Synchronization Planning and Deployment Considerations for the Converged Network

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1 Layer 1 Synchronization

Synchronization Management

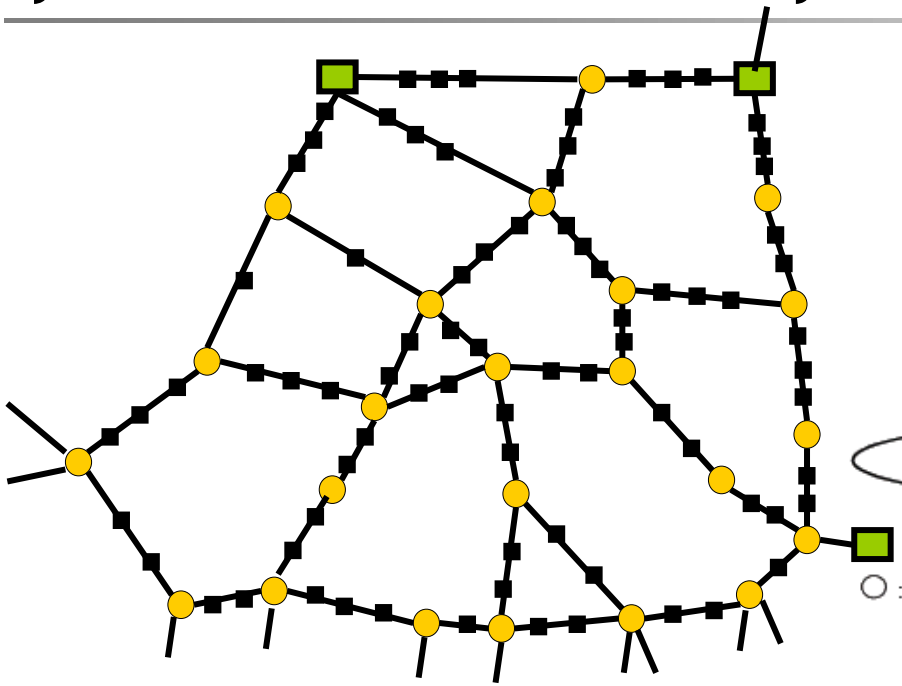
Synchronization Manager needs to ensure the resilient delivery of quality synchronization references to all the network elements

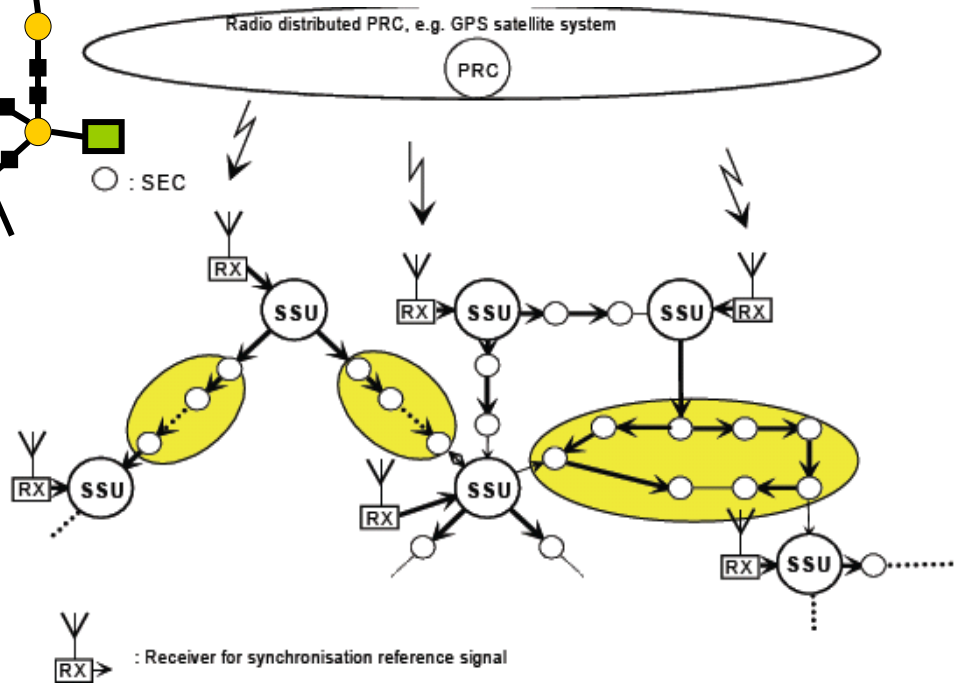
Highly Specialized knowledge base

Elements

- Stratum 1 Sources, GPS Receivers
- BITS/SSUs
- Network Elements (SEC/EEC)
- Physical Links

Synchronization Plan overlay of Physical Connectivity





Methods

- Paper exercise
- Automated assist/control

Management Focus

Configuration, Fault, Performance Management

Layer 1 Synchronization Distribution

- Redundant distribution to each node
- Maximum span between SSUs
- Loop avoidance

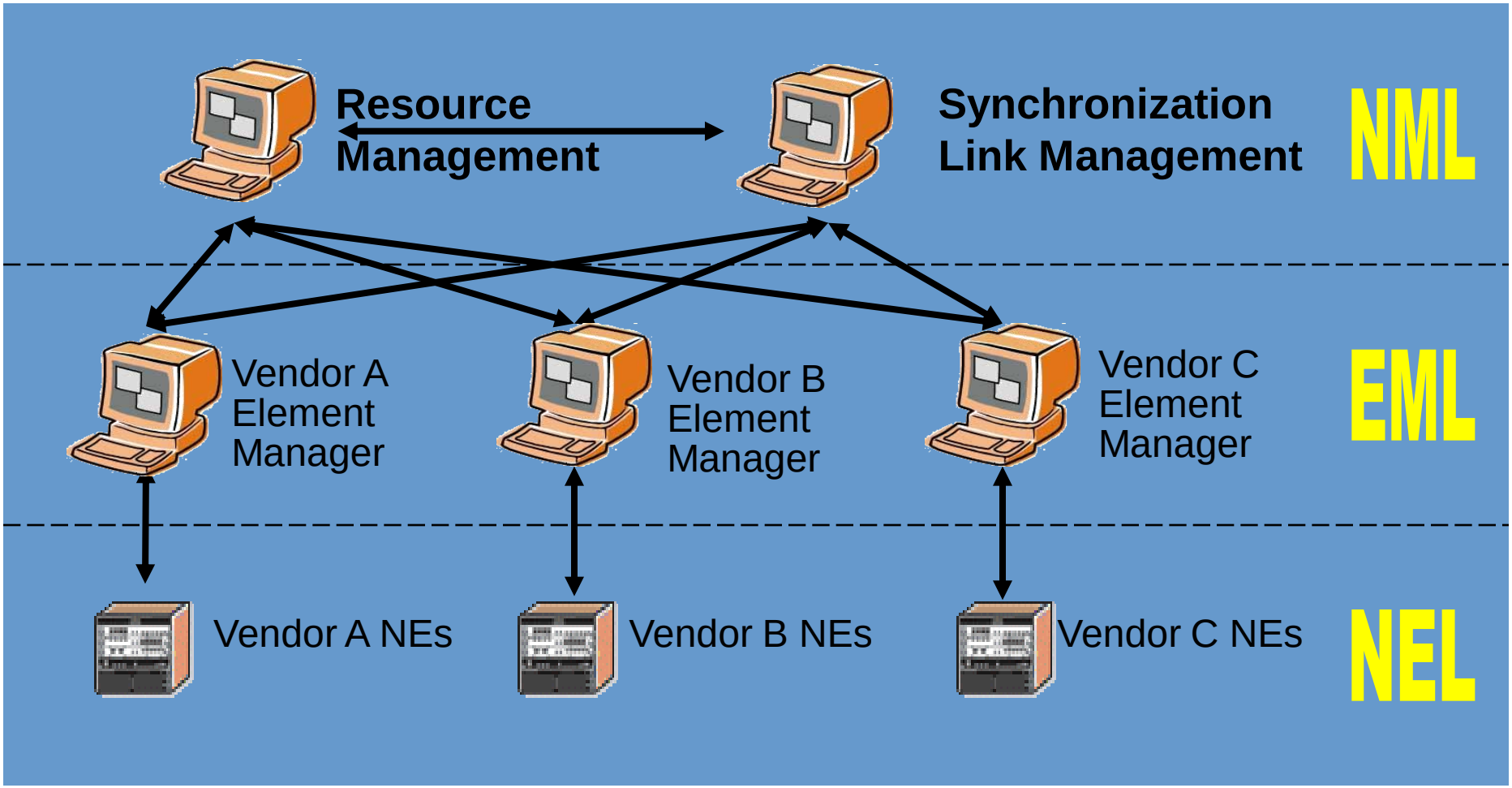
Plan vs Reality

- Monitoring of current distribution
- Analysis of failure/maintenance scenarios
- Re-architecting with the addition of network segments
- Correlation of distribution to performance

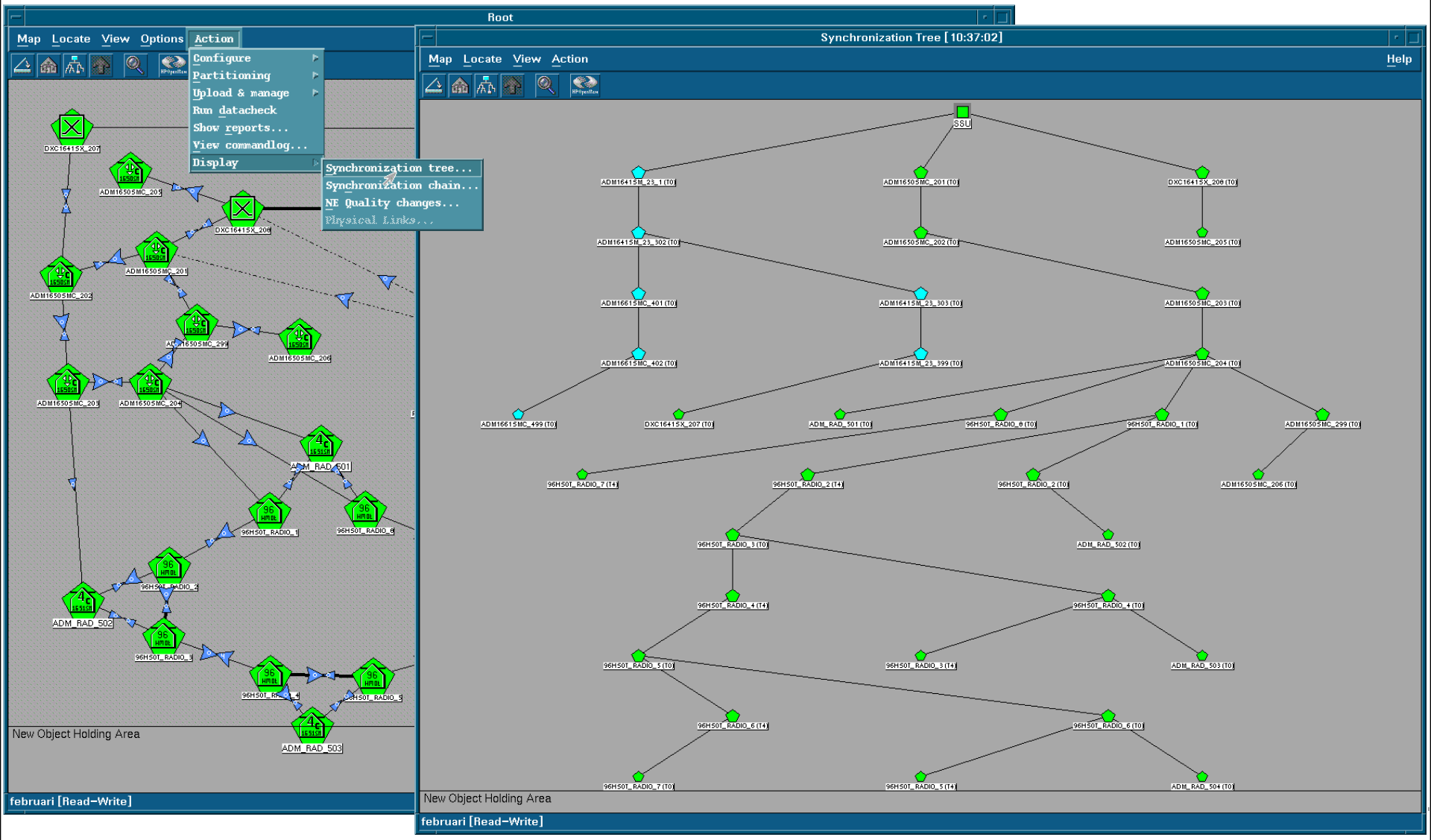
Efficient and timely analysis

- React quickly to problems
- Speed commissioning

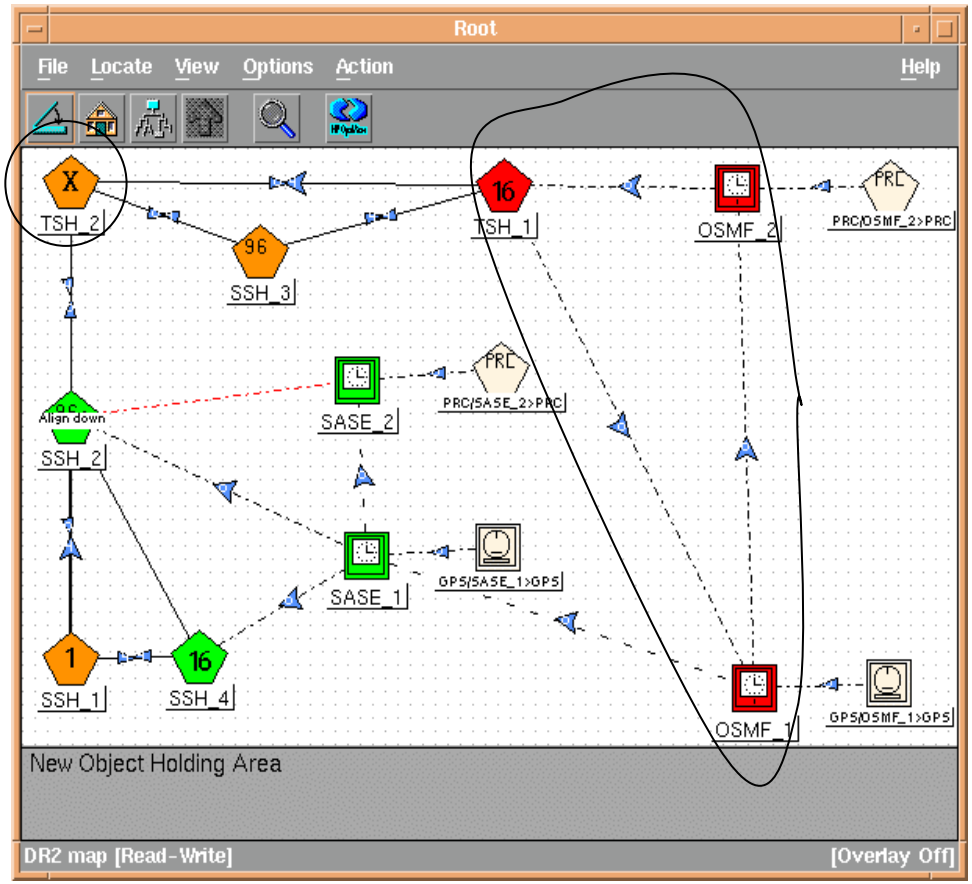
Synchronization Management Tools



Topology Analysis

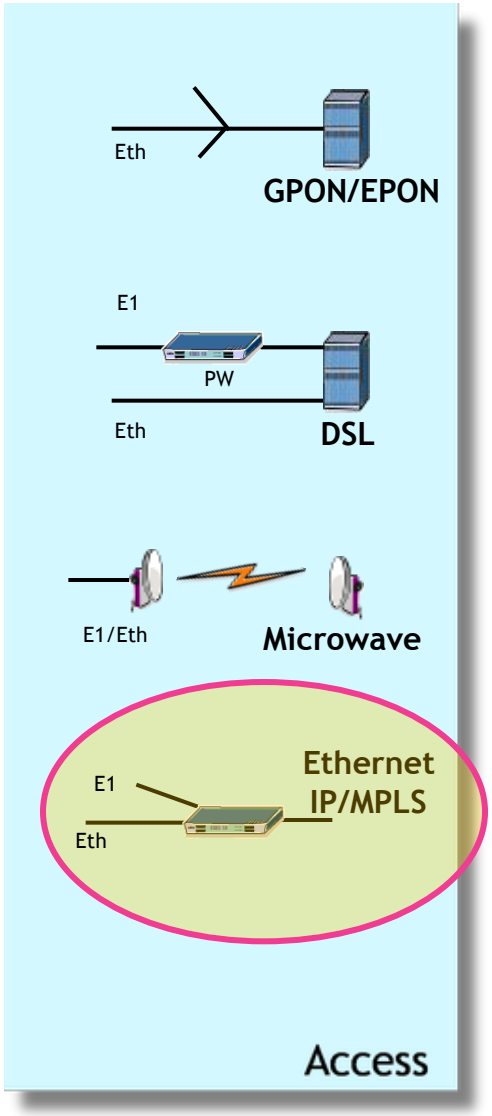


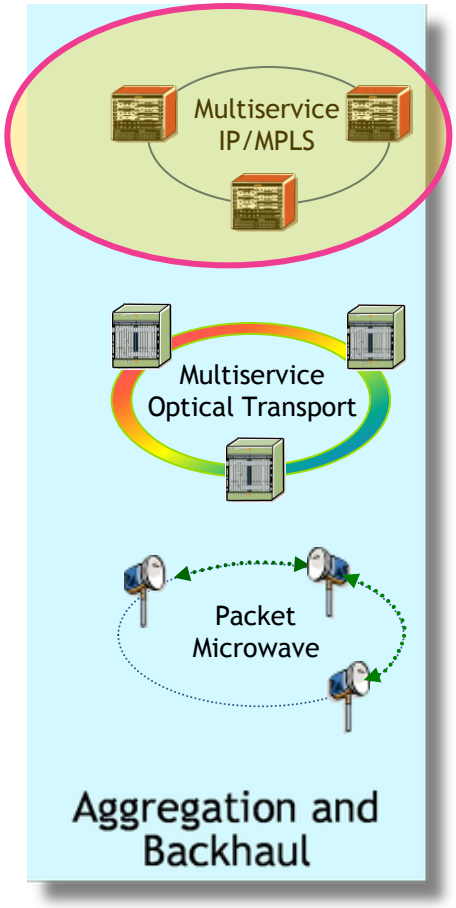
Distribution Maintenance

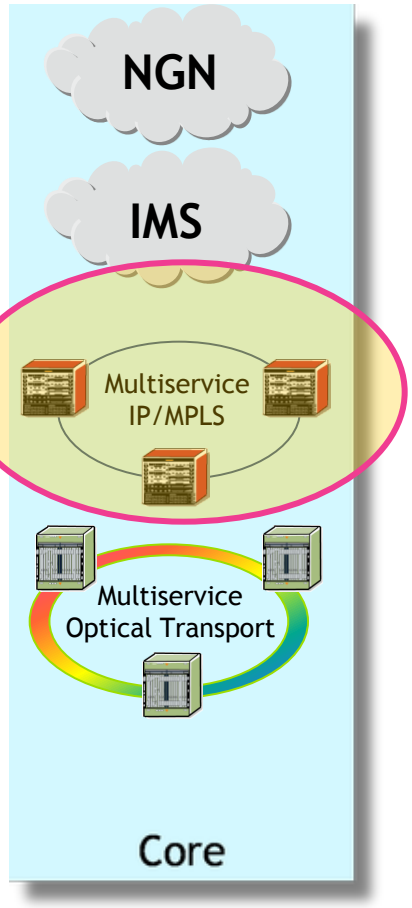


2 Convergence and Timing over Packet

Converged Network







Timing over Packet

Packet based techniques

- ACR for Circuit Emulation
- Carrier class NTP
- IEEE 1588-2008

Dynamic Paths

- Uses physical links but not fixed
- Routing protocols select paths
- L2/L3 flows need to be modeled

Timing over Packet Delivery

In band interactions

- Physical link characteristics (GE vs xDSL vs µWave)
- Switch/Router forwarding characteristics
- Packet prioritization
- User traffic dynamics

More variability in synchronization signal quality

- Increased monitoring
- Packet and frequency domain

Distribution Planning & Maintenance

PDV

- Needs characterization
- Rerouting control

Interworking Sites

- Layer 1 to Timing over Packet interchange
  - Traceability (SSM)
  - Signal Quality
- Migration from SDH to IP/MPLS may change these sites

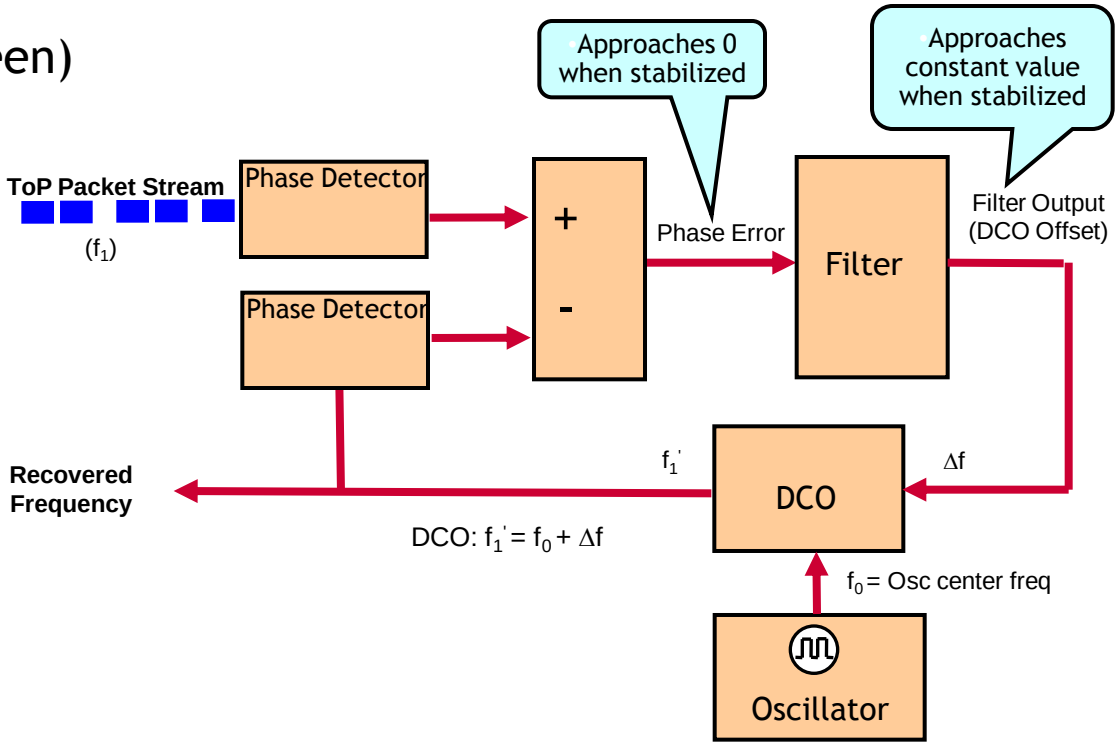
Additions of On Path Support nodes

- NTP servers
- Boundary clocks
- Transparent clocks

In service Monitoring

Performance monitoring

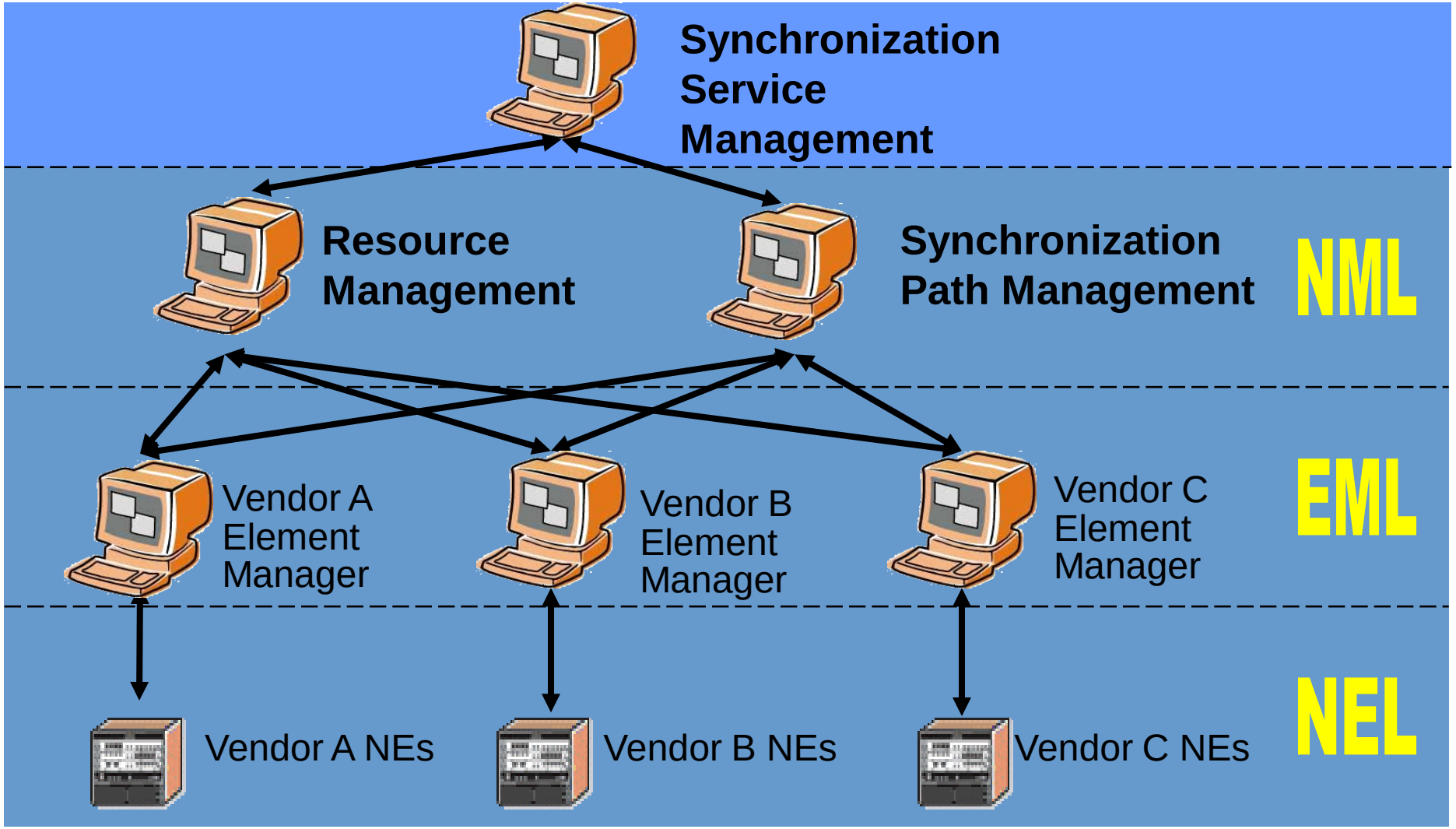
- ToP status (red/yellow/green)
- Stability metrics
- Event collection



Performance correlation

- Timing events vs network events
- Path load monitoring

Synchronization Management Tools



Conclusions

Synchronization Service planning and monitoring are essential

Addition of Timing over Packet synchronization delivery techniques increases the challenges

Automated tools for planning, characterizing, and monitoring the synchronization paths can provide significant assistance

Efficient correlation between path routing, traffic loading, and ToP performance

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