



Synchronisation in Optical Transport Networks (OTN)

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OTN Abbreviations

OCh	Optical Channel
OPU	Optical Channel Payload Unit
ODU	Optical Channel Data Unit
OTU	Optical Channel Transport Unit
OMS	Optical Multiplex Section
OMU	Optical Multiplex Unit
OTS	Optical Transmission Section
OTM	Optical Transport Module



OTN Abbreviations

OCC	Optical Channel Carrier
OSC	Optical Supervisory Channel
COMMS	Management Communications
OADM	Optical Add-Drop Multiplexer
OXC	Optical Cross-Connect
LC	Link Connection
REG	Regenerator



General OTN Features

- New transport networking layer proposed by ITU-T
- Transmission: optical fibre
- Multiplexing: Wavelength Division Multiplexing (WDM), each wavelength transports an Optical Channel (Och)
- Lightpath switching
- Data-rate per wavelength:
 - ❖ 2.5 Gbit/s or 10 Gbit/s or 40 Gbit/s
- Service transparency for clients
- Asynchronous and bit-synchronous payload mappings



OTN Standards

- G.781/Y.1301: Framework for OTN Recommendations
- G.872: Architecture of OTN
- G.709/Y.1331: Interfaces for the OTN
- G.798: Characteristics of OTN hierarchy functional blocks
- G.8251: The control of jitter and wander within the OTN

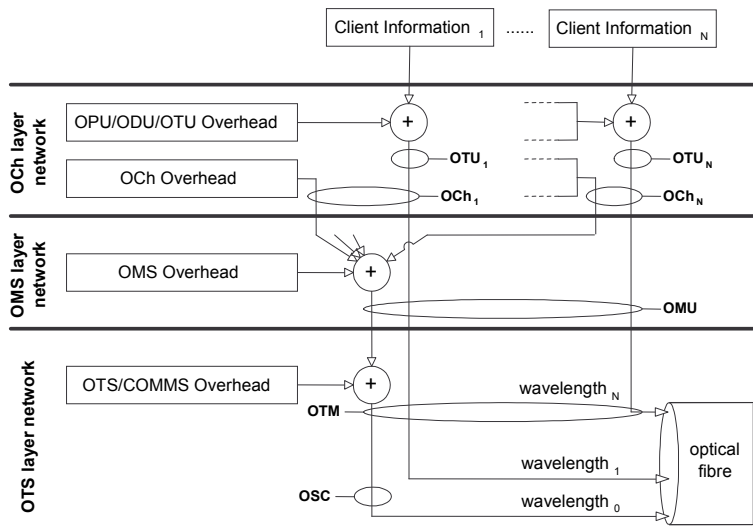


OTN Network Layering

- OPUk: Optical Channel Payload Unit-k
 - ❖ Provides for client mapping
- ODUk: Optical Channel Data Unit-k
 - ❖ Highest digital layer, includes ODUk and OPUk frame
- OTUk: Optical Channel Transport Unit-k
 - ❖ Lowest digital layer, terminated at 3R regenerator with clock recovery
- Och: Optical Channel
 - ❖ Highest optical (analogue) layer, each channel maps to one λ
- OMS: Optical Multiplex Section
 - ❖ Signal between multiplexers
- OTS: Optical Transmission Section
 - ❖ Optical (analogue) layer with set of λ 's



OTN Network Layering



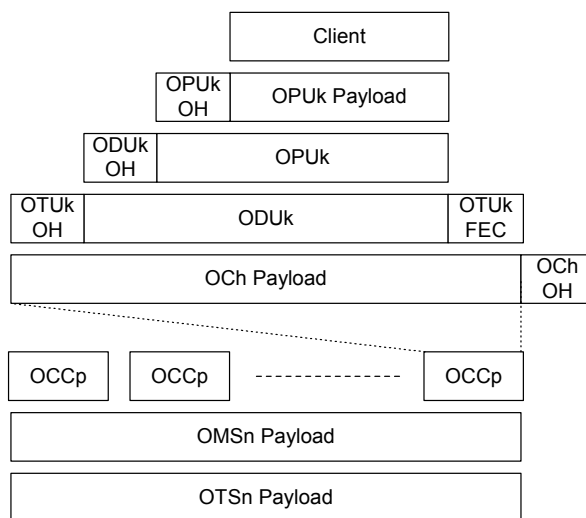
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OTN Network Layering



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Synchronisation Issues

- The OTN is required to allow the transport of synchronisation via SDH/SONET client connections.
 - ❖ SDH/SONET client connections must meet G.825 Network Limits after transport over the OTN.
 - ❖ A synchronisation reference chain which meets G.825 Network Limits is proposed in ITU-T Rec. G.8251.

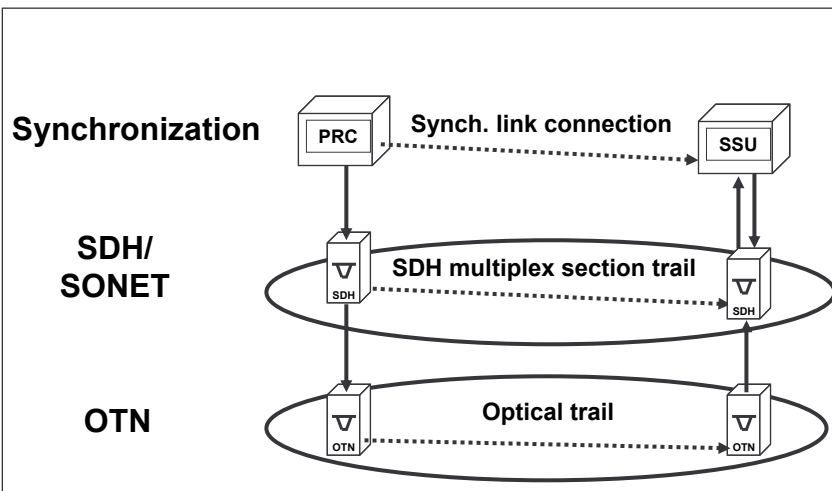


SDH synch. link connections

- Supported by an SDH multiplex section trail
- The SDH multiplex section trail may be supported by an optical channel of the OTN (Optical Transport Network)



SDH synch. link connections



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The control of jitter and wander

- SDH requires that jitter and wander be kept below tight network limits.
- This is achieved by inserting narrow-bandwidth SSUs in the synchronisation chain.
- Narrow-bandwidth SSUs attenuate jitter and wander components that lie outside the SSU bandwidth.

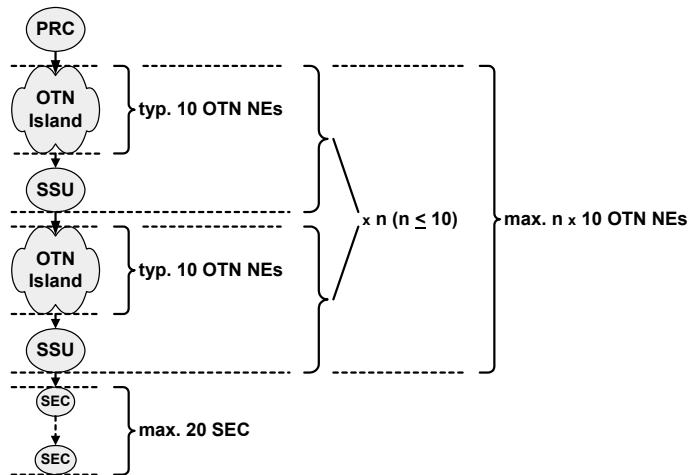
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Synch. reference chain for SDH over OTN



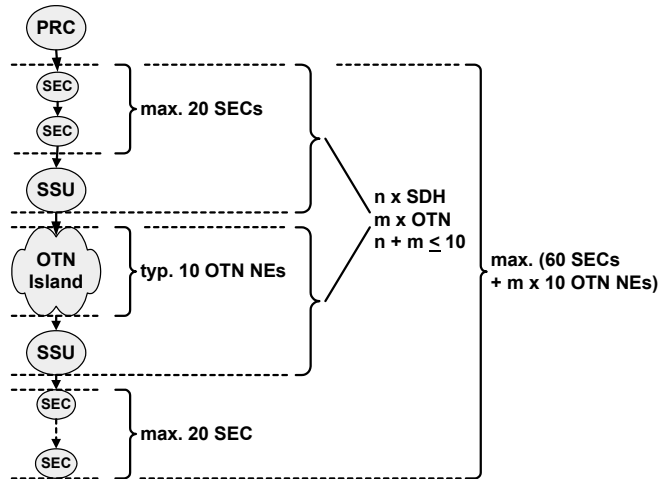
Synch. reference chain for SDH over OTN

○ ITU-T Rec. G.8251 for SDH over Optical Transport Network (OTN):

- ❖ Not more than 10 OTN islands in the chain
- ❖ Insertion of an SSU after each OTN island
- ❖ Not more than 10 OTN NEs per OTN island (may be redivided freely over the OTN islands)
- ❖ Not more than 20 SECs in the pure SDH tail



Synch. reference chain for SDH over OTN



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Synch. reference chain for SDH over OTN

- There may be a mix of pure SDH islands and SDH-over-OTN islands:
 - ❖ Not more than 10 islands altogether
 - ❖ Insertion of an SSU after each island
 - ❖ Not more than 20 SEC in a pure SDH island
 - ❖ Not more than 60 SEC in the entire chain

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Thank you