VoIP Principles

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Foreword

- This course describes the networking structure of the NGN and the registration process of a subscriber number in the SIP protocol.

Objectives

- Upon completion of this course, you will be able to:
  - Describe the networking structure of the NGN.
  - Understand the functions of the SIP protocol.
  - Master SIP commands.
  - Understand the message interaction process of the SIP protocol.

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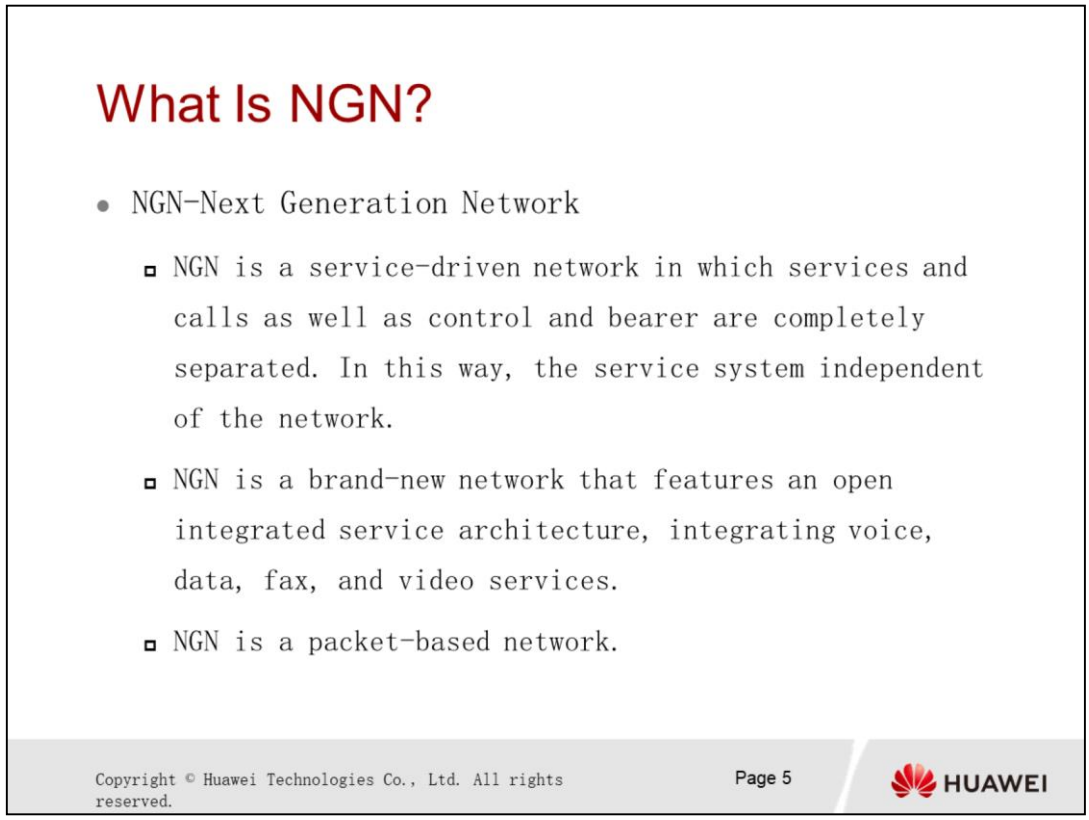
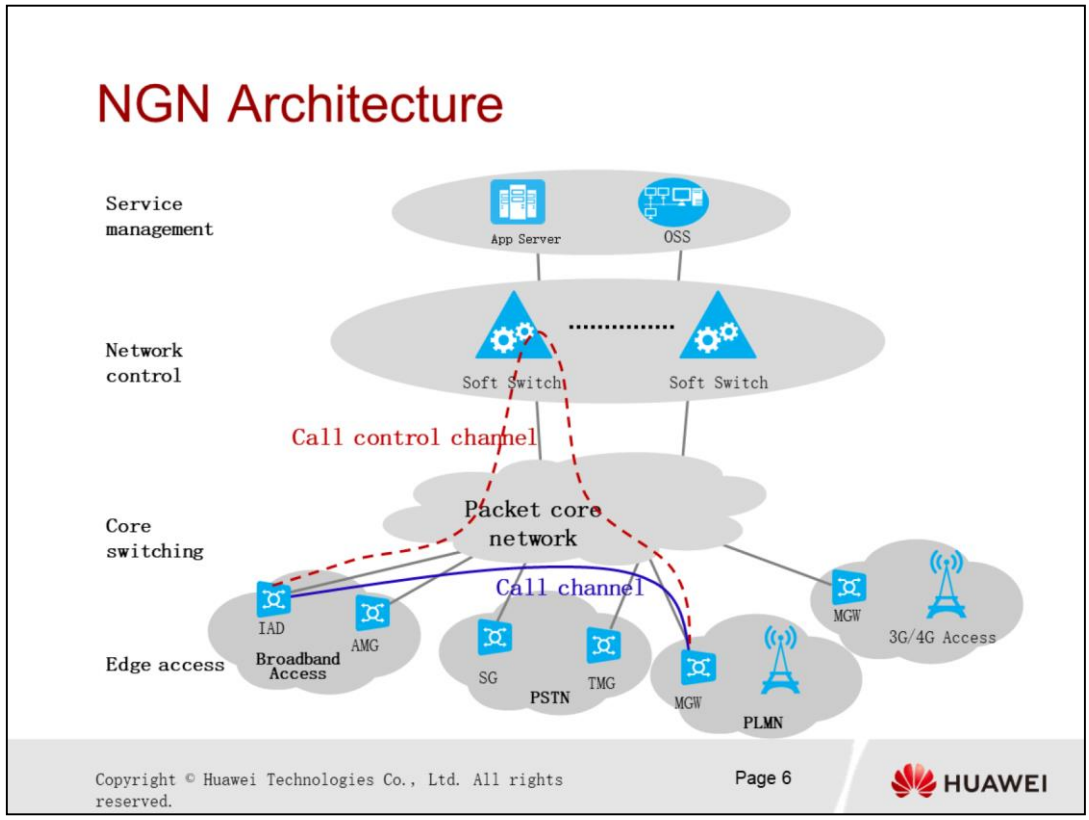


- NGN is the concept of defining and deploying networks. Because an NGN network is divided into different layers and planes with open interfaces, NGN provides a platform for service providers and carriers to evolve, create, provide, and manage new services.
- Advantages of the NGN network
  - NGN adopts the layered architecture.
  - NGN provides the media access layer, core switching layer, network control layer, and service management layer.
  - NGN separates control and connection, as well as services and calls.
  - NGN bearer networks tend to use the unified IP protocol to implement service convergence.
  - NGN is a network based on unified protocols.
  - NGN supports multiple services, such as voice, data, and video services.
  - NGN has advantages in access and coverage.
  - NGN features low construction and maintenance costs.

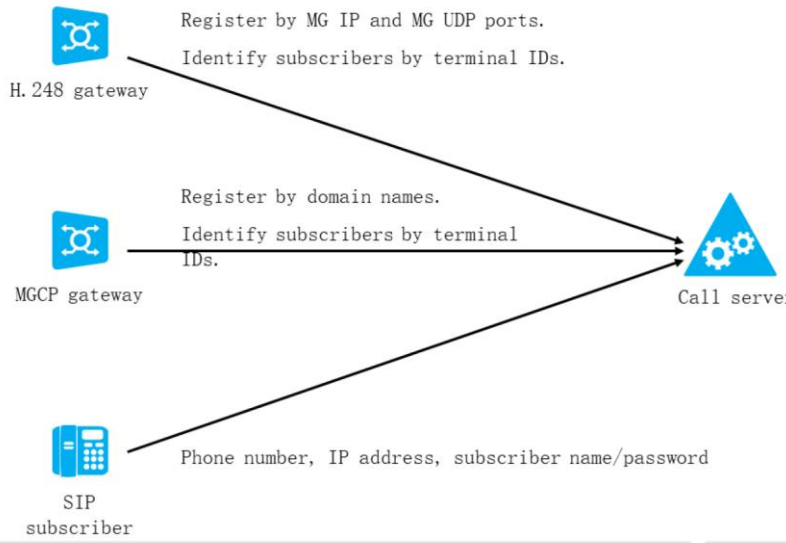


- Background of NGN
  - The NGN system divides the switching equipment into components for call control and media processing using a standard protocol. The call control is pure software running on a universal hardware platform, and media processing converts TDM into IP-based media streams.
  - The softswitch technology emerges as the core technology of NGN.
- Functions of each layer in an NGN system
  - Edge access layer: Use various access methods to connect various to the network and convert the information format into a format that can be transmitted on the network.
  - Core switching layer: Uses the packet technology to provide a highly reliable integrated transport platform with high QoS and large capacity.
  - Network control layer: Implements call control. The core technology of the network control layer is softswitch, which implements basic real-time call and connection control functions.
- Service management layer: Provides additional value-added services and operation support after call setup.

- NGN protocol classification
- According to the protocol functions, NGN protocols are classified into the following types:
  - Bearer control protocol
    - Function: It is used by the media gateway controller (MGC) to control the media gateway (MG), such as the access media gateway (AMG) and trunk media gateway (TMG).
    - Example: MGCP, H248
    - MGCP/H.248 is a media gateway control protocol based on the gateway separation structure. It works in master/slave mode.
  - Call control protocol
    - Function: Controls the establishment, connection, and termination of a call.
    - Example: SIP and H.323
    - Session initial protocol (SIP) is one of the framework protocols of a multimedia communication system. It is an application layer protocol used to establish, change, or end multimedia sessions.
    - H.323 is a protocol that provides multimedia information transmission for terminals or other entities based on the packet switched network.
  - Signaling transmission protocol
    - Function: Provides signaling transmission services for the softswitch.

- Example: SIGTRAN
- The Signaling Transport (SIGTRAN) protocol stack bears the communication between the signaling gateway and the MGC. It provides two functions: adaptation and transmission.

Registration and Authentication



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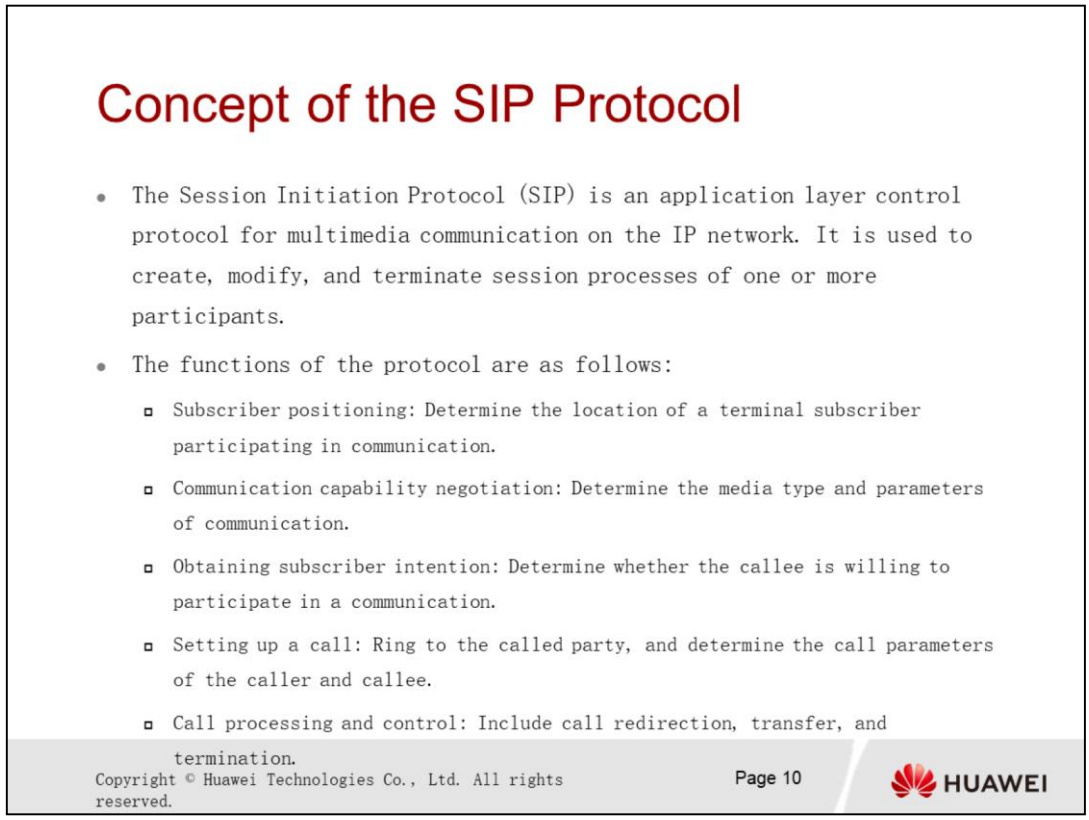
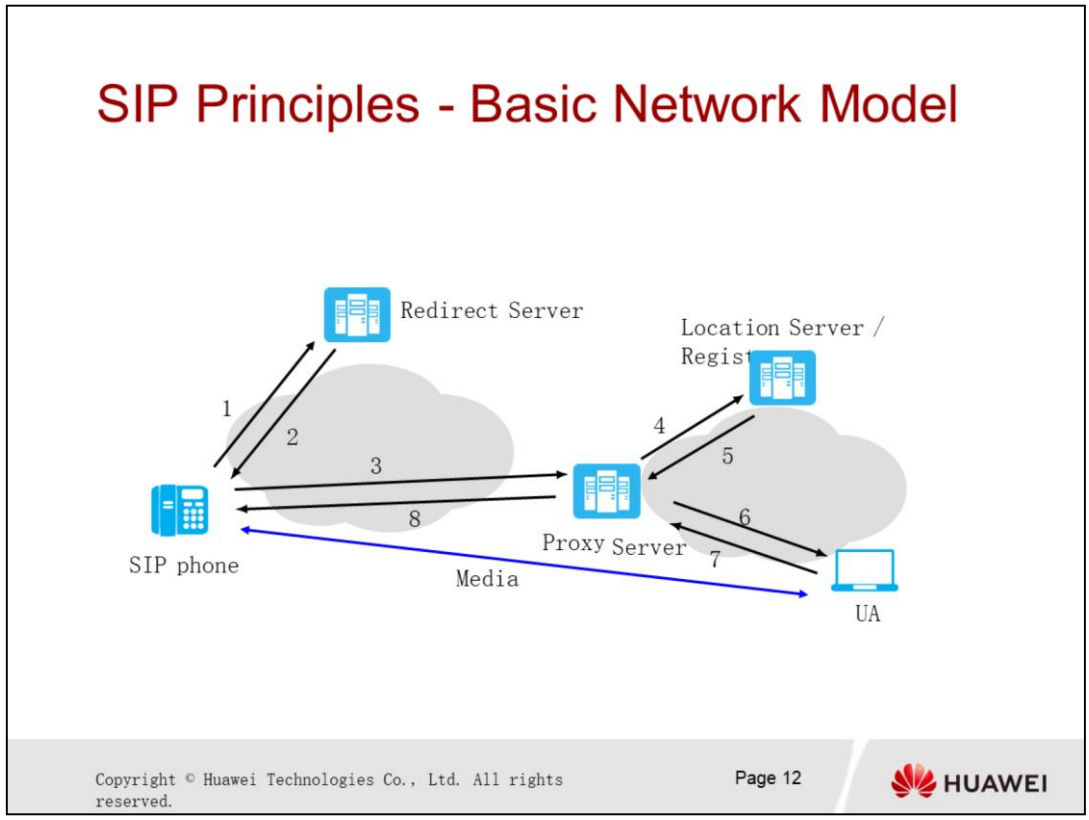
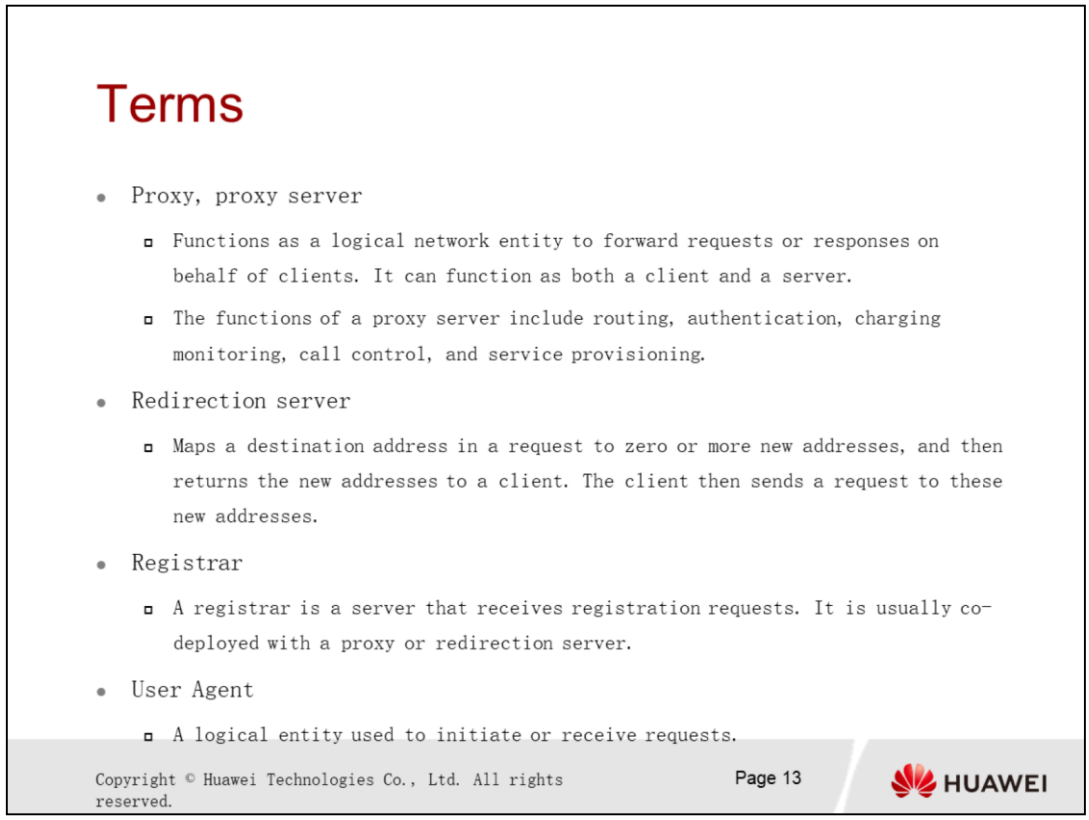


- Multi-Party Multimedia Working Group put forward two proposals for multimedia communication in the Internet in 1996:
  - Session Initiation Protocol (SIP)
  - Simple Conference Invitation Protocol (SCIP)
- At last, the two proposals are unified in Session Initiation Protocol (SIP).
- SIP is a protocol that is being developed and continuously researched. On the one hand, it adopts the design ideologies of other Internet standards and protocols. In style, it complies with the principles of simplicity, openness, compatibility, and scalability of the Internet, and takes full attention to the security problems in the open and complex network environment of the Internet. On the other hand, it also fully considers the support of various services on traditional public telephone networks, including IN service and ISDN service.
- In the SIP protocol, a session is created by using a SIP invite message with a session description, so that the participant can perform media type negotiation through SIP interaction. It requests the current location of a user through proxy and redirection to support the mobility of the user. Users can also register their current locations. The SIP protocol is independent of other conference control protocols. It is designed to be independent of the underlying transport layer protocols. Therefore, other additional functions can be flexibly extended.
- The SIP protocol can be used to initiate a session or invite a member to

join a session that has been established in another manner.



- Redirection server
  - The redirection server does not receive or reject calls. It implements the routing function and cooperates with the registration process to support the mobility of SIP terminals.
- Proxy, Proxy sever
- Location service/Registrar
  - A service that is used by the SIP redirection server or proxy server to obtain the location of the callee.
- User agent



- In the Huawei solution, the SoftX3000 functions as the redirection server, proxy server, and Registrar.

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Classification of SIP Messages

- SIP messages are encoded in text mode. There are two types of SIP messages: Request message and response message.
  - Request message: Sent by a client to the server to activate a specific operation.
  - Response message: Sent to respond to a request message and indicate the success or failure status of a call.
  - Both a request message and a response message include a SIP header field and a SIP message field.

Request Message

Request Message	Message Description
INVITE	Initiates a session request and invite a user to join a session. The session description is contained in the message body. During a call, the caller describes the acceptable media type and parameters in the session. The callee must specify the media to be accepted in the message body of the success response message, and may also specify the media to be sent. If a meeting invitation is received, the callee may determine, according to the Call-ID or the identifier in the session description, that the user has joined the conference, and return a success response message.
ACK	Confirms that the final response to the INVITE request has been received. This message is used only together with the INVITE message.
BYE	Ends a session.
CANCEL	Cancels a request that has not been completed, and has no impact on a completed request (that is, a request that has received a final response).
REGISTER	Performs registration.
OPTIONS	Queries the server capability.

Response Message

No.	Status Code	Message Function
1xx	Temporary response	Indicates that a request message has been received and is being processed.
2xx	Success response	Indicates that a request has been accepted and processed successfully.
3xx	Redirection response	Indicates that a further action needs to be taken to complete the request.
4xx	Client error	Indicates that a request message contains syntax errors or the SIP server cannot process the request message.
5xx	Server error	Indicates that the SIP server is faulty and cannot process a message.
6xx	Global error	Indicates that the request cannot be implemented on any SIP server.

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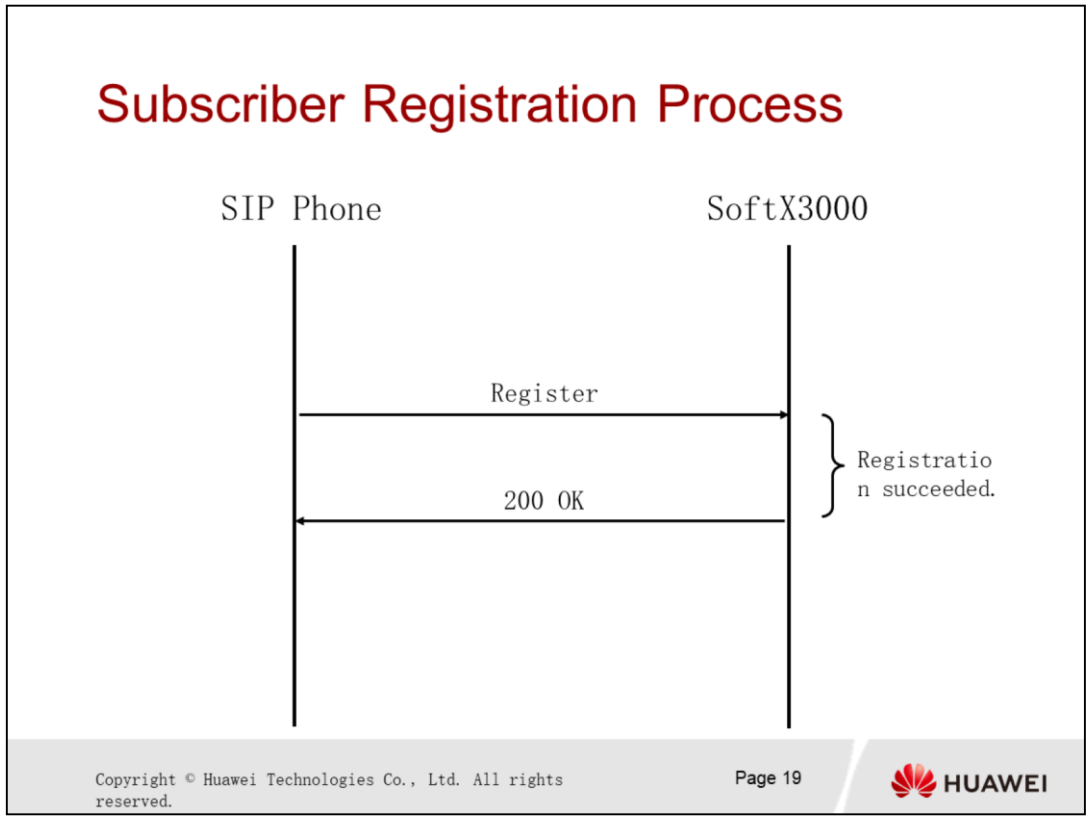
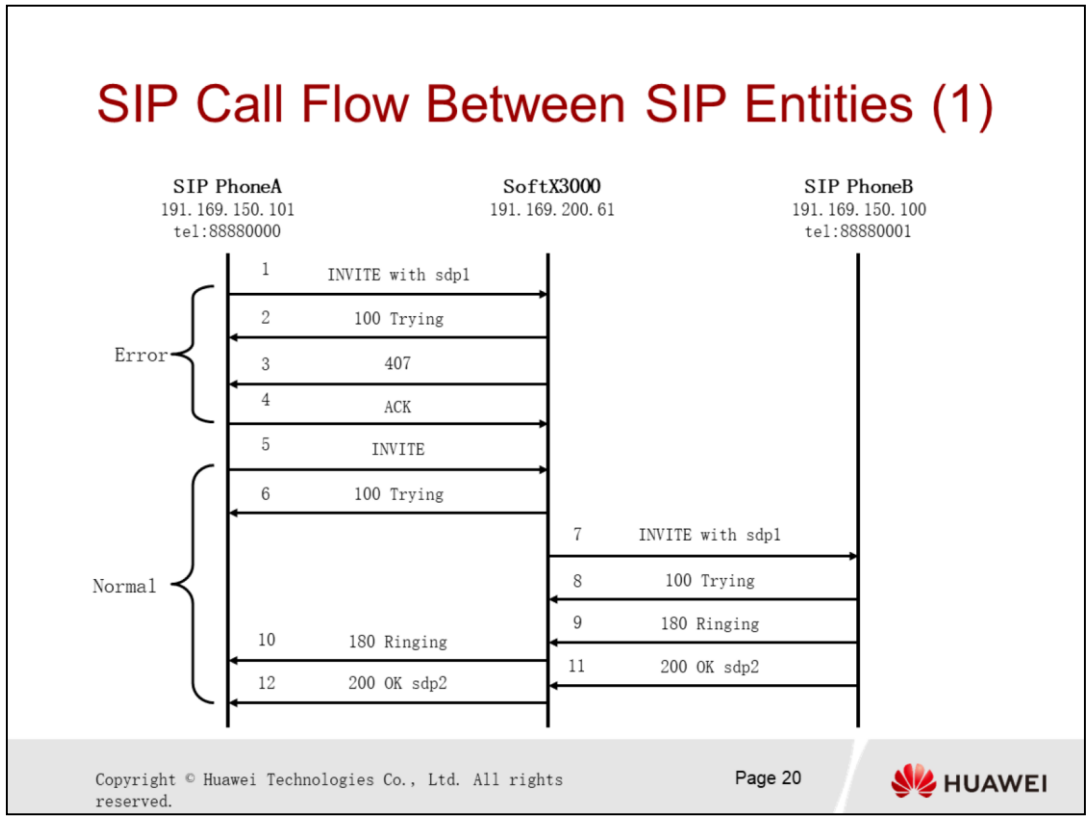
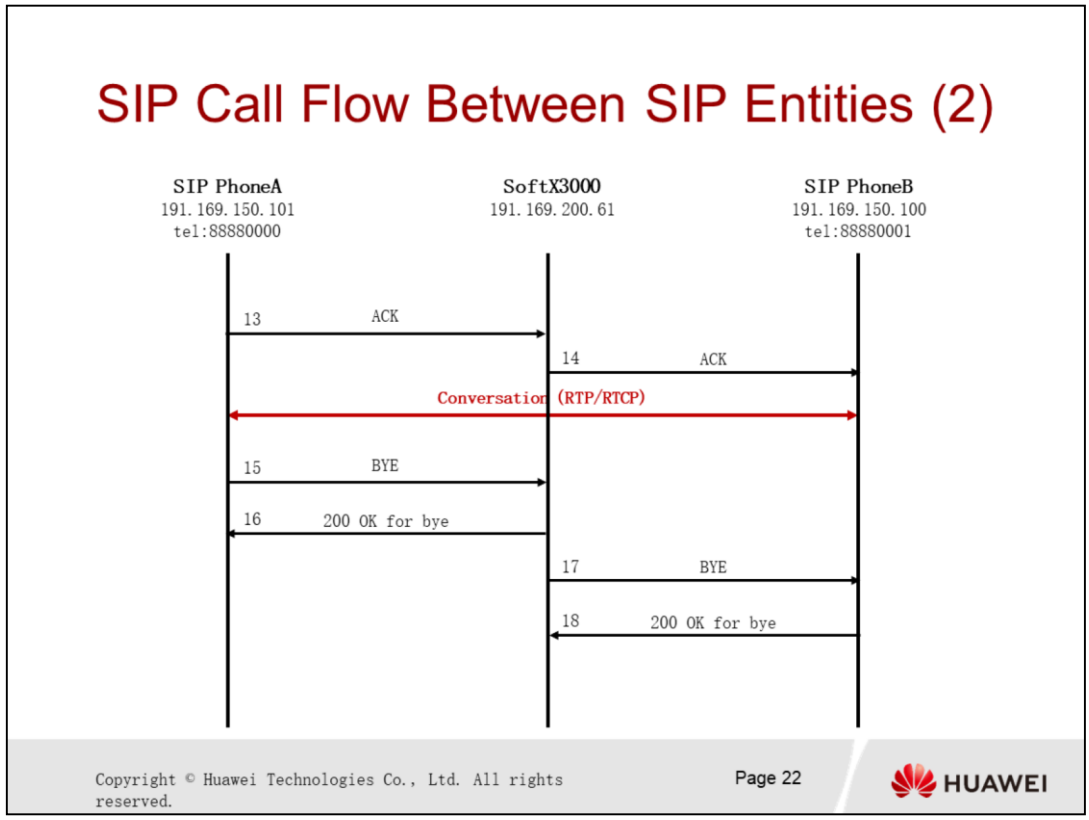


- The SIP AG sends a Register message to the SoftX3000 for each subscriber. The message contains information such as the user ID.
- After receiving the Register message, the SoftX3000 checks whether the subscriber is configured on the SoftX3000. If yes, the SoftX3000 returns a 200 message to the SIP AG.



- 1: SIP_A picks up the phone and sends an INVITE message to the SoftX3000, requesting the SoftX3000 to invite SIP_B to join the session. In addition, SIP_A sends the information such as the IP address 191.169.150.101, port number 8766, payload type, and payload type code to the SoftX3000.
- 2: The SoftX3000 returns a 100 Trying response to SIP_A, indicating that the request has been received and is being processed.
- 3: The SoftX3000 sends a 407 Proxy Authentication Required message to SIP_A, indicating that the SoftX3000 needs to authenticate the SIP A. The Proxy-Authenticate field in the message carries the authentication mode Digest and the SoftX3000 domain name huawei.com supported by the SoftX3000. The nonce for the authentication is generated, and the parameters are sent to SIP A in the response message for subscriber authentication.
- 4: SIP_A sends an ACK message to the SoftX3000, indicating that the final response to the INVITE request has been received from the SoftX3000.
- 5: SIP_A sends an INVITE message to the SoftX3000 again. The message carries the Proxy-Authorization field and contains the subscriber ID (phone number) of the authentication mode DIGEST and SIP_A, domain name of the SoftX3000, NONCE, URI, and RESPONSE. After receiving the 407 response, SIP_A uses a specific algorithm to generate the encrypted RESPONSE based on the information returned by the server and subscriber configurations.
- 6: The SoftX3000 sends a 100 Trying message to SIP_A, indicating that the request has been received and is being processed.



- 13: SIP_A sends an ACK message to the SoftX3000, indicating that the final response to the INVITE request has been received from the SoftX3000.
- 14: The SoftX3000 sends an ACK message to SIP_B, indicating that the final response to the INVITE request has been received SIP_B.
- 15: SIP_A hangs up and sends a BYE message to the SoftX3000 to request the termination of the session.
- 16: The SoftX3000 returns a 200 OK response to SIP_A, indicating that the session ends.
- 17: The SoftX3000 sends a BYE message to SIP_B, indicating that the session is ended successfully.
- 18: SIP_B hangs up and returns a 200 OK response to the SoftX3000, indicating that the session is ended successfully.

Summary

- Functions and Concepts of the SIP Protocol
- Types and Functions of SIP Messages
- Message Exchange Process of the SIP Protocol

Thank You

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