

# VOICE OVER IP, SIP, SECURITY, 5G AND IoT

*A two-day course covering VoIP and SIP, Security and What's Next: 5G and IoT... in plain English.*

Course 130 Voice over IP, SIP, Security, 5G and IoT is a two-day vendor-independent course for non-engineers covering VoIP and SIP, a comprehensive survey of security, and 5G and the Internet of Things (IoT), finishing with examples of applications like Smart Cities, tracking and monitoring, and platoons of cars on highways.

You'll get up to speed on the fundamentals of Voice over IP, the components of VoIP phone systems and what each does. We'll demystify VoIP by understanding how voice is packetized, how packets move end-to-end, how the voice is re-created at the far end... and what it sounds like with packets missing.

We'll cover Internet VoIP for individuals, and business VoIP phone systems: call managers, softswitches, hosted PBXs, cloud services and SIP trunking. We'll finish the VoIP portion of the course with carrier connections, and a "final exam" to confirm your knowledge, in groups, open-book.

On Day 2 is a comprehensive survey of security risks and measures: phishing and extortion, network security, ports and packet filtering, firewalls, passwords, fingerprints, public key encryption, Internet VPNs, SD-WANs, digital certificates, Wi-Fi security, viruses, trojans, zero-day exploits and VoIP security... in plain English.

We'll get you up to date on 5G and New Radio, with its immediate benefit (40% more b/s than LTE) and how it is being deployed on 700 MHz, 800 MHz and the new 2.5 GHz and 3.5 GHz bands, plus cool bleeding-edge ultra-broadband millimeter-wave applications.

We'll finish with the Internet of Things: what the Things are, how and what they communicate, Smart City traffic management, trackers, temperature logging, flush detection, highway platooning: cars in road trains, and more.

<p><b>Course Objectives</b></p> <ul style="list-style-type: none"> <li>• Fill gaps. Understand jargon and buzzwords.</li> <li>• Establish a complete, vendor-independent understanding of all major VoIP and SIP topics.</li> <li>• Survey all major security topics.</li> <li>• Update on 5G: its benefits, how it will be deployed.</li> <li>• Understand the IoT and its opportunities.</li> <li>• Develop career-enhancing knowledge skills.</li> </ul>	<p><b>Course Content</b></p> <p><b>Part 1: Voice over IP and SIP</b></p> <ul style="list-style-type: none"> <li>• Components &amp; operation of VoIP phone systems</li> <li>• Internet VoIP telephone service</li> <li>• Business VoIP systems: call managers, SIP servers, hosted PBX, cloud services, Centrex.</li> <li>• What SIP is and how it works</li> <li>• Voice quality: delay, jitter, packet loss</li> <li>• SIP Trunking and Carrier Connections</li> </ul> <p><b>Part 2: Security</b></p> <ul style="list-style-type: none"> <li>• Security risk areas &amp; attacker objectives</li> <li>• Phishing, credential reuse and extortion</li> <li>• Network security, ports and firewalls</li> <li>• Public key encryption, Internet VPNs and SD-WAN</li> <li>• Digital certificates &amp; SSL, authentication, passwords</li> <li>• Viruses and trojans; zero-day exploits</li> <li>• Wi-Fi security and VoIP security</li> </ul> <p><b>Part 3: 5G and IoT</b></p> <ul style="list-style-type: none"> <li>• New Radio: more bits/second and new spectrum</li> <li>• 700 MHz, 800 MHz, 2.5 GHz, 3.5 GHz and mmWave</li> <li>• 5G use cases; 5G handset chip: Snapdragon X55</li> <li>• Things Communicating over the Internet</li> <li>• IoT examples: Smart City traffic management, flush detection, trackers, monitors, highway platooning,</li> </ul>
<p><b>Prerequisites</b></p> <p>Course 101, or equivalent IP network knowledge</p>	
<p><b>Who should attend</b></p> <ul style="list-style-type: none"> <li>• Those needing to fill the gaps, understand jargon and technologies like VoIP, SIP, SIP Trunking, phishing, network security, encryption, 5G and IoT.</li> <li>• Ideal for non-engineering professionals in need of a solid knowledge base to be more effective in dealing with technology projects and technical personnel.</li> </ul>	
<p><b>Tuition Fees</b></p> <p>Value priced at \$1195 live online or \$1295 in-person          Compare to \$2495 for lower quality elsewhere.          Course 130 is days 4-5 of Course 111 BOOT CAMP.          Save \$695 attending the full week BOOT CAMP!</p>	

Register online at [www.teracomtraining.com](http://www.teracomtraining.com) or call us toll-free: 1-877-412-2700

## **Demystify How Voice Moves in Packets**

The best way to end buzzword and knowledge-gap frustration is to understand the fundamentals and build a solid vendor-independent knowledge base.

We'll start with a big-picture view, identifying the components of VoIP systems and what each does: VoIP phones, SIP, soft switches and gateways.

You'll learn all the steps involved in putting sound coming out of someone's mouth into IP packets, transporting the packets across the IP network, and reproducing the sound in someone's brain at the far end.

Then we'll put the theory into practice with a practical demonstration of Voice over IP over Wi-Fi in the classroom, to the Internet, to a cellphone in the classroom.

We'll trace the voice packets end to end through all of the devices, circuits and carriers involved, laptop to cellphone. Some people rate this part of the course the best!

Understanding how the packets move end-to-end gives you confidence and a solid knowledge base to build on; in the future, even if you're not familiar with the exact VoIP or SIP product someone is discussing, you'll still know what they are talking about.

## **Learn About VoIP Phone Systems for Businesses**

After covering Internet VoIP for individuals, we'll compare and contrast all of the different configurations for business VoIP telephone systems.

We'll examine all of the different choices including premise softswitch, call manager, IP PBX vs. PBX replacement, hosted PBX, cloud services, SIP trunking, IP Centrex.

You'll also learn about Power over Ethernet for business phones and the recommended LAN configuration for VoIP.

## **Understand SIP Trunking and Carrier Connections**

You'll learn what SIP trunking is, and how it replaces expensive PRI and PBX trunks with a lower-cost service that moves VoIP over an IP network between business locations, plus includes a gateway service for PSTN phone calls, saving money in two ways.

You'll learn how Session Border Controllers are used as the edge equipment to connect different VoIP networks, and all the functions the SBC does including SIP security.

We'll see how carrier networks connect via native VoIP. You'll also learn how the 1980s switched access tariffs for connecting a call between carriers using POPs and Tandem Access Trunks on channelized digital trunk carrier systems are still used in the US, Canada and many other countries... and why it will take time to evolve that to packets.

## **Learn About Voice Quality**

Whether it is Skype or Skype for Business over the Internet, or a Cisco Call Manager and SIP trunking, call quality is of primary importance, particularly for the callers!

You'll gain useful knowledge of what affects VoIP quality and how problems can be corrected. You'll learn how voice quality is measured and factors that affect it including codec, delay, jitter and lost packets. We'll demystify how packets actually get delayed or "lost", and listen to the sound effects.

## **Get a Broad Survey of Security Risk Areas and Measures**

Telecommunications allows information transfer; but can also be a venue for malicious attacks. We'll update your knowledge and fill the gaps with a wide survey of all things security, risks and measures, beginning with phishing and extortion emails, then network security, firewalls and ports, and Public Key Encryption.

Understanding encryption leads to understanding Internet VPNs and SD-WANs, digital certificates, digital signatures and Wi-Fi security.

We complete this extensive section with viruses, trojans and exploits.

## **Get Up to Speed on 5G**

You'll get up to speed on the current state of 5G, and learn about its immediate benefit: 40% more efficient than LTE.

We'll understand the design goals for 5G and review the New Radio spectrum allocations: 700 MHz, 800 MHz, 2.5 GHz and 3.5 GHz and millimeter-wave bands, and discuss the pros and cons and typical applications of each.

We'll finish with the Qualcomm Snapdragon X55 chip that is the enabler for the first wave of 5G smartphones... and commands a royalty of 3.25% of the retail price of a phone.

## **Understand IoT: The Internet of Things**

We'll start off understanding exactly what "Internet of Things" would mean, why an engineer would call it "Things Communicating Over the Internet", what the Things could be and how they communicate.

We finish with examples: Smart City traffic management systems, trackers and monitors, ultra low power applications, flush detection, temperature logging, highway platooning: road trains of cars on highways, ultra low-power, virtual and augmented reality.

## **Gain Vendor-Independent Knowledge You Can Build On**

The knowledge you gain taking this renowned training course is vendor-independent foundational knowledge in VoIP and SIP fundamentals, technologies, standard practices, and how it all fits together.

You will be able to build on this proven knowledge base to quickly get up to speed for a particular project - then have the versatility to work on subsequent projects. Not only will it eliminate buzzword frustration, the cost of this training will be repaid in improved accuracy and productivity gain many times over.

Teracom's proven instructor-led training courses have been developed and refined over many years providing training for organizations including AT&T, Verizon, Bell Canada, Intel, Microsoft, Cisco, Qualcomm, the CIA, NSA, IRS, FAA, US Army, Navy, Marines and Air Force and hundreds of others... and are totally updated for the 2020s.

Register today to get this career-enhancing addition to your knowledge skills!

## 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 people who have taken this course:

*"Outstanding! The instructor had an outstanding knowledge and presentation."*

- Larry Byrnes, NAVAIR, US Navy

*"The instructor was very knowledgeable and made sure you understood the subject matter."*

- G.M., Naval Undersea Warfare Center Newport

*"Thank you again for the great training you provided. I made my superiors aware of how helpful and integral your training was in developing my understanding of the communications world, not to mention putting me a step ahead of the competition."*

- Nyles Stockton-Davis, The United Companies

*"I sat in on a round table at a conference yesterday where VoIP was discussed by Time Warner Cable and Vonage – and I understood most of their diagrams and explanations – something that would have been 'Greek' to me two weeks ago. Thank you."*

- Bob Sabin, Tel Control, Inc.

*"Thank you! Thank you! I just spent an entire day talking about Session Initiation Protocol. Thanks to the course, and your instruction, I was actually able to follow the presenter (who spoke so quickly that I'm sure she must have had an oxygen tank nearby!)"*

- Janette Murray, Communications Analyst, Landstar System Holdings

Whether you work for an organization that is moving to VoIP, or a company that produces IP telecom or networking products or services – or just have to get up to speed on what all the rest of them are talking about when they say "softswitch", "call manager", "RTP", "G.711", "SIP", "Megaco" or "Transport Layer Security" ...

*"The instructor was very knowledgeable and explained things at a level that I could understand."*

- K.J., Novozymes NA

*"New technology - installing in new sites soon, and I needed to know everything that was taught.*

*Lots of new/good information, and it was presented in an understandable format."*

- Sharon H. Eastman, Kentucky Dept. of Labor

*"The instructor was excellent and presented a good, entertaining approach to the subject."*

- John P. Spinks, Lockheed Martin

*"Gave me an overall understanding of the workings of VoIP. The instructor was very good – he was able to answer all questions and made the course interesting."*

- Garry Waddell, Ricoh Corporation

*"Made clear that which had previously been muddy."*

- Nick Whittier, EPA

## Eight Reasons to Take This Course

Teracom's courses have been taught to wide acclaim across North America since 1992 and are designed for the non-engineering professional needing to fill in the gaps, build a solid base of knowledge... and see how it all fits together. Totally up to date for the 2020s!

1. Cut through the jargon and vendor hype to gain a structured understanding of VoIP and SIP, allowing you to make informed choices and meaningful comparisons – knowledge you can't get on the job, reading trade magazines or talking to vendors.
2. Eliminate uncertainty and frustration from not knowing terms and technologies with a clear understanding of VoIP fundamentals, components, systems, standards, jargon and buzzwords. Be more confident, more accurate and more productive.
3. Get a broad overview of security risks, measures and best practices: network security, computer security, OS security, application security, information security, communication security.
4. Find out what 5G wireless is going to be and how it will be used.
5. Understand IoT and explore the ways that everything will be online in the future: from shipping containers to streetlights, self-driving transport trucks, VR and brain implants.
6. Learn more with instructor-led training, where you can interact and ask questions – the best kind of training you can get – and instructors consistently rated “excellent” on student evaluations.
7. Get Certifications: CVA with Course 130; CTNS, CVA and CTA with BOOT CAMP.
8. Get a 230-page high-quality color course book with copies of graphics plus detailed text notes, bringing together all of this information, impossible to find in one place anywhere else, sure to be a valuable reference for years.

## Course Schedule – How to Register

We're constantly adding new dates. To see the latest schedule, please visit [teracomtraining.com](http://teracomtraining.com). Or have us come to you for a private on-site seminar!

Space in our seminars is limited, and may sell out, so please register as early as possible to reserve your place. Register online at [teracomtraining.com](http://teracomtraining.com), or call us at 1-877-412-2700. You will receive a registration package with full details plus a confirmation letter to sign and return.

## Your Course Materials: An Invaluable Reference

*No-one expects anyone to learn all of this in one shot!* For self-study and day-to-day reference, every course comes with a high-quality printed color course book that's been called the best on-the-job reference tool around. Written in plain English, this easy-to-use reference includes copies of all graphics PLUS extensive detailed text notes.

Topics are organized in logical groups to give you easy reference to the practical experience, theoretical background, and unbiased information on industry technologies, products and trends you will need. With numerous chapters covering all major topics, you'll obtain an invaluable resource impossible to find anywhere else in one book.

## Free Bonuses! Online Courses and TCO Certifications

TCO Certified VoIP Analyst (CVA) Certification with its six online courses is included with Course 130. If you take BOOT CAMP (Course 101 + 130), you also get:

Certified Telecommunications Network Specialist (CTNS) with eight online courses, and Certified Telecommunications Analyst (CTA) Certification Package with sixteen courses.

You get unlimited repeats and there are no time limits. The courses are a good second pass through the topics, and let you refresh your knowledge anytime in the future. Write the optional course exams to verify your knowledge and earn TCO Certifications.

## Detailed Course Outline

Our philosophy is: start at the beginning. Understand the fundamental ideas. Understand mainstream technologies that implement these ideas. Learn the acronyms, abbreviations and jargon. Get an unbiased big-picture view that will give you the knowledge you need to ask the right questions, make meaningful comparisons and informed decisions.

Our goal is to eliminate frustration, increase confidence, accuracy and productivity by building a solid vendor-independent knowledge base that has both immediate and long-term value.

Course 130 adds VoIP and SIP, Security, 5G and IoT on top of core knowledge gained in Course 101.

### Part 1: VoIP and SIP

In the first six chapters, you will get up to speed on Voice over IP, what SIP is and how it works, all of the jargon, buzzwords and concepts, SIP Trunking, and sort out pros and cons of VoIP systems: Softswitch / Call Manager vs. Hosted PBX vs. IP Centrex vs. Cloud Service.

#### 1. VoIP Components, Systems, Standards, Jargon and Buzzwords

We'll start with VoIP jargon and buzzwords, basics of communicating voice in IP packets, what the components of VoIP systems are and what each does: soft switches, media servers, gateways and terminals, plus the main standards and protocols used in VoIP systems. The last lesson is "where this is headed": what will people have as basic "telephone" service 20 years from now.

- A. The Big Picture
- B. VoIP System Components
  1. Terminals
  2. Voice in IP Packets
  3. Softswitches / SIP Servers / Call Managers
  4. Media Servers and Unified Messaging
  5. Gateways
  6. LANs and WANs
- C. Key VoIP Standards
- D. Where This is Headed: Broadband IP Dial Tone

#### 2. VoIP for Individuals

"Voice over IP" can happen in many different ways. We'll begin understanding VoIP phone calls with how it all started: VoIP between individuals over the Internet. You'll learn how Internet VoIP telephone service works with a practical demonstration of Voice over IP over the Internet to a cellphone. We'll trace the voice packets end to end through all of the devices, circuits, carriers and buildings involved, from a laptop in the class to the Internet then to a cellphone in the class.

- A. Internet Telephony: Computer-Computer VoIP over Internet
- B. Internet Telephony Clients
- C. VSPs: Internet to Phone e.g. Skype to Phone
- D. Class Exercise: Trace a Phone Call from Laptop to Cellphone
- E. VSP: Internet VoIP with Adapter and PSTN Phone Number e.g. Vonage
- F. VoIP Becomes the New POTS

#### 3. VoIP Implementations for Businesses

We will compare and contrast all the different choices for a business VoIP phone system: upgrading an existing PBX, replacing the PBX with a Call Manager / softswitch; implementing a Hosted PBX; using Softswitch as a Service, Cloud-based services, IP Centrex, and review VoIP application examples. You'll gain the knowledge to confidently differentiate VoIP architectures and discuss pros and cons of options.

- A. VoIP-Enabled PBX and Migration Options
- B. Premise Softswitch / Call Manager: PBX Replacement
- C. Hosted PBX and Cloud Services: Softswitch as a Service (SaaS)
- D. SIP Trunking
- E. IP Centrex
- F. Asterisk and Open-Source Softswitch Software
- G. Phone Powering and PoE
- H. LAN Configuration for VoIP
- I. Public Safety Communications
- J. Star-Trek Personal Communicators for Hospitals
- K. Applications Running on Business VoIP Phones
- L. IP Call Center Application Example

#### 4. SIP and Call Flow in the IP World

SIP is the open, standard protocol for setting up Voice over IP telephone calls. All standards-based VoIP systems must adhere to the Session Initiation Protocol. It defines the procedure and messages to set up a phone call – or any other kind of communication. You'll learn what SIP is, how it works, demystify jargon like proxy server, understand how SIP fits in with softswitches and call managers, and trace the establishment of an IP phone call step by step. At the end of this, you'll understand how phone calls happen in VoIP telephone systems – maybe worth attending the course all by itself!

- A. What SIP is and What it Can Do
- B. Relationship to Other Protocols
- C. SIP URIs: "Telephone Numbers"
- D. Registration and Location
- E. Outbound Proxy
- F. Finding the Far End
- G. The SIP Trapezoid
- H. SIP Message Example
- I. How SIP Relates to Softswitches and Call Managers
- J. Relating PSTN Phone Numbers to SIP URIs
- K. Google Voice: Cloud SIP Services for Individuals

#### 5. Voice Quality

Call quality is of primary importance, particularly for the callers! In this chapter, you'll learn what affects VoIP quality and how problems can be corrected. You'll learn how voice quality is measured and factors that affect it including codec, delay, jitter and lost packets. We'll demystify how packets actually get delayed or "lost", and listen to the resulting effects. We conclude with a practical checklist of tips and recommendations for ensuring success.

- A. Voice Packetization
- B. Measuring Voice Quality
- C. Factors Affecting Voice Quality
- D. Codecs: G.711, G.729, HD Voice
- E. Network Delay and Jitter
- F. RTP
- G. VoIP Protocol Stack: RTP, UDP, IP, MAC
- H. How Packets Get "Lost"
- I. Packet Loss and Sound Samples – In-Class Demo
- J. Testing and Troubleshooting
  - 1. First Step: The IP Network
  - 2. Second Step: The VoIP
- K. Tips for Maximizing Voice Quality

## 6. VoIP Carrier Services

We round out the Voice over IP part of the course with connections to carriers, beginning with Class of Service (CoS) performance guarantees in Service Level Agreements (SLAs) and ending with selecting a VoIP carrier. We'll cover SIP trunking to replace PBX trunks for business phone systems; connecting with gateways and Megaco; and understand how cellular, cable, internet and incumbent carriers connect for PSTN VoIP phone calls.

- A. Carrier Class of Service (CoS)
- B. SIP Trunking Service
- C. VoIP at Carriers: Session Border Controllers
- D. PSTN VoIP Interconnection at the Toll Center
- E. PSTN Tandem Access Trunk Interconnection at the Toll Center
- F. Connecting Legacy PBX Trunks with Gateways
- G. Comparing Transmission Choices: SIP Trunking, MPLS VPN and SD-WAN
- H. Selecting a VoIP Carrier

The VoIP section concludes with a Final Exam, fill-in-the-blanks to identify all the different pieces of information necessary to make a VoIP phone call happen, at each layer of the OSI Model. Don't panic: the class separates into groups to do the exam together, open book. It is a very useful tool to confirm BOOT CAMP knowledge gained up to this point in the week.

## Part 2: Security

### 7. Security Risks and Measures

In this extensive section, you'll get a comprehensive overview of security. We'll begin with an overview, and identification of valuable targets. We'll cover phishing and extortion, and what is actually done with data from "breaches". Next, we'll explore the risks and measures taken and best practices in network security, firewalls and ports; public and private key encryption, digital signatures, digital certificates, Internet VPNs, SD-WANs, viruses, trojans and exploits, Wi-Fi and VoIP security.

- A. Security Areas, Risks and Policy
- B. Attacker Objectives
- C. Phishing and Extortion
- D. Using Stolen Usernames and Passwords
- E. Social Engineering
- F. Network Security: Segmentation and Perimeters
- G. Packet Forwarding vs. Packet Filtering
- H. Port Filtering & Open Ports
- I. Firewalls & Firewall Proxies
- J. Stateful Packet Inspection Firewalls
- K. Public Key and Private Key Encryption
- L. Authentication, Passwords and Digital Signatures
- M. Digital Certificates, TLS and SSL
- N. Wi-Fi Security and WPA2
- O. IP VPNs
- P. SD-WAN
- Q. Country-Spoofing VPN Service
- R. Anonymizer VPN Service
- S. Viruses
- T. Trojan Horses and Spyware
- U. Exploits, Zero-Day Exploits & National Vulnerability Database
- V. VoIP Security

## Part 3: 5G and IoT

The course wraps up with upcoming technologies, including 5G wireless and the Internet of Things: how everything from toasters to self-driving trucks to human brain implants will be online.

### 8. 5G: New Radio and New Spectrum

In this chapter, you'll learn about the latest developments for the deployment of the next generation of wireless: 5G. You'll learn the immediate impact of 5G: 40% increase in bits per second per Hz, support for massive MIMO and the longer-term ultra-broadband millimeter wave applications. We'll understand the design goals for 5G and review the New Radio spectrum allocations, and finish with the chip that is the enabler for the first wave of 5G smartphones.

- A. 5G's Immediate Impact: More Bits Per Second
- B. 5G Design Goals and Use Cases
- C. New Radio: New Spectrum Allocations
- D. Millimeter-Wave Bands
- E. Massive MIMO
- F. 5G Consumer Device Enabler: Qualcomm Snapdragon X55 Chip

### 9. IoT

The Internet of Things: we'll start off understanding exactly what that means, exactly, what the Things could be and how they can communicate. We complete Course 130 and BOOT CAMP with examples of IoT, Low Power Wide Area (LPWA) and 5G applications like ultra-low-power tracking, optimizing traffic flow and parking in Smart Cities, metering and monitoring, and platooning cars into road trains on highways.

- A. The Internet of Things (not)
- B. Communications for Things
- C. A Computer in Everything
- D. Smart Cities: Intelligent Traffic Management Systems
- E. Smart Cities: Parking, Trash
- F. Asset Tracking and Monitoring
- G. Metering and Monitoring
- H. Low-Power Wide-Area (LPWA) Radio Networks
- I. 5G + IoT: Platooning

## This is an easy sell with management

Your increased efficiency, productivity and informed decision-making will repay the cost of the training many times over.

You'll have an advantage over the competition with this broad career-enhancing knowledge. You'll be more effective and less frustrated, understanding the ensemble of communications technologies, the jargon, buzzwords and how it all works together.

[Register today at teracomtraining.com!](http://teracomtraining.com)

## Who Should Attend

- Professionals needing to fill knowledge gaps, understand buzzwords, jargon, and VoIP and SIP technologies, and more importantly, the ideas behind these technologies... and how it all fits together.
- Non-engineers in need of a solid knowledge base to be more effective in dealing with technology projects and technical personnel.
- Decision-makers and project managers who need to understand what the "techie" are saying.
- Managers and planners. Telecom and network system administrators. Finance, tax and accounting personnel. Software and support system developers.
- Anyone who wants to eliminate buzzword frustration to be more confident and more productive.
- Anyone who needs a comprehensive overview of security risks, measures and best practices.
- Anyone interested in 5G and IoT applications and trends.
- Anyone willing to invest two days in career-enhancing training, with certification and reference book.

## Bring This Course to Your Location

Since 1992, we have provided high-quality on-site training in telecommunications for non-engineering professionals at AT&T, Verizon, Bell Canada, TELUS, Qualcomm, 3Com, Cisco, Intel, Alcatel, Nortel, Teleglobe, the NSA, Defense Information Systems Agency, US Coast Guard, US Air Force, Office of Naval Intelligence, MindSpring, APEX Telecom, Equifax, Transamerica Insurance, The Hartford, American Broadband, Cap Gemini, ComSec Establishment, MicroCell Telecom, TDS Telecom, Kyocera, Winstar, Western Wireless, US Cellular, Ericsson/Hewlett-Packard, Entergy, Intelsat, RangeTel, Alltel, Vertek, DSCI, Cox Cable, Florida Power and Light, Frontier Communications, Western Iowa Telephone, Genuity, LG Electronics, Panasonic, SouthEast Telephone, State of Nebraska, State of Montana, Tektronix, Bermuda Telecom, UTS and the Universal Service Administrative Company... to name a few. Plus, we have a GSA contract with pre-approved government pricing.

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 of telecom and networking from fundamentals to the latest technologies... customizable to meet your requirements.
- 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.
- Pre- and post-training testing is available, including team results on a spreadsheet

We have built a solid reputation for delivering high-quality private team-training programs that are a resounding success. We'd like to do the same for you! Please contact us at 1-877-412-2700 for more information.

## 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 of Engineering and Master of Engineering (Electrical) degrees.

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 telecom network equipment design, and on satellite radar systems, consulting on Wide Area Network design, and many other projects in capacities ranging from detailed design and implementation to systems engineering, project leader and consultant.

In addition to being founder and Director of Teracom Training Institute, Mr. Coll provides consulting to the telecommunications industry, specializing in telecommunications technology R&D and as a Subject Matter Expert in tax matters.

## Teracom Online Courses

Get up to speed and build a solid base of knowledge in telecom, datacom, networking, IP, MPLS and wireless... with certification to prove it. Based on Teracom's proven instructor-led training courses developed and refined over twenty years providing training for organizations including AT&T, Verizon, Bell Canada, Intel, Microsoft, Cisco, Qualcomm, the CIA, NSA, IRS, FAA, US Army, Navy, Marines and Air Force and hundreds of others, Teracom online courses are top-notch, top-quality and right up to date with the topics and knowledge you need.

Many of Teracom self-paced online telecom training courses are a full multimedia experience. The text spoken by the instructor is displayed on the right side of the screen while animated diagrams, pictures, bullets and video are displayed on the left. Each lesson in a course has several parts, followed by informal quiz questions to ensure key points are understood. Every course includes a full-color course completion certificate suitable for framing.

Take advantage of these courses for individual learning, or for an entire organization. The scalable myTeracom Learning Management System can register and manage all of your people, and generate management reports showing progress and scores with the click of a button.

You can also select individual courses, or select from other packages of discounted courses as best meets your learning needs.

We've partnered with the Telecommunications Certification Organization for certifications. Register for a Certification Package, complete the courses and exams, and earn TCO Certification, with diploma, personalized Letter of Introduction / Letter of Reference explaining your knowledge skills, and more.

## TCO Telecommunications Certifications

Upgrade your knowledge – and your résumé – with high-quality telecom training courses by Teracom Training Institute plus TCO Certification from the Telecommunications Certification Organization.

### [Certified Telecommunications Network Specialist \(CTNS\)](#)

The internationally-recognized CTNS Certification is the core network knowledge required by anyone serious in the telecom world today.

### [Certified Telecommunications Analyst \(CTA\)](#)

The prestigious TCO Certified Telecommunications Analyst CTA Certification is the most comprehensive telecommunications certification available, demonstrating to employers that the holder has broad and deep telecom, datacom and network knowledge.

### [Certified VoIP Analyst \(CVA\)](#)

CVA covers all aspects of Voice over IP, including all the different ways VoIP is implemented, how calls are set up with softswitches and SIP, how voice is packetized and the factors affecting sound quality, connecting to carriers and SIP trunking, and network quality with MPLS, Service Level Agreements and Class of Service.

### [Certified Wireless Analyst \(CWA\)](#)

TCO Certified Wireless Analyst Certification covers the core technical knowledge needed by anyone serious in the wireless business today, full range of wireless technologies including radio and spectrum fundamentals, mobile communications concepts and network technologies, as well as WiFi and other fixed wireless.

### [Certified Telecommunications Subject Matter Expert \(CTSME\)](#)

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