



Synchronization Survey Results

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Oscilloquartz at a Glance



- Member of the ADVA Optical Networking Group
- Focused offerings for communications, governmental and enterprise applications
- Longstanding relationship with customers worldwide
 - Around 100 sync focused partners in about 80 countries around the globe
- State-of-the-art time and frequency systems
- End-to-end solutions for all markets
- Timing delivery and assurance Excellency



Innovation leader for timing distribution and assurance

Our Timing Portfolio



Sources



GNSS-Based Clocks



Cesium Clocks



NTP/ToD Sources

Distribution



SSU/TSG



PTP Grandmaster



Mini Grandmaster
APTS



Assurance



Sync Probe Devices



Services



Factory Services



Field Services



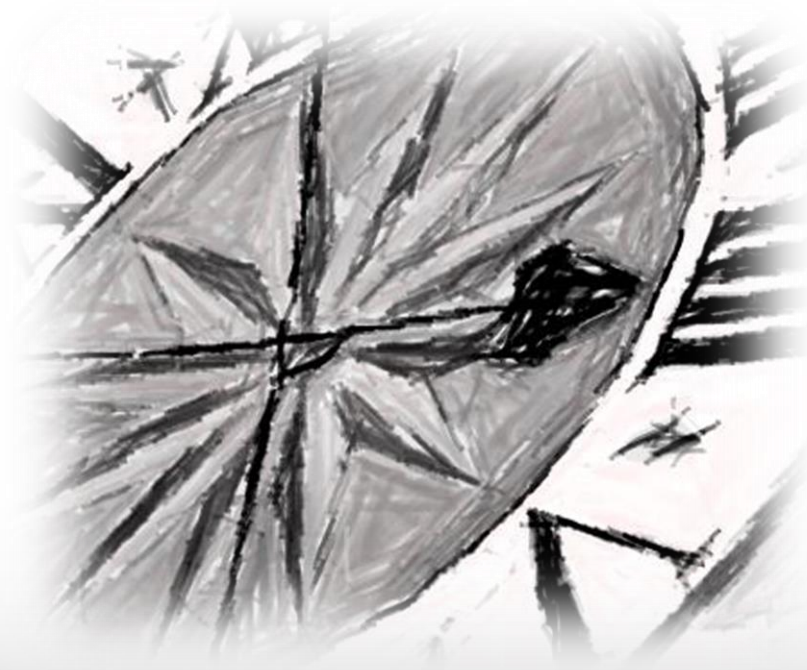
Network Survey
and Design

End-to-end solution for timing distribution and assurance

Survey Objectives and Methodology



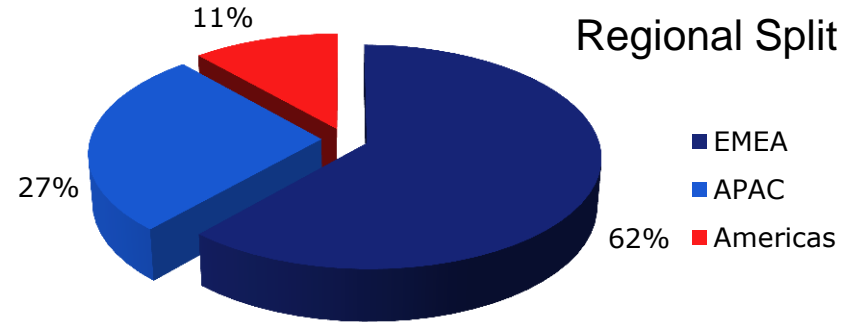
- Objectives
 - assess phase synchronization capability of existing MBH networks
 - analyze synchronization enablement strategies for achieving TD-LTE and LTE-A requirements
- Methodology
 - interviews with major Mobile Network Operators
 - questionnaire with 10 multiple-choice questions
 - statistical analysis of responses
 - interpretation



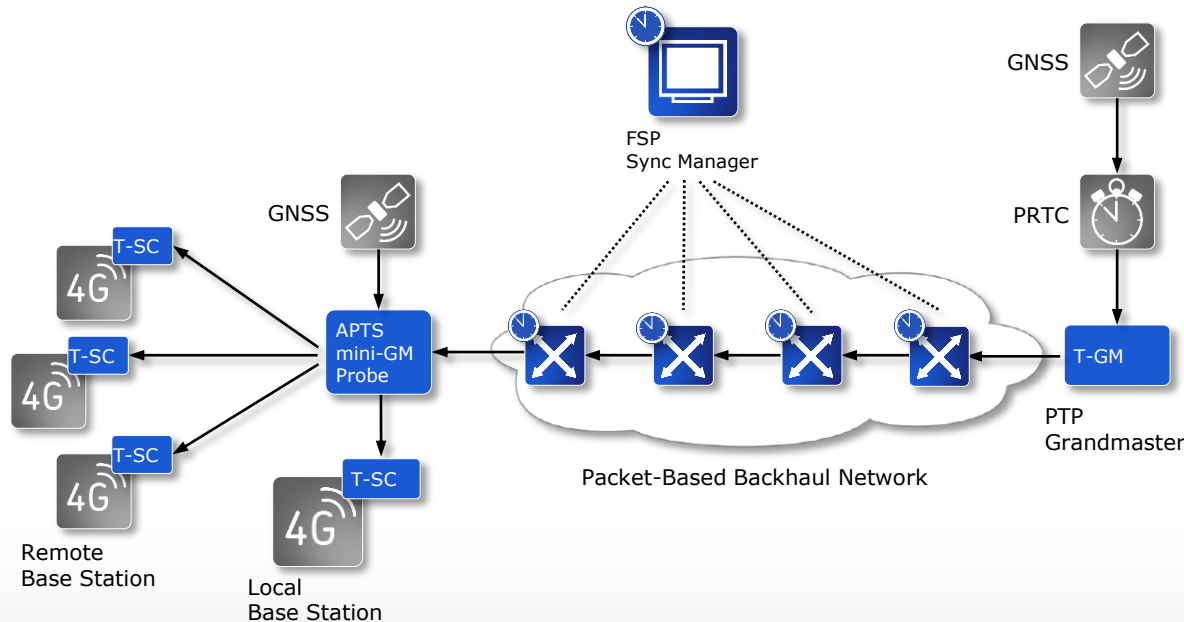
Participation



- Survey was done by ADVA Technical Marketing Department
- 26 responses provided by synchronization experts of major MNOs
- Interviews at conferences (BBWF, ITSF among others) and at synchronization workshops
- Timeframe: 4th quarter of 2013
- Global coverage with focus on Europe



The Survey was about Telecom Networks

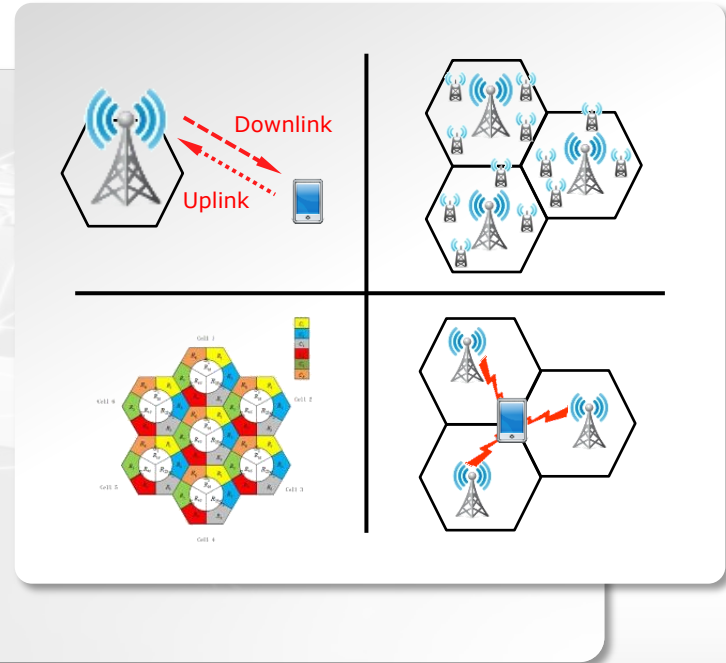


How to achieve efficient, accurate and assured phase synchronization ?

Need for Phase Synchronization



- Time Division Duplex mode (TD-LTE)
- Small cells enable more efficient spectrum utilization
- Enhanced Inter-Cell Interference Coordination (eICIC)
- Coordinated Multipoint transmission (CoMP)



Challenge to synchronization architecture of today's networks

Mobile Backhaul Synchronization Needs



Application	Radio Interface		Backhaul	
	Frequency	Phase	Frequency	Phase
CDMA 2000	$\pm 50\text{ppb}$	± 3 to $10\mu\text{s}$	GPS	GPS
GSM	$\pm 50\text{ppb}$	n/a	$\pm 16\text{ppb}$	n/a
WCDMA	$\pm 50\text{ppb}$	n/a	$\pm 16\text{ppb}$	n/a
LTE (FDD)	$\pm 50\text{ppb}$	n/a	$\pm 16\text{ppb}$	n/a
LTE (TDD)	$\pm 50\text{ppb}$	$\pm 1.5\mu\text{s}$	$\pm 16\text{ppb}$	$\pm 1.1\mu\text{s}$
LTE-A MBMS	$\pm 50\text{ppb}$	± 1 to $5\mu\text{s}$	$\pm 16\text{ppb}$	$\pm 1\mu\text{s}$ (G.8271)
LTE-A CoMP LTE-A CoMP JT	$\pm 50\text{ppb}$	± 1 to $5\mu\text{s}$ $\pm 0.5\mu\text{s}$	$\pm 16\text{ppb}$	$\pm 1.1\mu\text{s}$ < $0.5\mu\text{s}$ (?)
LTE-A eICIC	$\pm 50\text{ppb}$	± 1 to $3\mu\text{s}$	$\pm 16\text{ppb}$	$\pm 1.1\mu\text{s}$

MBMS-Multimedia Broadcast Multicast Services

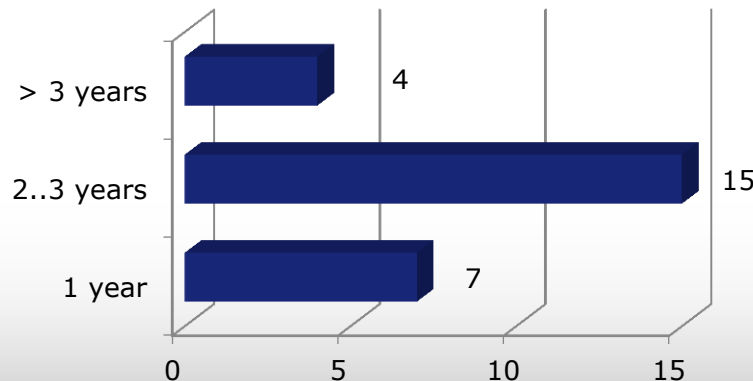
JT- Joint Transmission

Timelines Phase Synchronization



- Majority of respondents assume a need for phase synchronization within 2..3 years (4.Q 2013)
- **Conclusion:** Development of phase synchronization enablement strategy will happen in 2014 including feasibility analysis
 - New sync deployment is done for phase

When will precise phase synchronization become mandatory for backhaul services?

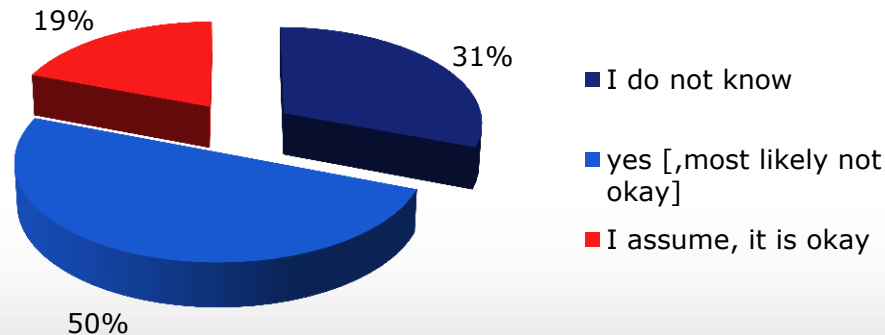


Synchronization Delivery Capability of Existing MBH Network



- Majority by far of the respondents does not know the synchronization delivery capability of installed base
 - How they will know?
 - Hope can't be a sync strategy
- **Root cause:** existing MBH networks do not provide means to evaluate phase sync capability

Do you know how your backhaul network performs for phase synchronization using 1588v2 PTP?

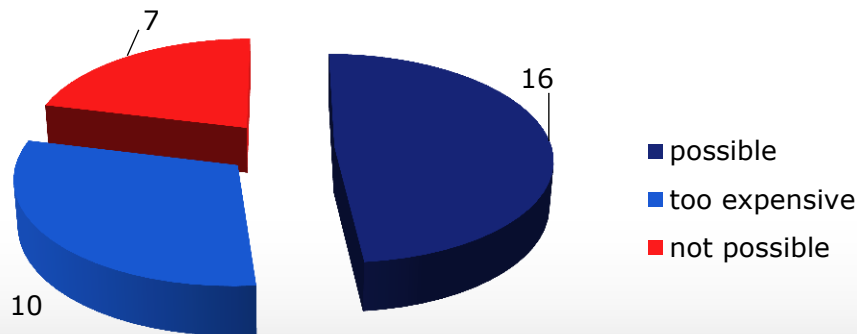


Upgrading Existing Networks



- Less than 50% of existing MBH networks can be upgraded for LTE-A
- Multiple responses as different technologies/suppliers are applied in a MBH network
- **Conclusion:** More than 50% of installed networks require alternative means for synchronization delivery

Can your current backhaul network be upgraded to support precise phase synchronization for LTE-A?

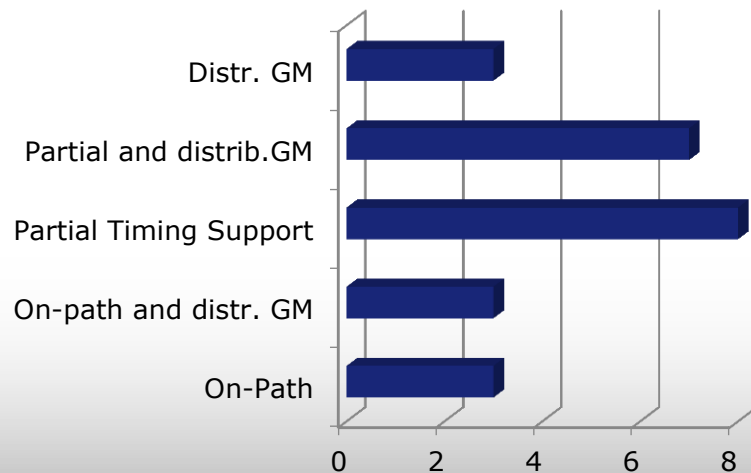


Synchronization Deployment Architectures



- Majority of respondents prefers partial timing support with or w/o distributed Grandmaster
- **Conclusion:** Emerging G.8275.2 and Assisted Partial Timing Support (APTS) seems to be a prefect fit for most MNOs

Which of the ITU options for phase synchronization makes most sense to you?

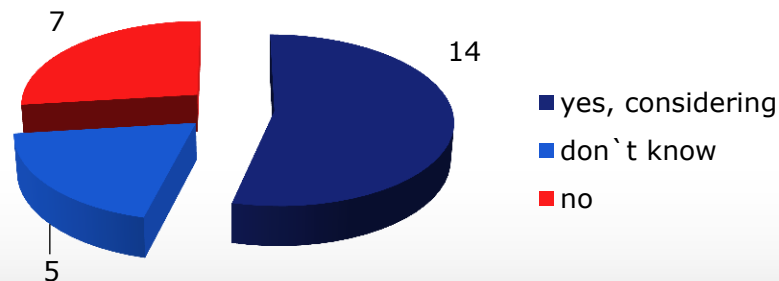


Distributed Grandmaster



- More than 50% of respondents already consider distributed Grandmasters
- **Please note:** major share of respondents believe in a favorable combination of distributed GM and network-based timing delivery

Do you consider deploying distributed mini grandmaster solutions?

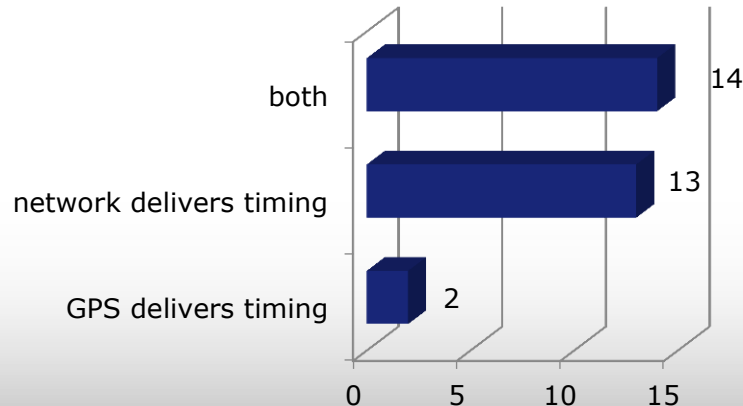


Network-based Synchronization Delivery



- GPS is not accepted as sole method for synchronization delivery
- **Conclusion:** mobile operators are eager to mitigate risk of GPS unavailability and combine it with network-based 1588v2 PTP synchronization

Is network-based 1588v2 PTP synchronization delivery an important backup solution for GPS-based synchronization?

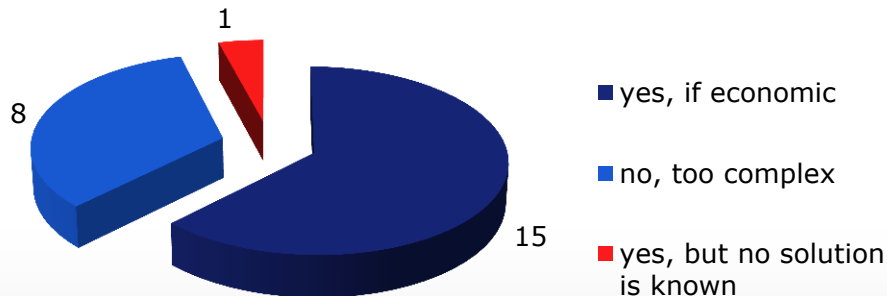


Dedicated Synchronization Solution



- The majority of respondents are interested in a dedicated synchronization solution
 - Economics is clearly important factor for such solution
- **Conclusion:** Decoupling of data and synchronization delivery should be analyzed for each MBH network in addition to evaluation of upgrade options

Would you consider deploying a dedicated sync solution for delivering precise phase synchronization?

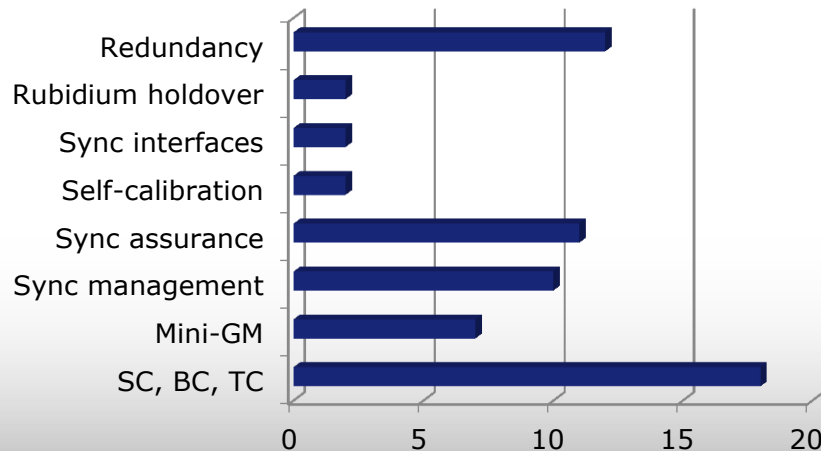


Synchronization Feature Set



- Slave Clock, Boundary Clock and Transparent Clock are obvious requirements
- Synchronization assurance, management and redundancy have highest rating
- **Conclusion:** Availability and manageability are key criteria for synchronization solution

What functionality needs to be delivered by a synchronization solution?

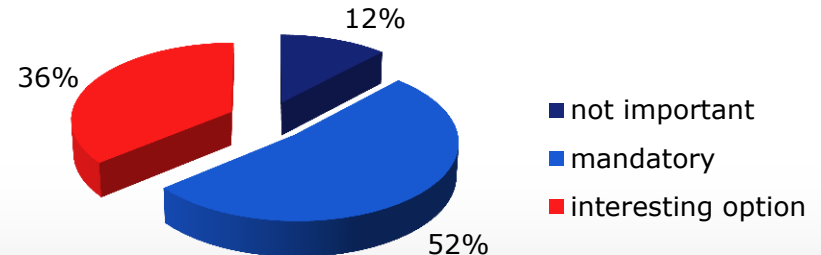


Synchronization Assurance



- Synchronization assurance is a highly relevant feature
- Need to be part of the service
- **Conclusion:** Mobile operators want to see such capability with their synchronization delivery solution

Do you rate synchronization service assurance as an important tool for delivering mobile backhaul services?

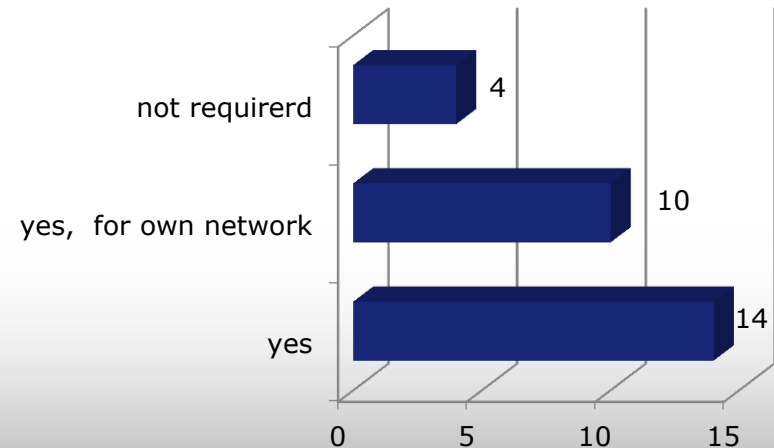


Service Level Agreements (SLAs) for Synchronization Delivery



- Most operators are eager to specify and monitor Synchronization SLAs
 - Needed in order to charge premium for Synchronization as a service
- **Conclusion:** Mobile operators will implement synchronization delivery solutions which support Synchronization SLAs

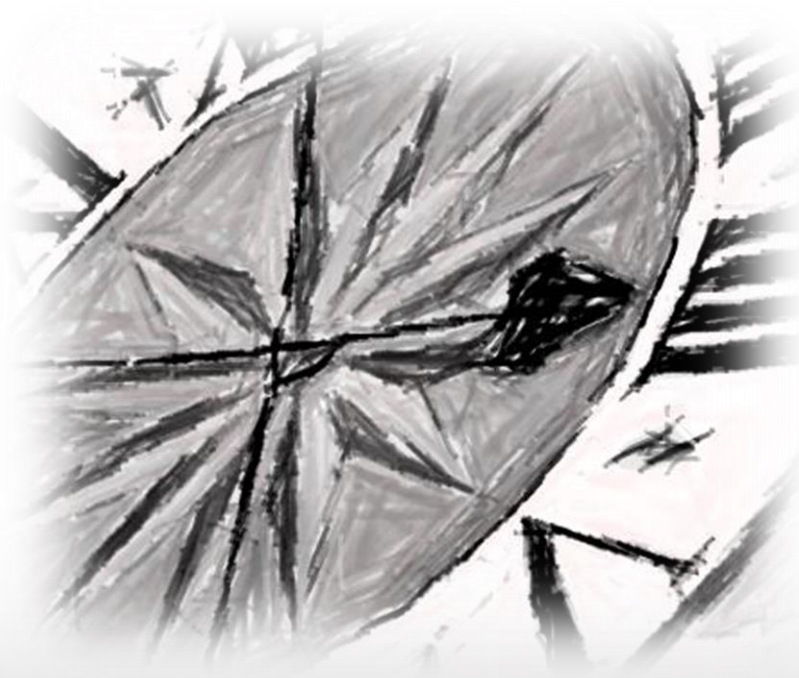
Do you see a need for dedicated SLA-based synchronization service delivery?



Key Findings



- GNSS (GPS) will not be used as the only means for phase sync delivery
- Strong preference for network-based 1588v2 PTP synchronization delivery
- Assisted Partial Timing Support is the preferred approach to solve the phase delivery challenge
- Understanding synchronization performance of existing networks and assuring synchronization performance with future solutions is key requirement
- Operators request redundant synchronization delivery





Thank You

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Timing Solutions Portfolio



- Timing Sources
 - Cesium clocks
 - GNSS-based clocks
- Time Distribution
 - NTP servers
 - ToD sources
- SONET/SDH Distribution
 - SSU/TSG solutions
- Time & Frequency PTP Distribution
 - Grandmaster clocks
 - Mini Grandmaster clocks
 - PTP to n x BITS/1PPS/ToD
- Timing Assurance
 - Sync Probe Devices
 - Syncjack technology
- Synchronization Management



OSA 3230B CS



OSA 5210 GNSS



OSA 5548C SSU/TSG



OSA TCC-PTP OSA TCC-NTP



OSA 5331 PTP



OSA 5225B TN



OSA 5410 (SP-100)

End-to-end distribution and assurance of precise timing information