AKADEMIA GÓRNICZO-HUTNICZA
IM. STANISŁAWA STASZICA W KRAKOWIE

Systemy sygnalizacji i zarządzania TI

SS7: ISUP, usługi

Krzysztof Wajda

Katedra Telekomunikacji AGH
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Outline

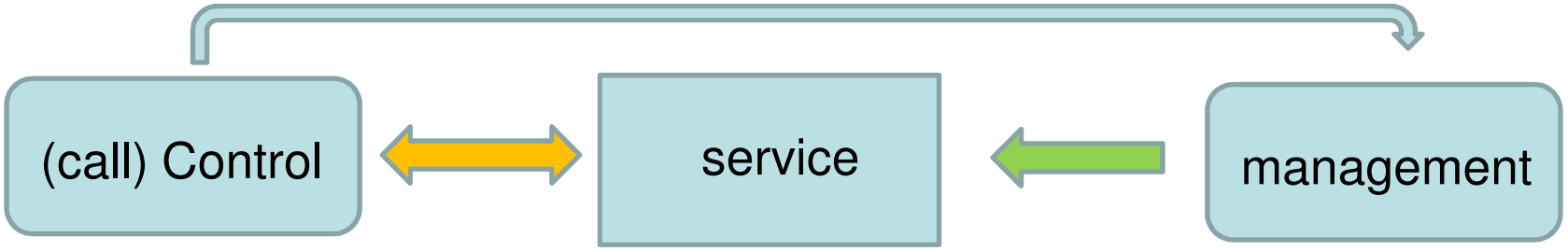
- Service provisioning
- ISDN - revisited
- ISDN access signalling – DSS1
- Messages
- Basic call process
- Services: basic and supplementary

Service provisioning

Services (types)

- Basic services
- Supplementary services
- Advanced (*intelligent*) services

Services



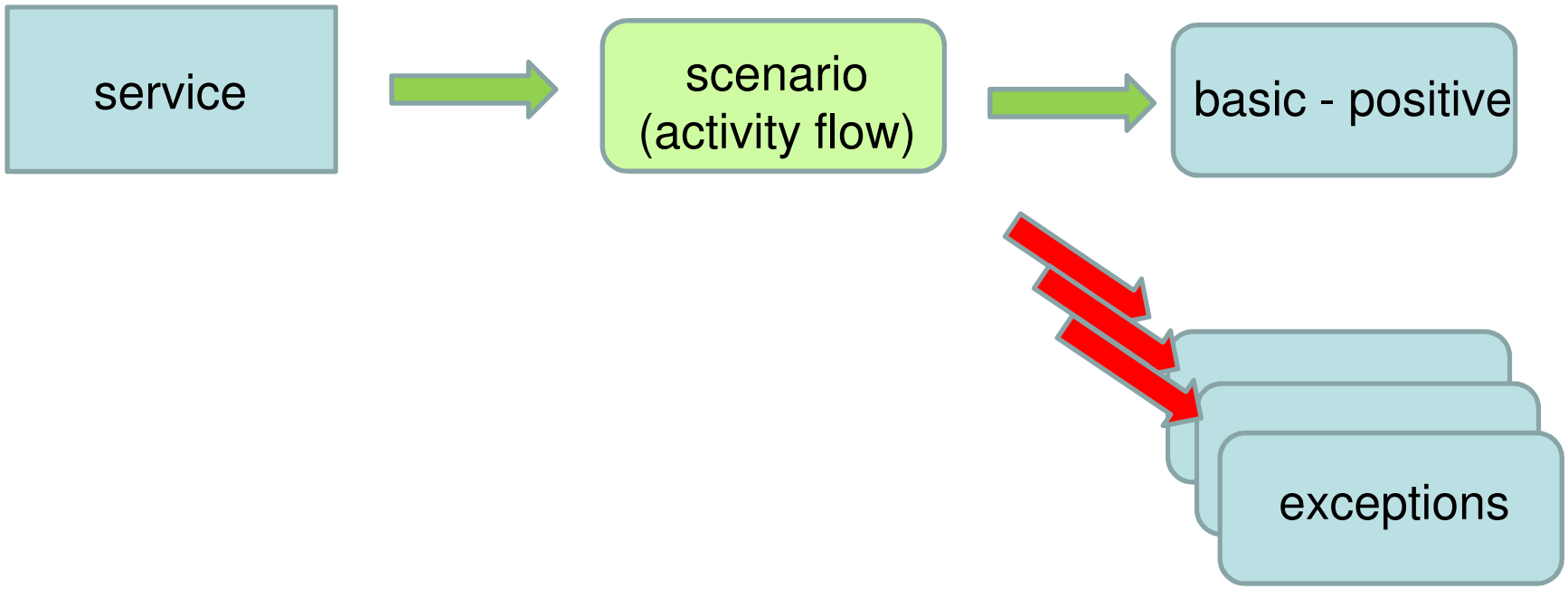
each instance

service template

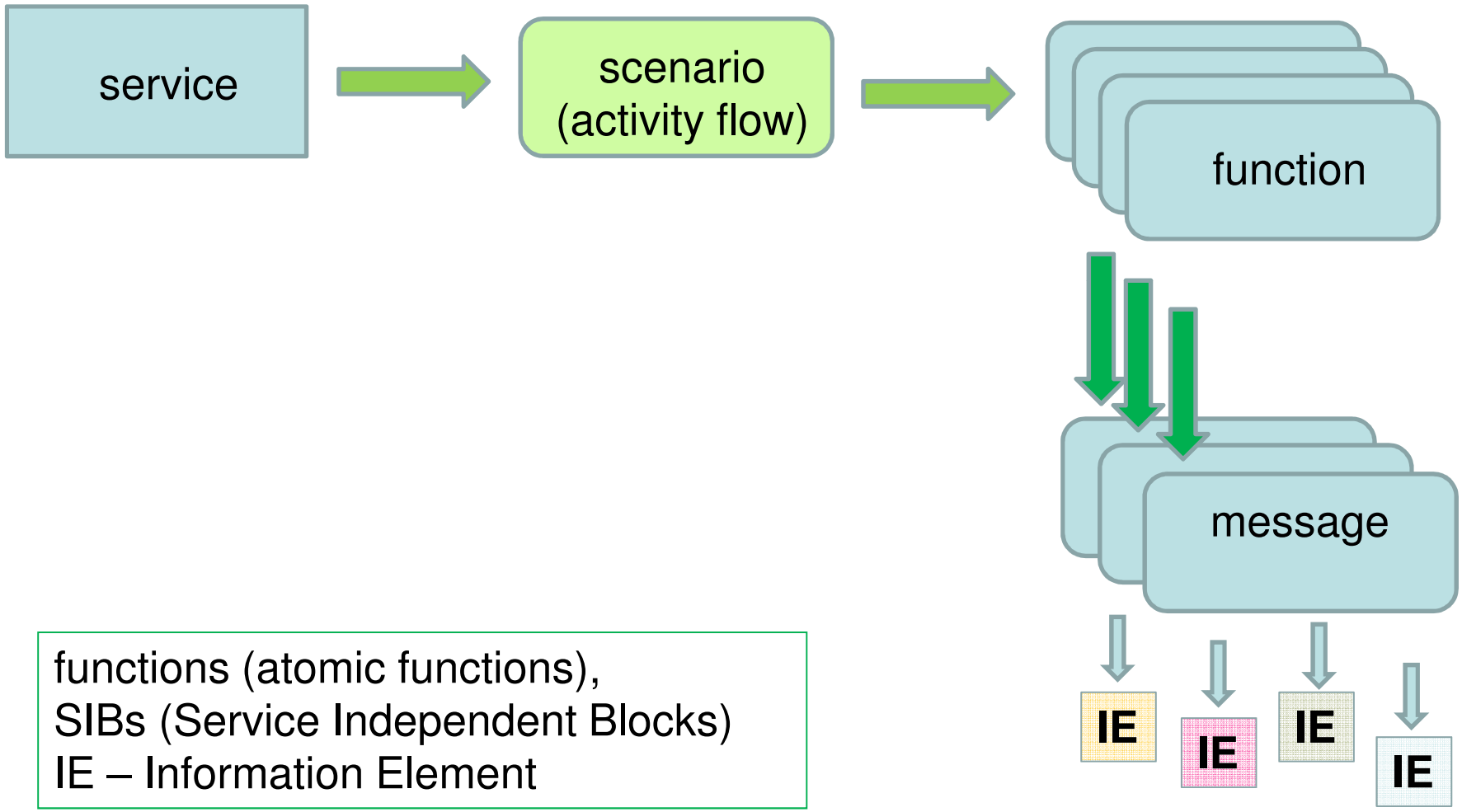
service provisioning

service reconfiguration

Services – versions, clauses



Services – building blocks



functions (atomic functions),
SIBs (Service Independent Blocks)
IE – Information Element

Services in (B)ISDN

ISDN

- ISDN service is a digital technology for access and intranetwork
- The basic ISDN bearer capability is circuit-switched mode unrestricted digital transmission, supporting on-demand, point-to-point, bidirectional and symmetric digital connectivity

ISDN - access configuration

- **2B+D** 2x 64kbit/s channels + 16 kbit/s packet/signalling channel (Basic Rate Access)
- **23B+D** 23 x 64 kbit/s + 16 kbit/s packet/signalling channel (Primary Rate Access)
- **n x 64 + D** n x 64 kbit/s channels (n from 1 to 23)
- **30B+D** 30 x 64 kbit/s + 64 kbit/s packet/signalling channel
- **H0+D** A nonchannelized 384 kbit/s channel plus 64 kbit/s packet/signalling channel
- **H11** A nonchannelized 1.536 (signalling within another D-channel interface)
- **H12** A nonchannelized 1.920 (signalling within another D-channel interface)

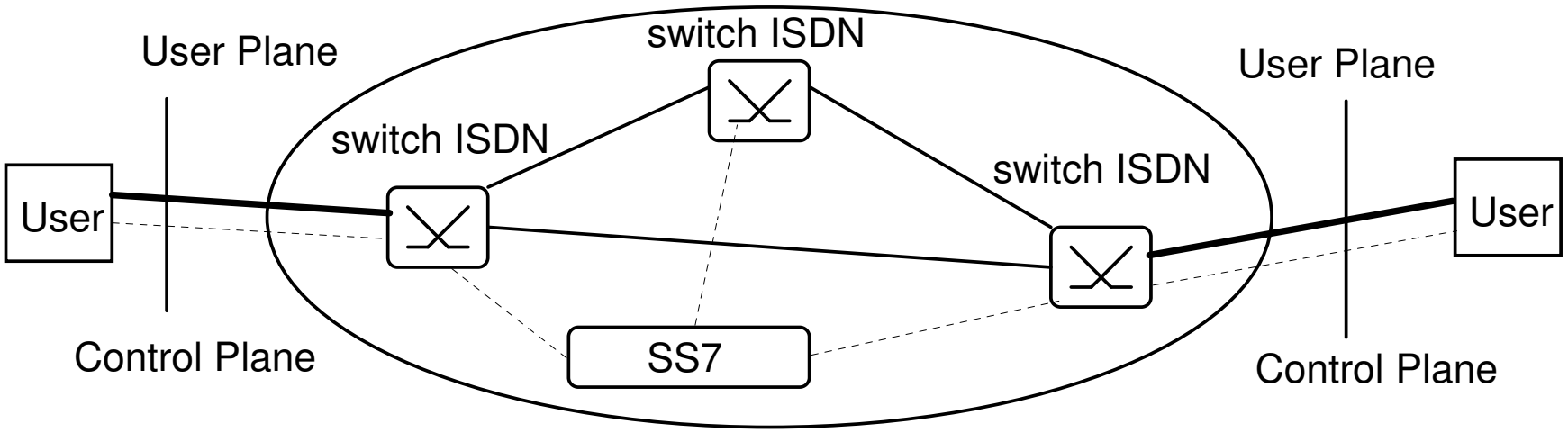
SS7 for ISDN

- User-network signalling (done using complementary system DSS1)
- ISUP
- Basic call process
- Supplementary services

SS7 and DSS1

- User-network signalling - DSS1, H323, SIP, UNI
- Intranetwork signalling - SS7 (and next dedicated systems like SIGTRAN, B-ISUP, B-ICI, P-NNI, H.323, SIP, RSVP-TE, … CR-LDP)

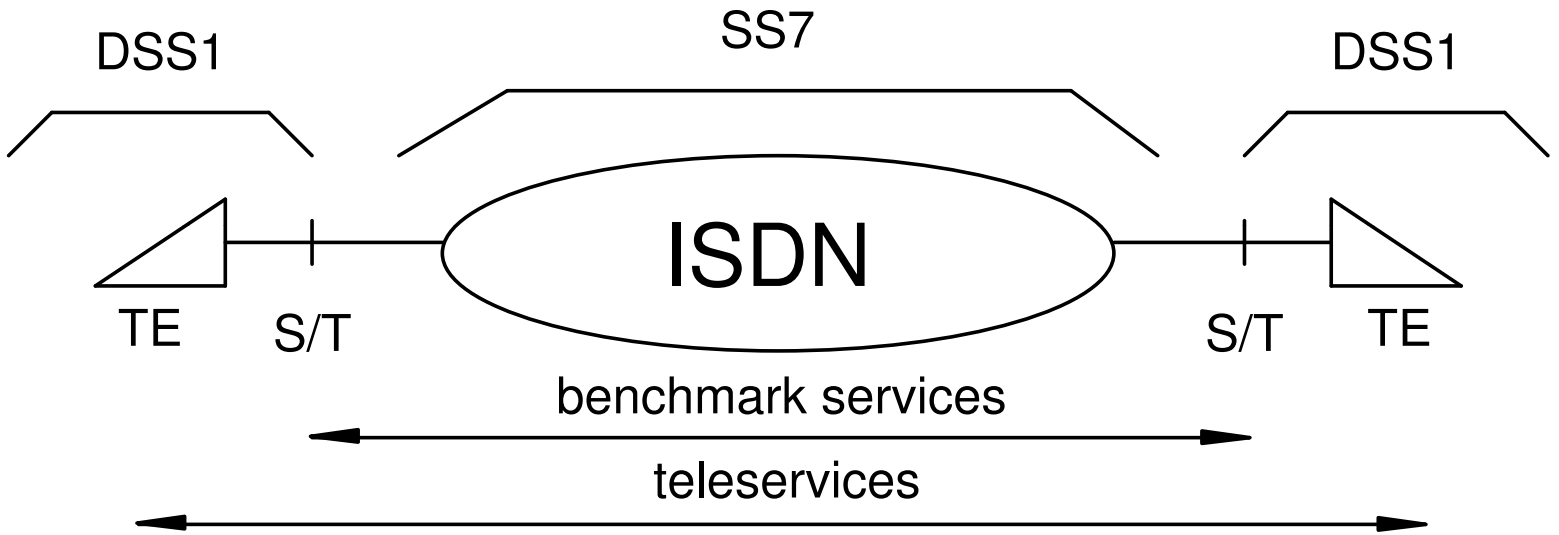
ISDN network



ISDN signalling

- Call control
- Message functional definitions and content
- Information elements coding
- Description of various control procedures

User and network signalling in ISDN



DSS1

- User-network signalling
- Limited number of services
- Narrowband services
- Described in Q.931

Messages for Circuit Mode Connection Control - DSS1 [1]

- Call Establishment Messages
- Call Information Phase Messages
- Call Clearing Messages
- Miscellaneous Messages

Messages for Circuit Mode Connection Control - DSS1 [2]

- Call Establishment Messages:
  - ALERTING
  - CALL PROCEEDING
  - CONNECT
  - CONNECT ACKNOWLEDGE
  - PROGRESS
  - SETUP
  - SETUP ACKNOWLEDGE

Messages for Circuit Mode Connection Control - DSS1 [3]

- Call Information Phase Messages
  - RESUME
  - RESUME ACKNOWLEDGE
  - RESUME REJECT
  - SUSPEND
  - SUSPEND ACKNOWLEDGE
  - SUSPEND REJECT

Messages for Circuit Mode Connection Control - DSS1 [4]

- Call Clearing Messages
  - DISCONNECT
  - RELEASE
  - RELEASE COMPLETE

Messages for Circuit Mode Connection Control - DSS1 [5]

- Miscellaneous Messages
  - INFORMATION
  - NOTIFY
  - STATUS
  - STATUS ENQUIRY

Brief description of Q.931 Messages [DSS1]

- Each message contains:
  - The protocol discriminator
  - The length of the call reference value
  - The call reference
    - (CR does not have end-to-end significance across ISDN)
  - The message type
  - Other IEs

Brief description of Q.931 Messages

- **ALERTING***: message sent by the called user to the network and by the network to the calling user to indicate that called-user alerting has been initiated
- **CALL PROCEEDING***: message sent by the called user to the network or by the network to the calling user. In the network-user direction, it indicates that the requested call establishment information will be accepted
- **CONNECT***: message sent by the called user to the network or by the network to the calling user to indicate call acceptance by the called user

Brief description of Q.931 Messages

- **CONNECT ACKNOWLEDGE**. This message is sent by the network to the called user to indicate the user has been awarded the call. It may also be sent by the calling user to the network to allow symmetric call control procedures.
- **DISCONNECT**. This message is sent by the user to request the network to clear an end-to-end connection, or is sent by the netw ork to indicate that the end-to-end connection is cleared.
- **INFORMATION.** This message is sent by the user or the network to provide additional information. It may be used to provide information for call establishment or miscellaneous call-relate information.

Brief description of Q.931 Messages

- **NOTIFY.** This message is sent by the user or network to indicate information pertaining to a call, such as user suspended.
- **PROGRESS.** This message is sent by the user or the network to indicate the progress of a call in the event of interworking or in relation with the provision of inband information or pattems.

Brief description of Q.931 Messages

- **RELEASE.** This message is sent by the user or the network to indicate that the equipment sending the message has disconnected the channel (if any) and intends to release the channel and the call reference, and that the receiving equipment should release the channel and prepare to release the call reference after sending.
- **RELEASE COMPLETE.** This message is sent by the user or network to indicate that the equipment sending the message has released the channel (if any) and call reference,the channel is available for reuse,and the receiving equipment will release the call reference.

Brief description of Q.931 Messages

- **RESUME.**This message is sent by the user to request the network to resume a suspended call.
- **RESUME ACKNOWLEDGE.** This message is sent by the network to the user to indicate completion of a request to resume a suspended call.
- **RESUME REJECT.** This message is sent by the network to the user to indicate failure of a request to resume a suspended call.

Brief description of Q.931 Messages

- **SETUP.** This key message is sent by the calling user to the network and by the network to the called user to initiate call establishment.This message is discussed more below.
- **SETUP ACKNOWLEDGE.** This message is sent by the network to the calling user (or by the called user to the network) to indicate that call establishment has been initiated,but additional information may be required.
- **STATUS.** This message is sent by the user or the network in response to a STATUS ENQUIRY message or at any time during a call to report certain error conditions.

Brief description of Q.931 Messages

- **STATUS ENQUIRY.** This message is sent by the user or the network at any time to solicit a STATUS message from the peer layer 3entity (sending a STATUS message in response to a STATUS ENQUIRY message is mandatory).
- **SUSPEND.** This message is sent by the user to request the network to suspend a call.
- **SUSPEND ACKNOWLEDGE.** This message is sent by the network to the user to indicate completion of a request to suspend a call.
- **SUSPEND REJECT.** This message is sent by the network to the user to indicate failure of a request to suspend a call.

Brief description of Q.931 Messages

- SEGMENT,CONGESTION CONTROL, and USER lNFORMATION messages are not shown above since they are not for basic call control

Information elements used in ISDN Signalling

Most important:

- protocol discriminator
- call reference
- message type

Information elements used in ISDN Signalling

- Single-Octet Information Elements
  - Shift BCC
  - More data BCC
  - Sending complete BCC
  - Congestion level BCC
  - Repeat indicator BCC

BCC: basic call control and possibly other procedures.
Other: used in other than basic call control.

Information elements used in ISDN Signalling

- Variable-Iength Information Elements
  - Segmented message BCC
  - Bearer capability BCC
  - Cause BCC
  - Call identity BCC
  - Call state BCC
  - Channel identification BCC
  - Progress indicator BCC
  - Network-specific facilities BCC

Information elements used in ISDN Signalling

• Notification indicator	BCC
• Display	BCC
• Date/time	Other
• Keypad facility	BCC
• Signal	BCC
• Information rate	Other
• End-to-end transit delay	Other
• Transit delay selection and indication	Other
• Packet layer binary parameters	Other

Information elements used in ISDN Signalling

• Packet layer window size	Other
• Packet size	Other
• Closed user group	Other
• Reverse charge indication	Other
• Calling-party number	BCC
• Calling-party subaddress	BCC
• Called-party number	BCC
• Called-party subaddress	BCC
• Redirecting number	BCC

Information elements used in ISDN Signalling

• Transit network selection	BCC
• Restart indicator	BCC
• Low-layer compatibility	BCC
• High-layer compatibility	BCC
• User-user	BCC
• Escape for extension	Other

ISDN-UP (ISUP)

- Provides signalling functions for basic bearer services and supplementary services, for switched voice and non-voice (data) applications in an ISDN
- Provides all functions accomplished by TUP plus additional functions for non-voice services, ISDN and Intelligent Network services
- First version of ISUP was published in 1984 CCITT Red Book, then enhanced in 1988 Blue Book

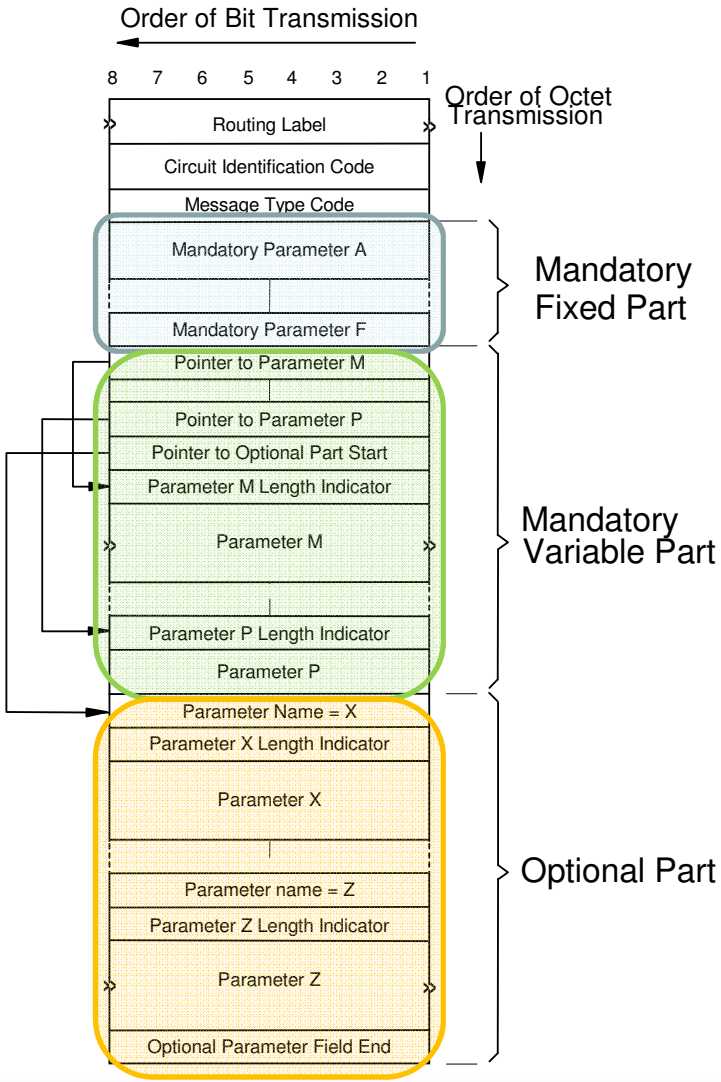
ISUP

- The ISUP meets the requirements defined by ITU for worldwide international telephone and circuit-switched data traffic
- The ISUP is also suitable for national applications.
- Most signaling procedures, information elements, and messages specified for international use are also applicable in national versions.
- There are some fields reserved in order to allow national administrations and private operating agencies to introduce network-specific signaling messages and elements of information within the protocol structure
- There is necessity to tune an international version of ISUP to national requirements

ISUP

- ISUP messages have variable lengths (up to 272 octets including MTP level headers)
- All ISUP messages have:
  - routing label indetifying the origin and destination of the message
  - Circuit Identification Code (CIC)
  - Message Type Code
  - Mandatory Fixed Part
  - Mandatory Variable Part
  - Optional Part

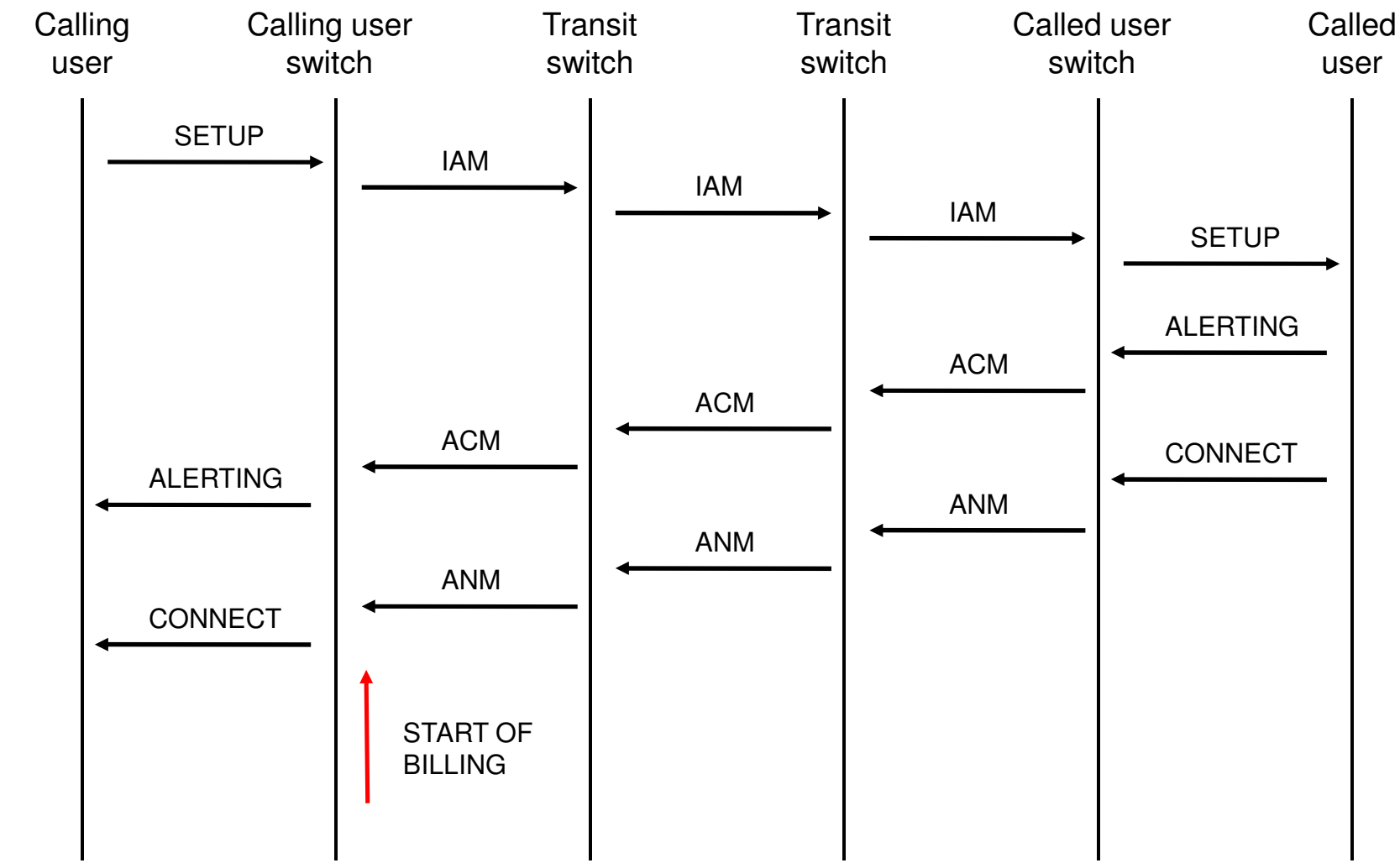
Detailed structure of ISUP message



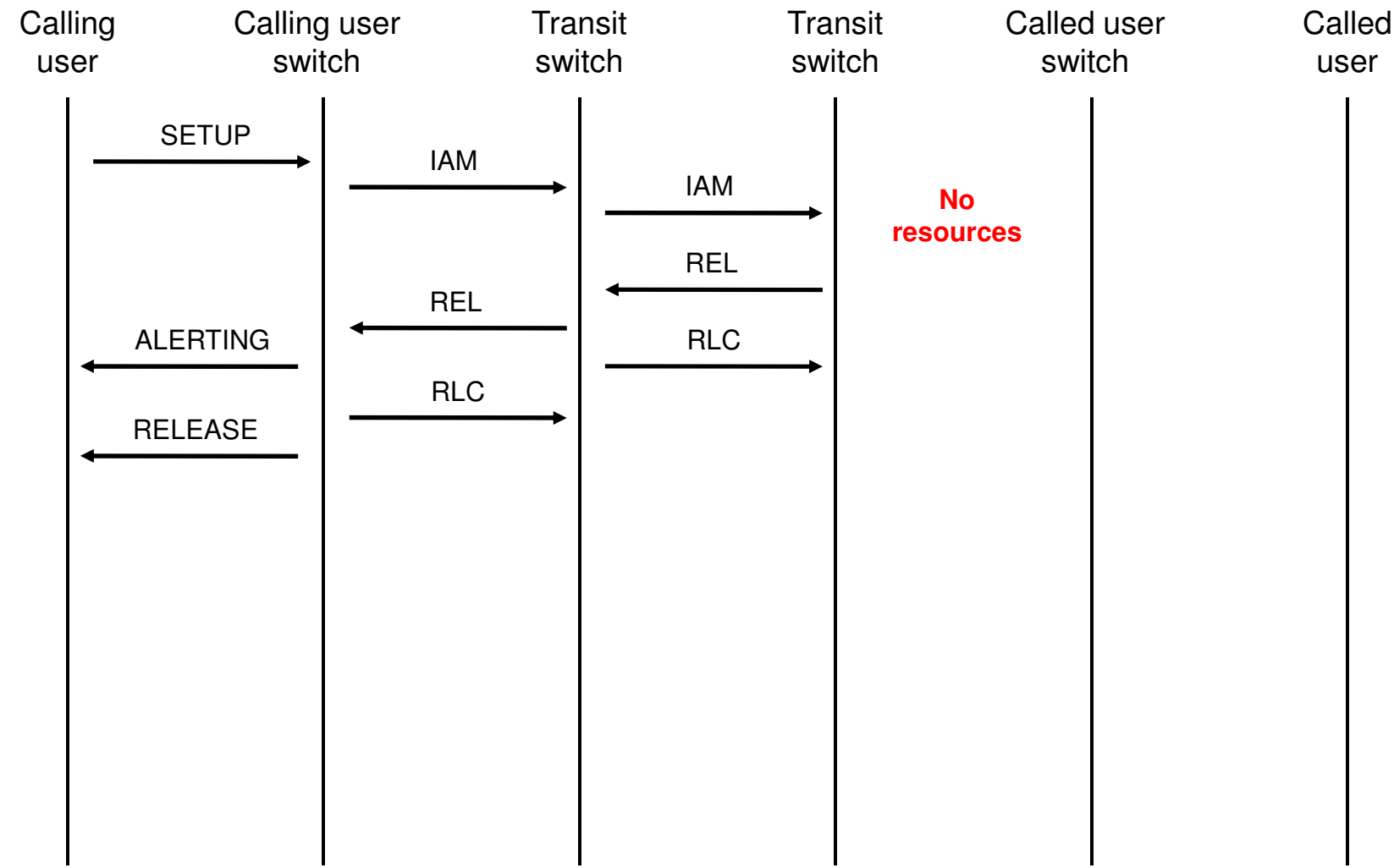
Basic Bearer Service

- Basic service offered by ISUP is controlling of circuit-switched network connections between subscriber-line exchange terminations
- User-network signalling is accomplished by DSS1 protocol on the D-channel
- Call set-up and release needs interworking of DSS1 and ISUP procedures

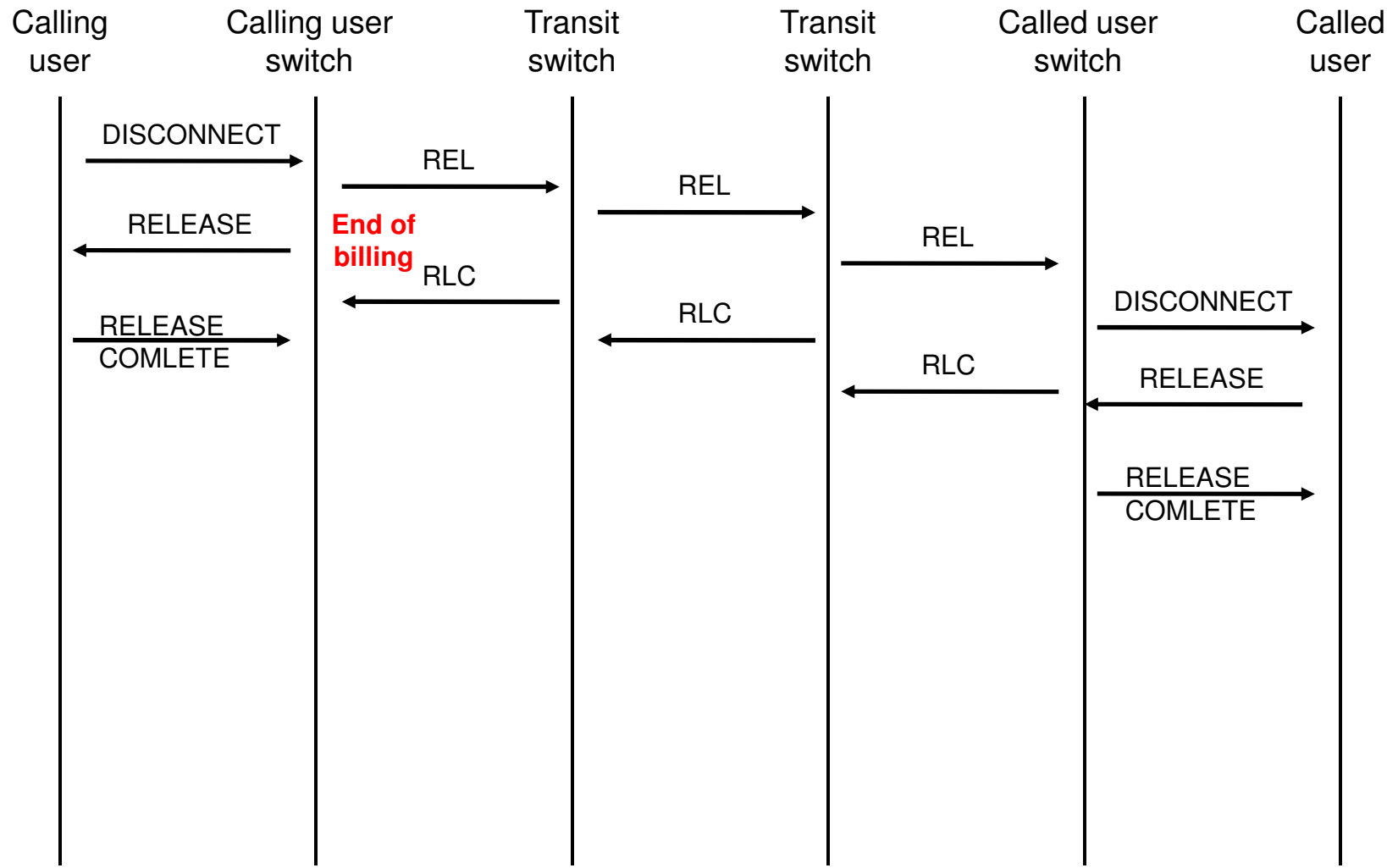
Basic call setup - positive



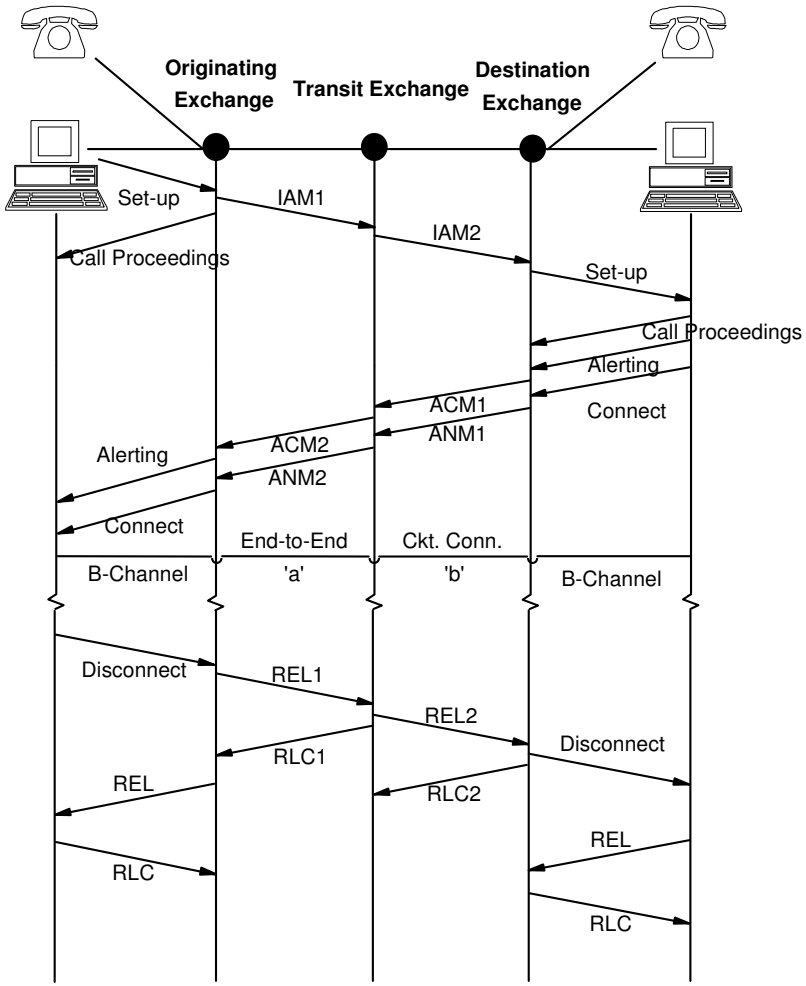
Basic call setup - negative



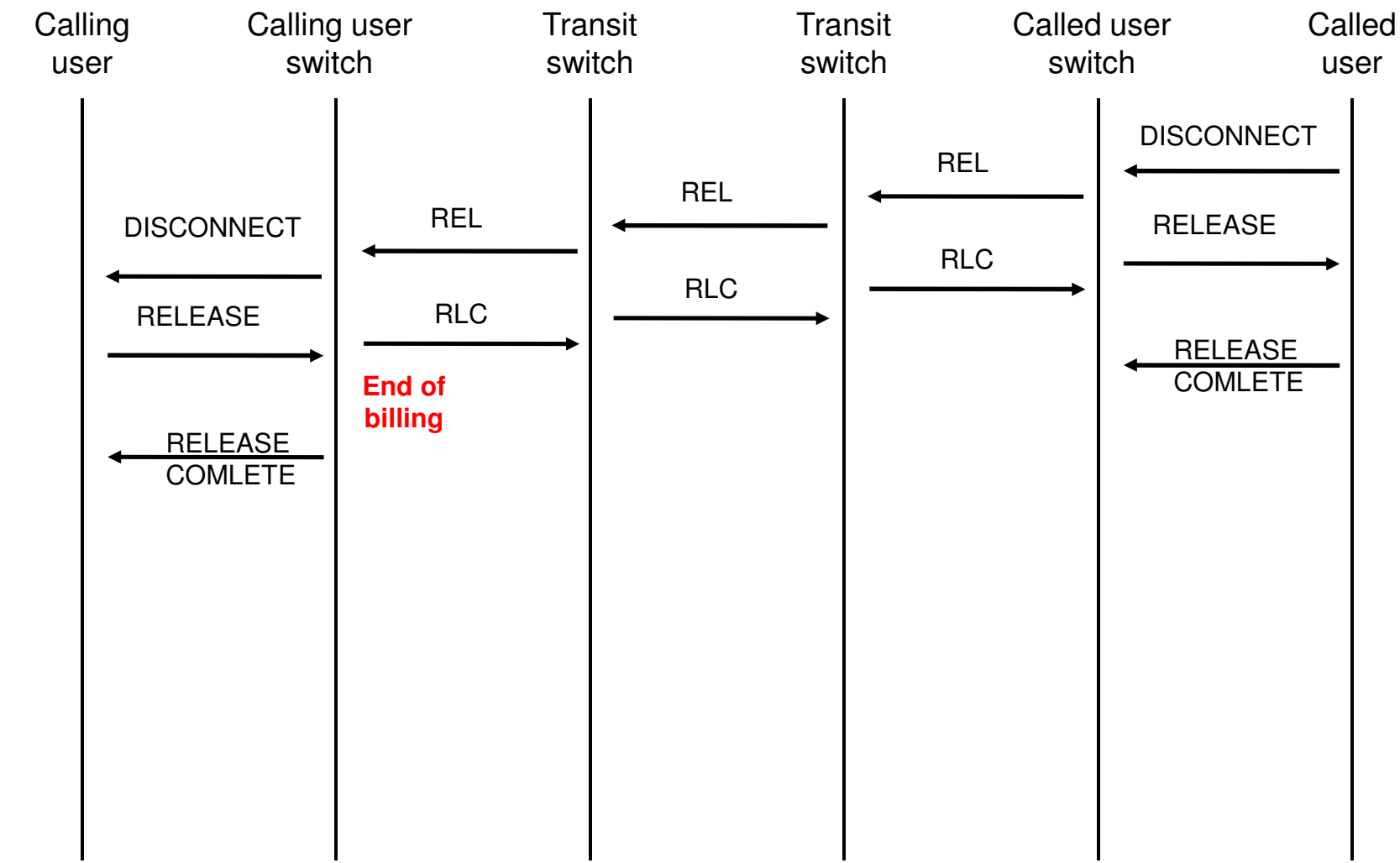
Basic call setup – disconnection from calling party (A)



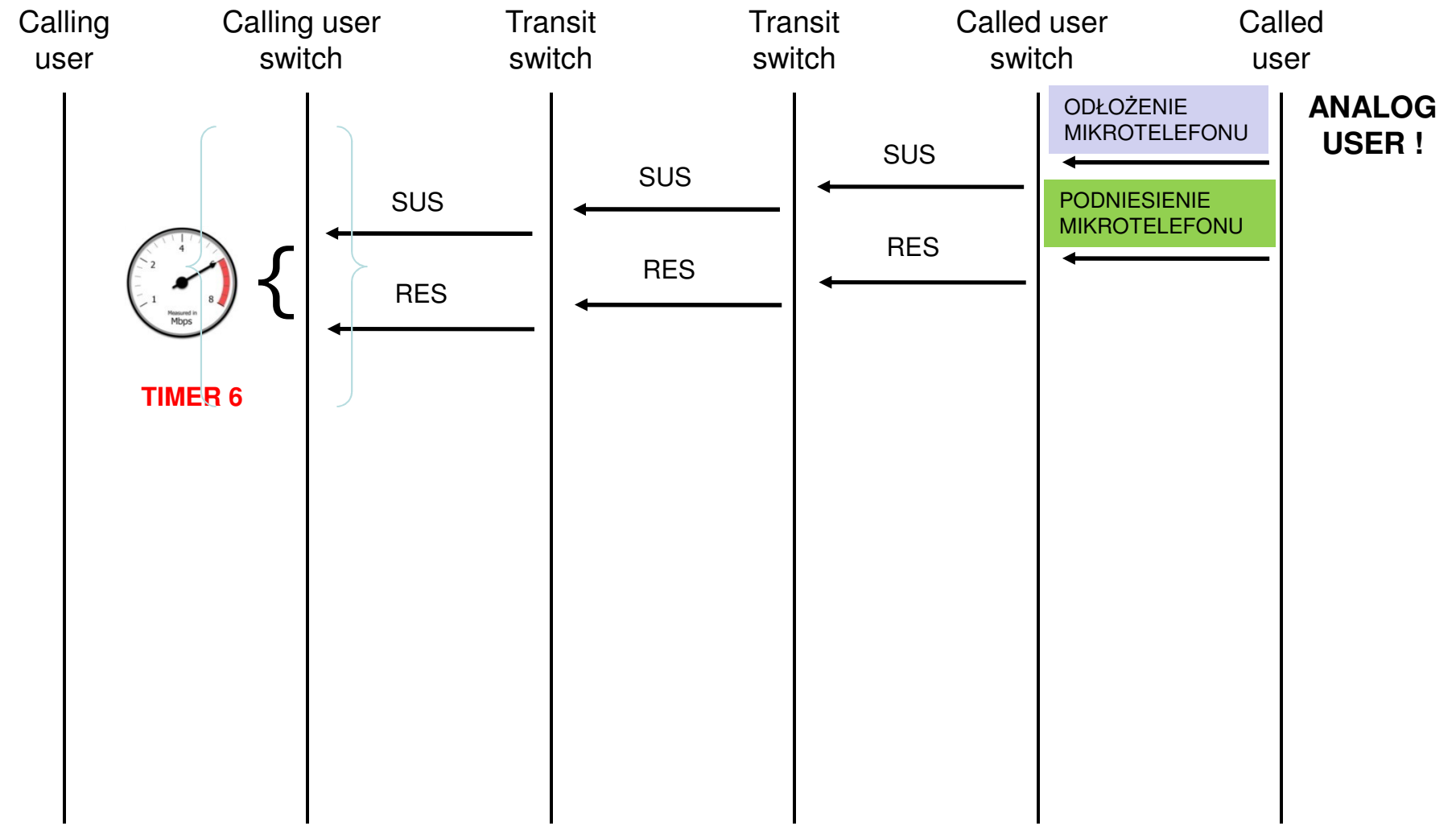
ISDN-UP message scenario



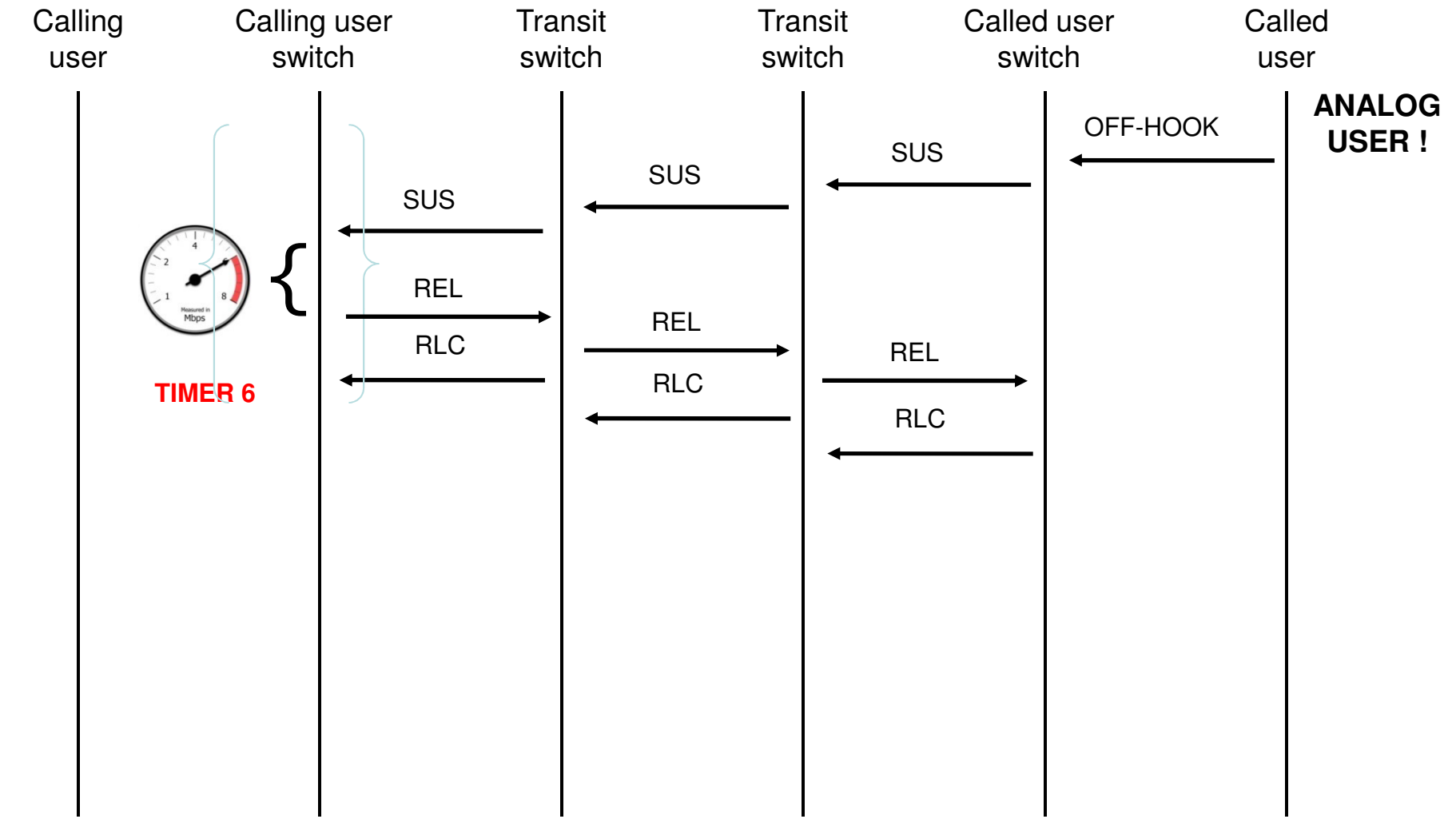
Basic call setup – disconnection from called party (B)



Basic call setup – SUSPEND + RESUME from called party (B)



Basic call setup – disconection from called party (B)



Summary

- ISUP includes a basic set of services
- Basic call control procedures are simple and reliable
- Supplementary services enhance functionality and are open for further additions

References

- G. Danilewicz, W. Kabaciński, System Sygnalizacji nr 7, WKŁ, 2005
- Q.931
- Q.761-764
- Lectures available at: http://kt.agh.edu.pl/~wajda

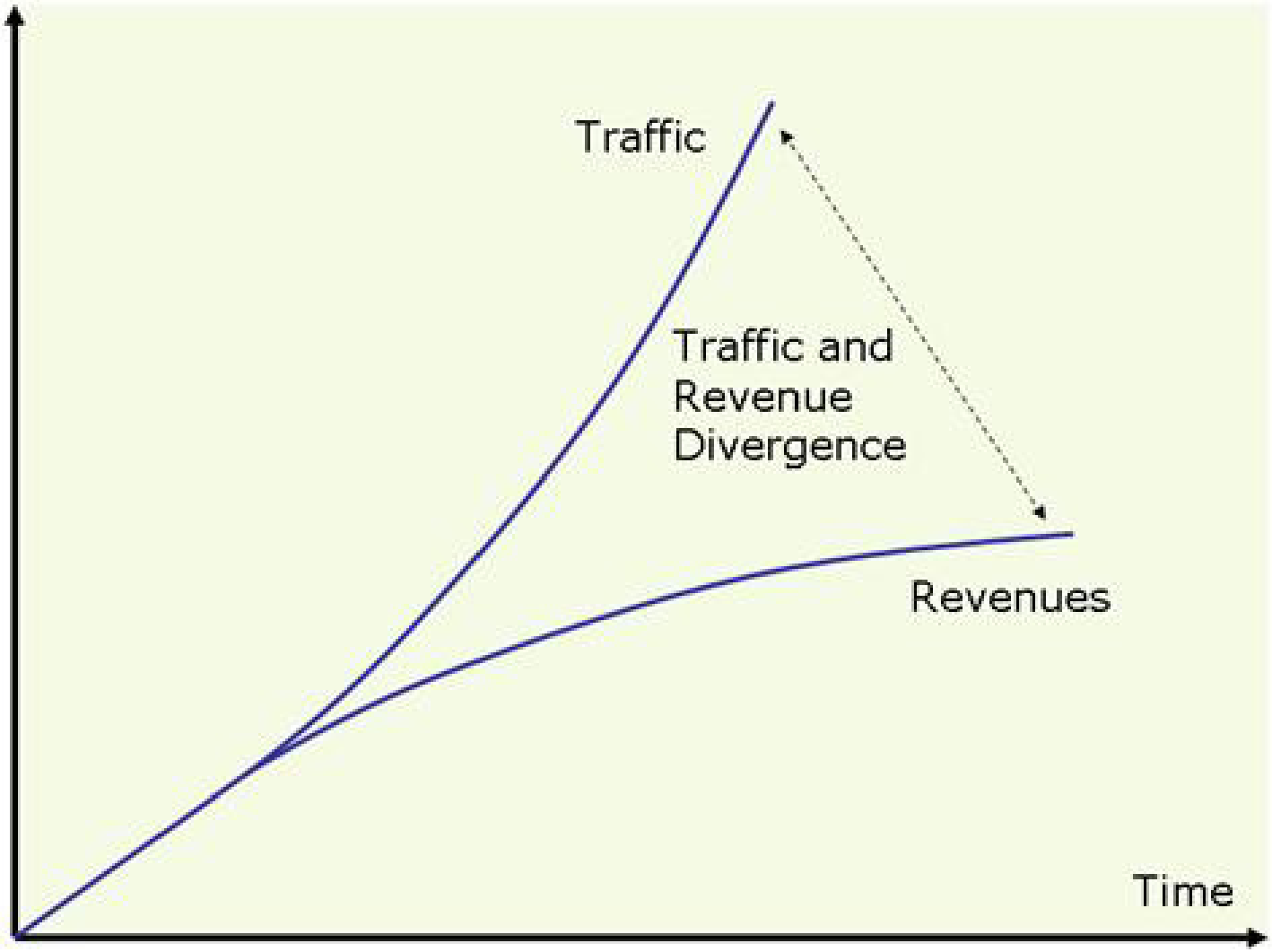
ISUP - services

Supplementary Services for ISDN

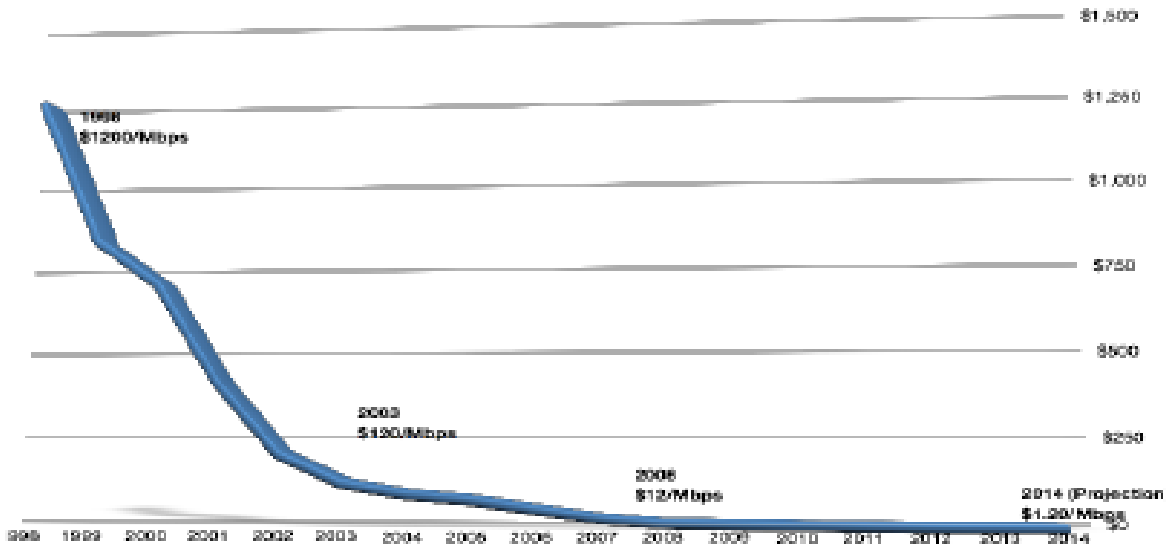
Towards IN

- „dumb pipe”
- Reduction of operator’s role to data transit (no advanced services)
- More competition, lowering revenue
- Competition stimulated by prices

Pricing trends in telecom market

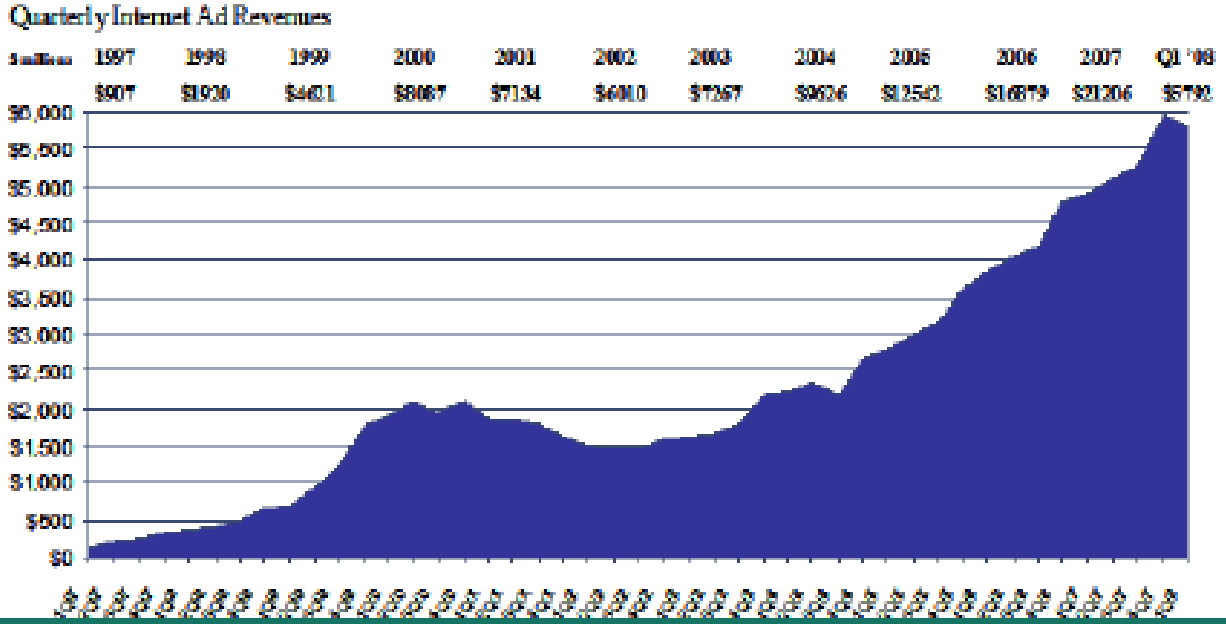


Market Forces in New Internet



Revenue from Internet Transit

Source: Dr. Peering, Bill Norton



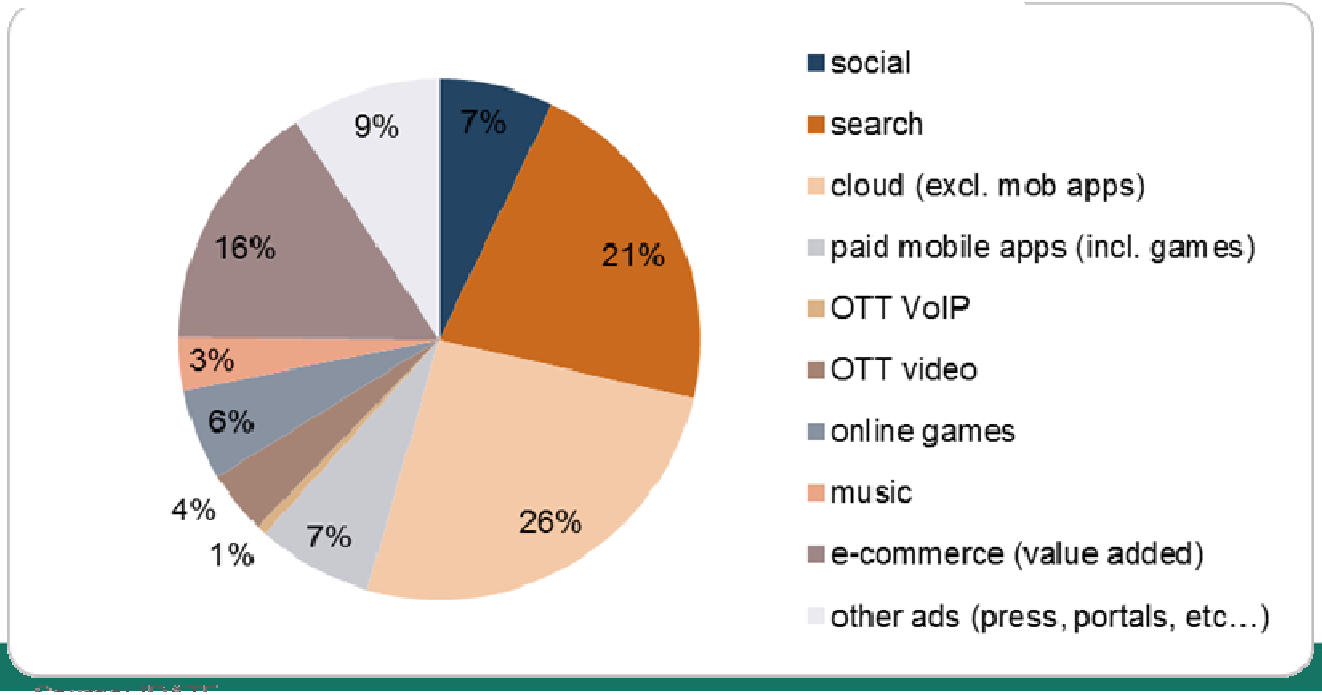
Revenue from Internet Advertisement

Source: Interactive Advertising Bureau

OTT (Over-the-Top)

- termin oznacza dostarczanie treści i usług, np. audio i wideo przez internet bez zaangażowania i kontroli ze strony operatora

Breakdown of OTT service market, 2015



Supplementary services

- Supplementary services add more functionality to calls established in ISDN network
- They invoke some functions which are terminal-specific
- Typical supplementary services are:
  - user-to-user signalling — SMS
  - closed-user group — VPN
  - call forwarding — ROUTING
  - calling line identification — SECURITY
  - etc.

Abbr.	Service/Feature	Abbr.	Service/Feature
AAB	Automatic Alternative Billing (S)	ABD	Abbreviated Dialling (SF)
ACB	Automatic Call-Back (F)	ACC	Automatic Card Calling (S)
ATT	Attendant (F)	AUTC	Authentication (F)
AUTZ	Authorization Code (F)	CCBS	Completion of Call to Busy Subscriber (S)
CCC	Credit Card Calling (S)	CD	Call Distribution (SF)
CF	Call Forwarding (SF)	CFC	Call Forwarding on Busy Line/Don't Answer (F)
CHA	Call Hold with Announcement (F)	COC	Consultation Calling (F)
CON	Conference Calling (S)	CPM	Customer Profile Management (F)
CRA	Customized Recorded Announcement (F)	CRD	Call Rerouting Distribution (S)
CRG	Customized Ringing (F)	CUG	Closed User Group (F)
CW	Call Waiting (F)	DCR	Distribution Call Routing (S)
DUP	Destination User Prompter (F)	FMD	Follow-Me Diversion (SF)
FPH	Freephone (S)	GAP	Call Gapping (F)
LIM	Call Limiter (F)	LOG	Call Logging (F)
MAS	Mass Calling (SF)	MCI	Malicious Call Identification (S)
MMC	Meet-Me Conference (F)	MWC	Multi-Way Calling (F)
OCS	Originating Call Screening (SF)	ODR	Origin-Dependent Routing (F)
OFA	Off-Net Access (F)	ONC	Off-Net Calling (F)
ONE	One Number (F)	OUP	Originating User Prompter (F)
PN	Personal Numbering (F)	PNP	Private Numbering Plan (F)
PRM	Premium Rate (S)	PRMC	Premium Charging (F)
QUE	Call Queueing (F)	REVC	Reverse Charging (F)
SCF	Selective Call Forward on Busy/Don't Answer (S)	SEC	Security Screening (S)
SPL	Split Charging (S)	SPLC	Split Charging (F)
TCS	Terminating Call Screening (SF)	TDR	Time-Dependent Routing (F)
TRA	Call Transfer (F)	UAN	Universal Access Number (S)
UDR	User-Defined Routing (S)	UPT	Universal Personal Telecommunications (S)
VOT	Televoting (S)	VPN	Virtual Private Network (S)

Supplementary services

- Number identification:CLIP, CLIR, COLP, COLR, SUB
- Connection offering:CFU, CFB, CFNR,CD
- Call management: HOLD,TP
- 3 –party calling:3PTY
- Add info: UUS

Number Identification Supplementary Services

- Calling line identification presentation (CLIP)
- Calling line identification restriction (CLIR)
- Connected line identification presentation (COLP)
- Connected line identification restriction (COLR)
- Direct Inward Dialing Service
- Multiple Subscriber Number (MSN Supplementary Service
- Malicious Call Identification (MCID) Supplementary Services
- Sub-addressing Supplementary Services (SUB)

Supplementary services (details)

- **Q.731**
- **Stage 3 description for number identification supplementary services using signalling system No. 7**

- Clause 1 (02/92) Direct-dialling-in (DDI)
- Clause 3 (1993) Calling line identification presentation (CLIP)
- Clause 4 (1993) Calling line identification restriction (CLIR)
- Clause 5 (1993) Connected line identification presentation (COLP)
- Clause 6 (1993) Connected line identification restriction (COLR)
- Clause 8 (02/92) Sub-addressing (SUB)

DDI

- **Direct-Dialling-In** (DDI) enables a user to directly call another user on an integrated services private branch exchange or other private system without attendant intervention.
- This supplementary service shall be based on the use of the ISDN number. At least the significant part of the ISDN number shall be passed to the private ISDN, in order to progress the call to the destination.
- Direct-Dialling-In shall apply to public ISDNs having either a closed or an open numbering plan.
- This service shall be provided/withdrawn after pre-arrangement with the service provider. The service provider shall allocate a set of ISDN numbers.

MSU

- The **Multiple Subscriber Number (MSN)** supplementary service provides the possibility for **assigning multiple numbers** (not necessarily consecutive) to a single public or private interface. This enables the selection of one or multiple distinct terminals attached to the same interface. The service provider shall fix the length of the numbers to be transmitted to the user's installation. They may comprise the least significant digit up to the full integrated services digital network ISDN number (E.164)

MSU

- **Multiple Subscriber Number** provides the possibility for assigning multiple integrated services digital network numbers to a single interface. For example, this service:
  - 1) allows dialling from a line connected to a public network directly to terminals connected to a basic access which bas subscribed to Multiple Subscriber Number (e.g. in a passive bus configuration);
  - 2) enables the network to determine which ISDN number is applicable on originating calls (e.g. for charging purposes, for notification to the called party and application for supplementary services).

MSU

- Administrations:
  - may not have knowledge or control over what is connected to the basic access, e.g. an network termination 2 (NT2) or passive bus;
  - may have different numbering methods;
  - may agree that common international terminal specifications are desired.

CLIP

- **Calling Line Identifcation Presentation (CLIP)** is a supplementary service offered to the called party which provides the calling party's ISDN-number, possibly with sub-address information, to the called party.
- When **Calling Line Identification Presentation** is applicable and activated, the network provides the called party with the number of the calling party at call set-up on **all** incoming calls.
- The calling party number may be accompanied by a sub-address.The network should be capable of transmitting at least 15 digits [maximum length of an integrated services digital network (ISDN) number]. In addition, if provided by the calling party, the network should be capable of transmitting a sub-address.

Sub-addressing

- The **sub-addressing** supplementary service allows the called (served) user to expand his addressing capacity beyond the one given by the ISDN number.
- A sub-address, if presented by a calling user, is delivered unaffected to the called (served) user. Only the
- served user defines tbe significance of tbe sub-address. Applications can be for example:
  - 1) to select or to prefer a specific terminal at the called customer's termination;
  - 2) to invoke a specific process in a terminal at the called customer's termination.
- The maximum size of the sub-address is 20 octets.

Supplementary services

- **Q.732**
- **Stage 3 description for call offering supplementary services using Signalling System No. 7**
- Clause 2 (1993) Call diversion services
- Clause 3 (1993) Call forwarding no answer
- Clause 4 (1993) Call forwarding unconditional
- Clause 5 (1993) Call deflection

Call forwarding unconditional

- **Call forwarding unconditional** permits a "served user" to have the network send to another number/interface all incoming calls for the served user's ISDN number (or just those associated with a specified basic service).
- The served user's originating service is unaffected. If this service is activated, calls are forwarded no matter what the condition of the termination. Other call forwarding services provide for call forwarding based on condition, e.g. Call Forwarding Busy and Call Forwarding No Reply.
- The forwarded-to number is registered with the network for use for all calls.

Supplementary services

- **Q.733**
- **Stage 3 description for call completion supplementary services using Signalling System No. 7**
- Clause 1 (02/92) Call waiting (CW)
- Clause 2 (1993) Call hold (HOLD)
- Clause 4 (1993) Terminal portability (TP)

Supplementary services

- **Q.734**
- **Stage 3 description for multiparty supplementary services using Signalling System No. 7**
- Clause 1 (1993) Conference calling
- Clause 2 (1993) Three-party service

Community of interest supplementary services

- **Are aimed at a specific group of users who share special communication needs**
- it is preliminary attempt to VPNs
- **C**losed User Group (CUG)
- Private Numbering Plan (PNP)
- Multi-level precedence and preemption
- Priority Service
- Outgoing Call Barring

Supplementary services (details)

- **Q.735**
- **Stage 3 description for community of interest supplementary services using SS No. 7**
- Clause 1 (1993) Closed user group (CUG)
- Clause 3 (1993) Multi-level precedence and preemption
- **Q.737**
- **Stage 3 description for additional information transfer supplementary services using SS No. 7**
- Clause 1 (1993) User-to-user signalling (UUS)

Closed User Group

- **A closed user group consists of a group of users who have a restricted access arrangements and features.**
- A user can be a member of one or more CUGs.
- Restriction categories:
  - Call permitted only within the CUG
  - Calls within the CUG and incoming calls only from users outside the CUG
  - Calls within the CUG and outgoing calls only to users outside the CUG
  - Calls within the CUG and both incoming and outgoing calls to users outside the CUG
- Typically if a user is a member of many CUGs, one CUG is registered with the network as preferential CUG.

List of ISUP Messages

- **(38 messages)**
- **Address Complete Message (ACM).** A message sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received.
- **Answer Message (ANM).** A message sent in the backward direction indicating that the call has been answered. In semiautomatic working, this message has a supervisory function. In automatic working, this message is used in conjunction with charging information in order to:
  - (1) start metering the charge to the calling subscriber
  - (2) start measurement of call duration for international accounting purposes.

List of ISUP Messages

- **Blocking (BLO).** A message sent only for maintenance purposes to the exchange at the other end of a circuit to cause an engaged condition of that circuit for subsequent calls going out from that exchange. When a circuit is used in the ` `bothway'' mode of operation, an exchange receiving the blocking message must be capable of accepting incoming calls on the concerned circuit unless it has also sent a blocking message. Under certain conditions, a blocking message is also a proper response to a reset circuit message.

List of ISUP Messages

- **Blocking Acknowledgment (BLA).** A message sent in response to a blocking message indicating that the circuit has been blocked.
- **Call Progress (CPG).** A message sent in the backward direction indicating that an event has occurred during call setup which should be relayed to the calling party.
- **Charge Information (CRG)** (national use). Information sent in either direction for accounting and/or call-charging purposes.

List of ISUP Messages

- **Circuit Group Blocking (CGB)**. A message sent to the exchange at the other end of an identified group of circuits to cause an engaged condition of this group of circuits for subsequent calls going out from that exchange. An exchange receiving a circuit group unless it has also sent a blocking message. Under certain conditions, a circuit group blocking message is also a proper response to a reset circuit message.

List of ISUP Messages

- **Circuit Group Blocking Acknowledgment (CGBA).** A message sent in response to a circuit group blocking message to indicate that the requested group of circuits has been blocked.
- **Circuit Group Reset (GRS).** A message sent to release an identified group of circuits when, due to memory mutilation or other causes, it is unknown whether, for example, a release or release complete message is appropriate for each of the circuits in the group.If at the receiving end a circuit is remotely blocked, reception of this message should cause that condition to be removed.

List of ISUP Messages

- **Circuit Group Reset Acknowledgment (CGRA).** A message sent in response to a circuit group reset message and indicating that the requested group of circuits has been reset. The message also indicates the maintenance blocking state of each circuit.
- **Circuit Group Unblocking (CGU).** A message sent to the exchange at the other end of an identified group of circuits to cause cancellation in that group of circuits of an engaged condition invoked earlier by a blocking or circuit group blocking message.

List of ISUP Messages

- **Circuit Group Unblocking Acknowledgment (CGUA).** A message sent in response to a circuit group unblocking message to indicate that the requested group of circuits has been unblocked.
- **Circuit Group Query (CQM).** A message sent on a routine or demand basis to request the far-end exchange to give the state of all circuits in a particular range.
- **Circuit Group Query Response (CQR).** A message sent in response to a circuit group query message to indicate the state of all circuits in a particular range.

List of ISUP Messages

- **Confusion (CFN).**A message sent in response to any message (other than a confusion message) if the exchange does not recognize the message or detects a part of the message as being unrecognized.
- **Connect (CON).**A message sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received and that the call has been answered.
- **Continuity (COT).** A message sent in the forward direction indicating whether or not there is continuity on the preceding circuit(s) as well as on the selected circuit to the following exchange,including verification of the communication path across the exchange with the specified degree of reliability.

List of ISUP Messages

- **Continuity Check Request (CCR).** A message sent by an exchange for a circuit on which a continuity check is to be performed to the exchange at the other end of the circuit, requesting continuity checking equipment be attached.
- **Facility Accepted (FAA).** A message sent in response to a facility request message indicating that the requested facility has been invoked.
- **Facility Reject (FRJ).** A message sent in response to a facility request message to indicate that the facility request has been rejected.

List of ISUP Messages

- **Facility Request (FAR).**A message sent from an exchange to another exchange to request activation of a facility.
- **Forward Transfer (FOT).**A message sent in the forward direction on semiautomatic calls when the outgoing international exchange operator wants the help of an operator at the incoming international exchange.The message will normally serve to bring an assistance operator into the circuit if the call is automatically set up at the exchange.When the call is completed via an operator (incoming or delay operator) at the incoming international exchange,the message should preferably cause this operator to be recalled.

List of ISUP Messages

- **Information (INF).** A message sent to convey information in association with a call,which may have been requested in an information request message.
- **Information Request (INR).** A message sent by an exchange to request information in association with a call.
- **Initial Address (IAM).** A message sent in the forward direction to initiate seizure of an outgoing circuit and to transmit number and other information relating to the routing and handling of a call.
- **Loop Back Acknowledgment (LPA)** (national use). A message sent in the backward direction in response to a continuity check request message indicating that a loop (or transceiver in the case of a 2-wire circuit) has been connected.

List of ISUP Messages

- **Overload (OLM)** (national use). A message sent in the backward direction on nonpriority calls in response to an IAM to invoke temporary trunk blocking of the circuit concerned when the exchange generating the message is subject to load control.
- **Pass-Along (PAM).** A message that may be sent in either direction to transfer information between two signaling points along the same signaling path as that used to establish a physical connection between those two points.

List of ISUP Messages

- **Release (REL).** A message sent in either direction to indicate that the circuit is being released due to the reason (cause) supplied and is ready to be put into the idle state on receipt of the release complete message. In case the call was forwarded or is to be routed, the appropriate indicator is carried in the message, together with the redirection address and the redirecting address.

List of ISUP Messages

- **Release Complete (RLC).** A message sent in either direction in response to the receipt of a released message or, if appropriate, to a reset circuit message when the circuit concerned has been brought into the idle condition.
- **Reset Circuit (RSC).** A message sent to release a circuit when, due to memory mutilation or other causes, it is unknown whether, for example, a release or a complete message is appropriate. If at the receiving end the circuit is remotely blocked, reception of this message should cause that condition to be removed.
- **Resume (RES).** A message sent in either direction indicating that the calling or called party, after having been suspended, is reconnected.

List of ISUP Messages

- **Subsequent Address (SAM).** A message that may be sent in the forward direction following an initial address message to convey additional called-party number information.
- **Suspend (SUS).** A message sent in either direction indicating that the calling or called party has been temporarily disconnected.
- **Unblocking (UBL).** A message sent to the exchange at the other end of a circuit to cancel, in that exchange, the engaged condition of the circuit caused by a previously sent blocking or circuit group blocking message.

List of ISUP Messages

- **Unblocking acknowledgment (UBA).** A message sent in response to an unblocking message indicating that the circuit has been unblocked.
- **Unequipped Circuit Identifcation Code (UCIC)** (national use). A message sent from one exchange to another when it receives an unequipped circuit identification code.
- **User-to-User Information (USR).** A message to be used for the transport of user-to-user signaling independent of call control messages.

Information elements in ISUP messages

- 83 IEs in current version

Information elements in ISUP messages

- **In order to support the required signaling functionality, the messages listed above need to transfer appropriate information**
- **The types of information that need to be communicated to allow connections to be established end-to-end include the Information Elements are given below:**

Information elements in ISUP messages

- **Access Transport.** Information generated on the access side of a call and transferred transparently in either direction between originating and termination local exchanges. The information is significant to both users and local exchanges.
- **Address Presentation Restricted Indicator.** Information sent in either direction to indicate that the address information is not to be presented to a public network user, but can be passed to another public network. It may be used to indicate that the address cannot be ascertained.
- **Address Signal.** An element of information in a network number. The address signal may indicate digit values 0 to 9, code 11 or code 12. One address signal value (ST) is reserved to indicate the end of the called-party number.

Information elements in ISUP messages

- **Automatic Congestion Level.** Information sent to the exchange at the other end of a circuit to indicate that a particular level of congestion exists at the sending exchange
- **Call Forwarding** May Occur Indicator. Information sent in the backward direction indicating that call forwarding may occur, depending on the response received (or lack thereof) from the called party
- **Call Identity.** Information sent in the call reference parameter indicating the identity of a call in a signaling point
- **Call Reference.** Circuit-independent information identifying a particular call

Information elements in ISUP messages

- **Called-Party Number.** Information to identify the called party.
- **Called Party 's Category Indicator.** Infortnation sent in the backward direction indicating the category of the called party (e.g., ordinary subscriber or pay phone).
- **Called Party 's Status Indicator.** Information sent in the backward direction indicating the status of the called party (e.g., subscriber free).
- **Calling-Party Number.** Information sent in the forward direction to identify the calling party.

Information elements in ISUP messages

- **Calling-Party Address Request Indicator.** Information sent in the backward direction indicating a request for the calling-party address to be returned.
- **Calling-Party Address Response Indicator.** Information sent in response to a request for the calling-party address indicating whether the requested address is included, not included, not available, or incomplete.
- **Calling-Party Number Incomplete Indicator.** Information sent in the forward direction indicating that the complete calling-party number is not included.

Information elements in ISUP messages

- **Calling Party 's Category.** Information sent in the forward direction indicating the category of the calling party and, in case of semiautomatic calls, the service language to be spoken by the incoming, delay, and assistance operators.
- **Calling Party 's Category Request Indicator.** Information sent in the backward direction indicating a request for the calling party's category to be returned.
- **Calling Party's Category Response Indicator.** Information sent in response to a request for the calling party's category indicating whether or not the requested information is included in the response.

Information elements in ISUP messages

- **Cause Value.** Information sent in either direction indicating the reason for sending the message (e.g., release message). Recommendation Q.762 contains definitions for cause values (e.g., cause 1= unallocated number; cause 2 = no route to specified transit network, and so on).
- **Charge Indicator.** Information sent in the backward direction indicating whether or not Ihe call is chargeable.
- **Charge Information Request Indicator** (national use). Information sent in either direction requesting charge information to be returned.
- **Charge Information Response Indicator** (national use). Information sent in response to a request for charge information indicating whether or not the requested information is included.

Information elements in ISUP messages

- **Circuit Group Supervision Message Type Indicator.** Information sent in a circuit group blocking or unblocking message indicating whether blocking (unblocking) is maintenance or hardware-oriented.
- **Circuit Identification Code.** Information identifying the physical path between a pair of exchanges.
- **Circuit State Indicator.** Information indicating the state of a circuit according to the sending exchange.
- **Closed User Group Call Indicator.** Information indicating whether or not the concerned call can be set up as a closed user group call and, if a closed user group call, whether or iot outgoing access is allowed.

Information elements in ISUP messages

- **Closed User Group Interlock Code.** Information uniquely identifying a closed user group within a network.
- **Coding Standard.** Information sent in association with a parameter (e.g., cause indicators) identifying the standard in which the parameter format is described.
- **Connected Number.** Information sent in the backward direction to identify the connectedparty.
- **Connection Request.** Information sent in the forward direction on behalf of the SCCP requesting the establishment of an end-to-end connection.

Information elements in ISUP messages

- **Continuity Check Indicator.** Information sent in the forward direction indicating whether or not a continuity check will be performed on the circuit(s) concerned or is being (has been) performed on a previous circuit in the connection.
- **Continuity Indicator.** Information sent in the forward direction indicating whether or not the continuity check on the outgoing circuit was successful. A successful continuity check indication also implies continuity of the preceding circuits and successful verification of the path across the exchange with the specified degree of reliability.
- **Credit.** Information sent in a connection request indicating the window size requested by the SCCP for an end-to-end connection.

Information elements in ISUP messages

- **Diagnostic.** Information sent in association with a cause and that provides supplementary information about the reason for sending the message.
- **Echo Control Device Indicator.** Information indicating whether or not a half echo control device is included in the connection.
- **End-to-End Information Indicator.** Information sent in either direction indicating whether or not the sending exchange has further call information available for end-to-end transmission. In the forward direction, an indication that end-to-end information is available will imply that the destination exchange may obtain the information before alerting the called party.

Information elements in ISUP messages

- **End-to-End Method Indicator.** Information sent in either direction indicating the available methods, if any, for end-to-end transfer of information.
- **Event Indicator.** Information sent in the backward direction indicating the type of event that caused a call progress message to be sent to the originating local exchange.
- **Event Presentation Restricted Indicator.** Information sent in the backward direction indicating that the event should not be presented to the calling party.
- **Extension Indicator.** Information indicating whether or not the associated octet has been extended.
- **Facility Indicator.** Information sent in facility-related messages identifying the facility or facilities with which the message is concerned.

Information elements in ISUP messages

- **Holding Indicator** (national use). Information sent in either direction indicating that holding of the connection is requested.
- **Hold-Provided Indicator** (national use). Information sent in either direction indicating that the connection will be held after the calling or called party has attempted to release.
- **Inband Information Indicator.** Information sent in the backward direction indicating that inband information or an appropriate pattern is now available.
- **Internal Network Number Indicator.** Infortnation sent to the destination exchange indicating whether or not the call is allowed should the called-party number be an internal network number (e.g., mobile access point).

Information elements in ISUP messages

- **Interworking Indicator.** Information sent in either direction indicating whether or not SS7 is used in all parts of the network connection.
- **ISDN Access Indicator.** Information sent in either direction indicating whether or not the access signaling protocol is ISDN.
- **ISUP Indicator.** Information sent in either direction to indicate that the ISUP is used in all preceding parts of the network connection. When sent in the backward direction, the preceding parts are those towards the called party.

Information elements in ISUP messages

- **ISDN User Preference Indicator.** Information sent in the forward direction indicating whether or not the ISUP is required or preferred in all parts of the network connection.
- **Local Reference.** Information sent in the connection request indicating the local reference allocated by the SCCP to an end-to-end connection.
- **Location.** Information sent in either direction indicating where an event (e.g., release) was generated.
- **Malicious Call Identification Request Indicator** (national use). Information sent in the backward direction to request the identity of the calling party for the purpose of malicious call identification.

Information elements in ISUP messages

- **Modifcation Indicator.** Information sent in the call modification indicators parameter indicating whether the call modification is to service 1 or service 2.
- **National/International Call Indicator.** Information sent in the forward direction indicating to the destination national network whether the call has to be treated as an internationalcall or as national call.
- **Nature of Address Indicator.** Information sent in association with an address indicating the nature of that address (e.g., ISDN international number, ISDN national significant number, or ISDN subscriber number).

Information elements in ISUP messages

- **Numbering Plan Indicator.** Information sent in association with a number indicating the numbering plan used for that number (e.g., ISDN number, telex number).
- **Odd/Even Indicator.** Information sent in association with an address indicating whether the number of address signals contained in the address is even or odd.
- **Original Called Number.** Information sent in the forward direction when a call is redirected and identifies the original called party.
- **Original Redirection Reason.** Information sent in either direction indicating the reason why the call was originally redirected.

Information elements in ISUP messages

- **Point Code.** Information sent in the call reference parameter indicating the code of the signaling point in which the call identity allocated to the call reference is relevant.
- **Protocol Class.** Information sent in the connection request parameter indicating the protocol class requested by the SCCP for the end-to-end connection.
- **Protocol Control Indicator.** Information consisting of the end-to-end method indicator, the interworking indicator, the end-to-end information indicator, the SCCP method, and the ISUP indicator. The protocol control indicator is contained in both the forward and backward call indicators parameter field and describes the signaling capabilities within the network connection.

Information elements in ISUP messages

- **Range.** Information sent in a circuit group supervision message (e.g., circuit group blocking) to indicate the range of circuits affected by the action in the message.
- **Recommendation Indicator.** Information sent in association with a cause value identifying the recommendation to which the cause value applies.
- **Redirecting Indicator.** Information sent in either direction indicating whether the call has been forwarded or rerouted and whether or not presentation of redirection information to the calling party is restricted.

Information elements in ISUP messages

- **Redirecting Number.** Information sent in the forward direction when a call is redirected more than once, indicating the number from which the call was last redirected.
- **Redirecting Reason.** Information sent in either direction indicating, in the case of calls undergoing multiple redirections, the reason why the call has been redirected.
- **Redirection Counter.** Information sent in either direction indicating the number of redirections that have occurred on a call.
- **Redirection Number.** Information sent in the backward direction indicating the number towards which the call must be rerouted or has been forwarded.

Information elements in ISUP messages

- **Routing Label.** Information provided to the MTP for the purpose of message routing.
- **Satellite Indicator.** Information sent in the forward direction indicating the number of satellite circuits in the connection.
- **SCCP Method Indicator.** Information sent in either direction indicating the available SCCP methods, if any, for end-to-end transfer of information.
- **Screening Indicator.** Information sent in either direction to indicate whether the address was provided by the user or network.
- **Signaling Point Code** (national use). Information sent in release message to identify the signaling point in which the call failed.

Information elements in ISUP messages

- **Solicited Information Indicator.** Information sent in an information message to indicate whether or not the message is a response to an information request message.
- **Status.** Information sent in a circuit group message (e.g., circuit group blocking) to indicate the specific circuits, within the range of circuits stated in the message, that are affected by the action specified in the message.
- **Suspended Resume Indicator.** Information sent in the suspend and resume messages to indicate suspend/resume was initiated by an ISDN subscriber or by the network.

Information elements in ISUP messages

- **Temporary Trunk Blocking After Release** (national use). Information sent to the exchange at the other end of a circuit (trunk) to indicate low level of congestion at the sending exchange and that the circuit (trunk) should not be reoccupied by the receiving exchange for a short period of time after release.
- **Transit Network Selection** (national use). Information serlt in the initial address message indicating the transit network(s) requested to be used in the call.
- **Transmission Medium Requirement.** Information sent in the forward direction indicating the type of transmission medium required for the connection (e.g., 64-kbps unrestrictedtransmission, speech).

Information elements in ISUP messages

- **User Service Information.** Information sent in the forward direction indicating the bearer capability requested by the calling party.
- **User-to-User Indicators.** Information sent in association with a request (or response to a request) for user-to-user signaling supplementary service(s).
- **User-to-User Information.** Information generated by a user and transferred transparently through the interexchange network between the originating and terminating local exchanges.

Summary

- ISUP supports not only ISDN but also multipurpose flexible services
- Further enhancement was dedicated and distributed intelligent network – independent from operator
- Intelligent services are grouped in sets (Capability Sets)
- Currently service are provisioned by flexible environments

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