MSAN
(Multi Service Access Node)
Soft switches
Overview

• Challenge for Telekom Austria
• Clock requirements
• Syncronisation Concept
• 10GWAN contra 10GLAN
• MSAN synchronisation
• Testresults

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Challenge

- Mobile Backhauling
  - Sync supply with 1588 via Fiber over GbE

- Substitution of digital exchanges
  - Maintain Sync requirements for ISDN BRA&PRA

- Reduce maintenance costs per year
Overview MSAN, Soft switch

Legend:
- GigE SX
- GigE LX
- GigE TX

Site A
- Call Agent 1
- PEV 1A
- PEV 2A
- Fiber Channel
- TA-DWDM protected
- Clock required
- USP active
- GWC

Site B
- Call Agent 1
- PEV 1B
- PEV 2B
- Fiber Channel
- Clock required
- USP
- GWC

Development
- Call Agent 1
- Clock required
- USP
- GWC

POP Site 1
- Clock required
- MGW

Clock required

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Clock requirement ISDN

- Sliprats G.822, ETR 299 for IDSN BRA und PRA
  - Transit Network: 0.3 slip/day
  - Local Network: 2 Slips/day

0.3 Slips/day should be reached
Clock concept MSAN ISDN BRA

SyncE
ETY -> TE
External T3

BRA:

NT Loop Timing

Line Card

Signal processing

Buffer 1

Buffer 2

Signal processing

Buffer xxxx

Layer 2 Switch

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Clock concept MSAN ISDN BRA

BRA1

NT Loop Timing

MSAN 1

Line Card

Signal prozessing

Buffer 1

Layer 2 Switch

MSAN 2

Line Card

Signal prozessing

Buffer 1

Layer 2 Switch

BRA2

NT Loop Timing

Transport network

IP

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Why Slips

If $f_0 \neq f_1$ one of the buffer will come to his max. threshold and then Bits will be dropped.

Frameslips: PCM31, Buffer 125µsec

<table>
<thead>
<tr>
<th>Clock accuracy</th>
<th>1 Frameslip in</th>
</tr>
</thead>
<tbody>
<tr>
<td>10E-12</td>
<td>700 days</td>
</tr>
<tr>
<td>10E-11</td>
<td>70 days</td>
</tr>
<tr>
<td>10E-10</td>
<td>7 days</td>
</tr>
<tr>
<td>10E-9</td>
<td>17 days</td>
</tr>
<tr>
<td>10E-8</td>
<td>11,75 hours</td>
</tr>
<tr>
<td>10E-7</td>
<td>10 hours</td>
</tr>
<tr>
<td>10E-6</td>
<td>1 minute</td>
</tr>
<tr>
<td>10E-5</td>
<td>6 seconds</td>
</tr>
</tbody>
</table>

Comply to 15ppb for UMTS
10GWAN contra 10GLAN

10G-WAN = Layer 1 STM-64 Interface => STM N Overhead

STM64-OH: B1, B2, S1 + AIS/RDI
10GWAN contra 10GLAN

WAN PHY mode (10GWAN = STM64) on 10GE Interfaces
detect bit-errors on underlying WDM-Systems per Segment - so it’s needed to troubleshoot complex networks

**Multiplex section**

**B2 parity**

N x 3 bytes for Bit error monitoring over the whole multiplex section are available. The BIP 24 value will be calculated to even parity over all Bits of the frame except the lines 1 to 3 of the ROHS (Regenerator section overhead) and transmitted in the next frame
10GE WAN Synchronization: Standards Conflict

802.3ae std

- Ethernet transport was not intended to be used for network synchronization
  Prohibits “network” clock recovery: pg 372 table 50-2
  - Relies upon free-running OSC
- Since WAN framing based on SDH/SONET
  - SSM conveyed in physical layer S1 byte
  - S1 set to a fixed QL=DUS (do not use for sync): pg 372 table 50-2

G.8262 & G.8264

- Defines network timing distribution support using Ethernet transport physical layer
  - Requires “network” clock recovery based on hierarchical clock distribution
- All framing convention references IEEE 802.3
  - Therefore, physical layer assumes std Ethernet framing/preamble
  - Conveys network clock quality level via (L2) messaging defined by slow protocol
Overview: 10GE WAN Synchronization Feature Issue

IEEE 802.3ae

The WAN Interface Sublayer (WIS) is an optional PHY sublayer that may be used to create a 10GBASE-W PHY that is data-rate and format compatible with the SONET STS-192c transmission format defined by ANSI, as well as the Synchronous Digital Hierarchy (SDH) VC-4-64c container specified by ITU.

The purpose of the WIS is to allow 10GBASE-W equipment to generate Ethernet data streams that may be mapped directly to STS-192c or VC-4-64c streams at the PHY level, without requiring MAC or higher-layer processing.

ITU-T G.8262 & G.8264

G.8262 specifies the Ethernet clock performance

G.8264 specifies the Ethernet SSM equivalent process

SSM is based on a L2 802.3 slow protocol

- Clock recovery based on network traceable coordination of physical layer signal
Overview: 10GE WAN Synchronization Feature Issue

Option 1

- Address conflict between IEEE & ITU-T and modify 802.3 to allow
  - Clock recovery
  - S1 byte sync messaging

- Risk/Benefit
  - Slow process, but consistent & coordinated result
  - Assures network interoperability

Option 2

- Provide proprietary solution:
  - Enable SONET/SDH L1 clock recovery
  - Enable SSM messaging via L2 Ethernet slow protocol

- Risk/Benefit
  - Quick process
  - Proprietary solution - no/little interoperability
Additional frequency back up points

- GPS OK
- SSU OK
- PTP Slaves OK

Stressed Slave:
Frequency accuracy 1ppb

Holdover PTP Slave: 1 Week about 15ppb
## SyncE contra 1588

<table>
<thead>
<tr>
<th>Feature</th>
<th>SyncE</th>
<th>IEEE1588</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient response</td>
<td>+</td>
<td>To 10 times longer *as SyncE</td>
<td><em>Will be improved with Fast Lock etc.</em></td>
</tr>
<tr>
<td>Frequency accuracy</td>
<td>Better 1xE-10</td>
<td>x ppb*</td>
<td>•With traffiv &gt;50% etc...</td>
</tr>
<tr>
<td>Clock accuracy independent from trafficload, framesizes,</td>
<td>Yes</td>
<td>No Compensation with transparent Clock</td>
<td></td>
</tr>
<tr>
<td>Clock selection</td>
<td>with SSM</td>
<td>Yes 2. Grandmaster</td>
<td></td>
</tr>
<tr>
<td>Frequenzsynchronisation</td>
<td>Very good</td>
<td>good</td>
<td></td>
</tr>
<tr>
<td>Phasensynchronisation</td>
<td>no</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
## SyncE contra 1588

<table>
<thead>
<tr>
<th>Feature</th>
<th>SyncE</th>
<th>IEEE1588</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwith</td>
<td>No</td>
<td>Down 148kBit/sec</td>
<td>64 Syncmessages/sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Up ca. 45kBit</td>
<td></td>
</tr>
<tr>
<td>Pollicy MPLS</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Holdover</td>
<td>2 days</td>
<td>Better 15ppb/week</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G.813</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Option 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarms, metrics suitable for SLA</td>
<td>SSM</td>
<td>In future</td>
<td></td>
</tr>
</tbody>
</table>
Impelementation rules:

- Clock distribution over 2 Ways:
  Aggregation 1 and 2
  Topology: Ring: OK
  Chain: additional frequency input points

- SSM from source (MPLS Node) to sink (MSAN)
- Alarms MSAN: Holdover, Change of SSM Value
- SNMP Traps
Clock distribution

Clock distribution 2009

Core Sync-Distribution via SDH

Sync Level 1

FOKUS 2009
- SSU
- Upgrade NMS
- Rollout 1588 Mobile Synchronisation

Forecast 2010/11
- e2e Sync-Services
- Rollout SyncE
- Redesign Core-Sync

Sync Level 2

MPLS Network
Synchronous Ethernet (SyncE) + IEEE1588

Sync Level 3

Digital switches, nx64k, SDH,
MSAN Synchronization Concept Phase 1
MSAN Platform:

Services:
- Pots
- IDSN BRA & PRA
- Leased Lines

Technologie
- SHDSL
- VDSL
- GPON

10G Uplinks in future
MSAN Synchronisation Concept Phase 3
Test environment for SyncE tests

Ethernet
MPLS
Test-Plattform

ANT20
Jitter & Wander

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MSAN: Wander generation

Comply with:
G.8262 8.1.1 EEC Option 1
Wander generation

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Comply with:
G.8262 11.1.1 EEC-Option 1
Short-term phase transient response

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Comply with:
G.8262 11.1.1 EEC-Option 1
Long-term phase transient response

Figure 11 – Permissible phase error for an EEC-Option 1 under holdover operation at constant temperature

Holdover 1.5 ppb
After about 23h!

Better than G.8262
Many Thanks!

Questions?

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