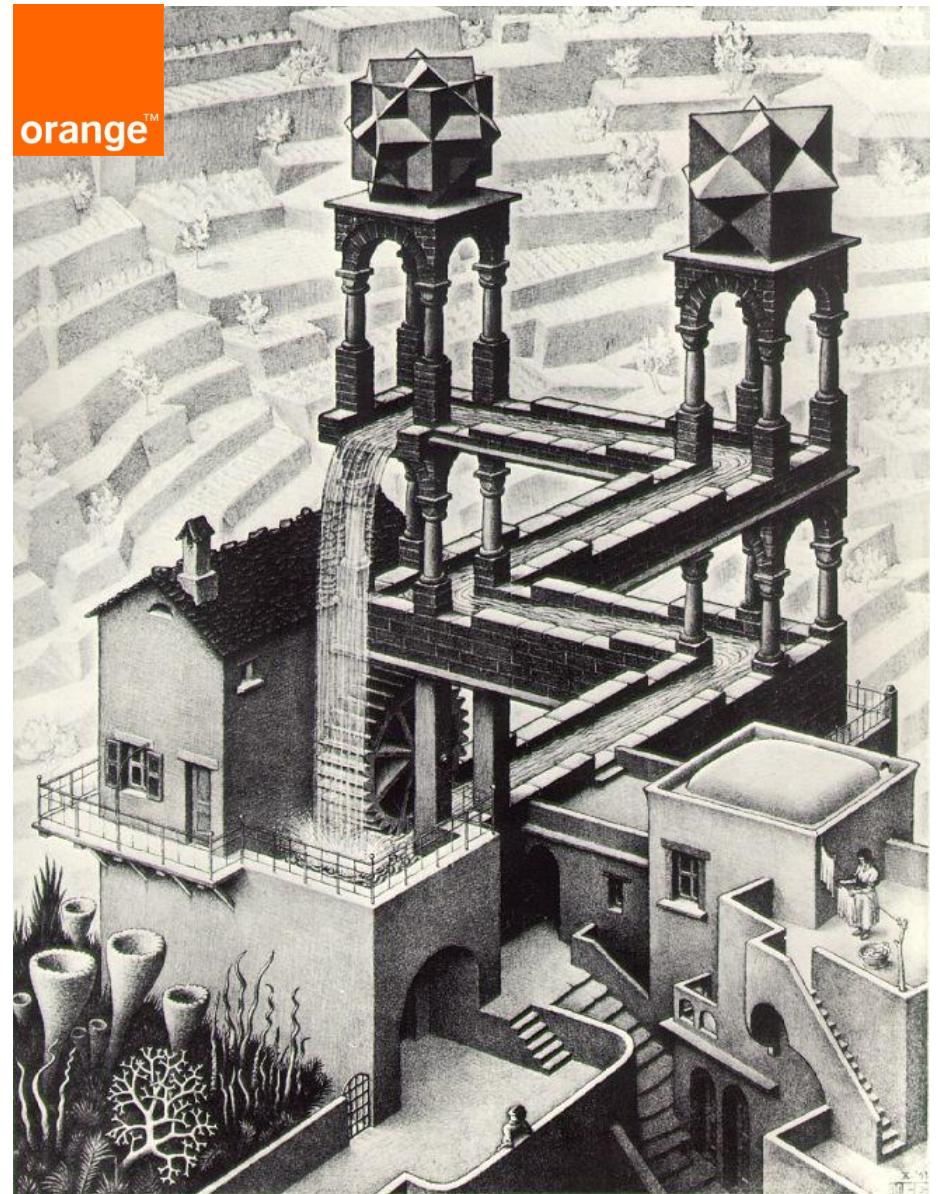# Synchronisation in Transport Networks for Mobile backhaul

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Evolution of the 'Next Generation Service Provider'

Either you are on the way there, or you are on the way out!

Convergence is key to the NGSP…

…But what is convergence?

Application convergence: the tendency for multiple services - voice, video, Internet and so on – to be available together over a particular bearer – broadband for example.

Service convergence: the tendency for particular services or content to be available in a seamless way across multiple access bearers. For example, users could be offered voice services that work seamlessly across broadband, mobile and wi-fi hotspots.

Network convergence: the tendency for the aforementioned applications, services and access bearers to converge on a common network capability based, by default, on Internet Protocols (IP).

Transport Network Convergence is the foundation

- Convergence of Transport may be a technical pre-requisite for convergence as a whole.

- Much of the cost of providing services comes from the underlying transport.

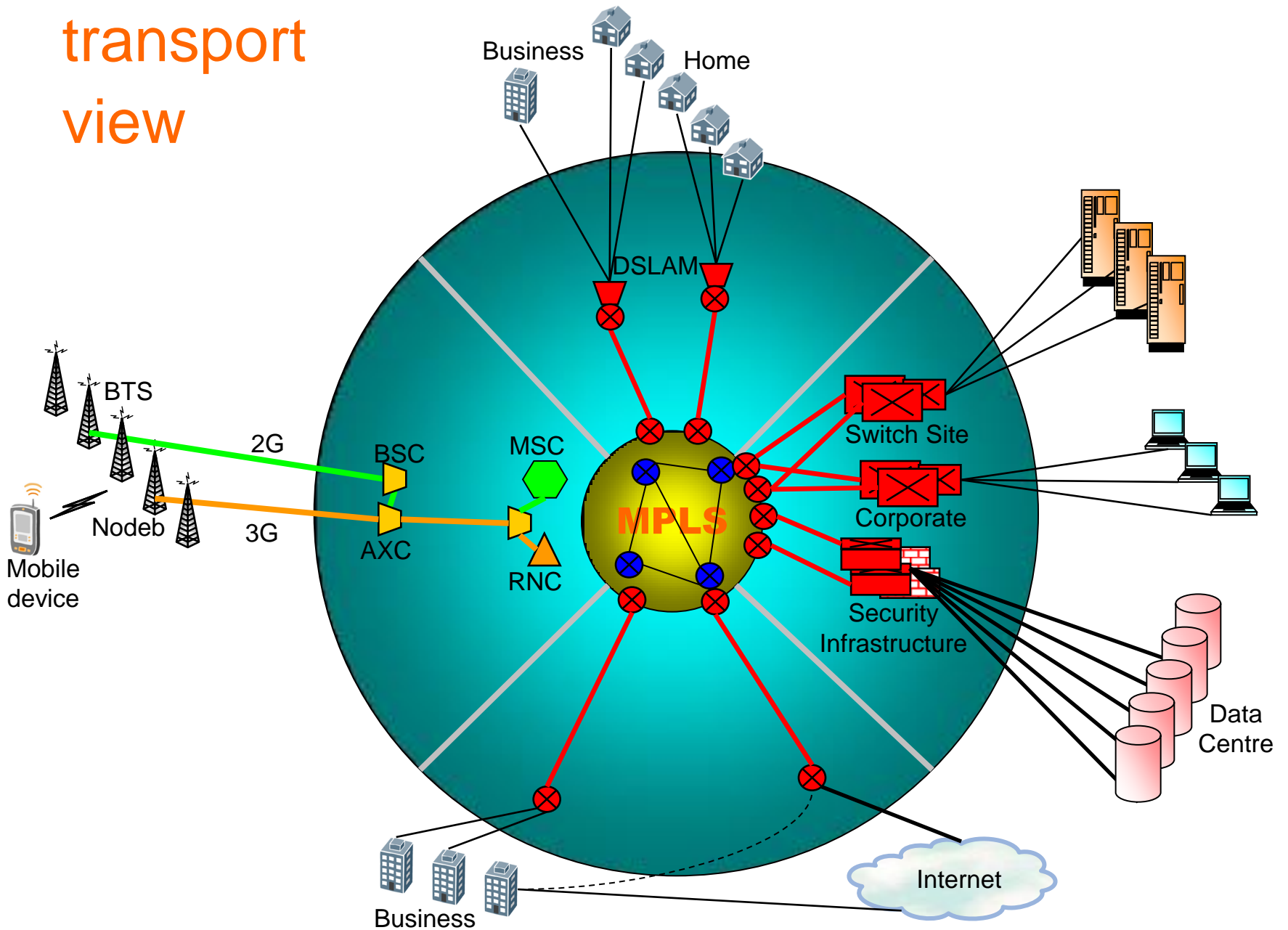 - much of that from the transmission.

Operators are implementing transport network convergence as quickly as possible as a strategic enabler and to reduce cost to serve.

A unifying transport layer is necessary to abstract the many different service requirements and to enable opportunist exploitation of different transmission technologies, but we should seek to converge networks starting at the physical layer, taking into account the transport and service architectures being supported, to get the greater part of the cost reduction as early as possible.
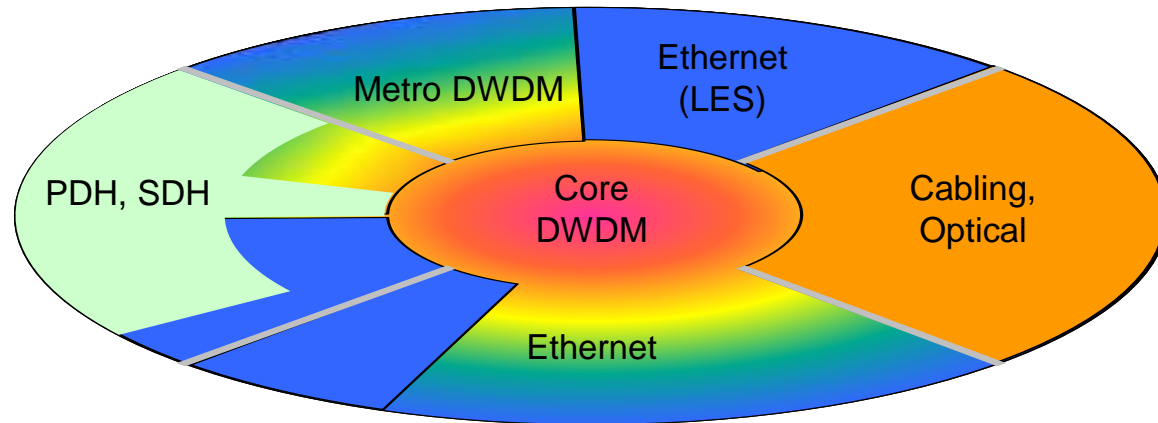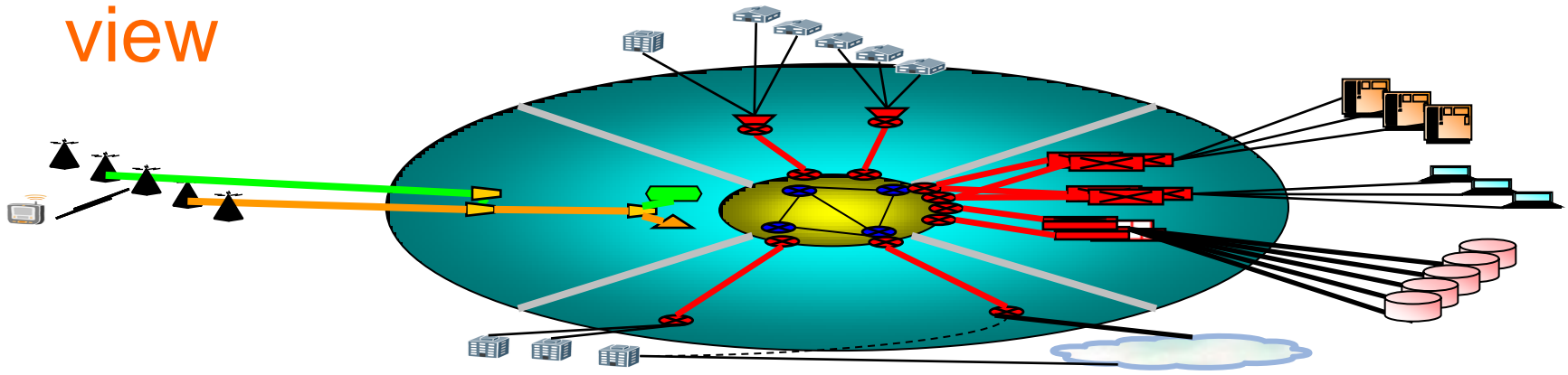
Evolution of NGSP Transport

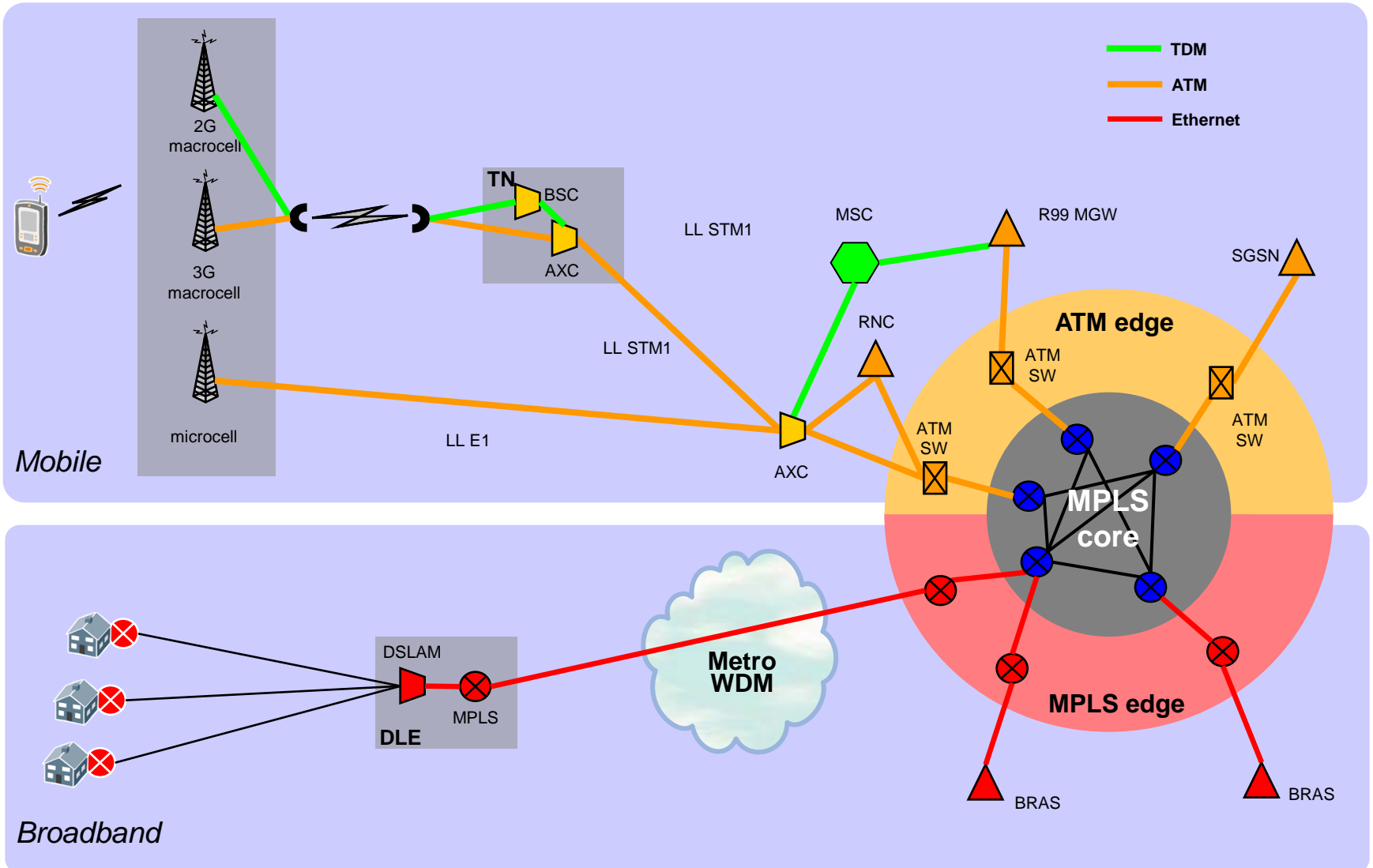*Either you are on the way there, or you are on the way out!*

transport view

Business

Home

DSLAM

BTS

2G

MSC

Switch Site

Nodeb

3G

BSC

AXC

MPLS

RNC

Corporate

Mobile device

Security Infrastructure

Data Centre

Business

Internet

transmission view

Legend:

Metro DWDM · Ethernet (LES) · PDH, SDH · Core DWDM · Cabling, Optical · Ethernet
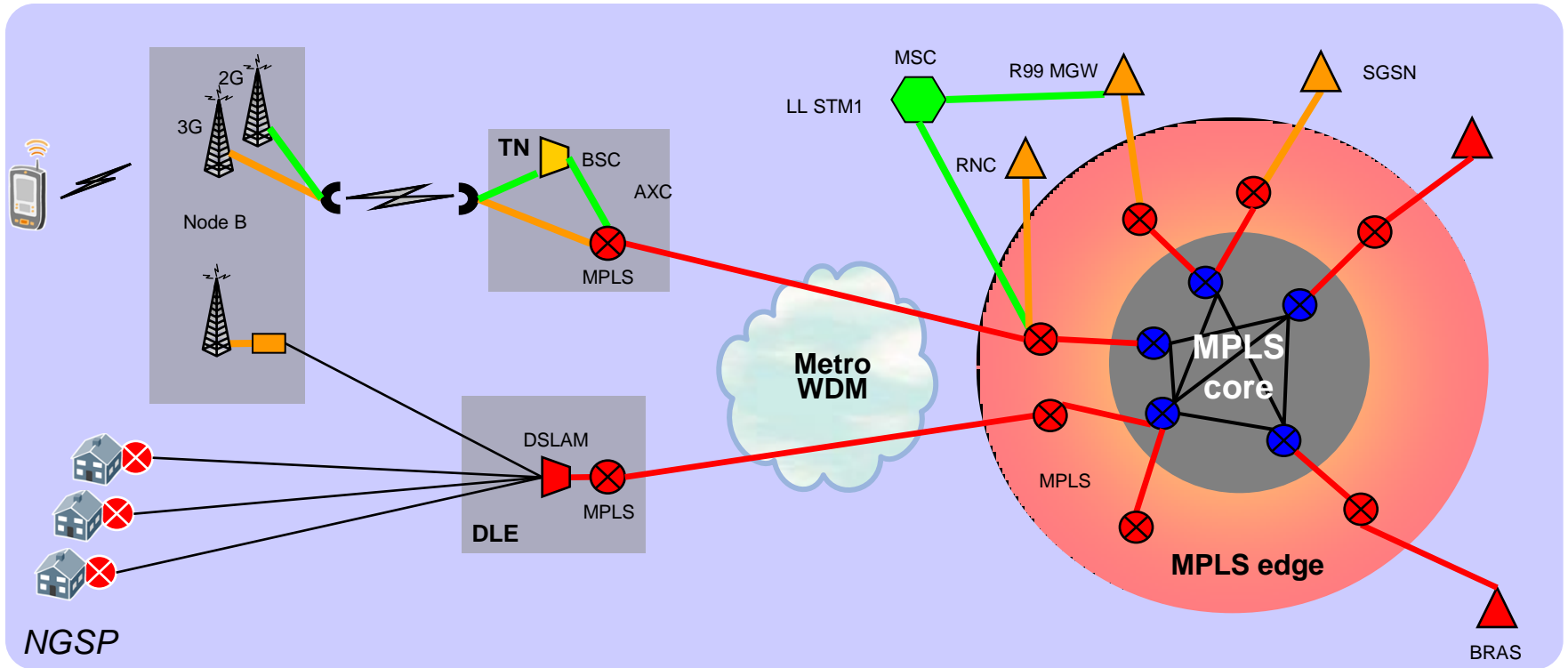
Microwave Radio · Leased Lines · DWDM · Campus

# legacy architecture

2007 architecture

NGSP synchronisation for base stations

Base stations require synchronisation for the air interface to function correctly. For 2G GSM and 3G UMTS FDD, frequency synchronisation (syntonisation) only is required, and this is generally achieved by using the incoming TDM transmission physical layer to derive a reference. Typically, this means that the synchronisation at this interface must be traceable to a primary reference, and meet the jitter / wander requirements of G.823 for a traffic interface. This requirement must still be met by a converged transport network.

NGSP 2007 architecture synchronisation scenarios:

- Microcells – Solution required for synchronisation over Ethernet:
    - Physical layer continuous between base station and DSLAM (dependant on DSL physical layer), but
    - Ethernet between DSLAM and core.
- Macrocells – Solution required for synchronisation over Ethernet:
    - Physical layer continuous between base station and MSR aggregation point but,
    - Ethernet between aggregation point and core.

3G base station synchronisation – DSL case
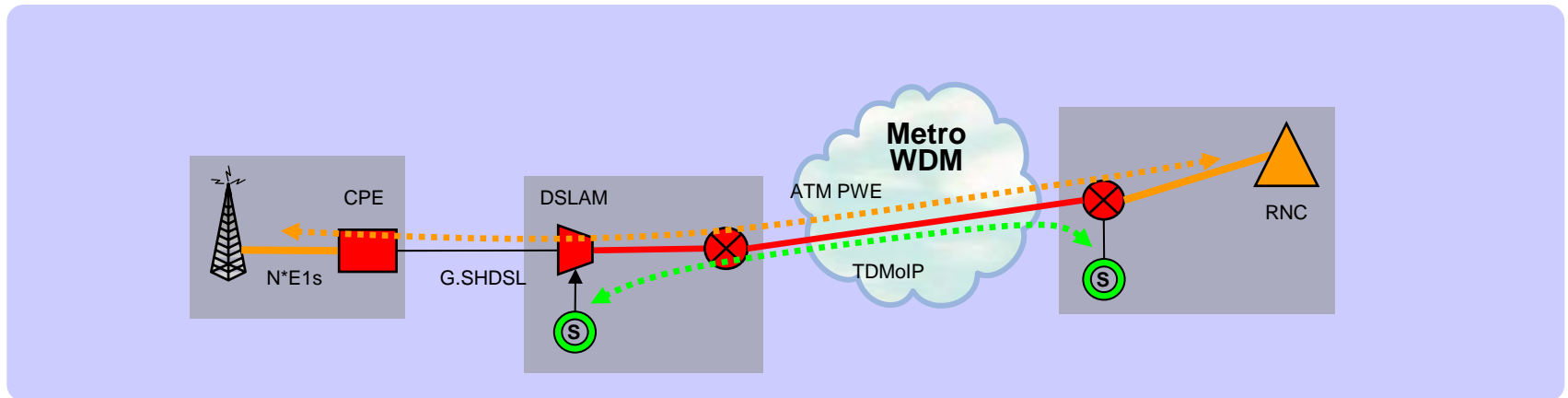
Not the only approach, but one we have tested:

- PRC is available at core site
- Reference transported to DSLAM using TDM pseudowire. MPLS QoS protects pseudowire form other traffic
- DSLAM synchronised via BITS interface
- Reference transported to CPE via DSL NTR
- CPE provides reference to base station via E1 interface

Alternatives:

- Primary Reference can be provided at DSLAM
    - ☹ Capex cost, installation issues
- Leased service can be used to synchronise DSLAM (either E1 leased line from core, or sync service)
    - ☹ Opex cost
- TDMoIP can be used to deliver reference all the way to the CPE
    - ☹ DSL bandwidth consumption

3G base station synchronisation - MSR case
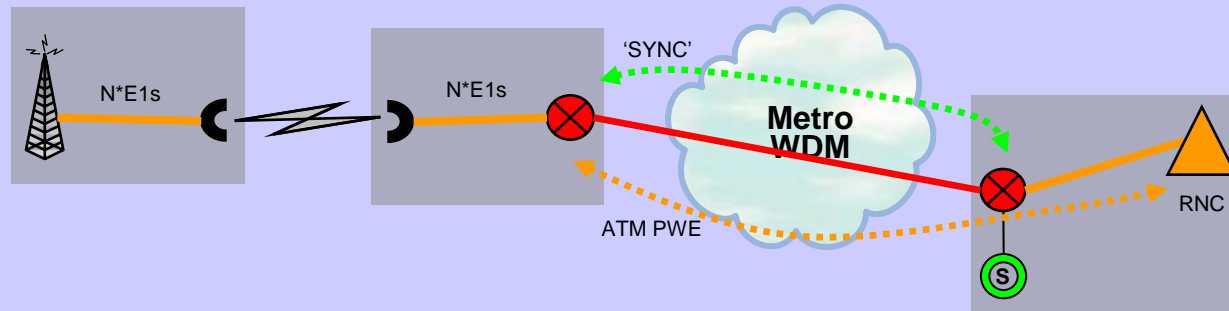
PRC is available at core site

MSR at aggregation point synchronised using a 'Sync over Ethernet' method

MSR provides reference at physical interface

Reference transported to base station via TDM microwave radio

Sync over Ethernet Methods:

- Synchronous Ethernet
  - Compatibility with Ethernet transport?
- TDM pseudowire (similar to DSL case)
- IEEE1588 or similar

All of these approaches are subject to the MSR vendors choosing to support them.

MSR support for Sync over Ethernet

Vendor 'A'

- Synchronous Ethernet
    - ☹ Not planned
- TDM pseudowire
    - ☹ Not planned
- IEEE1588
    - ☹ Not planned

Vendor proposes add on box solution

Vendor 'B'

- Synchronous Ethernet
    - ☺ Implemented
- TDM pseudowire
    - 😐 Future release
- IEEE1588
    - 😐 Future release

Vendor 'C'

- Synchronous Ethernet
    - ☹ Not planned
- TDM pseudowire
    - 😐 Future release
- IEEE1588
    - ☹ Not planned

Crystal ball view

- Base stations will have Ethernet interfaces from mid 2007

  - Will sync over Ethernet be needed all the way to the base station?

- Base stations may benefit from time synchronisation

  - Enhanced performance (particularly spectral efficiency) for base stations based on 3GPP LTE

the future's bright

orange™

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Image by Emily Alston of the Young Creatives Network.