Redes WAN de Banda Larga

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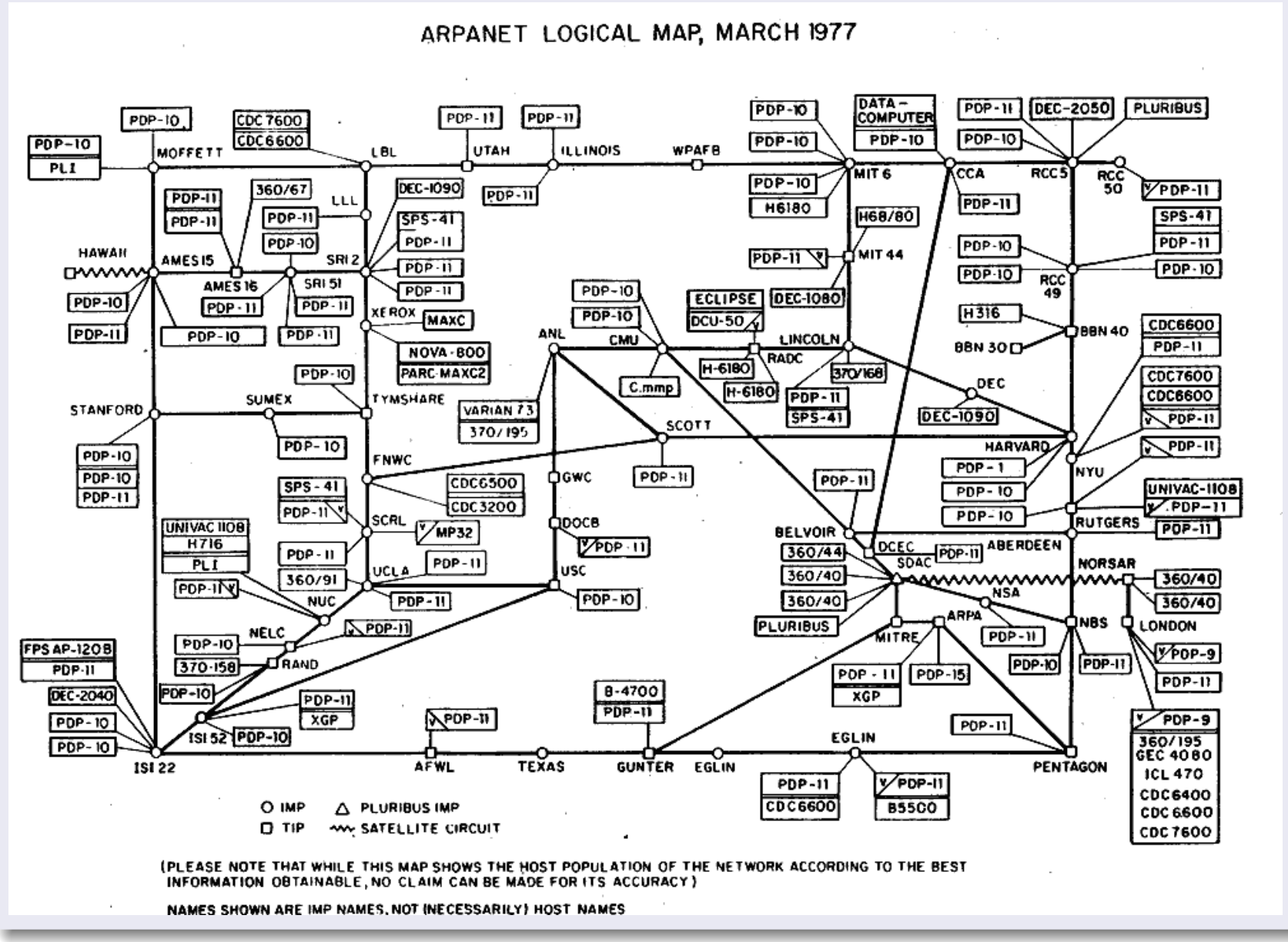
Redes WAN de Banda Larga

Sumário - Áudio:`tec1Intro.mp3`

ARPANET - Áudio:arpanet.mp3

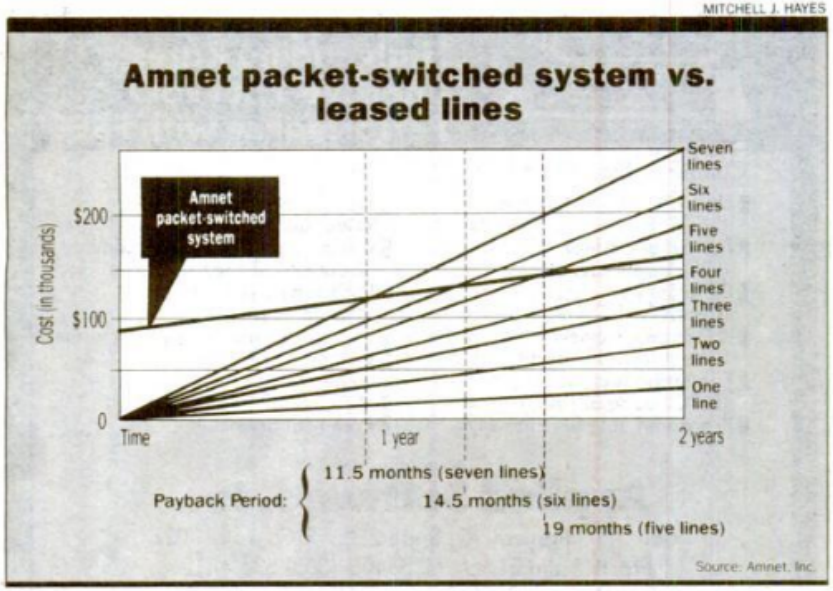


(PLEASE NOTE THAT WHILE THIS MAP SHOWS THE HOST POPULATION OF THE NETWORK ACCORDING TO THE BEST INFORMATION OBTAINABLE, NO CLAIM CAN BE MADE FOR ITS ACCURACY)

NAMES SHOWN ARE IMP NAMES, NOT (NECESSARILY) HOST NAMES

X.25 - Áudio:tec1x25intro.mp3

MITCHELL J. HAYES



Replacing a homespun net

From page 53

without a Nucleus 6000 packet-switching system (see diagram left). The study's figures are based on an actual link between a cluster of ATMs in Wilmington, Del., and an Mtech data center in Dallas.

Projected expenses for the Nucleus 6000 installation include up-front costs of approximately $90,000, which is the price of a typical entry-level system. The Amnet installation's expenses over the next two years comprise the cost of leasing two private lines and two modems.

While the non-packet-switched leased line installations depicted in the diagram have no up-front costs, the line and equipment leasing costs over time increase as the company's data traffic needs increase. Amnet spokesman Peter Thornton said packet-switched technology enables the Nucleus 6000 configuration to support the same amount of data traffic as four to 10 ordinary 9.6K bit/sec. leased lines. As the diagram indicates, the greater the user's data communications needs, the less time it takes for the Nucleus 6000 installation to start saving money over a comparable leased line installation.

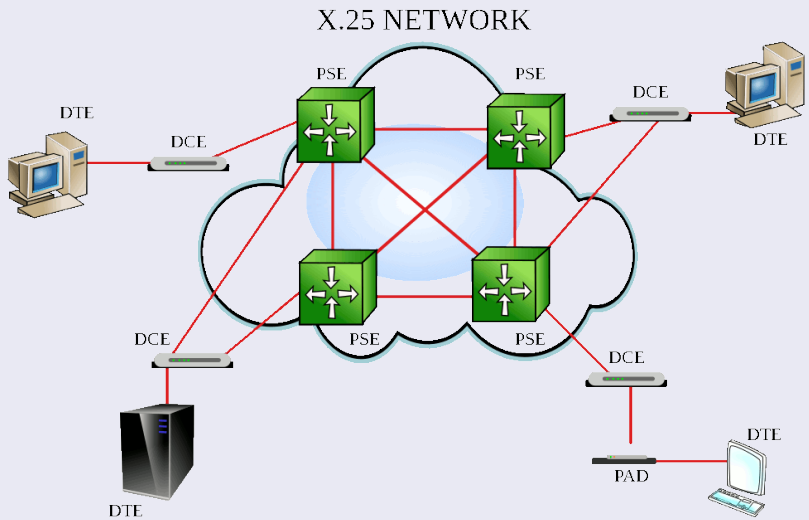
Mtech has allocated a budget of $5 million for installing the network in the next three years. The initial network, completed approximately eight months ago, links just three nodes. Mtech said it expects to recoup its initial investment in approximately 2½ years.

Características X.25 - Áudio:`tec1x25.mp3`

Tecnologia X.25

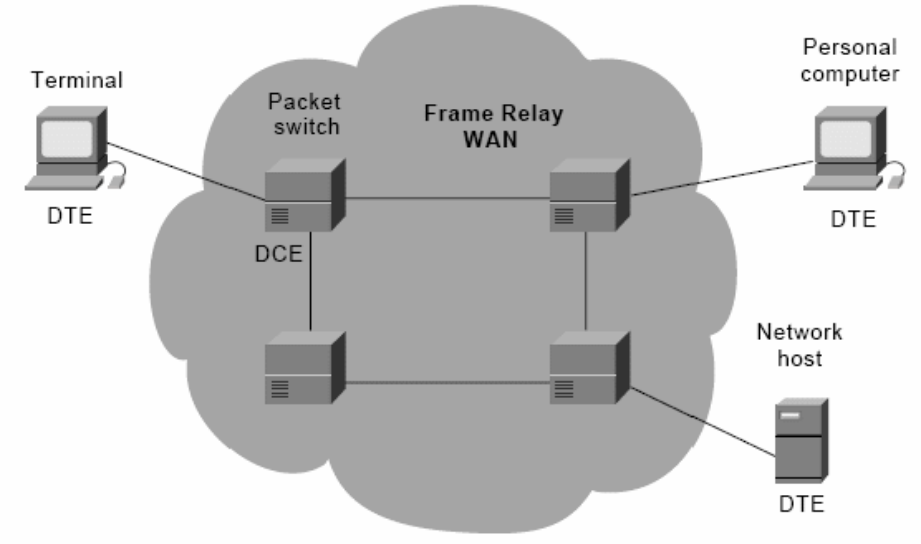
- CCITT 1976
- Protocolo WAN
- Interconexão de LAN
- Camada 1 - X.21 ou RS232
- Camada 2 - LABP (HDLC)
- Rede de Pacotes Orientada à Conexão
  - Circuitos Virtuais Permantentes (PVC)
  - Circuitos Virtuais Comutados (SVC)
  - Endereçamento X.121

Modelo X.25 - Áudio:tec1x25Modelo.mp3



- Data terminal equipment (DTE)
- Data circuit-terminating equipment (DCE)
- Packet-switching exchange (PSE)

Modelo Frame Relay- Áudio:`tec1frmodelo.mp3`



- Data terminal equipment (DTE)
- Data circuit-terminating equipment (DCE)

Áudio:`tec1fr.mp3`

Tecnologia Frame Relay

- Proposta ANSI/CCITT Anos 80 - Avança anos 90 (Consórcio)
- Protocolo WAN
- Interconexão de LAN
- Camada 1 e 2 apenas (Física e Lógica)
- Link Access Procedure to Frame Mode Bearer Service (LAPF)
- Rede de Pacotes Orientada à Conexão
  - Circuitos Virtuais Permantentes (PVC)
  - Circuitos Virtuais Comutados (SVC)
  - Multiplexação Estatística

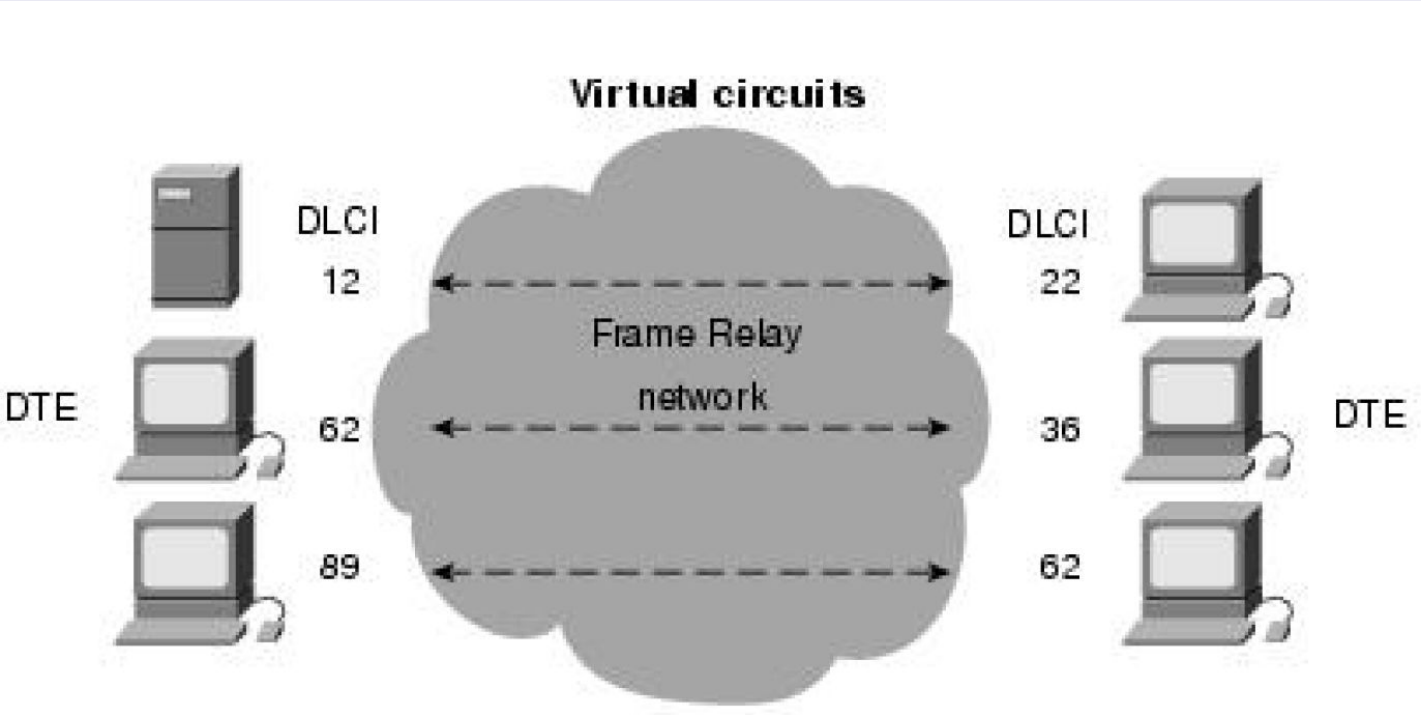
Áudio:`tec1frxx25.mp3`

Comparação com X.25

- Elimina a complexidade da Camada 3 (ARQ)
- Melhor adaptado a meios confiáveis e de alta taxa
- Melhor adaptado para o tráfego IP (Grandes Pacotes)
- LAPF em vez do LAPB

Áudio:tec1frvirtuais.mp3

PVC e SVC



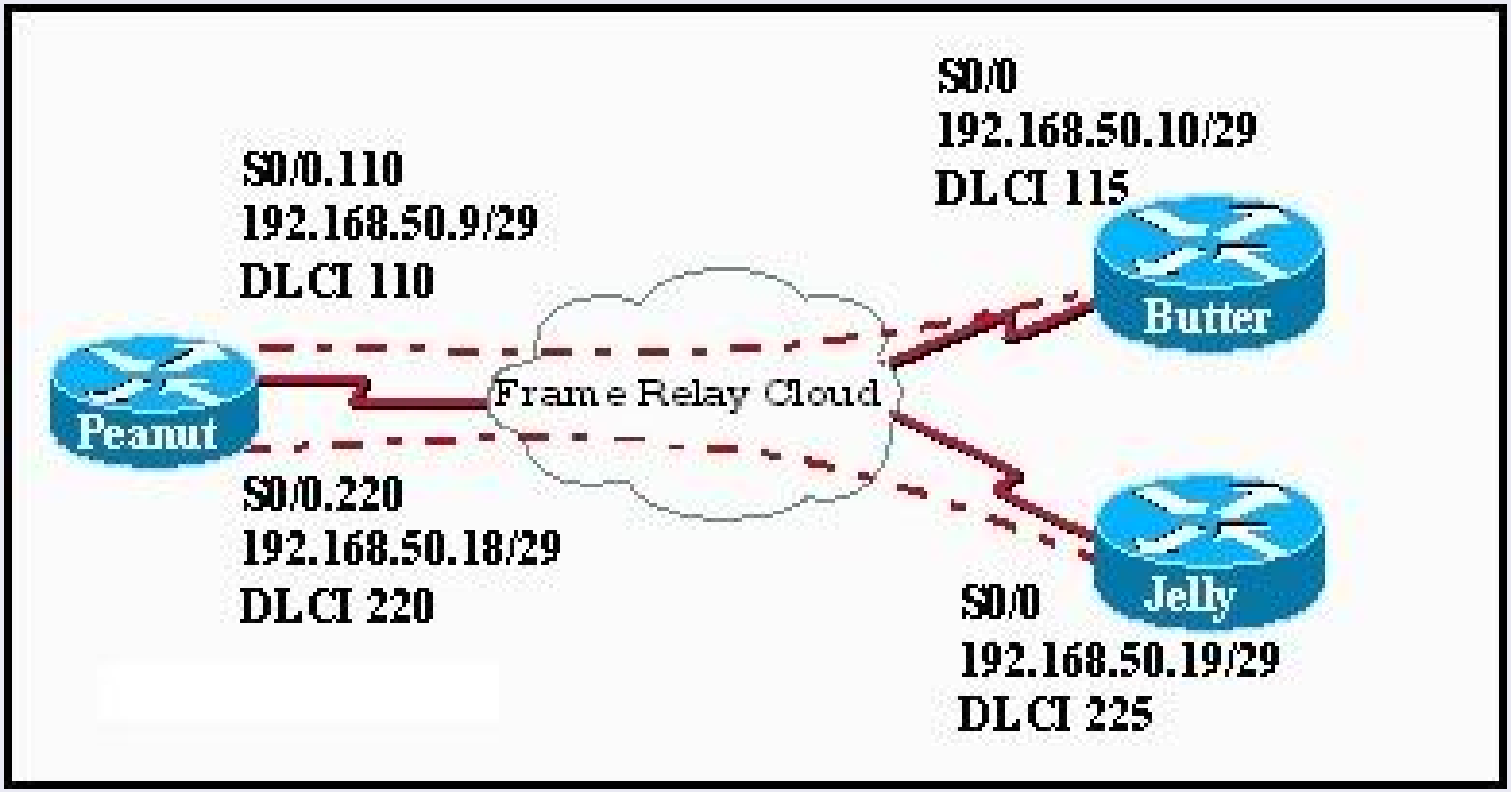
Áudio:tec1frestados.mp3

Estados de Um Circuito Virtual

- Call setup (SVC)
- Data transfer (SVC e PVC)
- Idle (SVC e PVC)
- Call termination (SVC)

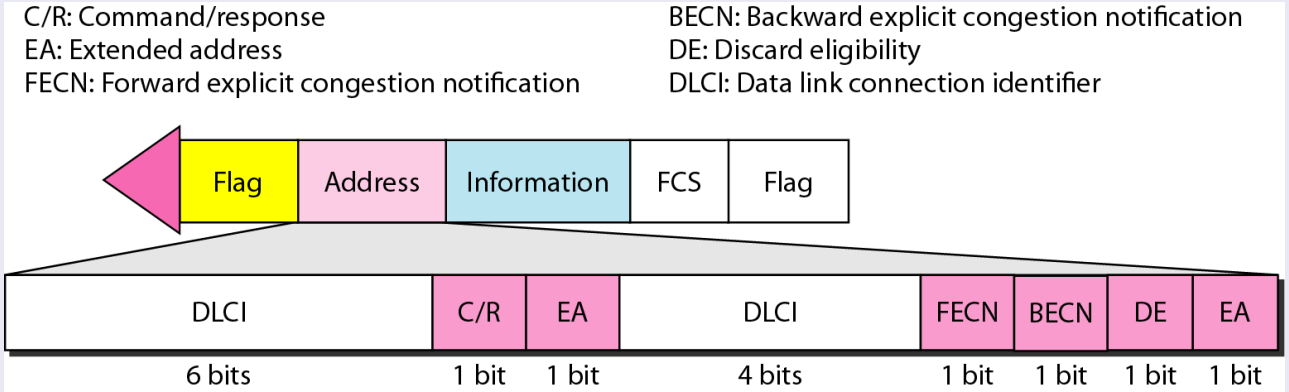
Áudio:tec1frip.mp3

Mapeamento das Camadas IP e DLCI



- Áudio:`tec1frframe.mp3`

Estrutura de um quadro



- DLCI de 10, 16 e 23 bits
- FLAG 1 Byte
- FCS (CRC) 2 bytes
- HDLC

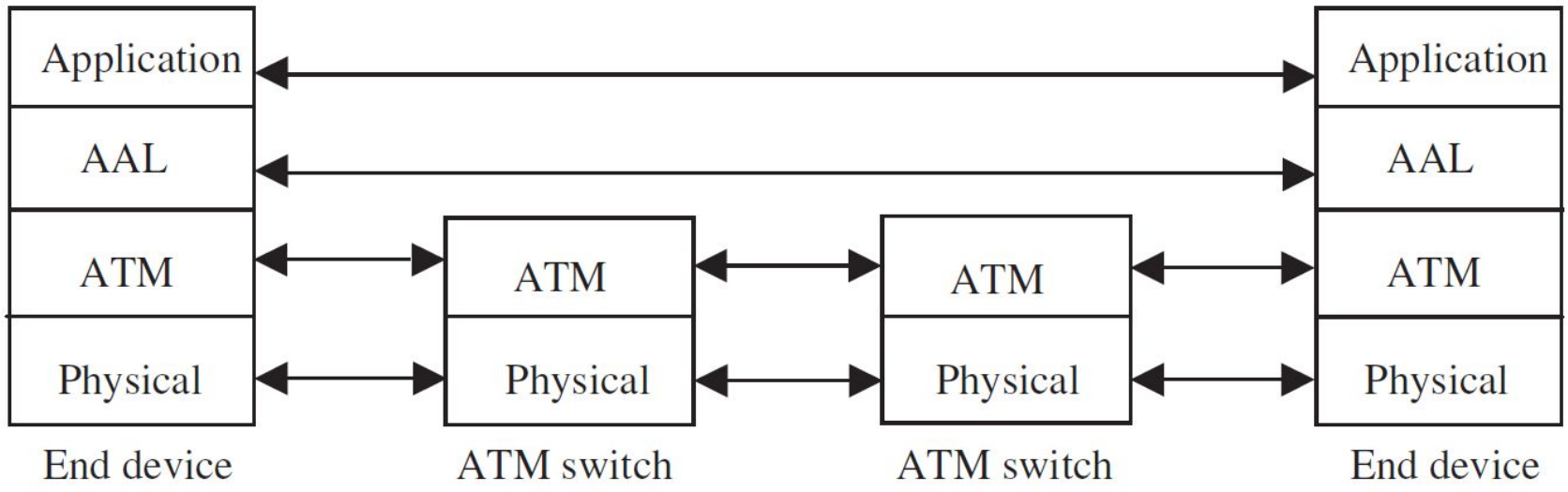
- Áudio:tec1frlmi.mp3

Local Management Interface

- Melhoramento do Frame Relay (Cisco)
- Endereçamento Global
- Mensagens de Status de VC (Buracos negros)
- Multicasting

Áudio:tec1atmmodelo.mp3 I

Modelo de Referência ATM



- AAL - ATM adaptation layer

Áudio:tec1atm.mp3

Tecnologia ATM

- Asynchronous transfer mode (ATM)
- Protocolo WAN
- B-ISDN
- Garantia de QOS
- Altas taxas
- Rede de Pacotes Orientada à Conexão
  - Caminhos virtuais
  - Canais virtuais
  - Multiplexação Estatística

Áudio:tec1atmxfr.mp3

Comparação com Frame Relay

- Permite garantia de QOS.
- Melhor adaptado a meios confiáveis e de alta taxa.
- Permite a comutação de canais virtuais.
- Inclui a camada 3.

- Áudio:`tec1atmphy.mp3`

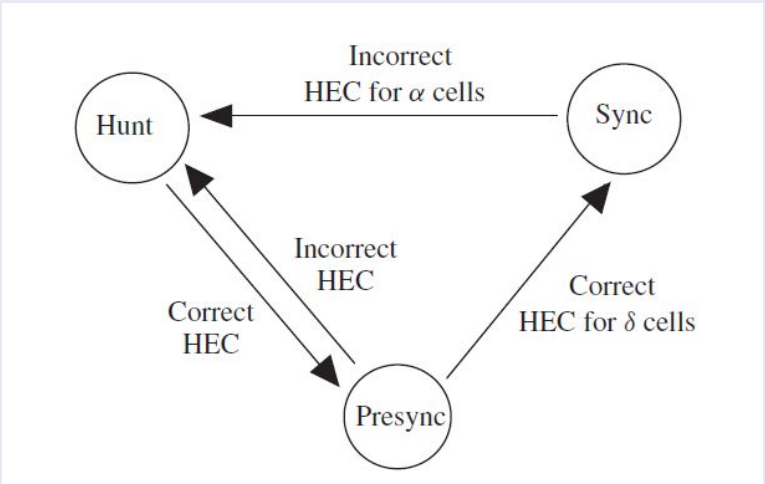
Physical Medium-Dependent Sublayer

- Recuperação do Relógio
- Códigos de linha:
  - bit-by-bit;
  - 4B/5B;
  - 8B/10B
- Fluxo de bits

- Áudio:`tec1atmtcs.mp3`

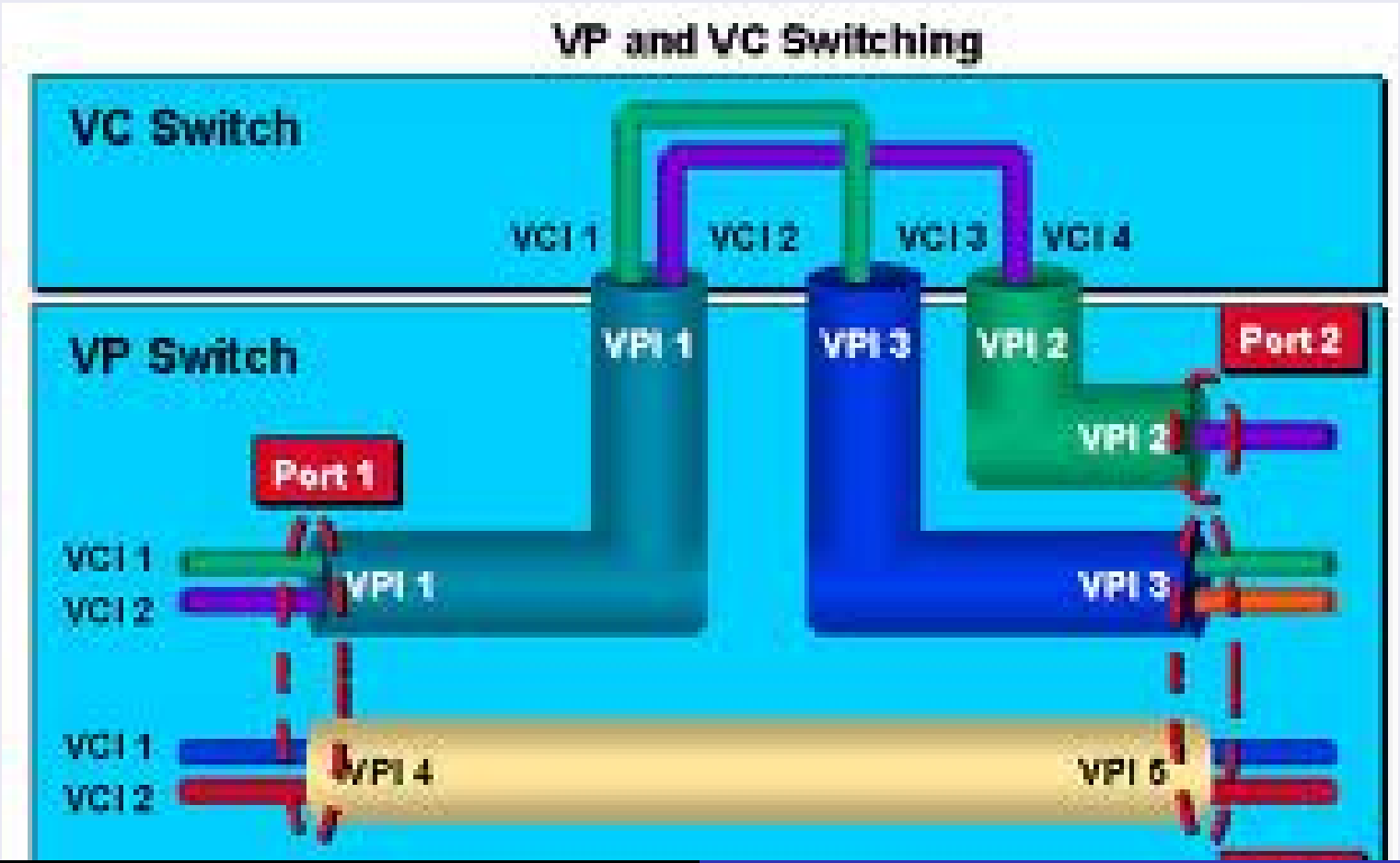
Transmission Convergence Sublayer

- Geração e Verificação de HEC
- Inserção de células idle
- Delineamento de células



- Áudio:`tec1atmvcvp.mp3`

VC e VP



Áudio:`tec1atmconnect.mp3`

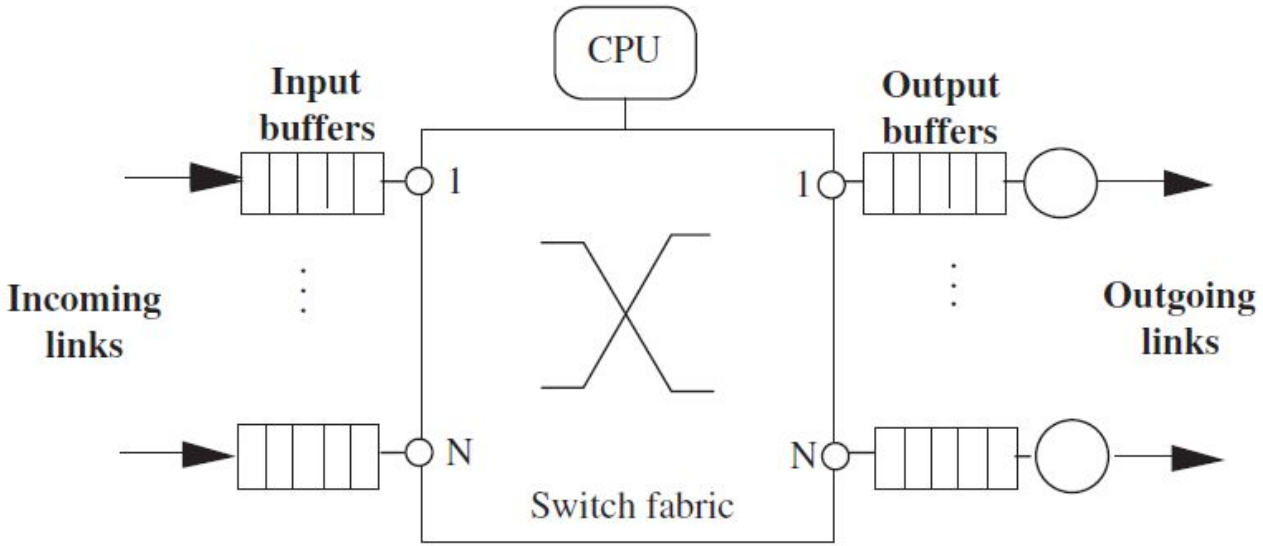
Conexões ATM

- Conexões ponto-a-ponto (bidirecionais)
- Conexões ponto-multiponto (unidirecionais)
- Permanent virtual connection (PVC)
- Switched virtual connection (SVC).

Áudio:`tec1atmcomuta.mp3`

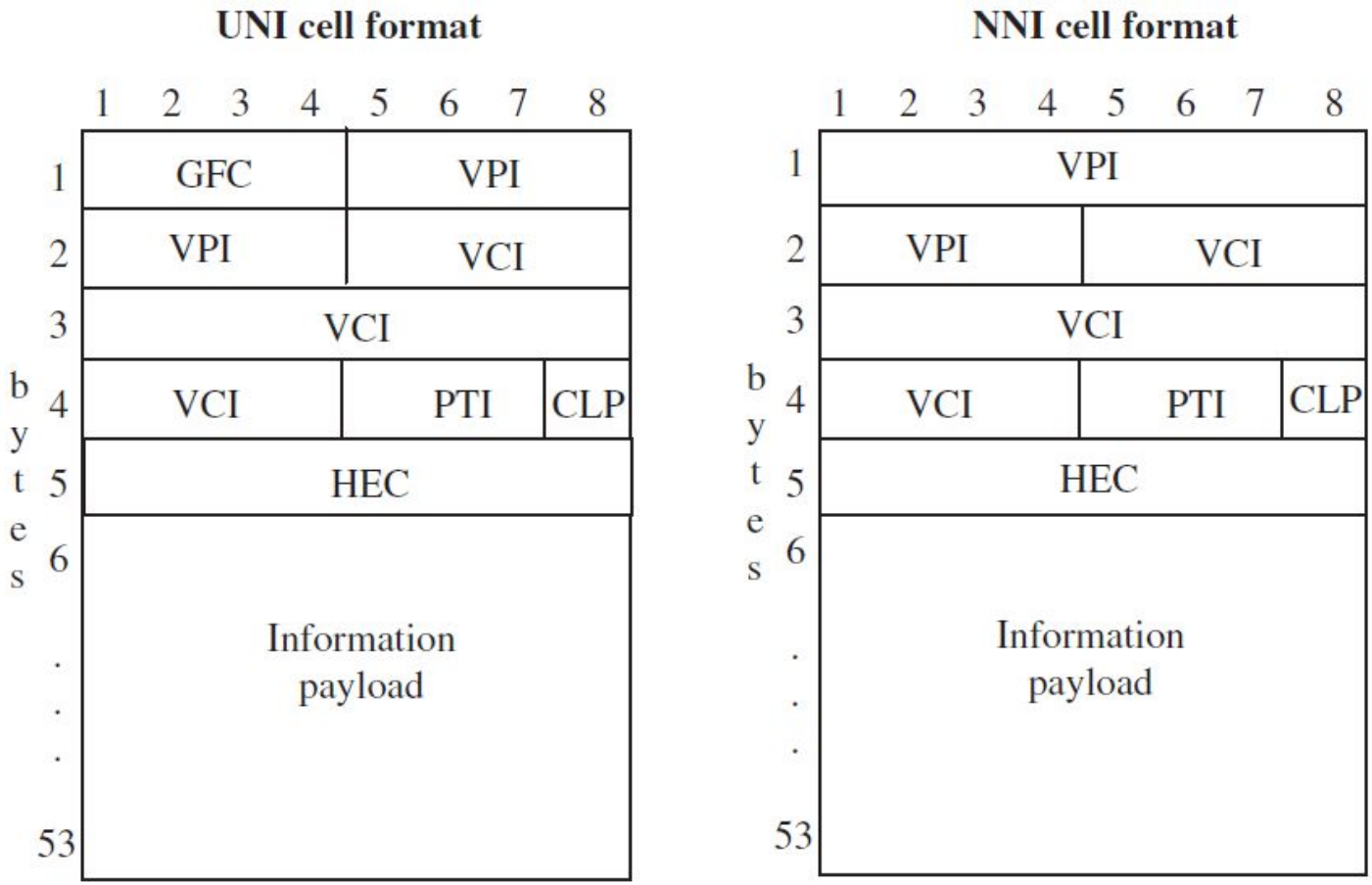
Comutação de Células

- Sem controle de fluxo
- Sem controle de erro
  - Erro implica retransmissão da camada superior.



Áudio:`tec1atmcell.mp3`

Estrutura de uma Célula



Áudio:`tec1atmheader.mp3`

Cabeçalho das Células

- user network interface (UNI)
- network-network interface (NNI)
- cell loss priority (CLP)
- header error control (HEC)
- generic flow control (GFC)
- virtual path identifier (VPI)
- virtual channel identifier (VCI)
- payload type indicator (PTI)

Áudio:tec1atmpti.mp3

Códigos PTI

- 000 User data cell, cong. not experienced, SDU type = 0
- 001 User data cell, cong. not experienced, SDU type = 1
- 010 User data cell, cong.n experienced, SDU type = 0
- 011 User data cell, cong. experienced, SDU type = 1
- 100 Segment OAM flow-related cell
- 101 End-to-end OAM flow-related cell
- 110 RM cell
- 111 Reserved

Áudio:`tec1atmcat.mp3`

Categorias de QOS

- constant bit rate (CBR) - PCR/CDVT - CD,
- real-time variable bit rate (RT-VBR),
- non-real-time variable bit rate (NRT-VBR),
- available bit rate (ABR) - Taxa Alocada Dinamicamente,
- unspecified bit rate (UBR) - Best Effort,
- guaranteed frame rate (GFR).

Áudio:tec1atmpar1.mp3

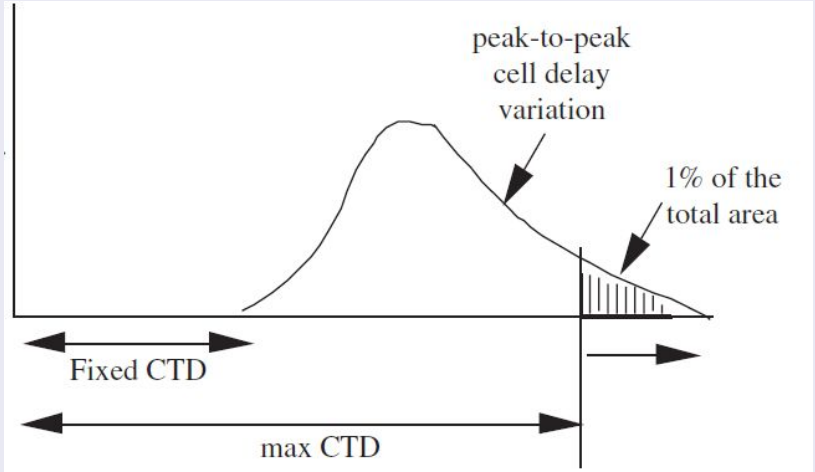
Caracterização de Tráfego

- peak cell rate (PCR),
- sustained cell rate (SCR),
- maximum burst size (MBS),
- minimum cell rate (MCR),
- maximum frame size (MFS),
- cell delay variation tolerance (CDVT) .

Áudio:`tec1atpar2.mp3`

Parâmetros de QOS

- cell loss rate (CLR),
- cell transfer delay (CTD),
- maximum cell transfer delay (max CTD).
- peak-to-peak cell delay variation.



Áudio:`tec1atmparxcat.mp3`

Parâmetros x Categorias de QOS

	Traffic Parameters		QoS Parameters		
Service	Bandwidth	Burst Size	Loss	Delay	Jitter
CBR	PCR		CLR	maxCTD	CDV
rt-VBR	PCR, SCR	MBS	CLR	maxCTD	CDV
nrt-VBR	PCR, SCR	MBS	CLR		
ABR	PCR, MCR		low		
UBR	PCR*				
GFR	PCR,MCR, MBS,MFS		low		

Áudio:`tec1atmcac.mp3`

Call Admission Control

- Mecanismo Preventivo de Controle de Congestionamento.
- Determina se uma conexão pode ou não ser aceita.
  - Alocação estatística
  - Alocação determinística (PCR)

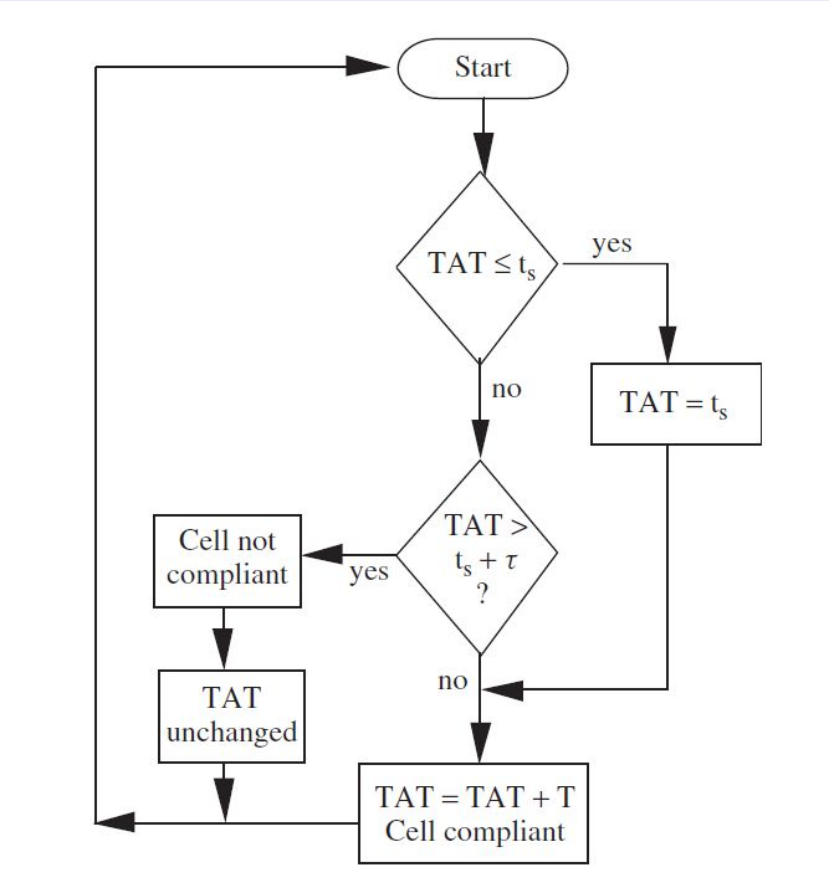
Áudio:`tec1atmpolicia.mp3`

Policiamento de Tráfego

- Mecanismo Reativo de Controle de Congestionamento.
- Generic Cell Rate Algorithm (GCRA)
- Determina se uma célula viola ou não o contrato de QOS.
  - theoretical arrival time (TAT)
  - instante de chegada de uma célula (t_s)
  - τ é uma tolerância em relação ao tempo de chegada teórico,
  - T = 1/PCR, 1/SCR,

Áudio:tec1atmgcra.mp3

Algoritmos GCRA



Áudio:`tec1atmabt.mp3`

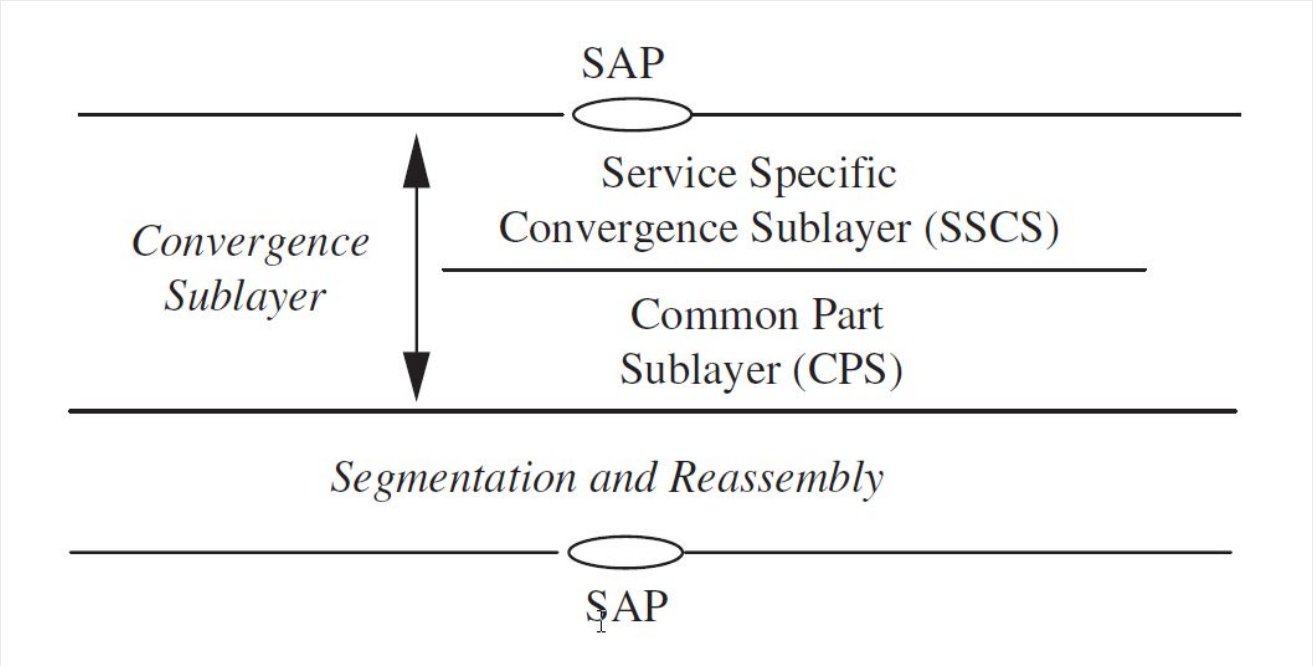
ATM Block Transfer

- Esquema de alocação rápida de banda.
- Solicitações de incremento e decremento de banda podem ser feitos.
- A banda deve permanecer entre o e PCR,
- As solicitações são enviadas a todos nós do caminho.
  - Incrementos ocorrem se houver uninimidade
  - fast reservation protocol (FRP)

Áudio:`tec1atmaal.mp3`

Subcamadas AAL

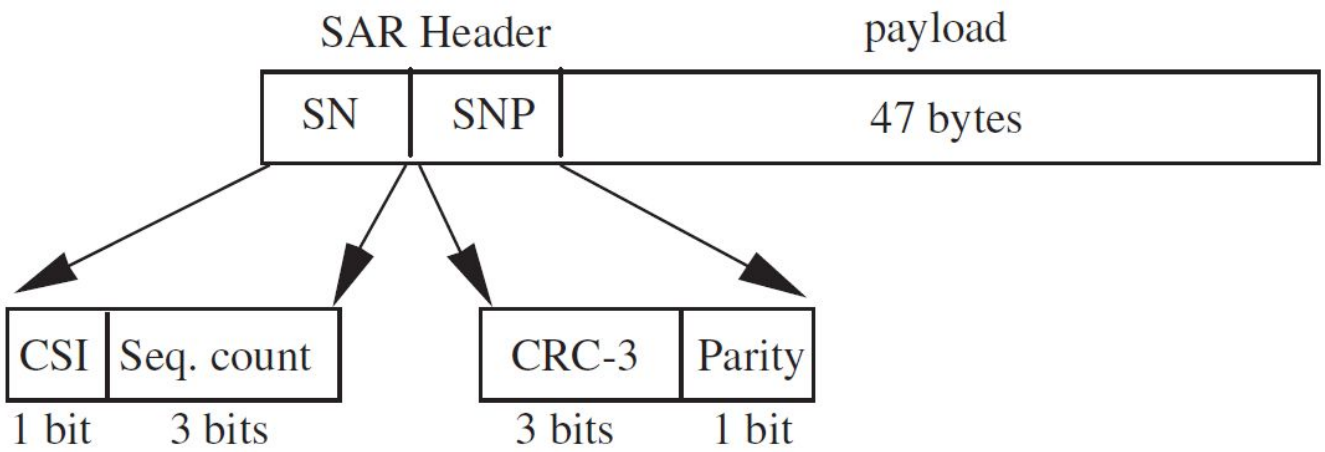
- CS e SAR



Áudio:tec1atmaal1.mp3

AAL1

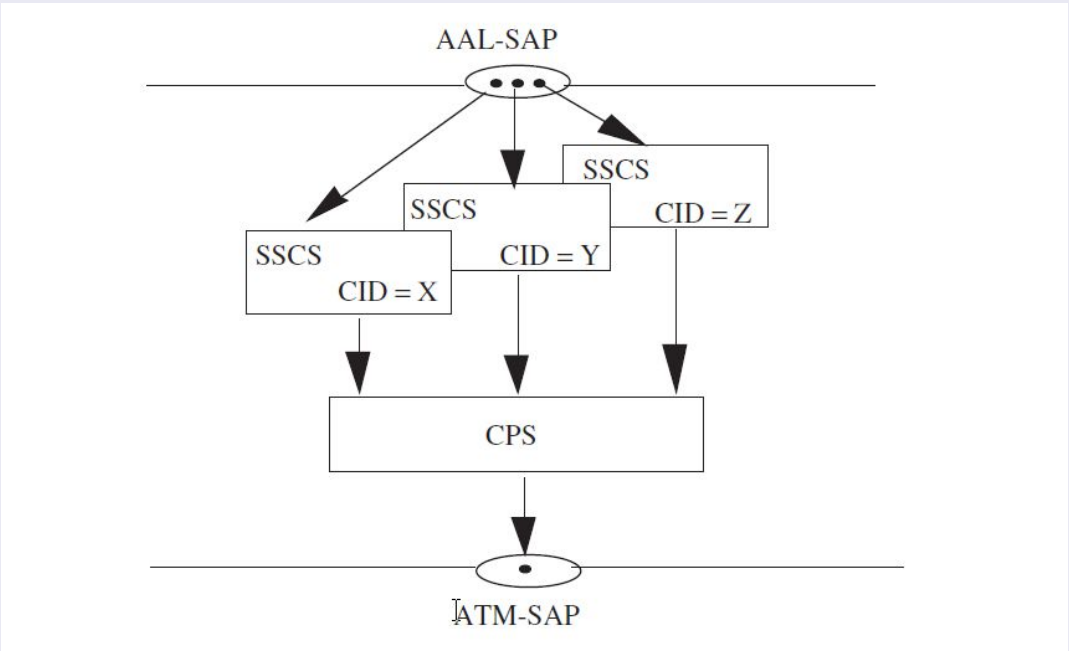
- Taxa Constante, tempo real



Áudio:tec1atmaal2.mp3

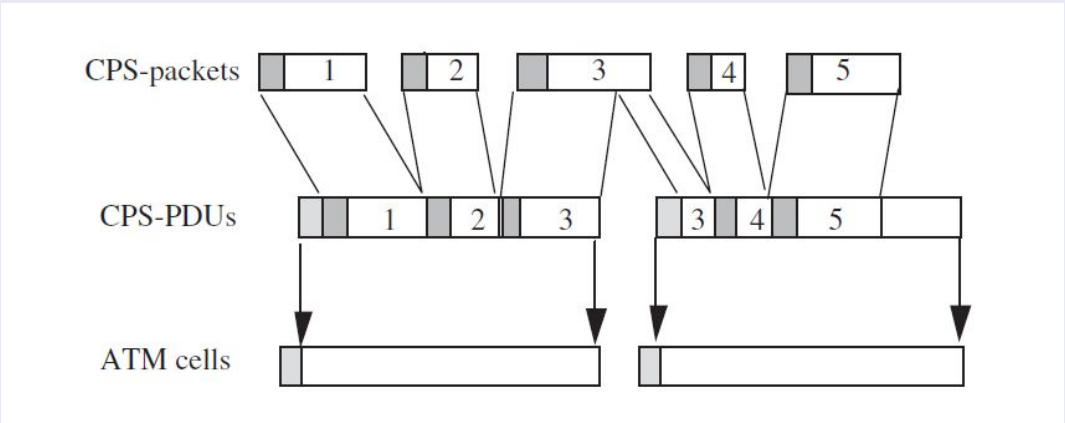
AAL2

- Taxa variável, tempo real, multiplexação de fluxos



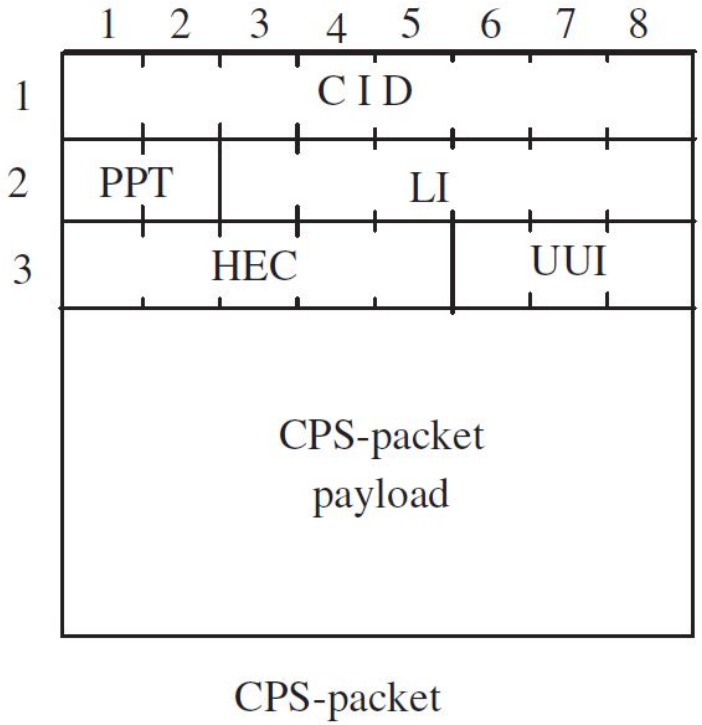
Áudio:`tec1atmaal2pac.mp3`

Empacotamento AAL2

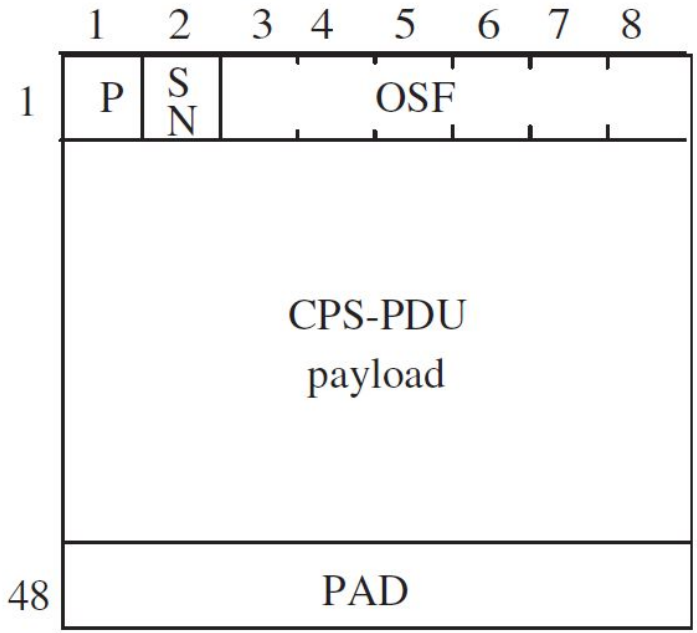


Áudio:tec1atmaal2cab.mp3

Cabeçalhos AAL2



CPS-packet

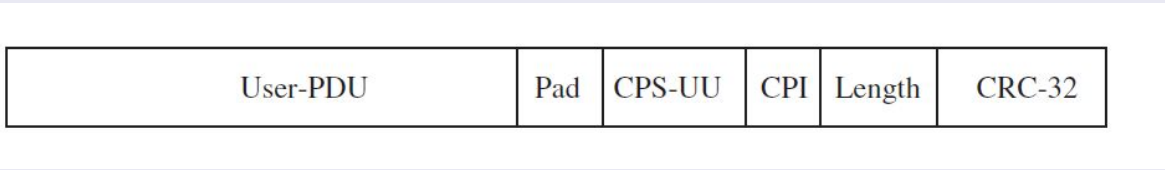


CPS-PDU

Áudio:tec1atmaal5.mp3

AAL5

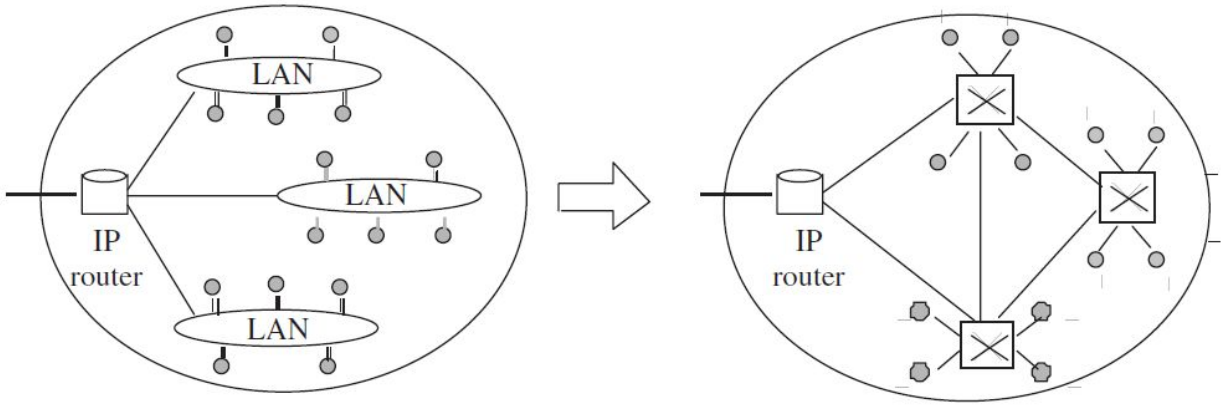
- Tráfego NRT
- PAD - 0/47 bytes
- CPS-UU - user-to-user indication 1 byte
- CPI - Common part indicator 1 byte
- Length - 2 bytes
- CRC - 4 bytes



Áudio:tec1atmlan.mp3

Classical IP and ARP over ATM

- Padrão IETF
- Subrede IP
- Maximum transfer unit (MTU) = 9180 bytes + 8-byte LLC/SNAP = 9188 bytes (default para AAL 5)



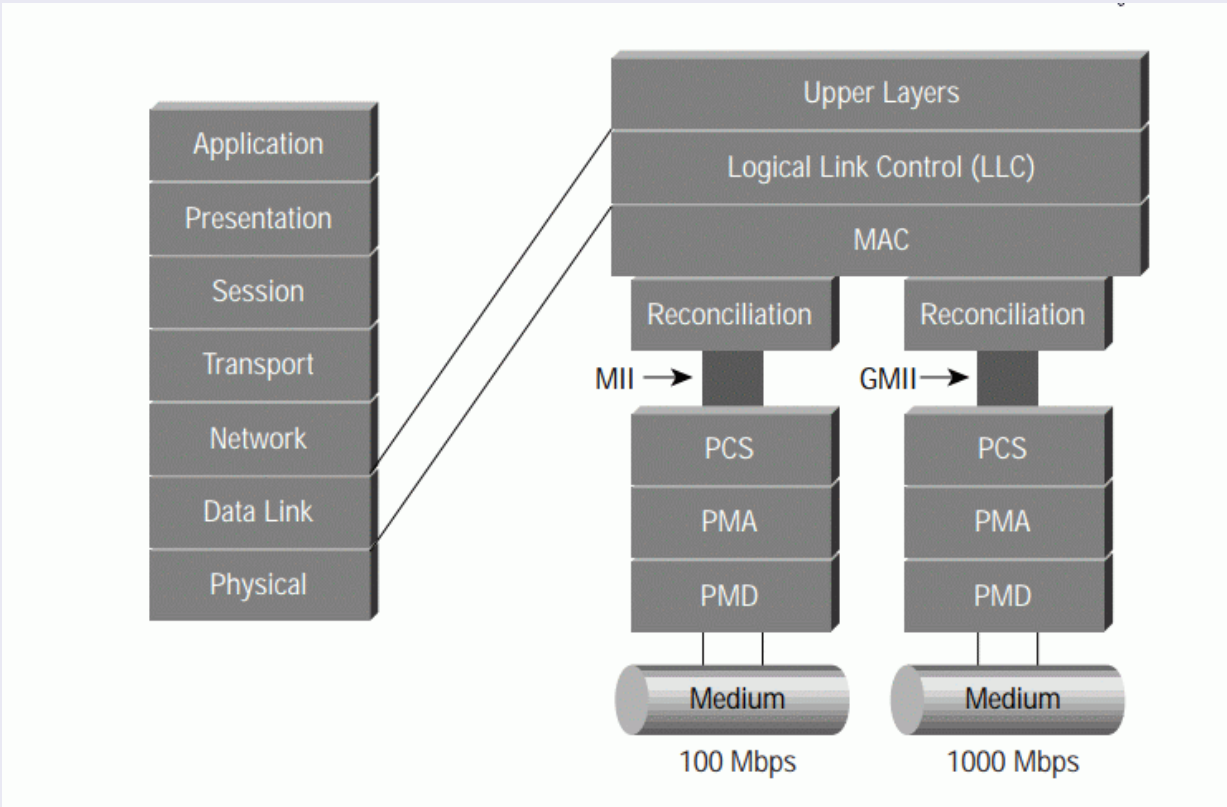
Áudio:tec1gbe.mp3

Gigabit Ethernet

- Ethernet - Xerox / IEEE - 1970
- 1 Gbps - 1998
- 1, 2, 5, 10, 25, 40 e 100 Gbps
- 1000BASE-X e 1000BASE-T
  - IEEE 802.2 LLC
  - Fibra e Cabo Blindado
    - Codificação 8B/10B
  - Par Trançado

Áudio:tec1gbepilha.mp3

Pilha de Protocolos



Áudio:tec1gbestd.mp3

Especificações 1 Gbps