

Sync MasterClass



Implementing Phase or Rolling Out 5G?

Introduction:

As 5G introduces new concepts and new network architectures that will have a huge impact on core, transport and radio network design, join our industry leading Synchronisation MasterClass to discover how synchronisation will be affected.

- Will network slicing slice through your KPIs?
- Will virtualisation virtualise your revenue?
- Will RAN functional decomposition rot your ARPU?

If you are in the early stages of rolling out 5G, timing and synchronisation options should be at the centre of architecture discussions.

- Can your existing network hardware provide full on-path support for PTP & SyncE?
- Does your PRC need upgrading to be a PRTC?

Delivered to more than 1500 UK and overseas manufacturers and operators since 1999, the Sync MasterClass is delivered on a public basis at Stowfield House or it can be brought to your location anywhere in the world and tailored to meet your specific requirements. The course will always include the essential elements overleaf.

Duration:

The course takes place over two days at Stowfield House. Please [visit our website](#) for dates of the next public event. Often the MasterClass is over subscribed so it is a good idea to book early to avoid disappointment.

Prior Knowledge:

It is assumed that attendees have a basic understanding of telecoms transmission including an overview of SDH and PDH.



Content:

- Introduction to Synchronisation
- Fundamental Concepts: Frequency, Phase, Time, Oscillators & Phase Locked Loops
- Synchronisation Elements: Clock Sources, networks clocks and distribution techniques
- Standards: relevant standards from ITU, ETSI, IETF and IEEE
- Quality Metrics & Testing
- Networks: Time & Phase Synchronisation
- Core Networks: SyncE, SDH, DWDM
- Core Networks: Packet based Synchronisation NTP, PTPv2 and others
- Leased Line & Access Networks
- Mobile Networks including 5G
- Architecture & Planning

Essential for:

- Sales and bid preparation staff
- Network planners and architects
- Engineers and technicians
- Operations and maintenance staff
- Customer liaison staff
- Network management staff
- Senior line management of staff involved with sync issues

Detailed Syllabus Day 1:

Pre-Course Question Session

Day 1 starts with a quiz covering basic telecoms terminology and sync. It is marked before the start of day 2 and feedback given to the delegates. It is used to measure the improvement in delegates' knowledge as the test is repeated on Day 2.

- Written test to assess level of knowledge
- Over 40 questions and acronym definitions

Introduction to Synchronisation

- History of Telecoms Synchronisation
- Emerging technologies, convergence of voice/data/internet services
- Basic misconceptions about sync
- Typical sync routes through a network
- Impact of poor sync on carriers' services
- Impact of poor Sync on Mobile Networks

Fundamental Concepts: Frequency, Phase, Time, Oscillators & Phased Locked Loops

- Acronyms and Definitions
- Classical Network Sync Architecture
- Clock Noise and Noise Characterisation
- Jitter and Wander
- Slips and Pointer Adjustments
- Introduction to mixed technology problems

Synchronisation Elements: clock sources, networks clocks and distribution techniques

- Types of Oscillator
- Atomic clock fundamentals
- Introduction to GPS
- Other PRS Clocks
- PRTC—Time Masters
- Slave Clocks—SSU and SEC
- Comparison of Regional Standards
- VCO and PLL Principles
- Examples of SSU and PRC products
- Other off-air references—GLONASS, Galileo, BeiDou, eLORAN
- GPS based PRCs & PRTCs—including practical considerations

Standards: relevant standards from ITU, ETSI, IETF and IEEE

- Evolution to NGN timing protocols- IEEE and IETF standards
- Clock standards
- Electrical interface standards
- Jitter and Wander standards
- Comparison of Regional standards

Quality Metrics and Testing

- Definitions
- Derivation of TIE and sample data
- Derivation of MTIE and sample data
- Derivation of TDEV and sample data
- Real application examples
- Sync test equipment & solutions
- Evolving metrics for PSNs—minTDEV, MAFE and MATIE
- Metrics and measurements for 1PPS signals

Day 2:

Core Networks: SyncE, SDH & DWDM

- Review of SDH technology
- Network Elements
- Pointers
- Sync Status Messaging
- Sample SDH network MTIE “signatures”
- Use of Retimers
- Sync over DWDM
- High level review of Sync in Optical Transport Networks
- Optical Network Signal Structure
- OTN Sync Transport Mechanisms
- Examination of transport of SDH clients over the OTN
- SyncE theory
- Frequency transport mechanism
- Standards limited MTIE/TDEV

Core Networks: Packet based Sync NTP, PTPv2 and others

- Review of packet network technology
- Network elements
- Transport mechanism
- Network Synchronous, Adaptive Clock Recovery (ACR) and SRTS (Differential) methods
- Sample ATM and ACR network element MTIE 'signatures'
- Sync over Packet Networks—PTP, NTP and 'Carrier Class' NTP
- The evolution to Next Gen Network standards including G.8260 & G.8270 series
- Synchronous Ethernet introduction
- Emerging technologies—UTI

Leased Line & Access Networks

- PDH issues
- SDH issues
- ATM issues
- Packet access
- HDSL and SHDSL issues
- Measured results
- Conclusions

Mobile Networks including 5G

- Mobile network requirements
- 5G, GSM, 3G & 4G
- Small cell requirements
- Network and Base Station sync
- Mobile Network Architecture and Connectivity
- Sync for location based services
- WiMAX sync requirements

Architecture & Planning

- Inter-Network Architecture
- Intra-Network Architecture
- Master Slave PRC
- Flat PRC
- Hybrid PRC
- Intra-Node Architecture
- Sync Element Interworking
- Planning Rules: PRC level; SSU level; SEC level
- Interworking of SDH/DWDM/SyncE/PTP
- Network Examples

Post Course Questions

- Repeat of questions from day one
- Comparison of marks and review of answers