Ethernet and the Mobile Backhaul

Synchronous Ethernet and IEEE-1588v2
Rev. A00
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
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
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.
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
No problem with synchronous network…

Current synchronization distribution in circuit switched networks
- T1/DS1 or E1
- SONET or SDH
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 from Central Source
Integrated in Physical Infrastructure

Access
Metro

Network is one Sync Domain

Core

New technologies, new places in network, add complexity

Courtesy of Mike Gilson & BT
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)
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).
- 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
G.8261 – Reference Clock Location
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 cannot 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

1588 Master Clock – Recovered from the synchronous Ethernet

Core Packet Network

Access

Edge

Core
- 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?