



H.323



Call Signaling

- For the establishment and tear-down of calls
- Q.931 modified by Rec. H.225.0
 - Reuse some messages with few modifications
 - A clever use of User-to-User information element
 - Convey all of the extra information needed in H.323
 - E.g., H.245 addresses to be used for logical channel



Setup

- The first call-signaling message
- Bearer Capability
 - Most of the fields are not used.
 - Used in the circuit-switched world
 - It may be used when the call has originated from outside the H.323 network and has been received at a gateway.
 - A gateway needs to perform the mapping
- User-to-User information element
 - Mandatory: call id, call type, the caller information
 - Optional: source alias, destination alias, H.245 address



Call Proceeding & Alerting

- Call Proceeding
 - Optional
 - call-establishment procedures are underway
 - Mandatory
 - User-to-user information element: destination information
 - Optional - H.245 address of the called party
- Alerting
 - The called user is being alerted
 - Indicating specific alerting tone to the calling party (optional)
 - The same parameters as Call Proceeding



Progress & Connect

- Progress

- Sent by a called gateway to indicate call progress in the case of inter-working with a CS network
- Conveying in-band tones or announcements (optional)

- Connect

- The called party has accepted the call.
- Must be sent if the call is to be completed
 - Call Proceeding and Alerting are optional
- User-to-User information
 - The same as Call Proceeding



Release Complete & Facility

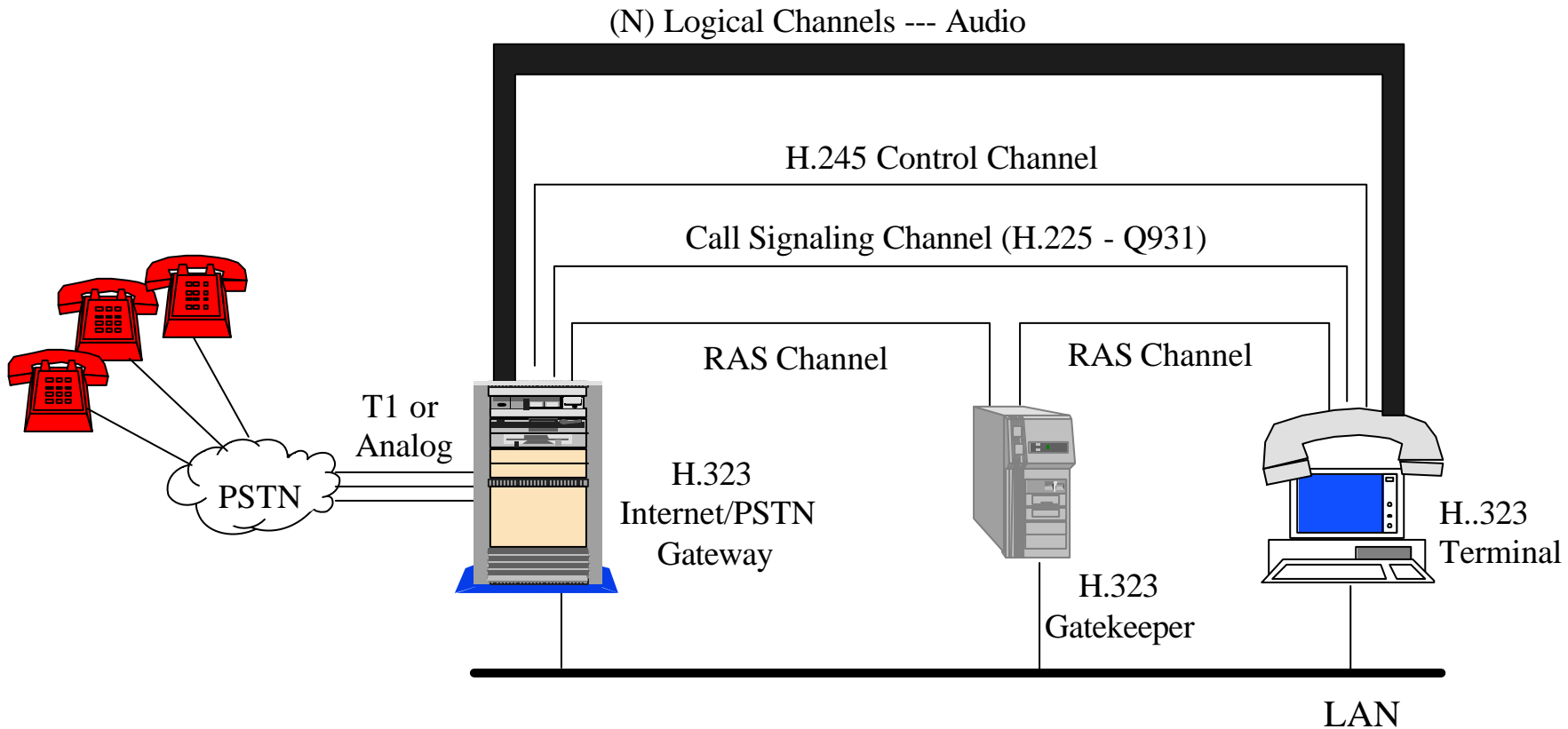
- Release Complete
 - Terminate a call
 - No Release message
 - In ISDN, Release and Release Complete
 - Cause information element, optional
 - Otherwise, a Release reason in User-to-User information element.
- Facility (Q.932)
 - A call should be redirected
 - Also be used for supplementary services
 - User-to-User contains reason parameter
 - E.g., routeCallToGatekeeper



Interaction between Call Signaling and H.245 Control Signaling

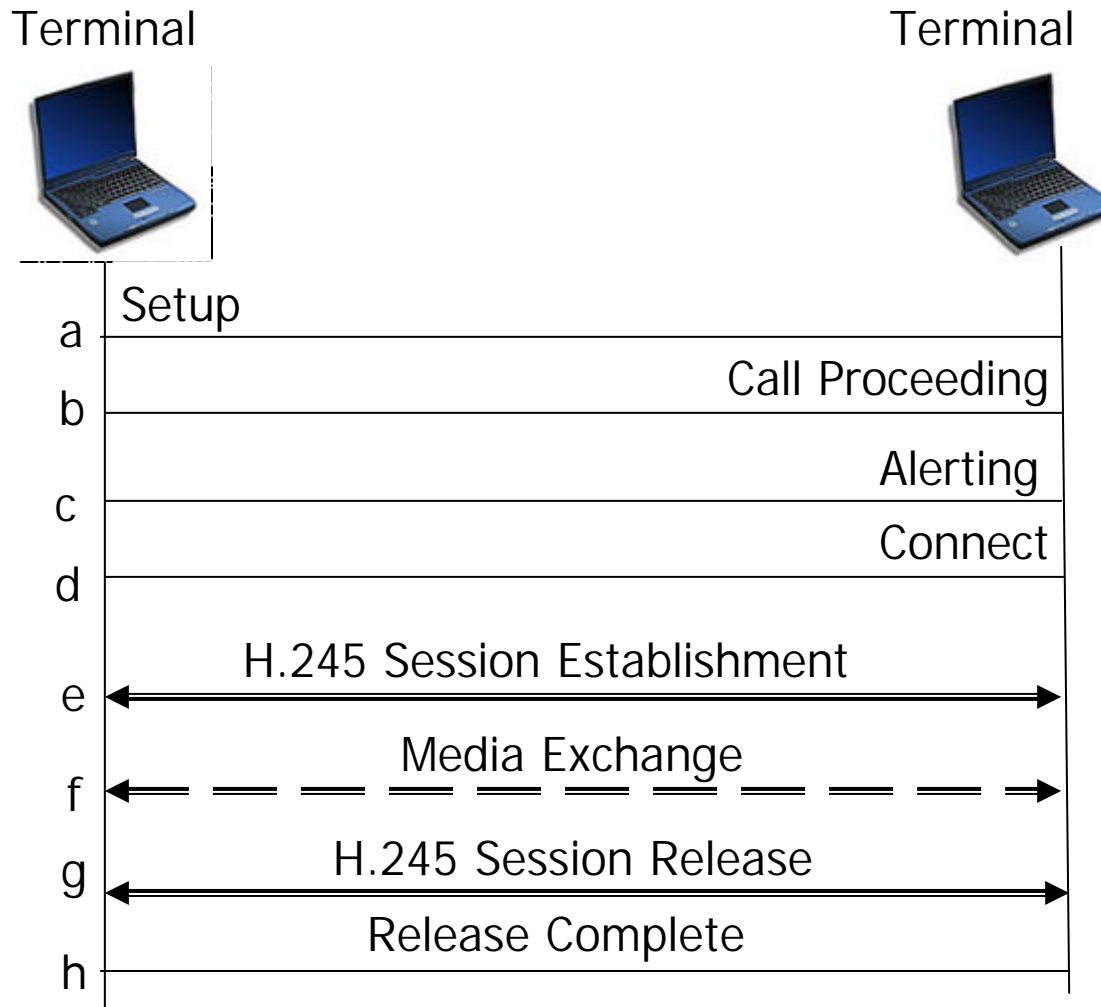
- Call signaling: call establishment and tear-down
- H.245: the negotiation and establishment of media streams
- The two signaling protocols are closely tied together.
- When to begin the exchange of H.245 messages?
 - Between the Setup and Connect messages
 - Immediately after the Connect message
 - Equipment dependent

PC to Phone Communication



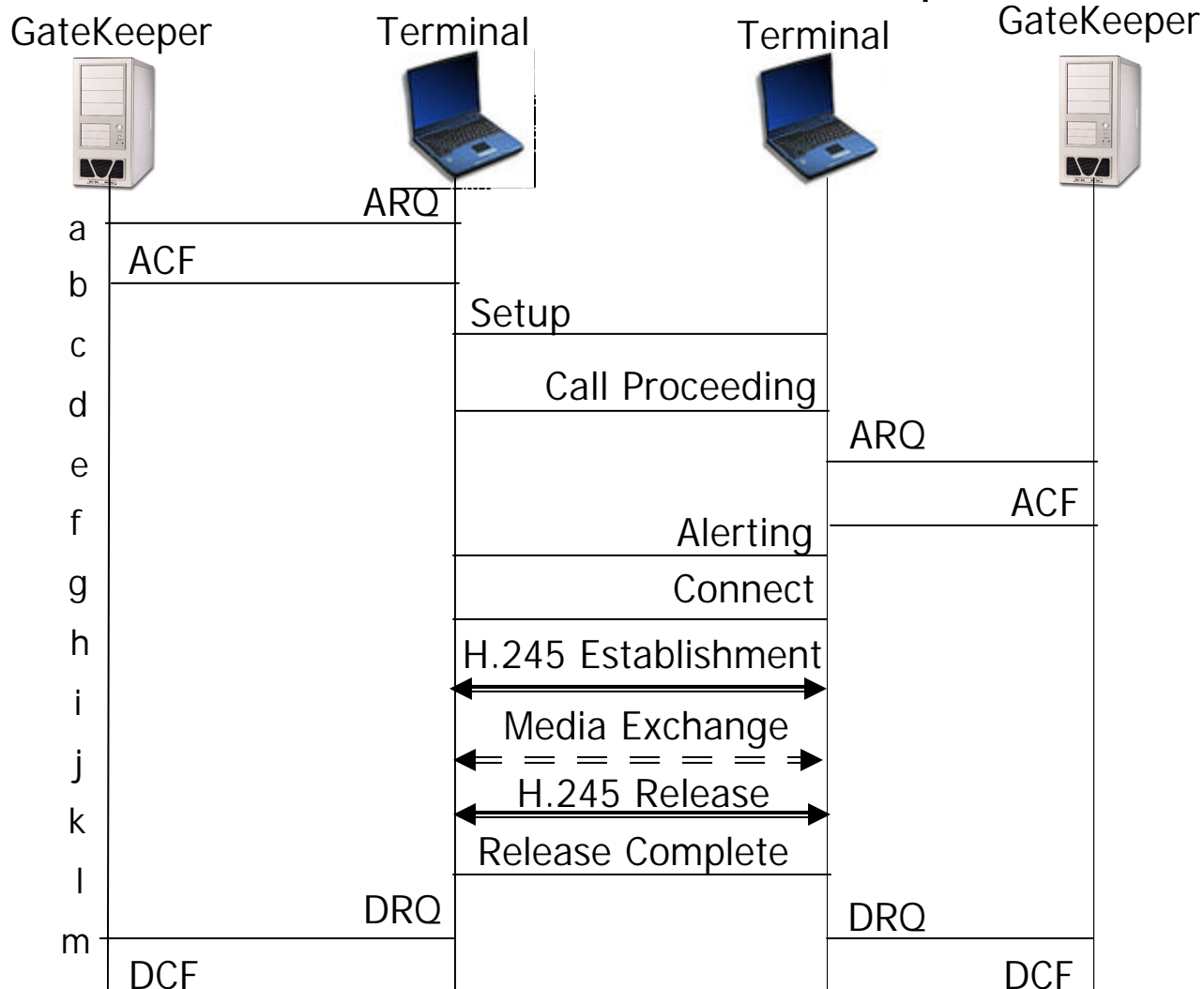
Call Scenarios [1/5]

- Basic Call without GKs



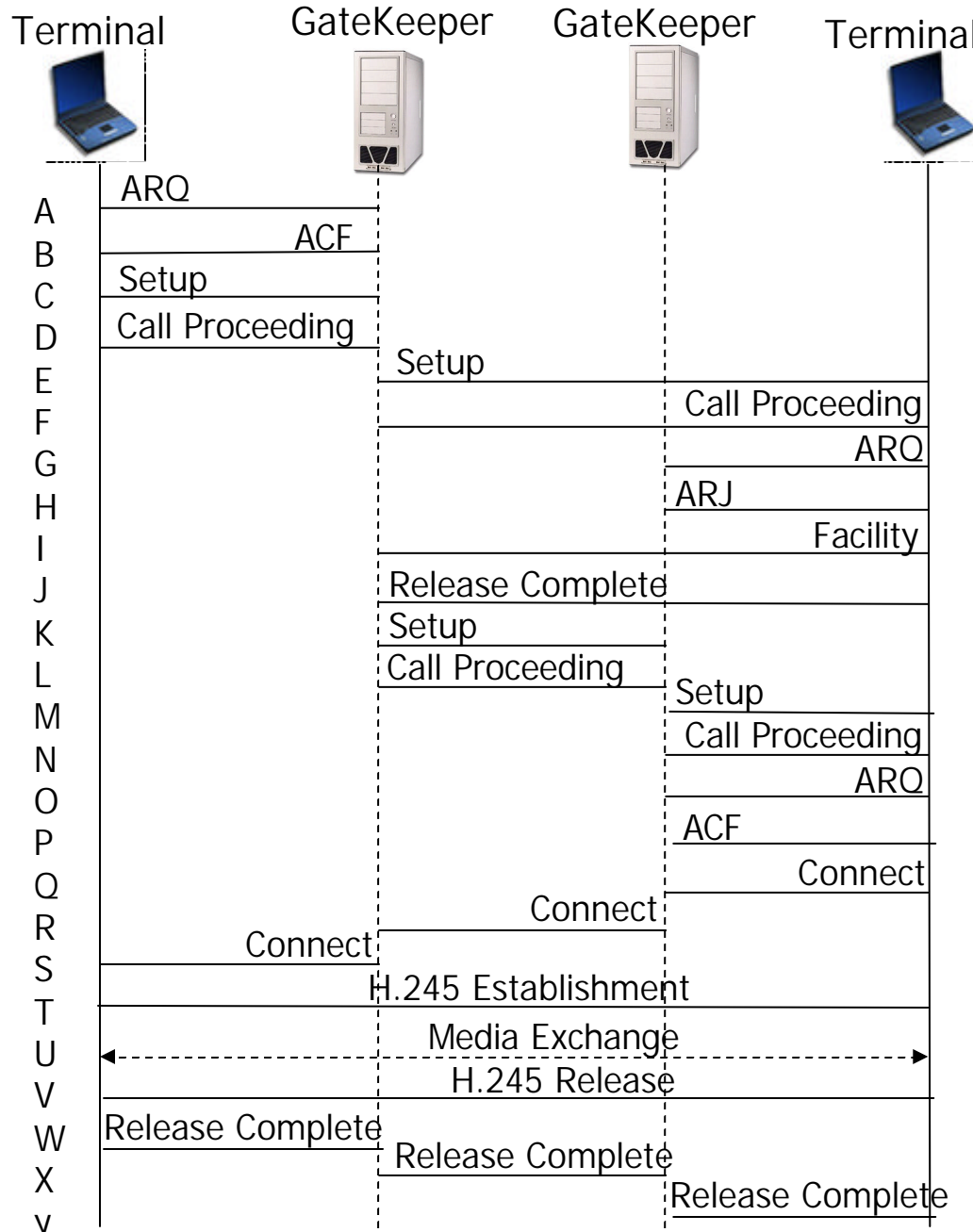
Call Scenarios [2/5]

- A Basic Call with GKs and Direct Endpoint Call Signaling



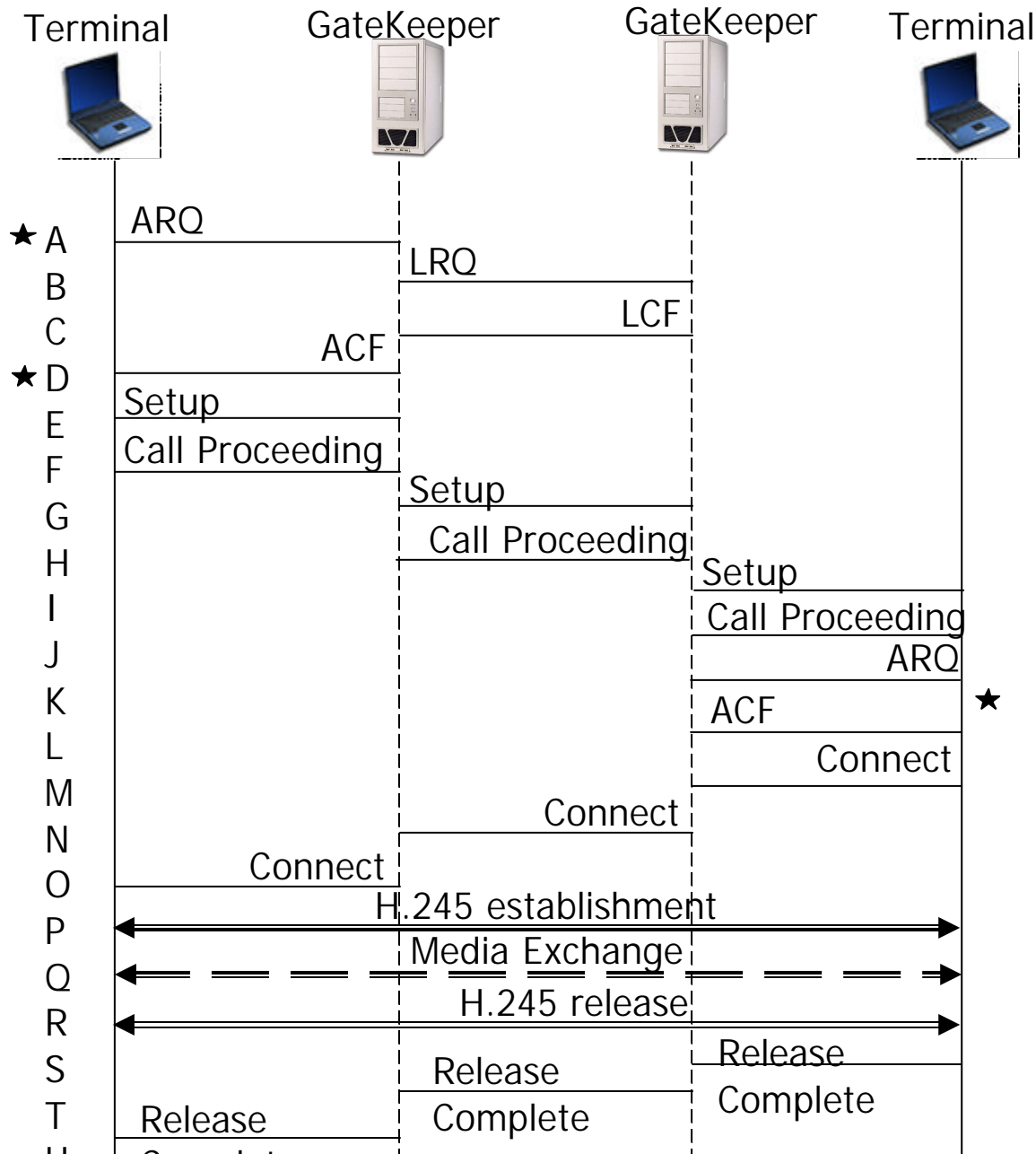
A Basic Call with Gatekeeper-Routed Call Signaling

- ARJ with a cause code of routeCallToGatekeeper
- A Facility with a reason indicating the call be rerouted



Optional called-endpoint signaling

■ LRQ, LCF





H.245 Control Signaling

- Used between session participants to establish and control media streams
 - Agree on the media formats and bandwidth
 - Multiplexing multiple media streams
 - E.g., for lip synchronization between audio and video
 - Not carrying the actual media
 - A generic protocol for the control of media streams
 - Not dedicated for VoIP
 - How it works in an H.323 system?



H.245 Message Groupings

- Requests
 - Require the recipient to perform some action and to send an immediate response
- Responses
 - In reply to Requests
- Commands
 - Require the recipient to perform some action, but no explicit response is required.
- Indications
 - Of an informational nature only
 - No action and response is expected.



The Concept of Logical Channels

- A Logical channel
 - A unidirectional media path
 - An IP address and port number supporting a particular type of media
 - Has a number that is specified by the sending entity
- A two-party conversation
 - Two logical channels exist
 - Potentially in different formats
- An endpoint issues **Open Logical Channel**
 - Logical channel number and media information (RTP payload type)
- Far endpoint responds with **Open Logical Channel Ack**
 - An RTP port
- Messages over H.245 Control Channel (channel number 0)
 - Permanently open as long as the endpoint is involved a call



Capability Exchange [1/2]

- Share information regarding the endpoint's reception and transmission capabilities
- Indicate a preference
- **TerminalCapabilitySet** message
 - A request message
 - A sequence number plus the types of audio and video formats
- **TerminalCapabilitySetAck**
 - with a sequence number
- **TerminalCapabilitySetReject**
 - With a reason for rejection

Capability Exchange [2/2]

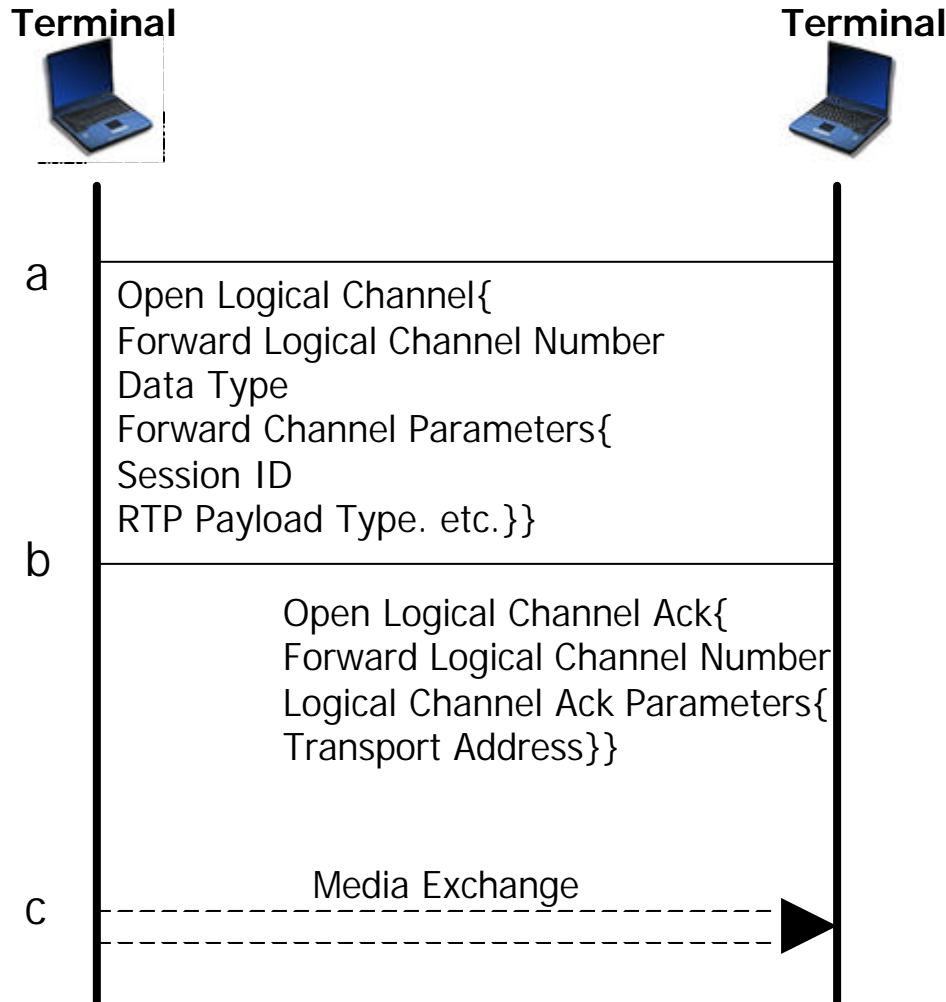
- **TerminalCapabilitySetRelease**
 - If no response within a timeout period
- **SendTerminalCapabilitySet**
 - Request Terminal Capability information
 - A command message that does not requires a specific response
 - The endpoint that receives the messages should subsequently send a **TerminalCapabilitySet** message.
 - The SendTerminalCapabilitySet message contains two options.
 - The sender requests that the far endpoint indicates all its capabilities.
 - For confirmation
 - E.g., there has been a break in communication and one endpoint wants to make sure that it still has the latest information about the other.



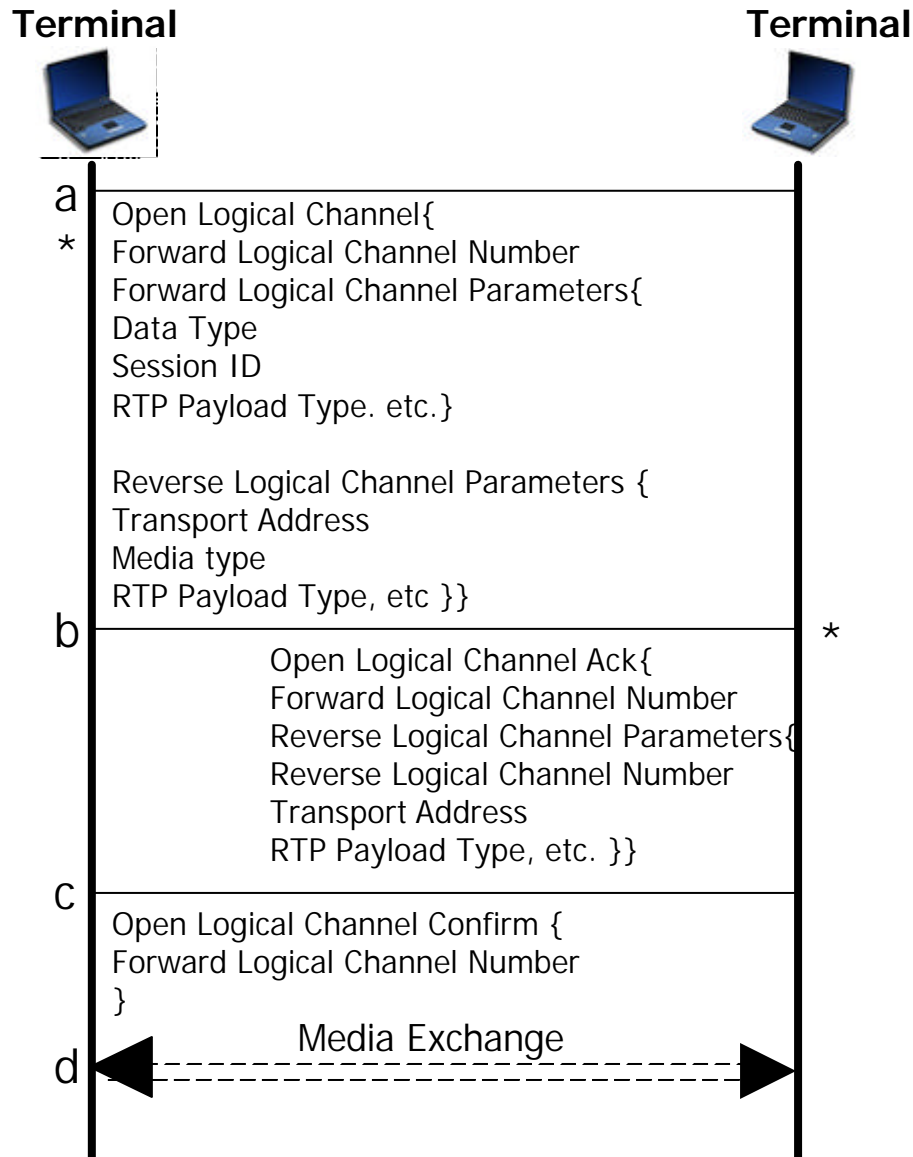
Master-Slave Determination

- One of the endpoints needs to be the master
 - Of particular importance for the setup of a multi-party conference
- Compare two pieces of information at each entity
 - A terminal type value
 - A terminal without an MC: 50
 - A gateway without an MC: 60
 - An MCU that supports audio, video and data conferencing: 190
 - An MCU that is currently managing a conference: 240 (the highest)
 - A random number (1..16,777,215)
- Master-Slave Determination message
- Master-Slave Determination Ack
 - A “master” or “slave” indication

Open Unidirectional Logical Channel

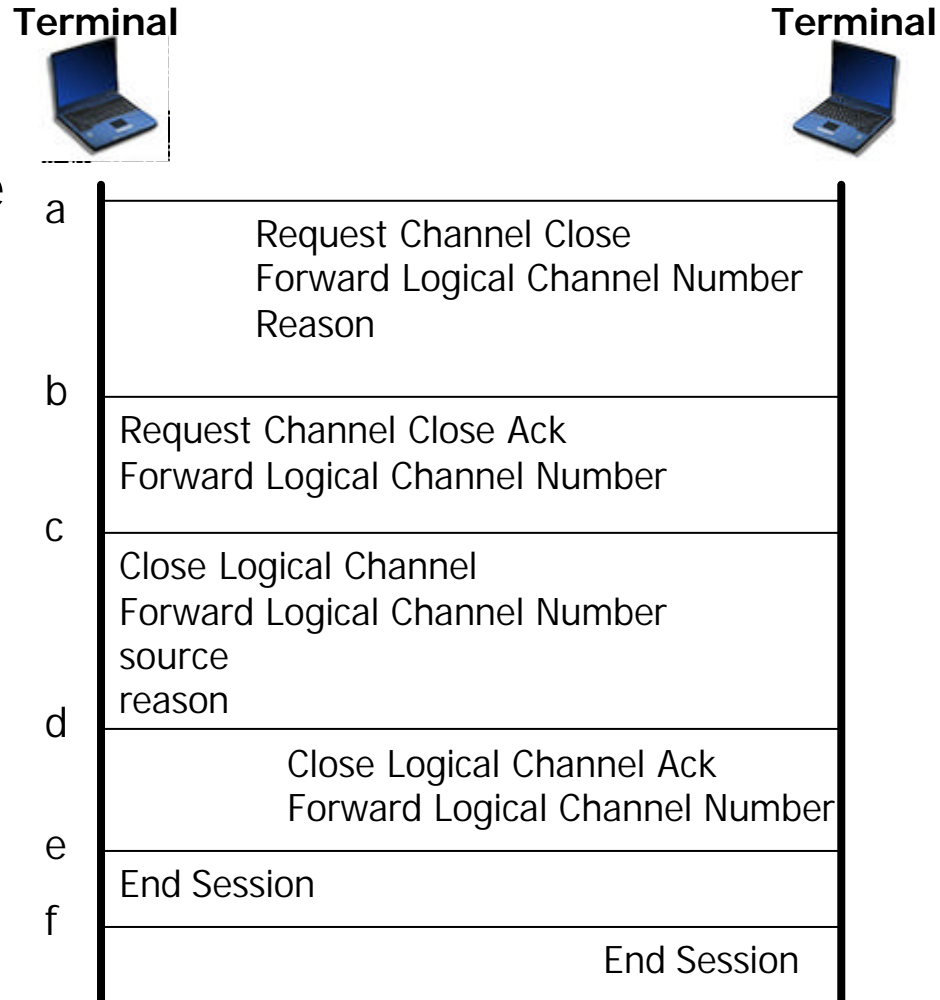


Open Bidirectional Logical Channels

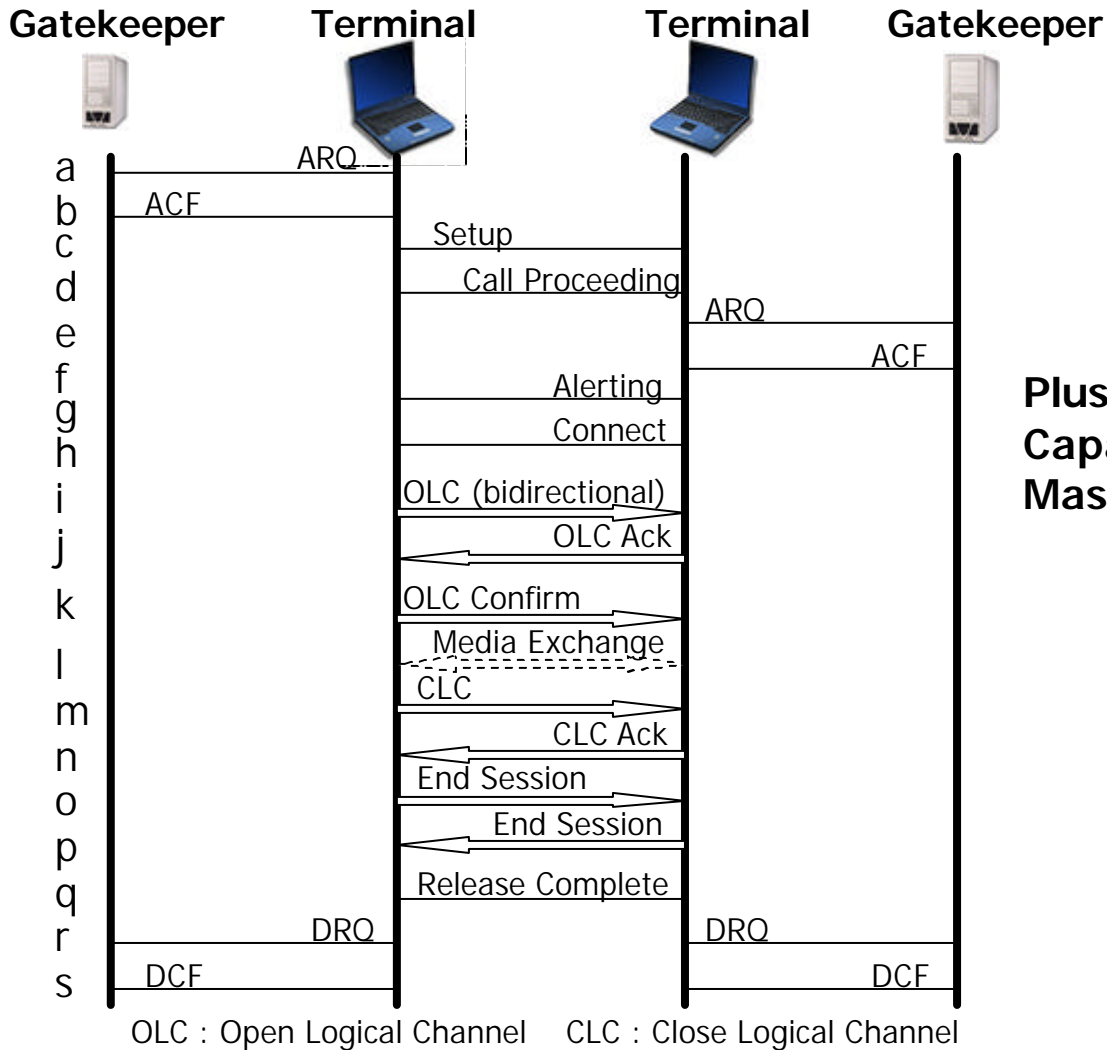


Closing Logic Channels and Ending a Session

- `CloseLogicalChannel`, `CloseLogicalChannelAck`
- Only the initiator can issue
- Or the receiving end can humbly request
- A bidirectional channel can be closed by either end
- Once all logical channels are closed
 - `EndSession`, `EndSession` commands



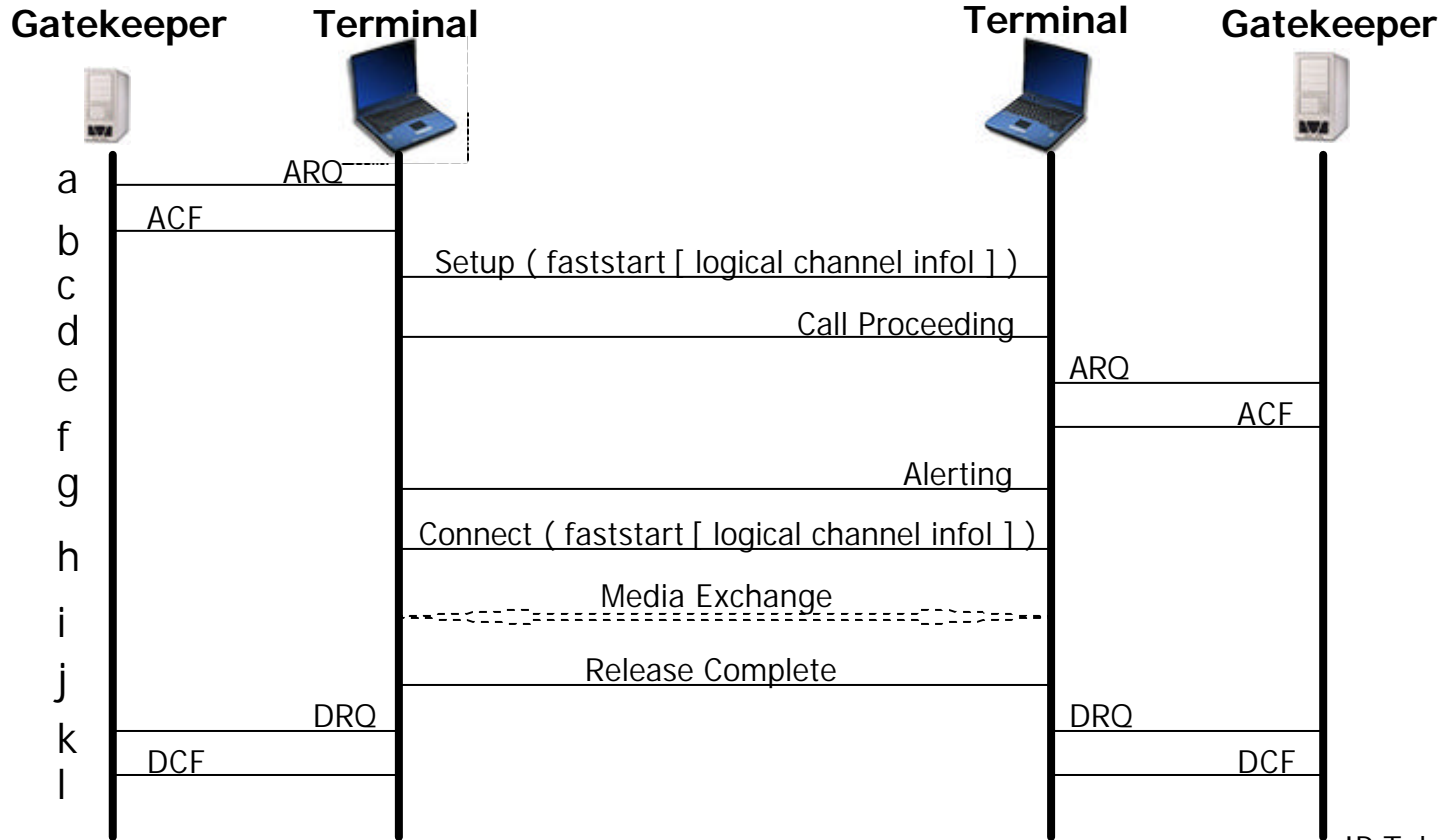
A Slow Start



**Plus
 Capability exchange
 Master-slave determination**

Fast-connect Procedure

- Q.931
 - A faststart element : OpenLogicalChannel requests
 - No H.245 control channel





H.245 Message Encapsulation

- H.245 message encapsulated with Q.931 messages as octet strings
 - Set the element **h245Tunneling** to true
 - The encapsulated data is contained within the h245Control element.
- A conflict exists between encapsulation and fast-start.
- What happens if an endpoint needs to send an H.245 message at a time when it does not have a need to send a Q.931 message?

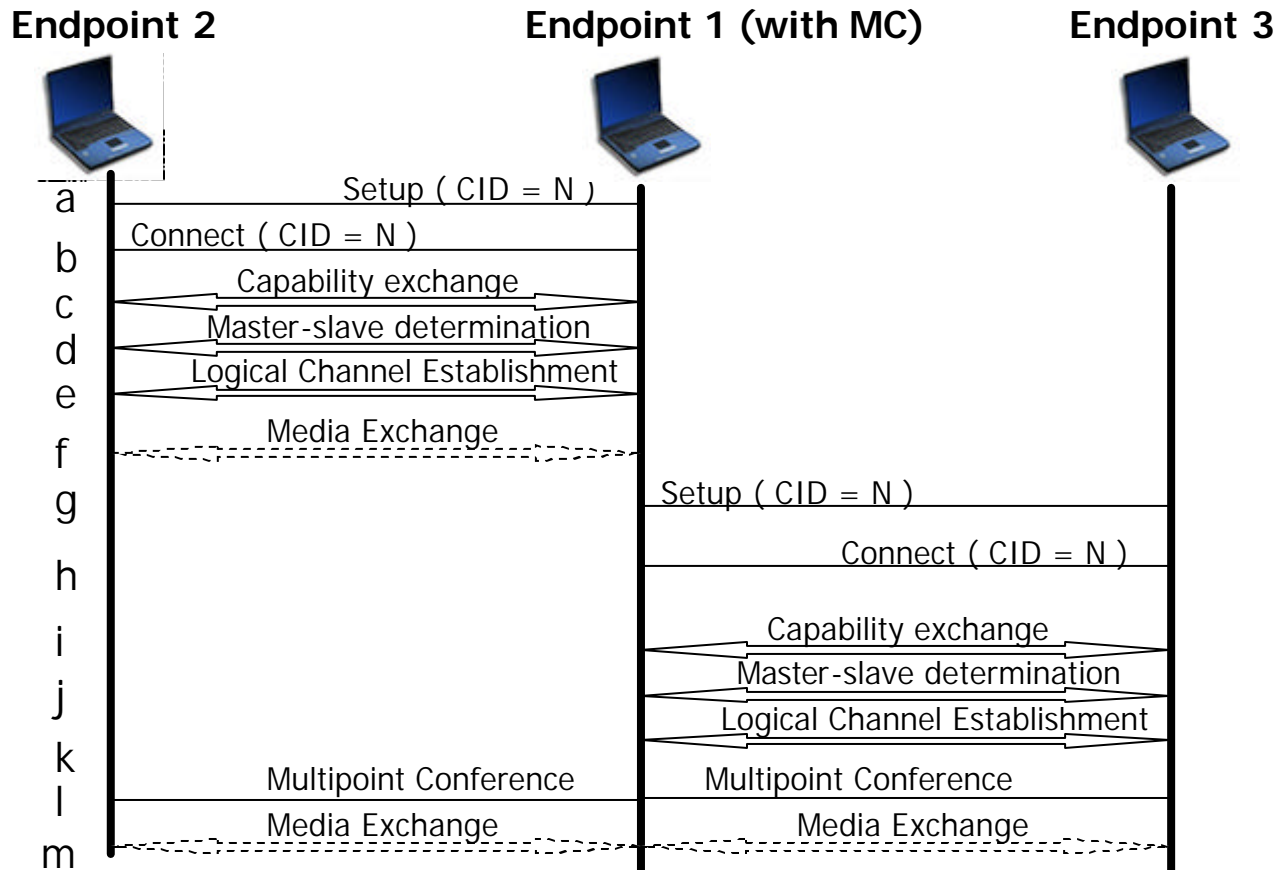


Conference Calls

- MC manages multi-point conference
- Pre-Arranged Conference
 - Participants call in to a separate MCU through Q.931 call signaling.
- The MCU specifies the conference mode (centralized or de-centralized).
 - **Communication Mode** command (H.245)

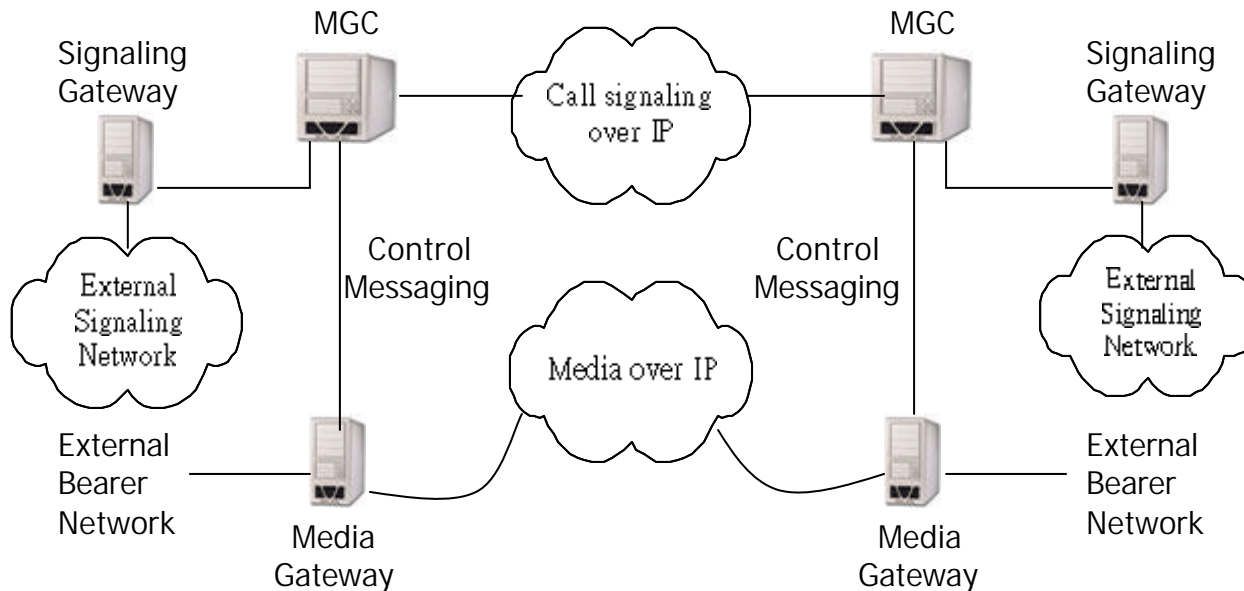
An Ad-Hoc Conference

- Expand an existing two-party call to a conference call
 - One of the endpoints (or one of the endpoints' gatekeepers) must contain an MC (master).



The Decomposed Gateway

- The H.323 gateway can comprise
 - Media Gateway (MG): handles media stream
 - Media Gateway Controller (MGC): performs call control
 - Signaling Gateway (SG): interfaces with external signaling network (e.g., SS7)
- The function of MGC is separate from that of GK.





H.323

iGSM: VoIP Service for Mobile Network



Introduction to iGSM [1/2]

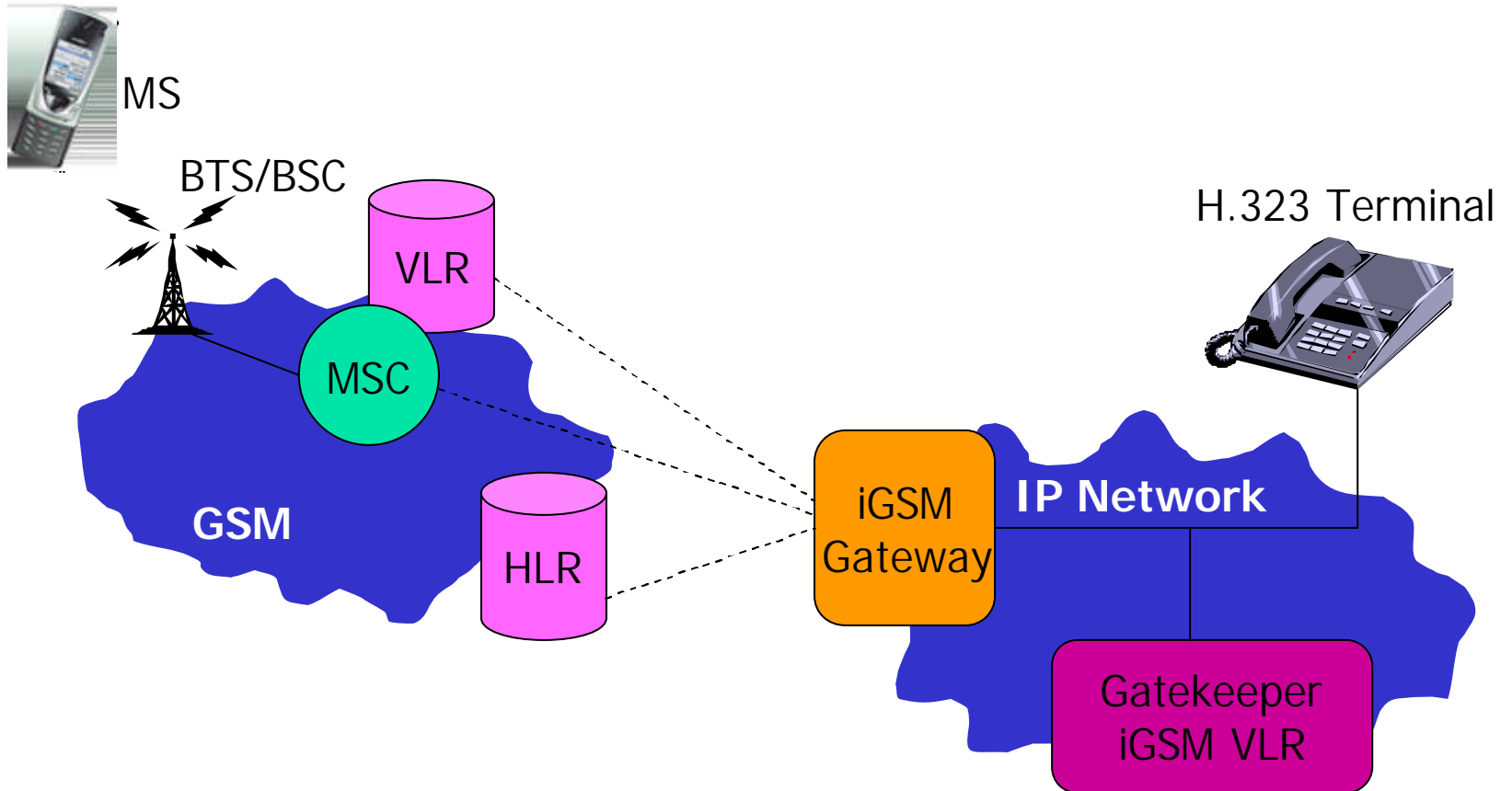
- A VoIP value-added service for mobile network
- iGSM supports user mobility for GSM subscribers to access VoIP services.
 - With the same identity, a GSM subscriber can receive the service when he changes the terminal from the GSM MS to the H.323 terminal.
 - The GSM network remains the same.
- Terminal Mobility, Session Mobility, Service Mobility



Introduction to iGSM [2/2]

- iGSM Gateway performs the conversion for communication protocols and transmission formats between GSM and H.323 networks.
 - GSM MAP and RAS protocol translation
 - GSM/PSTN/IP call setup and release
- iGSM Gatekeeper records location information as the VLR in a GSM network.

iGSM Architecture





iGSM Gatekeeper

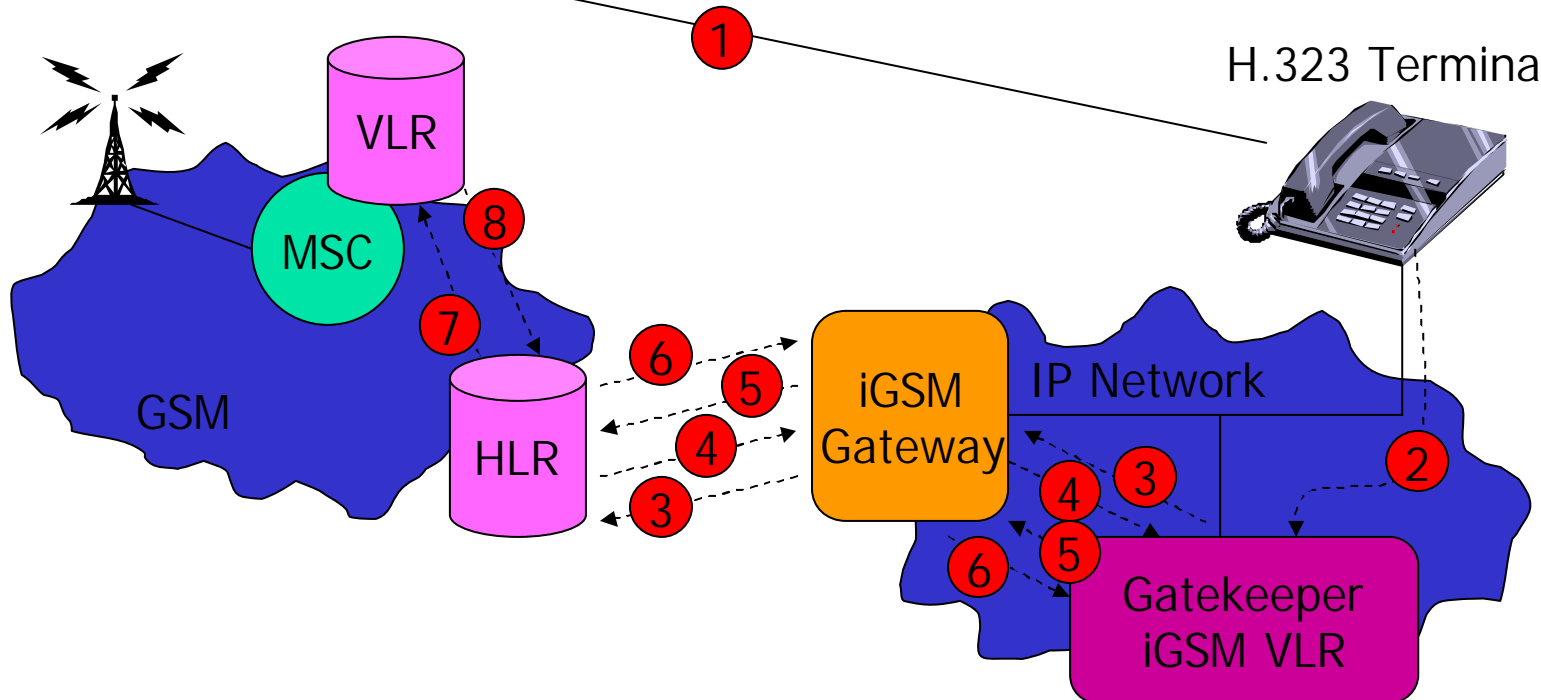
- The iGSM gatekeeper maintains a database that stores information for all iGSM subscribers.
 - MSISDN of the MS
 - Transport address of the H.323 terminal (MS resides)
 - Password of the iGSM subscriber
 - HLR address of the iGSM subscriber
 - IMSI of the MS
 - User profile that indicates the service features and restrictions of the iGSM subscriber
 - Presence indication

Registration

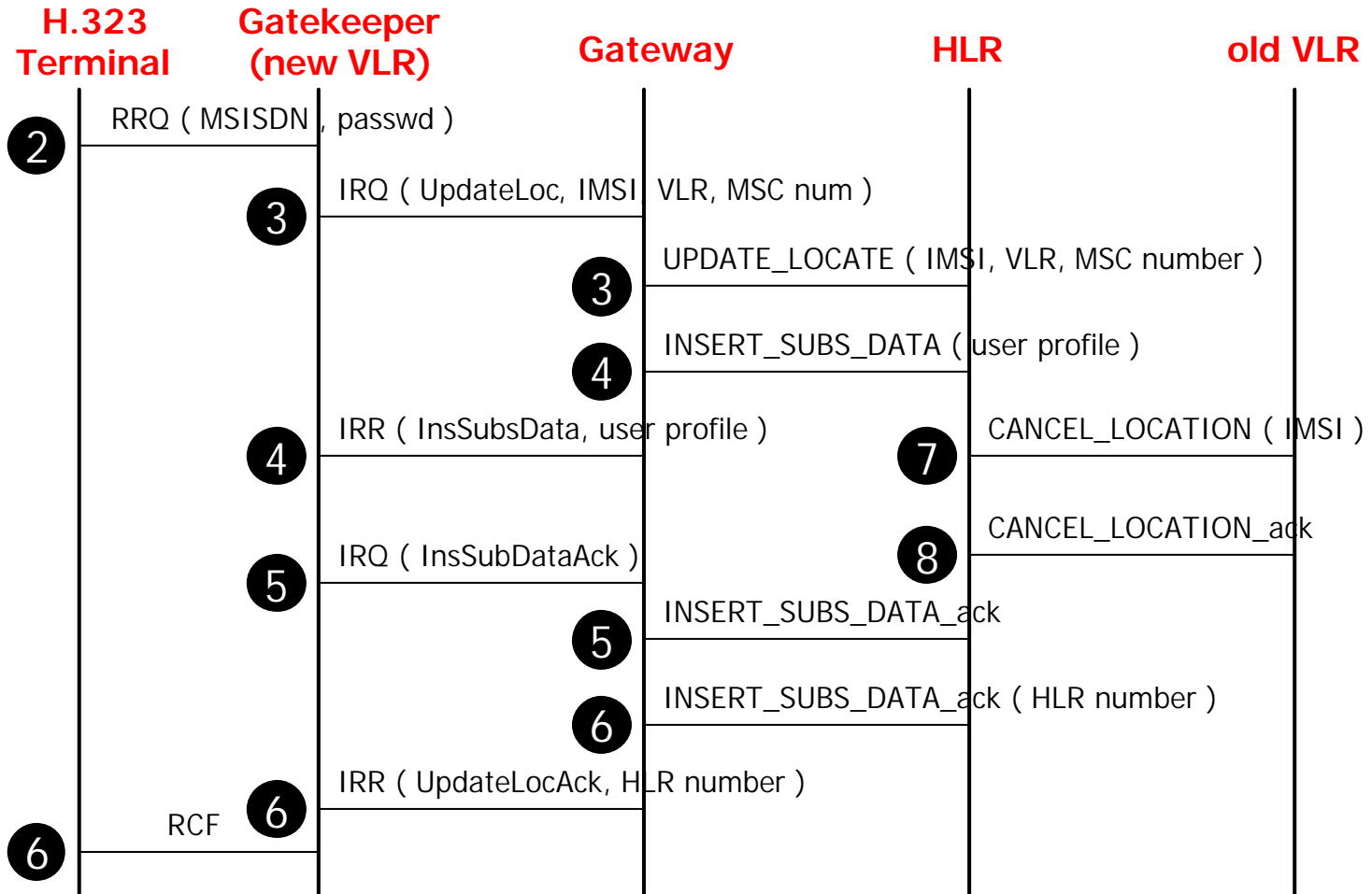


MS

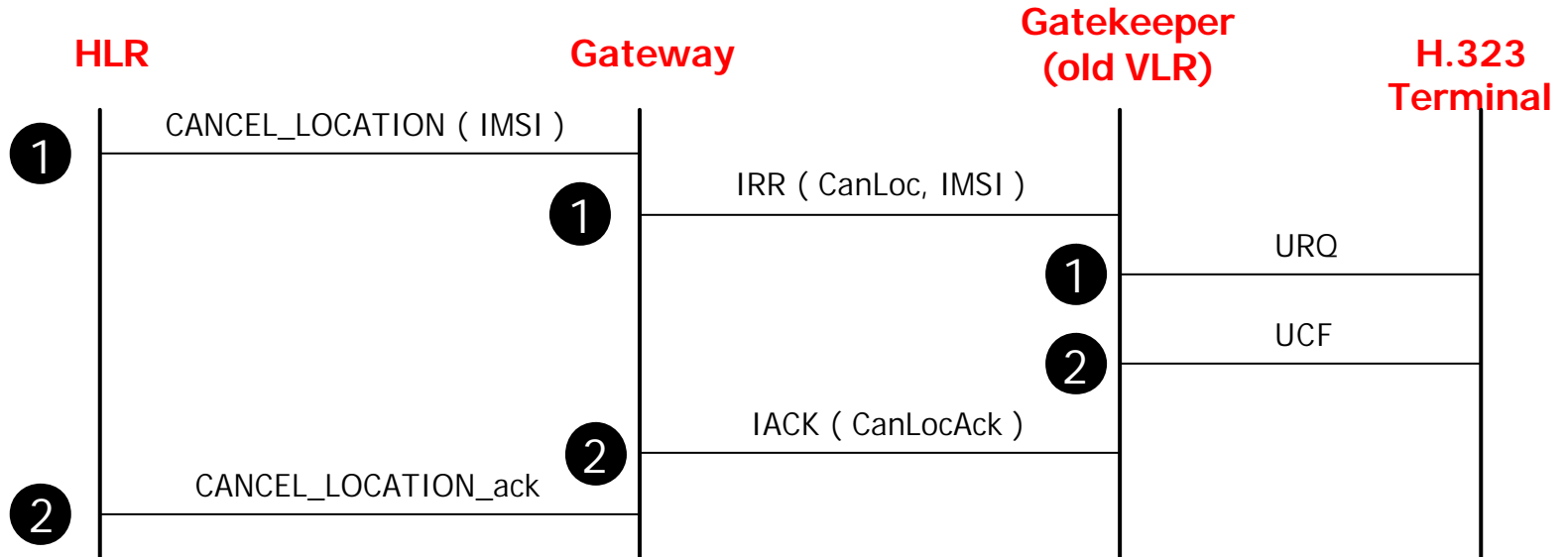
H.323 Terminal



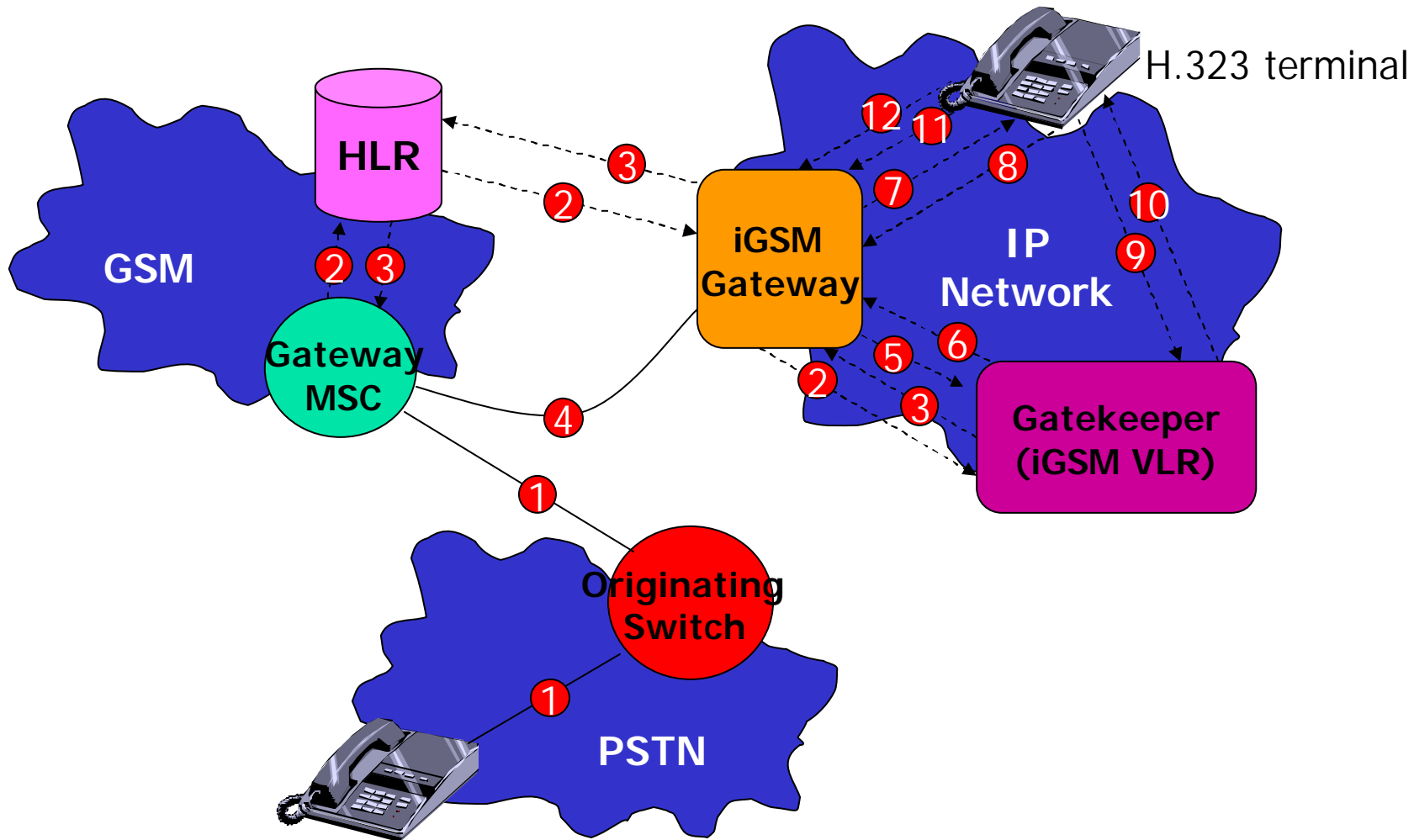
Message Flow (Registration)



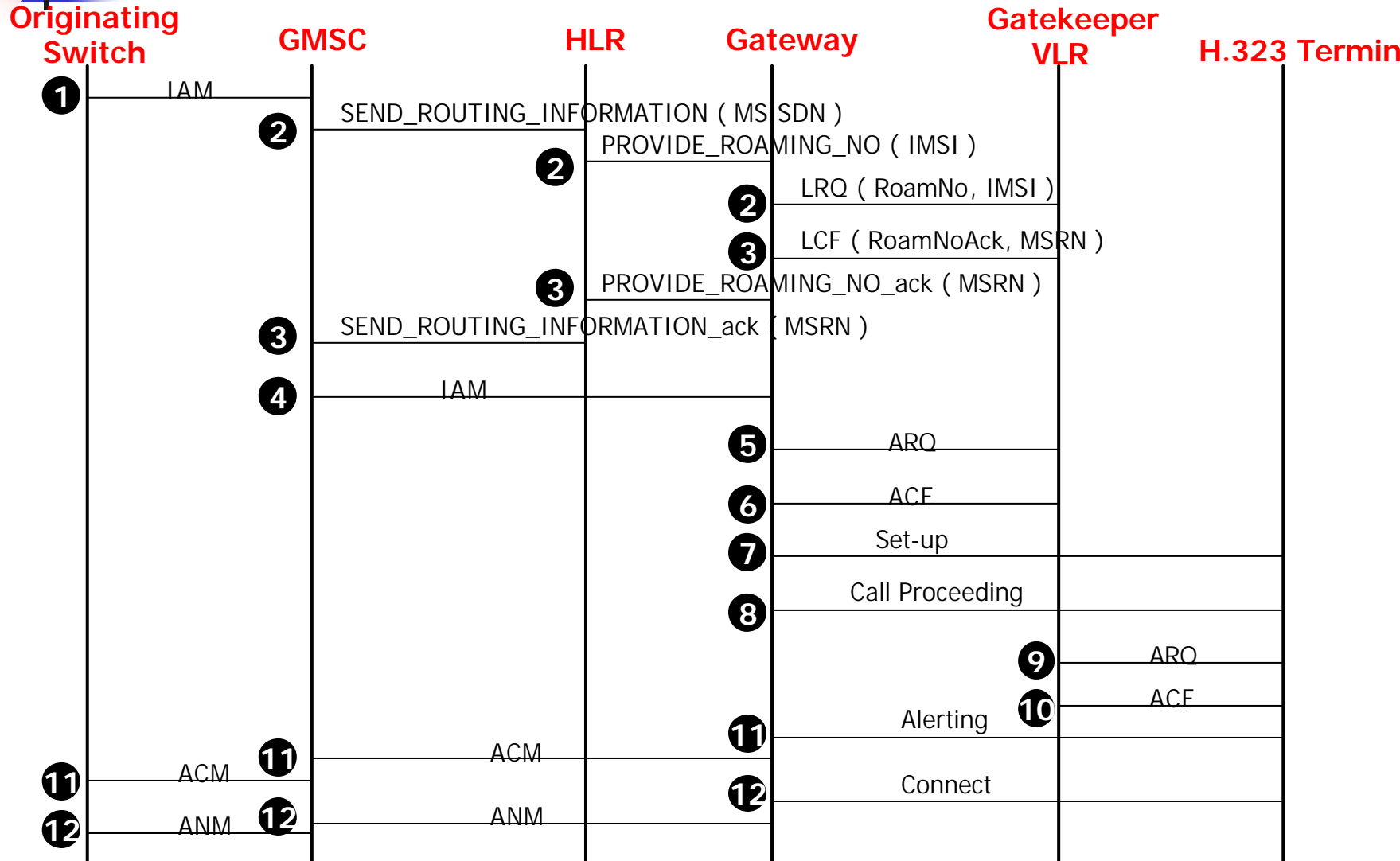
Message Flow (De-registration)



Call Delivery

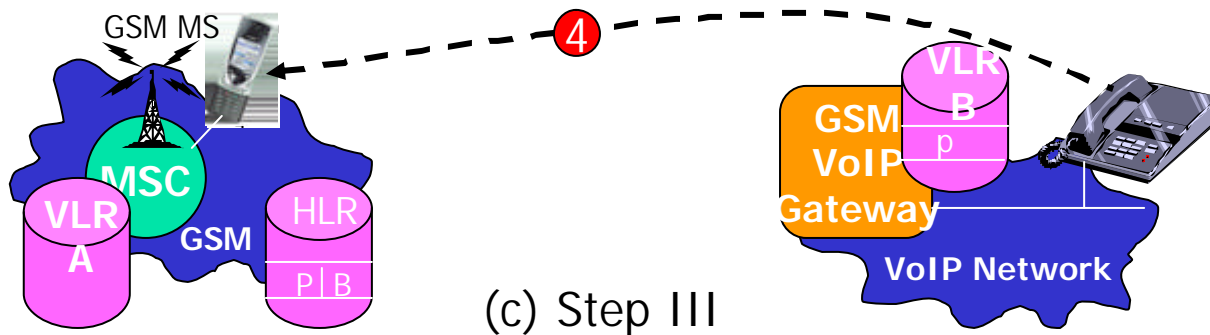
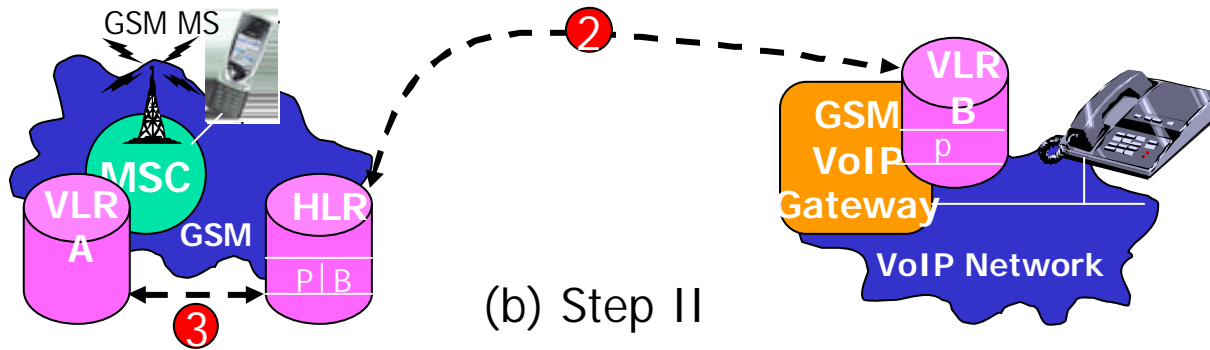
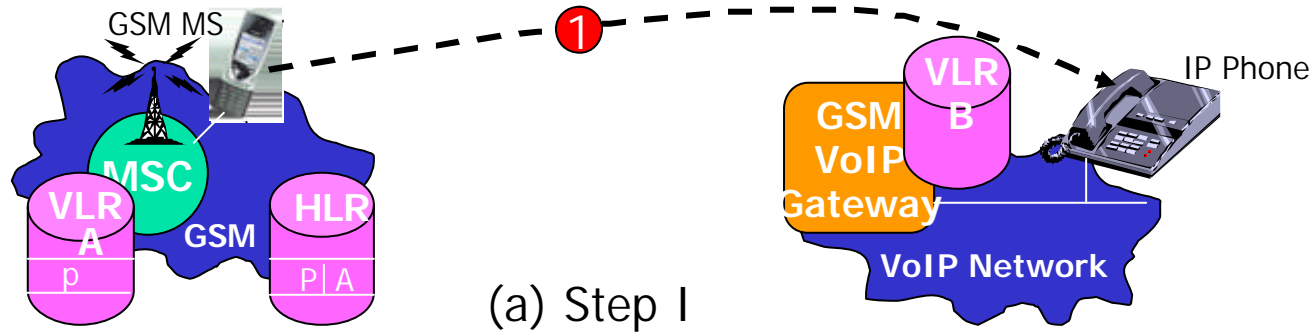


Message Flow (Call Delivery)



Conversation

Mis-routing Scenario [1/2]



Summary

- The incoming calls to the user are misrouted until one of the following events occurs.
 - The subscriber originates a call.
 - The subscriber moves to another location area (LA).
- We proposed an analytic model to study mis-routing due to user mobility in iGSM.
- The results indicate that the probability of one mis-routed call delivery is about 1~20%.
- To avoid the mis-routing problem, the iGSM subscriber should turn off their MS when moving to the IP network.
 - The “turn-off” action results in a detach GSM message to de-register the MS.
 - When the subscriber turns on the MS in the GSM coverage area, an explicit registration is performed.
- Mis-routing calls are not necessarily lost. With call forwarding on no reply, these calls can be forwarded to an appropriate destination or mailbox.