

ETSF05 – Internet Protocols

PPP
TDM
Asynchronous Transfer Mode
Synchronous Optical Networks
WLAN

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Routing

- Konsten att bygga least-cost trees
 - Från sändare till mottagare
 - Från varje nod till varje annan nod
- Tre principer
 - Distance Vector
 - Link State
 - Path Vector
 - Policy-based routing

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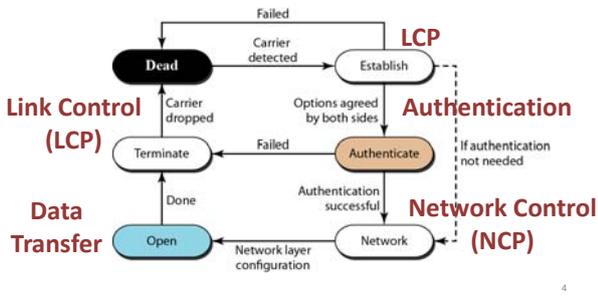
Point-to-point protocol (PPP)

- Direct connection between two nodes
 - Internet access
 - Home user to ISP
 - Telephone line
 - Cable TV

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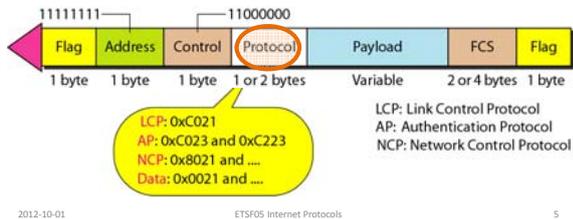
State transitions in PPP

- We need more protocols



PPP frame format

- Support for several (sub)protocols
- Address & control not used
- Maximum payload 1500 bytes



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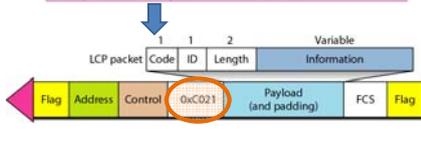
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Link control protocol (LCP)

- Establish
- Configure
- Terminate

- Options
- Maximum receive unit (payload size)
 - Authentication protocol (none/PAP/CHAP)
 - Protocol field compression (on/off),
 - Address and control field compression (on/off)

Code	Packet Type	Description
0x01	Configure-request	Contains the list of proposed options and their values
0x02	Configure-ack	Accepts all options proposed
0x03	Configure-nak	Announces that some options are not acceptable
0x04	Configure-reject	Announces that some options are not recognized
0x05	Terminate-request	Request to shut down the line
0x06	Terminate-ack	Accept the shutdown request
0x07	Code-reject	Announces an unknown code
0x08	Protocol-reject	Announces an unknown protocol
0x09	Echo-request	A type of hello message to check if the other end is alive
0x0A	Echo-reply	The response to the echo-request message
0x0B	Discard-request	A request to discard the packet

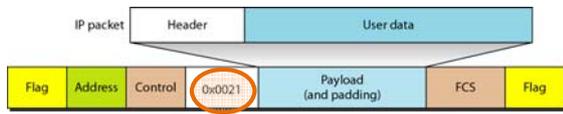


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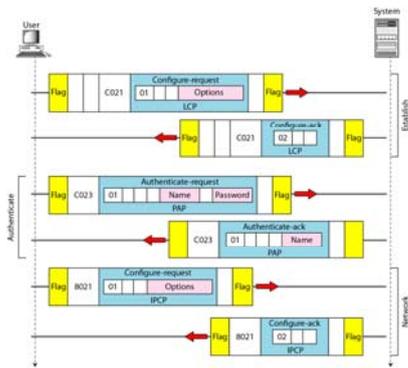
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IP datagram encapsulation in PPP



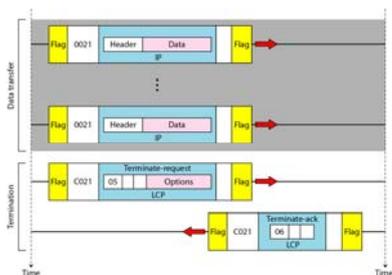
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PPP session example



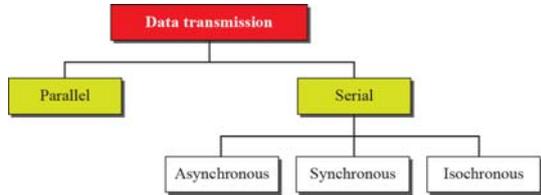
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PPP session example (cont.)

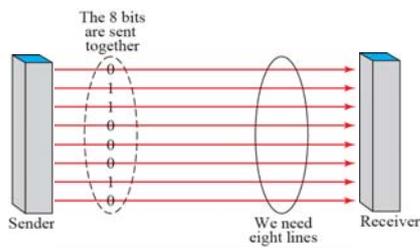


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Transmission modes



Parallel transmission

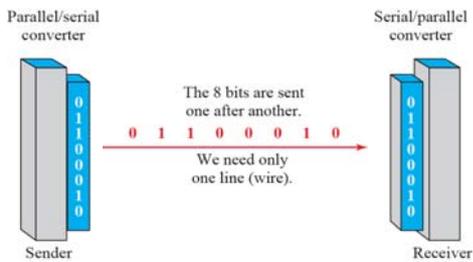


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Serial transmission



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Transmission modes

- Asynchronous
- Synchronous

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Time-division multiplexing (TDM)

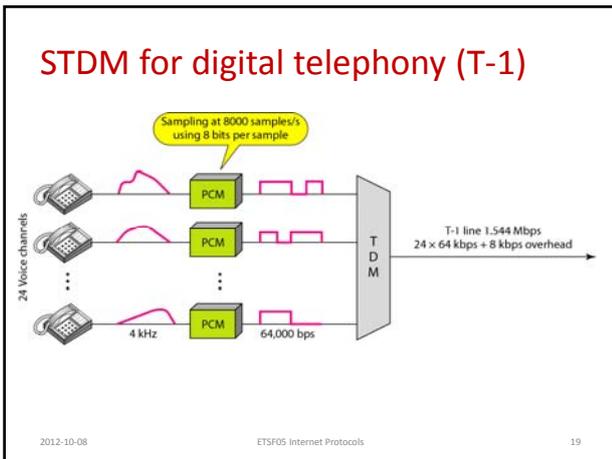
- Sharing available bandwidth
 - Actually, time-sharing available bit rate

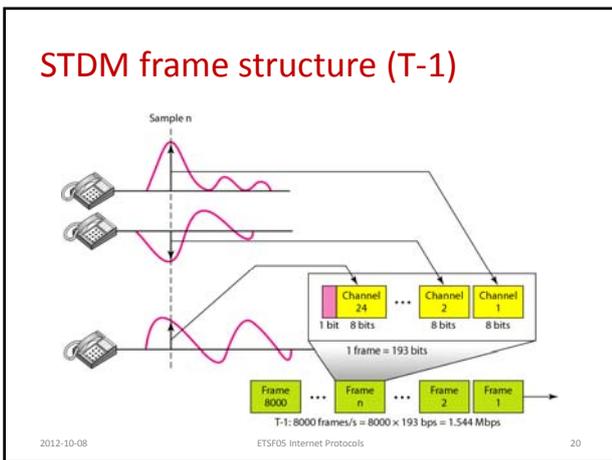
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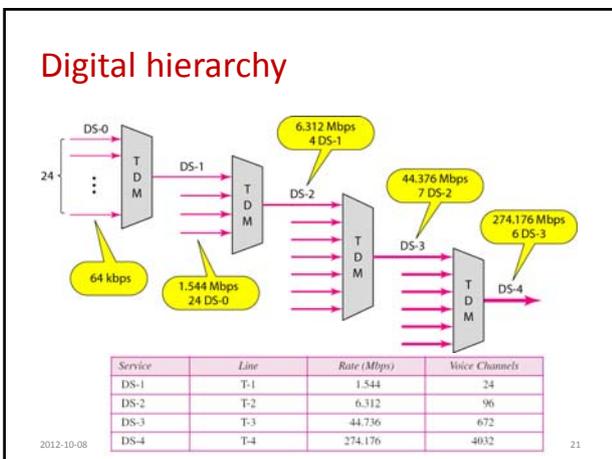
Synchronous TDM

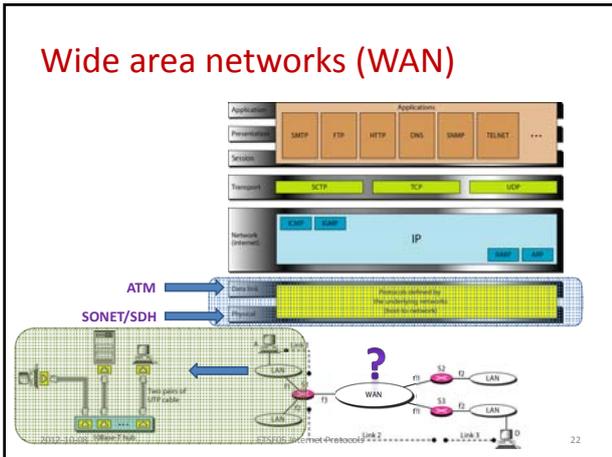
- Outgoing link faster than incoming links
 - At least n times

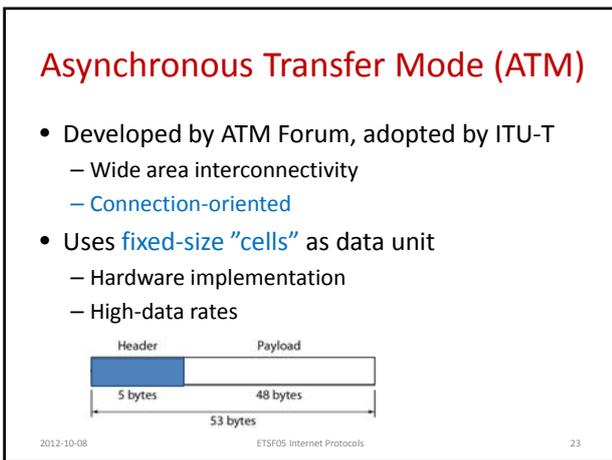
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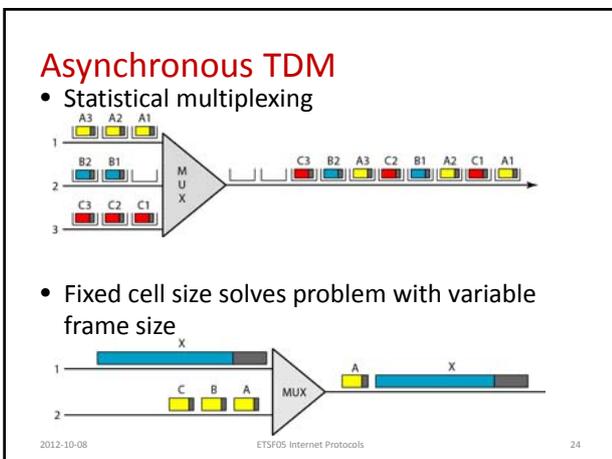






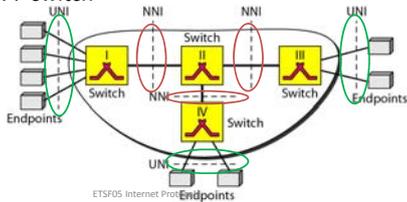






ATM network architecture

- User-to-network interface (UNI)
 - Endpoint ↔ switch
- Network-to-network interface (NNI)
 - Switch ↔ switch



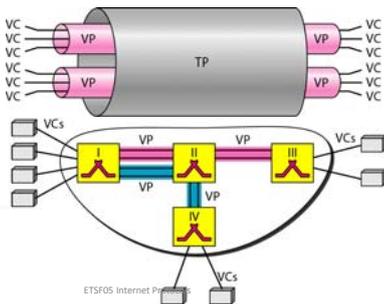
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Virtual paths, virtual circuits

- Logical subunits of a physical transmission path



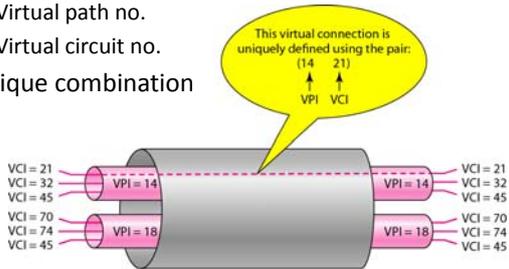
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Virtual connections

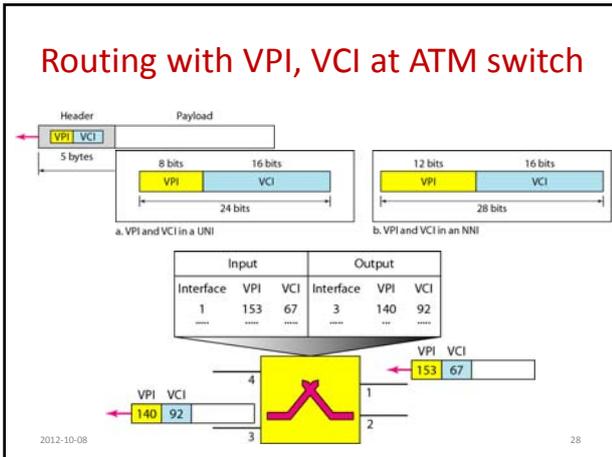
- Identified by
 - Virtual path no.
 - Virtual circuit no.
- Unique combination

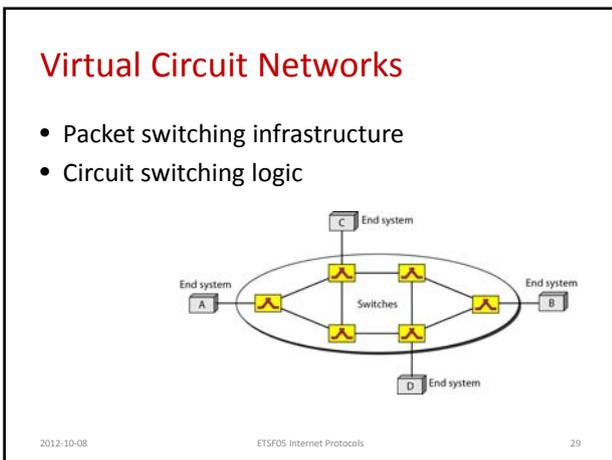


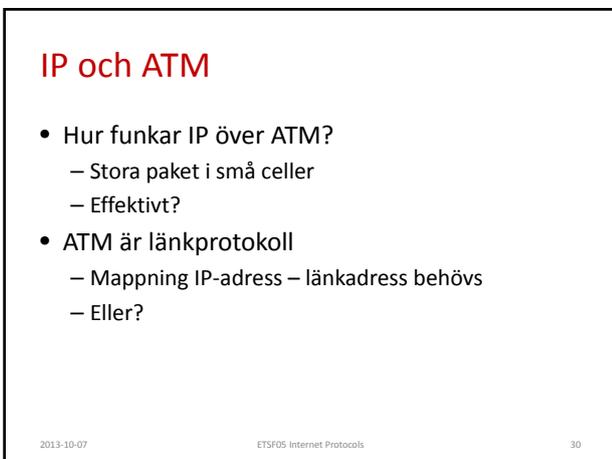
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Synchronous Optical Networks

- SONET, developed by ANSI



Synchronous Digital Hierarchy

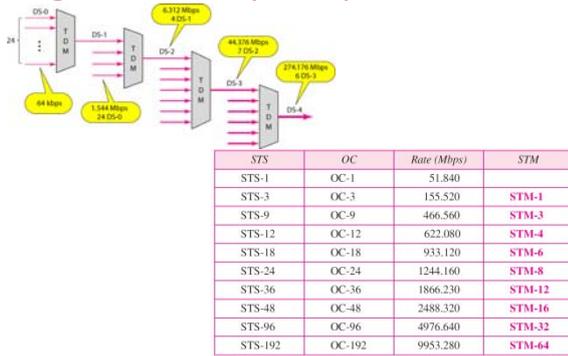
- SDH, developed by ITU-T

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Digital hierarchy on optical links



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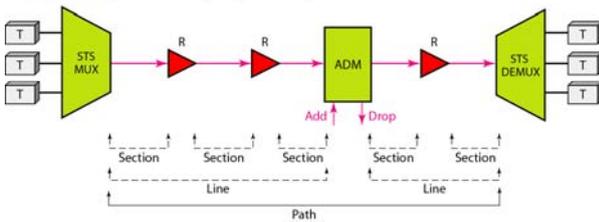
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Network architecture

- Devices and connections

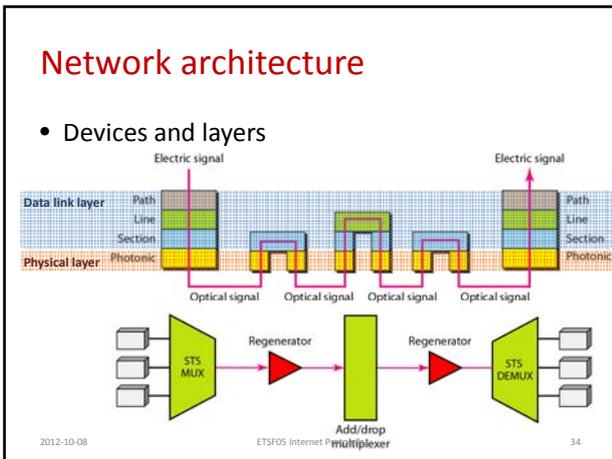
ADM: Add/drop multiplexer
 STS MUX: Synchronous transport signal multiplexer
 STS DEMUX: Synchronous transport signal demultiplexer
 R: Regenerator
 T: Terminal

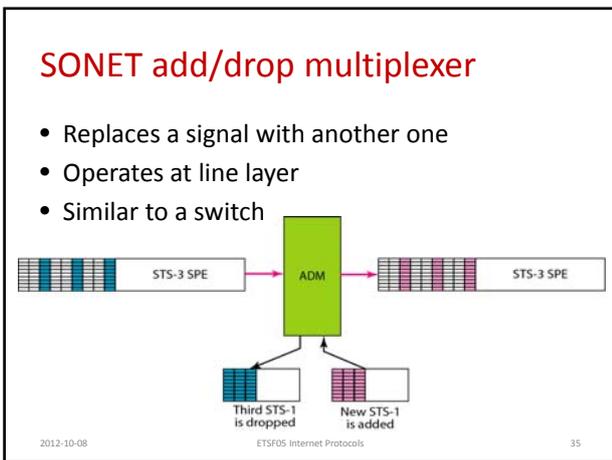


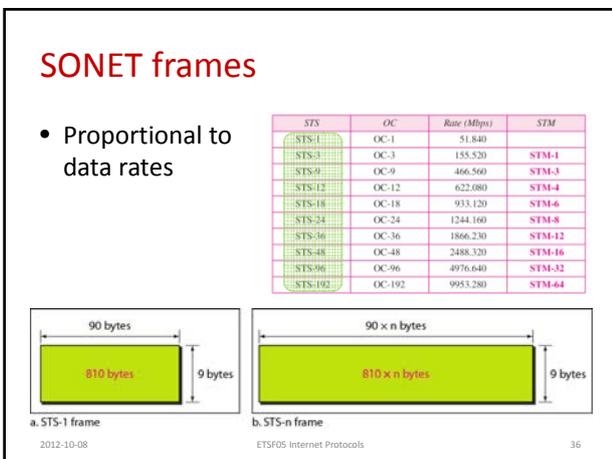
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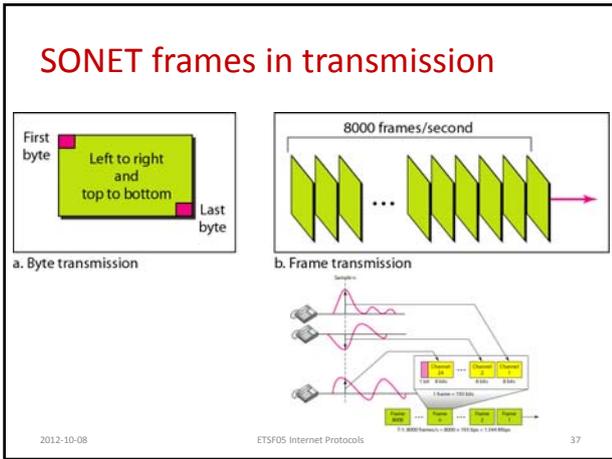
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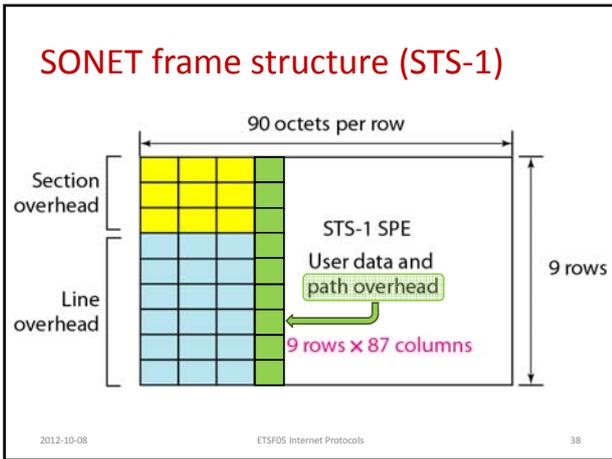
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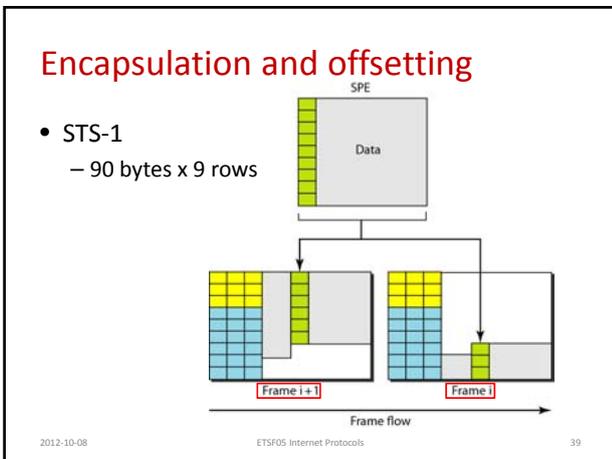






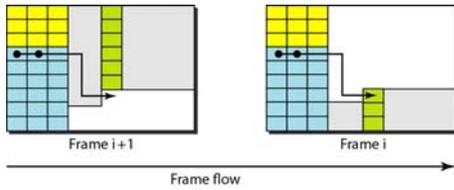






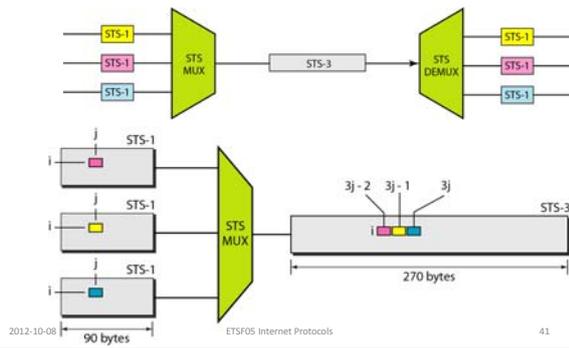
Pointers H1+H2

- Where does the next frame start?
– 2 bytes to address 774 possibilities



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Multiplexing and byte interleaving



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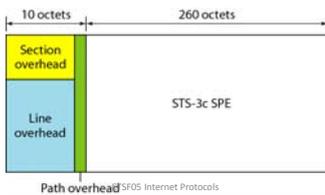
Multiplexed SONET frame (STS-3)



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Concatenated signal (STS-nc)

- Data rate > STS-1
 - Put in an STS-*n* signal
 - Not demultiplexable
 - Path overhead in single column



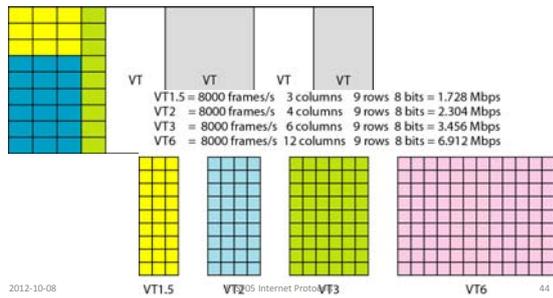
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Path overhead

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Virtual tributaries

- Backward compatibility with DS-1 and DS-3



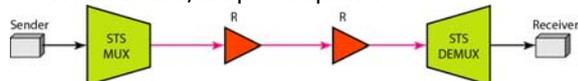
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Internet Proto

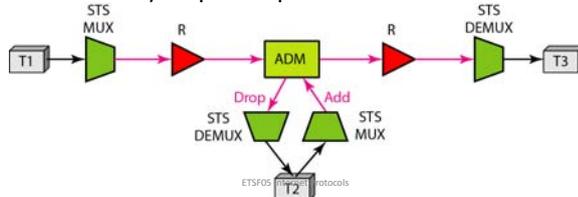
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Linear SONET topology

- Without add/drop multiplexer



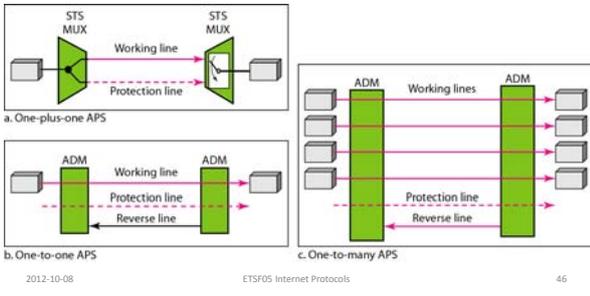
- With add/drop multiplexer



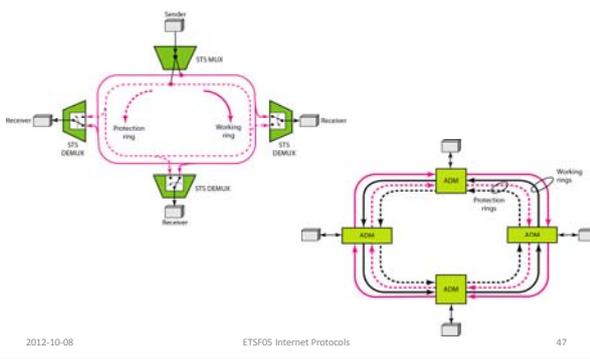
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Automatic protection switching

- Failure protection through line redundancy



Ring SONET topology



Mesh SONET topology

- Better scalability
 - Multiplexing/demultiplexing at switches

