


VeEX
The Verification Experts

Ethernet and the Mobile Backhaul

Synchronous Ethernet and IEEE-1588v2

Rev. A00

Background

Next Generation Networks (NGN) are migrating to a packet-based network

Service providers worldwide are faced with major challenges

- Increasing service revenue
- Lowering network costs
- Delivering Quality of Service (QoS)

Service providers are moving from voice services to networked services and solutions

- TDM transport continues to represent significant revenue for carriers
- TDM must be supported in this new model

Background

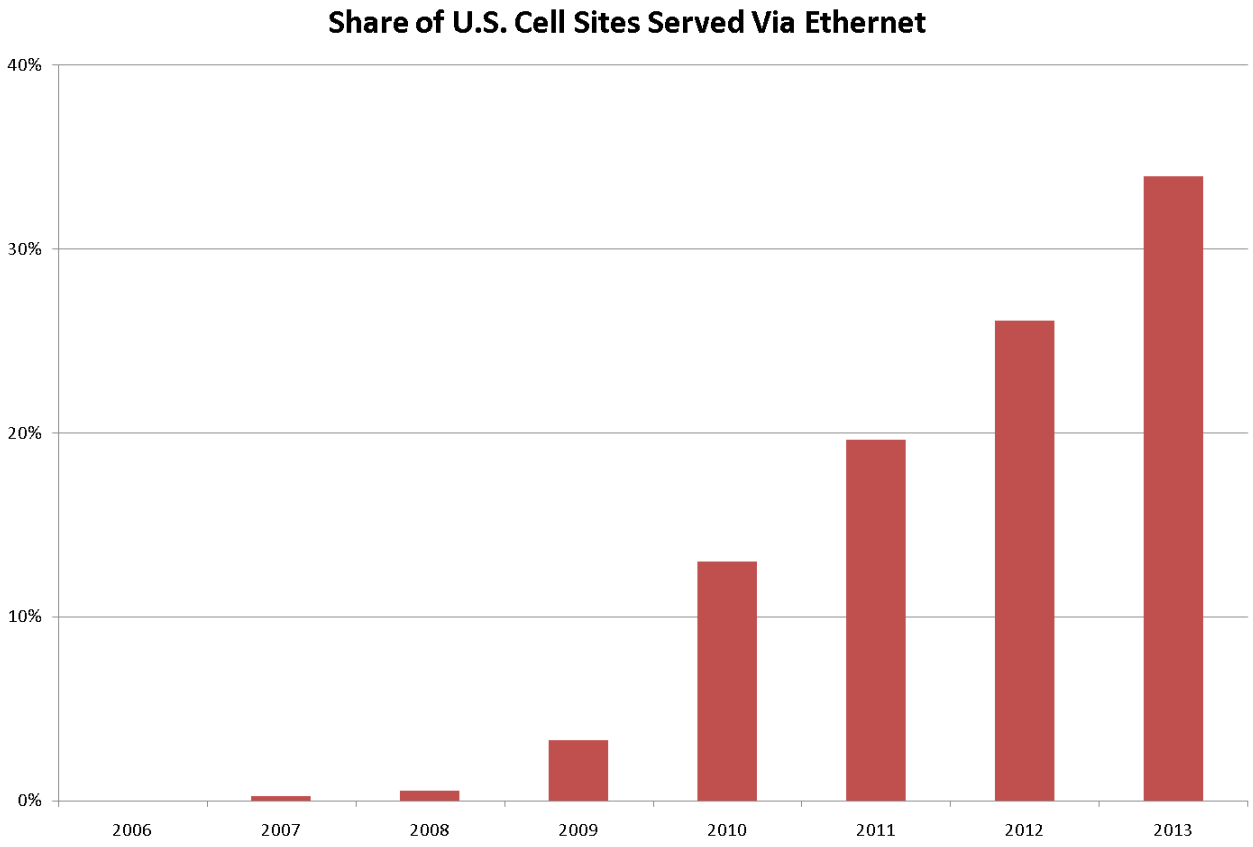
There are applications that still require synchronization in a Packet Switched Network

- Cellular base station
- Synchronization allows smooth call hand-off between base stations, minimizes dropped calls, and reduces customer churn
- Legacy services: E1, fax, modem
- Increases bandwidth utilization
- Improves QoS

Synchronization is essential for wireless and wired carriers to move to NGN

Carrier Ethernet for Mobile Backhaul

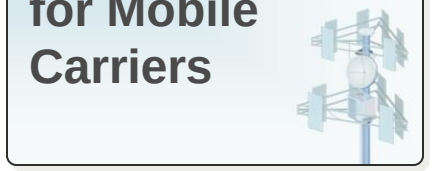
- NPRG forecasts Carrier Ethernet services gain traction in 2009, driven by accelerating 3G cellular data plan penetration and mainstreaming of broadband wireless services (e.g., “Clear” WiMAX from Clearwire)
- Revenue gains for Ethernet providers could be dramatic, as NPRG forecasts solid double-digit CAGR for the overall backhaul market through 2013
- In 2008, notable contract wins were scored by Ethernet providers in the Midwest, New York, Florida, and California; additional wins are on the horizon for 2009

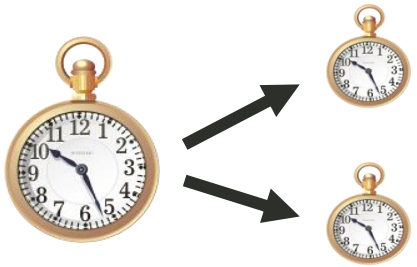


Source: Wireless Backhaul Market Study, New Paradigm Resources Group, Inc.

How MEF (22) Addresses the Key Questions

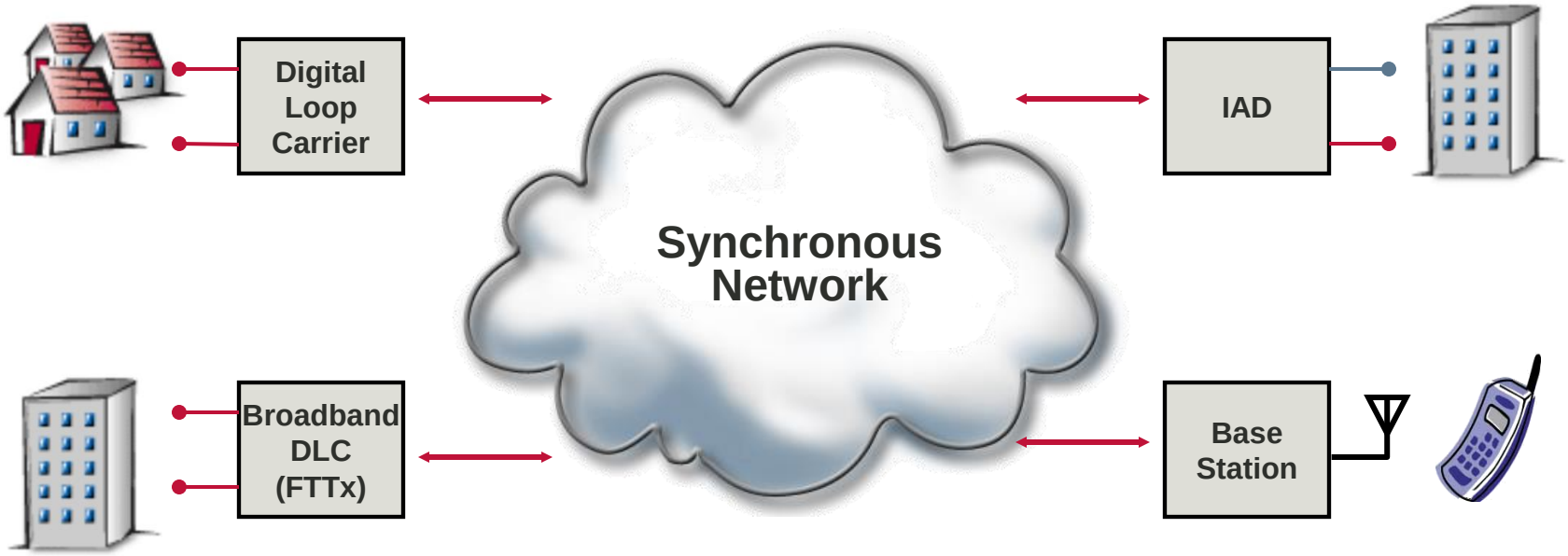
- Operational experience
  - OAM is built into today's equipment
  - Ethernet OAM allows monitoring of Ethernet services
  - Draws on and includes existing standards
- Synchronization
  - Migration to all-packet networks means loss of TDM clock source
  - Phase 1 of the IA covers packet based synchronization
  - Several options are available for clock recovery
- Reliability and availability
  - Reliability is a key Carrier Ethernet attribute
  - Required at network controller
  - Not mandatory at base station





Synchronous Networks

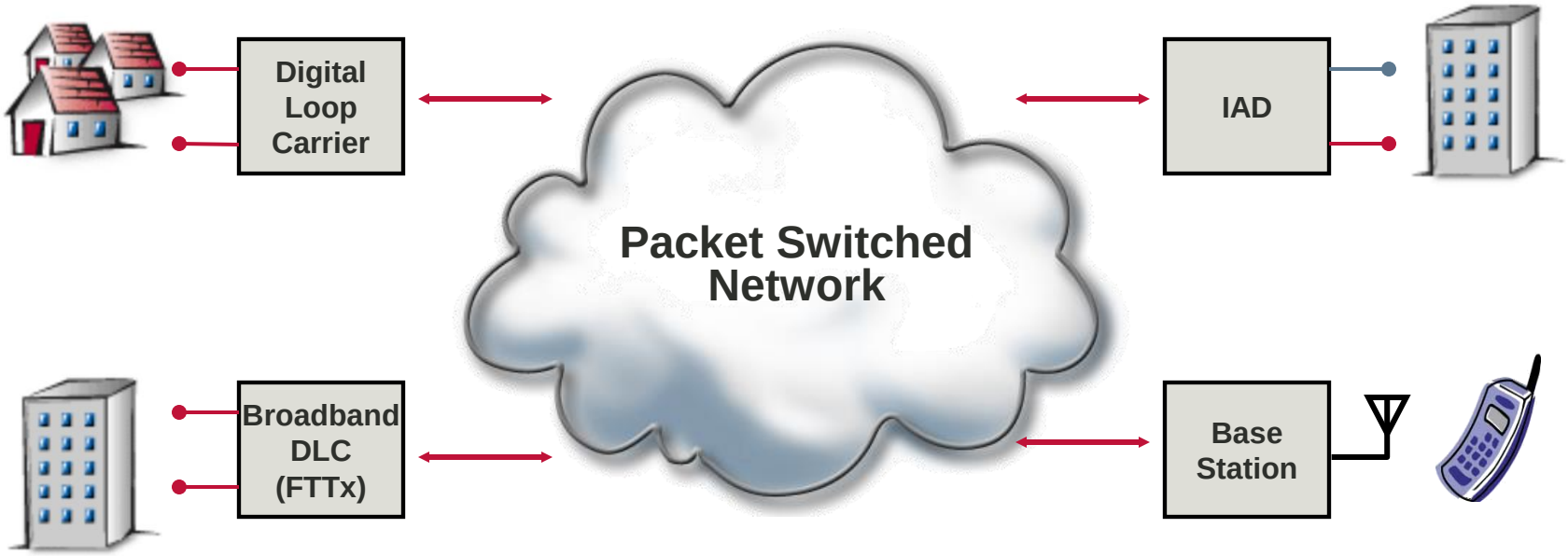
- No problem with synchronous network…
- Current synchronization distribution in circuit switched networks
  - T1/DS1 or E1
  - SONET or SDH



Packet Switched Networks

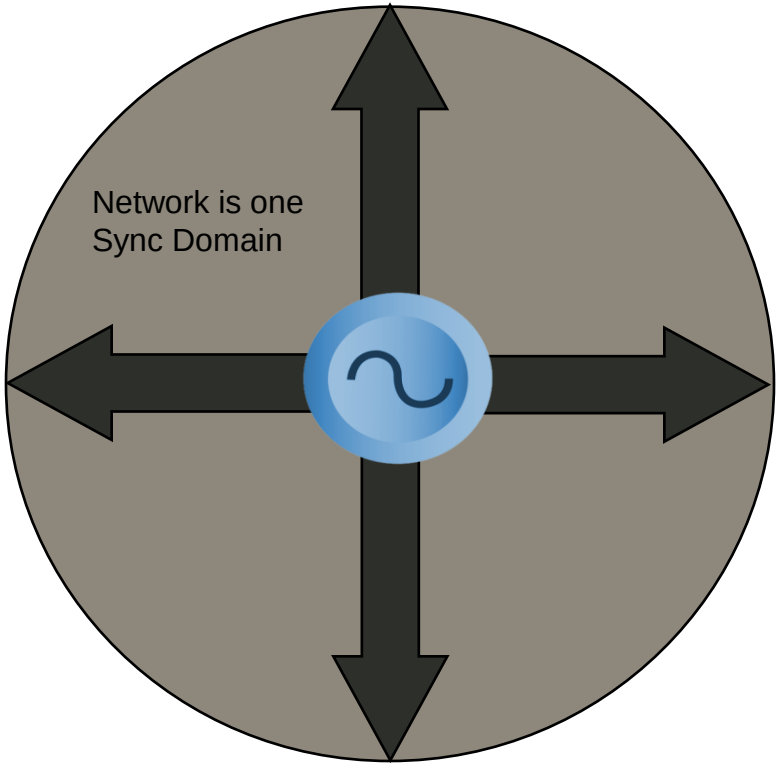
The Basic Problem

- In the PSN, the synchronization chain is broken…
- But there is still a need for synchronization to support time-sensitive services over PSN

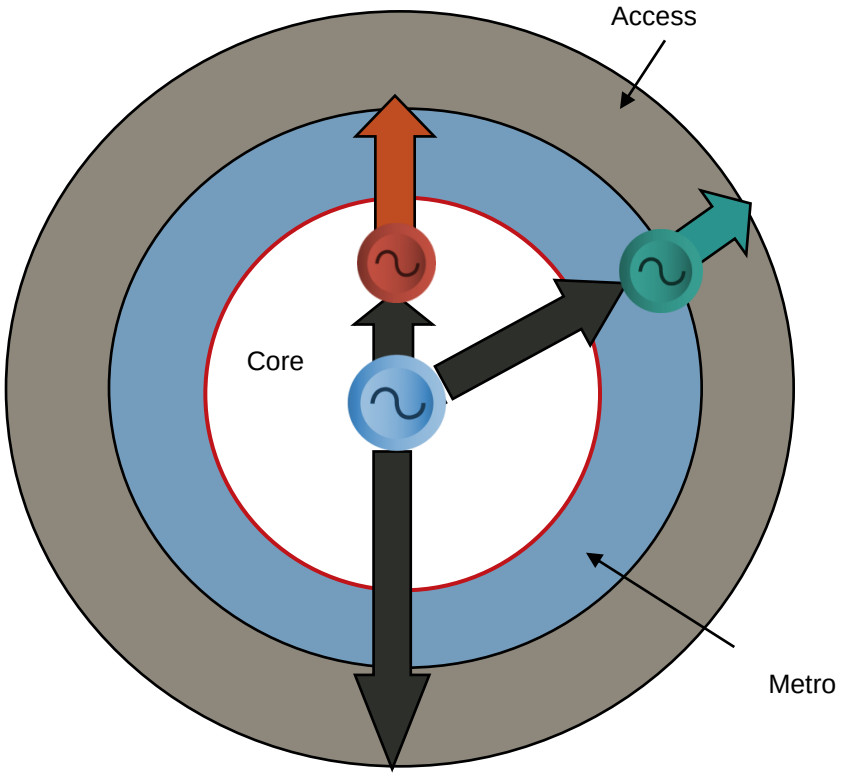


Synchronization Requirements

Unified Model replaced by more Fragmented Model



T1/SONET
Distribution rrom Central Source
Integrated in Physical Infrastructure



Courtesy of Mike Gilson & BT

New technologies, new places in network, add complexity

ITU-T Recommendation G.8261

- Recommendation published in May 2006
- Defines timing and synchronization elements of packet networks
- Specifies the minimum equipment tolerance to jitter and wander at the boundary of the packet networks at TDM interfaces
- Outlines the minimum requirements for the synchronization function of network elements
- Two methods for clocking distribution:
  - Network synchronous methods (Synchronous Ethernet)
  - Packet based methods (IEEE-1588 is an example of this method, but ITU does not refer to it)

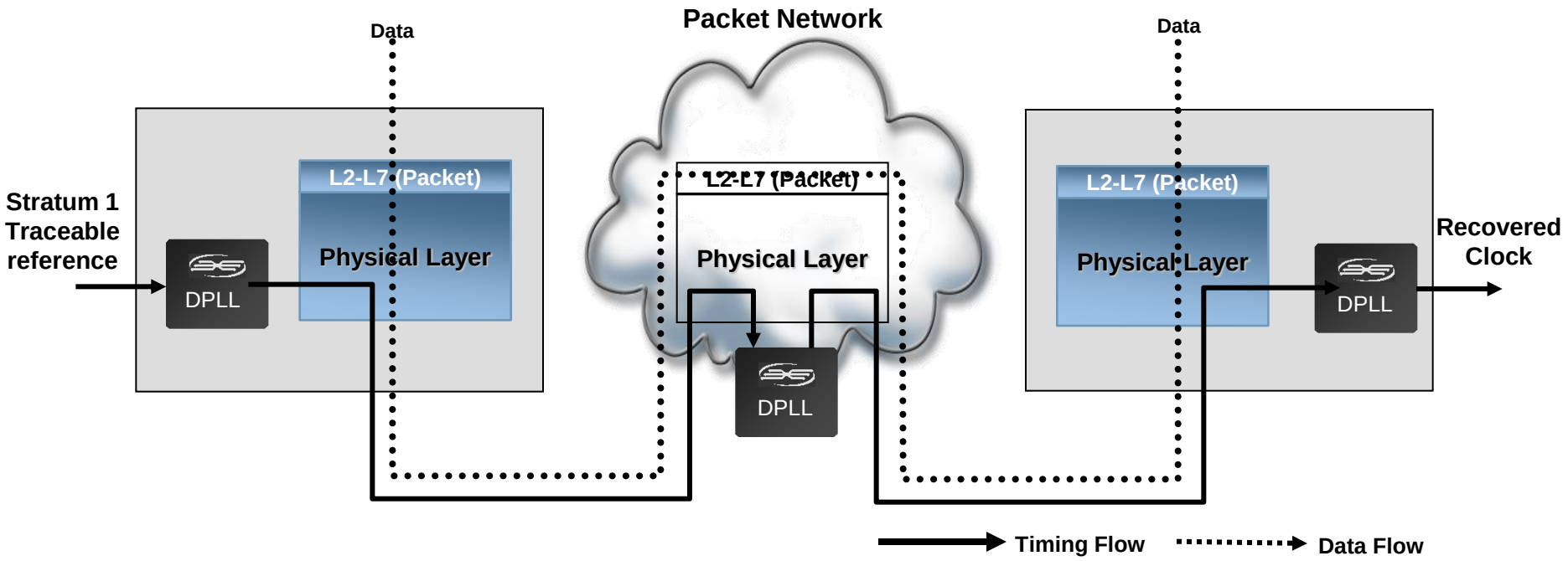
ITU-T G.8261

Synchronous Ethernet

- Synchronous Ethernet clocking distribution can be considered an extension of the current synchronization distribution network
- It does not impact any existing IEEE 802.3 specifications, such as frequency tolerance, but refers to the new additional network element clock functionality
- Uses the Protocol Data Units (OAMPDU) to pass Synchronization Status Message (SSM)

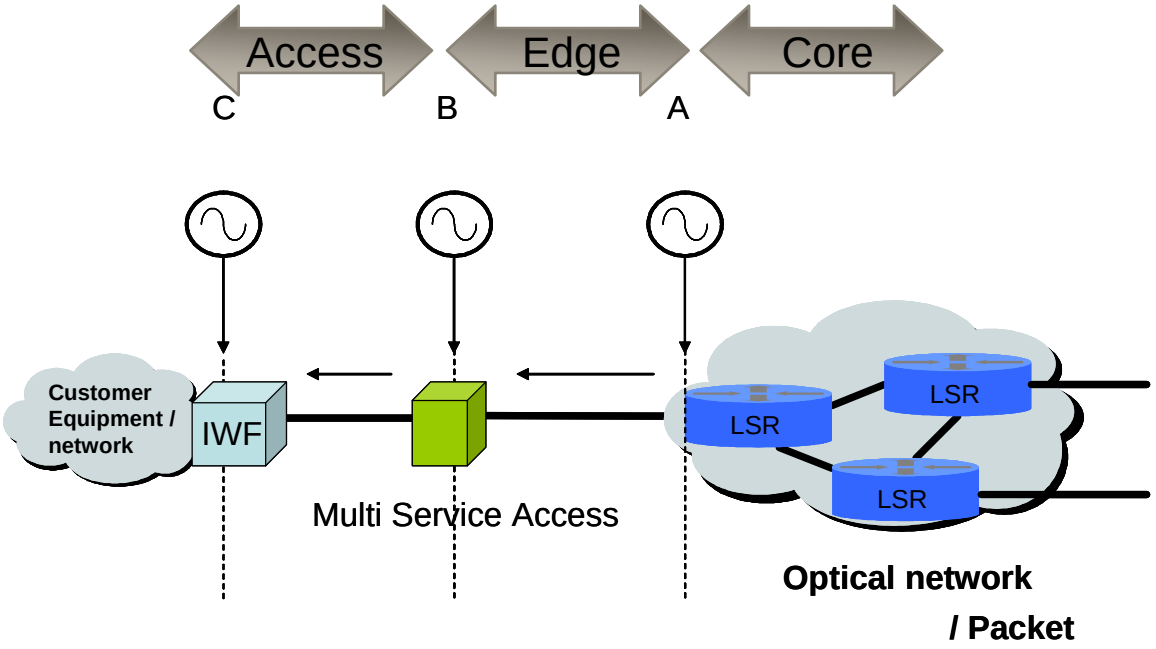
Synchronous Ethernet Concept

- Uses the PHY clock
  - Generates the clock signal from “bit stream”
  - Similar to traditional SONET/SDH/PDH PLLs
- Each node in the Packet Network recovers the clock
- Performance is independent of network loading



ITU-T G.8261

Architecture for Synchronous Ethernet



G.8261 – Reference Clock Location

IEEE-1588v2

Precise Timing Protocol

- Packet based synchronization mechanism
  - UDP/IP layers messaging (multicast and unicast) over Ethernet
  - NTP, Adaptive Clock Recovery
- Frequency, Phase and Time
  - TDM Synch/SyncE are Layer 1 mechanisms that support frequency only
- Client/Server model
  - Master clock, slave clock (ordinary clock)
  - Intermediary nodes may or may not support IEEE1588 PTP (unlike SyncE)
  - On-pass-support mechanisms
    - Boundary clock
    - Transparent clock

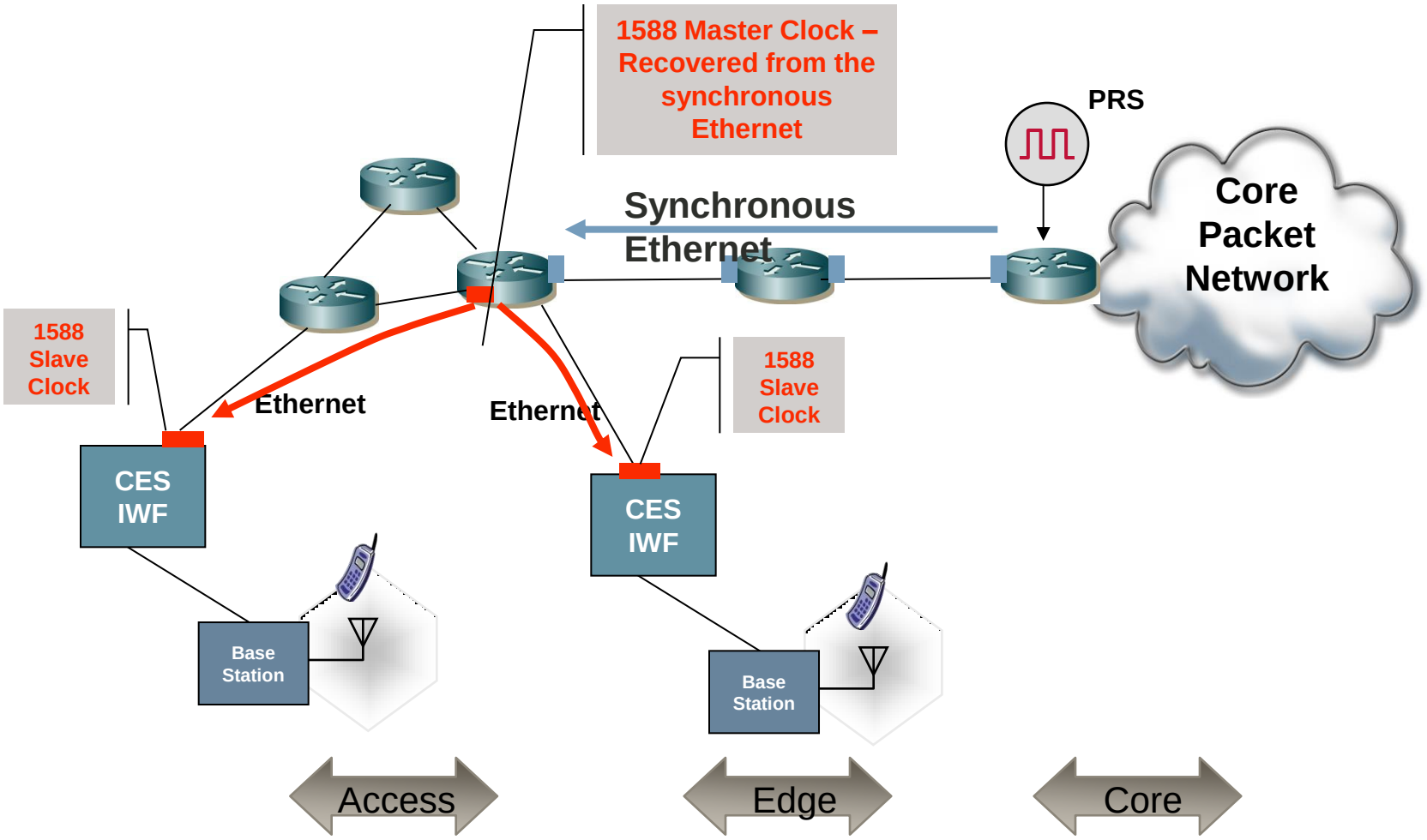
Note: Accurate time-of-day distribution is required for precise SLA monitoring and TDD radio applications.

IEEE-1588v2 and Synchronous Ethernet

- IEEE-1588v2
  - Independent of the physical layer
  - Can distribute time of the day and frequency
  - Can be affected by impairments of the telecom network such as packet delay variation
- Synchronous Ethernet
  - Uses the physical layer of Ethernet
  - Can only distribute frequency, it can not distribute time of the day
  - It is not affected by impairments introduced by the higher levels of the network

- Applications such as billing and Service Level Agreements (SLA) can benefit from a network that is aware of the time of the day
- Some networks are very noisy and there is a need to have carrier class synchronization
- In these conditions, Synchronous Ethernet can be used to deliver frequency, and IEEE-1588 can be used to deliver the time of the day

Example of IEEE-1588v2 and Synchronous Ethernet



Summary

- Synchronization is required in Ethernet!
- SyncE and IEEE-1588v2 work as a team
- Ethernet OAM plays a role
- Gather customer test requirements for field testing with v100+ and v300 units

Thank you.

Any questions?