

# SIP ESSENTIALS

Course Code: 3251

Learn about Session Initiation Protocol (SIP) and other protocols related to SIP implementations.

Session Initiation Protocol (SIP) is the protocol uniting every communication management suite, be it Cisco Call Manager, Avaya Session and Communication Manager, Avaya IP Office, Oracle Session Border Controllers, Ericsson IMS cores, Asterisk, ShoreTel and Mitel products.

You'll make live call analyses with Wireshark and TCPDump. Via the PCAPs you create, as well as those accessed from an extensive library of premade captures, you'll have no problems understanding why SIP makes the phone ring, how RTP carries real time voice and video, or troubleshooting and identifying errors.

The lessons in this course are clear and very technical. Attending students will receive access to the Alta3 Research SIP certification exam. Upon successful completion of the exam, students will be awarded a SIP certificate.

## What You'll Learn

- SIP Requests and Responses
- Live call capture
- Wireshark Analysis (pcaps & ng-pcap)
- RTP Voice and Video
- Session Description Protocol (SDP) negotiation
- DTMF transmission
- SIP Routing and Dialplan construction (regular expression)
- Call flow analysis
- Testing with SIP-p
- Troubleshooting (failed calls, 1-way or no way voice)
- STUN / TURN / ICE

## Who Needs to Attend

Any company or individual who wants to advance their comprehension of VoIP and SIP

## Prerequisites

To gain the most from this class, you should have networking experience.

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CLASSROOM LIVE

\$3,650 CAD

5 Day

## Classroom Live Outline

### 1. VoIP Introduction

- Circuit Switching
- VoIP Protocols
- VoIP Deployments: First Installations to Now
- SIP and the Softswitch

### 2. SIP Architecture

- The SIP Architecture
- UA, Proxy, Redirect, Forking, and B2BUA
- Multimedia Architecture
- RTP/RTCP
- SDP
- Methods
- REGISTER
- INVITE and ACK
- UPDATE
- OPTIONS
- REFER
- CANCEL
- SUBSCRIBE and NOTIFY
- MESSAGE
- BYE
- SIP Responses
- Via Path
- Record-Route

### 3. REGEX

- Regular Expression

### 4. Routing the SIP INVITE

- The Via: path
- Creation of Response-Path

- Response Merging
- Record-Route: and Route:
- Forking
- Loops and Spirals

## **5. The SIP Dialog**

- The Purpose of the SIP Dialog
- How to Begin and End a Dialog
- The Dialog ID

## **6. SIP Entities**

- B2BUA
- Proxy
- SBC
- Outbound Proxy
- UA

## **7. SIP Call Flow Examples**

- The Following Call Flows Set Up and Examined Using Wireshark
- REGISTER
- Normal Call
- Busy
- Redirect
- Transfer (REFER)

## **8. SIP Call Routing**

- How SIP Routing Is Used to Route Calls
- Use of Record-Route in Stateless Routing Proxies
- How SIP Is Used in the PSTN Migration to an All IP Network

## **9. SIP Uniform Resource Indicators (URIs)**

- Generic URI information (RFC 2396)
- Direct or Proxy
- PSTN Number (RFC 2808)
- Instant Messaging
- Presence
- In Registrations

## **10. SIP Message Headers**

- Via
- Branch
- Max-Forwards
- Dialog (To, From, and tag= fields, Call-ID)
- CSeq
- Proxy Authenticate
- Proxy-Authorize
- Contact
- Expires

- User-Agent
- Content-Length
- Allow
- Supported
- P-Access
- Network-Info
- P-Charging-Vector, P-Preferred-Identity, P-Asserted-Identity
- Authorization
- Security-Client
- Security-Server
- Content-Type

### **11. Session Description Protocol (SDP)**

- Session Parameters
- SDP Format
- Extending SDP
- SDPng
- Media Negotiation
- Changing Session Parameters
- Controlling the Media

### **12. SIP and the DNS**

- Basic Resource Records (RR)
- A-Record, SOA, NS Record, MX Record
- The SRV Record (RFC 2782)
- How SIP Uses the SRV Record (RFC 3263 Locating SIP Servers)
- How to Configure a SRV Record
- The NAPTR Record (RFC 2915)

### **13. ENUM**

- ENUM Protocol (RFC 3761)
- Dynamic Delegation Discovery System (RFC 3401, 3402, 3403, 3761, 3764)
- How SIP Uses ENUM

### **14. SIP and DHCP**

- DHCP Protocol
- SIP DHCP Options

### **15. Interoperating SIP with Legacy PSTN Signaling**

- Call Transfer (REFER)
- 183 Early Media
- Interworking SIP with Local Call Control (E&M or DID)
- SIP and the PSTN
- SIP-T

### **16. RTP and Real-Time Control Protocol (RTCP)**

- Dealing Packet Loss, Latency, Jitter
- How RTP Defines the Session

- Session Description Protocol
- The RTP Profile
- The RTP Payload Type Field
- RTP Telephony Events (RFC 2833)
- How RTP Removes Jitter
- How RTP Handles Packet Loss
- How RTP Identifies the Talking Party
- How RTP Handles Silence Suppression
- How RTP Handles Fixed Length Packets (Padding)
- How RTP is Used to Mix Voice (Conference Calls)
- The RTP Header
- RFC 2833 Protocol
- RTP Control Protocol
- SDP
- Sender/Receiver Reports
- Bye Reports

## **17. DTMF Handling**

- Inband
- RFC 2833
- SIP INFO

## **18. Fax Handling**

- Inband
- Fax Relay
- T.38

## **19. Presence**

- SIMPLE - SIP for Instant Messaging and Presence Leveraging Extensions
- Terminology
- Framework
- Resource List Manipulation Requirements
- Authorization Policy Manipulation
- Acceptance Policy Requirements
- Notification Requirements
- Content Requirements
- General Requirements

## **20. SIP Timers**

- T1, T2, T4
- Timer A - K

## **21. SIP Security**

- Security for Call Setup
- Authentication
- S/MIME
- TLS

## **22. NAT Traversal**

- How NAT Operates on SIP and SDP
- NAT Types
- STUN
- TURN
- ICE

### **23. SIPp: A SIP Testing Tool**

- SIPp
- SIPp XML Examples

### Classroom Live Labs

- Lab 1: Construct and Enable a VoIP Network
- Lab 2: SIP User Agent Configuration
- Lab 3: Direct UA to UA Routing with No Proxy
- Lab 4: Proxy Based SIP Routing
- Lab 5: Adding Authorized UAs to a Domain
- Lab 6: Intra Domain Routing (SIP in the Same Domain)
- Lab 7: SIP REGISTER - Registering a SIP UA
- Lab 8: Registering a SIP UA Soft Client
- Lab 9: Registering a SIP UA Client to a Mobile Device
- Lab 10: Inter Domain Routing (SIP in Different Domains)
- Lab 11: Strip off the Leading 9
- Lab 12: PDT Management
- Lab 13: Using Wireshark
- Lab 14: Capture a SIP Registration via Wireshark
- Lab 15: Capture a Normal SIP Call via Wireshark
- Lab 16: Capture a Call to a Vacant Number via Wireshark
- Lab 17: Capture a SIP Call to Busy Number via Wireshark
- Lab 18: Capture a Call Forward via Wireshark
- Lab 19: Via, Record Route, and Route Headers
- Lab 20: Examining Max Forwards
- Lab 21: INVITE with SDP - sendonly vs. sendrecv
- Lab 22: Silence Suppression
- Lab 23: DTMF RFC 2833 and SIP INFO
- Lab 24: SIP B2BUA Configuration Example
- Lab 25: Register Linksys SIP Phone with Asterisk PBX
- Lab 26: SIP Presence (NOTIFY)
- Lab 27: RTP Relay
- Lab 28: Direct RTP Flow between Two UAs - 3PCC
- Lab 29: ENUM Call Routing
- Lab 30: Testing SIP Connectivity Using SIP OPTIONS
- Lab 31: Advanced: SIP Testing with SIP-p

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VIRTUAL CLASSROOM LIVE

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5 Day

## Virtual Classroom Live Outline

### 1. SIP Introduction

- SIP Message Format
- Legacy Call Control
- Compare SIP
- Packetizing Voice
- SIP Call Flow
- How SIP Routes Media
- SIP Call Control
- SIP in 4G

### 2. SIP Architecture

- SIP UA
- SIP Requests
- SIP Response
- SIP URI
- SIP Architecture
- SIP Domain
- SIP Registration
- SIP Call Routing
- Loose Routing

### 3. Regular Expression

- Metacharacters
- Substitution
- REGEX Modifications

### 4. Routing the SIP INVITE

- Proxy Routing
- Via and Record-Route

### 5. The SIP Dialog

- SIP Dialog
- The reINVITE

### 6. SIP Entities

- SIP Topology

- SIP Proxy
- B2BUA
- Outbound Proxy

## 7. **SIP Call Flow Examples**

- Wireshark Colors
- Wireshark Preferences
- SIP Stack
- REGISTER with Authentication
- Wireshark Analysis of SIP Dialog
- SIP Redirect
- CFNA
- REFER and Call Transfer

## 8. **SIP Call Routing**

- PRACK 100-rel
- Call Forking
- Loop and Spiral
- Third Party Call Control
- Path Minimization
- SIP in the PLMN
- OPTIONS Method

## 9. **SIP Uniform Resource Indicators (URIs)**

- URI vs. URL vs. URN
- SIP URI Examples
- URI Delimiters
- SIP and SIPs
- Tel URI
- URI Escape Codes

## 10. **SIP and the DNS**

- Zone File
- SOA and NS Records
- A-Record
- SRV Record
- NAPTR Record
- Locating SIP Servers

## 11. **ENUM**

- ENUM Database Example
- ENUM Query and Response
- ENUM REGEX
- Post ENUM Routing

## 12. **SIP and the PSTN**

- Early Media
- SIP-T and SIP-I

## 13. **SIPp**

- SIP QA testing
- SIP DOS Testing

- 14. **SIP Message Headers**
  - SIP Header Overview
  - Dialog ID Headers
  - User-Agent
  - SIPp Header Modification
  - Proxy-Authenticate
  - Allow and Supported
  - History Info
  - Join
  - Session Expires
  - PPI and PIA
  - Establish Service Path
  - IMS Hosted
  - Content-Type
- 15. **Session Description Protocol (SDP)**
  - SDP Background
  - SDP Format
  - SIP = one way?
  - SDP Lines
  - SDP Offer/Answer
  - Call Hold
- 16. **RTP and Real-Time Control Protocol (RTCP)**
  - RTP Headers
  - RTP Dejitter
  - Conferencing
  - RTCP
- 17. **DTMF Handling**
  - DTMF
  - SIP INFO
  - RFC 2833
- 18. **Fax Handling**
  - T.30
  - T.38
  - SDP RFC 3407
- 19. **Presence**
  - Presence Overview
  - PIDF XML Example
  - Rich Presence
  - Presence Message Flow
  - Instant Messaging
- 20. **SIP Timers**
  - Standard Timer Values
  - Session-Expires
- 21. **SIP Security**
  - Security for Call Setup

- Authentication
- S/MIME
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## 22. SIP NAT Traversal

- NAT
- NAT Types
- STUN & TURN

## Virtual Classroom Live Labs

- **Summary - A short overview on how to navigate the lab environment**
  1. Welcome to Alta3 Labs
  2. Linux Fundamentals
  3. Using vim
- **Packet Captures - Learn how to use wireshark to test and debug SIP calls**
  1. Wireshark
  2. Making pcaps with tcpdump
  3. Making pcaps with tshark
- **SIP Registrars - Analyze the SIP REGISTRATION**
  1. REGISTER a SIP UA to SipGate
  2. Successful REGISTER by a User Agent
  3. REGISTER Fails Auth
  4. Live capture of SIP REGISTER with tcpdump
- **SIP Calls - Analyze SIP call flows via B2BUA**
  1. The SIP INVITE
  2. SIP INVITE Packet Analysis with Wireshark
  3. Troubleshooting Common SIP Failures with Wireshark
  4. Live capture of SIP INVITE with tcpdump
- **SIP Proxies - Analyze call flow through a proxy**
  1. INVITE Relay by SIP Proxies
  2. Canceled SIP call
  3. No Record Routes
- **SIP Tools - Use various SIP testing tools to view special call flows.**
  1. SIPp SIP Tester
  2. SIP Swiss Army Knife
- **Exploring Media**
  1. Methods for Transport of DTMF

Jul 6 - 10, 2026 | 10:00 AM - 6:00 PM EDT

Sep 14 - 18, 2026 | 10:00 AM - 6:00 PM EDT

Nov 30 - Dec 4, 2026 | 10:00 AM - 6:00 PM EST

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ON-DEMAND

\$345 CAD

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PRIVATE GROUP TRAINING

5 Day

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