ARCHITECTURE AND TRANSPORT FOR MOBILE BROADBAND BACKHAUL

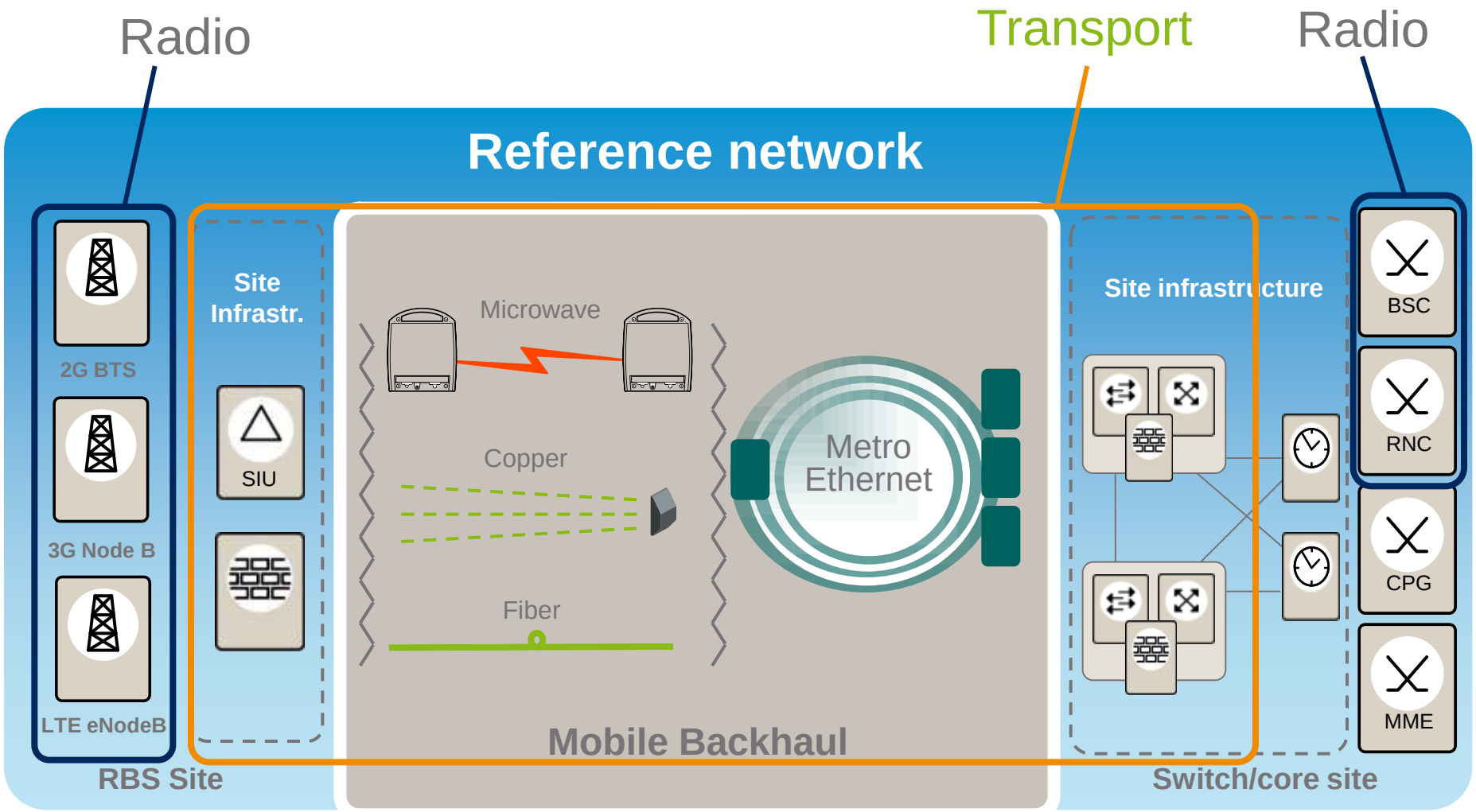
KÅRE GUSTAFSSON
ERICSSON RESEARCH

2010-11-04

OUTLINE

- Technology and market drivers
- Link technologies
- Backhauling of Heterogeneous Networks
- Main remote connection technology
- Sync issues in mobile broadband backhauling
- Summary

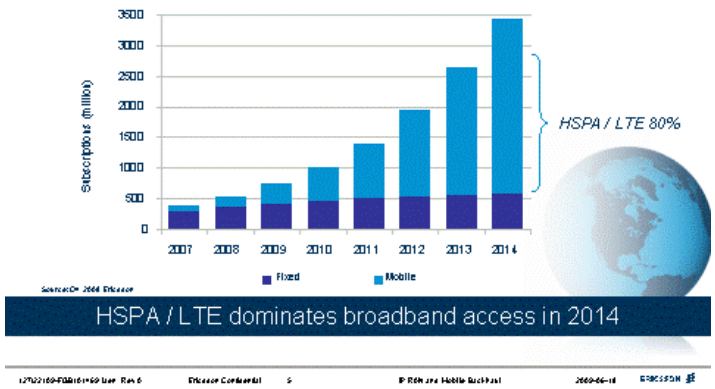
ARCHITECTURAL VIEW OF SCOPE



RADIO DRIVERS FOR TRANSPORT NETWORK MODERNIZATION

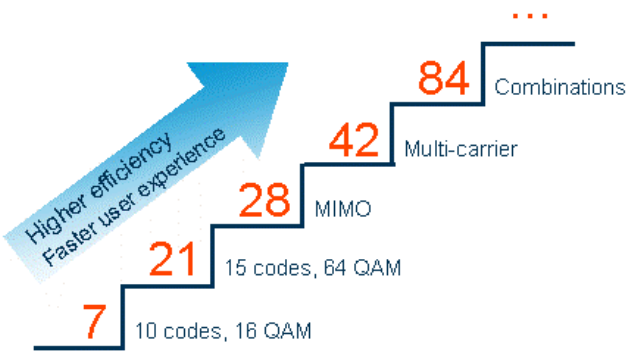
Broadband goes mobile

From household to individuals and devices

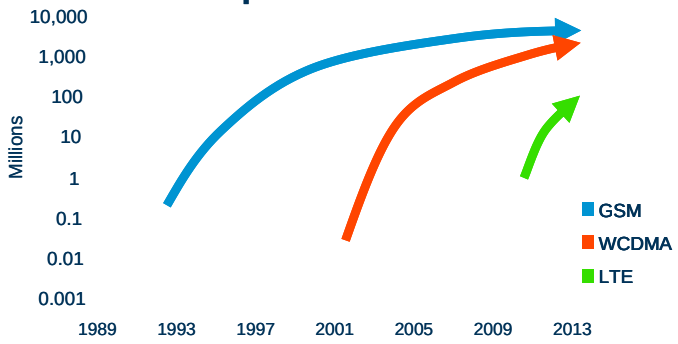


Continued HSPA Evolution

Peak rate in Mbps



Subscription forecast

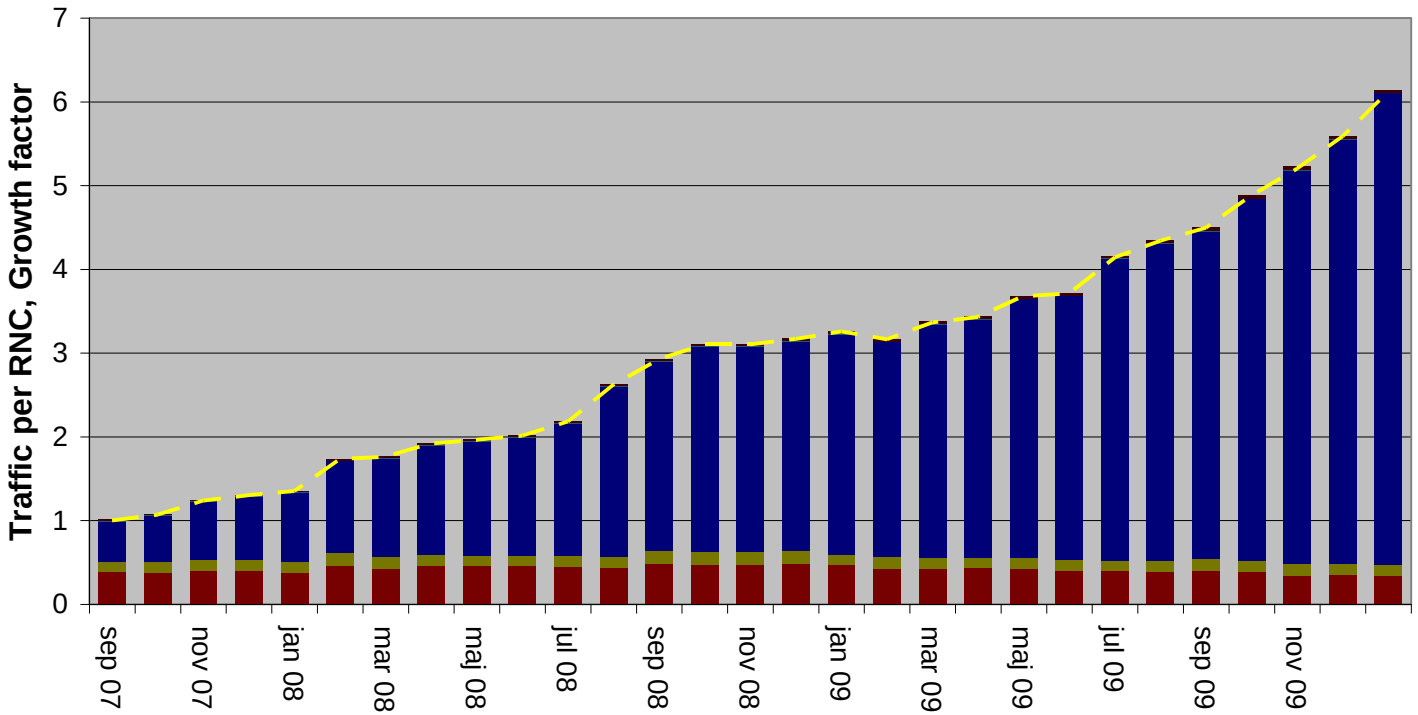


50 billion mobile connections 2020

THE BEGINNING OF MOBILE BROADBAND

HSPA →

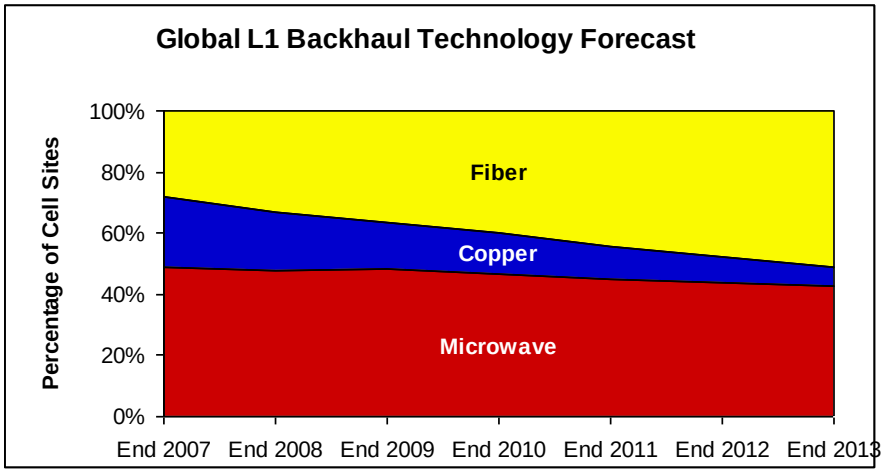
Voice →

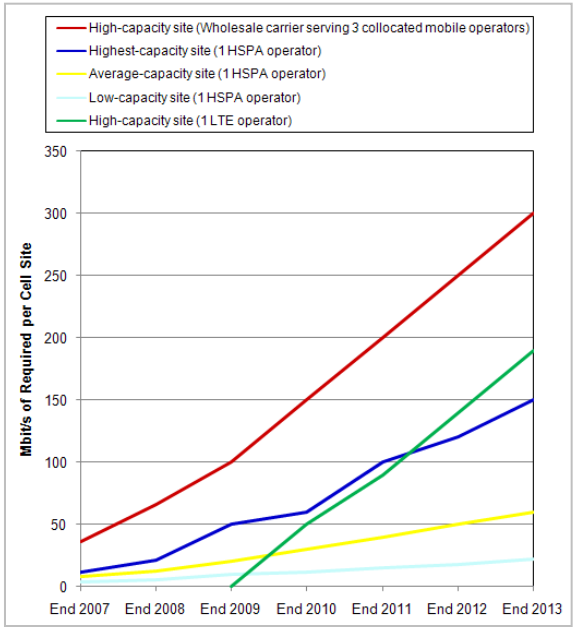


Mobile Broadband will require packet technologies Both in Radio and in Backhaul

THE BACKHAUL SITUATION

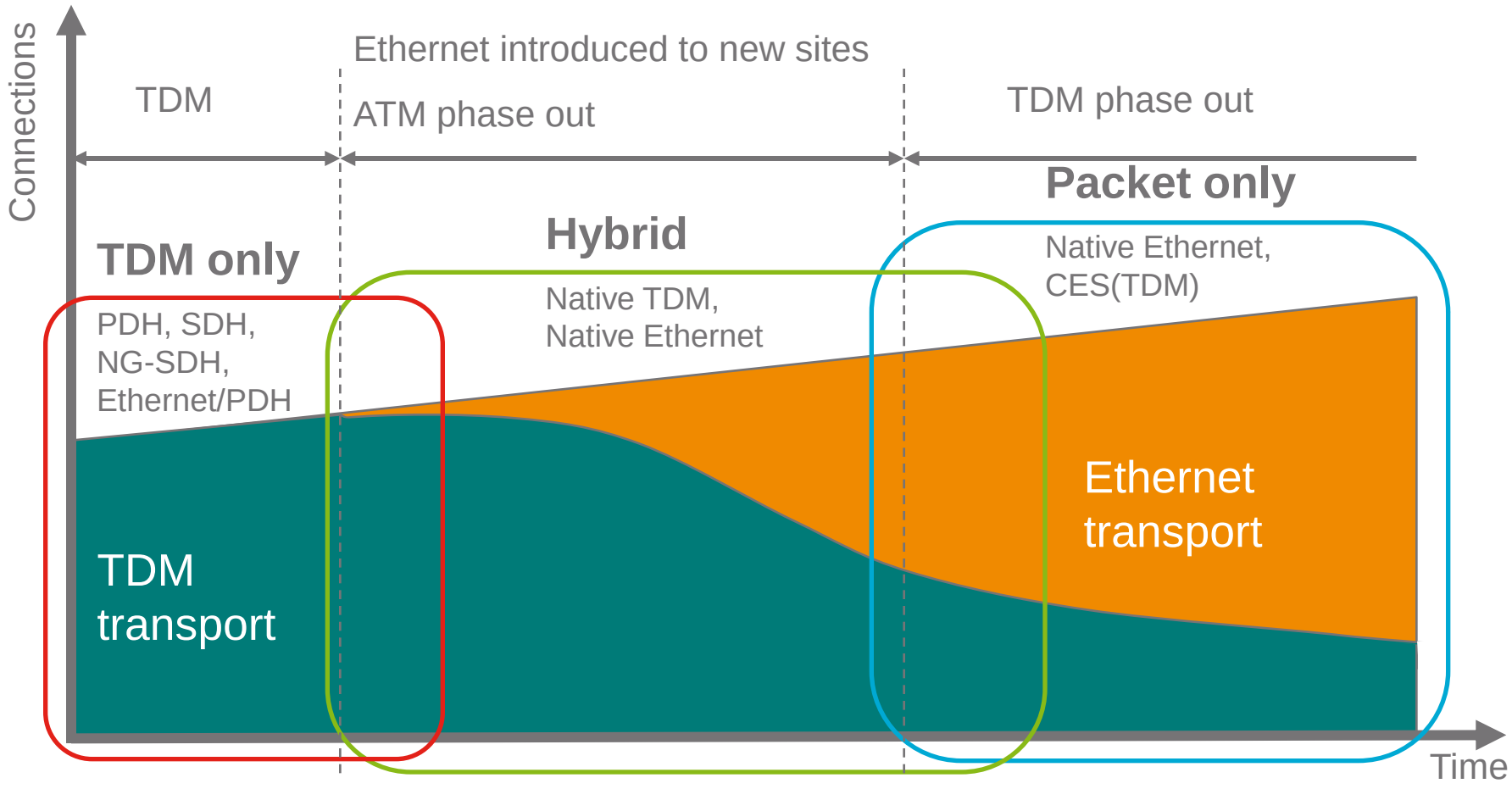
- Globally
  - 48% micro wave
  - 37 % fiber
  - 15 % Copper
- Large regional variations
  - Fiber common in China, Korea, Japan
  - Microwave dominant in India and strong in Europe
  - Copper dominant in US
- Variations depending on operator type
  - Incumbent has own backhaul and ‘access to L1’ → control of delay
  - Non-incumbent rents backhaul and has ‘access to L2’ → less control
- Microwave Ethernet and Fiber dominate new macro installations





Source: heavy reading

TRANSFORMATION SCENARIOS – TOWARDS PACKET TRANSPORT



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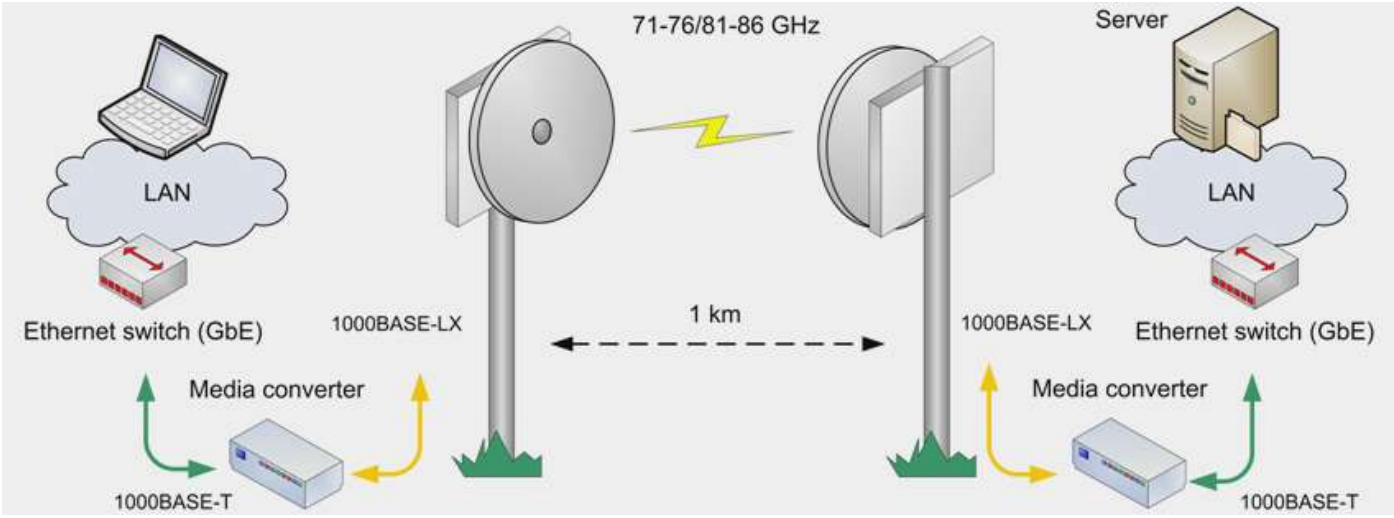
HIGH CAPACITY MICROWAVE LINKS

- 1 Gbps, 2,5 Gbps and higher can be reached
- Future-proof microwave solution for LTE and LTE-Advanced
- Optical Ethernet interface
- 70/80 GHz channel (E-band)
- FDD RF interface
- Live Gb test link has been running for 1,5 years

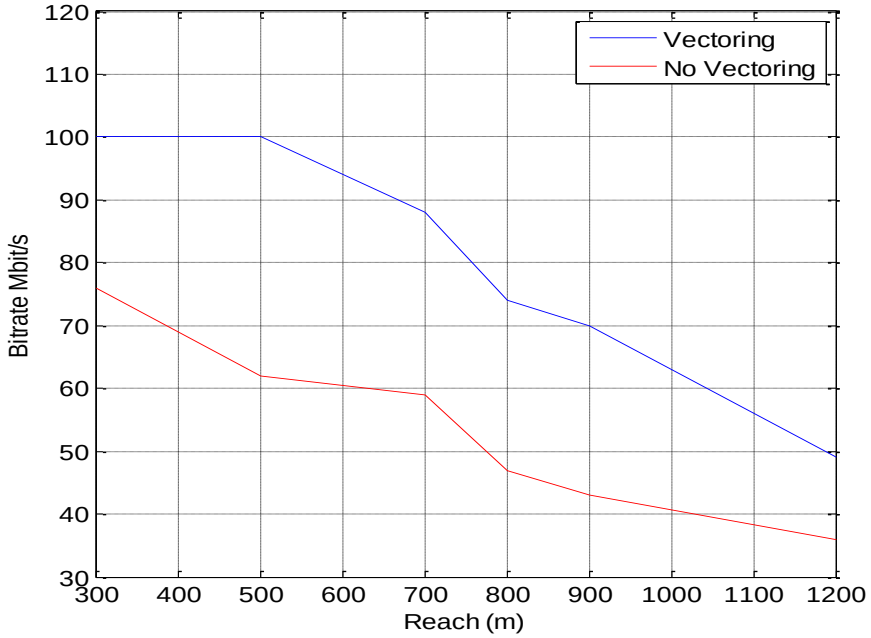


Microwave capacity will not be a bottleneck

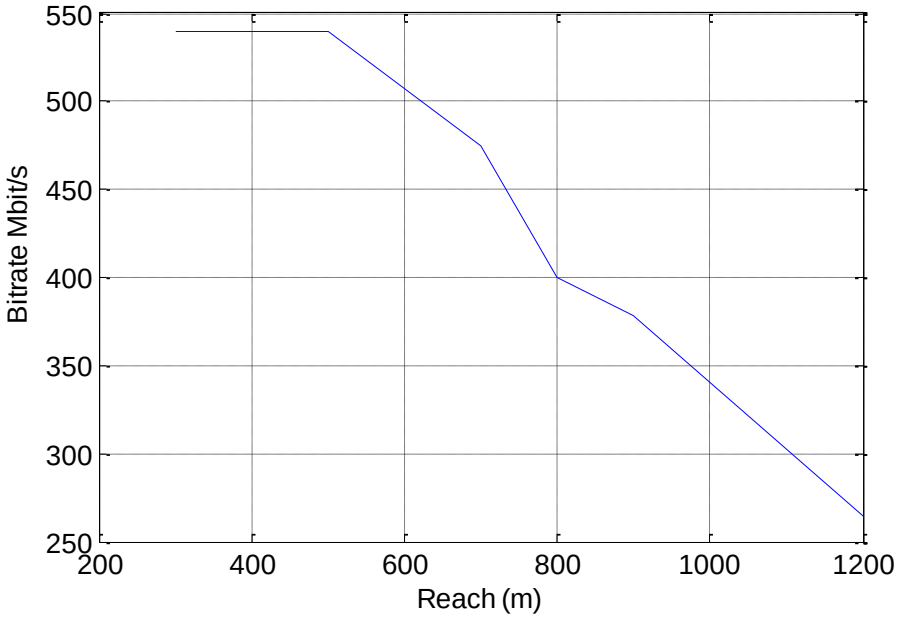
BONDED AND VECTORIZED VDSL2

VDSL2 can reach 500 Mbps over 600 m using bonding and vectoring technologies

Bitrate on Line 1



Bonding rate



Existing Cu infrastructure can handle high capacities

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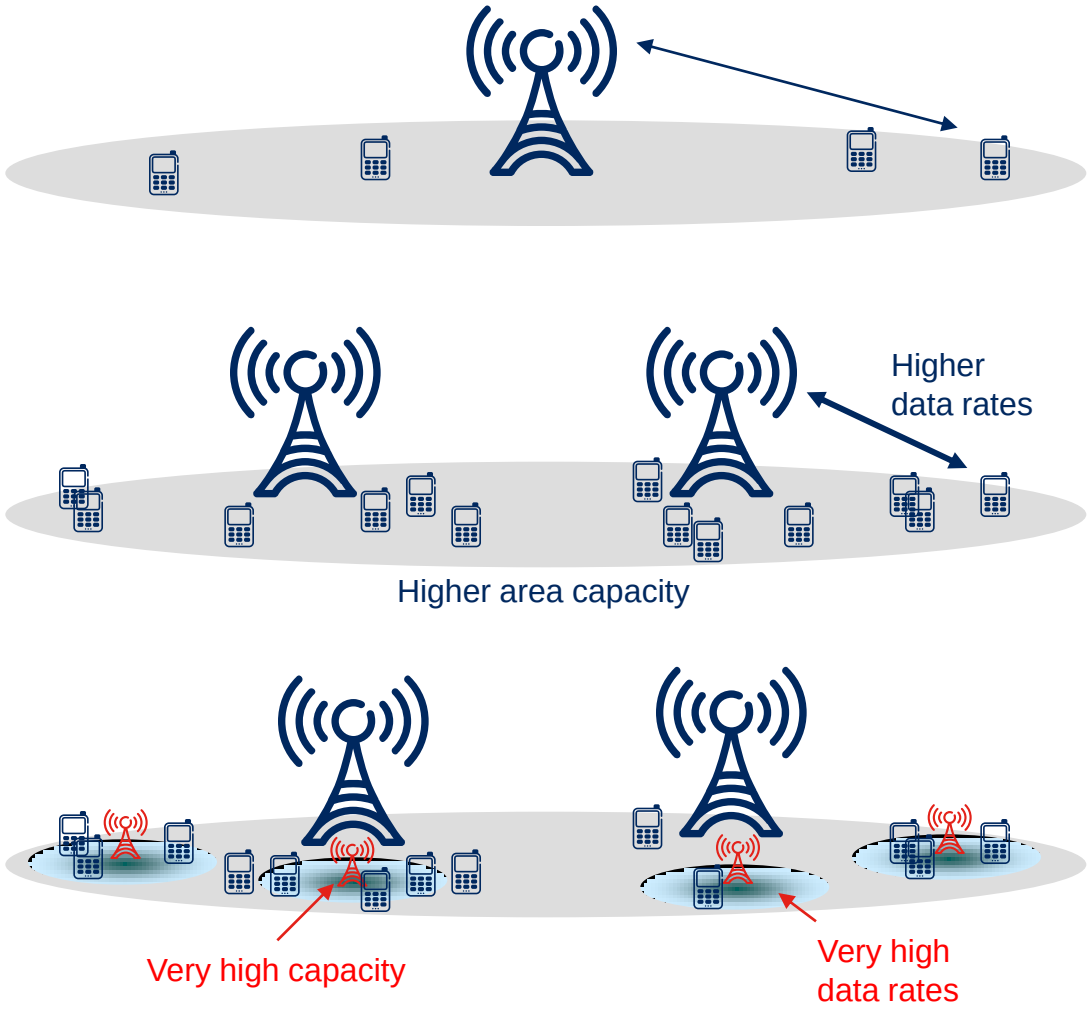
WHEN TO DO WHAT?

Enhanced macro site
› Most straightforward - first step
› Uniform capacity and coverage
› Limited potential

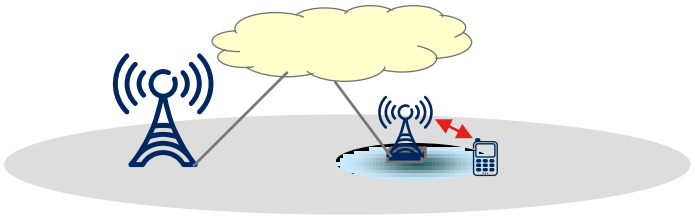
More dense macro layer
› Long term solution for uniform coverage and capacity enhancements
› Limited by site availability

Additional low-power nodes
› Especially for non-uniform traffic demand
› Avoids need for additional macro sites



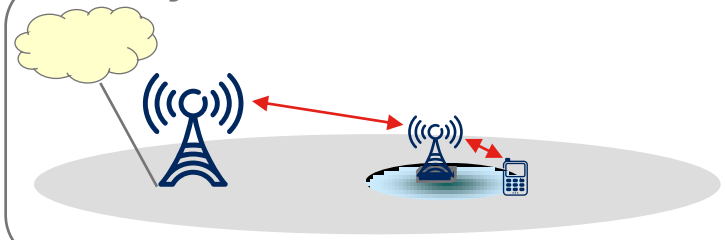
HETEROGENEOUS NETWORKS – DIFFERENT APPROACHES

Conventional Pico RBS



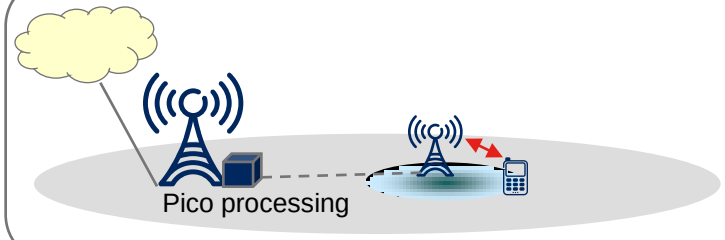
- Main part of processing locally at “pico” site
- Conventional backhaul (copper, fiber, μ-wave, …)

Relay



- Main part of processing locally at “pico” site
- Backhaul using cellular radio-access/spectrum
- Backhaul consumes cellular spectrum

RRU

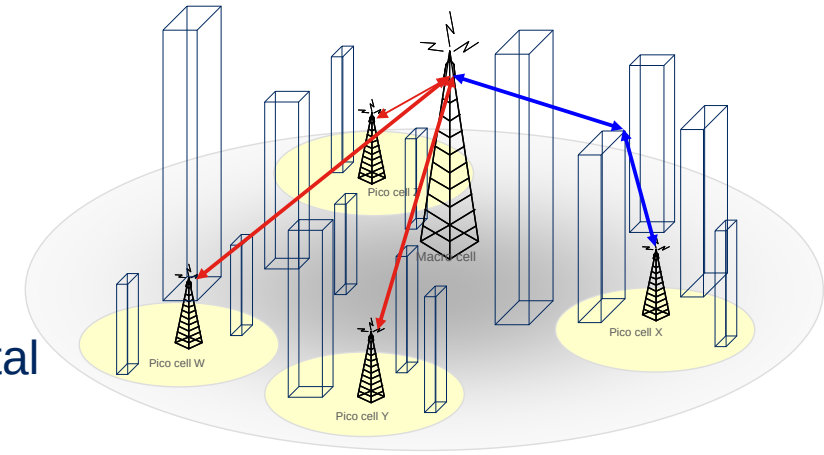


- Mainly radio at “pico” site, main part of processing centralized (e.g. at macro site)
- High-speed fiber-based backhaul

WIRELESS BACKHAUL?

Densification of radio networks will happen ~2015 and beyond.

- Many bottlenecks in MBB networks
  - cell edge and uplink capacity
  - indoor coverage
- Heterogenous radio networks
  - Initial deployment of macro for coverage
  - Pico and relay basestations for incremental capacity growth and extended coverage
    - Order of 100 meters inter-site distances
    - Fast roll-out of pico relays, with later roll-out of dedicated transport to the highly loaded relays.
  - Hierarchical radio structures to handle inter-cell interference and resource management
    - Low delay required on X2, and time/phase sync



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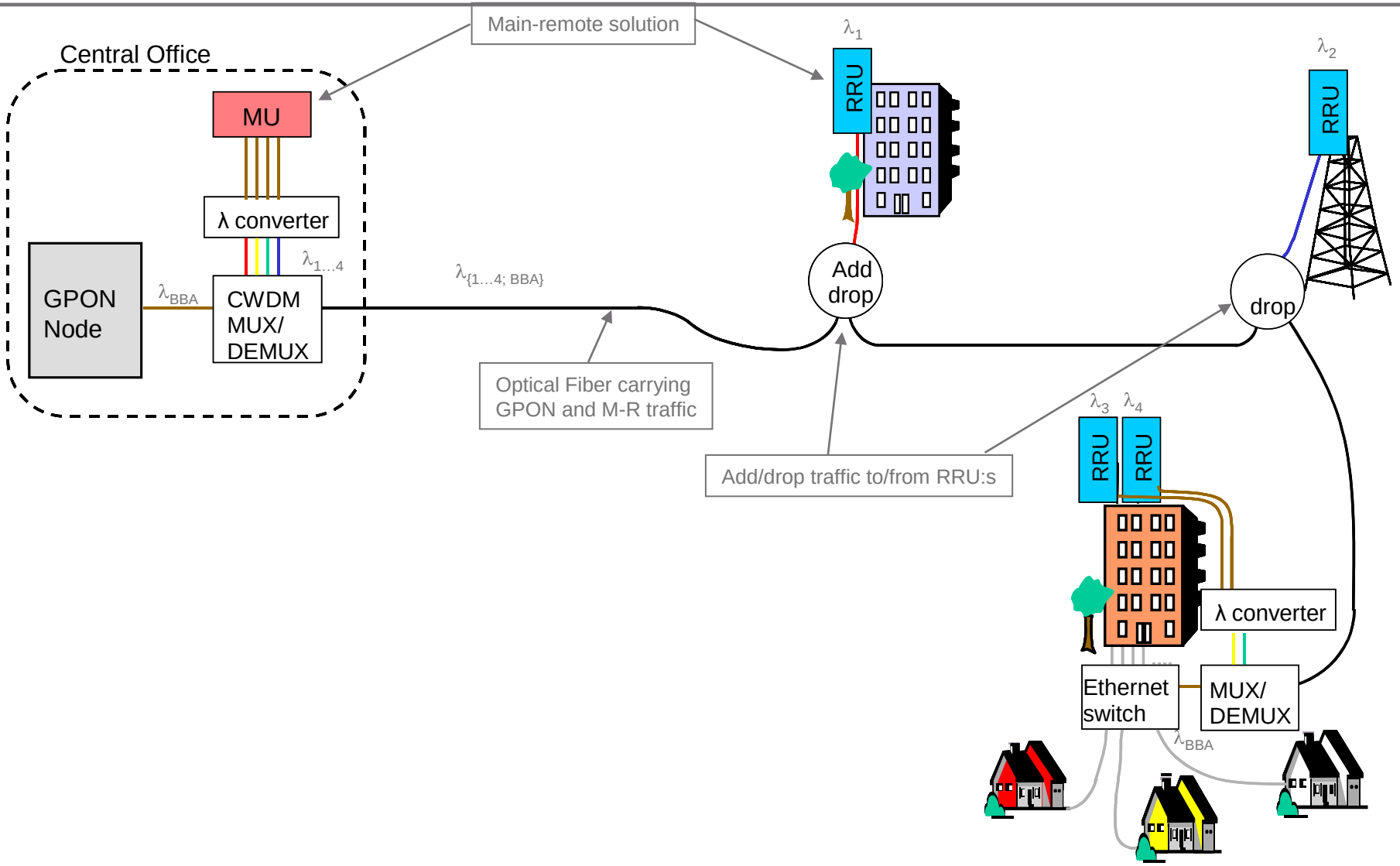
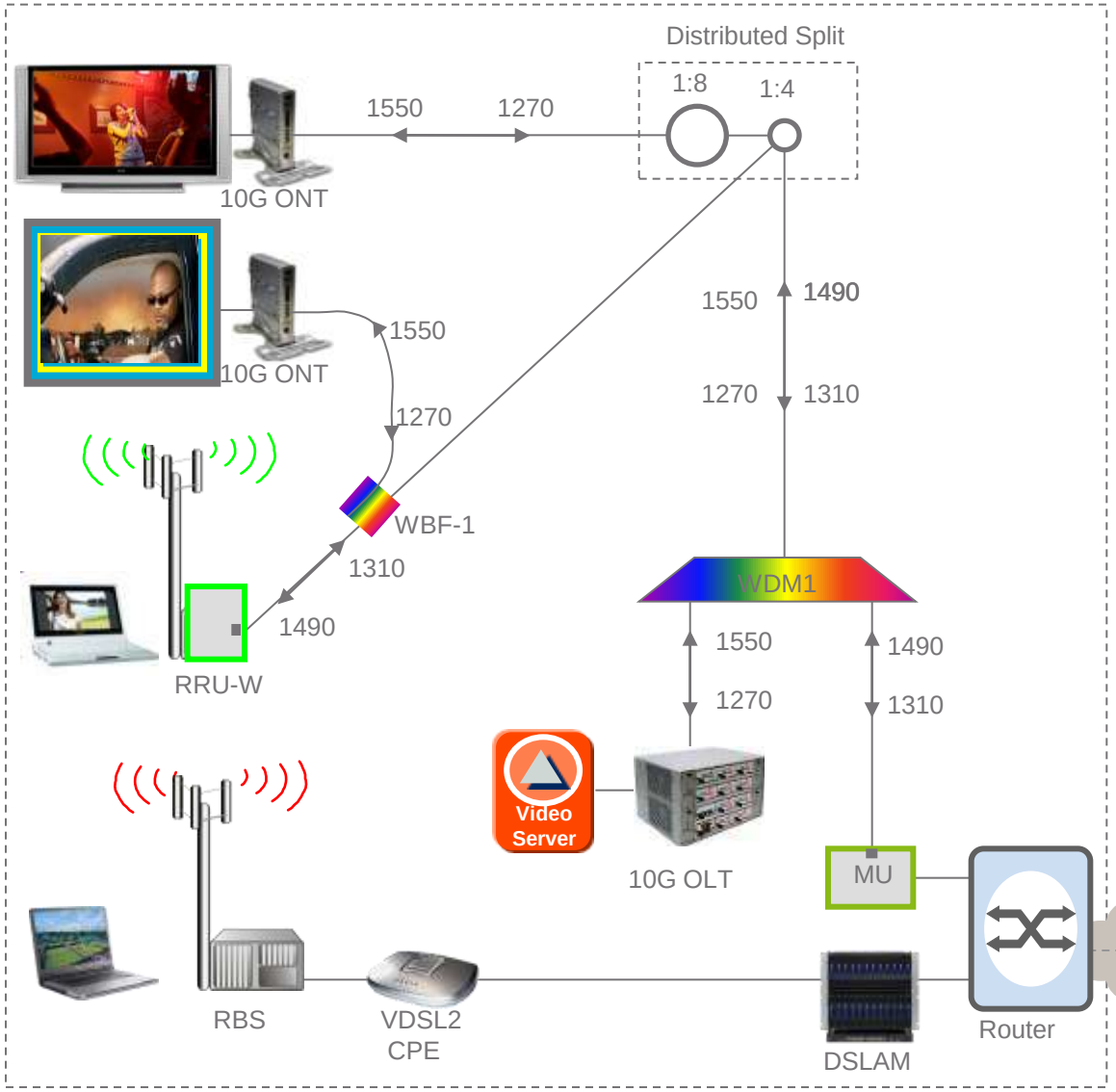
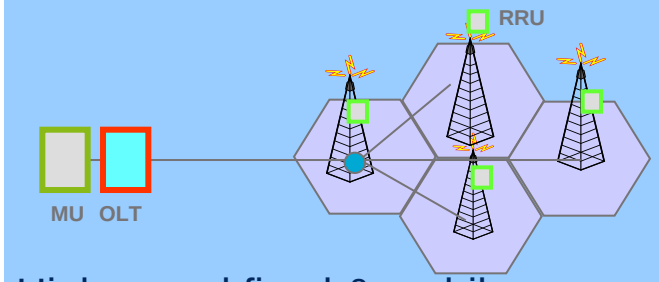
USE CASE FOR MAIN-REMOTE CONNECTION OVER GPON INFRASTRUCTURE



MAIN-REMOTE CONNECTIONS
OVER GPON INFRASTRUCTURE

CONVERGED ACCESS NETWORK





High speed fixed & mobile access infrastructure convergence using GPON to support:

- Fixed residential and business FTTH users
- Bonded VDSL2 over GPON connections
- CPRI MU-RRU links for RBSs

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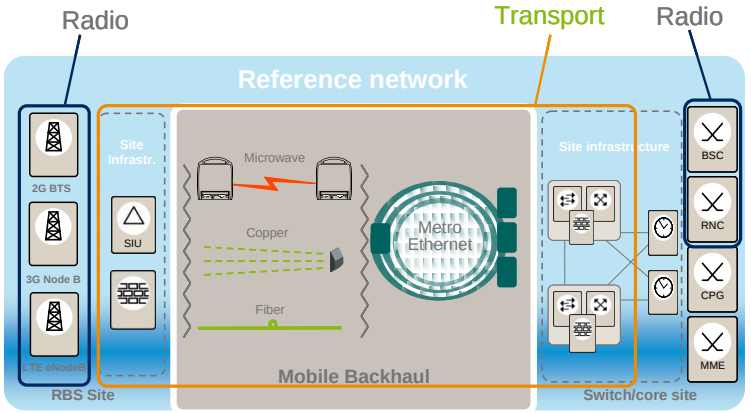
IMPORTANCE OF SYNCHRONIZATION IN MOBILE BACKHAUL

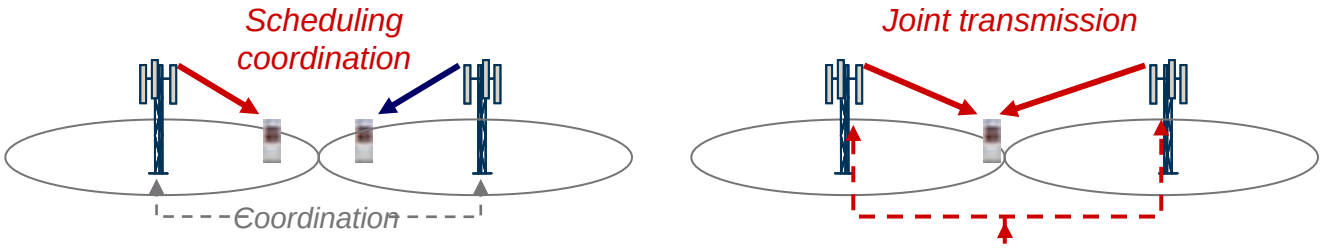
Synchronization (frequency, time-phase or both) is a key aspect in mobile broadband backhaul networks to support:

- the services carried over the packet network (including proper interworking with legacy TDM networks)
- the end-application operations, such as radio base stations.



SYNC TECHNOLOGY HIGHLIGHTS

- ✓ SyncE to become an established technology also in Mobile backhaul (frequency sync only, but may be used to aid IEEE1588 for time delivery).
  - Some limitations in multi-operator scenarios
- ✓ Increased need to deliver accurate phase-time synchronization
- ✓ PTP (IEEE1588) being specified for Telecom
  - Frequency Telecom Profile just released; time sync profile being discussed
- ✓ Access technologies are challenging environments to deliver accurate time due to intrinsic asymmetry (e.g. GPON ; xDSL)
- ✓ Sync solutions for CoMP, CPRI, wireless backhaul in heterogeneous NW requires careful analysis



SUMMARY - CONCLUSIONS

- With the rollout of Long Term Evolution the capacity of the radio access network backhaul needs to be upgraded to 100–150 Mb/s. Next generation mobile networks, such as LTE Release 10, will increase the requirement for backhaul capacity to gigabits per second.

- The need for increased capacity and decreased cost per transported bit drives packet-based mobile backhaul capacity boosts over microwave, copper and fiber. Backhaul link technologies will not be a bottleneck for Mobile Broadband Traffic.

- Variations of backhaul deployment depending on operator type
  - Converged versus mobile only operator
  - Possibility to use existing infrastructure (Fiber and Copper)

- Microwave Ethernet and Fiber will dominate new backhaul installations

- Proper sync solutions are one key aspect for a succesfull deployment of next generation mobile backhaul networks

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