Internet Transport

ITS 214
Structure

• Access Structure
  • DSL
    • Customers connect to switching offices via DSLAM
  • Cable
    • Customers connect to fiber node, then cable head-end via CMTS

• Traffic from multiple connection points needs to be combined and sent to the Tier 1 backbone providers
Structure

- From the ISP perspective
  - Tier II ISPs serve many Tier IIs
  - Tier II ISPs connect to a number of Tier I providers, at multiple points
- Everyone uses fiber, but...
- We need a standard, flexible way to connect traffic streams together and pull them back apart
Requirements

• The fiber network ultimately has to carry packets, but
  • Putting packets directly on the fiber is possible, but
    • Expensive (packet switching are really high speed)
    • Not easy to manage (aka troubleshoot)
    • Does not address contracts, e.g.
      • Pay me $$$ for a 100Mbps connection

• We need a way to set up paths through the fiber network - Provisioning
Fiber Networks

• First
  • Every fiber can handle WDM - multiple optical carriers
    • “Optical Switching”

• Then
  • Multiplexing
    • Use lower-speed equipment near the edge of the network, then combine those into higher and higher speed paths in the backbone
PDH

- In the (digital) beginning, there was
  - PDH - Plesiochronous Digital Hierarchy
  - Digital multiplexing standard(s)
    - Combine 64kbps streams into a 1.5Mbps stream
    - Combine 1.5Mbps streams into ....
    - etc.
  - Plesiochronous means devices can differ slightly in speed
    - That makes assembling and disassembling traffic streams really hard (and expensive)
SDH

- Synchronous Digital Hierarchy
  - Internationally compatible
  - All devices run on the same clock
  - Adding and Removing traffic streams is much less expensive
  - Traffic Streams are called Tributaries or Containers
  - Adding/Removing traffic is called
    - Add-Drop Multiplexing, or
    - Grooming
SDH Optical Standards

• OC-1
  • Roughly 50Mbps
  • Defines a basic frame structure (how many bits per frame)
  • Optical encoding

• Higher speeds by combining multiples of OC-1
Higher Multiplexing Levels

- The Standard allows any multiple
- In practice
  - OC-3 (150Mbps) is the lowest level implemented
  - OC-12 (600Mbps)
  - OC-48 (2.5Gbps)
  - OC-192 (10Gbps)
- Grooming is easy in this structure
The frame content

- Not everyone agrees on frame content
  - Europe
    - OC-1 contains one STM-0 frame
    - OC-3 contains one STM-1 frame
  - US
    - ANSI SONET
      - OC-1 contains one STS-1
      - OC-3 contains one STS-3
SDH/SONET and Rings

In Use

Idle
SDH/SONET and Rings

Sunday, February 14, 2010