S D H

CONCEPTS

CONTENTS

- SDH
- PROTECTION
- PLANNING
- SYNCHRONISATION

SDH: DISCUSSION AREA

WHAT IS SDH ?
EVOLUTION
DRIVING FORCES
LIMITATIONS OF PDH
ADVANTAGES OF SDH
SIGNAL HIERARCHY
MULTIPLEXING STRUCTURE
FRAME REPRESENTATION
NETWORK ELEMENTS
NETWORK TOPOLOGY, etc....

WHAT IS S D H ?

SYNCHRONOUS :
ONE MASTER CLOCK & ALL ELEMENTS SYNCHRONISE WITH IT.

DIGITAL:
INFORMATION IN BINARY.

HIERARCHY:

SET OF BIT RATES IN A HIERARCHIAL ORDER.

WHAT IS S D H ? (CONTD)

SDH IS AN ITU-T STANDARD FOR A HIGH CAPACITY TELECOM NETWORK.

SDH IS A SYNCHRONOUS DIGITAL TRANSPORT SYSTEM, AIM TO PROVIDE A SIMPLE, ECONOMICAL AND FLEXIBLE TELECOM INFRASTRUCTURE.

SYNC STANDARDS -EVOLUTION

ATTEMPTS TO FORMULATE STANDARDS FOR TRANSMISSION OF SYNCHRONOUS SIGNALS BEGAN IN U.S. AT THE BEGINNING OF 1984, BY ANSI ACCREDITED T1X1 COMMITTEE.

IN 1985 'SONET' STANDARD WAS BORN.

IN 1986 CCITT BECAME INTERESTED IN SONET STANDARD.

SYNC STANDARDS -EVOLUTION
(CONTD)

CCITT PROPOSED CHANGES TO 'T1X1' COMMITTEE TO ACCOMMODATE BOTH AMERICAN AND EUROPEAN HIERARCHIES.

FINAL AGREEMENT WAS REACHED IN 1988 AND CCITT WORKING GROUP-XVIII CAME OUT WITH RECOMMENDATIONS ON SDH.

DRIVING FORCES

NEW ENHANCED SERVICES NEEDING SYNCHRONIZATION SOLUTION.

QoS REQUIREMENT

MULTI-OPERATOR ENVIRONMENT

LIMITATION OF TO-DAY'S NETWORK

ADVANTAGES OF SDH

LIMITATIONS OF PDH

- **NON STANDARD EXPERIENCES:**

-THREE DIFFERENT HIERARCHIES WITH DIFFERENT SIGNAL FORMATS AND LINE ENCODING METHODS.

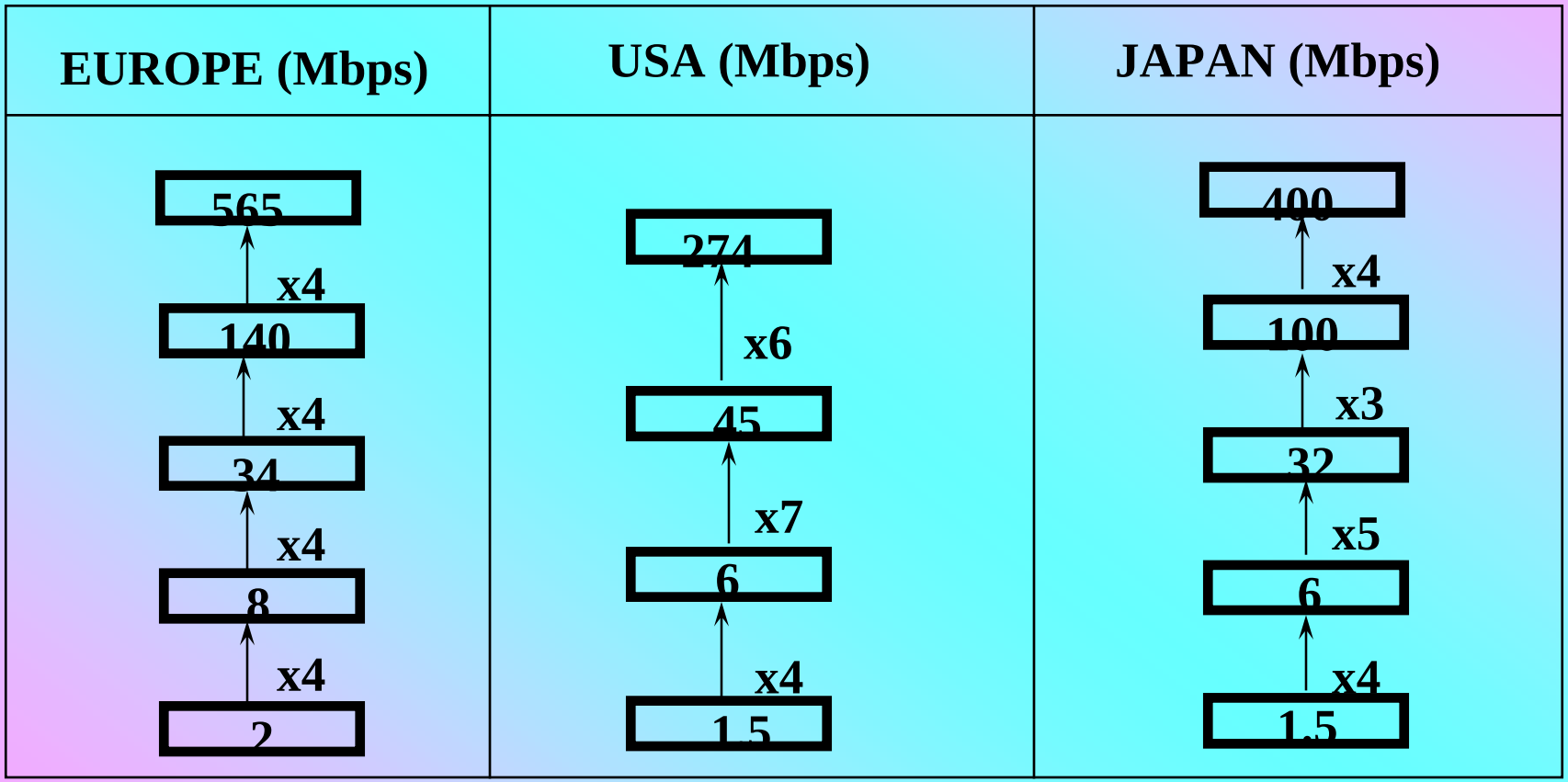
- **BASIS OF TODAY'S HIGH CAPACITY NETWORK**

-ELABORATE ARRANGEMENT FOR DROPPING

- **NETWORK REQUIREMENT**

-CHANGING REQUIREMENT

PDH HIERARCHIES



LIMITATIONS OF PDH

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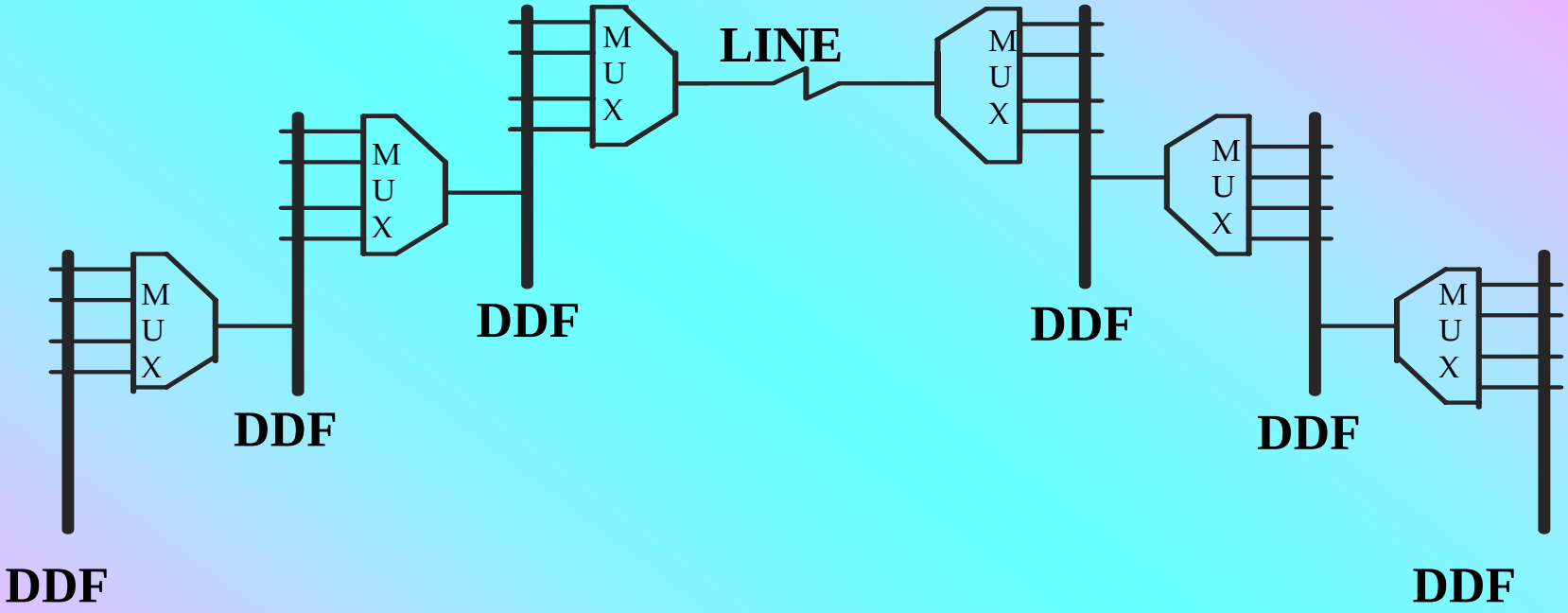
  -ELABORATE ARRANGEMENT FOR DROPPING

- **NETWORK REQUIREMENT**

  -CHANGING REQUIREMENT

BASIS OF TODAY'S NETWORK



- **ELABORATE DROPPING ARRANGEMENT**

LIMITATIONS OF PDH

- **NON STANDARD EXPERIENCES:**

  -THREE DIFFERENT HIERARCHIES WITH DIFFERENT SIGNAL FORMATS AND LINE ENCODING METHODS.

- **BASIS OF TODAY'S HIGH CAPACITY NETWORK**

  -ELABORATE ARRANGEMENT FOR DROPPING

- **NETWORK REQUIREMENT**

  -CHANGING REQUIREMENT

CHANGING NETWORK REQUIREMENT

TODAY'S NETWORK	CUSTOMER'S NEED	TOMORROW'S NETWORK
POINT-TO-POINT TRANSMISSION	FASTER PROVISIONING OF CIRCUITS AND SERVICES	TELECOMMUNICATION NETWORKING
SUPPORTED BY	&	SUPPORTED BY
MANUAL APPROACH TO NETWORK MANAGEMENT AND MAINTENANCE.	DEMANDS FOR SOPHISTICATED TELECOM SERVICES	COMPUTER BASED INTEGRATED NETWORK MANAGEMENT MAINTENANCE

SDH- ADVANTAGES

SIMPLIFICATION (ABILITY TO DIRECTLY DROP LOWER TRIB)

CAN ACCOMMODATE BOTH EXISTING AND FUTURE SIGNALS
IMPROVED SERVICE QUALITY (THROUGH SUPERVISION)

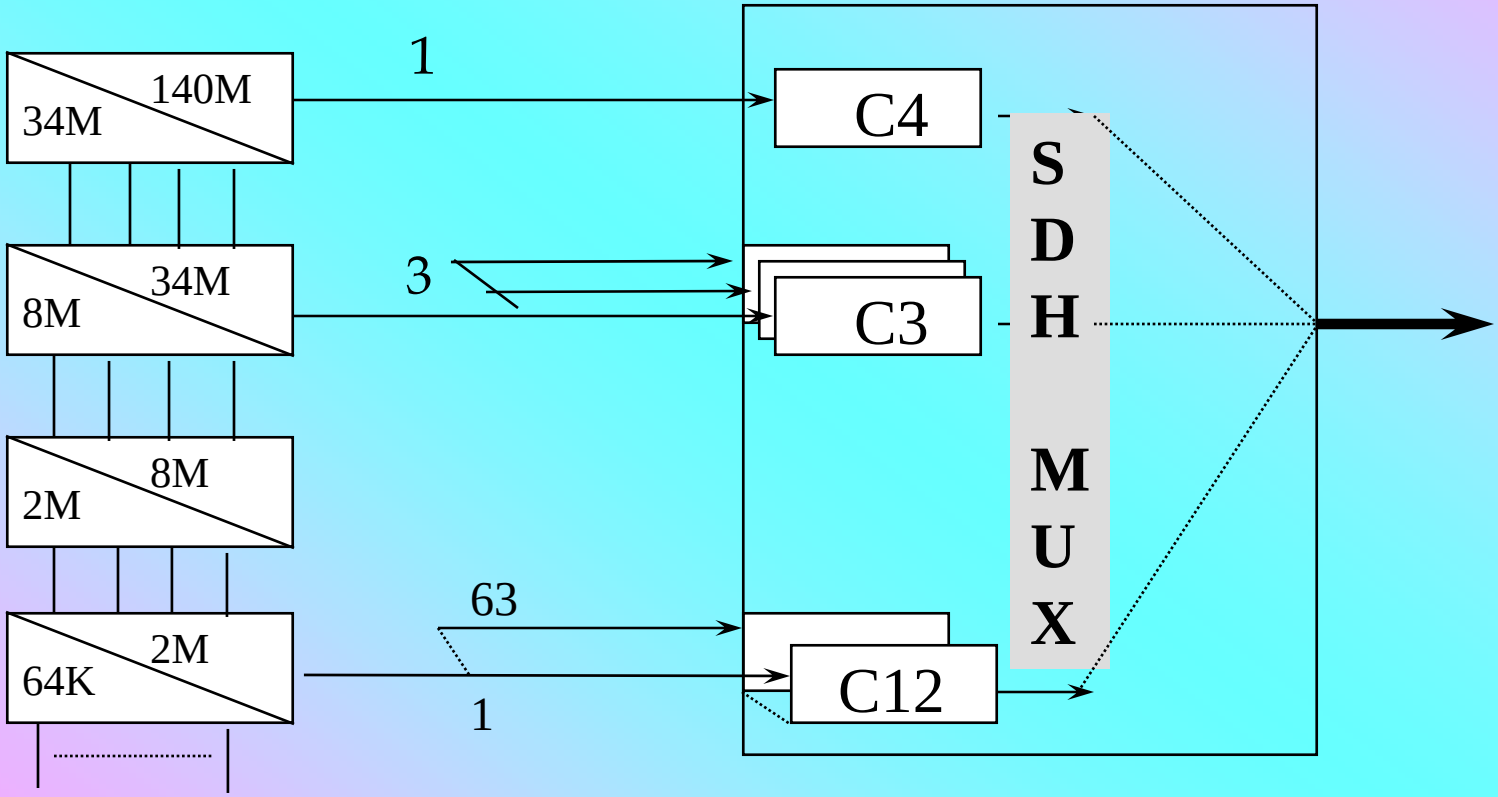
ADVANCED N/W MANAGEMENT AND MTCE CAPABILITIES.

N/W SURVIVABILITY

DYNAMIC N/W CAPACITY MANAGEMENT

MULTI VENDOR NETWORKING (MID FIBRE MEET)

SDH ACCOMMODATES EXISTING SIGNALS



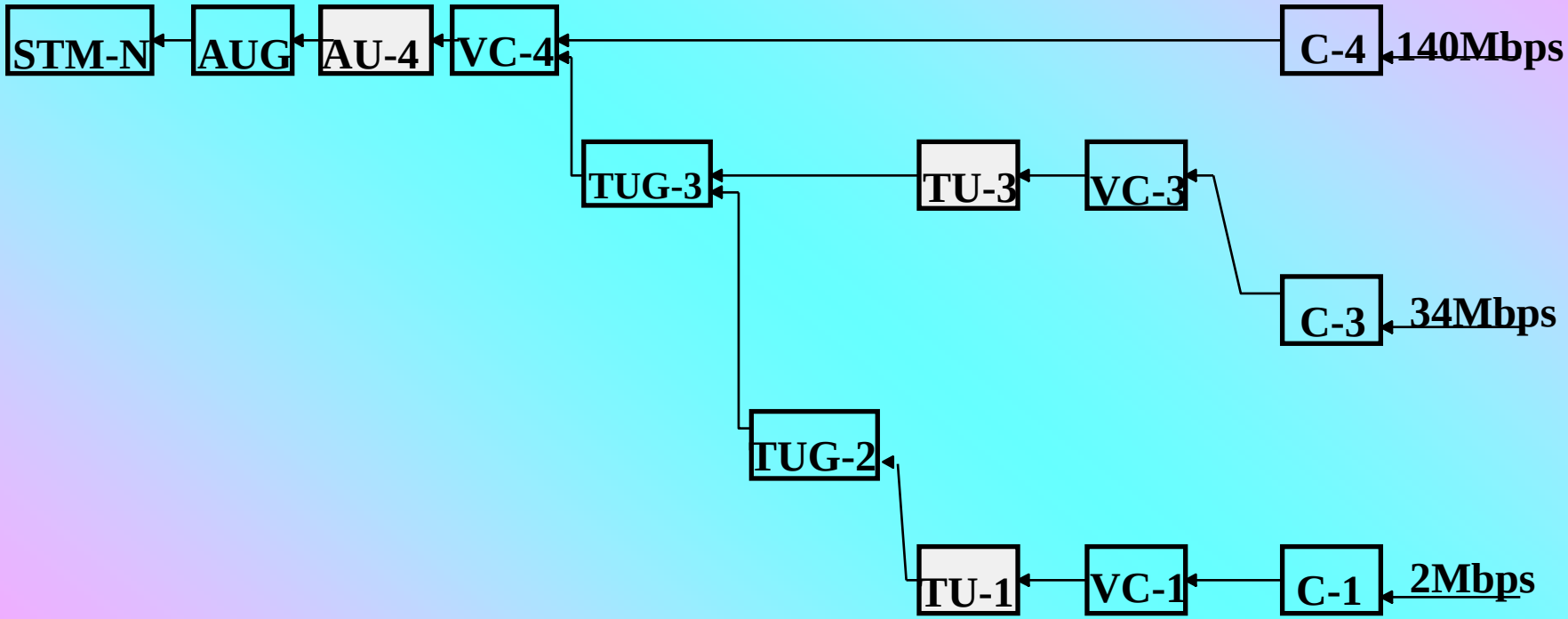
SIGNAL HIERARCHY

SONET vs SDH BIT RATES

SONET			SDH
SYNCHRONOUS TRANSPORT SIGNAL	OPTICAL CARRIER	BIT RATE MBPS	SYNCHRONOUS TRANSPORT MODULE
STS-1	OC-1	51.84	----
STS-3	OC-3	155.52	STM-1
STS-9	OC-9	466.56	----
STS-12	OC-12	622.08	STM-4
STS-18	OC-18	933.12	---
STS-24	OC-24	1244.16	---
STS--36	OC-36	1866.24	---
STS-48	OC-48	2488.32	STM-16
STS-192	OC-192	9953.28	STM-64

*BIT RATES FOR HIGHER ORDER IS N-TIMES THE LOWER ORDER

REDUCED MUX STRUCTURE

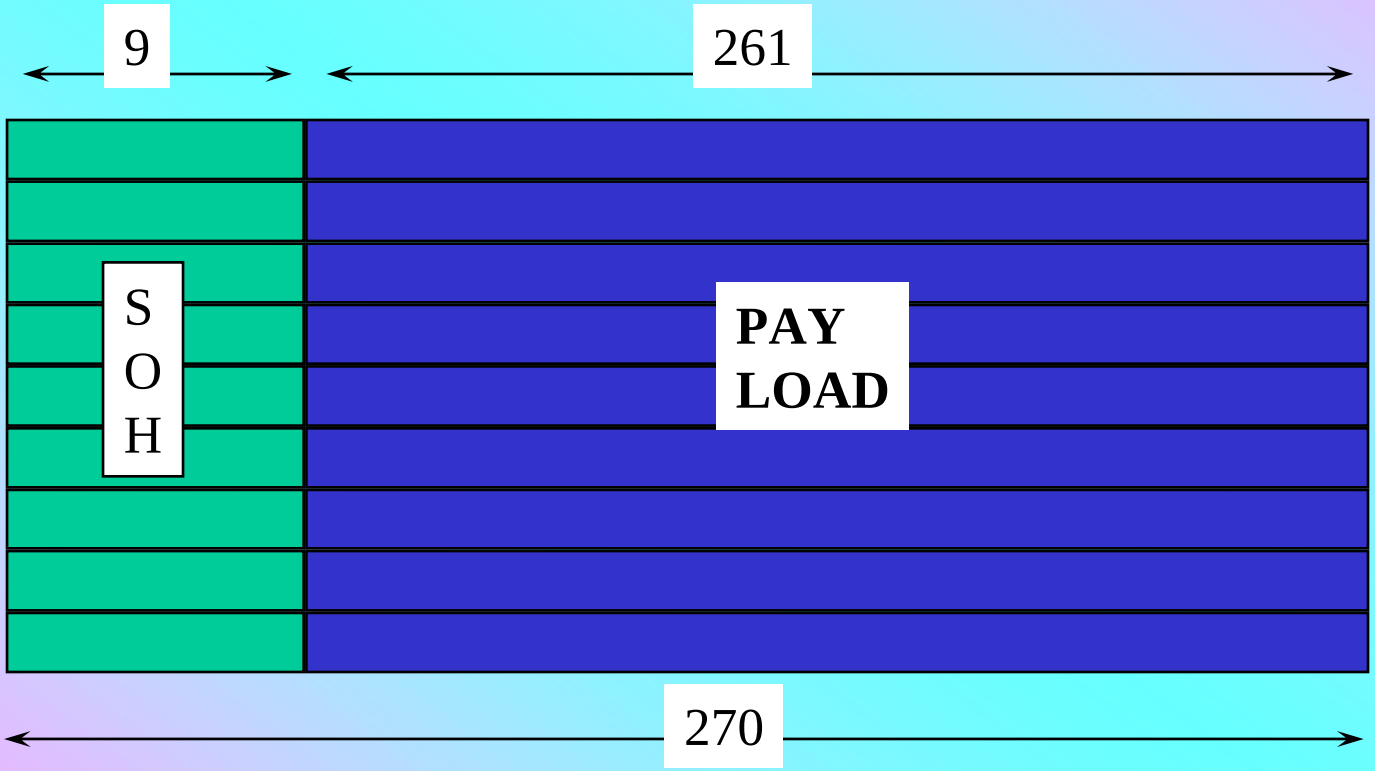


(REDUCED DIAGRAM FOR SDH-MULTIPLEXING)

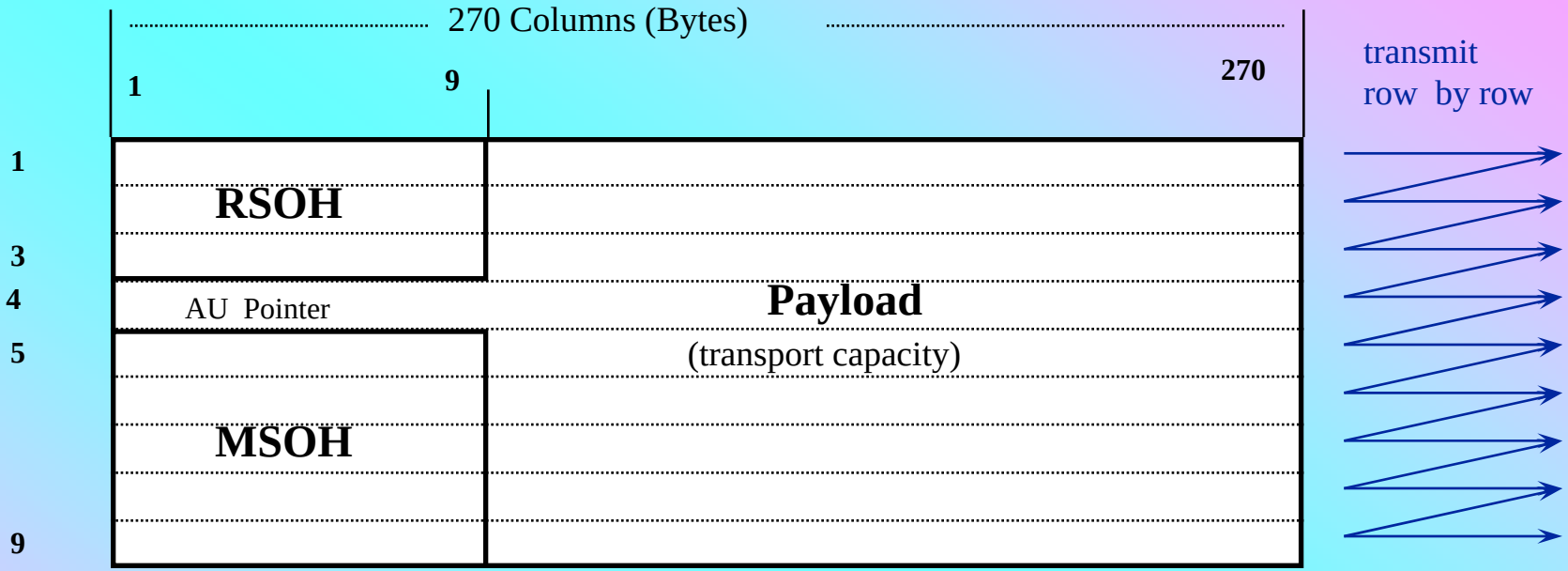
- The Container (C)
  - Basic packaging unit for tributary signals (PDH)
  - Synchronous to the STM-1
  - Bitrate adaptation is done via a positive stuffing procedure
  - Adaptation of synchronous tributaries by fixed stuffing bits
  - Bit by bit stuffing
- The Virtual Container (VC)
  - Formation of the Container by adding of a POH (Path Overhead)
  - Transport as a unit through the network (SDH)
  - A VC containing several VCs has also a pointer area

- The Tributary Unit (TU)
  - Is formed via adding a pointer to the VC
- The Tributary Unit Group (TUG)
  - Combines several TUs for a new VC
- The Administrative Unit (AU)
  - Is shaped if a pointer is allocated to the VC formed at last
- The Syncronous Transport Module Level 1 (STM-1)
  - Formed by adding a Section Overhead (SOH) to AUs
  - Clock justification through positive-zero-negative stuffing in the AU pointer area
  - byte by byte stuffing

SDH FRAME REPRESENTATION



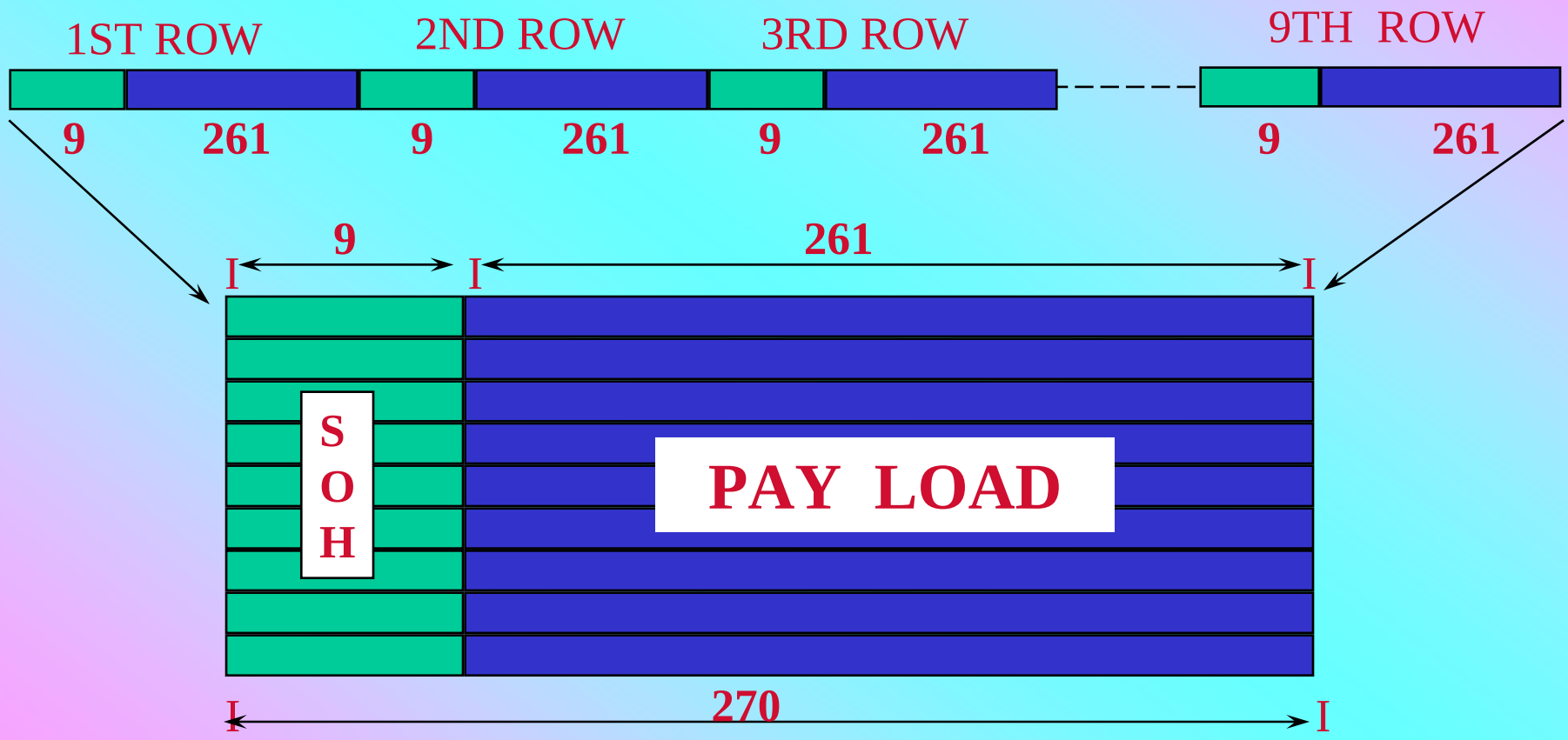
(MATRIX REPRESENTATION)



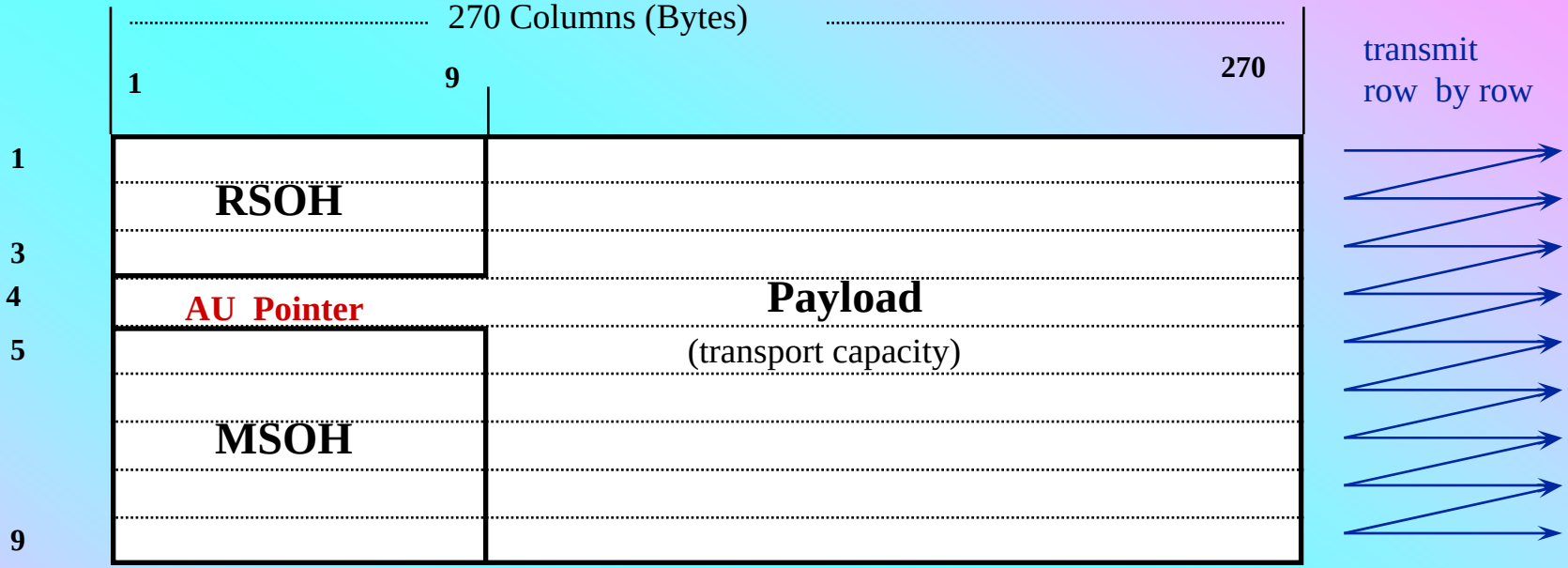
RSOH: Regenerator section overhead
MSOH: Multiplex section overhead
Payload: Area for information transport

Transport capacity of one Byte: 64 kbit/s
Frame capacity: 270 x 9 x 8 x 8000 = 155.520 Mbit/s
Frame repetition time: 125 µs

FRAME REPRESENTATION



(MATRIX REPRESENTATION)



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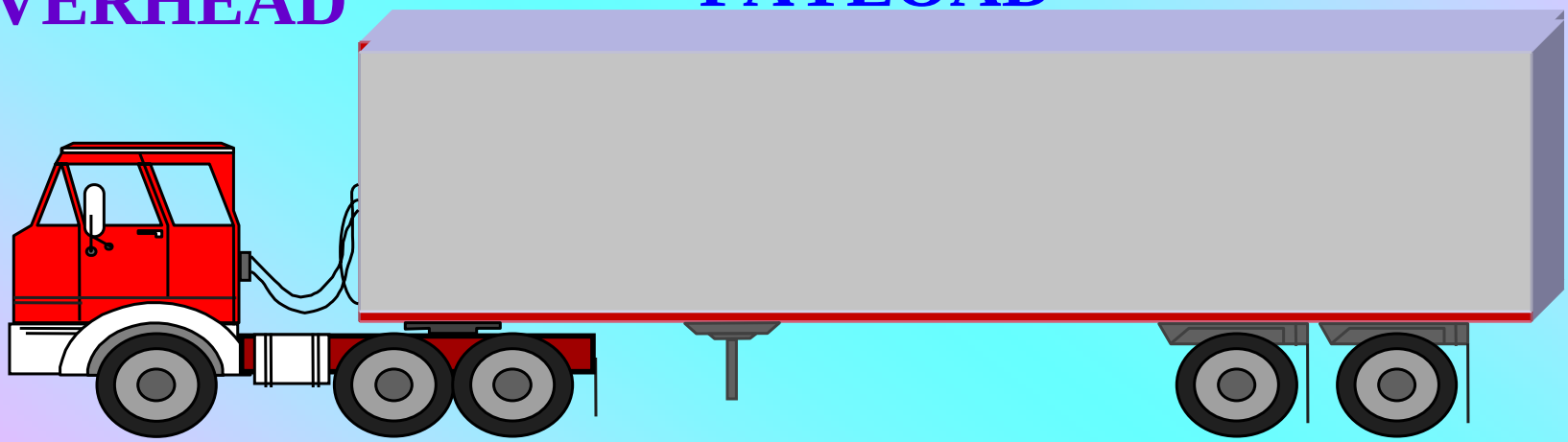
THE TRUCK

OVERHEAD

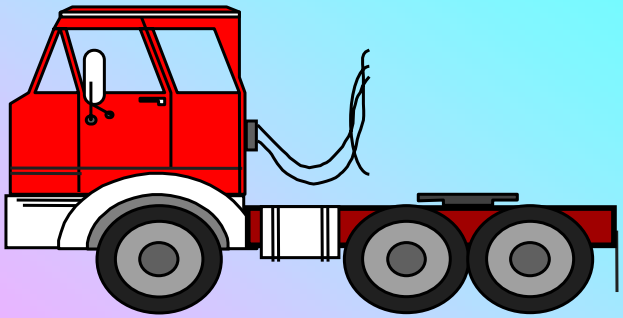
PAYLOAD

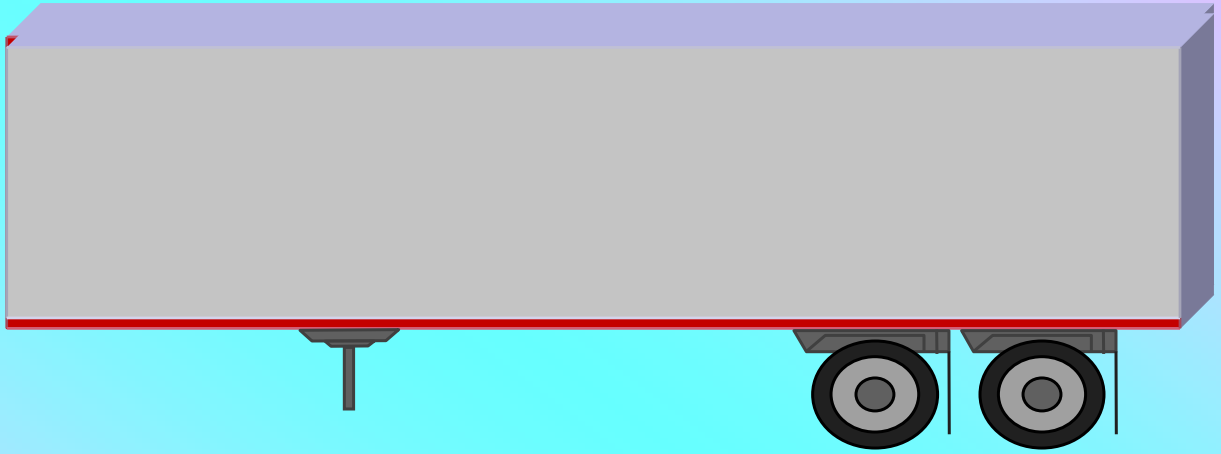


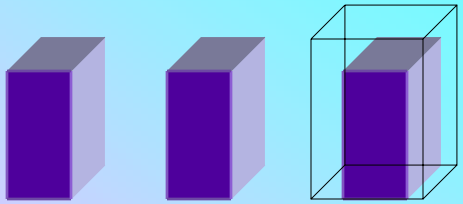
THE TRUCK

OVERHEAD

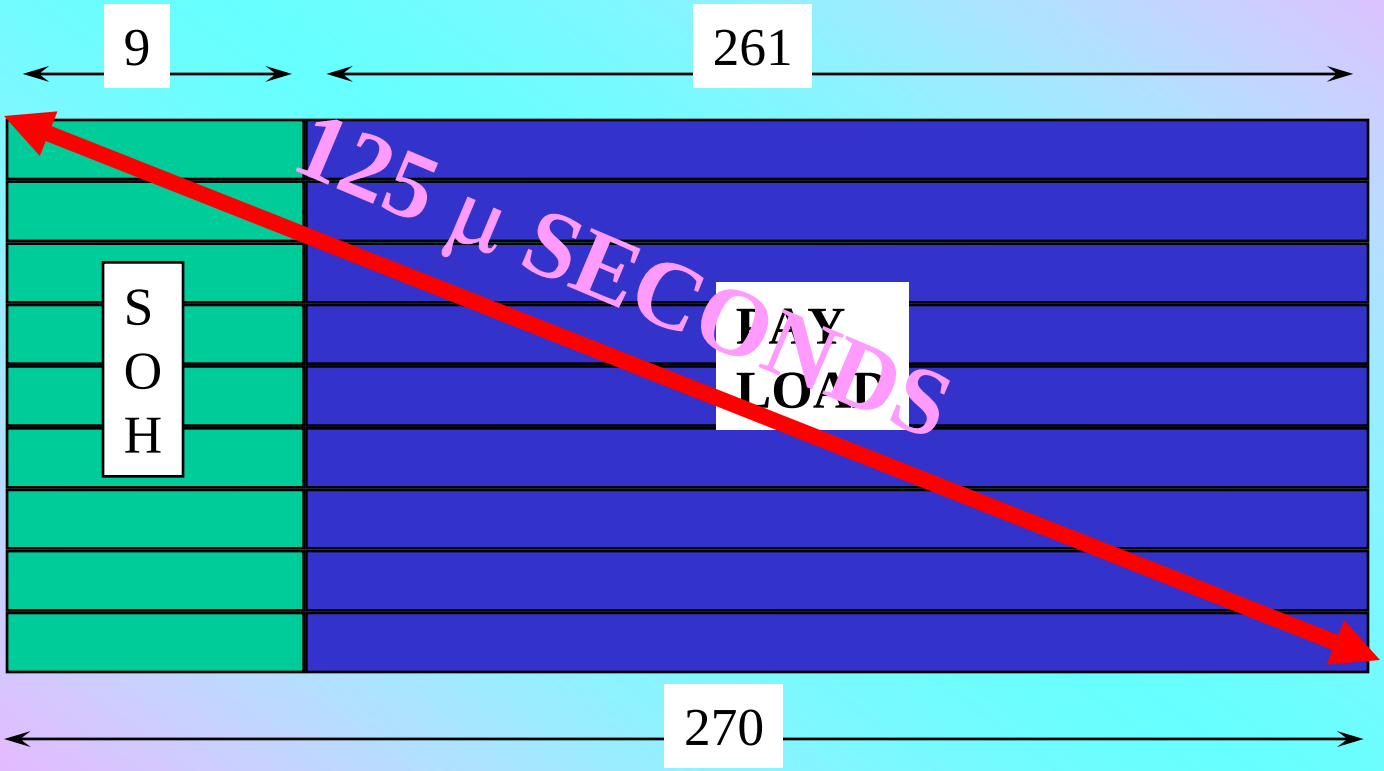
PAYLOAD







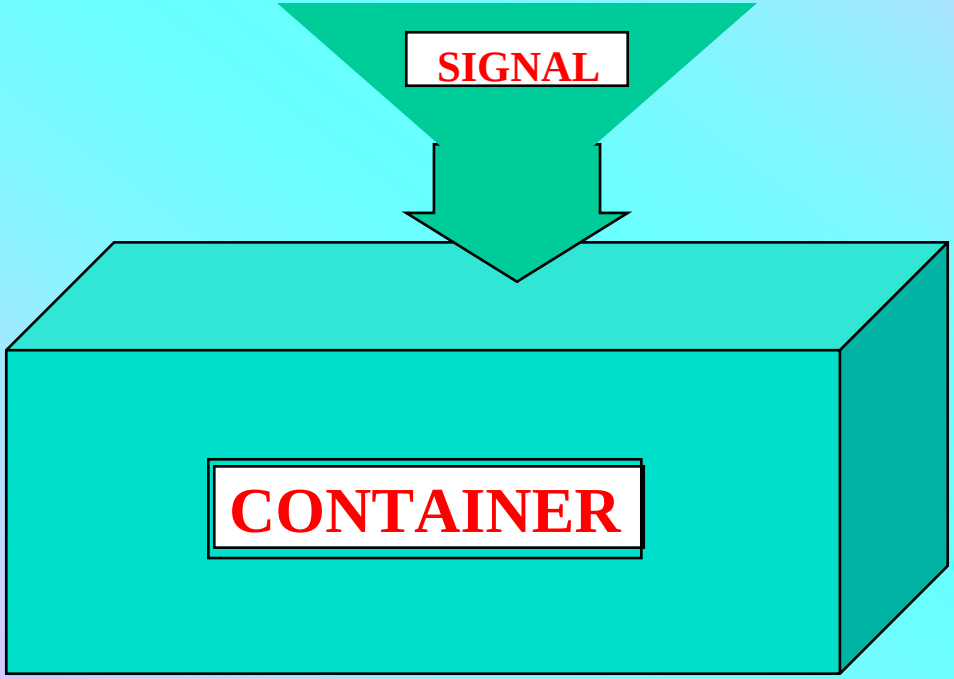
BIT RATE : STM-N ??



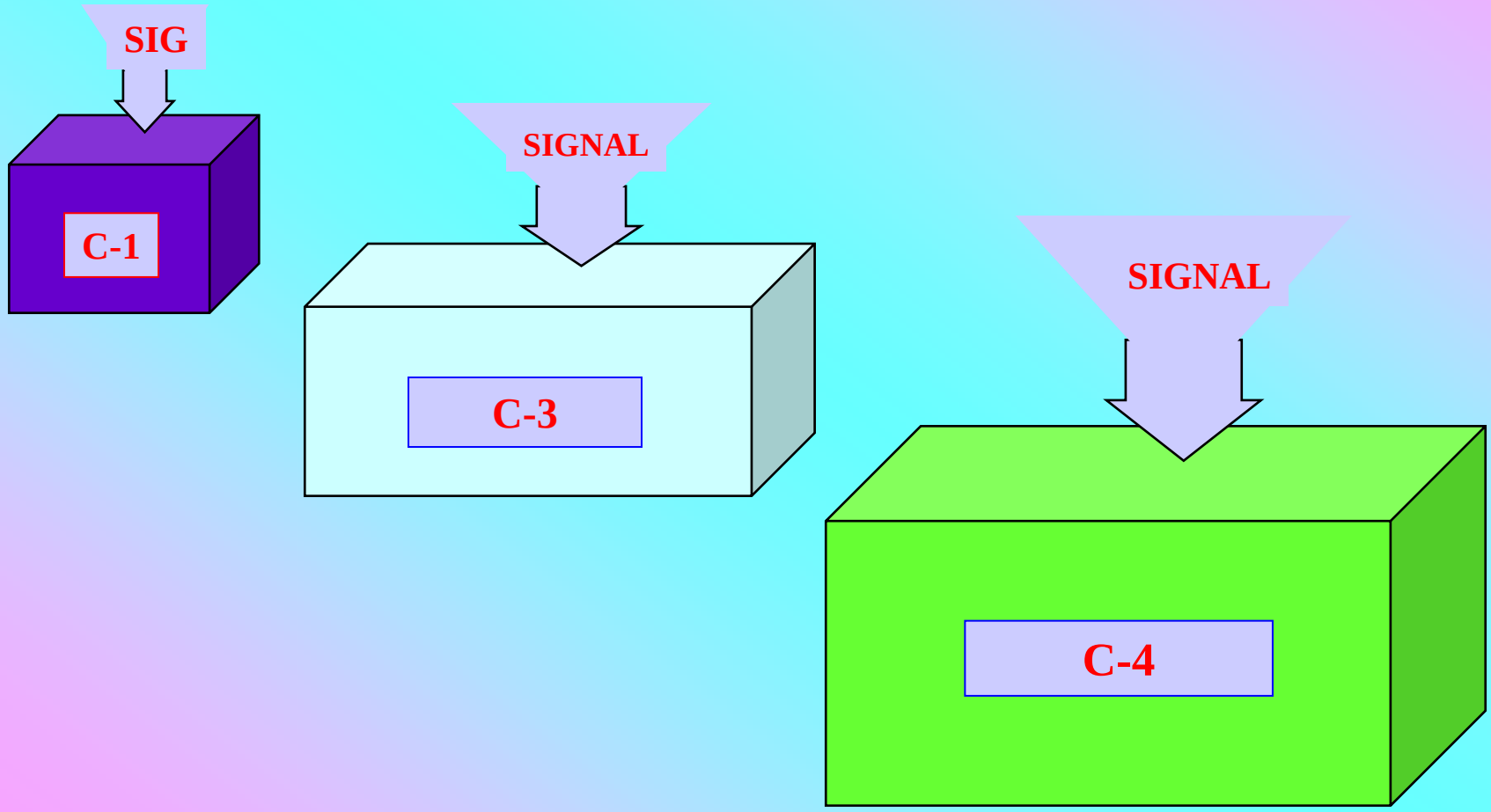
(MATRIX REPRESENTATION)

MUX PRINCIPLE

Container-n(n=1-4): A container is the information structure which forms the network synchronous information payload for a virtual container



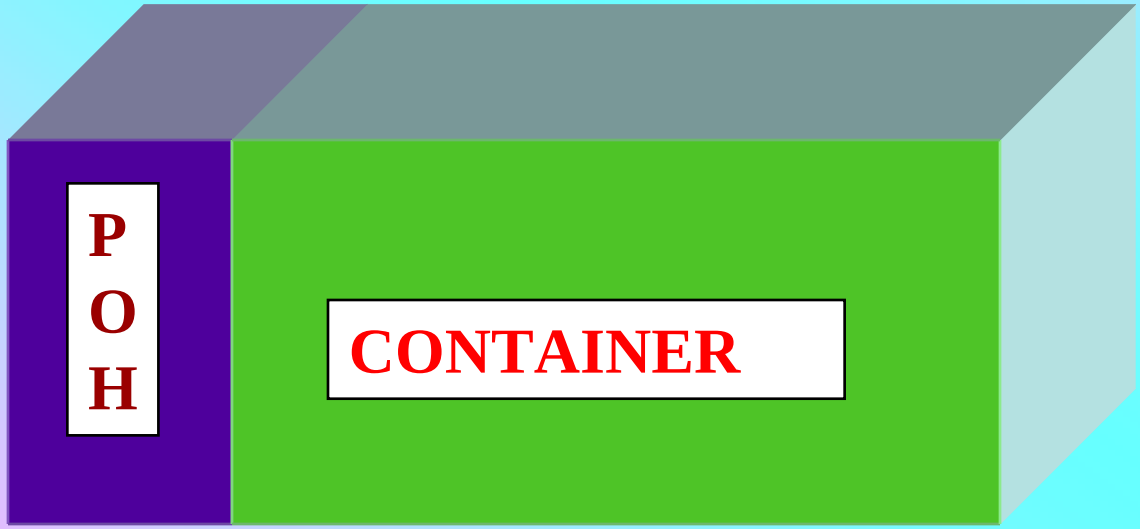
MUX PRINCIPLE: CONTAINERS(C-n)



MUX PRINCIPLE: VC-n

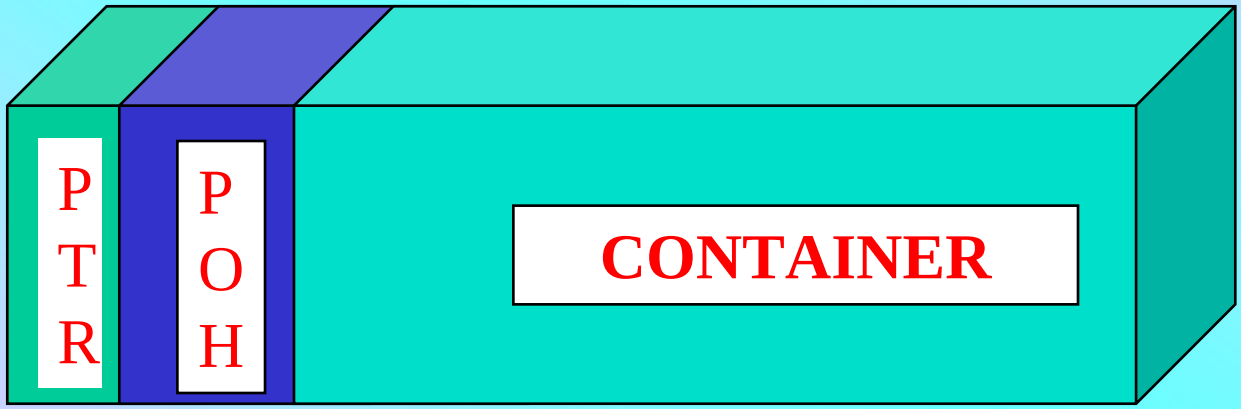
Virtual Container-n(VC-n): It is the information structure used to support path layer connections in the SDH.

Two types of VCs: Lower order VC-n(n=1,2)
Higher order Vc-n(n=3,4)



MUX PRINCIPLE: TU-n/ AU

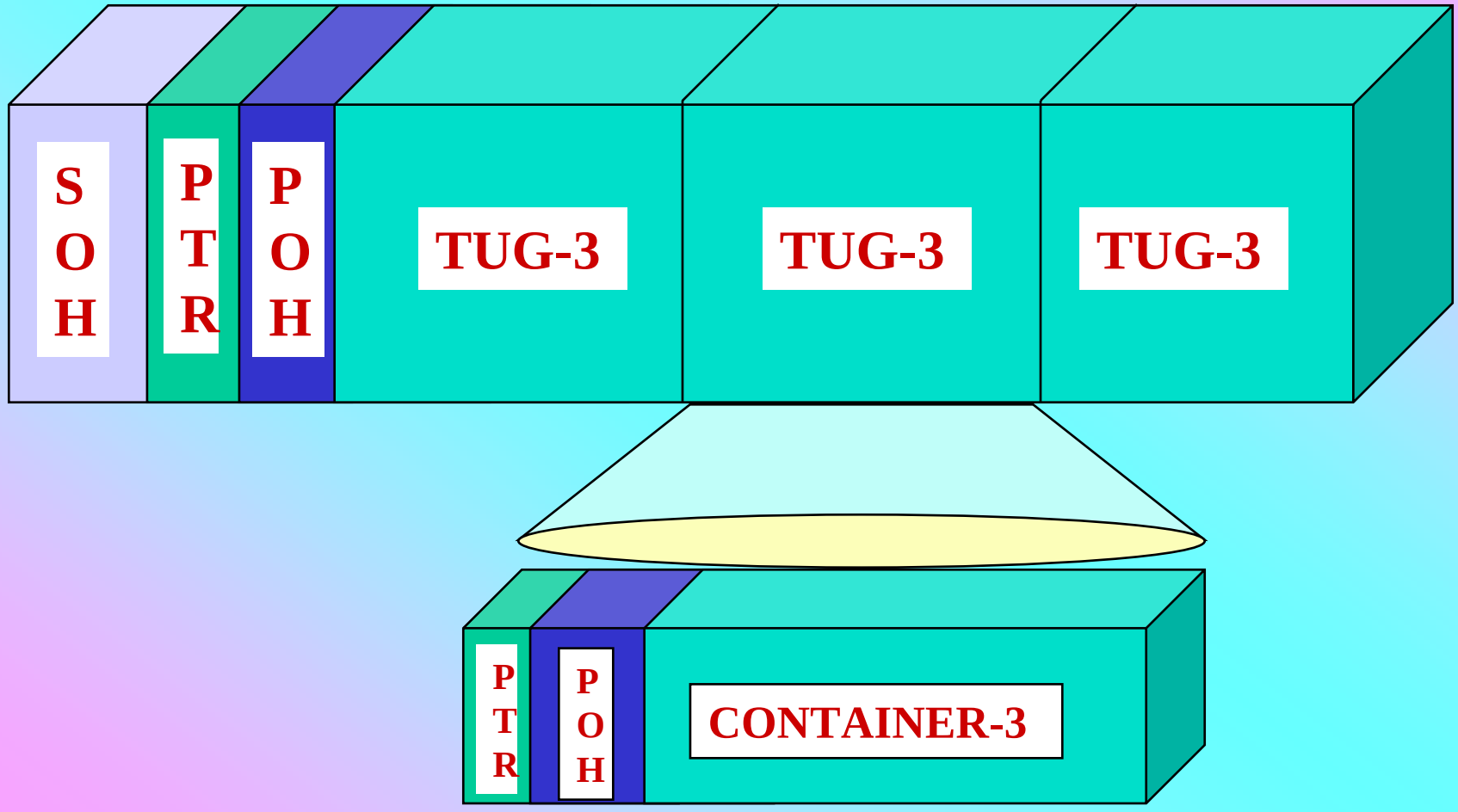
•**It is an information structure which provides adaptation between two layers:** -Between lower and higher order path layers for TU
-Between higher order path layer and section layer for AU



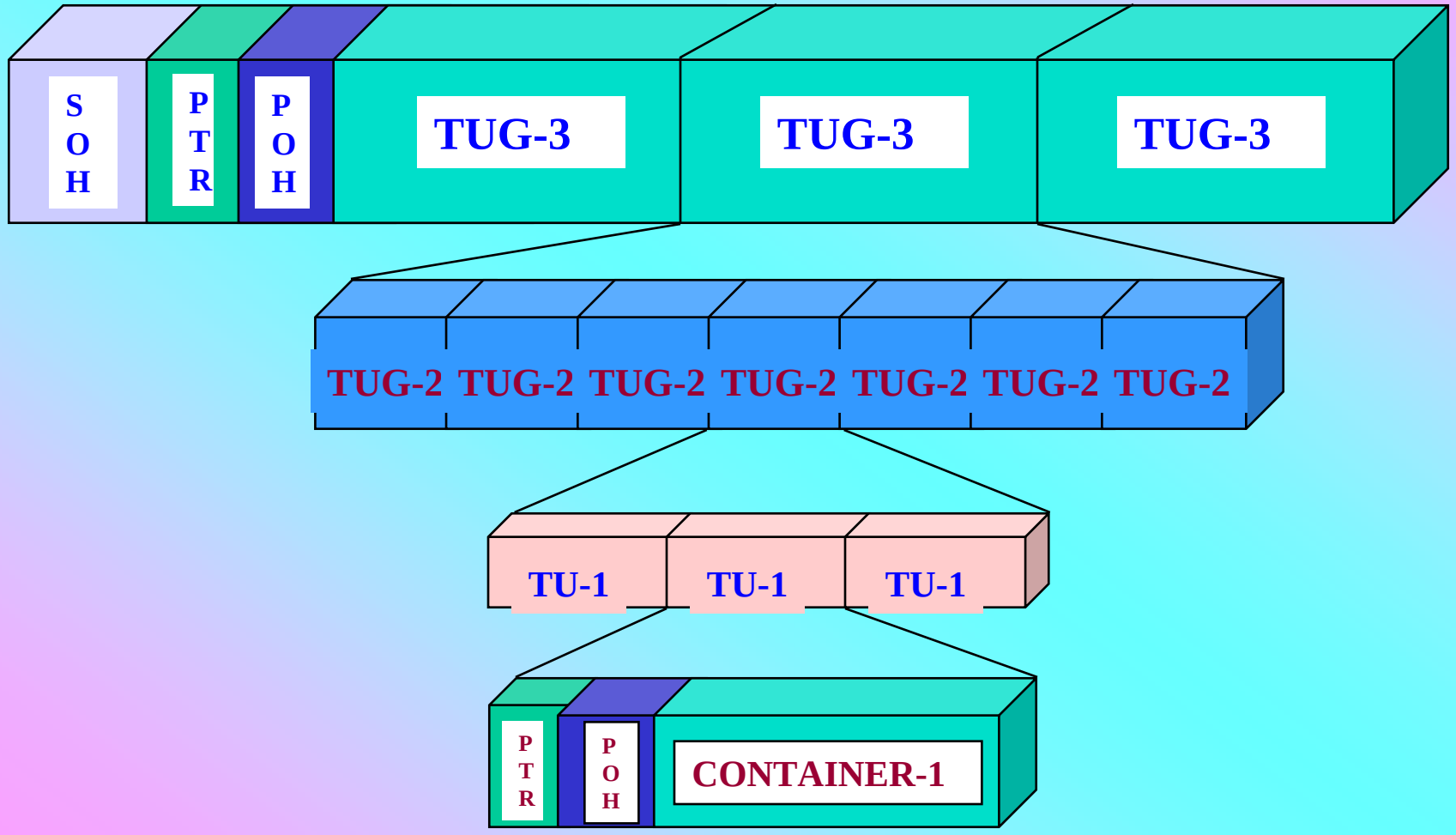
POINTER is an indicator whose value defines the frame offset of a VC with respect to the frame reference of the transport entity on which it is supported

MUX PRINCIPLE: STM-1(from C-4)

MUX PRINCIPLE: STM-1(from C-3)

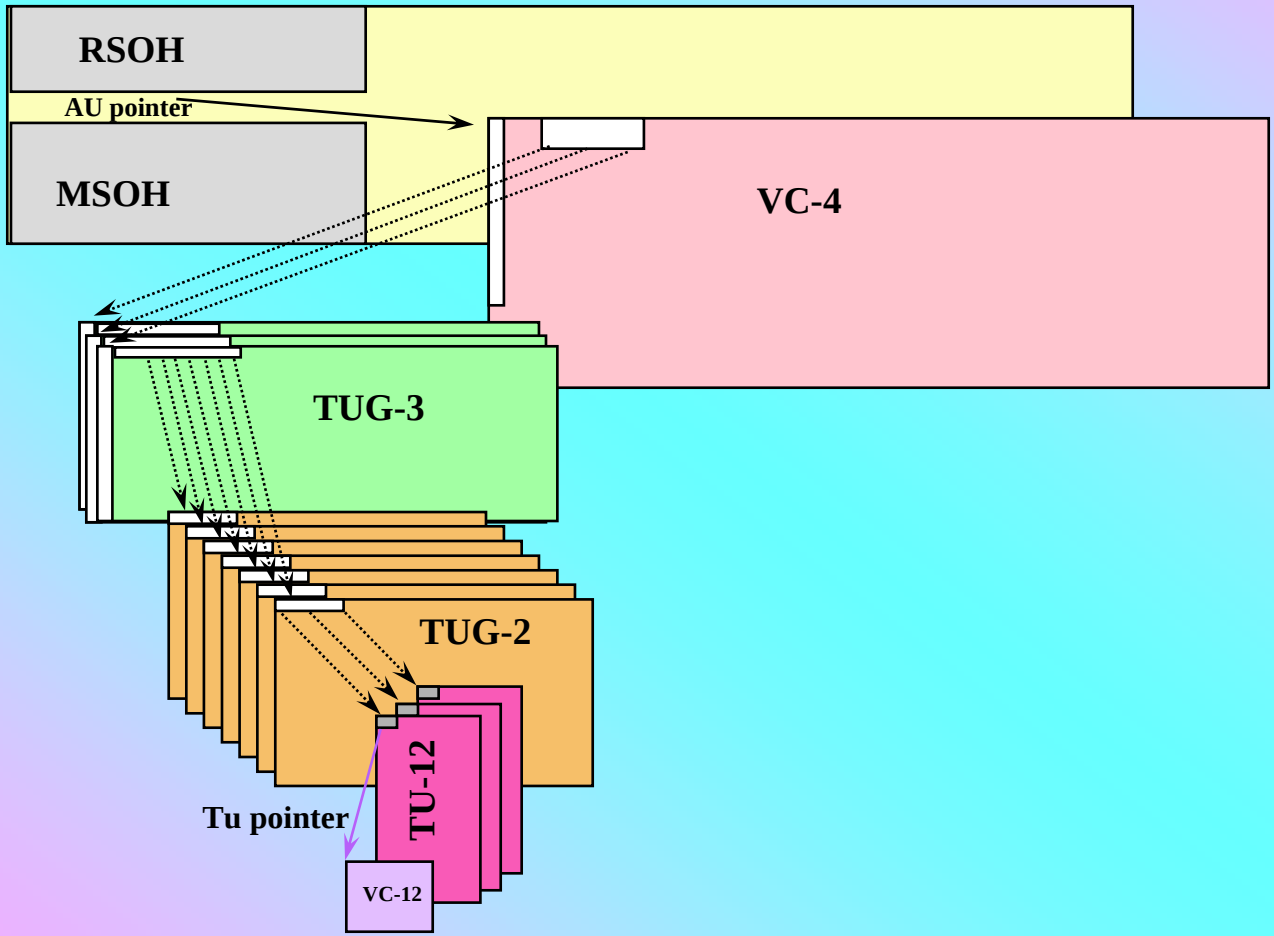


MUX PRINCIPLE: STM-1(from C-1)



BIT RATE : STM-N

- NUMBER OF ROWS = 9
- NUMBER OF COLUMNS = 9+261=270
- NUMBER OF BYTES = 9x270
- NUMBER OF BITS = 9x270x8
- NUMBER OF BITS / SECOND = 9x270x8x8000
  =155520000
  =155.520 Mbps (STM-1)
- BIT RATE OF STM-N = (Nx155.520) Mbps


RSOH
AU pointer
MSOH
VC-4
TUG-3
TUG-2
TU-12
Tu pointer
VC-12

SECTION OVERHEAD DETAILS

A1	A1	A1	A2	A2	A2	J0		
B1	○	○	E1	○		F1		
D1	○	○	D2	○		D3		

B2	B2	B2	K1			K2		
D4			D5			D6		
D7			D8			D9		
D10			D11			D12		
S1					M1	E2		

A FRAMING
D DATACOM FOR NMS
F USER CHANNEL
K APS
X RESERVED FOR NATIONAL USE
UNUSED RESERVED FOR FUTURE USE

B PARITY CHECK
E ORDERWIRE
M MS-REI
○ MEDIA DEPEDENT

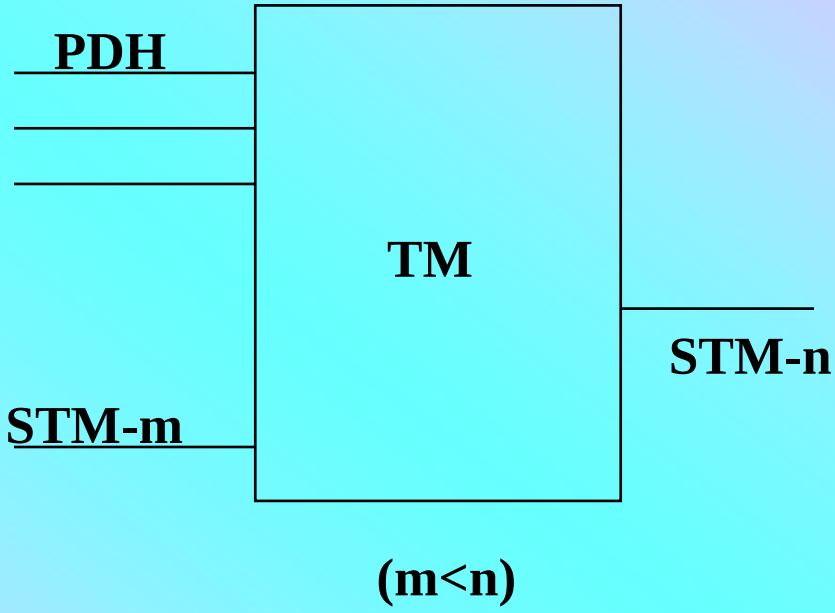
NETWORK ELEMENTS

SYNCHRONOUS MULTIPLEXER (MUX):

*** MAPPING OF PDH SIGNALS INTO SDH.**

*** MULTIPEXING OF LOWER -ORDER SDH SIGNALS INTO SDH**

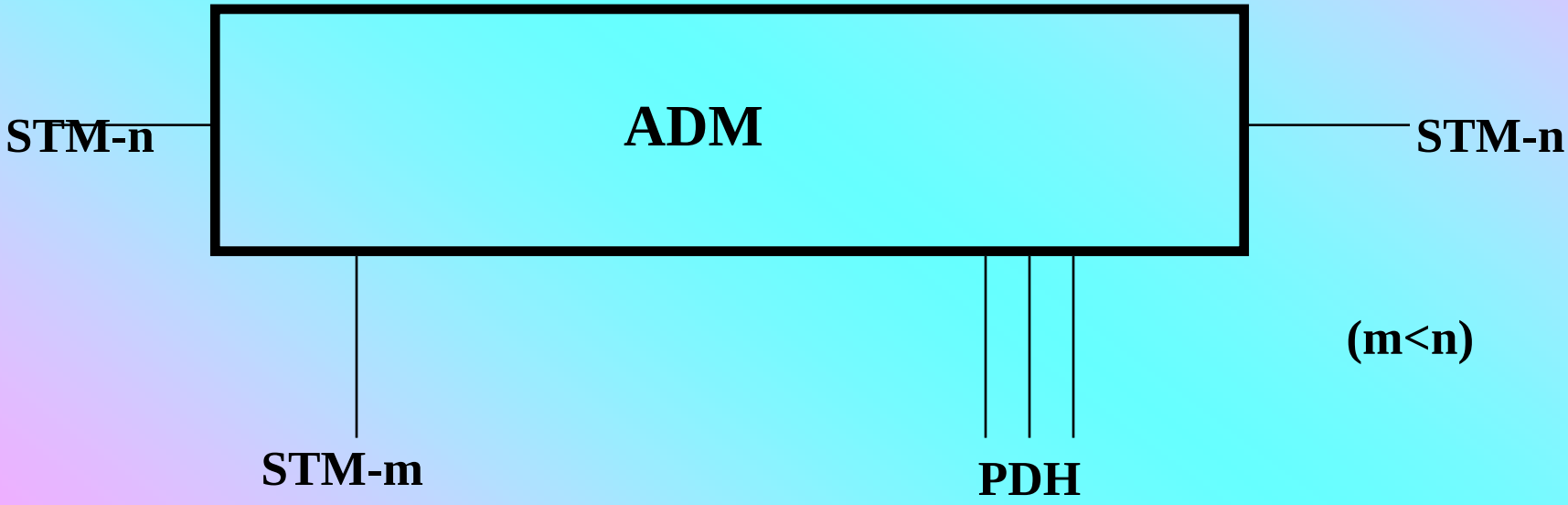
63 Nos. OF 2Mbps or
3 Nos.of 34Mbps or
1 Nos. of 140Mbps or
combination of above



NETWORK ELEMENTS

ADD & DROP MULTIPLEXER (ADM):

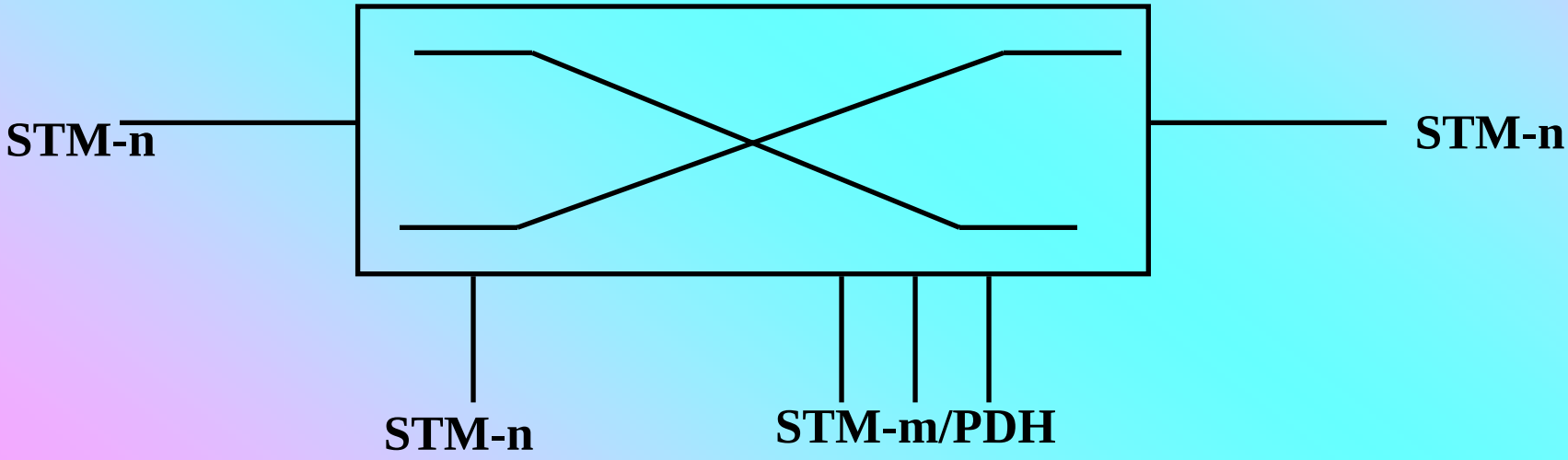
*** PERMITS ADD& DROP OF LOWER ORDER SIGNALS.**



NETWORK ELEMENTS

SYNCHRONOUS DIGITAL CROSS CONNECT (SDXC):

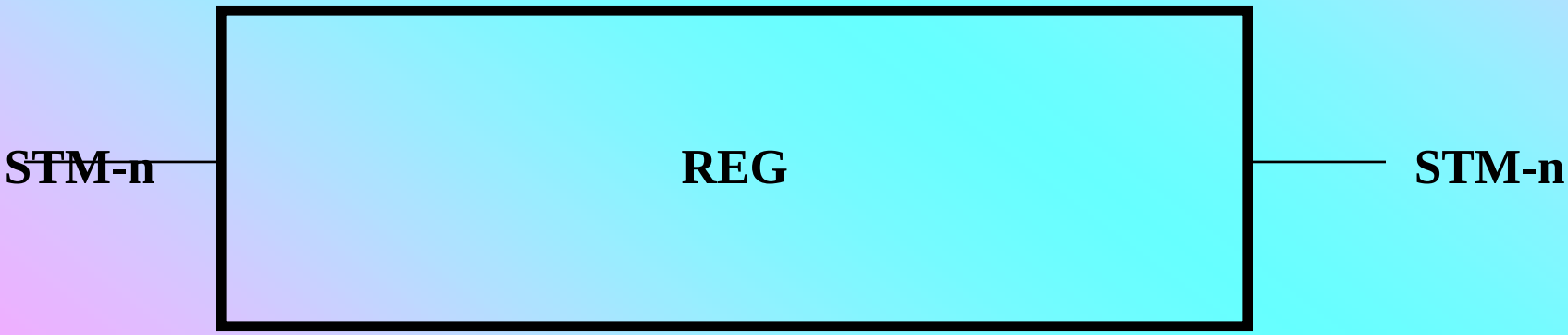
* **PERMITS SWITCHING OF TRANSMISSION LINES WITH DIFFERENT BIT-RATES.**
* **SDXC CAN ADD AND DROP LOWER-ORDER SIGNALS.**



NETWORK ELEMENTS

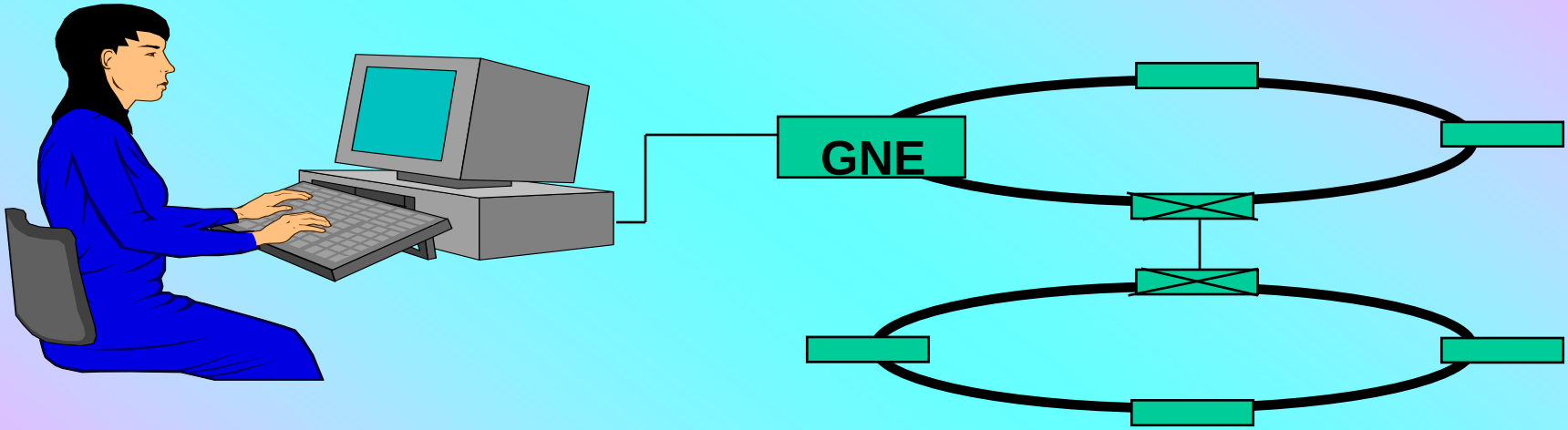
SYNCHRONOUS REGENERATOR (REG):

* REGENERATES THE INCOMING LINE SIGNAL.
* SUPERVISE THE TRANSMISSION QUALITY OF THE LINE



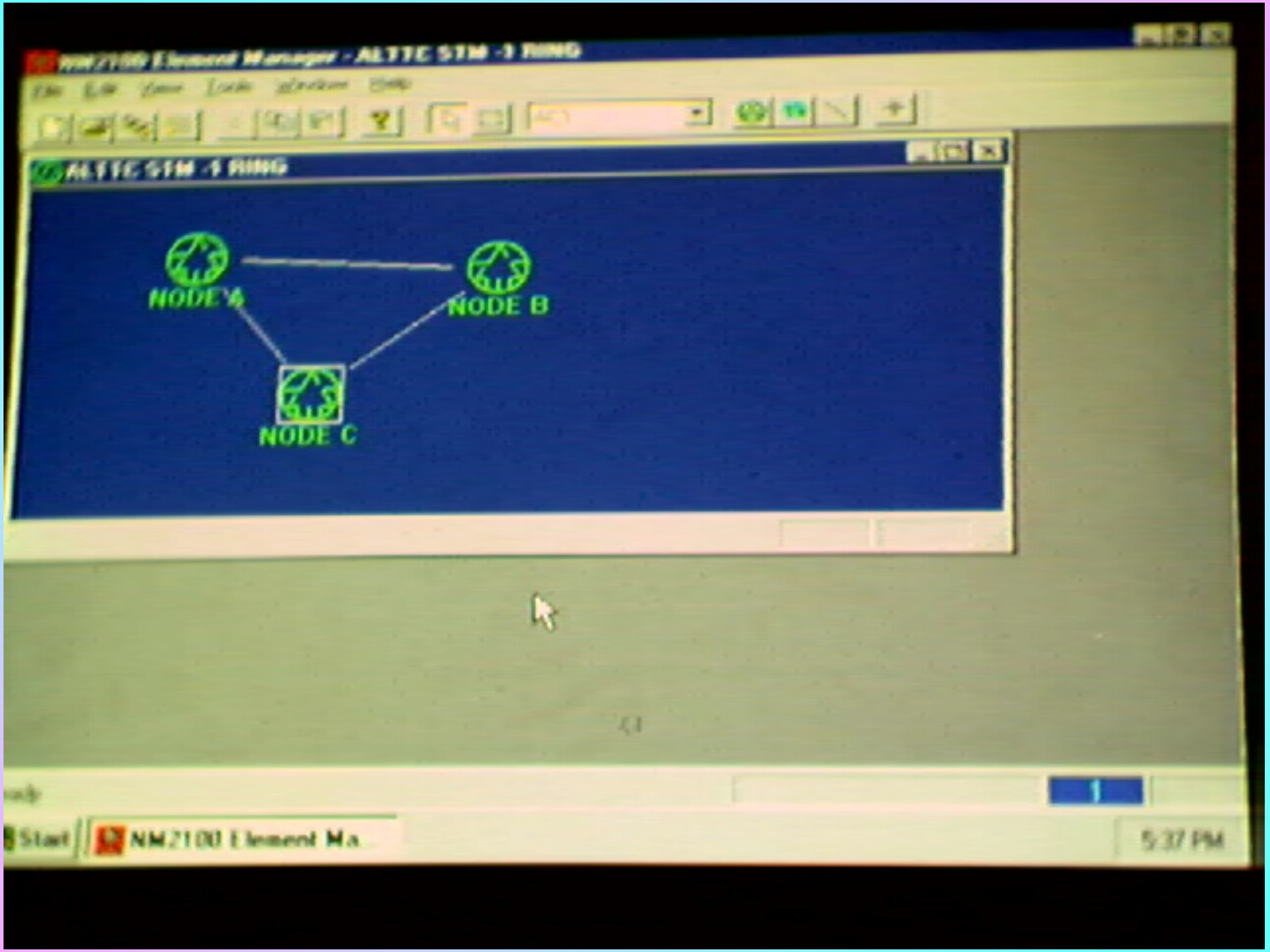
NETWORK ELEMENTS

N M S



SDH AIMS TO PROVIDE:

STANDARDISED , CENTRALISED O&M SYSTEM .

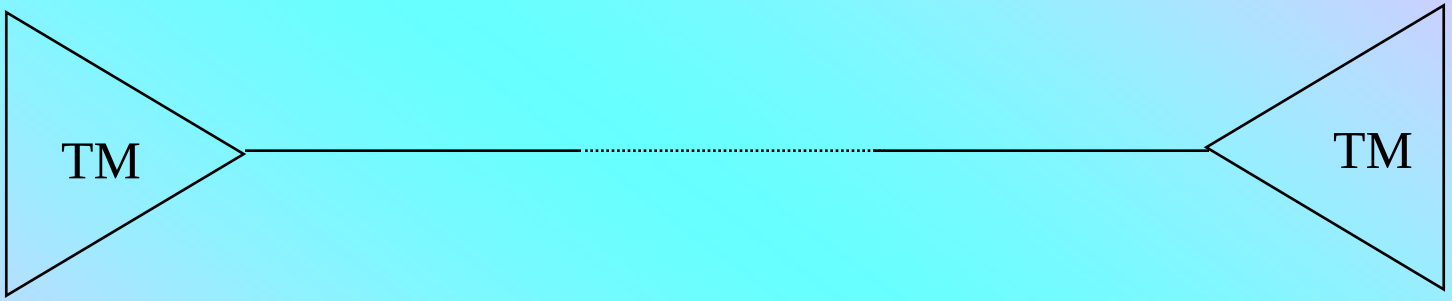

ALTTC STM -1 RING
NODE A
NODE B
NODE C
Start
5:37 PM

SDH MANAGEMENT

- Performance Management
- Fault / Event Management
- Configuration Management
- Accounting Management
- Security Management

NETWORK TOPOLOGY

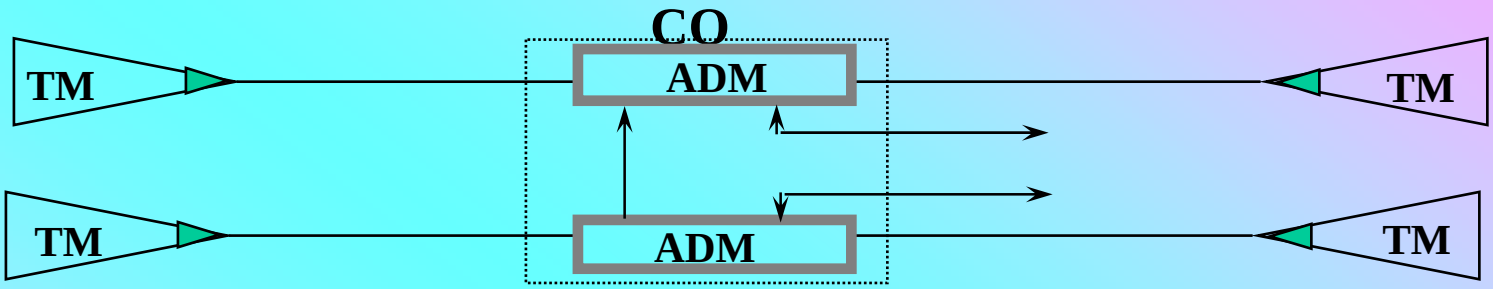
* **POINT-TO-POINT:**



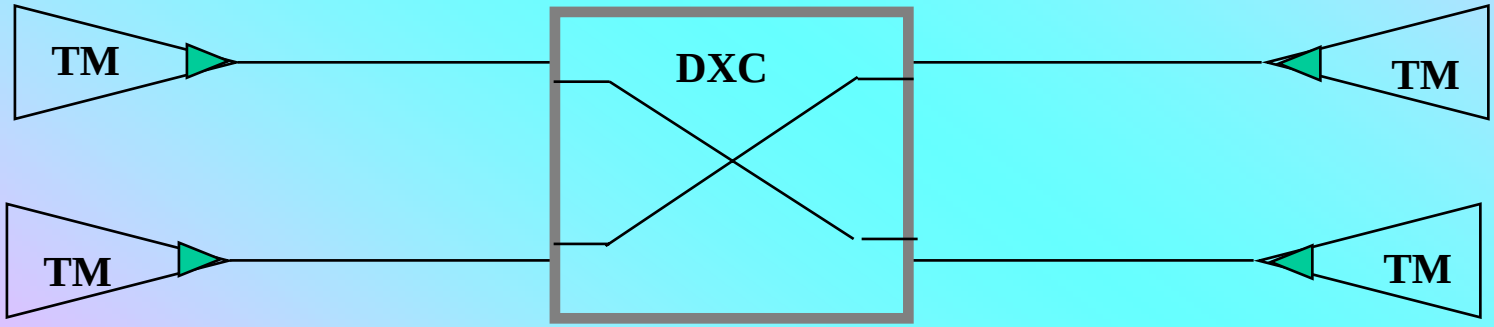
* **POINT-TO-MULTIPOINT:**

NETWORK TOPOLOGY

*** HUB-TOPOLOGY:**



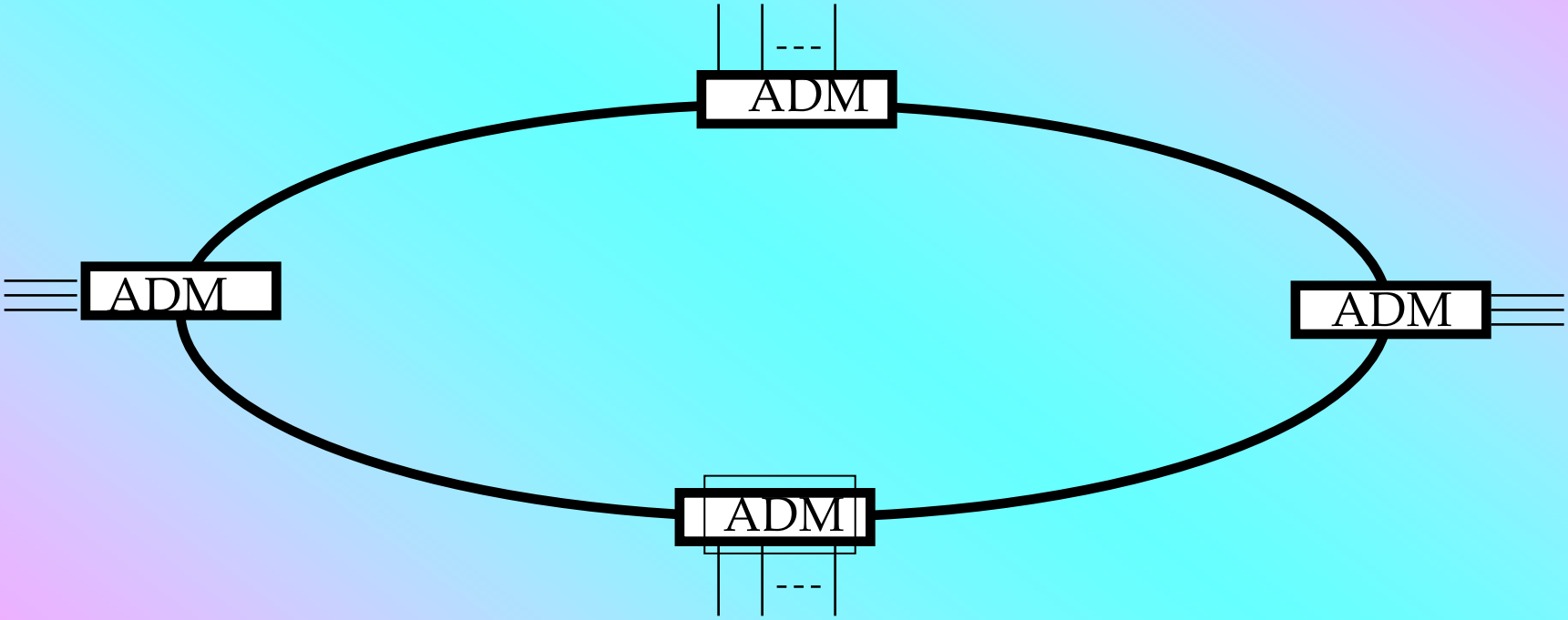
(a) HUB WITH TM & ADM



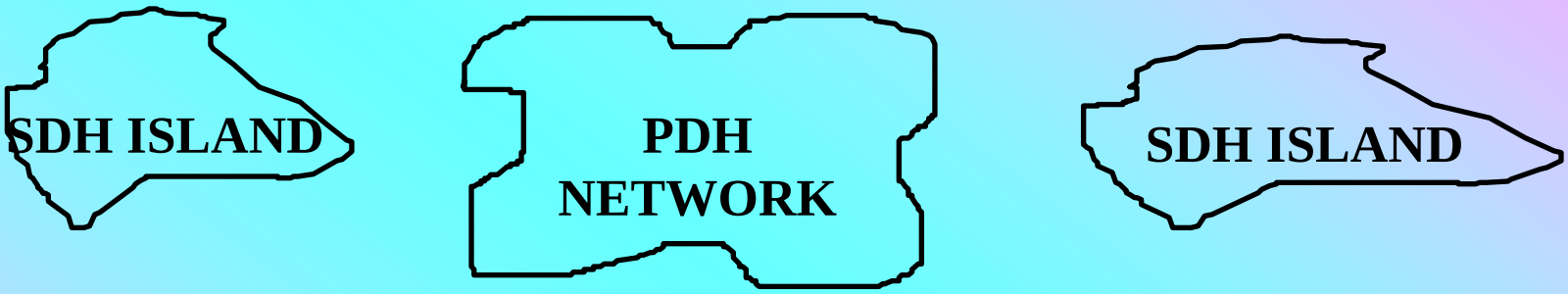
(b) HUB WITH TM & DXC

NETWORK TOPOLOGY

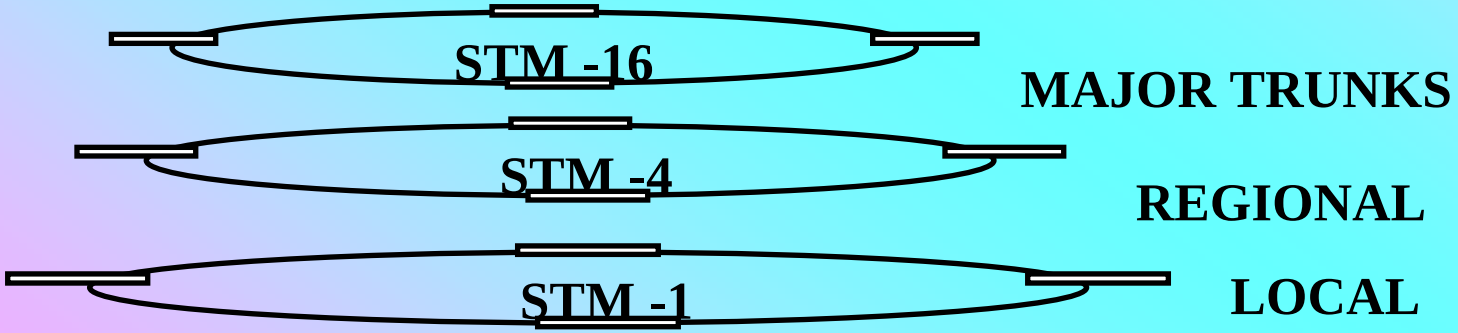
*** RING-TOPOLOGY:**



SDH NETWORK STRUCTURE



a) Mixed SDH-PDH network



b) Typical use of SDH rates.

THANK YOU