

IP, VoIP and MPLS for the Non-Engineering Professional

Course 110 IP, VoIP and MPLS for the Non-Engineering Professional is the second course in our instructor-led "core training" section. Course 110 covers virtually all aspects of IP networks, equipment and services, including IP networks from the ground up, VoIP, SIP, MPLS, competitive services, IP security and more.

Designed for non-engineers, this professional training course will give you the solid, vendor-independent foundation necessary to deal with IP telecom network, VoIP and MPLS projects and applications with confidence. In three days, you'll build a solid understanding of IP/MPLS networks and the equipment that implements them, the players, competition, Internet vs. MPLS services, interconnect, PLUS full coverage of VoIP: packetized voice, VoIP protocols, the workings of SIP, softswitches, gateways and mainstream solutions for IP telephony and more.

You'll get up to speed, demystify jargon and buzzwords, fill the gaps, understand the technologies, the underlying ideas and how it all fits together... knowledge you can't get reading trade magazines or talking to salespeople.

This investment will be repaid many times over, eliminating frustration at buzzword-filled meetings, increasing your efficiency, and helping ensure you make the right choices.

IP, VoIP and MPLS is an essential knowledge set going forward in telecommunications. Get this career- and productivity-enhancing training today!

What You Will Learn:

- ✓ **IP and IP networks from the ground up**
 - Fiber, optical Ethernet, broadband, VDSL, GPONs
 - LANs and VLANs, MAC addresses, frames vs. packets
 - IP addressing, DHCP, public/private NAT; routing; IPv6
- ✓ **VoIP training**
 - How packetized voice works; codecs and voice quality
 - SIP and call setup (Google Voice, anyone?)
 - Softswitches, gateways, blade servers and more
 - VoIP solutions: VoIP PBX, hosted PBX, SIP trunking
- ✓ **MPLS fundamentals and services; competition**
 - What is MPLS? What is an "MPLS service?"; SLAs
 - QoS with MPLS; traffic shaping and traffic policing
 - MPLS vs. Internet services, IP Transit, peering, resale
- ✓ **IP Security**
 - How and why VPNs are implemented
 - Public key encryption, authentication and IPsec
 - Firewalls; ports and packet filtering; SPI; VoIP security
- ✓ **Practical Mainstream Solutions and Products**
 - Understand the pros and cons of different solutions
 - In-class implementation case studies and discussion

Who Should Attend

- Anyone needing to eliminate jargon- and buzzword-related frustration, understand IP network and VoIP concepts and how it all fits together.
- Non-engineering professionals familiar with traditional telecom needing to establish a solid base in IP and VoIP.
- Decision-makers, managers, analysts and anyone else who wants to understand what the "techie" are saying.

- ✓ **Designed for Non-Engineering Professionals**
Demystify jargon and buzzwords, understand technologies and most of all the underlying *ideas* and how it all works together – in plain English.
- ✓ **Vendor independent**
Core foundation knowledge that can be applied to any related project or system.
- ✓ **Proven content**
This material, its content, order, timing, analogies and examples have been tuned and refined over a period of more than ten years... and we constantly update it. Hundreds of people have rated it "excellent".
- ✓ **Technically-qualified professional instructors**
Our instructors hold Engineering degrees or equivalent and have decades of experience working in the field. They consistently receive the highest ratings and written praise on evaluations.
- ✓ **High-quality course materials**
You will receive a 419-page high-quality manual, up-to-date and bringing together information impossible to find in one place anywhere else... sure to be a valuable reference for years to come.
- ✓ **Certification included**
You will receive an IP, VoIP and MPLS course completion certificate suitable for framing.
- ✓ **Value pricing**
This three-day course is value priced at \$1395. Compare to \$2999 for lower quality elsewhere.

Coverage of all major IP, VoIP and MPLS topics, high-quality course materials, certificate suitable for framing, bonus free textbook and value pricing... don't miss this opportunity to invest in yourself and your career!

Register online at www.teracomtraining.com or call us toll-free: 1-877-412-2700

Course Overview

Part 1: The Big Picture

The first part of the course is the big picture. To get started, we'll cover the strategic reasons for an all-IP telecommunications network and its business implications, the architecture of the all-IP network and the different categories of services and service providers. This section is completed with a solid start on VoIP: jargon and buzzwords, VoIP standards and protocols, softswitches and gateways, and different VoIP implementations: PBX replacement, hosted PBX, IP centrex, internet VoIP and more.

Part 2: IP and the IP Telecom Network, From the Ground Up

The second part is the fundamental concepts and principles of operation of an IP telecom network. Building from the ground up, you will understand all of the pieces and how they fit together - in plain English. We'll start with the physical layer: basics of fiber and broadband on copper. Then we'll understand Layer 2: Ethernet, MAC addresses, LANs and VLANs. Then Layer 3: IP addressing, public and private, DHCP and NAT, TCP ports and sockets, multicasting, plus the basics of routing, OSPF and CIDR. We'll finish with a comprehensive review of IP security: encryption and authentication, VPNs, firewalls, viruses and Trojans.

Without bogging down on details, you will build solid career-enhancing understanding that lasts a lifetime.

Part 3: MPLS, MPLS Services, Competition, POPs and MANs: IP as a Business

The third part of the course adds the real-world dimension of IP as a business: commercial-quality IP services and interconnect. We begin by understanding what is MPLS and how MPLS is used as a traffic management and quality of service tool on an IP network. You will understand the basic principles of Service Level Agreements, traffic profiles vs. transmission characteristics, traffic shaping and traffic policing. Then we will explore how carriers build networks with fiber rings, POPs, MANs and sometimes acting as CLECs, and trace a circuit from end to end across several different carriers. We'll compare MPLS VPN services to Internet services, and sort out IP transit vs. peering. We've come a long way since the switched access to competitive long-distance of the 1980s!

Part 4: Voice over IP - Fundamentals to Implementation and Case Studies

Most of the third day of the course is dedicated to VoIP: the nuts and bolts of how voice is packetized, choices for codecs, how delay and jitter affect quality and voice quality measurements. Then, a whole chapter on SIP and how VoIP phone calls are set up with SIP and softswitches (hello, Google Voice!). Following this, we'll examine in a practical way how to go about connecting a VoIP system to the traditional PSTN, and understand Megaco and PRI vs. SIP trunking. Chapter 16 is the Readiness Assessment, where you will identify and understand issues and solutions when planning or implementing a migration to VoIP. We bring everything together with a set of class-participation case studies, allowing you to identify the appropriate solutions for different business cases: an ideal opportunity to identify the best course of action for your situation.

Don't Miss This Opportunity!

The knowledge you will gain taking this course will put an end to buzzword-related frustration, improve your accuracy and efficiency and enhance your career prospects. This is the training you've been looking for to fill the gaps and get on top of IP, VoIP and MPLS. Coverage of all major topics, high-quality course materials, certificate suitable for framing, bonus free textbook and value pricing... don't miss this opportunity. [Register](#) now!

Twelve Reasons to Take This Course

Teracom's courses have been taught to wide acclaim across North America since 1992 and are designed for the **professional** needing to fill in the gaps, build a solid base of knowledge... and understand how it all fits together.

1. Cut through the buzzwords, jargon and vendor hype to gain a foundational understanding of IP, VoIP, and MPLS networks, services and technologies that you can put to use today... and going forward.
2. Develop a clear understanding of VoIP systems, components, standards, jargon and buzzwords, including packetized voice concepts, codecs and compression, RTP protocol, softswitches, gateways, servers, how SIP works and more.
3. Get *unbiased* explanations of the mainstream choices for implementing VoIP, allowing you to make meaningful comparisons and informed decisions with confidence.
4. Fill in the gaps and build a solid base of knowledge of IP networking and its components: IP addresses, NAT, subnets, routing, Ethernet, MAC addresses vs. IP packets, VLANs, L2/L3 switches, fiber optics, DWDM, GPONs, DSL, VDSL and cable modems.
5. Understand how MPLS is used to implement Differentiated Services (the opposite of "net neutrality"!) to meet Service Level Agreements, and learn about traffic profiles and traffic shaping.
6. Without bogging down on details, learn how routing works and why subnets and VLANs go hand-in-hand. Understanding this or #5 would probably be worth attending the course all by itself.
7. Gain a broad understanding of IP Security: firewalls, IPsec and VPNs, authentication, public key and private key encryption and VoIP security.
8. Share practical insights, tips and tricks with other class members, discussing implementation issues in the context of the Readiness Assessment, Case Studies and Vendor Survey.
9. Benefit from this course's proven content, originally developed for a major telecom carrier for 5,000 employees and subsequently tuned, refined, improved and updated over a period of five years.
10. Learn from the best. Not only do Teracom's instructors consistently receive highest ratings on student evaluations and specific praise of their ability to get *ideas* across, our instructors hold Bachelor of Engineering degrees or equivalent and have decades of experience working in the field.
11. Get a 300-page high-quality bound student manual / textbook with detailed text notes, totally up-to-date and bringing together all of this information, impossible to find in one place anywhere else.
12. Certification is included, with a certificate attesting to your IP telecom knowledge suitable for framing.

Without bogging down on unnecessary details, understand the ideas, concepts, technologies and solutions, increasing your confidence and allowing you to make informed choices and meaningful comparisons – knowledge you can't get on the job, reading trade magazines or talking to vendors.

Tuition Fees

This high-quality, up-to-date course is value priced at only \$1395 for the three days, including certification test, certificate and 419-page course book. Compare to \$2999 and up for lower quality courses elsewhere.

How to Register

Space in our seminars is limited, and may sell out, so please register as early as possible to reserve your place. You can register online or by phone:

- Register online at www.teracomtraining.com.
- Register by phone at 1-877-412-2700.

Once you register online or call us, we'll send your registration package by email, including a confirmation letter for you to sign and fax back to complete your registration. There is no obligation until you return the signed confirmation letter and you can cancel anytime up to two weeks before the course with no penalty.

We accept Visa, MasterCard and American Express, as well as checks and purchase orders.

FREE! Telecom 101 Textbook

Register for this course today, and you will receive a free electronic copy of Teracom's highly-acclaimed 400-page Telecom 101 textbook, 3rd edition, free!

Here's What Seminar Attendees Like You Are Saying

Hundreds of people like you have benefited from Teracom's training. Many tell us their Teracom course was their best course ever; filled gaps in their knowledge and tied everything together... knowledge they've been needing for years. Here's a sampling of comments from Teracom alumni:

"Extremely beneficial. Instructor and content were excellent. Extremely knowledgeable and excellent delivery."
– Lynn Teague, British Telecom

Whether you work for an organization that produces telecom, datacom or networking products or services; or you buy these products and services - or just have to get up to speed on what all the rest of them are talking about when they say "MPLS service", "Layer 2", "Internet transit", "SIP trunking", "softswitch" or "gateway"...

"Helped me fill in many gaps between information I had heard and didn't know. VoIP - I now get it!"
– Pattie Clifford, TriStar Telecom

"Provided me with the basic principles of VoIP and has assisted in a jumpstart of the events needed to deploy this technology. I most liked the instructor's great examples that helped the class make the connection. Not only well versed on the topic, he can communicate on all levels and kept the interest of the class." – Elizabeth Reyes, Director, New York City Employees Retirement System

"Learned IP addressing, routing - useful directly for my career. Awesome job explaining things in multiple ways so that the relationships made sense" – Will Zoldak, Sentenia Systems

"I had basic understanding, but now all missing pieces are filled in. The instructor had a wealth of knowledge and was able to use analogies that were understood across all level sets of attendees."
– Martina Hoagland, Trinity Health

"Seminar was beneficial to me - I started from ground zero with no VoIP knowledge. Pace was just about right, instructor had good presentation skills." – Jeffrey Brown, US Army Corps of Engineers

"Introduced me to Layer 2 & Layer 3 differences, VLAN functions. Introduced my staff to many new terms and ideas. Something for everyone – basic for beginners, advanced for experts. Instructor is very professional, friendly." – Phil Robinson, Western Iowa Telephone

"Good review of broad range of telecom with emphasis on VoIP. I liked most the opportunity to apply information learned to scenarios in the case study exercise." – Mary McKittrick, Alltel

"Very good discussions and a valuable text book to take home for reference."
– Paul Mersch, State Farm Insurance

"Amazing information. Tons of knowledge, very accessible"
– Matt Grace, GSA

"Sharpened my knowledge for selling new concepts. I liked the MPLS discussions. Instructor was very personable, down to earth" – Mark Meyers, MidContinent Communications

"Beneficial for information and where technology is headed in regard to SIP and VoIP. Jay has an excellent way of presenting information and passing it along to his students. Very professional."
– Max Brummels, G&D America

"I now understand IP backhaul. I liked the instructor's ability to explain the material: GREAT, smart, interesting. I would attend a Teracom seminar again!" – Ashley Clausen, iPCS

"Very beneficial. It covers a great deal of areas my job is directly involved in."
– Jin Yap, Comptel

"It gave me the knowledge of IP and VoIP necessary for my work."
– Monika Idzkowska, Edfund

"Very helpful understanding VoIP, aspects of networks and how to get better quality of service. Very good instructor, took time to answer all questions. I'm planning on taking other Teracom courses."
– Madelin Ramos, Tampa Calling Centers

Detailed Course Outline

PART 1: THE BIG PICTURE

The first part of the course is the big picture. To get started, we'll cover the strategic reasons for an all-IP telecommunications network and its business implications, the architecture of the all-IP network and the different categories of services and service providers. This section is completed with a solid start on VoIP: jargon and buzzwords, VoIP standards and protocols, softswitches and gateways, and different VoIP implementations: PBX replacement, hosted PBX, IP centrex, internet VoIP and more.

1. THE IP PACKET-SWITCHED TELECOMMUNICATIONS NETWORK (IP-PSTN): CONVERGENCE

We'll begin building your understanding of the IP telecom network and IP telecommunications with *Why*: what convergence means, the reasons for a converged network, who stands to benefit, and how this time is different than previous attempts at convergence: ISDN and ATM.

- A. The Way Humans Communicate Evolves, Again
 - 1. Convergence and Converged Networks
- B. The IP Packet-Switched Telecommunications Network (IP-PSTN)
- C. Benefits of VoIP and the All-IP Network
 - 1. Benefits to Cable TV companies
 - 2. Benefits to telephone companies
 - 3. Benefits to large organizations
 - 4. Benefits for everyone
- D. Opportunities
- E. Challenges
- F. A Sea Change in Network Technology
 - 1. Forget ATM and ISDN – Everything in IP

2. THE ALL-IP NETWORK ARCHITECTURE

Next is *How*. At a high level, we'll understand how from a network engineer's point of view carriers like Verizon and TELUS view the network as having three parts: core, edge and access; and how the CO links the core to the access using MANs and L2/L3 switches, with optical Ethernet, VDSL or DOCSIS systems for access... replacing "CO switches" and voiceband analog POTS.

- A. Core
- B. Edge
- C. Access

3. IP NETWORK SERVICES

Then comes *What*. We'll outline services and sort out types of service providers and types of services. You'll understand how we will cease to think of the "telephone network" and "high-speed internet" as being two different things, and how existing services like dedicated T1s, Frame Relay, ISDN, ATM will all disappear, to be replaced by one service: IP VPNs with QoS.

- A. Categories of Service Providers
 - 1. Facilities-Based Carriers
 - 2. Resellers
 - 3. Application Service Providers
- B. Network Services
 - 1. Broadband IP Dial Tone
 - 2. Service-Level Agreements and Quality of Service
 - 3. Customer-Premise-Based IPsec
 - 4. Network-based IPsec with QoS: "Carrier" VPNs
 - 5. Network-based Virus Detection, Proxying
- C. Value-Added Services
 - 1. Telephone Service: VoIP
 - 2. Integrated Messaging
 - 3. Internet Service
 - 4. Web Hosting
 - 5. Television Service: IPTV
 - 6. IPTV from the CO

4. VOICE OVER IP: VOIP SYSTEMS, COMPONENTS, STANDARDS, JARGON AND BUZZWORDS

Telephone service is, of course, one of the main services that will run over the IP telecom network. We'll complete the first, "big picture" part of the course going one step deeper into VoIP, identifying and explaining key components, jargon and buzzwords: soft switches, media servers, gateways and terminals, plus the main standards and protocols used to provide telephone service on an IP network and an unbiased look at different implementation choices.

- A. The Big Picture
- B. VoIP Components, Jargon and Buzzwords
 - 1. Terminals
 - 2. Softswitches
 - 3. Media Servers
 - 4. Gateways
- C. Key VoIP Standards
- D. Internet Telephony
 - 1. Computer-Computer: Skype
 - 2. Phone-Phone: Vonage
- E. VoIP from Carriers: Managed IP Telephony (MIPT)
- F. Softswitches and VoIP PBXs
- G. IP Centrex vs. Hosted PBX

PART 2: IP AND THE IP TELECOM NETWORK, FROM THE GROUND UP

The second part is the fundamental concepts and principles of operation of an IP telecom network. Building from the ground up, you will understand all of the pieces and how they fit together - in plain English. We'll start with the physical layer: basics of fiber and broadband on copper. Then we'll understand Layer 2: Ethernet, MAC addresses, LANs and VLANs. Then Layer 3: IP addressing, public and private, DHCP and NAT, TCP ports and sockets, multicasting, plus the basics of routing, OSPF and CIDR. We'll finish with a comprehensive review of IP security: encryption and authentication, VPNs, firewalls, viruses and Trojans.

Without bogging down on details, you will build solid career-enhancing understanding that lasts a lifetime.

5. FRAMEWORK

To be sure everyone is on the same page, we'll briefly review the OSI Reference Model, paying particular attention to Layers 2 and 3, data links and networks, frames and packets, and how these are related.

- A. OSI Layers
- B. Protocol Stacks
- C. Frames and Data Link Protocols
- D. Packets and Networks

6. LAYER 1: INFRASTRUCTURE

With a framework in place, we'll cover Layer 1: the physical layer connections in the IP-PSTN. In the long term, the access network will be fiber, so we will make sure you have a working knowledge of fiber optics, wavelengths, DWDM for transmission systems and Passive Optical Networks (PONs) for access networks. In the short term, residences and small business will continue to use the existing copper wires – so we'll cover DSL, VDSL and data over Cable TV systems.

- A. Fiber Optics and Wavelengths
- B. Fiber Access Networks (FTTN, FTTP, PON, EPON and GPON)
- C. DSL and VDSL
- D. Cable TV Systems

7. LAYER 2: LANS AND VLANS AND ETHERNET

In this section, we'll concentrate on Layer 2: the data link layer, implemented with Ethernet. We'll fill in gaps in your knowledge of LANs, 802 standards and MAC addresses, and bring you up to speed on VLANs, critical for IP traffic management for security and QoS, plus Optical Ethernet, the technology used for Metro Area Networks (MANs), connecting customers to COs.

- A. Ethernet LANs: Broadcast Domains
- B. IEEE 802 Standards
 - 1. 802 Frames, LLC and MAC Addresses
 - 2. 802.3 CSMA/CD Access Method and Physical Layer Specifications
 - 3. Gigabit Ethernet
- C. Layer 2 Switches and Broadcast Domains
- D. VLANs and 802.1Q
- E. L2 Switch Hierarchy and Trunking

8. IP

Here, you'll fill in the gaps in IP fundamentals including address classes, static vs. dynamic address, public vs. private, network address translators, and without spending a lot of time on it, ensure that you have a good working knowledge of IPv6.

- A. IPv4 Packets
- B. IPv4 Address Classes and Dotted-Decimal
- C. Dynamic Addresses and DHCP
- D. Private Addresses
- E. Network Address Translation
- F. Next-Generation IP: IPv6
- G. IPv6 Packets and Extension Headers
- H. IPv6 Addressing Hierarchy
- I. Next-Generation MAC Addresses: EUI-64
- J. Transitioning to IPv6
- K. DNS, ARP and RARP
- L. TCP, UDP, Ports and Sockets
- M. Multicasting and IGMP

9. IP ROUTING

In this chapter, you'll come to really understand how routing works – maybe worth attending the course all in itself!

- A. Networks with Gateways: 1980s IP Thinking
- B. Subnets and CIDR
- C. Prefix and Subnet Mask
- D. Assigning VLANs to Subnets: DHCP and L2/L3 Switches
- E. Elements of Routing
- F. Autonomous Systems
- G. Route Discovery Protocols
 - 1. RIP: Routing Information Protocol
 - 2. OSPF: Open Shortest Path First
 - 3. BGP: Border Gateway Protocol
- H. Routing Tables
- I. Calculating the Next Hop

10. IP SECURITY

Here, you'll get a comprehensive overview of security in the IP world, and an understanding of the tools and techniques used to implement security. We'll begin with a discussion of risk areas, vulnerabilities and measures. Then, we'll cover the critical concept of network segmentation, and how this is implemented by assigning IP subnets to VLANs and requiring traffic to pass through an L2/L3 switch as a point of control between subnet/VLANs. Understanding this concept is yet another reason to attend this course all by itself. Then we'll look at how this "control" is implemented, with firewall technologies; the important topics of encryption, IPsec and VPNs, and malicious software such as Trojans.

- A. Risks, Measures and Policy
- B. Network Security: Segmentation and Perimeters
- C. Mapping VLANs onto IP subnets with L2/L3 Routing Switches
- D. Firewalls: Packet Filtering, Proxies and Stateful Packet Inspection
- E. IPsec and IP VPNs
- F. Public Key Encryption, Authentication
- G. Digital Certificates
- H. Malicious Software: Viruses, Trojans
- I. VoIP Security Risk Areas
- J. VoIP Security Measures and Solutions

PART 3: MPLS, MPLS SERVICES, COMPETITION, POPS AND MANS: IP AS A BUSINESS

The third part of the course adds the real-world dimension of IP as a business: commercial-quality IP services and interconnect. We begin by understanding what is MPLS and how MPLS is used as a traffic management and quality of service tool on an IP network. You will understand the basic principles of Service Level Agreements, traffic profiles vs. transmission characteristics, traffic shaping and traffic policing. Then we will explore how carriers build networks with fiber rings, POPs, MANs and sometimes acting as CLECs, and trace a circuit from end to end across several different carriers. We'll compare MPLS VPN services to Internet services, and sort out IP transit vs. peering. We've come a long way since the switched access to competitive long-distance of the 1980s!

11. MPLS AND QUALITY OF SERVICE

Quality of Service (QoS) mechanisms to guarantee transmission characteristics across an IP network are essential. Without bogging down on details, you'll understand the real story behind "net neutrality" and gain a clear understanding of the tools and techniques for controlling traffic and implementing service levels in the IP world. Importantly, you'll understand how MPLS provides a mechanism to implement Differentiated Services to meet Service Level Agreements or specified transmission characteristics. *Understanding this may be worth attending the course all by itself.* We'll also include an overview of tools and techniques for measuring quality.

- A. Virtual Circuit Technologies
- B. MPLS
- C. Diff-Serv and QoS
- D. Implementing Differentiated Services with MPLS
- E. Service Level Agreements and Traffic Profiles
- F. Traffic Policing and Shaping
- G. Queues and How Prioritization is Implemented
- H. The "MPLS Service" Quiz

12. IP AS A BUSINESS. CARRIER NETWORKS, COMPETITION AND INTERCONNECT

Interconnecting IP networks – and controlling connections – is a critical piece of the Voice over IP story. In this chapter, we'll first update the network model of Chapter 2, to include a mature competitive carrier and its interaction with the ILEC, including CLEC activities and MANs. Then we'll understand what's for sale at the network – network level, IP transiting vs. peering, Internet vs. business customer services.

- A. Competition Today: Mature Competitive Carrier Network
 - 1. POPs and MANs
- B. Competitive Carrier –The Last Mile
 - 1. Switched Access or Subcontract to ILEC
 - 2. Colocation: Acting as a CLEC
 - 3. Bypass: Fiber to the Customer
- C. IP Interconnect
 - 1. Interconnect for Business Customer Services vs. Internet
 - 2. Transit vs. Peering

PART 4: VOICE OVER IP - FUNDAMENTALS TO IMPLEMENTATION AND CASE STUDIES

Most of the third day of the course is dedicated to VoIP: the nuts and bolts of how voice is packetized, choices for codecs, how delay and jitter affect quality and voice quality measurements. Then, a whole chapter on SIP and how VoIP phone calls are set up with SIP and softswitches (hello, Google Voice!). Following this, we'll examine in a practical way how to go about connecting a VoIP system to the traditional PSTN, and understand Megaco and PRI vs. SIP trunking. Chapter 16 is the Readiness Assessment, where you will identify and understand issues and solutions when planning or implementing a migration to VoIP. We bring everything together with a set of class-participation case studies, allowing you to identify the appropriate solutions for different business cases: an ideal opportunity to identify the best course of action for your situation.

13. PACKETIZED VOICE, VOICE CODING AND VOICE QUALITY

Here, we'll get down to brass tacks: understanding what exactly packetized voice is, how it happens and the standards and protocols used. You'll learn about codecs and compression, and understand the factors affecting sound quality. We'll listen to sound clips of impairments, and provide you with a practical list of tips and recommendations.

- A. Voice Packetization and RTP
- B. Protocol Stack: RTP, UDP, IP, MAC
- C. Measuring Voice Quality
- D. Factors Affecting Voice Quality
- E. Codecs: G.711, G.722, G.729
- F. Delay and Jitter
- G. Packet Loss
- H. In-Class Demo: Impairments and Effects on Sound Quality
- I. Tips for Maximizing Voice Quality
- J. Testing and Troubleshooting Voice Quality

14. SIP AND CALL FLOW IN THE IP WORLD

After understanding how voice is packetized and transported, the next question is how to find and connect to someone else to make a phone call? The answer: SIP, the Session Initiation Protocol. We'll get you fully up to speed on SIP ideas, architecture, terminology, operation, jargon and buzzwords, and trace the establishment of a phone call step-by-step from "dialing" to ringing and answer. At the end of this, you'll understand how softswitches use SIP for call flow in IP telephone systems – another knowledge set perhaps worth attending the course for all by itself! The chapter is completed with an extensive glossary of SIP terms.

- A. History: H.323
- B. SIP Overview
- C. The SIP Trapezoid
- D. SIP Addresses: URIs instead of URLs
- E. SIP Messages
- F. SDP: Session Description Protocol
- G. Server Types: Proxy, User Agent, Redirect Server, Registrar
- H. Tracing Call Flow Step-by-Step
- I. Peer-To-Peer SIP
- J. SIP Glossary

15. VOIP - PSTN INTERCONNECT

Here, you will understand in a practical way how to go about connecting a VoIP system to the traditional PSTN, and understand Megaco and PRI vs. SIP trunking. We'll survey methods of connecting IP networks to the PSTN and finish up with connections to carriers from a PBX-type environment.

- A. PSTN Interconnect
 1. Net to Phone VSPs (DS0 Interconnect to LEC)
 2. Net to Phone VSPs (IP Interconnect to LEC)
 3. Session Border Controllers
 4. Megaco (H.248/RFC2885)
 5. ENUM Directory Structure
- B. Connecting from a PBX-type Environment
 1. SIP Trunking vs. PRI

2. Co-Existence with a Legacy PBX
 3. Integrating Integrated Messaging
- C. Access Network: IP Video/Data/VoIP Triple Play Delivery Model

16. VOIP READINESS ASSESSMENT

Step-by-step, we'll walk through issues that must be considered, resolved and checked off when planning a migration to VoIP, and finish with a practical Readiness Assessment Checklist you can put to immediate use. This will allow you to plan for change, rather than having hidden issues become a series of career-limiting surprises.

- A. The Organizational Structure
- B. LAN Cabling and Powering
- C. LAN Architecture
- D. WAN Capacity / Scalability Assessment
- E. Calculating VoIP Bandwidth Requirements
- F. Comparing Transmission Choices: T1, Frame Relay, ATM, MPLS, Internet
- G. Redundancy and Disaster Recovery
- H. IPv6
- I. End-user Equipment
- J. Readiness Assessment Checklist

17. CASE STUDIES: VOIP IN-BUILDING

Continuing with the practical, to cement your knowledge, we'll present mainstream solutions for deploying VoIP in a series of interactive, class-participation case studies. The first case studies are VoIP inside the building:

- A. Case Study: Network-based VoIP Service (IP Centrex)
- B. Case Study: PBX-based VoIP
- C. Case Study: Softswitch-based VoIP

18. CASE STUDIES: VOIP ORGANIZATION-WIDE

The second set of case studies are VoIP for long-distance communications. Again, this is an ideal opportunity for you to compare and contrast different strategies, share practical implementation experience, and understand which approach may be best for your situation.

- A. Case Study: Private Network
- B. Case Study: Over Data Networks (Frame/ATM)
- C. Case Study: VoIP over the Internet
- D. Case Study: Internet VPNs (CPE-based IPsec)
- E. Case Study: Carrier VPN Service, MPLS, IPsec

19. WRAPPING UP

We'll wrap things up with a high-level view towards the future, convergence and converged applications, an example of web-enabled multimedia call centers and where we are headed with converged IP-based communications: the IP-PSTN.

- A. Convergence
- B. VoIP in the Call Center: Click to Talk
- C. The IP-PSTN

Don't Miss This Opportunity!

The knowledge you will gain taking IP, VoIP and MPLS for the Non-Engineering Professional, complete with its certification will put an end to buzzword-related frustration, improve your accuracy and efficiency and enhance your career prospects.

If you've read this far, you know by now that this is the training you've been looking for to fill the gaps and get on top of IP, VoIP and MPLS. Coverage of all major topics, high-quality course materials, certificate suitable for framing, bonus free textbook and value pricing... don't miss this opportunity.

Invest in yourself and your career and [register](#) for this course now.

Our Goal

Our goal is to bust the buzzwords, demystify jargon, understand technologies and mainstream solutions and - most importantly - the ideas underlying all of this, and how it all works together... knowledge you can't get on the job, talking to vendors or reading trade magazines.

How You Will Benefit

You'll gain a long-lasting, solid base of unbiased career-enhancing knowledge you can build on, an investment sure to be repaid many times over, increasing your confidence and productivity and eliminating jargon- and buzzword-related frustration.

Plus, you will receive a high-quality 419-page workbook – a valuable reference packed with detailed notes, diagrams and practical explanations, with experience, tips and templates you can put to immediate use, as well as a certificate attesting to your IP, VoIP and MPLS knowledge.

Is This Course Too Advanced For Me?

At Teracom, we specialize in explaining telecom technology to non-Engineers, and we've been doing it since before the Internet existed. We explain the jargon and buzzwords, but more importantly, the underlying *ideas*, without bogging down on unnecessary details.

We cover a wide range of information in this course, but no-one expects anyone to absorb all of it in one shot. However, the fact is that if you are involved in any kind of telecommunications – voice, data or video – it is going to be over IP, and having our professional instructor walk you through this proven set of topics to demystify the jargon, fill the gaps, understand IP telecom concepts and how it all fits together, plus take away high-quality detailed reference materials allowing you to refresh your knowledge when you run in to these topics in the future – is a necessary investment and one that will repaid many times over.

Bring This Course To Your Location

In addition to scheduled public seminars, since 1992, we have provided high-quality on-site training at 3Com, Qualcomm, Intel, Cisco, Nortel, AT&T, Alcatel, Kyocera, T-Mobile, Ericsson/Hewlett-Packard, Verizon, MindSpring, APEX Telecom, Equifax, Transamerica Insurance, CNA Insurance, the US Air Force, Bell Canada, TELUS, Cap Gemini, ComSec Establishment, MicroCell, TDS Telecom, Western Wireless... to name a few.

Onsite training has special advantages:

- Your personnel will be up to a common speed with a solid knowledge base.
- We'll fill in the gaps and put in place productivity-enhancing structured understanding.
- The seminar will be a strong team-building exercise.
- Significant reductions in training costs are often achieved.
- Each student receives a detailed workbook / textbook that will be a valuable reference for years to come.

We have built a solid reputation for delivering high-quality team-training programs that are a resounding success. Please contact us at 1-877-412-2700 or visit our web site for information on [onsite training](#).

About the Author



Eric Coll is an international expert in telecommunications, data communications and networking and has been actively involved in the industry since 1983. He holds Bachelor's and Master of Engineering (Electrical) degrees, and is licensed as a Professional Engineer in his home jurisdiction.

Mr. Coll has taught telecommunications technology training seminars to wide acclaim across North America since 1992, and has broad experience working as an engineer in the telecommunications industry.

He has worked for Nortel's R&D labs as a design engineer on projects including digital voice and data communications research and digital network equipment design; on satellite radar systems; Wide Area Network design for HMO applications; and many other projects in capacities ranging from detailed design and implementation to systems engineering, project leader and consultant.