

## Course Outline

© IDTNet 2009 All rights reserved

<b>Course Title:</b>	<b>T9106-Understanding SIP</b>
<b>Course Duration:</b>	2 Days Classroom without labs
	4 Days Classroom with hands on labs
	2 Days Webinar

---

### Course Overview

This course is a highly technical course covering the structure, operation, and integration with other networks of Session Initiation Protocol, SIP.

### Audience

This ground breaking course is for network professionals who need an in depth knowledge of the workings of SIP in the network.

### Course Prerequisites

It is essential the course participants have a sound operation knowledge of:

- IP
- IP Multicasting/IGMP
- TCP/UDP
- Ethernet LAN operation and components
- Routers and switches
- ISDN and SS7 ISUP
- Legacy TDM based voice telephony

### Course Objectives

At the conclusion of this course, the participant will be able to:

- State the main principles of VOIP
  - QOS
  - GOS
  - PESQ
  - RTP/RTCP
  - Codec techniques
- State the origins of SIP
- Discuss the reasons for deploying SIP
- Describe the role of SIP
- Compare SIP to other VOIP signalling protocols
- Describe the structure of SIP
- State the purpose of each of the SIP header fields
- Describe the operation of the SIP Methods and responses
- Monitor and diagnose problems in SIP operation
- State the operation and structure of Session Description Protocol, SDP
- Monitor and diagnose problems with SIP and SDP
- State the role of the SIP registrar
- Describe the operation of the SIP Registration Server
- Compare the different types of SIP proxy
- Describe the way in which SIP proxies are used to route SIP messages
- State the role of DNS and the NAPTR, SVR, and A record are used to support SIP

- State the SIP header fields and their values that are used to facilitate SIP routing
- Monitor and diagnose problems with SIP and SIP routing using DNS
- State the role of the SIP redirect and location servers
- Describe the operation of the SIP REDIRECT method
- Monitor and diagnose problems with SIP redirection
- Describe SIP forking
- State the role of IPv4 Multicasting with SIP
- Discuss the use of SIP for conference calls
- Identify the problems of using SIP with NAT firewalls
- Compare the methods of SIP NAT traversal
  - STUN
  - TURN
  - ICE
  - Application Layer Gateway, ALG
  - Session Border Controllers, SBC
- Implement SIP NAT Traversal
- Identify common threats to SIP
- State the commonly used methods of securing SIP
- Describe the functionality of the SIP PBX
- Configure a SIP PBX
- Configure a simple SIP contact centre
- Discuss the role of SIP gateways with respect to
  - The PSTN
  - ISDN
  - SS7 ISUP/SIPI
  - H323
  - H248/MEGACO
- Discuss the role of MPLS with respect to VOIP and SIP
- Implement SIP across and MPLS backbone



idtnet  
Training for Professionals

### Section 1

Welcome, Introductions, House rules, course agenda.

### Section 2

- The development of SIP.
- SIP and VOIP
- SIP Vs. H.323 and H.248/MEGACO
- What SIP does
- Review of VOIP operation
  - Challenges of transmitting voice signals over IP
  - Quality Of Service, QOS recap
  - Impact of QOS on Grade of Service, GOS
  - Concept of Connection Admissions Control, CAC/VCAC
  - Codec types
  - Real Time Protocol, RTP, and Real Time Control Protocol, RTCP
  - Voice Quality
    - Mean Opinion Scoring
    - Perceptual Evaluated Speech Quality, PESQ

### Section 3 SIP Protocol Operation

- Key SIP RFC's and Standards
- The SIP User Agent client and server
- The SIP URI and URI Structure
- SIP protocol Structure
- SIP Methods
- SIP Responses
- The SIP dialog
- The SIP session
- The SIP message line
- Key SIP header fields including:
  - From
  - Call-id
  - To
  - Via
    - The Via "Branch" parameters
  - Call tags
  - Contact
  - Cseq
  - Max forwards
  - Content fields
  - Allow
- SIP message exchange

- SIP Messages involved setting up a simple SIP call
  - INVITE method
  - 100 Trying
  - 180 Ringing
  - 200 OK
  - ACK
  - BYE method

### Lab 3.1 SIP calling and SIP in depth analysis

- Common SIP call Error Messages

### Lab 3.2 SIP Troubleshooting

## Section 4 Session Description Protocol, SDP

- SDP Description and Role
- SDP Structure
- SDP fields
  - Owner/Creator
  - Connection Information
  - Time Description
  - Media Description
  - Media Attributes

### Lab 4.1 SDP analysis

- SIP error messages relating to SDP

### Lab 4.2 SIP/SDP Troubleshooting

idtnet  
Training for Professionals

### Section 5 SIP and Servers

- SIP Registration and Location Servers
  - Role of the SIP Registration Server
  - SIP Registration Method

#### Lab 5.1 Setting up the SIP Registration

- SIP Proxy
  - SIP Stateful Proxy
  - SIP Call Stateful Proxy
  - SIP Stateless Proxy
  - SIP Stateful/stateless proxies
- SIP and DNS
  - SIP and the NAPTR record
  - SIP and the SVR record
  - SIP and the A record
- Routing with SIP proxies
  - Re writing the SIP INVITE and responses
    - Multiple VIA header fields
    - The Record-route fields
    - The Route fields

#### Lab 5.2 Routing SIP proxies

- The SIP Redirect Server
- SIP REDIRECT methods
  - 300 series SIP messages

#### Lab 5.3 SIP Redirection

- SIP Forking
- SIP and IP Multicasting
- SIP conferencing

### Section 6 SIP and NAT Traversal

- Problems of NAT Traversal
- Simple Traversal of UDP through NAT's, STUN
- Traversal using Relay NAT, TURN
- Universal Plug and Play, UPnP
- Application Layer Gateway, ALG
- Session Border Controller, SBC

#### Lab 6.1 NAT Traversal

### Section 7 SIP Security

- Potential threats to SIP
  - Registration Hijacking
  - Impersonating a Server
  - Tampering with Message Bodies
  - Tearing Down Sessions
  - Denial of Service and Amplification
- Securing SIP
  - Transport and Network Layer Security
  - SIPS URI Scheme
  - HTTP Authentication
  - Registration
  - Interdomain Requests
  - Peer-to-Peer Requests
  - DoS Protection
  - HTTP Digest
  - S/MIME
  - TLS
  - Privacy Warn-Codes

### Section 8 SIP PBX/Call Centre

- What is a SIP PBX
- Common features of the SIP PBX
- Designing a SIP PBX network
- SIP Trunking
- Distributed SIP based call centres

#### Lab 8.1 Building a SIP PBX and Contact Centre

### Section 9

#### Integrating SIP with other systems

- SIP Gateways
- SIP integration with the PSTN/ISDN
  - SIPI and SS7 ISUP
- SIP and H.248/Megaco
- SIP and H.225/H245
- SIP and MPLS/QOS

#### Lab 9.1 Setting up SIP over an MPLS WAN

#### Course wrap up

