ATM Signaling

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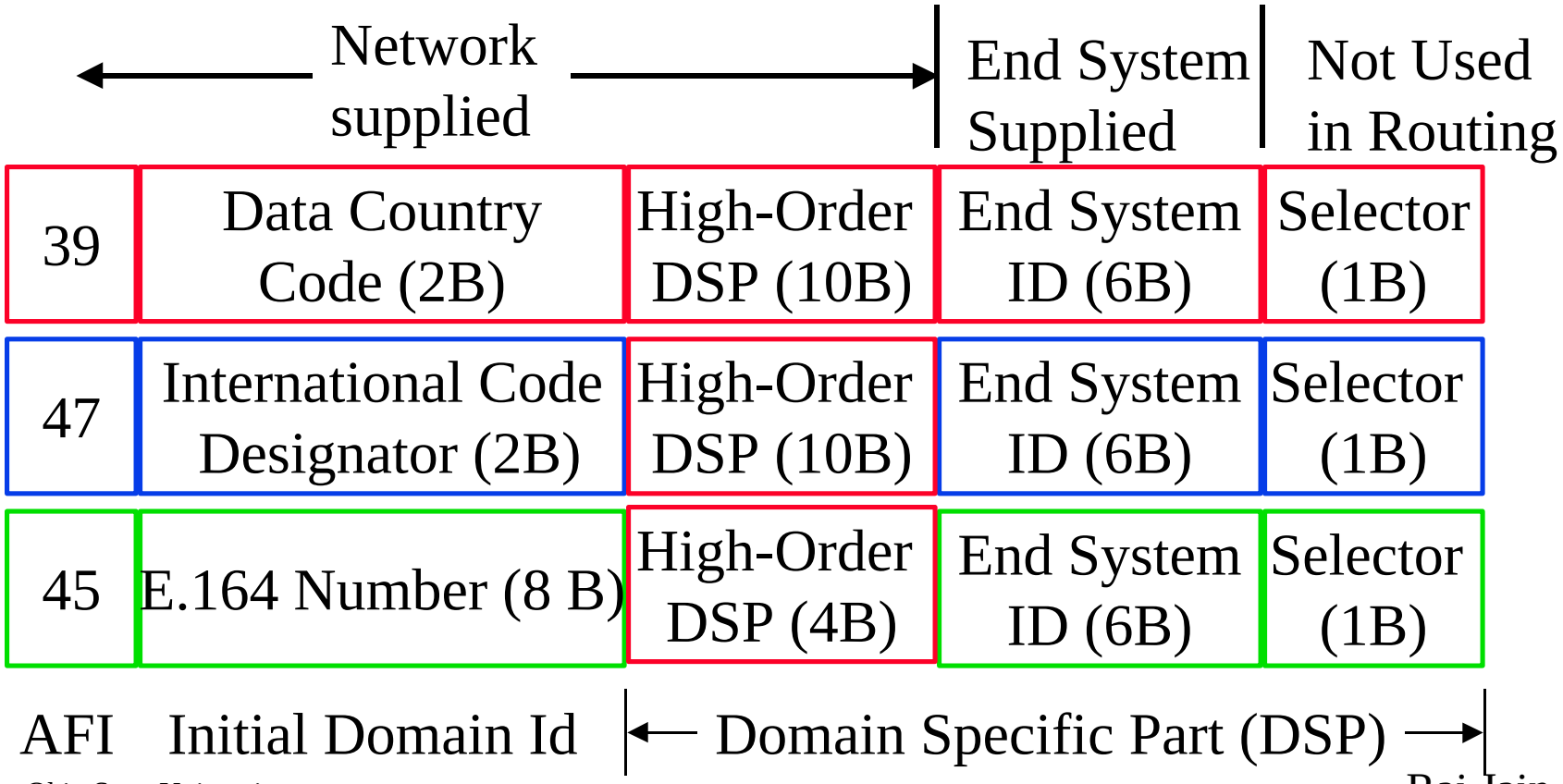
- Call Endpoints: Address Formats
- Call setup/release
- Traffic Contract: Bandwidth, Quality of Service
- Signaling Mechanisms: Message formats

Meta-Signaling

- Used to setup signaling channels
- All meta-signaling messages are one cell long and have VPI/VCI = 0/1
- Sets up 3 types of signaling channels:
  - Point-to-point
  - General broadcast
  - Selective broadcast
- Procedures to:
  - Set up new signaling channels
  - Release channels
  - Verify channels

ATM Addresses

- ATM Forum specifies three NSAP-like address formats: DCC ATM Format, ICD ATM Format, E.164 ATM Format. NSAP = Network Service Access Point



Addressing

- Authority and Format Identifier (AFI)
  39 = ISO DCC, 47 = British Standards Institute ICD, 45 = ITU ISDN
- Initial Domain Identifier (IDI). Domain Specific Part (DSP)
- ISDN uses E.164 numbers (up to 15 BCD digits)
- ATM forum extended E.164 addresses to NSAP format. E.164 number is filled with leading zeros to make 15 digits. A F_{16} is padded to make 8 bytes. AFI and DSP are added.

Addressing (Cont)

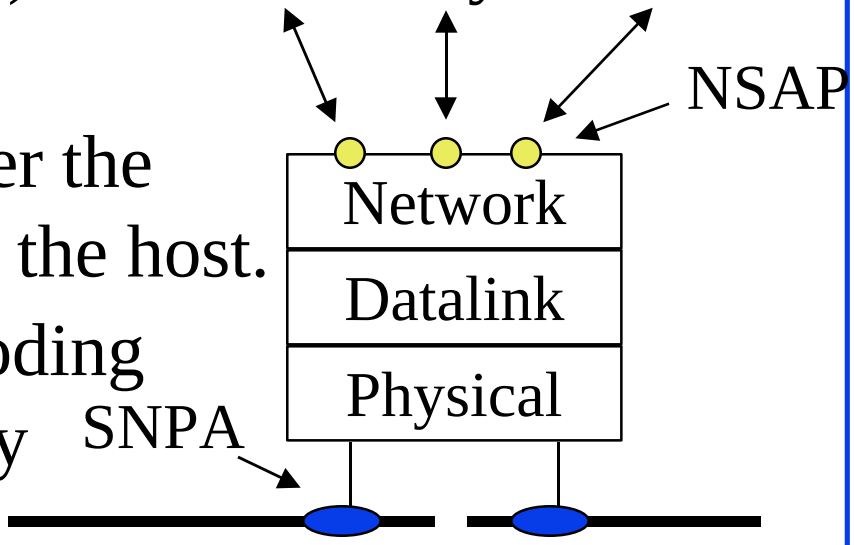
- End System Identifier (ESI): 48-bit IEEE MAC address.
- Selector is for use inside the host and is not used for routing.
- All ATM addresses are 20 bytes long.
- ATM forum removed the division of DSP into areas, etc.
- Private networks must support all three formats
  Type of Number field = Unknown
  Numbering Plan Indication field = ISO NSAP

Addressing (Cont)

- Public networks must support native E.164 and may optionally support three NSAP-encoded formats. For E.164:
  Type of Number field = International number
  Numbering Plan Indication field = Recommendation E.164
- If only native E.164 addresses, subaddress field in signaling messages used to convey private ATM address across.
- One Transit network selection possible using carrier identification code field.

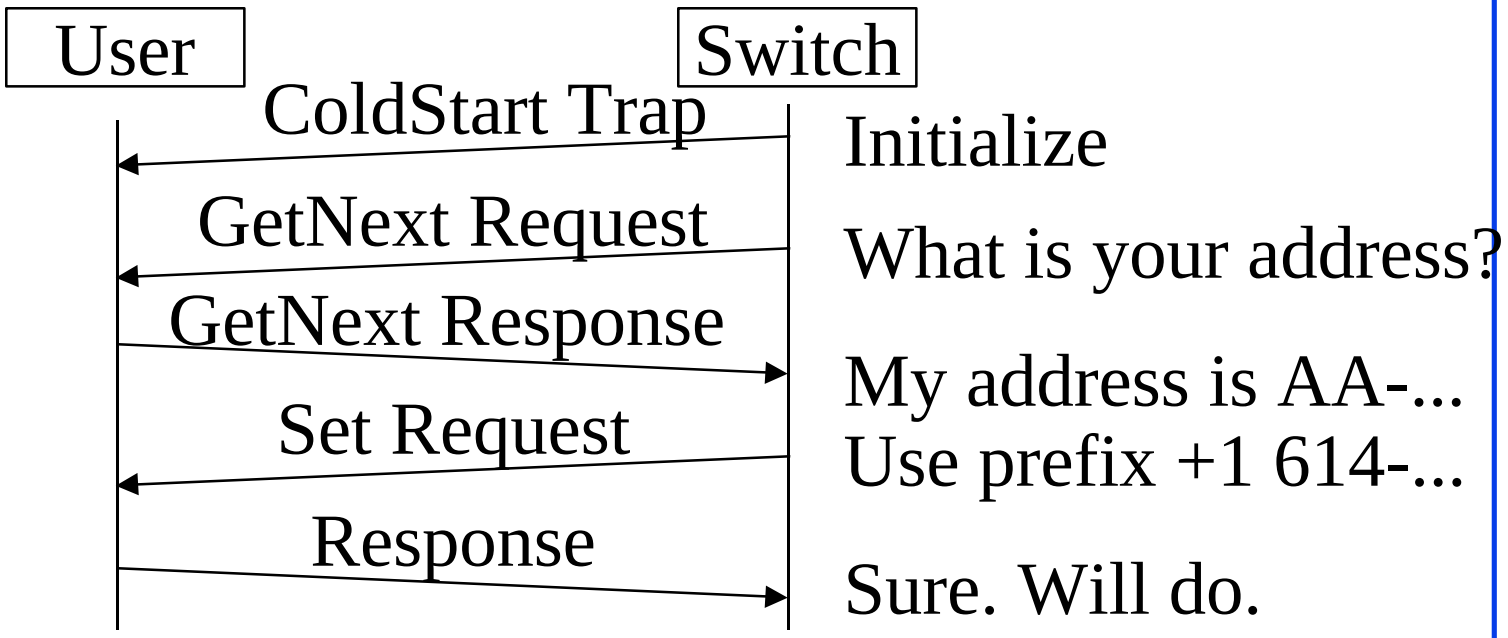
NSAP is a Misnomer!

- NSAP = Network Service Access Point. Identifies network layer service entry
- SNPA = Subnetwork point of attachment. Identifies the interface to subnetwork
- SNPA address (or part of it) is used to carry the packet across the network.
- CLNP uses NSAP to deliver the packet to the right entity in the host.
- ATM uses NSAP-like encoding but ATM addresses identify SNPA and not NSAP.



Address Registration

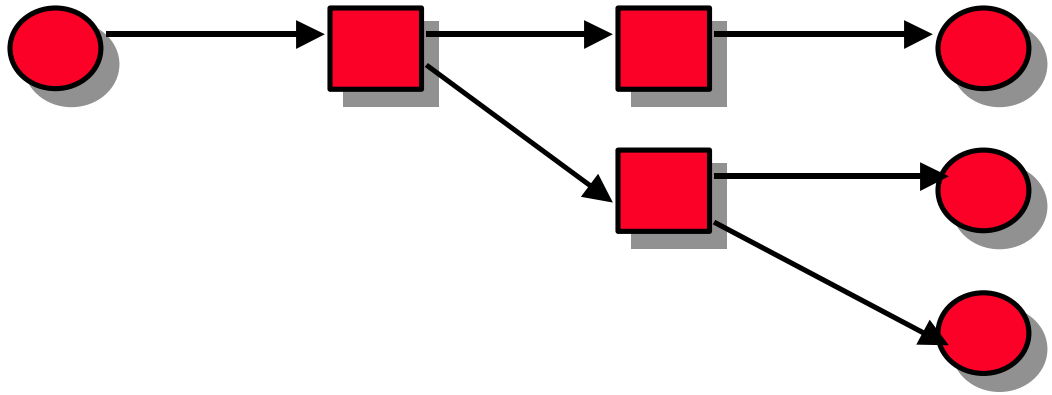
- User and switch register addresses using Interim Local Management Interface (ILMI) = Simple Network Management Protocol (SNMP)



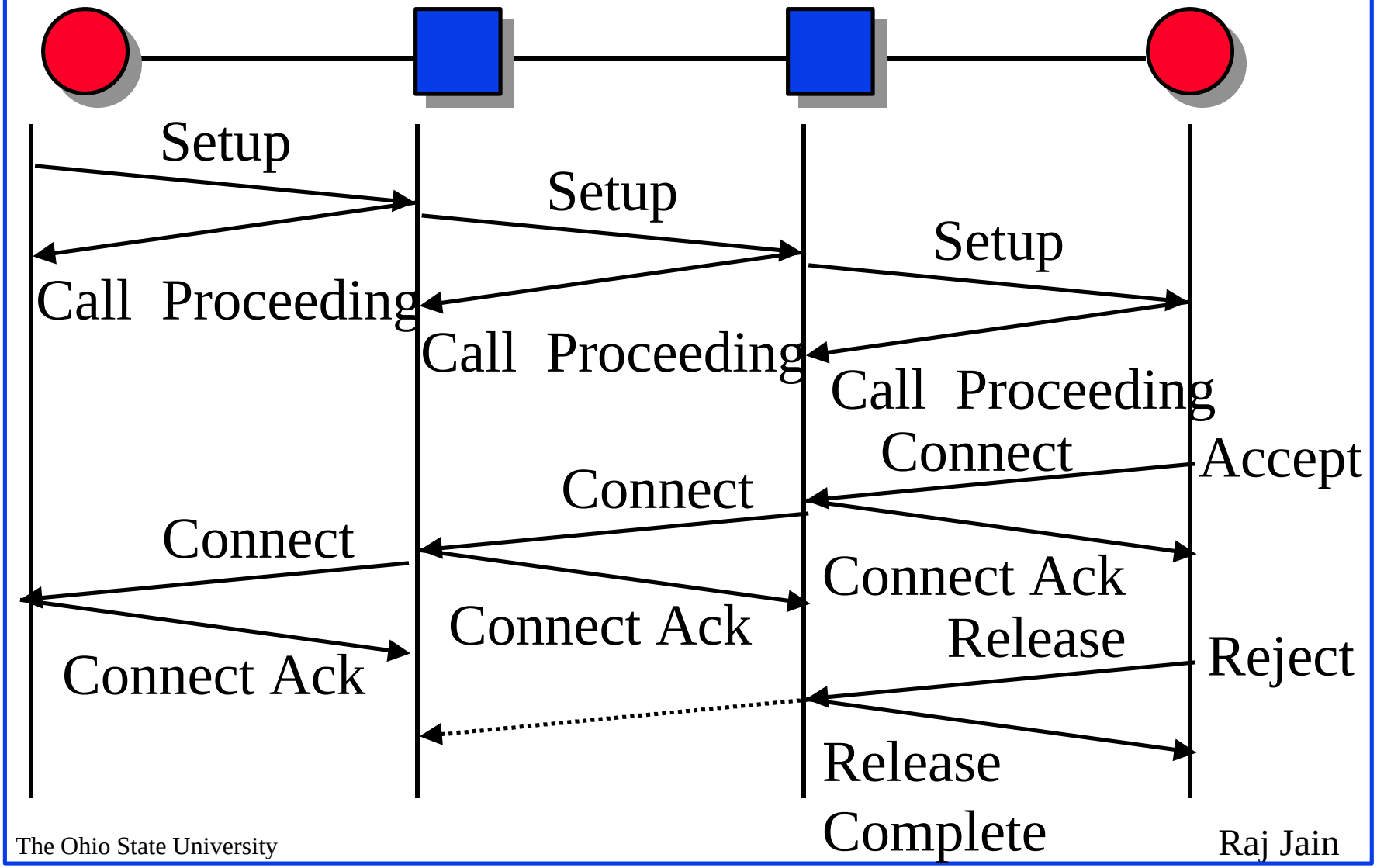
- Similar activities can occur in the reverse direction.

Connection Types

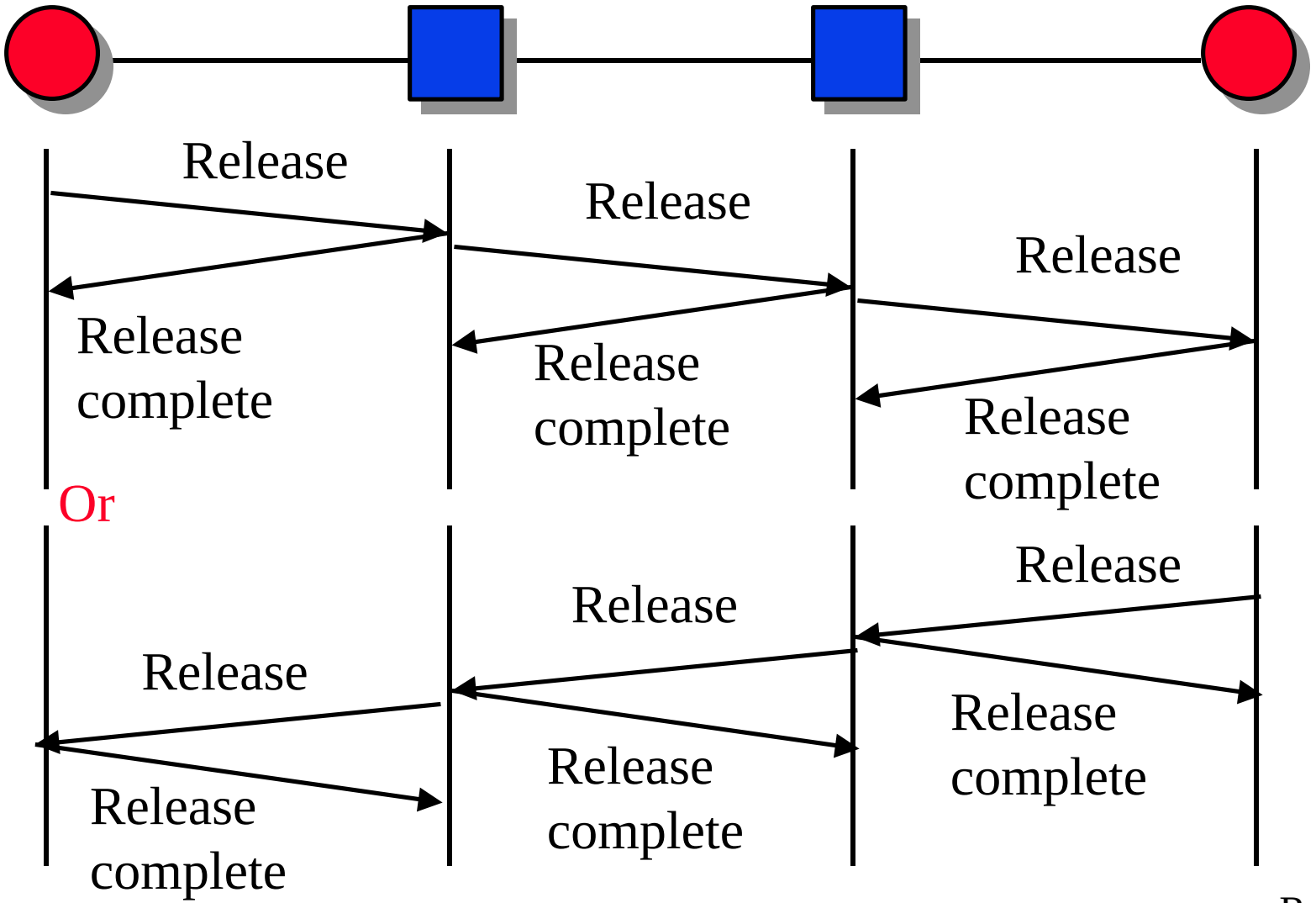
- Permanent and Switched
- Point to point
  - Symmetric or asymmetric bandwidth (Uni- or bi-directional)
- Point-to-multipoint: Data flow in one direction only. Data replicated by network.
  - Leaf Initiated Join (LIJ) or non-LIJ



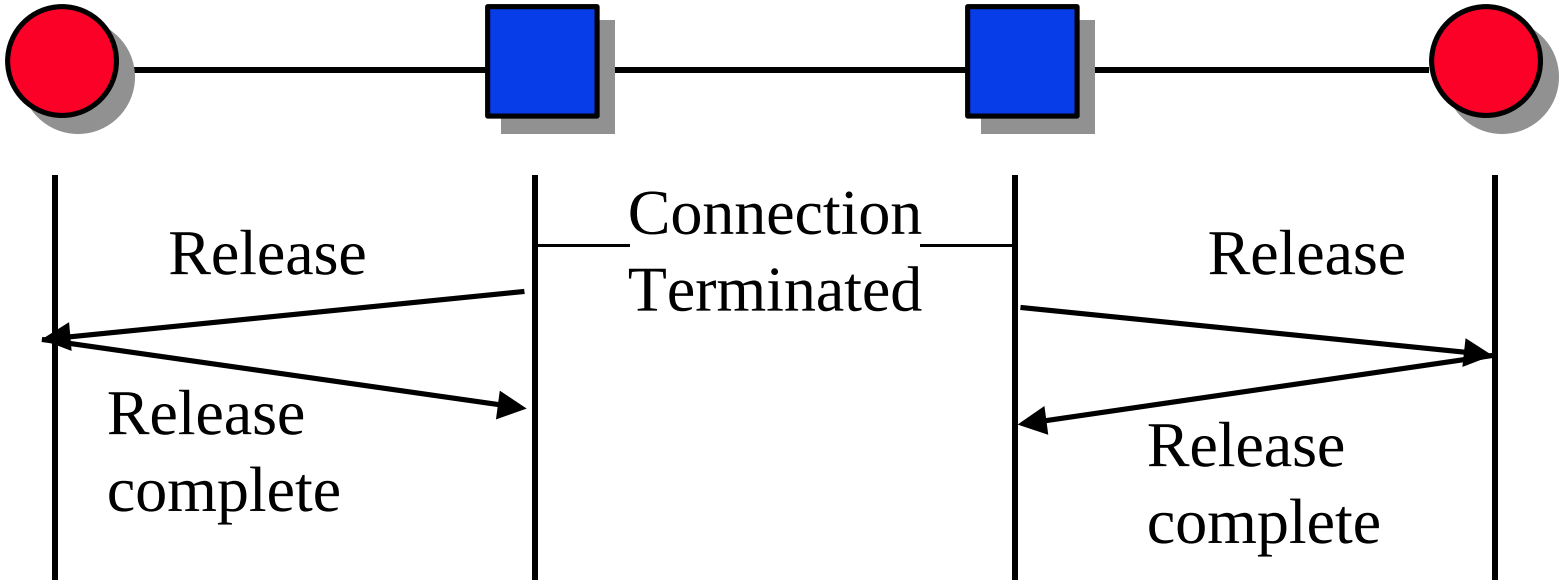
Connection Setup



Connection Release

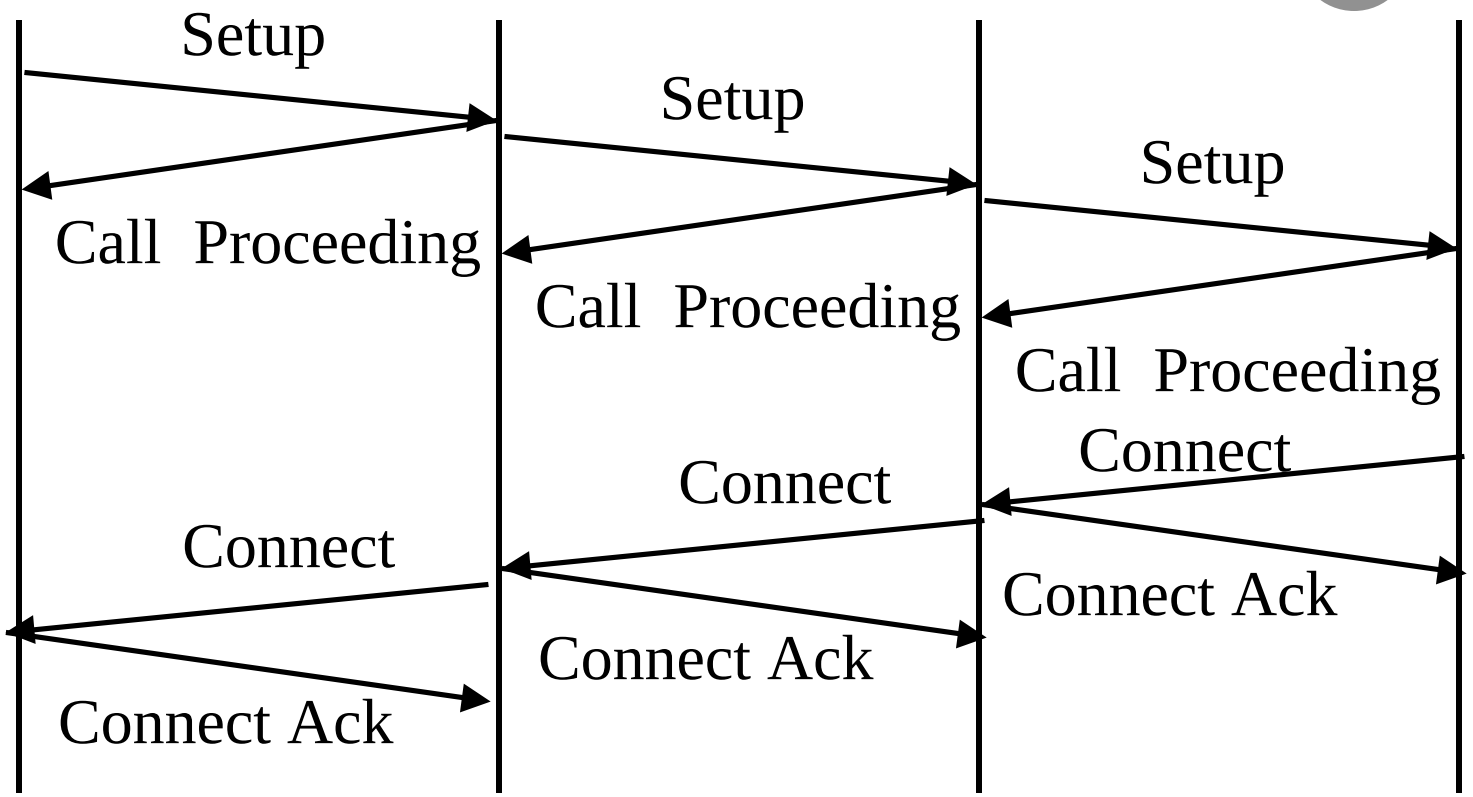


Connection Release (cont)

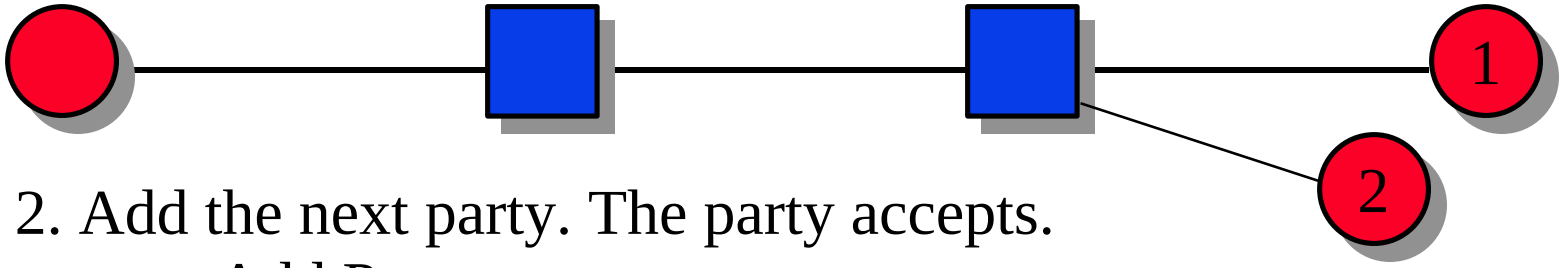


Multipoint Setup

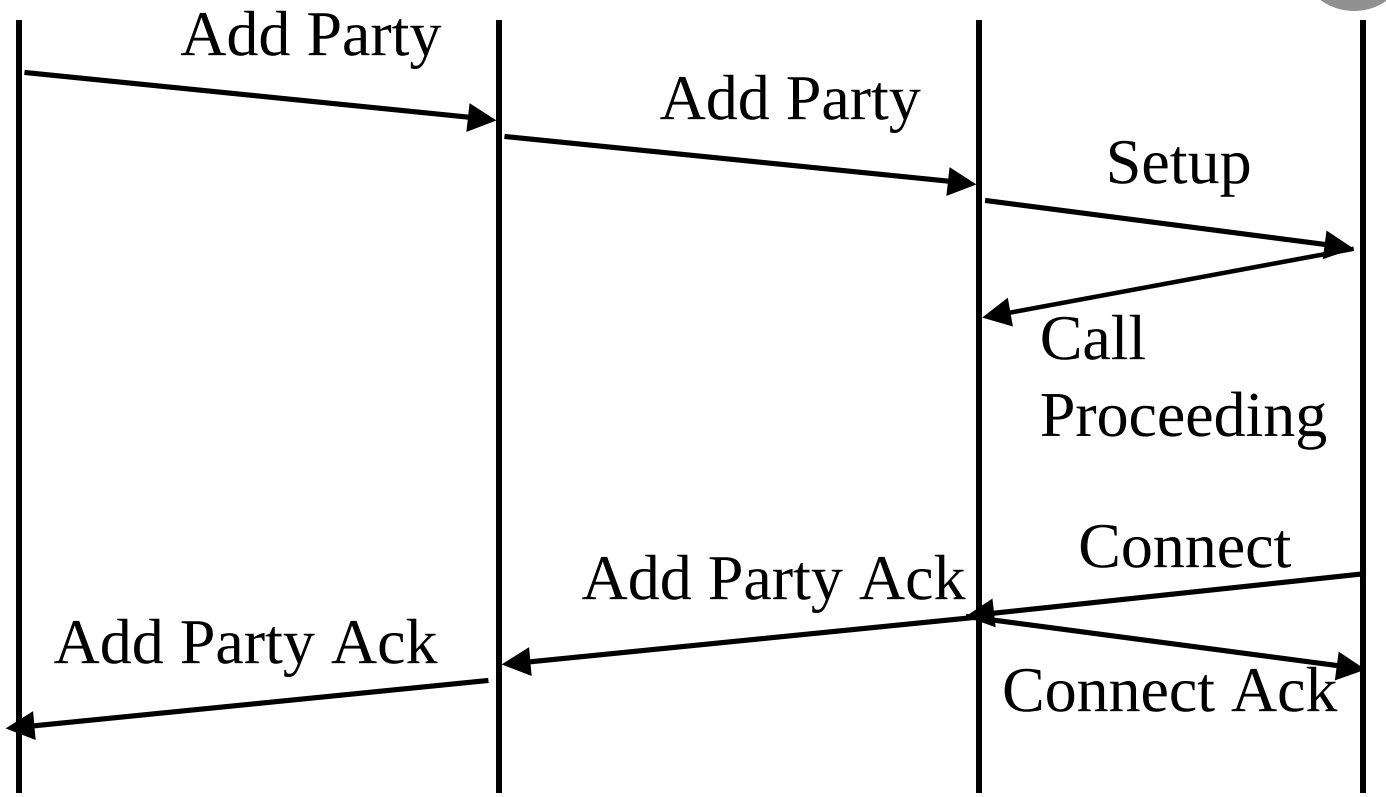
1. Connect to the first party



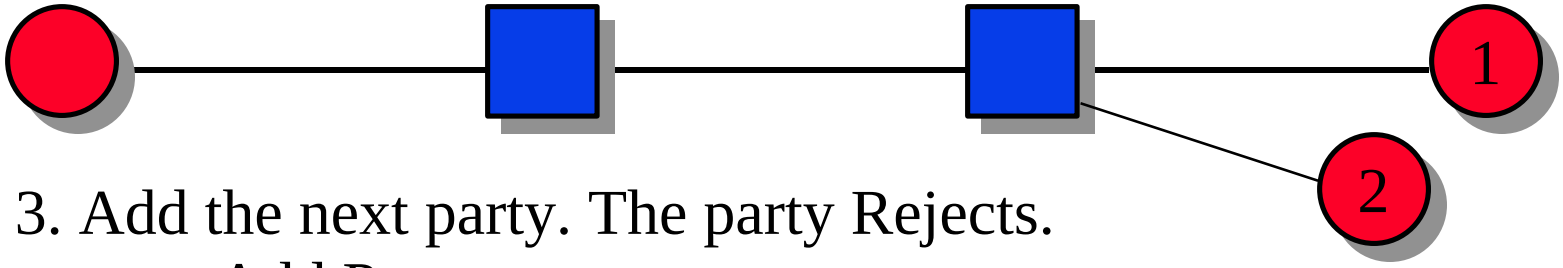
Multipoint Setup (Cont)



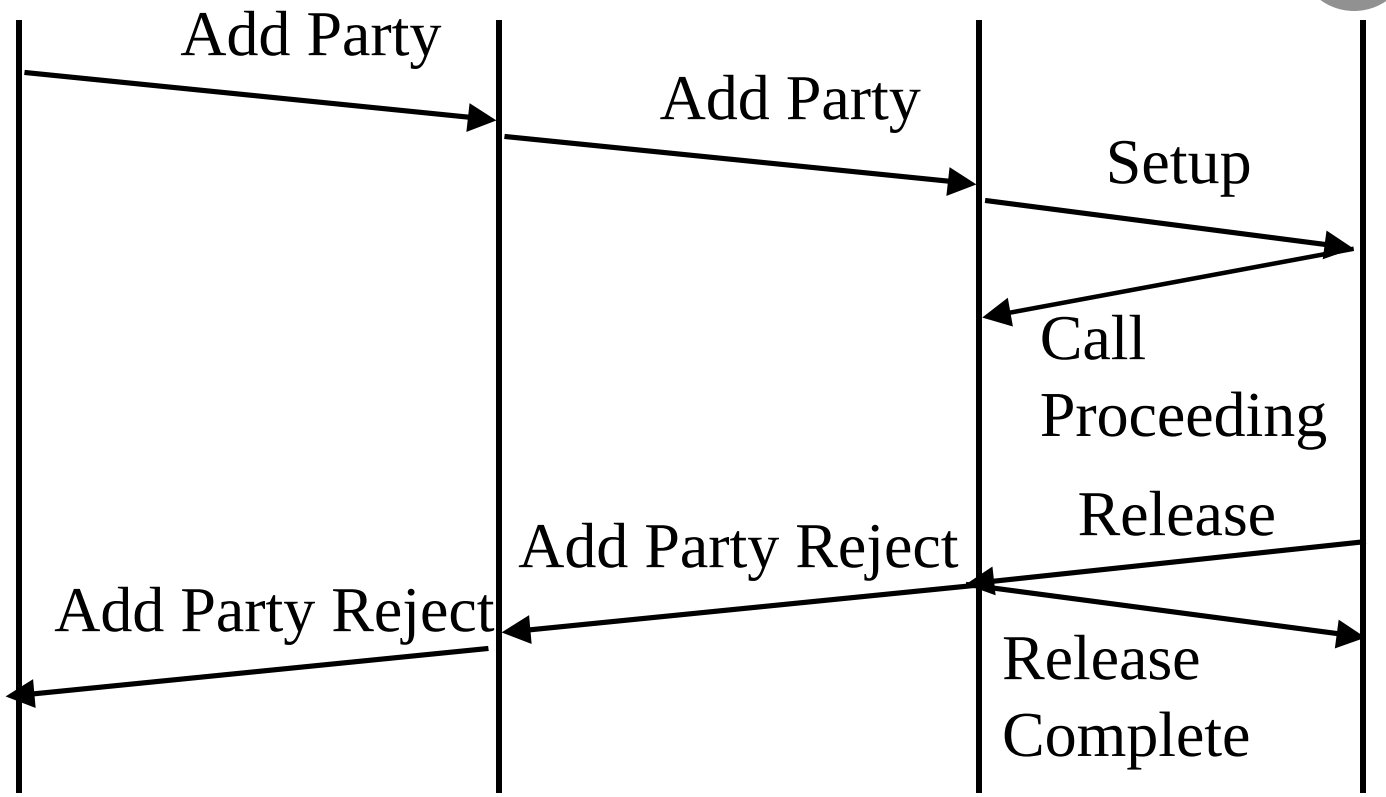
2. Add the next party. The party accepts.



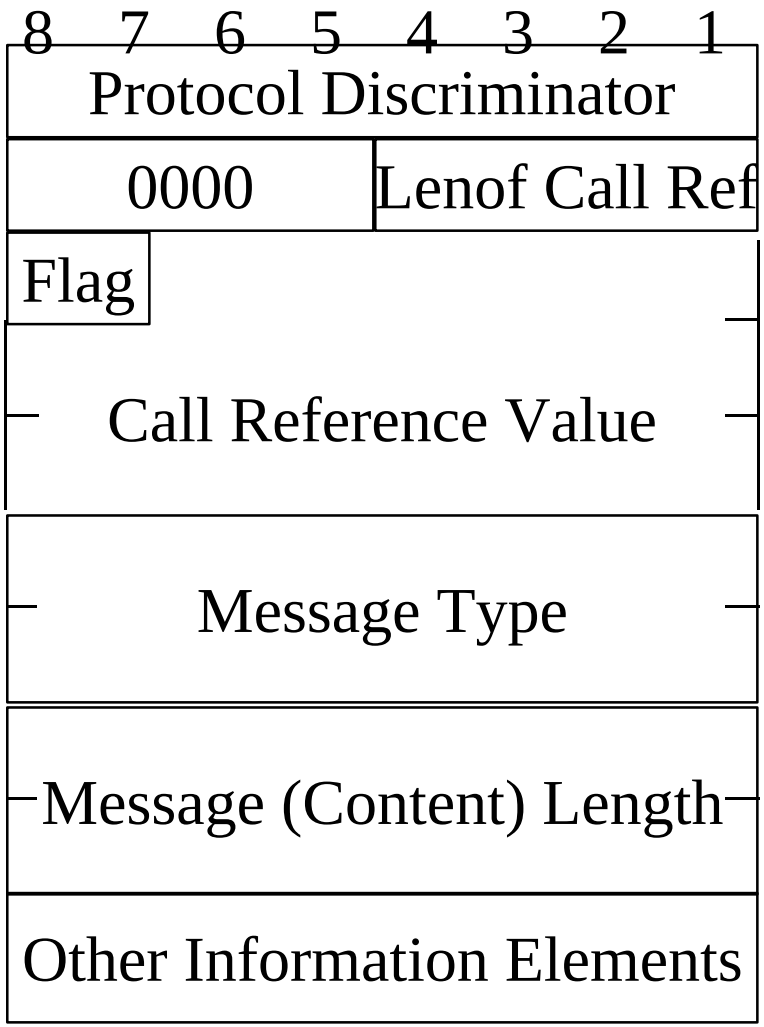
Multipoint Setup (Cont)



3. Add the next party. The party Rejects.



Message Format: Q.2931



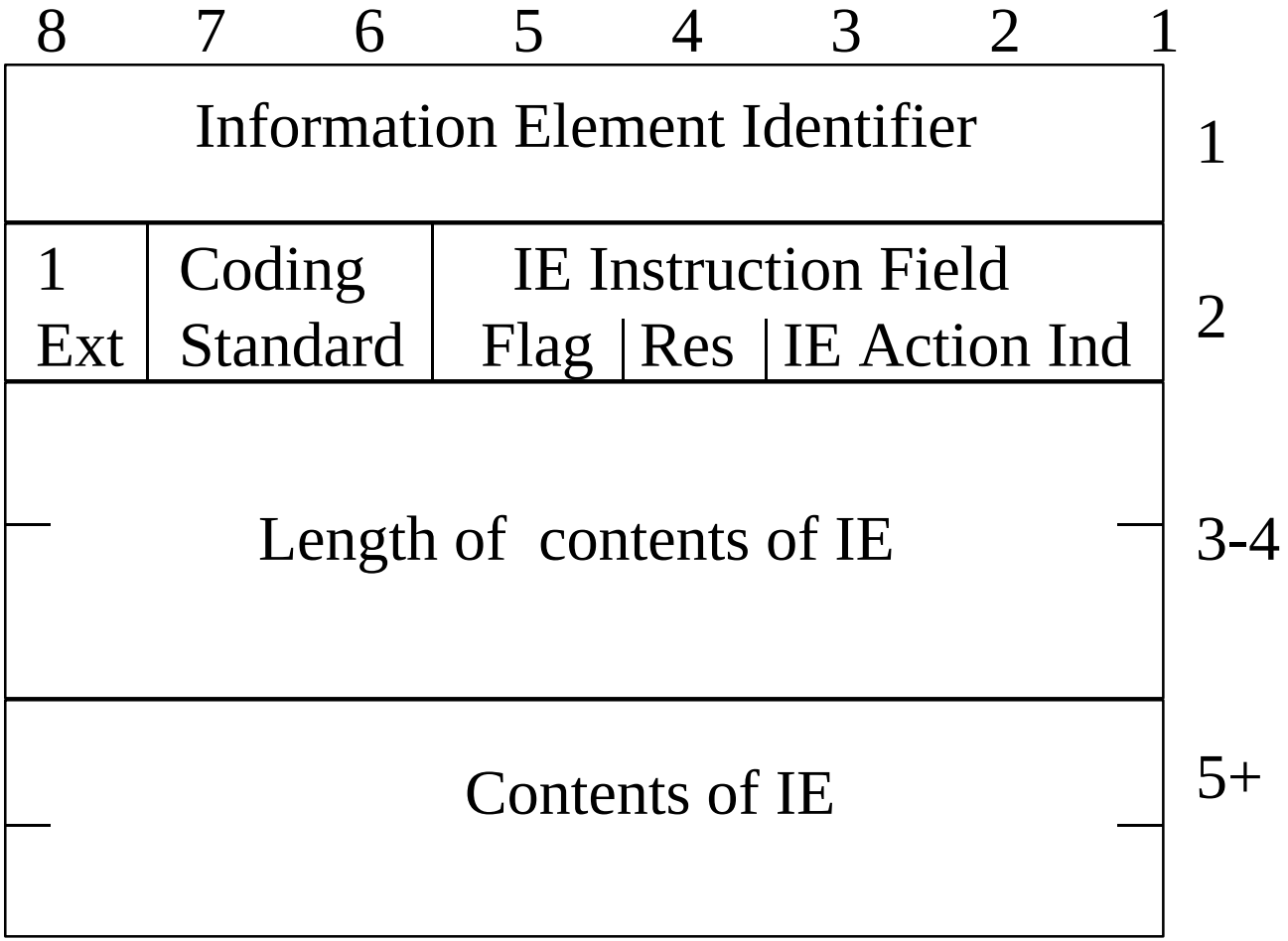
Message Format

- Protocol Discriminator (1 Byte) = Distinguishes Q.2931 messages from other messages
  08 = Q.931 09 = Q.2931
- Call reference (4 bytes) : Identifies call to which this message is related to. One user may have many calls simultaneously.
  - Flag = 1 Message is from call reference originator
  - Flag = 0 Message is to call reference originator
- Message Type (2 Bytes): Many types, e.g., connect, call proceeding, setup, release, etc.
- Message Length (2 Bytes): Length of contents

Sample Message Types

Bits 876	Bits 54321	Type
000		Call establishment messages
	00010	Call proceeding
	00111	Connect
	01111	Connect Ack
	00101	Setup
	01101	Setup Ack
010		Call Clearing Messages
	01101	Release
	11010	Release complete
011		Information
	10101	Status Inquiry
	11101	Status
111		Reserved for extension

Information Element Formats



Sample Information Elements

Bits 87654321	Information Element
01110000	Called party number
01110001	Called party subaddress
01111000	Transit network selection
01101100	Calling party number
01101101	Calling party subaddress
01011000	AAL parameter
01011001	ATM Traffic Descriptor
01011010	Connection Identifier
01011100	Quality of Service Parameter
01000010	End-to-end transit delay
01011110	Broadband bearer capability

Bandwidth Contract

- User specifies 12 leaky bucket parameters

	Forward	Backward
CLP=0	Peak Cell Rate	Peak Cell Rate
	Sustainable Cell Rate	Sustainable Cell Rate
	Maximum Burst Size	Maximum Burst Size
CLP=0+1	Peak Cell Rate	Peak Cell Rate
	Sustainable Cell Rate	Sustainable Cell Rate
	Maximum Burst Size	Maximum Burst Size

Protocol Stacks

- Signaling AAL (SAAL)
  - Service specific coordination function (SSCF): Provides interface to Q.2931
  - Service specific connection-oriented protocol (SSCOP): Error and loss recovery
  - AAL Common Part (AAL CP): Error detection

<table>
<tr><td colspan="2">Q.2931</td><td>TCP/IP</td><td>LMI, SNMP</td></tr>
<tr><td rowspan="3">SAAL</td><td>SSCF Q.2130</td><td rowspan="3">AAL</td><td rowspan="3">AAL</td></tr>
<tr><td>SSCOP Q.2110</td></tr>
<tr><td>AAL CP I.363</td></tr>
<tr><td colspan="4">ATM I.361</td></tr>
<tr><td colspan="4">SONET, DS1, E1, etc. I.432</td></tr>
</table>

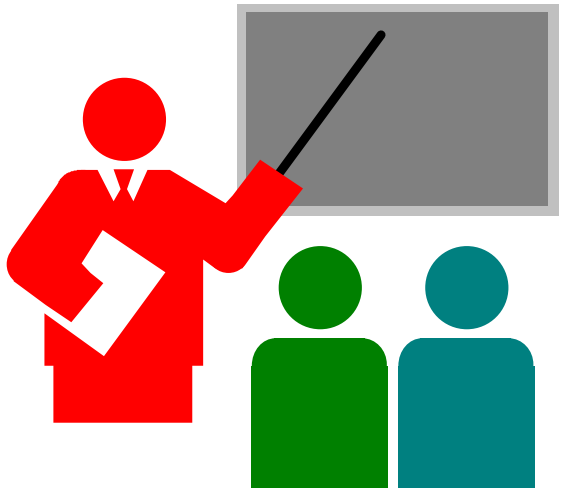
UNI 3.1 Features

- Align with Q.2931
- Use new version of SSCOP

UNI 4.0 Features

- Point-to-point and point-to-multipoint calls
- Leaf initiated join capability
- Notification of end-to-end connection completion
- ATM Anycast capability
- Multiple signaling channels
- Switched virtual path service
- Proxy signaling
- Frame discard capability
- ABR signaling for point-to-point calls
- Traffic parameter negotiation

Summary



- NSAP address formats
- Call setup and release: Point-to-point, point-to-multipoint, Leaf-initiated join
- Q.2931 Message formats and information elements
- Traffic contracts

Homework

- Read Sections 15.1-15.4 of McDysan's book