

TELECOM, DATACOM AND NETWORKING FOR NON-ENGINEERING PROFESSIONALS

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

Telecom, Datacom and Networking for Non-Engineering Professionals 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.

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.

The content, its order, our analogies and explanations have been refined over the course of *twenty years*... and we constantly update it.

- We start at the beginning of the story, progress through it in a logical order, and finish at the end.
- 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.
- Covering the topics in a systematic way, we build *structured knowledge* that lasts a lifetime.

This core training - and our superb instructors - consistently receive rave reviews on evaluations. Many attendees tell us that this is training they wish they'd had years ago!

Course Objectives <ul style="list-style-type: none">• Establish a solid base in the fundamentals of 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.	Course Content Part 1: Fundamentals of Telecommunications <ul style="list-style-type: none">• The PSTN, analog, loops and trunks, POTS• PBX, Centrex, Hosted PBX, IP Centrex• SIP, VoIP, soft switches, SIP trunking• Digital: 64 kb/s voice, MP4 video, binary pulses• Telecom industry, LECs, CLECs, POPs and IXCs• The Cloud & how services are provided• Wireless: Cellular, 3G, 4G LTE, WiFi, Satellite Part 2: "Data" Communications & Transmission <ul style="list-style-type: none">• Convergence: treat everything like data• Datacom basics: DTEs, DCEs, LANs and WANs• IP packets & MAC frames; ASCII, binary and hex• Ethernet LANs, cables, LAN switches, VLANs• TDM, DS0-DS3 & SONET vs. IP & Optical Ethernet• Fiber, wavelengths, modes, DWDM, FTTH, PONs• DSL and cable modems on the last mile Part 3: Networking <ul style="list-style-type: none">• OSI Layers and protocol stacks• Routers, IP addresses, DHCP, public-private NAT• IPv6 address types and allocation• Carrier packet networks, SLAs, Class of Service• MPLS for CoS, VPNs, integration and aggregation• Internet, ISPs, the Web, Internet VoIP and VPNs• Practical solutions and project methodology
Prerequisites None	
Who should attend <ul style="list-style-type: none">• This course is for those needing to fill in the gaps, understand buzzwords, jargon and technologies like SIP, LTE, Ethernet, MPLS and TCP/IP, and more importantly, the ideas behind these technologies and understand 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 only US\$1395 for the three-day course. Compare to \$1999+ for lower quality elsewhere.	

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 all of the acronyms, abbreviations, jargon and buzzwords.

The list goes on and on: POTS, PSTN, loops, trunks, VoIP, SIP trunking, Hosted PBX, DSL, DS1, T1, PRI, ILEC, CLEC, POP, MAN, TDMA, CDMA, WiFi, LAN, WAN, Ethernet, MAC address, MAC frame, IP packet, TCP/IP, OSI, Layer 2, Layer 3, VLAN, TDM, DWDM, FTTN, FTTH, FTTP, DHCP, NAT, MPLS, VPN, SLA, ISP, DNS ...

Plus, there is a second-order problem: even if you were to figure out all of the current jargon and buzzwords, it's certain that new ones will be invented next month!

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.

So the question is: how to get on top of all the jargon and buzzwords, knowing that there is going to be constant change?

Our answer: understand the fundamentals. Take the cover off the box and understand how it works. Once we do this, we discover that there are only a few main ideas in telecom technology, with incremental improvement in each area.

Taking this course and understanding the fundamental ideas puts you back in control, with the confidence to contribute effectively. Even if you don't know the exact details of a product someone is discussing, you will still know what they are talking about.

Understand The Network Cloud

People like to draw a diagram of a network as a cloud with sticks poking into it, and refer to the network as "The Cloud". This might be useful for drawing diagrams, but if you are using, planning, ordering, managing, troubleshooting, developing software for or otherwise involved with telecom circuits and services, understanding what's inside is productivity- and career-enhancing knowledge.

In this course, you will learn how circuits and services are actually provided, giving you the knowledge to make meaningful comparisons and accurate decisions.

We'll explore every different aspect of The Cloud:

- The fundamental structure of the network: access, switching and transmission;
- The companies that physically implement the network: ILECs, CLECs, IXC's, wireless carriers and how and where they interconnect, and
- The components of a service: access circuit technology, network service type and billing plan;
- The equipment used: switches, routers, multiplexers, fiber and modems;
- How users share the network: channels, packets and Service Levels.

Knowledge is power! Get it with this course.

Understand Trends and Developments in Telecommunications

Major changes are taking place in the telecom world. Taking this course, you'll get up to speed on these important changes and future trends:

- All new phone systems are VoIP. SIP trunking services replace PBX / PRI trunks provided by LECs.
- In the future, the Internet and the telephone network will be the same thing. Basic telephone service will be "IP dial tone": the ability to send an IP packet to any other point on the network. There will be no such thing as "long distance".
- Optical Ethernet has replaced SONET for all new core fiber network projects, and is also routinely used for "last mile" connections, achieving a long-held goal in telecommunications: one technology for all parts of the network.
- MPLS has replaced ATM for traffic management on carrier networks, achieving another long-held goal: convergence and service integration... one network service, one access circuit, one bill for all telecom services.
- 4G LTE has achieved the goal of a worldwide standard for mobile wireless.
- "Data" on cellular plans means IP dial tone. It can be used for phone calls, video on demand, web surfing, real-time traffic on maps, and any other application. It can be replaced with WiFi, which is often free.
- Broadband carriers, formerly known as Cable TV companies, have evolved into telecom companies, gaining a majority share of residential Internet access in the US, and providing services to business using both cable modems and fiber.
- Telephone companies provide Cable TV service using Fiber to the Neighborhood and VDSL over loops in brownfields, and Fiber to the Premise in greenfields.

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.

The cost of this training will be repaid in productivity gain many times over.

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.

Get started today to make this invaluable addition to your knowledge and 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

"The selection of material - the order of its presentation - the way it was presented... incredibly effective at presenting concepts and ideas - uses great analogies and stays on topic."

- Susan Lennon, Nortel

"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", 4G, MPLS or VPN...

"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, Ameritech

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

"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

"Great information that I will be able to use at work. Very easy to understand all the information especially the IP networking part. I wouldn't change a thing"

- Orlando Jasso, AboveNet Communications.

"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.

1. Cut through the buzzwords, jargon and vendor hype to gain a structured understanding of telecommunications and networking, allowing you to make meaningful comparisons and informed decisions... knowledge skills you can put to use today and in the future.
2. Get up to speed on the latest developments and trends. This course is totally up to date with SIP trunking, VoIP, 4G, Optical Ethernet, MPLS and more, providing far more benefit than outdated courses.
3. Get a solid base of vendor-independent knowledge of technologies, service providers, standard practices and mainstream solutions that you can build on.
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. Obtain course books with detailed text notes that will serve as a valuable reference for years.
6. Understand how it all fits together.

Develop a structure for understanding technologies and solutions, allowing you to make informed choices and meaningful comparisons -- knowledge you can't get on the job, reading trade magazines or talking to vendors.

Course Schedule

We're constantly adding new dates. To see the latest schedule, please visit teracomtraining.com.

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 and instructions plus a confirmation letter to sign and fax back to complete your registration.

Tuition Fees

This three-day intensive course is \$1395. We accept Visa, MasterCard and Amex, checks and purchase orders.

Free Bonus! Online Courses & TCO CTNS Certification

As a free bonus, you get the full set of Teracom's Online Courses. Not only are these an excellent way to take a second pass through various topics, the Online Courses include pictures of equipment and additional lessons beyond those in this course. If you choose to write the optional course exams, and pass, you will also earn the TCO CTNS certification, complete with certificate suitable for framing and letter of reference.

Free Bonus! Optional Final Exam & TCO CTA Certification

The full Certified Telecommunications Analyst (CTA) certification from the Telecommunications Certification Organization is also included. This is the optional “final exam” for this course. Upon successful completion, obtain your CTA certification with certificate suitable for framing and letter of reference. The Unlimited Plan allows you to repeat exams as needed until you pass... guaranteed to pass if you're willing to learn!

Your Course Materials: An Invaluable Reference

Every course comes complete with a high-quality 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 after the seminar to the practical experience, theoretical background, and unbiased information on industry technologies, products and trends you'll 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 Description

Telecom, Datacom and Networking for Non-Engineering Professionals is our core training, organized into three modular parts: telecom, datacom and... networking. We'll start at the beginning of the story, progress through key concepts in a logical order, and finish at the end. Our goal is to bust the buzzwords, cut through the jargon and doubletalk to put in place a clear, structured understanding of telecom, datacom, IP and networking.

Part 1: Fundamentals of Telecommunications

The first part provides an understanding of the telephone network, traditional telephony, SIP and VoIP, digital communications, the telecom business and players, the Cloud and wireless. We'll demystify buzzwords and jargon, provide a clear structure for understanding the components of telecom networks including loops and trunks, switches, VoIP, SIP trunking, digital voice and video, ILECs and CLECs, the network "cloud", how services are actually provided, plus wireless: mobile networks, cellular to 4G, WiFi... and how it all fits together.

Objectives	What you will learn
<ul style="list-style-type: none"> • Understand telecom fundamentals: • Telephony and the telephone network • Voice over IP • Digital voice and video • The telecom business, ILECs and CLECs • The Cloud and how services are provided • Wireless telecom: cellular to 4G and WiFi. • Fill in the gaps in your knowledge. • Form a solid base on which to build. 	<ul style="list-style-type: none"> • The structure and operation of the telephone network. • What analog means. The voiceband. Loops and trunks. • Plain Ordinary Telephone Service • Voice over IP (VoIP) concepts and components • Traditional PBX & Centrex vs. VoIP Soft switches • What digital means. How voice is digitized. MP4 video. • All about LECs, CLECs, IXCs and interconnections. • Wireless and cellular concepts, terminology, standards. • 3G CDMA, 4G LTE and WiFi

1. Fundamentals of Telephony

It all begins with the Public Switched Telephone Network and Plain Ordinary Telephone Service. We'll establish with a model for the PSTN, explaining analog circuits, loops, trunks, remotes, circuit switching and other telephony buzzwords and jargon. We'll understand how the network is organized into access, switching and transmission. We'll cover Centrex and traditional PBX, then understand Voice over IP (VoIP) concepts and components, soft switches and SIP trunking.

- A. History of Telecommunications
- B. The Public Switched Telephone Network (PSTN)
- C. Analog Circuits
- D. What is Sound?
- E. The Voiceband
- F. Plain Ordinary Telephone Service (POTS)
- G. DTMF Address Signaling
- H. Signaling System 7 (SS7)
- I. Network Architecture: Access, Switching, Transmission
- J. Telephone Switches
- K. Traditional PBX and Centrex
- L. VoIP
- M. SIP, Soft Switches, Hosted PBX and IP Centrex
- N. SIP Trunking

2. Digital

With the fundamentals in place, we'll cover digital. You will learn what is really meant by "digital", how voice is digitized to 64 kb/s, and MP4 digital video. We'll complete the story understanding how the resulting bits are communicated using binary pulses on copper and fiber.

- 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. Voice Digitization: 64kb/s G.711 Standard
- F. Digital Video: H.264 / MPEG-4 Standard
- G. Implementing Digital: Binary Pulses

3. The Telecommunications Industry, Competition and Interconnect

In this chapter, you will gain a solid understanding of the telecommunications business and how it is structured, including telephone companies, local and long-distance, and how these companies compete and interconnect. You will understand how each organization fits into the picture, including ILECs, IXCs, resellers, CLECs, collocations, regional rings, POPs and MANs.

- A. US Domestic Telcos
- B. AT&T and Verizon
- C. Canadian Telephone Companies
- D. PSTN Switching Center Hierarchy
- E. 1984: LECs, IXCs and POPs - Last Mile: Switched Access from ILEC
- F. Competitive Carrier - Last Mile: Dedicated Line from ILEC
- G. Competitive Carrier - Last Mile CLEC: Collocation plus ILEC Dark Fiber
- H. Competitive Carrier Network Model: Regional Rings, POPs and MANs

4. The Cloud

Next, we will demystify the Network Cloud. You will learn why people draw a picture of a cloud to represent a network, then most importantly, what is inside the cloud and understand what's really going on. You will learn about the three basic kinds of network services available, the equipment used to implement each, and how services are actually provided... highly useful knowledge when planning, ordering, troubleshooting, auditing, or otherwise dealing with carrier services.

- A. Anatomy of a Service
- B. Inside the Network Cloud
- C. Network Equipment: How and Where Each is Used
- D. Summary: How Services Are Provided

5. Wireless

We'll complete the first part of the course, and the first day, with wireless, concentrating on cellular. You will learn the components and basic principles of operation of mobile networks, tracing a call from end-to-end from mobile phone to landline. You'll understand the requirements for coverage, capacity and mobility, and why cellular radio systems are used. We'll cover voice over cellular, then the exploding area of "data" over cellular, which is actually Internet access. With the concepts in place, we'll sort out different cellular technologies and generations: without bogging down on details, you will learn the differences between 2G GSM/TDMA, 3G 1X, UMTS and HSPA CDMA, and 4G LTE with its OFDM. We'll conclude with WiFi, more properly called 802.11 wireless LANs, and satellite communications.

- A. Wireless
- B. Mobile Networks
- C. Cellular
- D. Second Generation: Digital Cellular
- E. Digital Cellular: Voice
- F. Digital Cellular: Data = Internet Access
- G. Spectrum-Sharing Technologies: FDMA, TDMA, CDMA, OFDM
- H. 3G: 1X, UMTS, HSPA (CDMA)
- I. 4G LTE and OFDM
- J. Dynamic Assignment of Subcarriers
- K. Wireless LANs: WiFi & 802.11 Standards
- L. Satellite

Part 2: “Data” Communications & Transmission

The second part of the course begins the second day with a discussion of how voice and video are treated like data to achieve convergence: one network and one service for everything. Then we'll put in place a solid base of the principles and technologies that were developed for communicating data, including circuit configurations, LANs and WANs, packets and frames and Ethernet. Then we'll cover transmission systems: legacy channelized TDM and SONET backbones, today's IP and Optical Ethernet core network, fiber optics, and finishing the module and the day with fiber to the neighborhood then DSL and cable modems on copper for the last mile.

Objectives

- Understand how convergence was achieved by treating telephone and television like data
- Learn the fundamentals of technologies originally developed for data and now used for everything.
- Understand legacy channelized TDM systems, today's packet-switched and Optical Ethernet systems, and the transition from old to new.
- Learn the fundamentals of fiber optics, fiber in the network core and fiber to the premise.
- Learn how fiber to the neighborhood then DSL and Cable modems are used for the last mile in brownfields.

What you will learn

- What convergence is and how it was achieved.
- Circuit components, DTEs and DCEs.
- Circuit configurations: LANs and WANs.
- Binary and hex, ASCII and unicode.
- Fundamentals of frames and packets, how they relate
- LANs: Ethernet, MAC addresses, LAN cable categories.
- Ethernet switches, VLANs and Optical Ethernet.
- Legacy channelized TDM transmission systems and DS0.
- DS1 vs. T1. DS3, SONET, ISDN.
- Today's IP packet & Optical Ethernet backbones.
- The transition from channels to packets.
- Fiber optics basics: wavelengths and modes, DWDM.
- Optical Ethernet to the business, PONs to the home.
- DSL, DSLAMs, and VDSL2 for the last mile.
- Broadband carriers, cable modems and DOCSIS

6. “Data” Communications Concepts

We'll begin the second day understanding what “convergence” is and how it was achieved by treating telephone calls and television like data communications. Then, we'll get you up to speed on the concepts, jargon, buzzwords and technologies that were originally developed for datacom and now used for everything. You'll learn the basic ITU model for data circuits, the components in the model, and practical examples of circuit configurations including LANs and WANs. This chapter serves as an introduction to topics that will be covered in the rest of the course.

- A. Convergence: Treat Everything Like Data
- B. Data Circuit Model
- C. Data Terminal Equipment (DTE)
- D. Analog and Digital Data Circuits
- E. Data Circuit-Terminating Equipment (DCE)
- F. Point-to-Point Circuits
- G. Multidrop Circuits
- H. LANs
- I. Wide Area Networks

7. Coding, Frames and Packets

In this chapter, we'll put in place a solid understanding of the key concepts of IP packets and LAN frames, ensuring that you have a solid foundation on which to build an understanding of IP packets, Ethernet MAC frames, routers, bandwidth on demand packet networks and the Internet. We'll begin with a quick review of binary and hexadecimal to ensure you're up to speed.

- A. Essential Functions
- B. Representing Quantities: Decimal, Binary and Hex
- C. Character Coding: ASCII and Unicode
- D. Start/Stop/Parity
- E. Frames
- F. Packets
- G. Packets and IP Addresses vs. Frames and MAC Addresses
- H. IP Packets

8. Ethernet, LANs and VLANs

Ethernet is now used in all parts of the network. In this chapter, you will learn the basic principles of Ethernet and LANs, how it was formalized in the 802 series of standards, the crucial concepts of MAC addresses and MAC frames, LAN cables and the important concept of a broadcast domain. You'll understand how LAN switches, also called Layer 2 switches, connect devices, and how VLANs separate devices.

- A. MAC Addresses, MAC Frames and Broadcast Domains
- B. Ethernet and 802 standards
- C. LAN Cables and Categories
- D. Ethernet / Layer 2 Switches
- E. VLANs

9. Transmission Systems

Channelized Time Division Multiplexing (TDM) is now referred to as a "legacy" technology – but there is a huge installed base that is not going to disappear overnight. We'll begin with the basics of TDM, multiplexers and channels. You'll learn about the DS0-DS3 hierarchy and the technologies that implement it: T1, SONET and ISDN. Then, we'll understand how today's packet-based transmission systems move IP packets in Ethernet frames on demand, and cover important issues in the transition from channels to packets.

- A. Channelized Time Division Multiplexing (TDM)
- B. Multiplexers
- C. DS0s and SONET Framing
- D. Channelized Digital Hierarchy: Standard Legacy Transmission Speeds
- E. Digital Carrier Systems: Legacy Transmission Technologies
- F. ISDN BRI and PRI
- G. Statistical Time Division Multiplexing
- H. Overbooking and Bandwidth on Demand
- I. IP Packets and Ethernet Framing
- J. Coexistence and Transition from Channels to Packets

10. Fiber

In this chapter, you will learn the fundamentals of fiber: how it is used to communicate bits, how fiber cables are constructed, the types of fiber, wavelengths, bands and modes, and the impairment called dispersion that limits transmission distances. We'll cover the important concept of Wave-Division Multiplexing, allowing huge increases in bandwidth. You'll understand how "high capacity" in the past was 1.5 Mb/s becomes 10 Gb/s in the near future. We'll complete the chapter with Optical Ethernet, which has emerged as the standard for fiber links, how fiber is used in the network core, how it is used to build Metropolitan Area Networks, and Fiber to the Premise.

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

11. DSL and Cable Modems: Last Mile on Copper

To finish the second part of the course, we'll explore how fiber is pulled to the neighborhood, then modems are used to communicate bits on the "last mile" in brownfields, i.e. established residential neighborhoods where copper wire cables are already installed. You'll learn what modems do and how they work. Then you will learn the telephone company's strategy: DSL and DSLAMs and the latest VDSL2 technology, then the cable TV company's strategy: cable modems on broadband coax, and compare and contrast the two.

- A. Modems: Representing Bits in a Frequency Channel
- B. Modulation Techniques
- C. DSL: Beyond the Voiceband
- D. DSLAMs
- E. Fiber to the Neighborhood (FTTN), DSL to the Premise
- F. VDSL2 Bands and Profiles
- G. Broadband Carriers: FTTN & Broadband Coax to the Premise
- H. DOCSIS and Cable Modem Standards

Part 3: Networking

The third part brings it all together with networking: starting the third day with the OSI Layers to provide a structure for the discussion, then the principles of overbooking, bandwidth on demand and packet switching, IP and routers, Customer Edge, IP addressing, DHCP, public and private addresses, Network Address Translation and IPv6. Then in the afternoon, we'll cover carrier packet networks, Service Level Agreements, MPLS and how MPLS is used to implement VPNs, classes of service, service integration and traffic aggregation. The last main chapter covers the Internet, ISPs, Internet VoIP and Internet VPNs. We'll conclude with a top-down review with templates for mainstream solutions you can put to immediate use and a peek at the future of telecommunications.

Objectives

- Understand networking fundamentals as well as current practical technologies, services and solutions.
- Understand what the OSI Layers are
- Understand how protocol stacks work
- Learn about routers and IP addressing
- Understand carrier packet network services
- Learn about MPLS and how it is used to manage traffic on the network.
- Understand Internet structure and operation, how ISPs fit into the picture and Internet voice and data.
- Learn technology deployment steps.

What you will learn

- The OSI layers and protocol stacks.
- How routers implement the network.
- The Customer Edge (CE) and what it does.
- IPv4 packets and address classes, and IPv6
- Static and dynamic addresses and DHCP
- Public and private addresses and NAT
- Structure and components of carrier packet networks.
- Service Level Agreements and traffic profiles.
- The crucial concept of virtual circuits
- Briefly review legacy Frame Relay and ATM
- MPLS jargon, buzzwords and principles of operation.
- How MPLS can be used to implement classes of service, service integration and traffic aggregation.
- MPLS business services and MPLS VPNs.
- The history, structure and operation of the Internet.
- ISPs, the Domain Name System and MIME
- Internet telephony and Internet VPNs
- Technology deployment practices and solutions.
- 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 third part of the course, and the third day 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. IP Networks, Routers and Addresses

With a structure in place for discussing *what* we need to do, we'll understand *how* networks are implemented. We begin with the simplest framework, a private network, to understand routing and bandwidth on demand. We'll introduce the term Customer Edge router and examine the functions performed by a router. Then we will cover IPv4 addressing: IPv4 address classes, static vs. dynamic addresses and DHCP, public and private addresses and NAT. Then we'll review IPv6, and how IPv6 addresses are allocated and assigned, and types of IPv6 addresses.

- A. Simplest IP Network Example: Routers Connected with Dedicated Lines
- B. Routers and Customer Edge (CE)
- C. IPv4 Address Classes
- D. DHCP
- E. Public and Private IPv4 Addresses
- F. Network Address Translation
- G. IPv6
- H. IPv6 Address Allocation and Address Types

14. 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 Quality of Service (QoS) mechanism, no way to prioritize or manage traffic. This is implemented with MPLS. In this chapter, you'll learn the basics of carrier packet networks, identifying Provider Edge (PE), Customer Edge (CE), access and core, and the important concept of a Service Level Agreement. Then you'll gain a practical understanding of the purpose and functioning of MPLS, virtual circuits and traffic classes, previous methods Frame Relay and ATM, then MPLS and how it is used to implement business customer services, differentiated services and Class of Service (CoS), service integration and traffic aggregation in the core.

- A. Carrier Packet Network Basics
- B. Service Level Agreement
- C. Provider Equipment at the Customer Premise
- D. Virtual Circuit Technologies
- E. Packet-Switching using Virtual Circuits
- F. Frame Relay using Virtual Circuits
- G. ATM
- H. MPLS
- I. MPLS VPNs for Business Customers
- J. MPLS and Diff-Serv to Support Classes of Service
- K. MPLS for Service Integration
- L. MPLS for Traffic Aggregation

15. The Internet

The Internet is a giant collection of interconnected IP networks called Autonomous Systems across which the public can communicate IP packets. In this chapter, we'll understand what an ISP is and how they connect to others via transit and peering, then review how DNS, HTML, HTTP, clients and servers work together to form the Web on top of the Internet. We'll conclude by understanding telephone calls over the Internet and secure VPNs over the Internet.

- A. A Network To Survive Nuclear War
- B. The Inter-Net Protocol
- C. Internet Service Providers
- D. World Wide Web
- E. Domain Name System
- F. HTML, HTTP and HTTPS
- G. MIME and Base-64 Encoding for Email Attachments
- H. Internet Telephony & VSPs
- I. Internet VPNs

16. Wrapping Up

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. Access and Transmission Technology Roundup
- F. Private Network
- G. Carrier IP Services
- H. The Future

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V3 Fundamentals of Datacom and Networking: WANs and LANs • MAC Frames, IP Packets • Network "Cloud"

V4 Understanding Networking 1: OSI Layers • Protocol Stacks • The FedEx Analogy • IP Addressing, DHCP, NAT • Bandwidth on Demand Services • Frame Relay • ATM • MPLS

V5 Understanding Networking 2: Internet • ISPs • Security • Viruses • Firewalls • Encryption • IPsec • VPNs

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V8 Understanding Voice over IP 1: Components • Standards • Architectures

V9 Understanding Voice over IP 2: Voice Packetization • Quality • Codecs, Jitter, Packet Loss • Diff-Serv • Network QoS with MPLS

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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, specializing in telecommunications technology R&D and as a Subject Matter Expert in tax matters.