

BROADBAND, TELECOM, DATACOM AND NETWORKING FOR NON-ENGINEERS

An intensive three-day course covering all major topics in telecom, datacom and networking... in plain English.

Course 101 Broadband, Telecom, Datacom and Networking for Non-Engineers is our "core training" - an intensive three-day course designed for non-engineering professionals, to get you up to speed on virtually all aspects of telecom, datacom and networking, from fundamentals and jargon to the latest technologies.

Totally up to date with broadband Internet and the converged IP telecom network in the front seat, the topics in this course represent the core knowledge set necessary for anyone serious in telecom today.

Thousands of people from organizations including Cisco, Intel and Microsoft, CIA, NSA, IRS, FAA and FBI, all branches of US Armed Forces, AT&T, Verizon, Bell Canada, Wells Fargo, Bank of America, TD Bank, Oneida Tableware, the San Francisco Giants and hundreds of others who needed to be more effective in understanding and dealing with telecom and networking technology have benefited from this course.

We bust the buzzwords, explain the jargon, and more importantly, the ideas and concepts behind the jargon: key concept-level knowledge that you can't get on the job, from magazines or vendors.

This core training - and our superb instructors - consistently receive rave reviews on evaluations. Covering the topics in a systematic way, we build structured knowledge that lasts a lifetime. Many attendees tell us that this is training they wish they'd had years ago. Join us today!

Course Objectives

- Establish a solid base in the fundamentals of today's telecom, datacom and networking.
- Fill in the gaps. Understand jargon and buzzwords.
- Understand mainstream technologies and solutions.
- Put a structure in place that project-specific knowledge can be built on in the future.
- Understand how it all fits together.
- Develop career-enhancing knowledge skills.

Prerequisites

None

Who should attend

- This course is for those needing to fill in the gaps, understand buzzwords, jargon and technologies like SIP, LTE, 5G, Ethernet, MPLS and TCP/IP, and more importantly, the ideas behind these technologies and how it all fits together.
- Ideal for non-engineering professionals in need of a solid knowledge base to be more effective in dealing with technology projects and technical personnel.

Tuition Fees

Value priced at \$1395 live online or \$1895 in-person. Compare to \$3250+ for lower quality elsewhere. Course 101 is days 1-3 of Course 111 BOOT CAMP. Save \$695 attending the full week BOOT CAMP!

Course Content

Part 1: The Fundamentals

- Today's broadband converged IP telecom network
- Telecom fundamentals: pulses, modems, multiplexing
- Network fundamentals: IP packets and MAC frames
- The Internet, ISPs and Net neutrality
- Web Services, Cloud Computing, Data Centers
- Residential, Business and Wholesale Services
- Digital Media: digital voice, video, images, data, text

Part 2: Telecom Technologies

- Wireless: Cellular, 4G, 5G, Mobile Internet
- Wi-Fi, Satellite, 3.5 GHz Broadband Home Internet
- Fiber: fundamentals, WDM, Optical Ethernet, PONs
- Copper: POTS, DSL, Cable Modems, T1, LAN cables

Part 3: Equipment, Carriers and Interconnect

- Core Routers and Layer 2 Switches
- CO Switches & PBXs vs. Softswitches, Gateways
- Internet Exchanges, Switched Access, POPs, CLECs

Part 4: Networking

- OSI Layers and Protocol Stacks
- Ethernet LANs, LAN switches and VLANs
- Routers, IP addresses, DHCP, public-private NAT
- IPv6 address types and allocation
- Carrier networks, SLAs, Class of Service
- MPLS for CoS, VPNs, integration and aggregation

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

Demystify Buzzwords and Jargon

One of the biggest challenges in telecommunications is dealing with all of the acronyms, abbreviations, jargon and buzzwords.

The list goes on and on: Broadband, Ethernet, TCP/IP, SIP trunking, OSI, Layer 2, VoIP, Hosted PBX, DSL, OE, PRI, ILEC, POP, MAN, Wi-Fi, LAN, WAN ...

It can be very frustrating sitting in meetings with these terms flying around and not understanding most of them... particularly when someone asks your opinion.

Plus, there is a second-order problem: even if you were to figure out all of the current jargon and buzzwords, there will surely be more next month!

The solution? Understand the fundamentals. Take the cover off the box and see what it does and how it works. Doing this, you'll find out there are only four or five fundamental ideas in telecom, with ongoing incremental improvement in each area.

Understand the Fundamentals

Once you understand the fundamentals, not only will the buzzwords and jargon be demystified, you'll have a solid knowledge base. In the future, if you're not familiar with the exact product someone is discussing, you'll still know what they are talking about.

We'll begin with a big-picture view, identifying the different parts of the network, understanding how circuits are implemented by carriers, how carriers interconnect, and the residential, business and wholesale services.

We'll make sure everyone is starting at the same level, with telecom essentials like how bits are represented using pulses on fiber and LAN cables, how bits are represented using modems on wireless and coax systems, and the different kinds of multiplexing.

Without bogging down on details, you'll learn the mechanics of the broadband converged telecom network: IP packets carried in MAC frames, and how phone calls, television, images and text are digitized and carried in the IP packets.

Understand the Technologies: Wireless, Fiber and Copper

With the fundamentals in place, we'll understand the technologies for communicating over radio, fiber and copper wires, and the mainstream technologies in each area.

In the wireless chapter, we'll start with spectrum, then you'll learn the components and operation of a mobile cellular network, 4G LTE and 5G, mobile internet, fixed wireless broadband internet, Wi-Fi and satellites.

In the fiber chapter, we'll understand the basic principles of fiber and fiber cables, wavelengths, Optical Ethernet and PONs. For copper, you'll learn how DSL and Cable modems work, along with LAN cable categories and more.

You'll learn the kinds of equipment used, what each does, and how it all interconnects for phone calls and Internet traffic.

Taking this course to understand the fundamental ideas and mainstream technologies puts you back in control, with the confidence to contribute effectively.

Understand the Telecom Network

In the not-too-distant future, the Internet and the Public Telephone Network will become the same thing, and all communications including phone calls, television and internet traffic will be in IP packets. A basic understanding of IP addresses and packets and what routers do is a cornerstone of modern telecommunications knowledge.

Taking this course, you'll fill the gaps in your knowledge of IP and packet networks, and fully understand the ideas of packets, IP addresses and routers. We'll demystify DHCP, static and dynamic addresses, private and public addresses and Network Address Translation. You'll also learn how everyone gets 18 billion billion IPv6 addresses.

We'll complete your knowledge with MPLS, understanding how MPLS is used as an IP packet traffic management system, to implement Class of Service quality guarantees, and to implement business communication services called MPLS VPNs.

Learn About Cloud Computing and Data Centers

Cloud computing and data centers are a mammoth business and one of the biggest growth areas in the telecom area today.

To understand data centers, we'll start by reviewing what the Internet actually is, and the role of ISPs. Then we'll understand the web: client-server computing over the Internet, what a web server is, how it serves web pages to clients, and how back-end processing is needed to do transactions and database operations like finding your bank balance and creating a web page to send to you to display it.

Then you'll learn how the computing power necessary to support thousands or millions of users doing this is implemented in Data Centers with Cloud Computing infrastructure to allow scalability and fault-tolerance... and how this service is sold as "Web Services" by the likes of Amazon's AWS and Microsoft Azure.

With the Web Services business sector revenue at \$50 billion per year and climbing, familiarity with Data Centers and Cloud Computing is career-enhancing knowledge.

Gain Vendor-Independent Knowledge You Can Build On

The knowledge you gain taking this renowned training course is vendor-independent foundational knowledge in telecommunications, networks, IP, packets, fiber, wireless: 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 core training. Many tell us this was their best course ever; filled gaps in their knowledge and tied everything together... knowledge they've been needing for years. Others on course their first week on the job remarked "what a wonderful way to get started in the business."

Here's a sampling of comments from Teracom alumni:

"Feedback from my team was TERRIFIC. It gave our entire technical Call Center a common foundation, and you seem to have crafted that perfect balance between technical depth, real-world applications, and lively delivery. I couldn't be happier with the results. The things my team learned from this training were applied in real-world situations almost immediately."

- Rusty Walther, Vice President, Client Services, AboveNet Communications

"Excellent! I learned a lot - everyday terms, definitions, and acronyms. Seminar notebook very helpful. The instructor was the best I ever had - lots of knowledge and experience and stories were GREAT."

- Serena Laursen, Microsoft

"Thank you for conducting a very successful course last week. It was both informative and interesting and you were able to find the perfect balance of sharing deep knowledge, provide relatable examples and lighten it up with great humor. The feedback that we have received has been extremely positive."

- Charlotte Kaheru, International Finance Corporation, World Bank

"The seminar delivered exactly what was advertised, at a very high quality.

Truth in advertising!" - Gary Lundberg, Copper Mountain Networks

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 "SIP trunking", "Ethernet", "MAC frame", 5G, MPLS, VPN, Data Center, Cloud Computing...

"Best course we have ever had onsite at 3Com"

"Perfect content; well organized, well paced, building block approach, resulted in a very nice cathedral" - Jim George, Qualcomm

"Course was excellent! One of the best I have taken. Extremely well organized and presented. Seminar workbook is outstanding - a very valuable reference" - Kieran Delaney, Maritime Life

"I liked most the use of analogies to explain complex concepts. It delivered exactly what the brochure promoted. Gave me a thorough understanding so I feel more confident."

- Judith Myers, AT&T

"Excellent! Tied the individual pieces of knowledge together into a picture... was interactive and built up the knowledge layers properly." - Jim Geiss, Century Link

"Filled in a lot of gaps in my knowledge of networking... able to deliver the knowledge effectively and entertainingly. Excellent seminar"- Kirk Kroeker, IEEE Computer Society

"Layman's terms with humor was very relaxing - helped me concentrate... understanding is now CLEAR ... the manual will be very helpful" - Linda Côté, Bell Canada

"Best instructor I have had on a course - excellent explainer in layman terms, not techie terms" - Susan Coleman, Bell Sygma

"Best course materials ever; the full text descriptions are invaluable. Course filled in so many gaps for me. Bravo!" - Ross Brooks, Vertek

"Outstanding! The best I've encountered, and I've attended many seminars."

- Bob Gibbons, WMX Technologies

Six 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 telecommunications and networking, allowing you to make informed choices and meaningful comparisons -- knowledge you can't get on the job, reading trade magazines or talking to vendors, and an investment that will be repaid many times over.
2. Eliminate buzzword frustration, be more confident, more accurate and more productive.
3. Get up to speed on the latest developments and trends. This course is totally up to date with SIP trunking, VoIP, 5G, Optical Ethernet, MPLS, Data Centers, Cloud Computing and more.
4. 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.
5. Get Certifications: CTNS with Course 101; CTNS, CVA and CTA with BOOT CAMP.
6. Get a 356-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

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

How to Register

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, 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.

Free Bonuses! Online Courses and TCO Certification

The TCO Certified Telecommunications Network Specialist (CTNS) Certification Package, with its eight online courses and exams is included as a free bonus with Course 101. The online courses are an excellent way to take a second pass the topics, and include additional pictures of equipment and discussion. If you choose to write the optional exams, you can also earn the TCO CTNS certification, complete with certificate suitable for framing and letter of reference.

If you attend BOOT CAMP (Course 101 and Course 130), the TCO Certified Telecommunications Analyst (CTA) and Certified VoIP Analyst (CVA) Certification Packages with their online courses are also included as a free bonus!

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.

Get a sneak preview of the course materials via the tutorials at www.teracomtraining.com.

Detailed Course Outline

Broadband, Telecom, Datacom and Networking for Non-Engineers is our core training, representing the knowledge set needed by anyone in telecom today. 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.

Part 1: Fundamentals

The first part of Course 101 is six chapters that cover the fundamentals of telecom, filling gaps, explaining concepts and establishing a solid knowledge base. First is a high-level pass with a big-picture view and introducing all of the course topics. Then we progress in a logical order: how telecom circuits are provisioned by carriers, telecom fundamentals, followed by IP packet network fundamentals. Then you'll learn about the Internet as a business: ISPs, web services like AWS, cloud computing and data centers. We'll review today's services in the residential, business and wholesale categories. The fundamentals are completed with digital media: how voice is digitized, digital video, digital images, digital quantities and digital text.

1. Introduction to Broadband Converged IP Telecommunications

We begin with a comprehensive big-picture introduction to broadband telecom: the concepts of convergence and broadband, today's telecom network, the parts of the network, the three key technologies: Ethernet, IP and MPLS, what they are and what each does. You'll learn how a circuit is implemented end-to-end, and identify today's standard residential, business and wholesale services.

- A. History of Telecommunications
- B. Convergence
- C. Broadband
- D. Today's Converged Telecom Network
- E. Network Core
- F. Ethernet, IP and MPLS
- G. Network Access: The Last Mile
- H. Anatomy of a Service
- I. Inside the Network Cloud
- J. Network Edge Equipment
- K. Interconnect to Other Carriers
- L. Residential, Business and Wholesale Services

2. Telecom Fundamentals

Next, we'll ensure you have a solid foundation in the fundamental ideas of telecom: the elements of a circuit; terminals, clients, servers and peers; how bits are represented on fiber with pulses; and how bits are represented with modems on wireless, cable TV and DSL. Then we'll understand how capacity is shared to carry many users' traffic on common facilities: Frequency Division Multiplexing, Time Division Multiplexing, overbooking and Bandwidth on Demand.

- A. Communication Circuit Model
- B. Terminals, Clients, Servers and Peers
- C. Representing Bits on Digital Circuits: Pulses
- D. Representing Bits in Frequency Channels: Modems
- E. Serial and Parallel
- F. Sharing: Frequency-Division Multiplexing

- G. Sharing: Channelized Time-Division Multiplexing (TDM)
- H. Efficient Sharing: Statistical Time Division Multiplexing
- I. Overbooking and Bandwidth on Demand

3. Network Fundamentals

In this chapter, we'll ensure you also have a solid foundation in the fundamentals and jargon of the network. Today's converged telecom network is based on what used to be called "data communications": packets in frames. Without bogging down on details, we'll review basic circuit configurations, understand how routers relay packets from one circuit to another, and how the packets are actually transmitted from one device to another in frames. You'll fill gaps and get up to speed on IP packets, MAC frames and MPLS labels, what each is for and how they work together.

- A. Data Links – Unbalanced: PONs, CATV, Wi-Fi, CAN-BUS
- B. Data Links – Balanced: LANs and Ethernet
- C. Frames & MAC Addresses
- D. Networks
- E. Packets, IP Addresses and Routers
- F. IP Packets vs. MAC Frames
- G. IP Packets
- H. MPLS Labels

4. The Internet, Cloud Computing and Data Centers

The Internet, which started out as a way to send text email messages, is now worldwide converged broadband communications. In this chapter, we'll understand what exactly an Internet Service Provider does, and how they get packets delivered world-wide. We'll review web clients, browsers and apps, web servers, then understand the huge business of web services, cloud computing and data centers.

- A. A Network to Survive Nuclear War
- B. The Inter-Net Protocol
- C. Internet Service Providers (ISPs)
- D. Domain Name System (DNS)
- E. Web Clients: Browsers and Apps
- F. Web Servers: HTTP, HTTPS, HTML
- G. Web Services and Cloud Computing
- H. Data Centers
- I. Net Neutrality

5. Telecom Services Overview

No foundation in telecom would be complete without understanding where the money is: services with recurring billing. We'll organize services into Residential, Business and Wholesale, and identify today's standard choices and offerings in each area. We'll cover Broadband Internet for residences, plus Internet VoIP with PSTN phone number, and streaming video; in the business category VPNs, SD-WAN, SIP trunking, PRI and Centrex; and wholesale services dark fiber, wavelengths, Carrier Ethernet and IP transit.

- A. Residential Services
- B. Business "Data" Services: MPLS, VPNs & Internet, SD-WAN
- C. Business Voice Services: SIP Trunking, PBX Trunks, PRI, Centrex
- D. Wholesale Services
- E. Content Delivery Networks

6. Digital Media: Voice, Video, Images, Quantities, Text

The converged network carries all media: voice, video, text and images in packets. An essential first step is digitizing the media, representing it using 1s and 0s, to be carried in said packets. We'll understand how voice is digitized and reconstructed, and the G.711 64 kb/s standard. The same principles apply to images and video in formats like jpg and mp4 video. We'll review binary and hexadecimal, and finish with unicode for text and emojis.

- A. Analog and Digital: What Do We Really Mean?
- B. Continuous Signals, Discrete Signals
- C. Voice Digitization (Analog → Digital Conversion)
- D. Voice Reconstruction (Digital → Analog Conversion)
- E. Digital Voice: 64kb/s G.711 Standard
- F. Digital Video: H.264 / MP4, HD, 4K
- G. Digital Images: JPG, GIF, PNG
- H. Digital Images in Emails: MIME
- I. Digital Quantities: Binary and Hex
- J. Digital Text: ASCII and Unicode

Part 2: Telecom Technologies

In the second part of the course, we explore the three main technologies for transmitting information from one place to another, grouped into wireless, fiber and copper. We'll cover wireless spectrum, mobile network components and operation, 4G LTE, 5G, fixed wireless broadband home internet, Wi-Fi and satellites. Then you'll learn optical basics, and how networks are built with point-to-point fibers running Optical Ethernet, wave-division multiplexing, fiber in the core, metro and to the premise. We'll finish with copper-wire technologies: DSL and POTS on twisted pair, Hybrid Fiber-Coax cable TV systems, T1 and the categories of LAN cables.

7. Wireless

In this chapter, you will learn all about wireless transmission. We'll identify the components and basic principles of operation of a mobile network. You'll understand the requirements for coverage, capacity and mobility, and why cellular radio systems are used. You'll learn how mobile to PSTN phone calls are connected, how mobile Internet works, roaming and virtual operators. You'll learn about 4G LTE and 5G for mobile, and fixed wireless broadband internet. We'll cover WiFi and the latest 802.11ax standard, and finish with satellite communications.

- A. Radio Fundamentals
- B. Spectrum
- C. Mobile Network Components and Operation
 - 1. Towers
 - 2. Transceivers
 - 3. Backhaul
 - 4. Mobile Switches & MTSOs
- D. Cellular and Handoffs
- E. PSTN Phone Calls using the Phone App ("Voice Minutes")
- F. Mobile Internet ("Data Plan")
- G. Broadband Delivery: Cellular + WiFi
- H. Mobile Operators, MVNOs and Roaming
- I. Spectrum-Sharing: FDMA, TDMA, CDMA, OFDM
- J. 4G LTE
- K. 5G New Radio (NR)
- L. 3.5 GHz Fixed Wireless Broadband Home Internet
- M. WiFi: Wireless LANs & 802.11 Standards
- N. LEO and GEO Satellite

8. Fiber Optics

The core of the converged network is routers connected point-to-point to other routers with fiber. Telephone companies that used to pull copper access wires to every home in a suburb are investing to pull an access fiber to every home. In this chapter, we'll cover the basics of fiber, the makeup of fiber cables, wavelengths and WDM. You'll understand how Optical Ethernet is used to actually implement the fiber connections, and how OE is used in the core, in metro areas, and fiber to the premise via Passive Optical Networks (PONs).

- A. Fiber Basics
- B. Fiber Optics and Fiber Cables
- C. Optical Wavelengths, Bands and Modes
- D. Wave-Division Multiplexing: CWDM and DWDM
- E. Optical Ethernet
- F. The Network Core
- G. Metropolitan Area Networks
- H. Fiber to the Premise (FTTP, FTTH): PONs and Optical Ethernet

9. Copper

Before wireless and fiber, two copper wires were used as the physical access circuit for telephone and cable TV service in suburbs and cities. Today, these wires are used to deliver broadband. In this chapter, we'll understand how DSL broadband service runs on twisted pairs put in place for analog POTS telephone service; how cable modems move broadband on coaxial cable; and how both are delivered as fiber to the neighborhood then copper to the premise. To finish up, we'll review digital on copper wires: LAN cables and T1s.

- A. The Public Switched Telephone Network (PSTN)
- B. Analog Circuits
- C. The Voiceband
- D. Plain Ordinary Telephone Service (POTS)
- E. DTMF Address Signaling
- F. DSL: Beyond the Voiceband
- G. DSLAMs
- H. Fiber to the Neighborhood (FTTN), DSL to the Premise
- I. VDSL2 Bands and Profiles
- J. Broadband Carriers: FTTN & Broadband Coax to the Premise
- K. DOCSIS and Cable Modem Standards
- L. T1 and E1
- M. LAN Cables and Categories

Part 3: Equipment, Carriers and Interconnect

In the third part of the course, we explore the equipment that is connected by the fiber, copper and wireless of Part 2 to form networks, and the place and purpose of each. Then we understand where and how connections physically take place for PSTN phone calls, for Internet traffic and CLEC services.

10. Telecom Equipment

In this chapter, we review the different types of telecom equipment, beginning with the essentials of the broadband telecom network: Ethernet switches and IP/MPLS routers, comparing costs and capabilities. Then, we'll review the different types of customer premise equipment for broadband. To explain soft switches, call managers and SIP servers, we'll begin with legacy CO switches and PBXs to see the fundamental differences. Gateways and how they convert packets to channels completes the chapter.

- A. Broadband Network Equipment: Routers and Ethernet Switches
- B. Broadband Customer Premise Equipment
- C. CO Switches, PBXs and Remotes
- D. Soft Switches, Call Managers and SIP Servers
- E. Gateways

11. Carriers and Interconnect

To allow communications between customers of different carriers, the carriers must implement physical connections between their networks. In this chapter, you'll learn how the Internet is actually implemented, with peering and transit agreements at Internet Exchange buildings. You will also learn about POPs in toll centers: how and where local exchange service providers: ILEC, mobile providers and CATV connect together and to other carriers for phone calls with a PSTN phone number; and SS7 to set up the calls. We'll finish by understanding where a CLEC fits into the picture with equipment collocated in wire centers.

- A. IX: Interconnect for Internet Traffic
- B. Toll Center: Interconnect for PSTN Telephone Calls
- C. Implementing Long-Distance Competition: LECs and IXCs
- D. Switched Access and POPs
- E. Wireless and CATV Local Exchange Carriers
- F. COs and Wire Centers
- G. CLEC: Local Competition – Collocation plus ILEC Dark Fiber
- H. SS7

Part 4: Networking

The fourth and final part of Course 101 is devoted to IP networking and MPLS. We begin with the OSI Reference Model and its layers to provide a structure for the discussion: what a layer is, what the layers are, the functions of each, and the standard protocols at each layer. Next is a chapter on Layer 2: Ethernet, 802 standards, broadcast domains and VLANs. Then, Layer 3: IP routers, IP addresses, DHCP, public and private addresses, Network Address Translation and IPv6. Chapter 15 covers the core traffic management system MPLS, and how MPLS is used to implement VPNs, classes of service, service integration and traffic aggregation. We'll conclude with a top-down review and roundup of technologies and a peek at the future of telecommunications.

12. The OSI Layers and Protocol Stacks

There are so many functions that must be performed to interoperate systems, a structure is required to organize the functions so that separate issues can be treated separately. We'll begin the fourth part of the course with the most commonly-used structure, the ISO Open Systems Interconnection 7-Layer Reference Model. You'll learn what a layer is, the purpose of each layer, examples of protocols like TCP and IP used to implement layers, and gain a true understanding of how a protocol stack works for applications like web surfing and VoIP.

- A. Protocols and Standards
- B. ISO OSI Reference Model
- C. OSI 7-Layer Model
- D. Physical Layer: 802.3, DSL, DOCSIS
- E. Data Link Layer: 802 MAC
- F. Network Layer: IP and MPLS
- G. Transport Layer: TCP and UDP
- H. Session Layer: POP, SIP, HTTP
- I. Presentation Layer: ASCII, Encryption, Codecs
- J. Application Layer: SMTP, HTML, English ...
- K. Protocol Stack in Operation: Babushka Dolls
- L. Standards Organizations

13. Ethernet, LANs and VLANs

Ethernet is used in all parts of the network for point-to-point links between devices, implementing Layers 1 and 2 of the OSI model together. In this chapter, we'll review the basic principles of Ethernet and LANs, how it was formalized in the 802 series of standards, the concepts of MAC addresses, MAC frames and broadcast domains. You'll understand how LAN switches, also called Layer 2 switches, connect devices, and how VLANs separate devices as a basic network security function.

- A. MAC Addresses, MAC Frames and Broadcast Domains
- B. Ethernet and 802 Standards
- C. LAN Switches, a.k.a. Layer 2 Switches
- D. VLANs

14. IP Networks, Routers and Addresses

This chapter is devoted to IP, used to implement Layer 3. We begin with IP addressing: IPv4 address classes, subnets, DHCP, static and dynamic addresses, public addresses, private addresses and NAT. We use the simplest IP network to explore how routers implement the network by relaying packets from link to link, and also act as a point of control to deny communications based on IP address and/or port number. We'll complete the chapter with IPv6 addressing.

- A. IPv4 Address Classes
- B. Subnets: Prefix and Subnet Mask
- C. DHCP, Static and Dynamic Addresses
- D. Assigning Subnets to Broadcast Domains
- E. IP Network: Routers and Routing Tables
- F. Routers and Customer Edge (CE)
- G. Public and Private IPv4 Addresses
- H. Network Address Translation (NAT)
- I. IPv6
- J. IPv6 Address Allocation and Address Types

15. MPLS and Carrier Networks

IP packets will be used to carry everything, including phone calls and television. But IP in itself does not include any way to prioritize or manage traffic to guarantee call quality or picture quality. In the core of a carrier's network, MPLS is used to implement those functions. In this chapter, you'll learn the basics of carrier networks and the important concept of a Service Level Agreement. Then you'll gain a practical understanding of how MPLS works and how it is used by carriers to implement VPNs, different Classes of Service, service integration and traffic aggregation.

- A. Carrier Packet Network Basics
- B. Service Level Agreements and Class of Service (CoS)
- C. Provider Equipment at the Customer Premise
- D. Virtual Circuit Technologies
- E. MPLS
- F. MPLS VPNs for Business Customers
- G. MPLS and Diff-Serv to Support Classes of Service
- H. MPLS for Service Integration
- I. MPLS for Traffic Aggregation

16. Wrapping Up Course 101

The final chapter brings all of the concepts together with a top-down review. You'll learn valuable insight into telecom project management and methodology, and review telecom, datacom and networking technologies, services and solutions. We'll conclude with a peek at the future of telecommunications, where the telephone network and Internet become the same thing.

- A. Technology Deployment Steps
- B. Requirements Analysis
- C. High-Level Design
- D. Review: Circuits and Services
- E. Technology Roundup
- F. Private Network
- G. Carrier IP Services
- H. The Future

Who Should Attend

- Professionals needing to fill knowledge gaps, understand buzzwords, jargon, and technologies like LTE, 5G, Ethernet, TCP/IP and MPLS, 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.
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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 and as a Subject Matter Expert in tax matters.

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