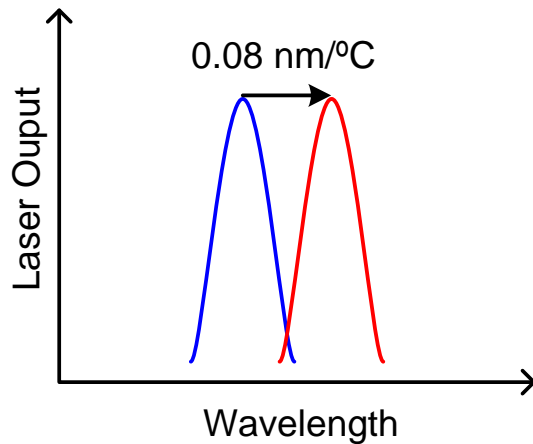
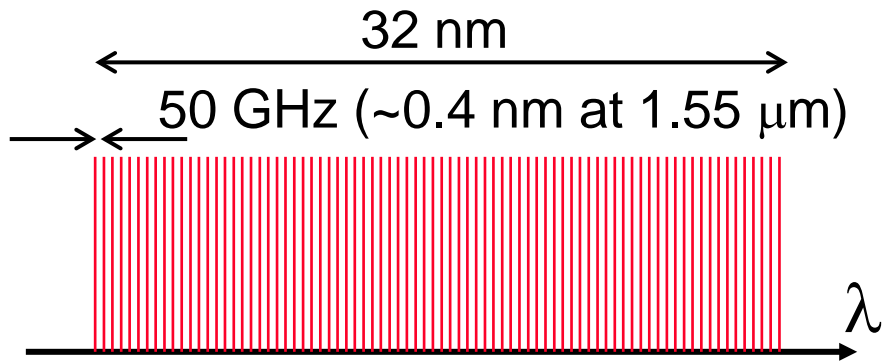


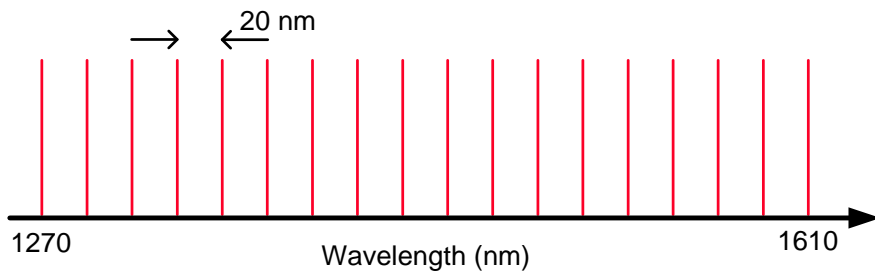
Dense Wavelength Division Multiplexing



- Very high throughput (80 channels over C-Band from 1530 to 1565 nm)
- Stabilized lasers and narrow-band filters required
- For use in metro and wide area networks

Coarse Wavelength Division Multiplexing

ITU Standard

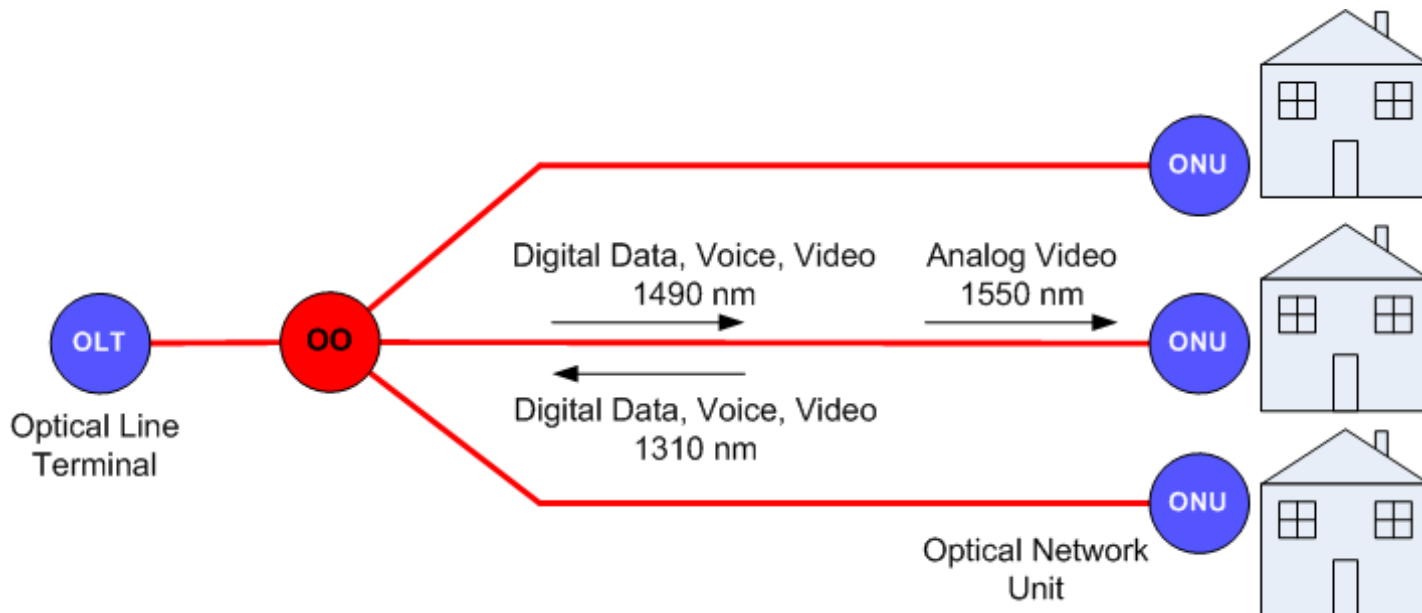


- Smaller number of channels and correspondingly smaller throughput
- **Compatible with less expensive, un-stabilized lasers and broadband filters**
- For use in local area and metropolitan networks

Very Coarse Wavelength Division Multiplexing



- For fiber-to-the-home applications



Synchronous Optical Network (SONET) Link Protocol

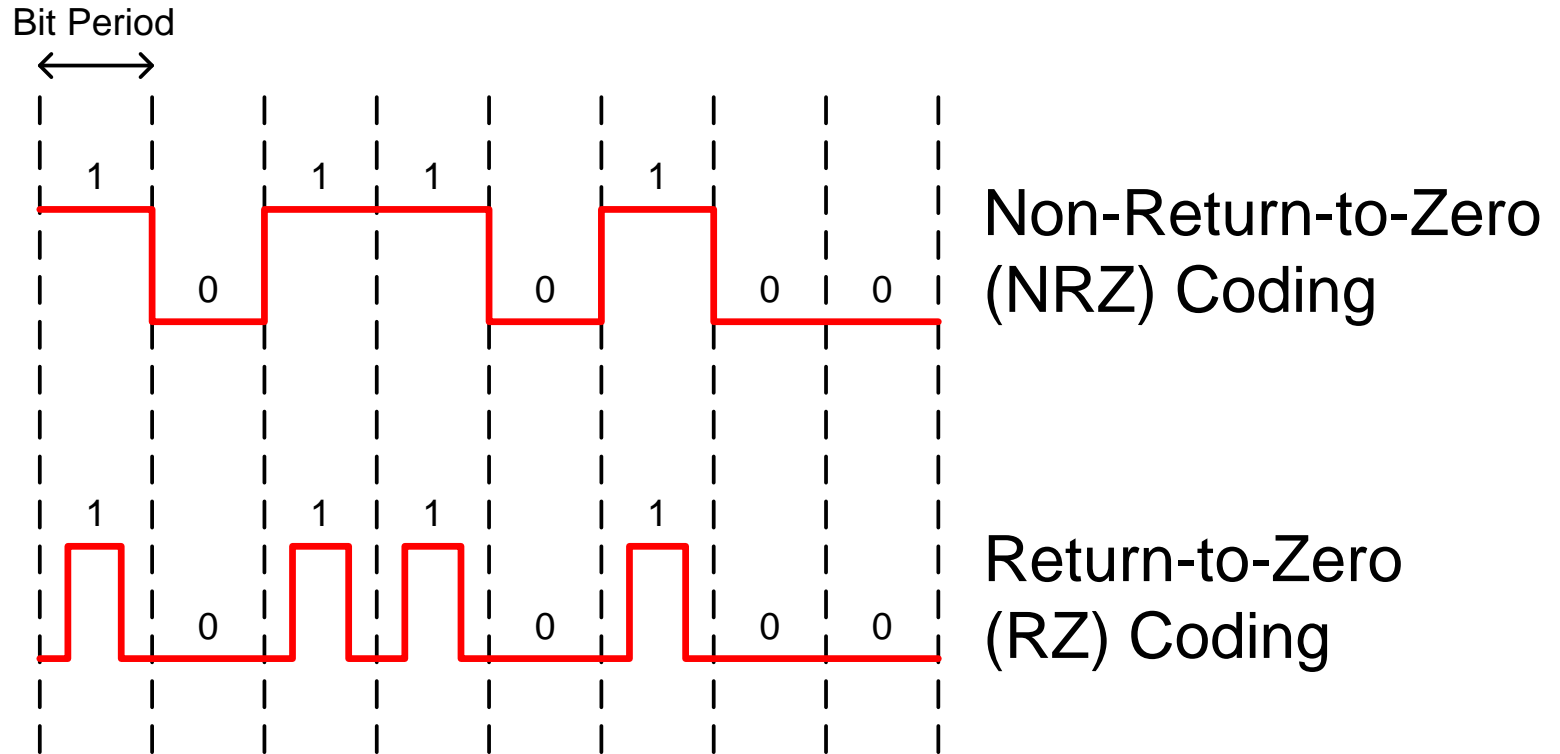
Transmission Link

Signal Designation	Data Rate (Mbps)	Phone Call Capacity
OC-1	51.84	672
OC-3	155.82	2016
OC-12	622.08	8064
OC-48	2488.32	32256
OC-192	9953.28	129024
OC-768	39,813.12	516096

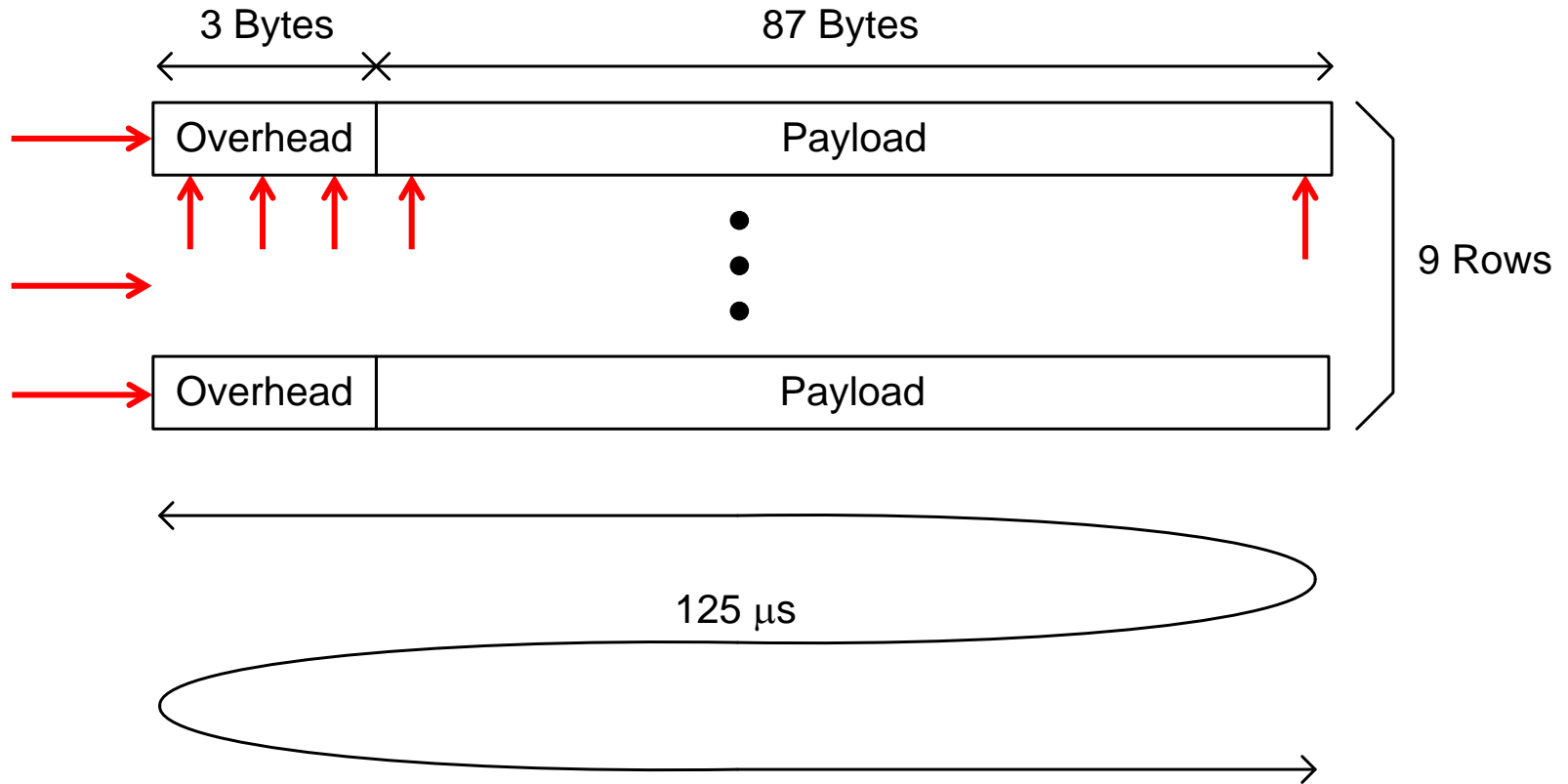
SONET versus SDH

- SONET is used in North America
- In the rest of the world the optical protocol is called Synchronous Digital Hierarchy or SDH
- SONET and SDH are the same with a some relatively minor exceptions

SONET Uses Binary, Amplitude Modulated, Non-Return-to-Zero Coding

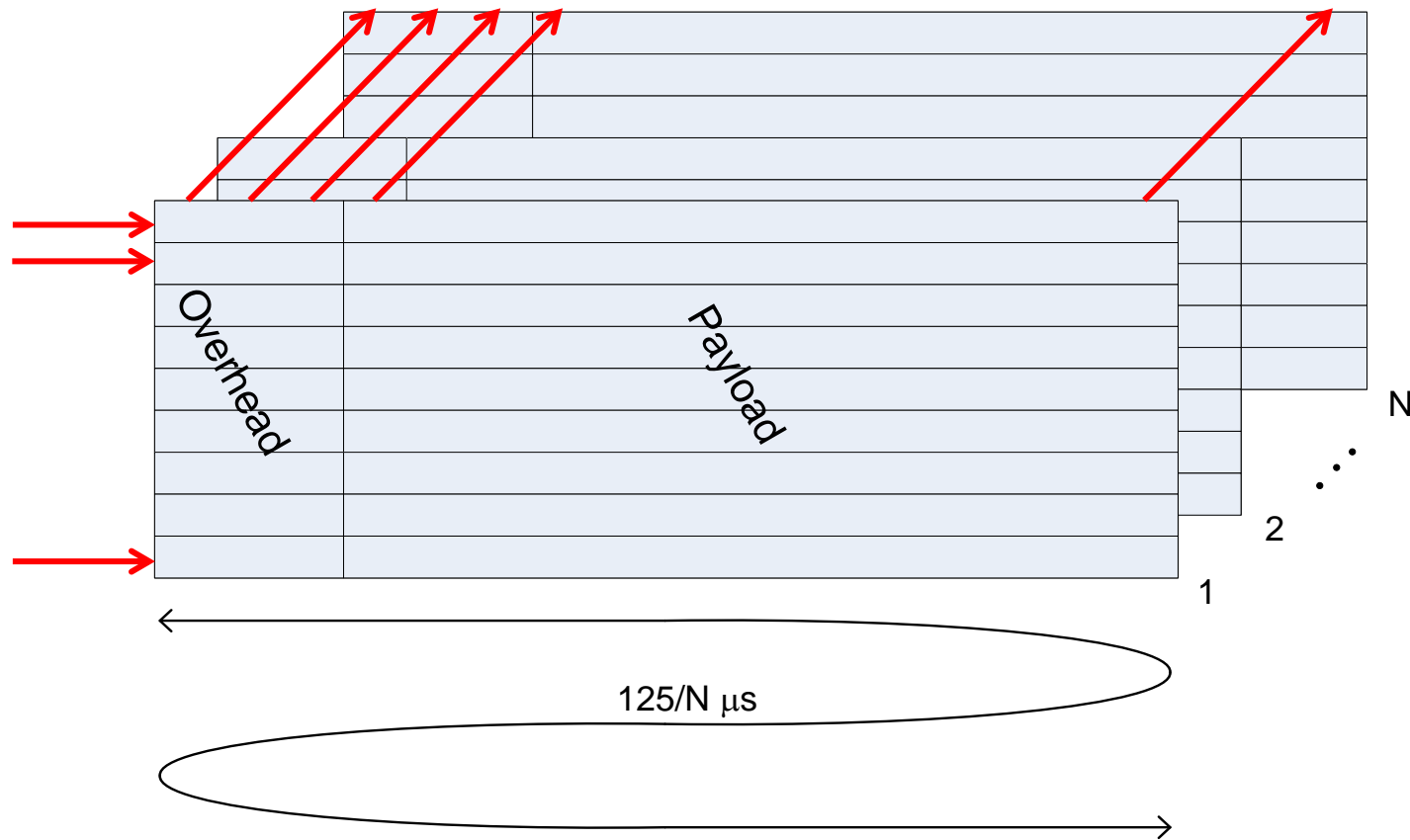


The Basic STS-1 (OC-1) Frame



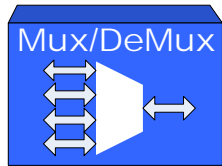
- Data is transmitted and read row by row from left to right

An STS-N (OC-N) Frame



- An STS-N frame is made by interleaving N STS-1 frames, each $125/N \mu\text{s}$ in length, byte by byte.
- An STS-N frame is also $125 \mu\text{s}$ in length.

SONET Node (Network) Equipment



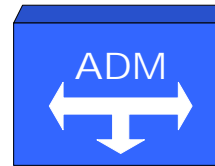
Terminal Multiplexer/ Demultiplexer

- Combines electrical signals into optical signal
- Separates optical signal into electrical signals



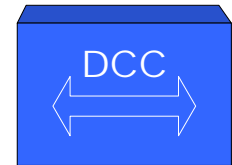
Optical-to-Electrical- to Optical (OEO) Regenerator

- Re-amplifies, re-shapes, and re-times optical signals



Add/Drop Multiplexer

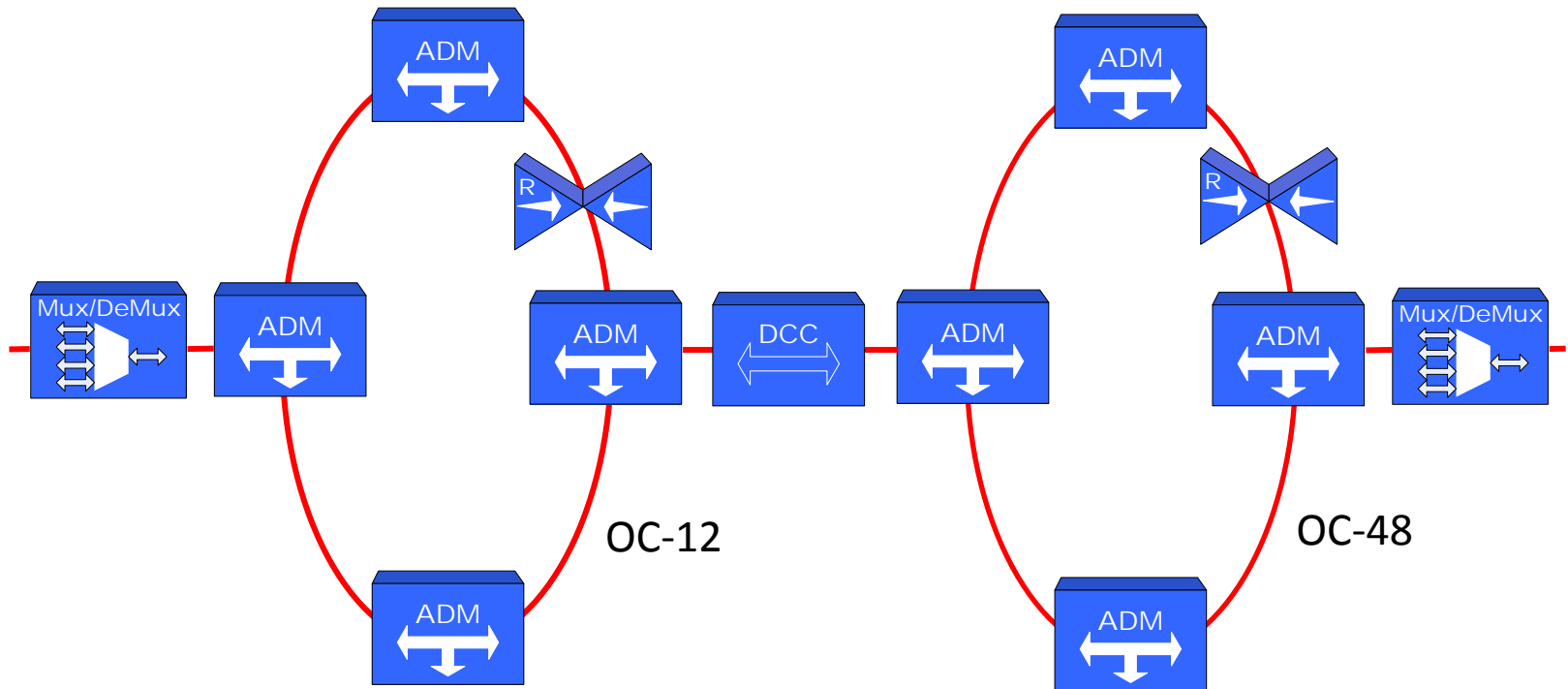
- Removes or adds a portion of the TDM signal.



Digital Cross Connect

- Connects traffic on SONET Rings

A SONET Network



- SONET networks can be a combination of rings and linear point-to-point connections