



# Label Switched Path (LSP) Dynamical Provisioning Performance Metrics in Generalized MPLS Networks

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# Requirements

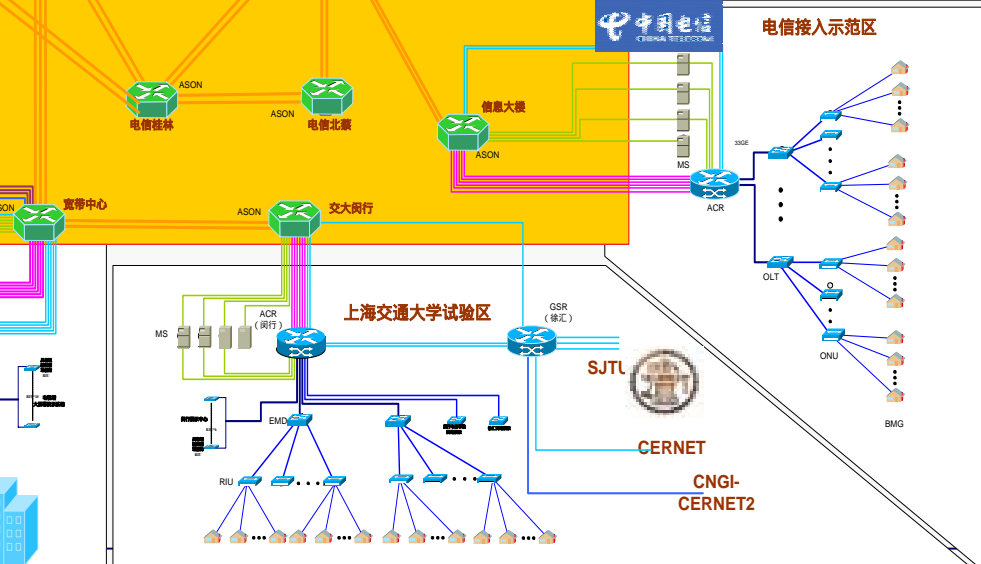
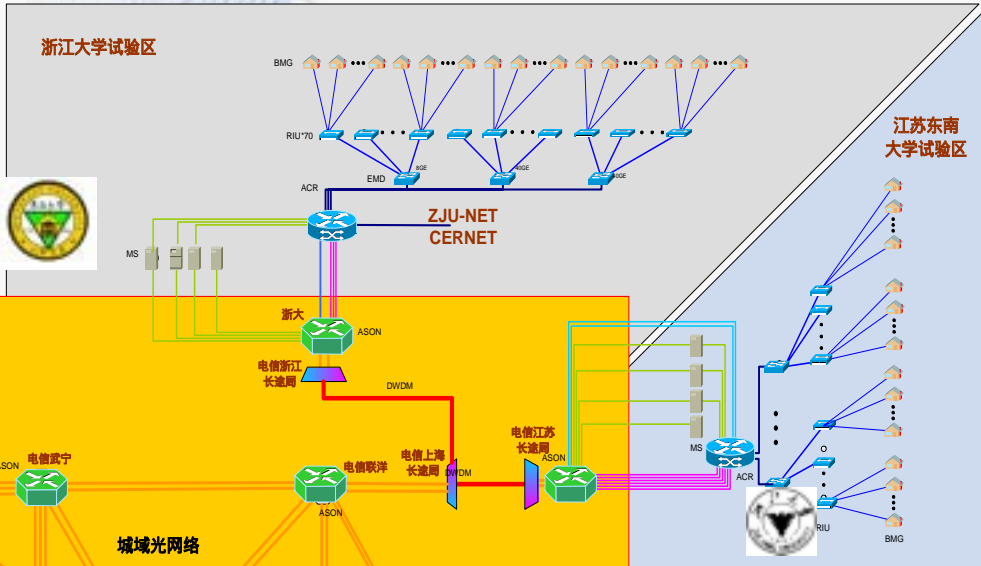
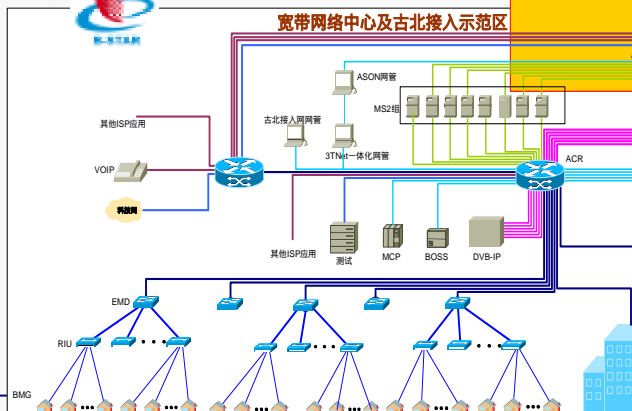
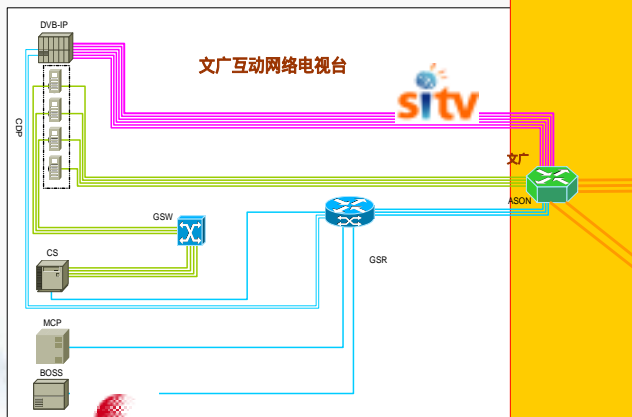
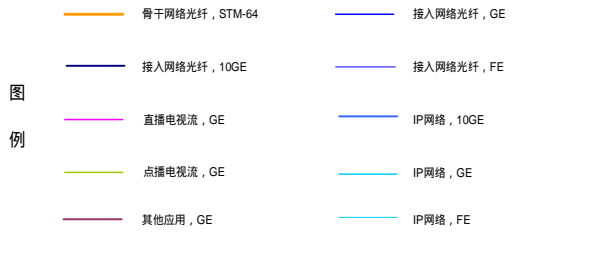
- Requirements of dynamical provisioning capability in GMPLS Networks:
  - Interactive Broadband Multimedia Services
    - **Video on Demand**
    - **Digital Video Brocasting-IP, IPTV**
    - **etc.**
- Growing needs for measuring and characterizing LSP provisioning performance in GMPLS networks
  - Mapping provisioning capability to application requirements
  - GMPLS Network maintenance and optimization.



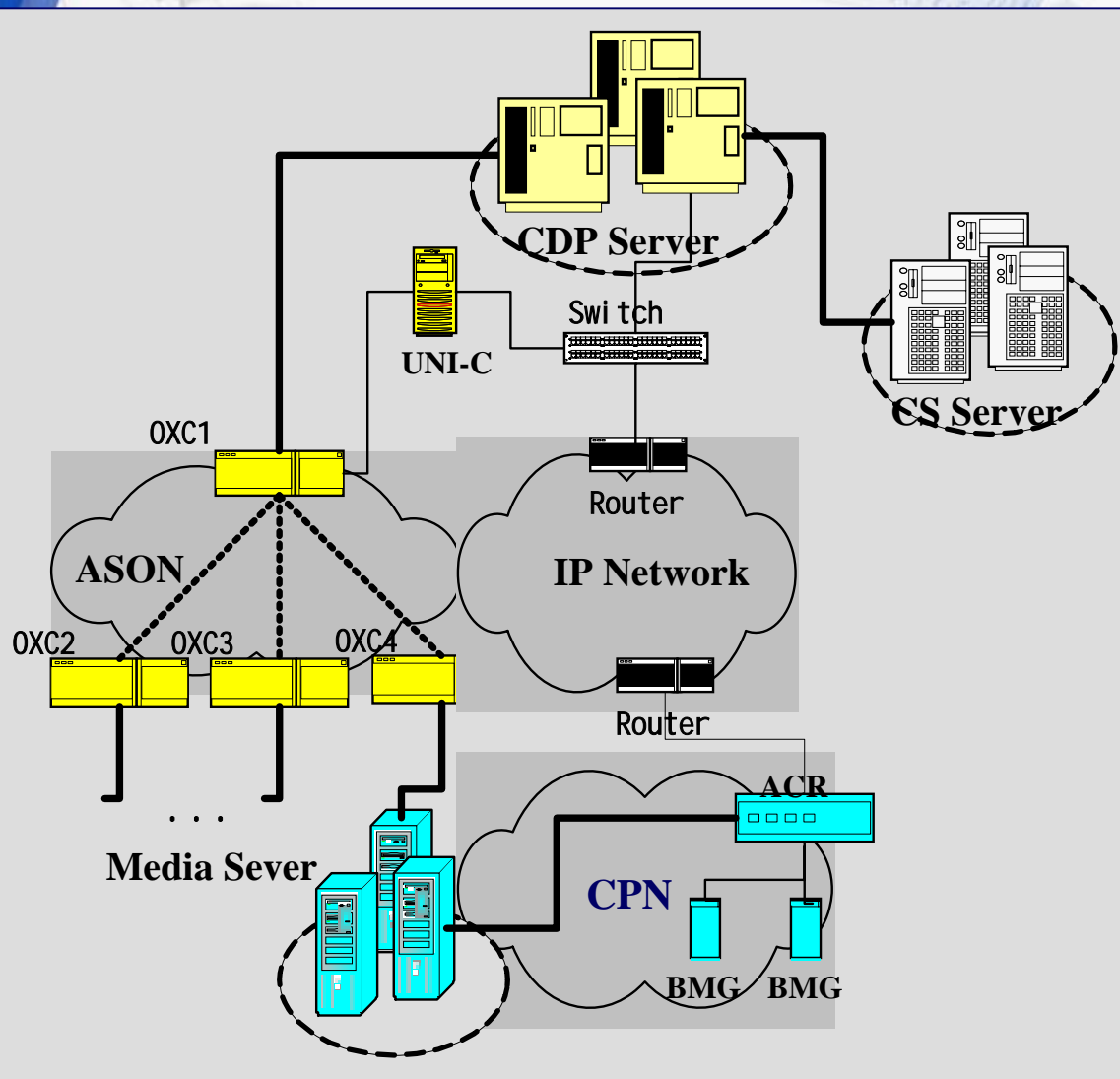
# Motivations

- China High Performance Broadband Information Network (3TNET) ----863 project Sponsored by the Ministry of Science and Technology
  - Circuit-switched and packet-switched hybrid network to support large-scale interactive broadband streaming media.
  - Network Infrastructure: IP +ASON/GMPLS+DWDM
  - Services: VOD, DVB-IP, high speed Internet access
- ASON/GMPLS network with burst scheduling and multicasting enhanced features.
- A large-scale field trial carried out in the Eastern China.

# 3TNet Topology



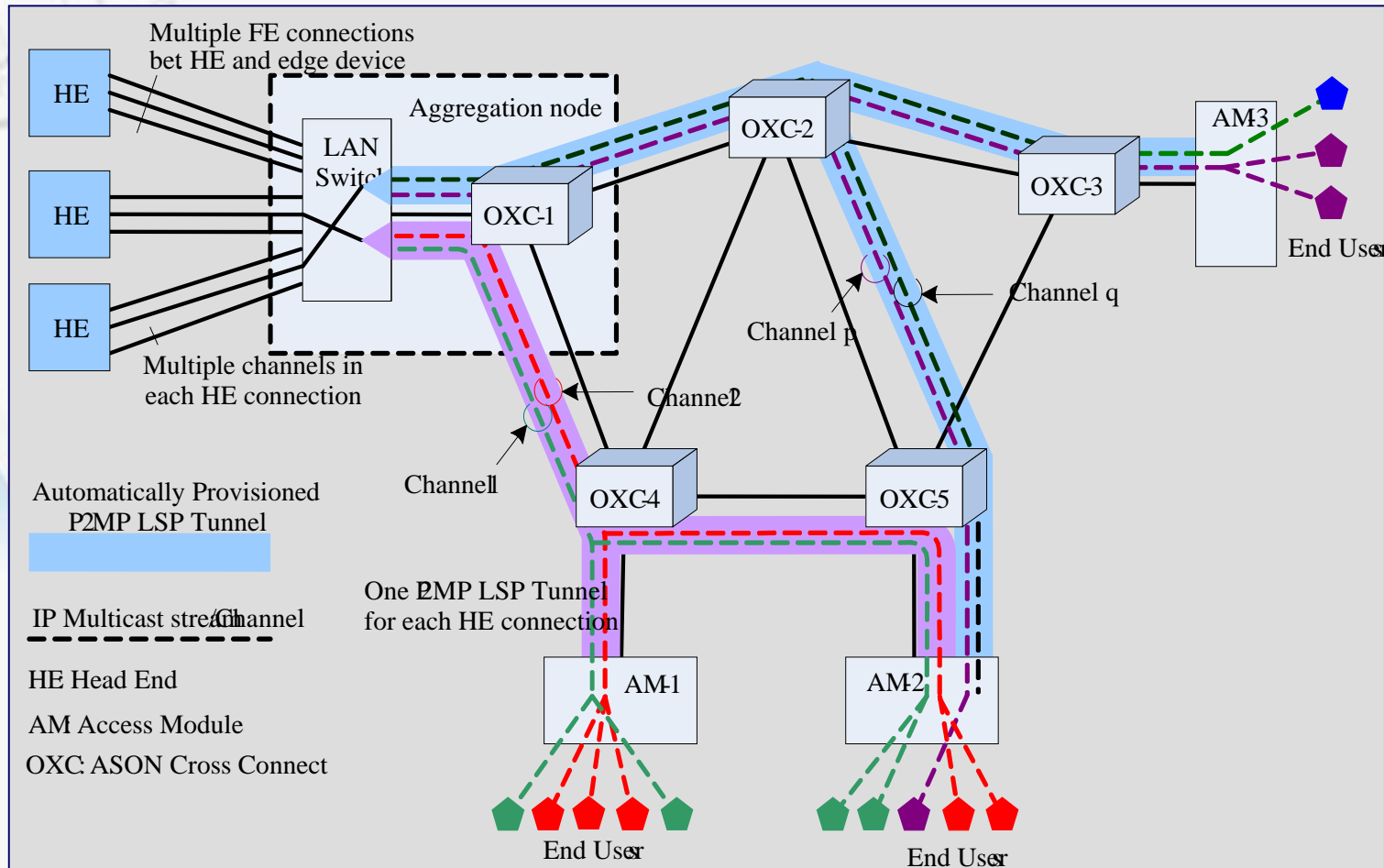
# VOD: Burst Scheduled LSP



**Finely tuned connection scheduling model**

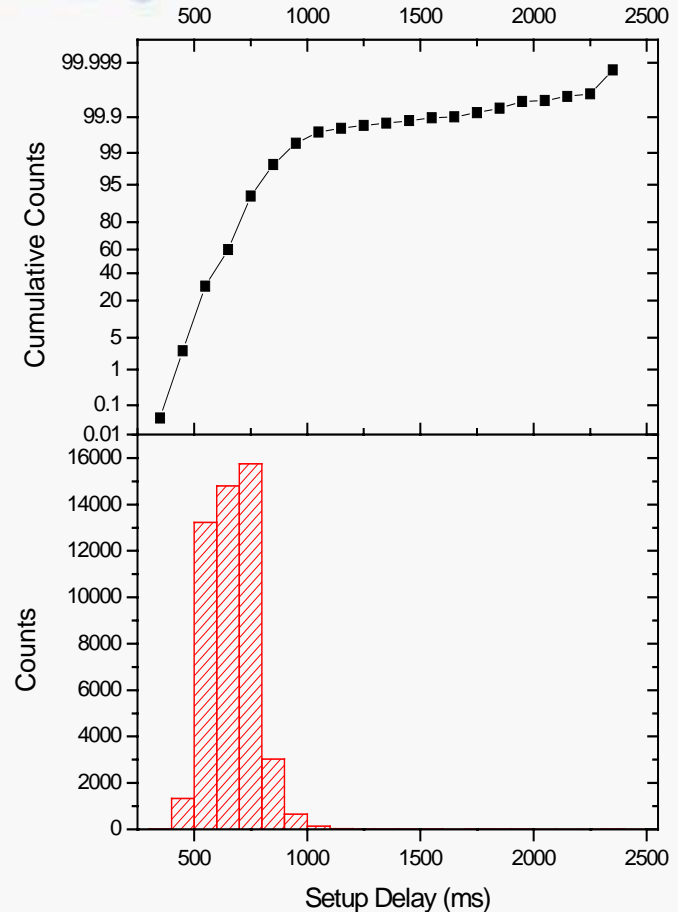
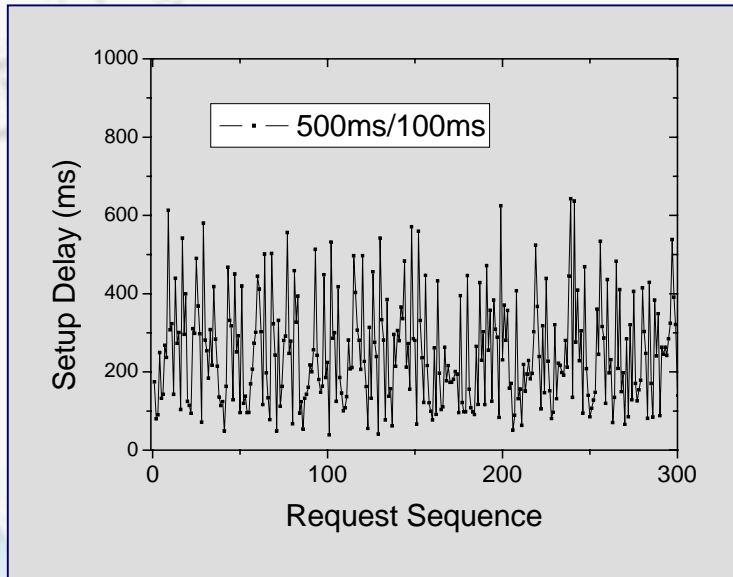
- **Periodic LSP provisioning for 5 experimental regions VOD media server.**
- **Hold a LSP only 10s, then release.**

# DVB-IP: Dynamic Multicast LSP



Arbitrary provisioning for DVB-IP head-ends

# Measured Performance in the Field Trial

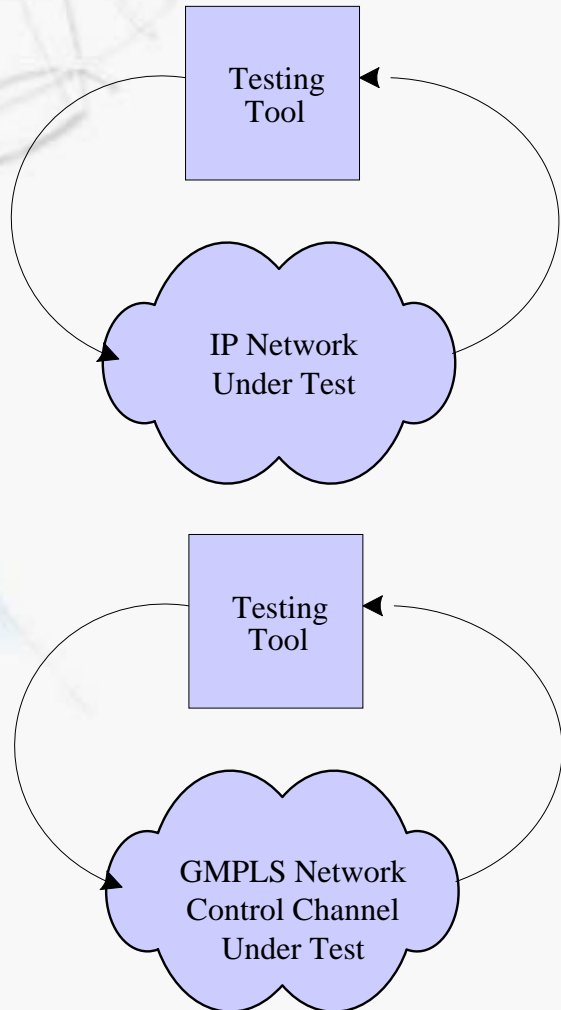


- Delay Variance observed at any load. Higher load will lead to higher variance and longer setup/release delay.

Average setup delay 668 ms

99.9% setup delay less than 1000ms

# Defined Metrics & Methodology



- GMPLS control channel testing is similar to IP network testing
  - **Round-trip delay**
- LSP DPPM uses the framework of IPPM.
  - **Measured performance**
    - **Unidirectional LSP Setup Delay**
    - **Bidirectional LSP Setup Delay**
    - **LSP Graceful Release Delay**
  - **Statistical performance**
    - **Min/Max/Median/Percentile**
    - **Variance**
    - **Blocking probability**



# Open Issues

- Performance metrics for LSP reroute & P2MP.
- Enhancement of MIBs: support monitoring of LSP provisioning metrics on GMPLS nodes, for maintenance/optimization.
- Etc.