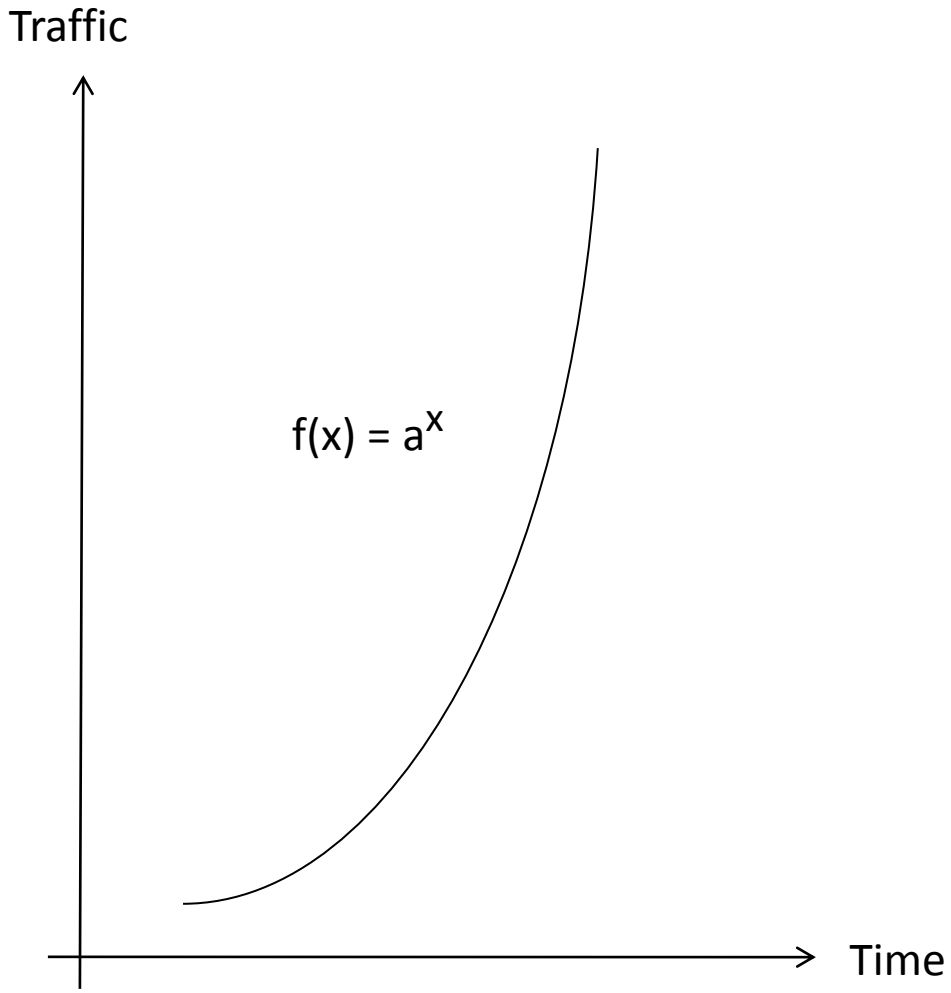
- MPLS Core
  - Switches **End to End MPLS tunnels** from NG-AN and L3PE
  - QoS to be DiffServ aware Traffic Engineering
  - Security
    - Must be impossible to hack from the Internet and by customers
      - Current solution is No native IP in the core apart from the control plane
  - OAM
    - Must be able to manage connections
  - Restoration at the appropriate network layers

NxGen Unified Control Architecture

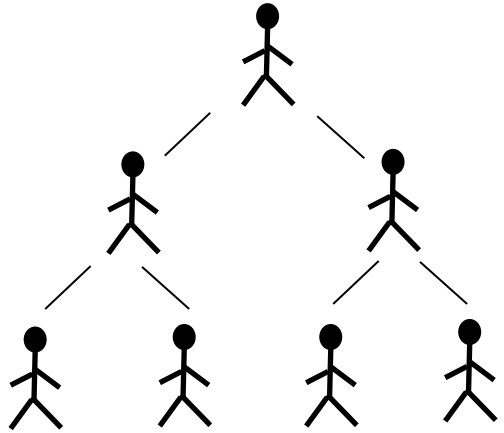


- Does CAPEX and OPEX have to follow the traffic growth ?
- How can Network Optimization help to close divergence ?

Traffic growth

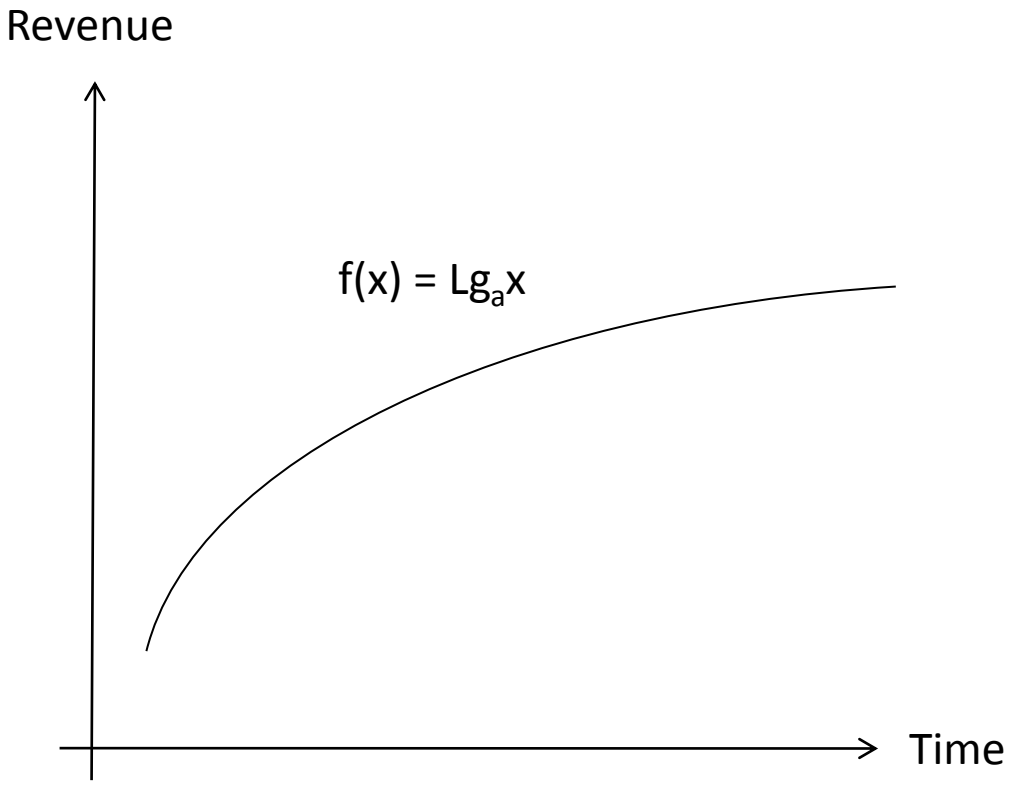


- Follows exponential growth patterns
- Applies to user plane and control plane (= signalling)



e.g. mobile usage

Revenue growth

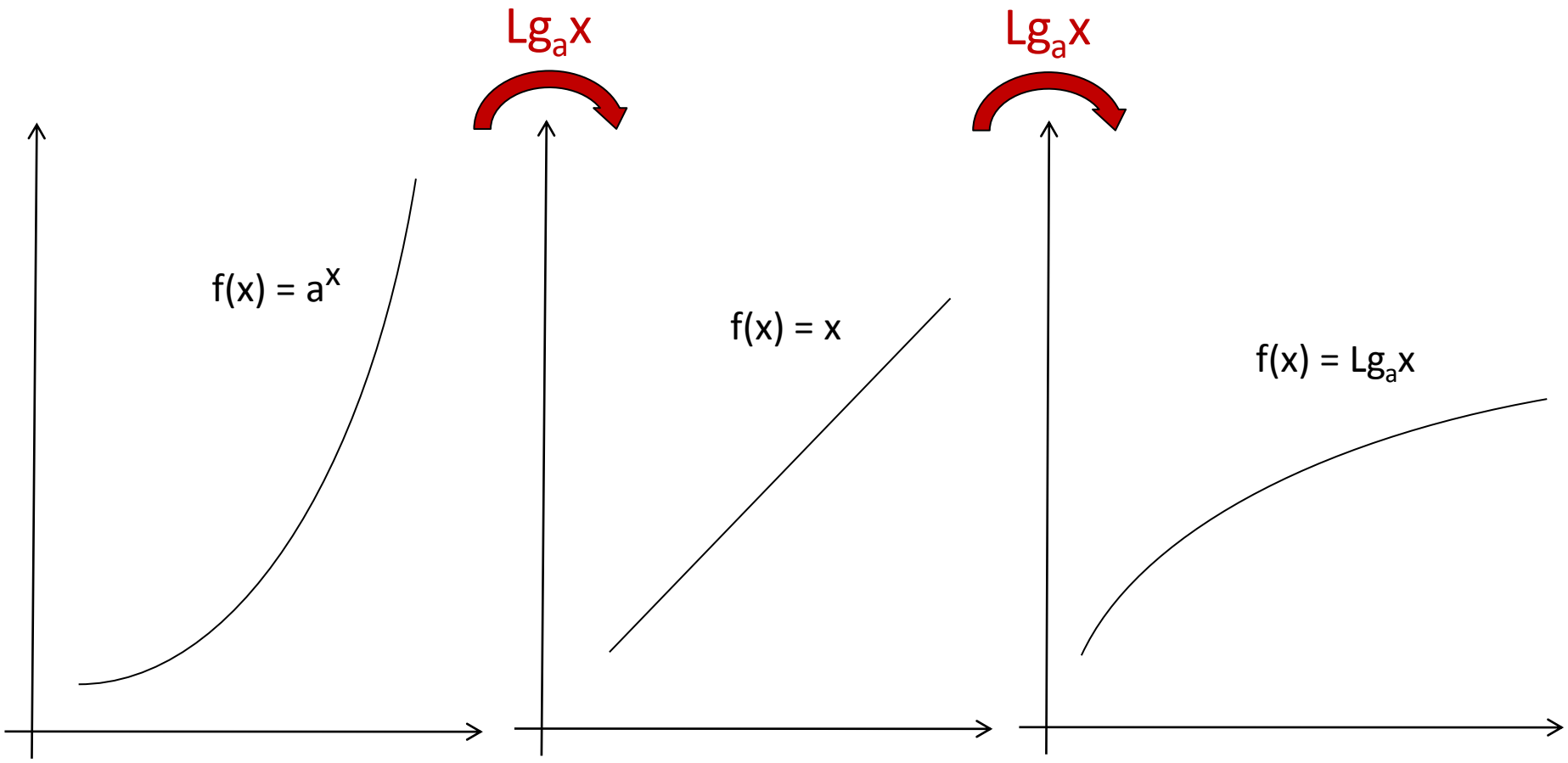


- Follows logarithmic growth patterns
- Caused by volume discounts and flat rate plans
- Further accelerates traffic growth

Creates the need for a controlled network growth

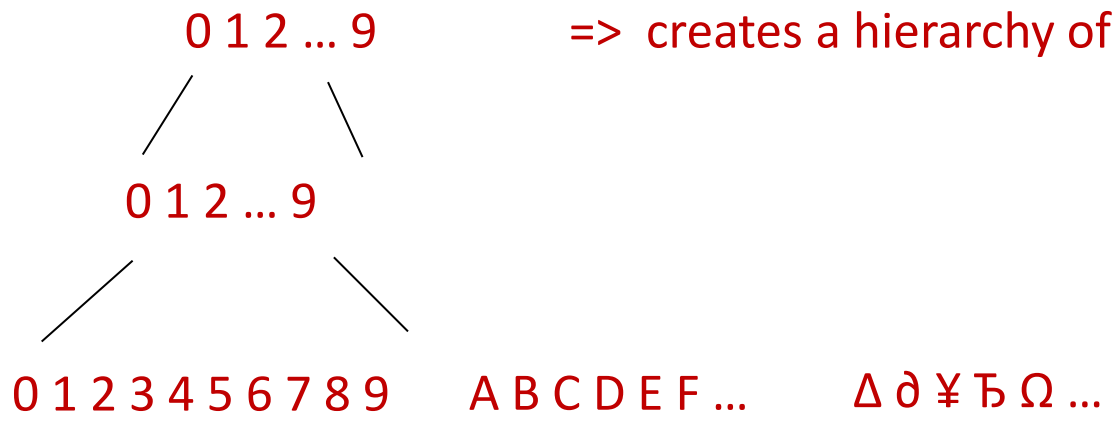
Solution approach

- How to avoid exponential CAPEX and OPEX growth in signalling networks ?



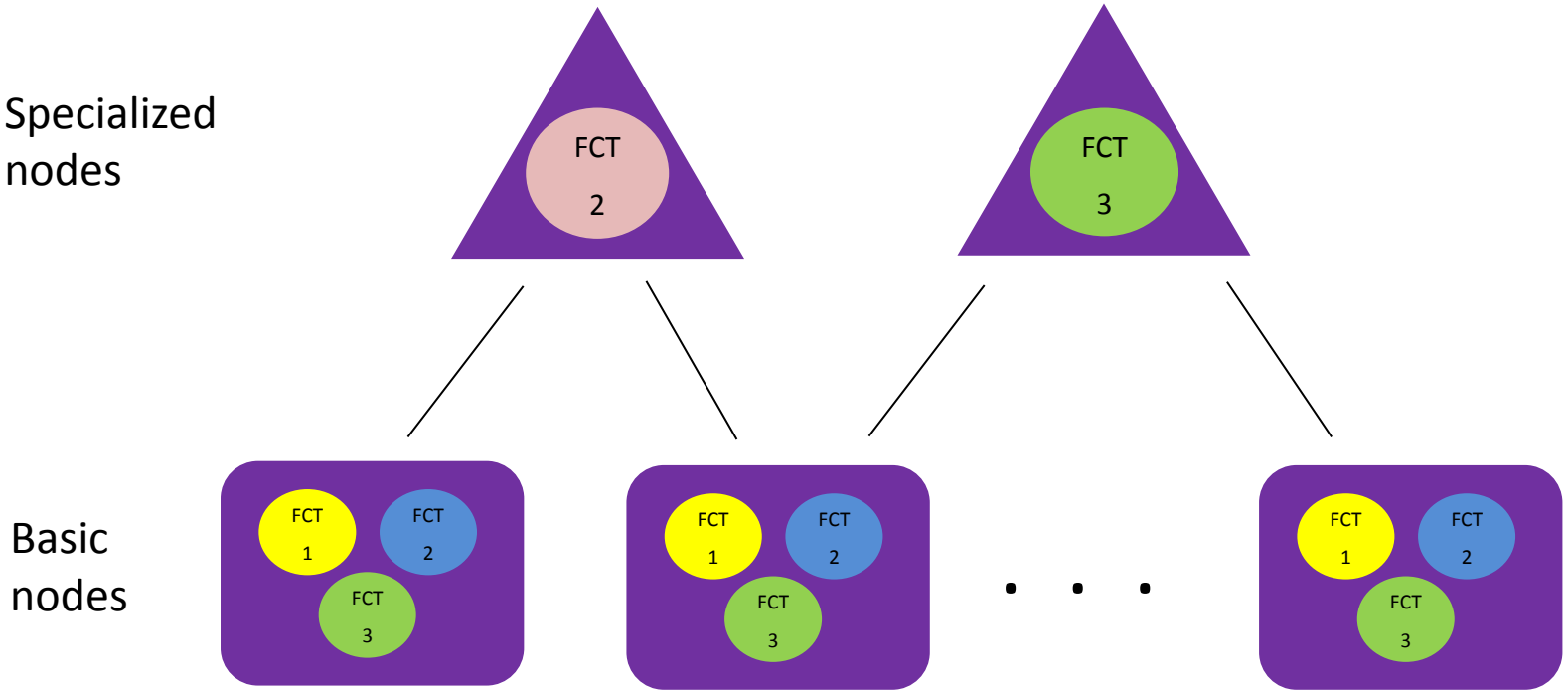
Taking the Logarithm of Numbers

- Logarithmic systems are hierarchical systems
- Decimal system is a typical example
- E.g. distinguish 1000 objects just by 3 decimal digits
  ($Lg_{10}1000 = 3$)



Taking the Logarithm of Network Elements (step 1)

- Create network hierarchies with specialized nodes
- SCPs, STP/SGWs or SMS hubs are typical examples in signalling networks

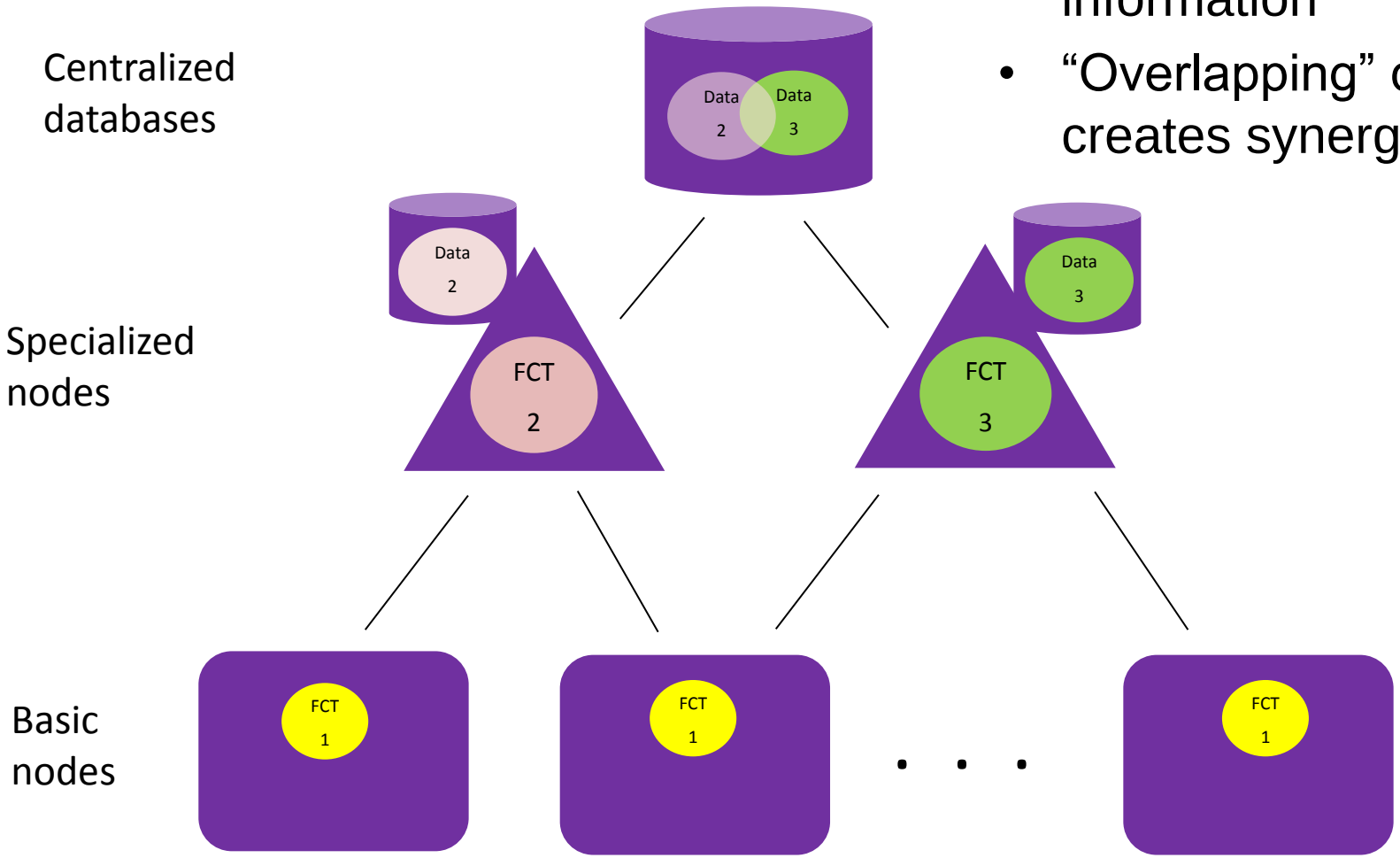


Supports a LINEAR network growth

Acknowledgement: Adapted from Tekelec Presentation

Taking the Logarithm of Network Elements (step 2)

- Centralize signalling information
- "Overlapping" data creates synergies

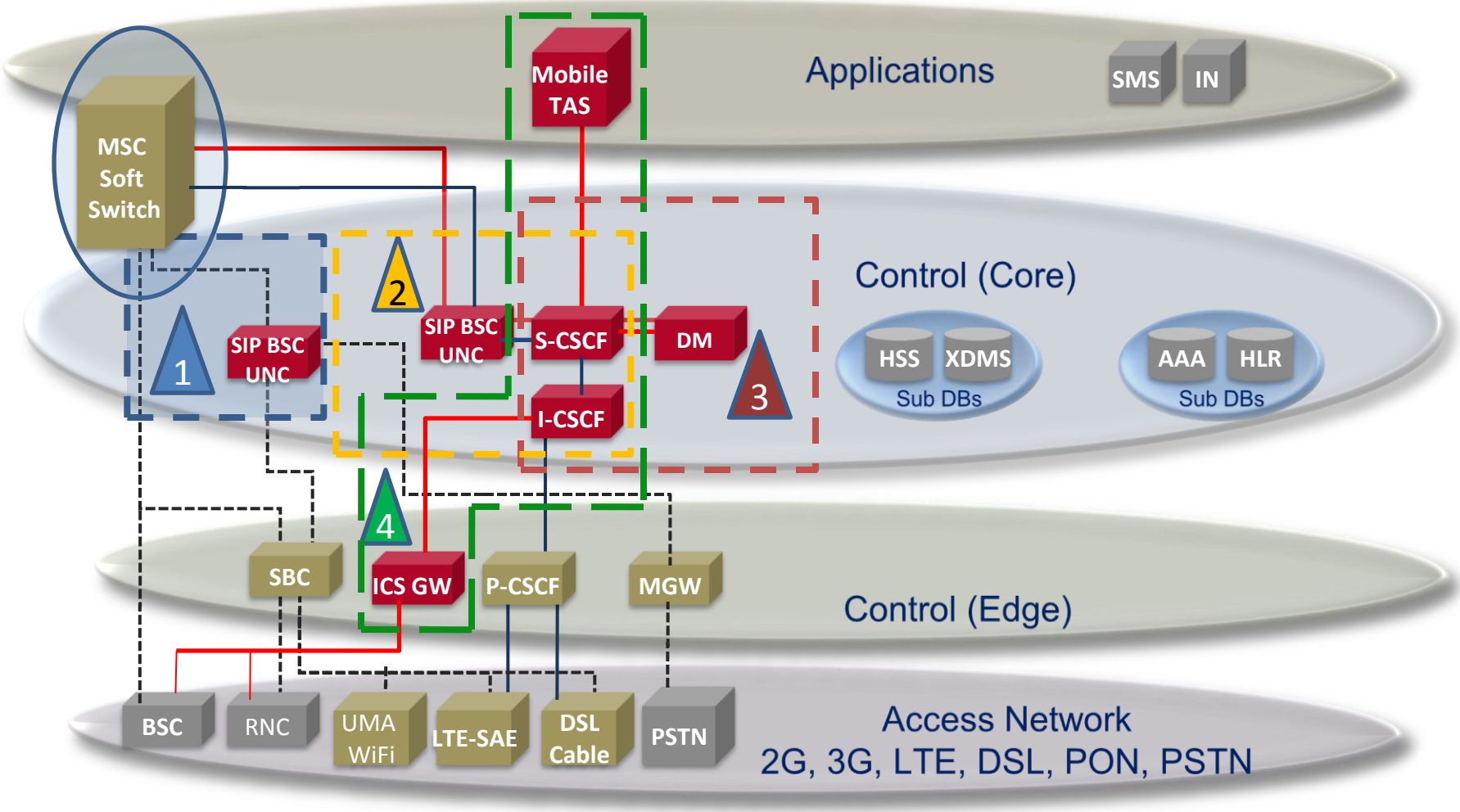


Hierarchical signalling networks support a LOGARTHMIC network data growth

IMS follows logarithmic network growth

- First step: Decompose soft switch functionality into specialized nodes (e.g. P-CSCF, I-CSCF, S-CSCF, TAS, SCCP routing, SIP routing, SMS routing, etc.)
- Second step: Consolidate data into centralized databases which creates synergies and thus a logarithmic growth of information (e.g. MNP data, ENUM data, Measurement data, etc.)
- Optimization of Resources

Recap of 4-Stage FMC-IMS implementation



Note: The MSC is replaced in stage 4 by Mobile Telephone Application Server (TAS) and IMS Call Server Access Gate Way (ICS GW)

THANK YOU