

# Datenkommunikation

Teil 2.3: Vermittlungssysteme

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## Übersicht

### 2.3 OSI-Referenzmodell: Schicht 3 - Vermittlungssysteme

Datenkommunikation über

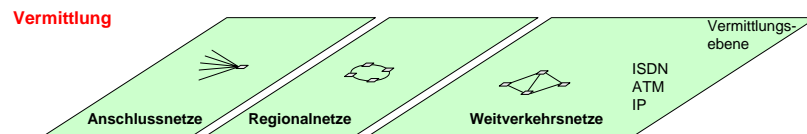
- ISDN (Integrated Services Digital Network)
- X.25
- FR (Frame Relay)
- ATM (Asynchronous Transfer Mode)

Signalisierung

- Analogleitung
- D-Kanal
- Signalisierungssystem Nr. 7

Netzintelligenz

## Netztechnologien: Vermittlung



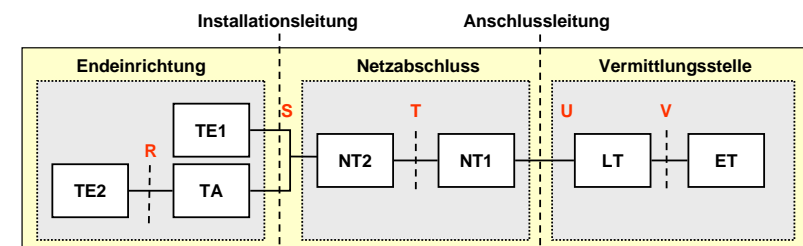
### Leitungsvermittlung

GSM Global System for Mobile Communication  
ISDN Integrated Services Digital Networks

### Paketvermittlung

GPRS General Packet Radio Service  
UMTS Universal Mobile Telecommunication System  
X.25 X.25 Packet Switching  
FR Frame Relay  
ATM Asynchronous Transfer Mode  
IP Internet Protocol

## ISDN-Basiskonfiguration



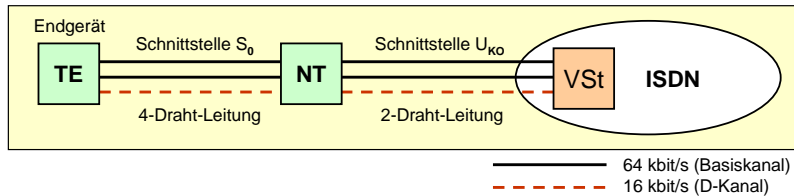
TE : Terminal Equipment  
TA : Terminal Adapter

NT : Network Termination

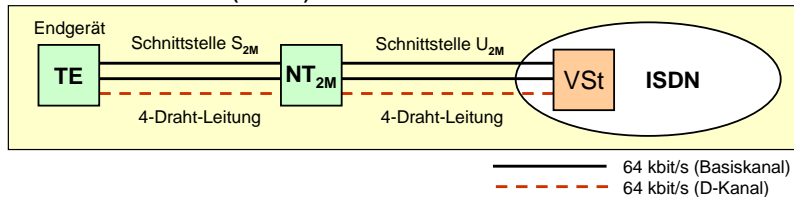
LT : Line Termination  
ET : Equipment Termination

## ISDN Basis- und Primäranschluss

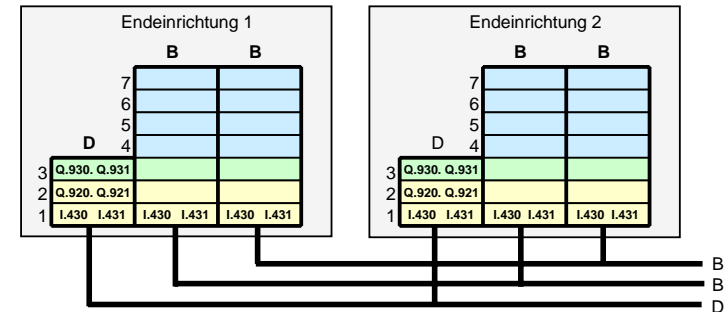
### Basisanschluss: 2B + D



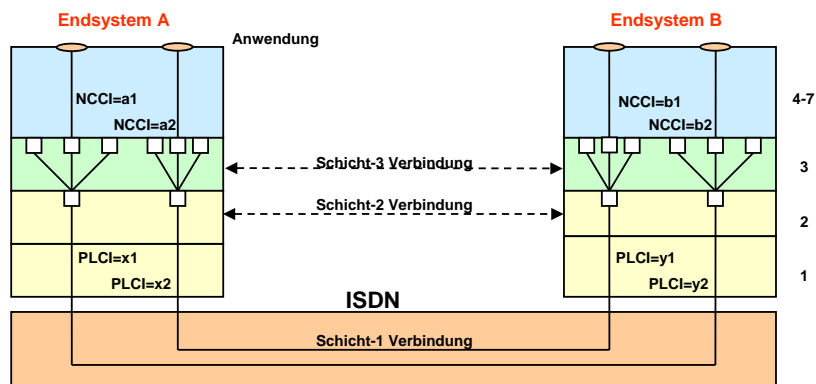
### Primäranschluss: 30B + D (2 Mbit/s)



## ISDN: Schichtenmodell

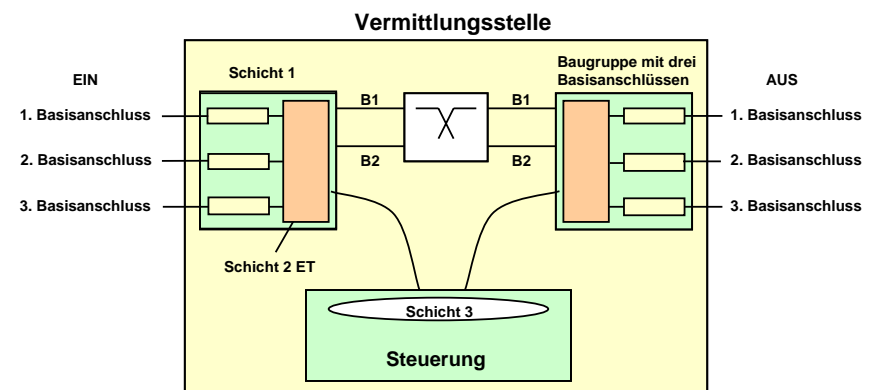


## ISDN-Schichtverbindungen

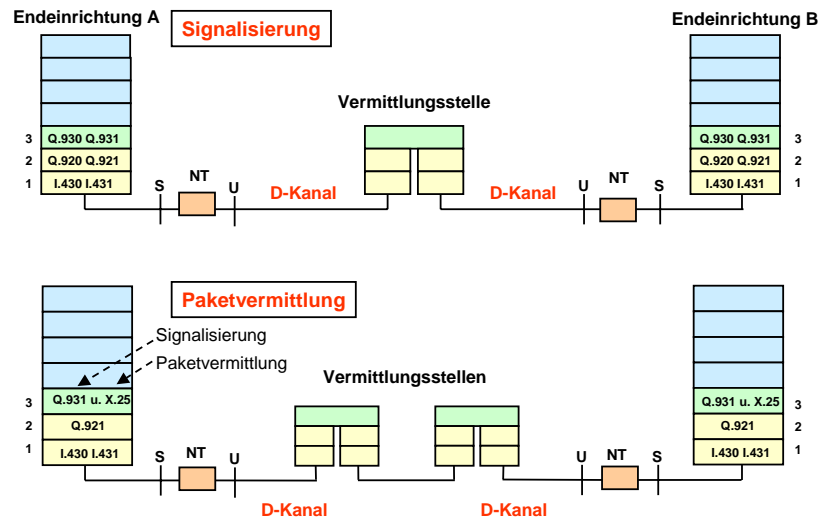


NCCI: Network Control Connection Identifier  
PLCI: Physical Link Connection Identifier

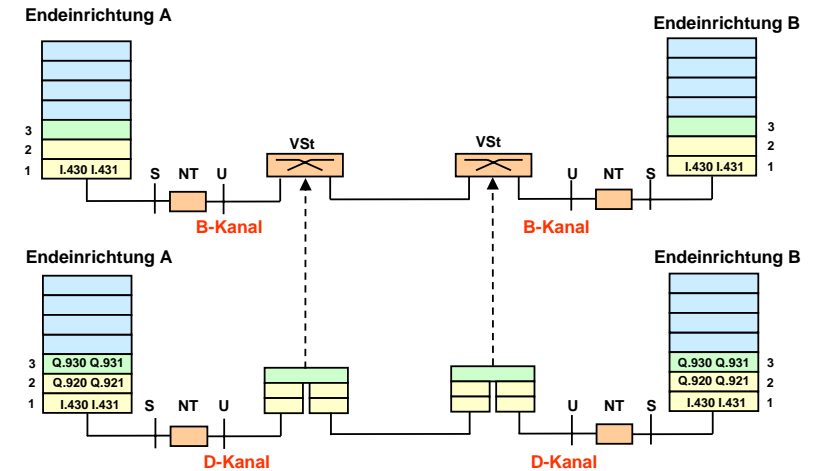
## Implementierung des D-Kanal-Protokolls



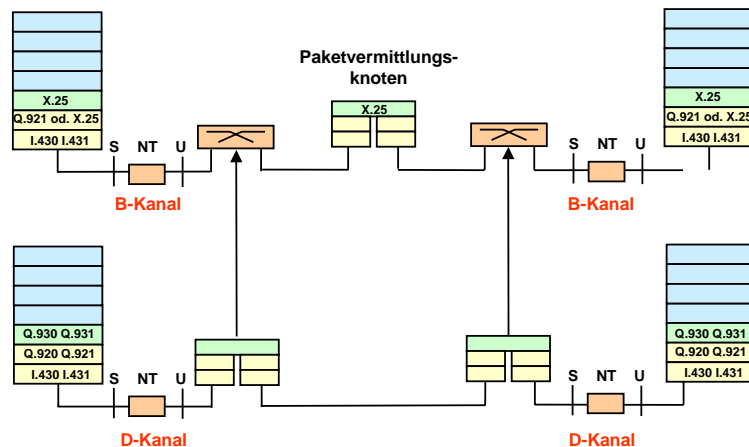
## ISDN: Verwendung des D-Kanals



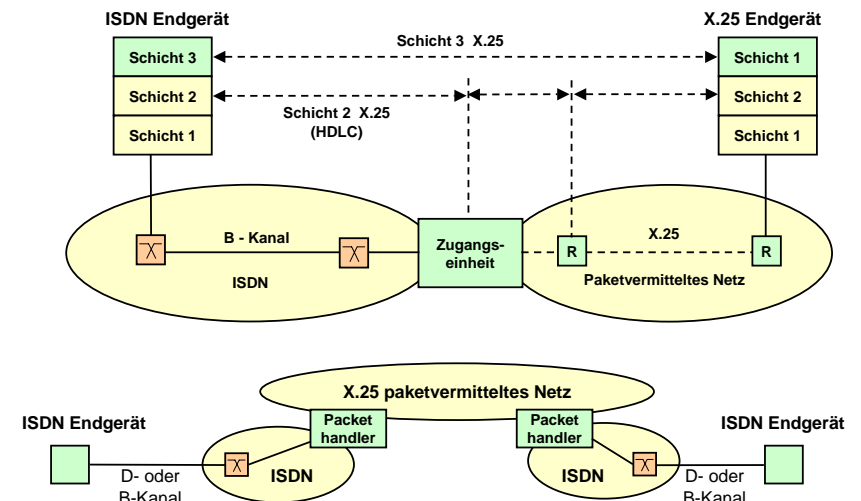
## ISDN: Leitungsvermittelte Verbindung



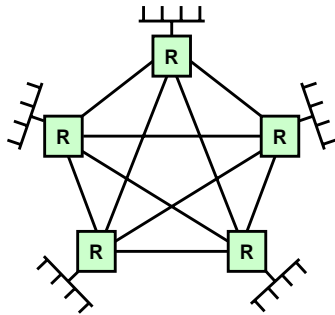
## ISDN: im B-Kanal Paketvermittelte Verbindung



## ISDN: Paketvermittlung im B-Kanal

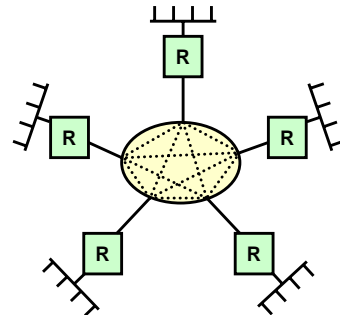


## Mietleitungen oder Paketvermittlung



**Mietleitungsnetz**

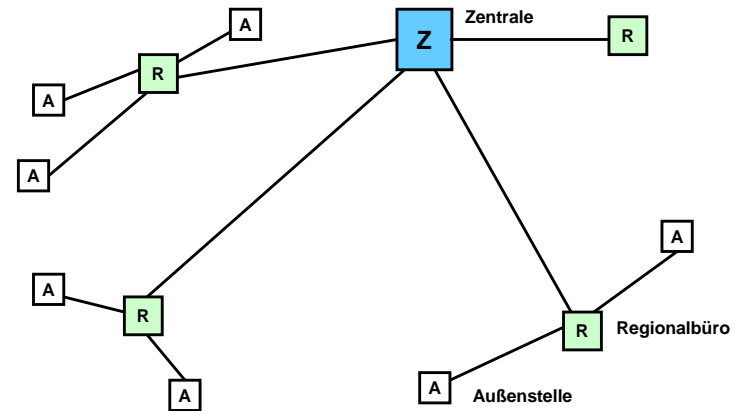
10 Leitungen  
20 Router-Ports



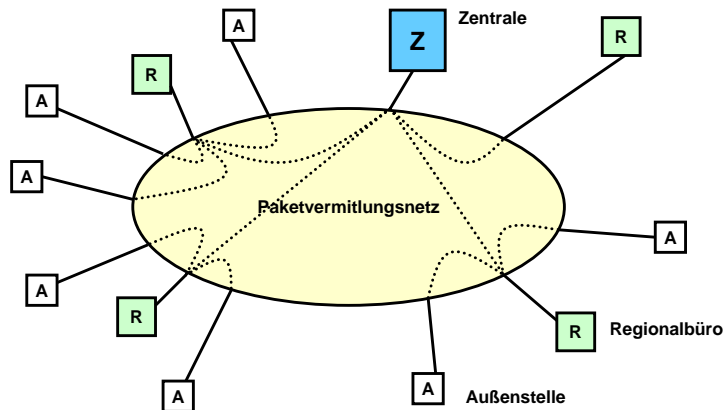
**Paketvermittlungsnetz**

5 Leitungen  
5 Router-Ports

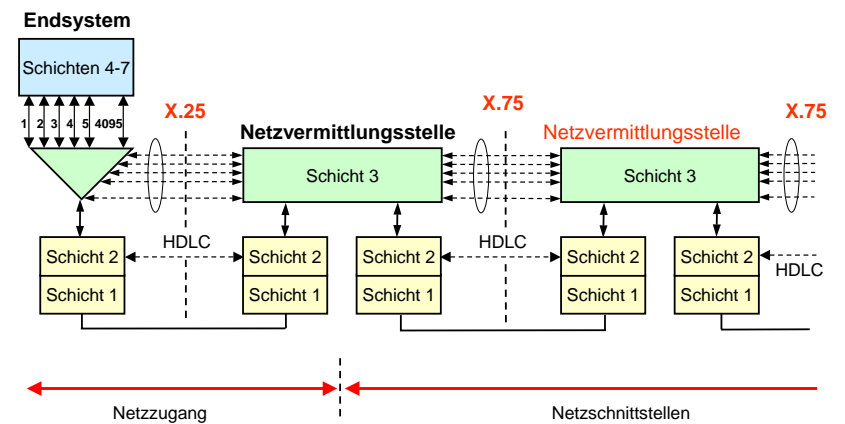
## Firmennetz: Mietleitungen



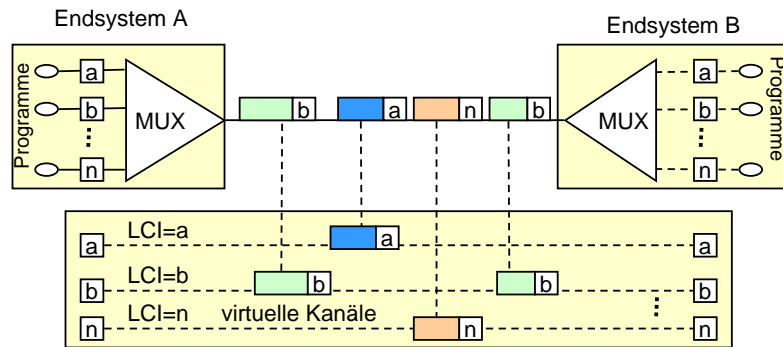
## Firmennetz: Paketvermittlungsnetz



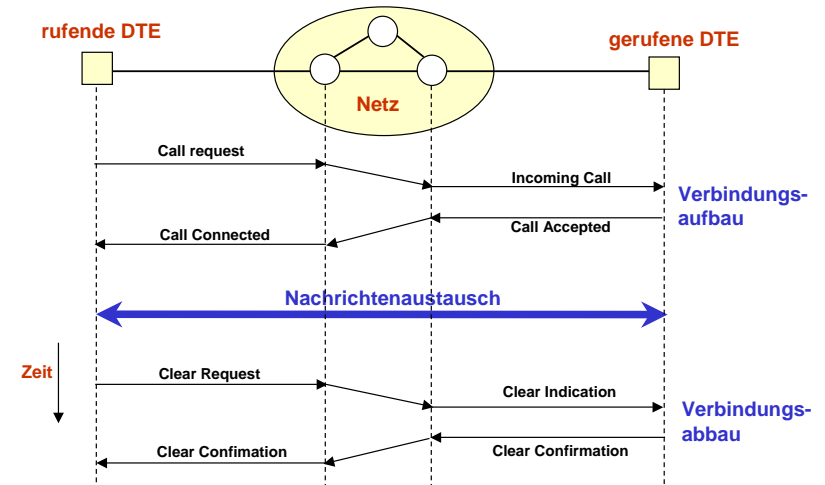
## X.25 und X.75 Schnittstellen



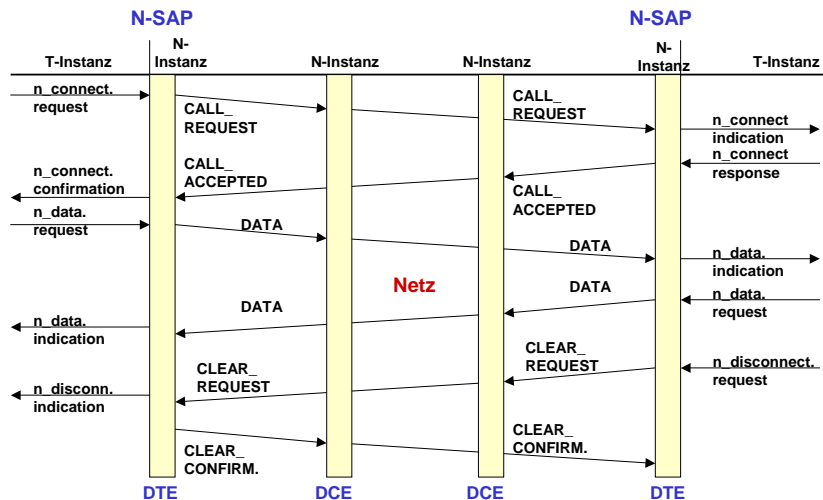
## X.25: logische Verbindungen



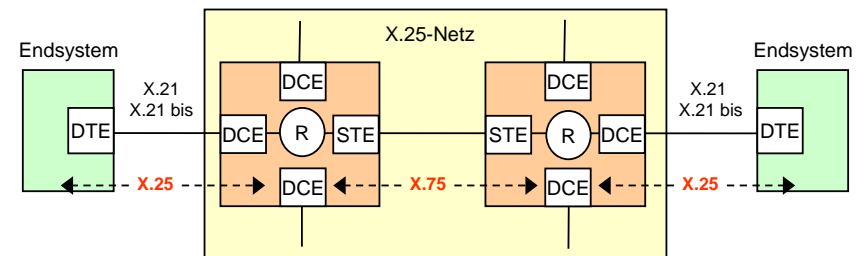
## Verbindungsaufbausteuerung



## Paketvermittlung nach X.25

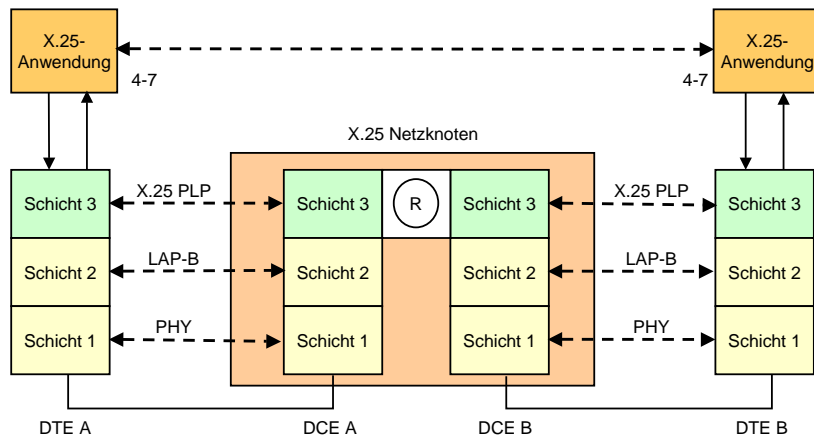


## Schnittstellen X.25 und X.75



DTE : Data Terminal Equipment  
 DCE : Data Communication Equipment  
 STE : Signalling Terminal Exchange  
 R : Routing

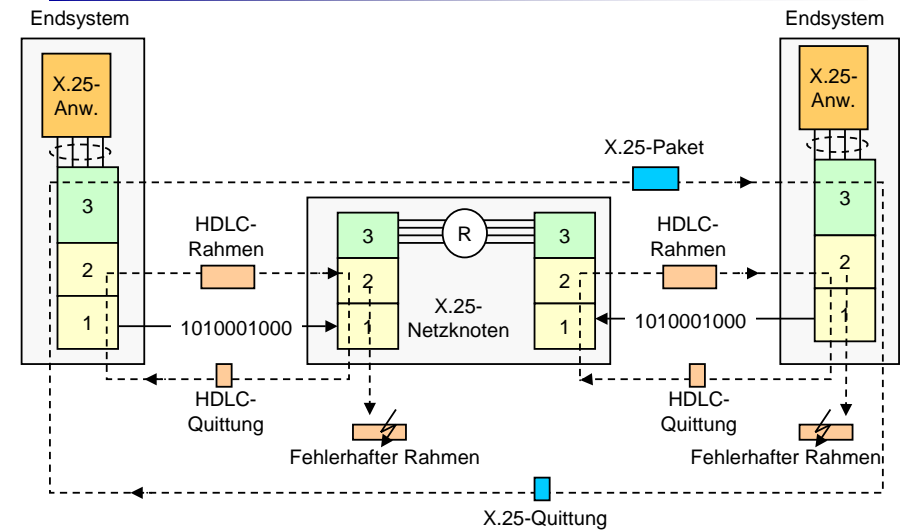
## X.25 Protokoll-Schichten



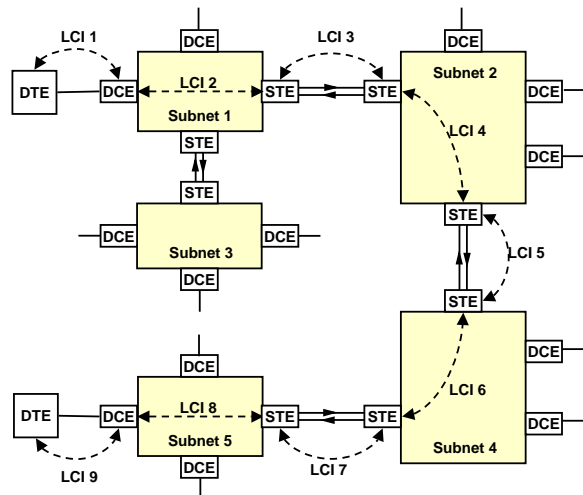
DTE : Data Terminal Equipment  
DCE : Data Communication Equipment  
R : Routing

PLP : Packet Layer Protocol  
LAP-B : Link Access Protocol - Balanced

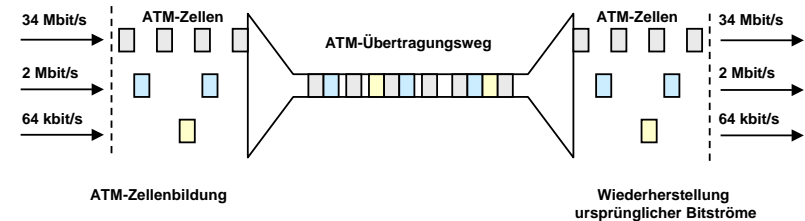
## X.25 Flusskontrolle



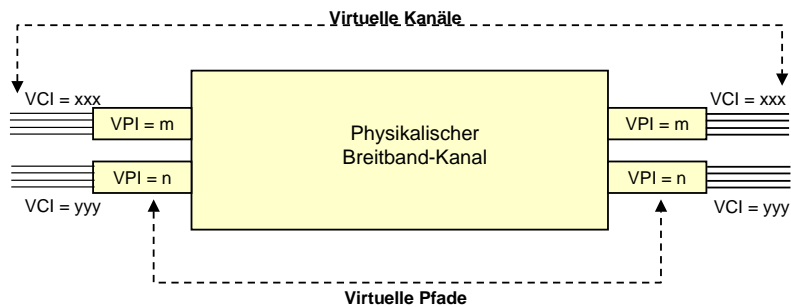
## X.25: Virtuelle Ende-zu-Ende Verbindung



## ATM: Asynchroner Transfer Modus

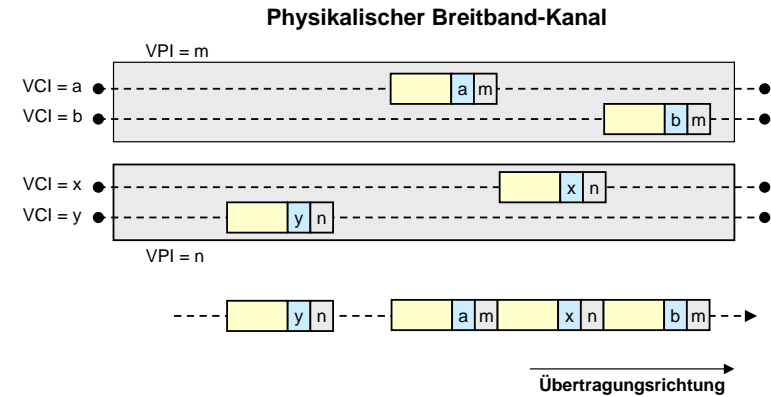


## Konzept der virtuellen Pfade und Kanäle



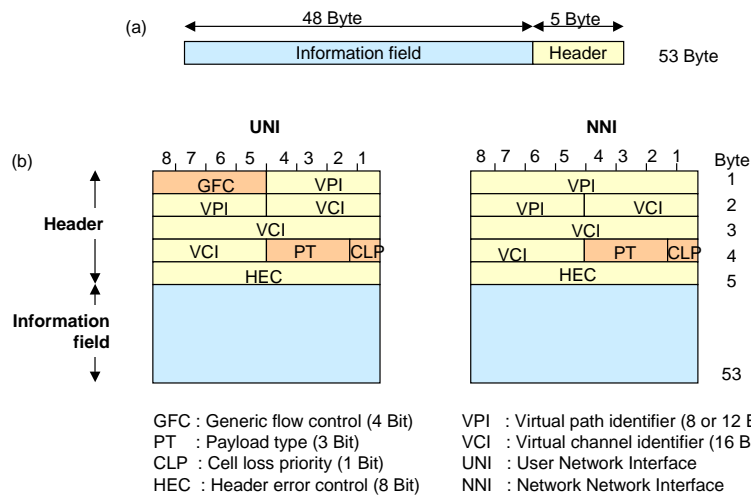
VPI: Virtual Path Identifier  
VCI: Virtual Channel Identifier

## Realisierung der virtuellen Pfade und Kanäle

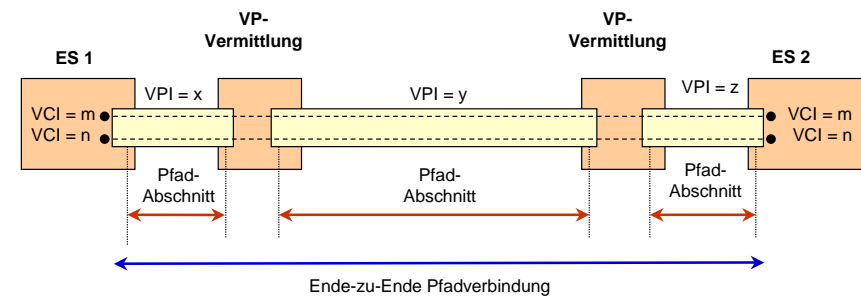


VPI: Virtual Path Identifier  
VCI: Virtual Channel Identifier

## ATM Zellenstruktur

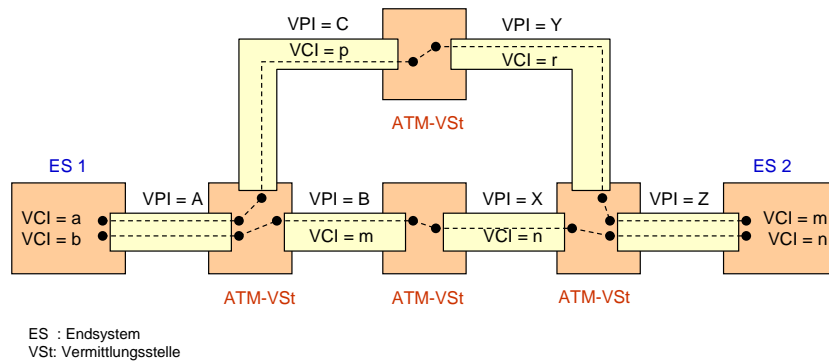


## ATM: Virtuelle Pfade

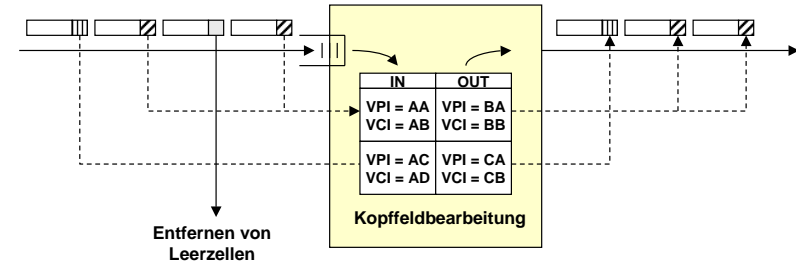


ES: Endsystem

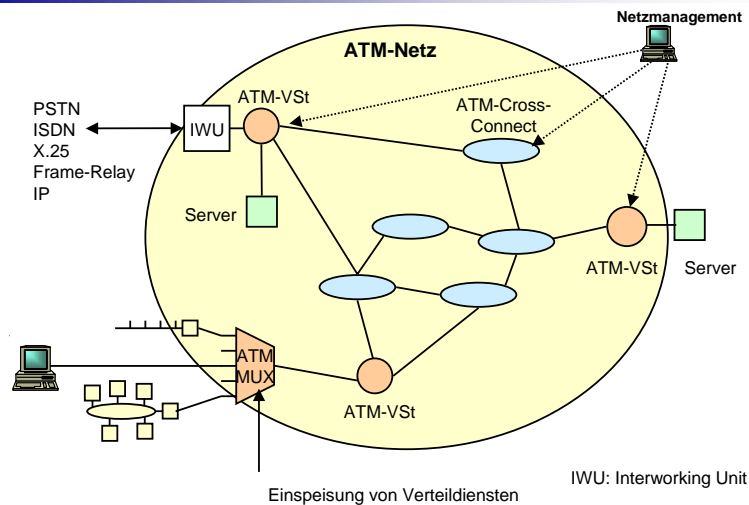
## ATM: Virtuelle Kanäle und Pfade



## Vermittlung der ATM Zellen

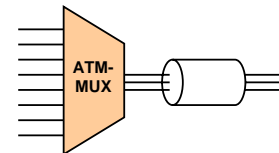


## ATM Netzelemente

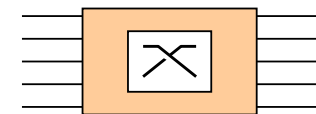


## Netzelemente

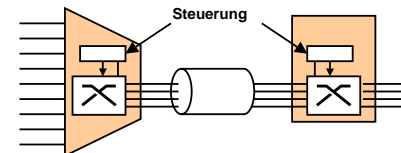
ATM-Multiplexer



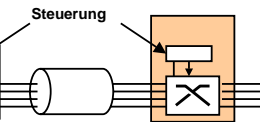
ATM-Cross-Connect



ATM-Konzentrator



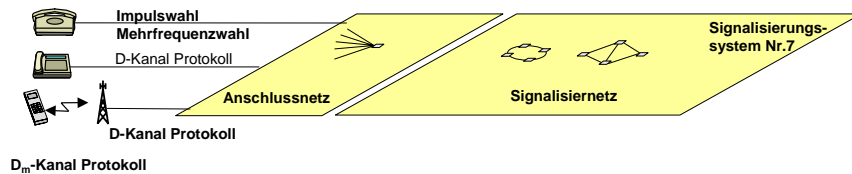
ATM-Vermittlungsstelle





# Netztechnologien: Signalisierung

## Signalisierung



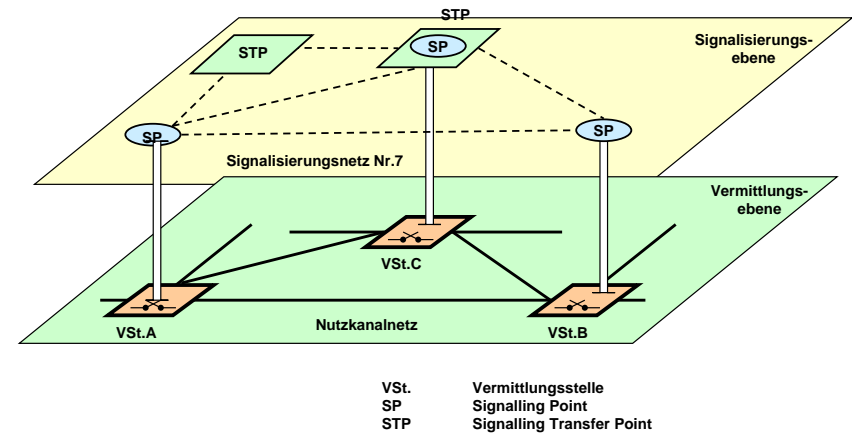
## Teilnehmer Signalisierung

- Analoge Teilnehmer: Impulswahl, Mehrfrequenzwahl
- ISDN Teilnehmer: D-Kanal Protokoll
- GSM Teilnehmer: D<sub>m</sub>-Kanal Protokoll

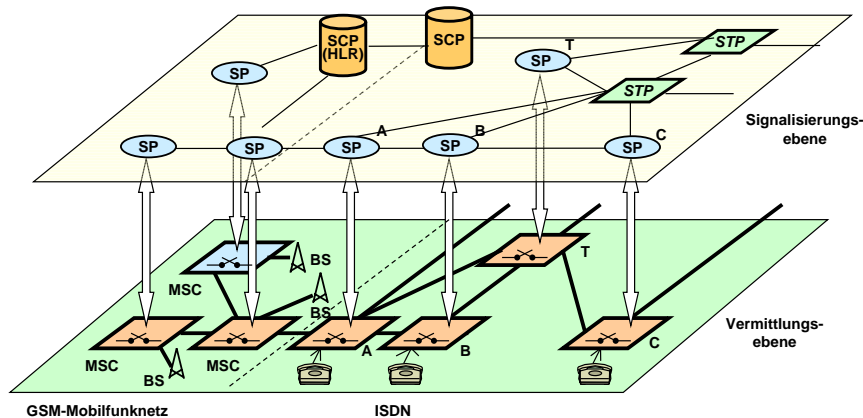
## Netzsignalisierung

- SS7 Signalling System Number 7
- SIP Session Initiation Protocol

# Signalisierungssystem Nr. 7



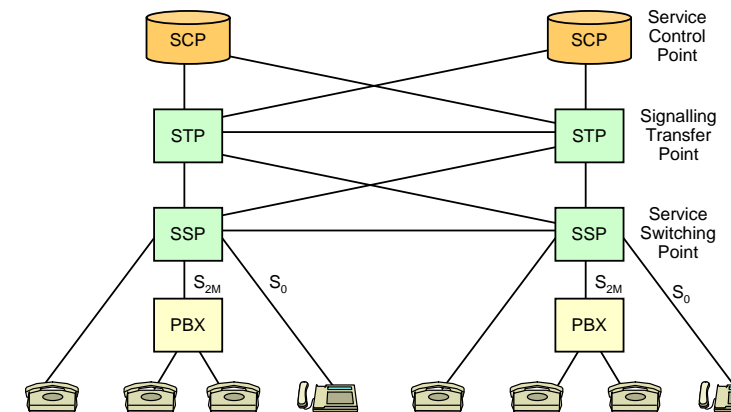
# Netzstruktur von GSM-Netzen



GSM - Global System of Mobile Communication  
MSC - Mobile Switching Center  
BS - Base Station  
ISDN - Integrated Services Digital Network

SP - Signalling Point  
SCP - Signalling Control Point  
STP - Signalling Transfer Point

# Signaling System 7 (SS7)

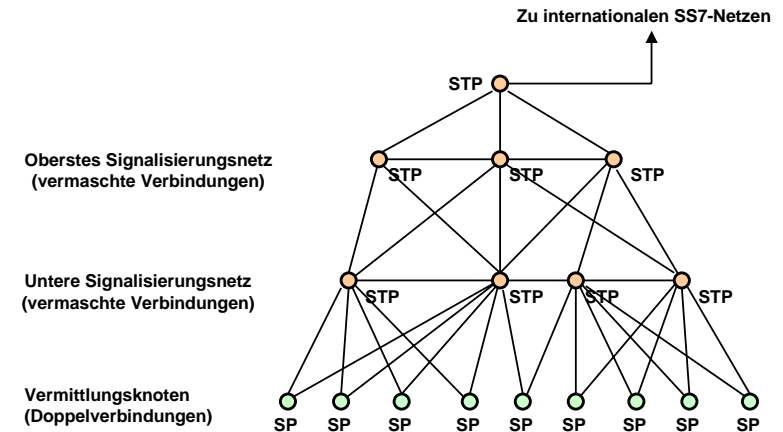


SP - Signalling Point  
SCP - Signalling Control Point  
STP - Signalling Transfer Point

## SS7-Komponenten

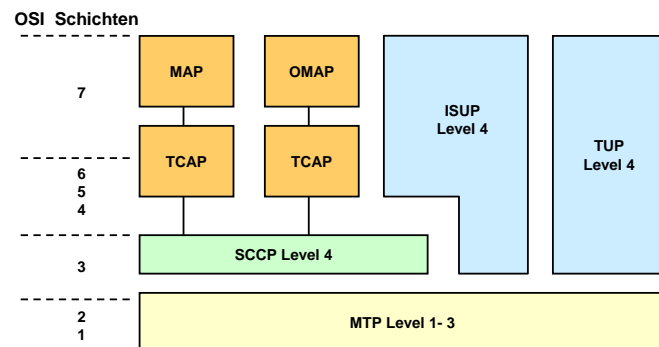
- **SSP**
  - Interface des Benutzers zum Transportnetz
  - Erzeugen und Übersetzen von SS7-Signalisierungsnachrichten
  - Wegewahl
  - Durchführen von Datenbankabfragen
- **STP**
  - Routing von Signalisierungsnachrichten, aber kein Erzeugen
  - Übersetzen von länderspezifischen Signalisierungsnachrichten
  - Statistiken für Operations and Management (OAM) und Billing
- **SCP**
  - Interface zur Datenbank
    - Business Services
    - Call Management Services
    - Line Information
    - Home/Visitor Location Register

## SS7 Netzstruktur



SP - Signaling Point  
STP - Signaling Transfer Point

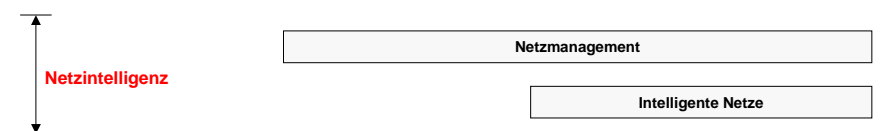
## Protokollarchitektur im SS7



OMAP - Operation, Maintenance and Administration Part  
MAP - Mobile Application Part  
TCAP - Transaction Capabilities Application Part  
SCCP - Signaling Connection Control Part

ISUP - ISDN User Part  
TUP - Telephone User Part  
MTP - Message Transfer Part  
OSI - Open Systems Interconnection

## Netztechniken: Steuerung



### Netzmanagement

- SNMP Simple Network Management Protocol
- TMN Telecommunication Management Network
- TINA Telecommunications Information Networking Architecture

### Netzintelligenz

IN Intelligent Network

