Teracom Training Institute

best of breed: telecommunications training - since 1992

Telecommunications Training and Certification for Non-Engineers

Training Catalog

GSA Contract GS-02F-0053X

AUTHORIZED FEDERAL SUPPLY SCHEDULE PRICE LIST

MISSION ORIENTED BUSINESS INTEGRATED SERVICES (MOBIS TRAINING)

Contract Number: GS-02F-0053X
Contract Period: December 20, 2020 to December 19, 2025
Business size: Small business
Revised 2020-12

Special Items Numbers (SIN):
611430 Instructor-Led Training, Web-Based Training Courses - PSC U012, NAICS: 611430
333318TDTM DVD-Video Courses and Books - PSC 6910, NAICS: 423490

Welcome to Teracom Training Institute!

At Teracom, we concentrate on telecommunications training for non-engineering professionals: telecom, datacom and networking, VoIP, IP, MPLS and wireless. This way, we can bring you the *best!*

Our specialty is explaining telecom fundamentals and technologies to professionals who need a comprehensive overview and update, and to newcomers to the field who need to get up to speed.

This is the ideal way to put a solid base of knowledge in place. Put an end to buzzword-related frustration, improve your accuracy and efficiency, and enhance your career skill set.

Understand telecom and network fundamentals, jargon, technologies, organizations and services, and most importantly, the underlying ideas, and how it all fits together. Get solid, structured, vendor-independent knowledge you can build on. Plus, detailed course books for future reference.

Buy with confidence! We've been in business for over 20 years, and scored 97% in quality rating by customers. Thousands of people in organizations ranging from the NSA to the SF Giants have benefited from Teracom training and consistently rate our courses "excellent" on evaluations.

Get this essential training **your** way:

- Instructor-Led Training: the gold standard in training, where you learn with a professional instructor, can ask questions and interact with the class. Attend a scheduled public seminar, or have a private onsite course. In-person or Live Online. Course books with full notes are included. Unlimited access to online courses and certifications is also included as a bonus.
- Online Courses are content-rich self-paced training based on our proven instructor-led training with the instructor's voice or video, bullets, graphics, text, illustrations and pictures of equipment, covering the knowledge set required for today's telecommunications.
- Certification Packages are online courses plus Telecommunications Certification Organization (TCO) certification, with Certificate and Letter of Reference, for individuals and teams. Guaranteed to Pass with the Unlimited Plan!
- Printed books are a valuable supplement to instructor-led training, and greatly enhance online courses and certification packages. These professional-quality textbooks can also be used in classroom, for self-study, and are ideal as a day-to-day reference.

Customer Ordering and Contact Information Essentials

Customer service, inquiries and telephone orders

Call us toll-free: 1-877-412-2700 (+1 450 923 2700 for international callers).

Email: customerservice@teracomtraining.com

Fax: 1-775-490-6227

Web: teracomtraining.com/contact_us.htm

Ordering Online

Please visit GSA Advantage for online ordering.

You may also order online on teracomtraining.com. Choose “pay later” and the price will be adjusted to the price in this catalog by our customer service.

Full Customer Ordering and Contact Information are at the end of the catalog.

Online access to contract ordering information, terms and conditions, up-to-date pricing, and the option to create an electronic delivery order are also available through GSA Advantage!, a menu-driven database system. GSA Advantage! is reached on the Internet at https://www.gsaadvantage.gov

Go directly to Teracom Training Institute on GSA Advantage:

https://www.gsaadvantage.gov/advantage/ws/search/advantage_search?searchType=1&q=19:5GS-02F-0053X

Table of Contents – Table of Awards

Instructor-Led Training

Instructor-led training is the gold standard, the best training you can get.

You can ask questions and interact with other people without distractions. Our instructors are professionals specializing in getting you up to speed.

Teracom's training is geared for professionals needing a comprehensive overview and update. It is ideal for those new to the business, and those starting a new project who need to get up to speed.

Our goal is to explain the jargon, buzzwords, standard practices and technologies, the telecommunications business, and most importantly, the underlying ideas, and how it all fits together. You will get a solid foundation of knowledge to build on – knowledge you can't get by reading trade magazines or talking to vendors.

Teracom's course materials and instructors are best-of-breed. Teracom instructors are professionals with broad and deep knowledge of telecommunications, with Engineering degrees and many years' experience in the field and teaching seminars. Both are consistently ranked "excellent" on evaluations!

Instructor-led training includes:

- A multi-day course with professional instructor in a classroom setting
- The ability to ask questions, discuss your situation and network with other students
- High-quality bound course book with full text notes and graphics, sure to be a valuable reference for years to come
- Course certificate and CPE credits

plus the free bonuses:

- CTNS Certification Package – Unlimited Plan (six online courses + certification)
- CTA Certification Exam – Unlimited Plan

Thousands of people have benefited from Teracom instructor-led training!

Join us at a scheduled public seminar, or hold a private course.

Bonus TCO Certification Packages Included

Sets of Online Courses and corresponding TCO Certifications are included with all seminars, both in-person and live online as a free bonus, as follows:

Course 101: CTNS Certification Package.

Course 130: CVA Certification Package.

Course 111 BOOT CAMP: CTNS, CVA and CTA.

Course 133: CVA Certification Package.

All other courses: CTNS.

There are no time limits or expiry dates on the courses.

Types of Instructor-Led Training Available

Public Seminars – resuming August 2021 in DC

Scheduled in-person instructor-led courses are held in major cities on a regular basis. Locations include Santa Clara in the heart of Silicon Valley, Denver (highly popular recently), New Orleans, Chicago, Atlanta, New York, Washington DC and more. Get this valuable training in an interesting city as your reward for suffering through the pandemic working from home! See the training request templates on teracomtraining.com for cut-and-paste persuasive reasons why your boss should approve the request.

View the current schedule for public Live Online and in-person BOOT CAMPs

Public Seminars – Live Online

BOOT CAMP is running strong during the pandemic Live Online via two-way video conferencing. All you need to join BOOT CAMP Live Online and get this world-famous training is Internet, a laptop with a webcam and Zoom.

We'll ship you the high-quality printed color course books in advance of the BOOT CAMP, and you'll be part of a class that runs 9 - 5 Monday - Friday.

The best part: BOOT CAMP was totally updated for 2020, with 5G, Cloud Computing, Data Centers, Smart Cities & more, just before the pandemic struck! This is the most up-to-date telecom-for-non-engineers training that can be found anywhere.

This is truly career-enhancing knowledge, and perhaps an ideal time to be "on course"

Private Seminars – Live Online

If you have as few as 7 people, you can have your own private course. Get this world-famous training when it best suits your team, at your preferred hours and using your preferred videoconferencing platform: Zoom, WebEx or Microsoft, app-based and browser-based.

We'll ship the high-quality printed color course books in advance individually to wherever your team members are working from.

The best part: BOOT CAMP was totally updated for 2020, with 5G, Cloud Computing, Data Centers, Smart Cities & more, just before the pandemic struck! This is the most up-to-date telecom-for-non-engineers training that can be found anywhere.

This is truly productivity-enhancing training, and perhaps a good time for team building and reinforcement. Not to mention there are no travel costs to pay.

Get more information on private Live Online or in-person onsite training

Private Onsite Courses

We'll come to teach your team.

- Your personnel will be up to a common speed with a solid knowledge base.
- The seminar will be a strong team-building exercise.
- Customization to meet your requirements is available.
- Significant reductions in training costs are often achieved.
- Each student receives a detailed course book that will be a valuable reference for years to come.
- The training is viewed as a resounding success.

List of Available Instructor-Led Courses

101 Broadband Telecom, Datacom and Networking for Non-Engineers

Our famous instructor-led core training; an intensive three-day course getting you up to speed on all major topics in telecom, datacom and networking, from fundamentals and jargon to the latest technologies – newly revised and fully up to date for the 2020s. Best-of-breed training, consistently rated "excellent" across the board on student evaluations. Valuable logically-organized 360-page course book with full text notes. Course 101 is the first three days of Course 111 BOOT CAMP.

102 Telecom for Non-Engineers

Our famous instructor-led Course 101 core training in a two-day format, available for private onsite classes. Course 102 is the standard set of topics for two days – but any combination of material from Course 101 can be taught to best meet your needs.

111 BOOT CAMP

A full week of the best you can get: instructor-led training on telecom and networking from A to Z, where you can ask questions and interact with other students. Get up to speed on broadband, the telecom business, fiber, Internet and ISPs, Cloud Computing and Data Centers, 5G cellular and WiFi, the PSTN, Ethernet LANs, basics of IP addresses, routers and networks, MPLS and Class of Service, DSL, Cable and VoIP fundamentals, SIP and SIP trunking, VoIP applications and implementation cases, a comprehensive Security module and finishing with 5G and IoT applications.

130 Voice over IP, SIP, Security, 5G and IoT

Course 130 is a vendor-independent VoIP training course explaining fundamentals, buzzwords, jargon, technologies and standard solutions for VoIP; plus Security, 5G and IoT. Start with basics of digitized voice, understand VoIP for individuals and for businesses, including softswitches, SIP trunking, gateways and carriers, IP Centrex, PBX & Hosted PBX, applications and case studies. The second day features a comprehensive survey of security, and concludes with "what's next": 5G and IoT. Course 130 is the last two days of Course 111 BOOT CAMP.

133 Fundamentals of VoIP & IP Telecom Networks

A three-day vendor-independent training course covering all aspects of Voice over IP and the network it runs on. Specifically designed for non-engineering professionals, this course will fill in the gaps and get you up to speed on all of the fundamental concepts and technologies involved with Voice over IP and telecom networks.

150 Understanding IP Call Center Technology

The course that covers virtually all aspects of IP in the call center with a complete, unbiased picture and a thorough understanding of IP contact center technologies, benefits, issues, options for solutions, migration and integration strategies and vendor offerings, complete with practical templates and checklists you can put to immediate use.

160 Understanding IPv6

A comprehensive course on the new version of IP, providing a structured understanding of the IPv6 addressing scheme, the different types of addresses machines will have, how addresses are allocated and used, the impact of IPv6 on other protocols, coexistence with IPv4, plus issues, solutions and current best practices for migrating to and implementing IPv6 in operations, products and services.

Instructor-Led Course Pricing

Public Seminars, In-Person Instructor-Led Classes (Contractor-Facility Courses)

ITEM/PART #	DESCRIPTION	DAYS	PRICE PER PERSON	2-3 SEATS AT SAME SESSION	4 SEATS AT SAME SESSION	5+ SEATS AT SAME SESSION
PS101	BROADBAND TELECOM, DATACOM AND NETWORKING FOR NON-ENGINEERS	3	$ 1,335.19	$ 1,201.67	$ 1,068.15	$ 1,001.39
PS111	BOOT CAMP	5	$ 1,909.46	$ 1718.51	$ 1527.57	$ 1,432.10
PS130	VOICE OVER IP, SIP, SECURITY, 5G AND IoT	2	$ 952.34	$ 857.11	$ 761.87	$ 714.26
PS133	FUNDAMENTALS OF VoIP & IP TELECOM NETWORKS	3	$ 1,335.19	$ 1,201.67	$ 1,068.15	$ 1,001.39

Prices include IFF

DISCOUNTS AND CONCESSIONS

10% discount for two or three seats at same session

20% discount for four seats at same session

25% discount for five or more seats at same session

Bonus TCO Certification Packages Included:

Course 101: CTNS Certification Package.

Course 130: CVA Certification Package.

Course 111 BOOT CAMP: CTNS, CVA and CTA.

Course 133: CVA Certification Package.

T101 Telecom 101 Printed Textbook 50% discount

SUPPORT MATERIALS INCLUDED
Printed course book

Register for a public seminar

Public Seminars, Live Online Instructor-Led Classes

ITEM/PART #	DESCRIPTION	DAYS	PRICE PER PERSON	2-3 SEATS AT SAME SESSION	4 SEATS AT SAME SESSION	5+ SEATS AT SAME SESSION
PS101-LO	BROADBAND TELECOM, DATACOM AND NETWORKING FOR NON-ENGINEERS	3	$ 1,335.26	$ 1,201.73	$ 1,068.21	$ 1,001.44
PS111-LO	BOOT CAMP	5	$ 1,813.85	$ 1632.47	$ 1,451.08	$ 1,360.38
PS130-LO	VOICE OVER IP, SIP, SECURITY, 5G AND IoT	2	$ 1,143.83	$ 1029.45	$ 915.06	$ 857.87

Prices include IFF

DISCOUNTS AND CONCESSIONS

10% discount for two or three seats at same session

20% discount for four seats at same session

25% discount for five or more seats at same session

Bonus TCO Certification Packages Included:

Course 101: CTNS Certification Package.

Course 130: CVA Certification Package.

Course 111 BOOT CAMP: CTNS, CVA and CTA.

T101 Telecom 101 Printed Textbook 50% discount

SUPPORT MATERIALS INCLUDED
Printed course book

Register for a public seminar

Private Courses – Live Online

ITEM/PART #	DESCRIPTION	DAYS	PRICE PER PERSON, MINIMUM 7
OS101-LO	BROADBAND TELECOM, DATACOM AND NETWORKING FOR NON-ENGINEERS	3	$ 952.39
OS102-LO	TELECOM FOR NON-ENGINEERS	2	$ 856.68
OS111-LO	BOOT CAMP LIVE ONLINE	5	$ 1430.98
OS130-LO	VOICE OVER IP, SIP, SECURITY, 5G AND IoT	2	$ 856.68
OS133-LO	FUNDAMENTALS OF VoIP & IP TELECOM NETWORKS	3	$ 952.39

Minimum 7 students.

Includes shipping of course materials directly to students wherever they are. Prices include IFF.

DISCOUNTS AND CONCESSIONS

Bonus TCO Certification Packages Included:
Course 101 and 102: CTNS Certification Package.
Course 130: CVA Certification Package.
Course 111 BOOT CAMP: CTNS, CVA and CTA.
Course 133: CVA Certification Package.
T101 Telecom 101 Printed Textbook 50% discount

SUPPORT MATERIALS INCLUDED

Printed course book

Get more information on private onsite courses

Private Onsite Courses (Customer Facility Courses)

ITEM/PART #	DESCRIPTION	DAYS	BASE PRICE FOR UP TO 20 STUDENTS	ADDITIONAL STUDENTS #21 AND ABOVE
OS101	BROADBAND TELECOM, DATACOM AND NETWORKING FOR NON-ENGINEERS	3	$ 11,779.82	$ 617.50
OS102	TELECOM FOR NON-ENGINEERS	2	$ 8,216.44	$ 427.50
OS111	BOOT CAMP	5	$ 17,500.55	$ 807.50
OS130	VOICE OVER IP, SIP, SECURITY, 5G AND IoT	2	$ 8,216.44	$ 427.50
OS133	FUNDAMENTALS OF VoIP & IP TELECOM NETWORKS	3	$ 11,779.82	$ 617.50
OS150	UNDERSTANDING IP CALL CENTER TECHNOLOGY	2	$ 8,216.44	$ 427.50
OS160	UNDERSTANDING IPv6	2	$ 8,216.44	$ 427.50

Instructor travel and living expenses are additional at GSA rates. Additional student rate is for each student #21 and above, if any, at any particular session. Prices include IFF.

CONCESSIONS
Bonus TCO Certification Packages Included:
Course 101: CTNS Certification Package.
Course 130: CVA Certification Package.
Course 111 BOOT CAMP: CTNS, CVA and CTA.
All other courses: CTNS
T101 Telecom 101 Printed Textbook 50% discount

SUPPORT MATERIALS INCLUDED
Printed course book

Get more information on private onsite courses

Instructor-Led Course Descriptions

101 Broadband Telecom, Datacom and Networking for Non-Engineers

Broadband Telecom, Datacom and Networking for Non-Engineers is our core training, tuned and refined over more than twenty years, yours in a brand-new edition, totally updated for the 2020s, with broadband Internet and the converged network in the front seat.

Taking this course, you will fill gaps and get up to speed on all major topics including broadband, telecom, datacom and IP networking, wireless, the Internet, MPLS services, cloud computing, web services, data centers, 5G, fiber, DSL and cable, equipment, connections and much more, from fundamentals to the latest technologies… in plain English.

Course 101 is the first three days of Course 111 BOOT CAMP. It is designed for professionals working in and with telecommunications, networks, products and services. You will demystify the jargon, bust the buzzwords and understand today's technologies, and even more importantly, the underlying ideas… and how everything fits together.

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.

Every course comes with a 366-page color course book with full diagrams, extensive detailed text notes and extra reference material, impossible to find in one place anywhere else, and sure to be a valuable reference for years to come.

Plus, an optional CTNS Certification Package with six online courses and TCO CTNS Certification is included with Course 101 as a free bonus.

You will gain a solid base of structured knowledge that you can apply to specific projects and build on in the future… an investment in career- and productivity-enhancing knowledge skills that will be repaid many times over.

Many people who take this course tell us they "wish they'd had this training years ago".

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

Join us today!

Course web page

Printable brochure with detailed outline

Private Onsite course information

102 Telecom for Non-Engineers

Our famous instructor-led Course 101 core training in a two-day format, for private onsite classes.

Learn telecom and network fundamentals, fill gaps, demystify buzzwords, master jargon, get up to speed on current technologies and standard practices, and most importantly, understand how everything fits together.

- Get the gold standard in training: instructor-led, where you can interact and ask questions
- Your team will be up to a common speed, with a common vocabulary and reference books
- Significant cost savings are often achieved with discounted group pricing and no travel costs
- The course will be a strong team-building exercise. Discuss your environment during the course!

The content, its order, our analogies and explanations have been refined over the course of more than twenty years… and totally updated for the 2020s.

The Course 102 outline in the link below is the standard set of topics for two days – but any combination of material from Course 101 can be taught. Feel free to start with the Course 101 brochure's detailed outline and select chapters to best meet your needs.

Hundreds of people have rated this training "excellent" across the board on evaluations!

Get started today!

Course web page

Printable brochure with detailed outline

Private onsite course information

111 BOOT CAMP

BOOT CAMP is a full week of the best training you can get: instructor-led training on telecom and networking from A to Z, where you can ask questions and interact with other students.

BOOT CAMP consists of two courses back-to-back: Course 101 BROADBAND TELECOM, DATACOM AND NETWORKING FOR NON-ENGINEERS then Course 130 Voice over IP**.**

Get up to speed on broadband and convergence, telecom and network fundamentals, the telecom business, Internet and ISPs, Cloud Computing, Web Services and Data Centers, 4G LTE and 5G cellular, WiFi, fiber, DSL and Cable, Ethernet LANs, basics of IP addresses, routers and networks, MPLS and Class of Service, VoIP fundamentals, SIP and SIP trunking, VoIP applications and implementation cases, Security, 5G and IoT applications.

This is the 5-day BOOT CAMP that hundreds of people have attended over the years.

Seize this opportunity to get up to speed and fill in the gaps. You'll have an advantage over the competition with this career-enhancing knowledge of broadband telecom, datacom, networking, IP, MPLS and VoIP, security, 5G and IoT. You'll be more effective and less frustrated, understanding the ensemble of communications technologies, the jargon, buzzwords and how it all works together.

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.

Plus, you benefit from a special discount, and get the free bonus Online Courses and Certifications, making it an unbeatable value.

Attending both courses as the 5-day BOOT CAMP is totally optional. You are welcome to attend one course, or the other, or both, as best meets your needs. But with the low incremental cost and wall-to-wall training, BOOT CAMP is a great opportunity.

Course web page

Public seminar schedule

Private onsite course information

130 Voice over IP, SIP, Security, 5G and IoT

Course 130 is a vendor-independent VoIP training course explaining fundamentals, buzzwords, jargon, technologies and standard solutions for VoIP; plus Security, 5G and IoT.

Course 130 is the last two days of Course 111 BOOT CAMP.

We start with basics of digitized voice, understand VoIP for individuals and for businesses, including softswitches, SIP trunking, gateways and carriers, IP Centrex, PBX & Hosted PBX, applications and case studies.

The second day features a comprehensive survey of security, and concludes with “what’s next”: 5G and IoT.

Taking this VoIP training course, you'll obtain the solid foundation necessary to intelligently discuss, compare and evaluate VoIP technologies, products and implementation choices, demystifying the jargon, understanding the fundamentals and how it all fits together.

Course web page

Printable brochure with detailed outline

Public seminar schedule

Private onsite course information

133 Fundamentals of VoIP and IP Telecom Networks

Fundamentals of VoIP & IP Telecom Networks is a three-day vendor-independent training course covering all aspects of Voice over IP and the network it runs on.

Specifically designed for non-engineering professionals, this course will fill in the gaps and get you up to speed on all of the fundamental concepts and technologies involved with Voice over IP, SIP, SIP trunking, VoIP phone systems and telecom networks.

- Learn what all of the VoIP jargon and buzzwords mean,
- How VoIP works end-to-end & the components involved
- Fundamentals of the network VoIP runs on
- Who supplies what, and how it all fits together
- Best practices, tips and tricks for migration & deployment
- Case studies and class exercises cement your knowledge
- Bonus: six online CVA courses and TCO
  Certified VoIP Analyst (CVA) certification included

Eliminate buzzword frustration, and gain the knowledge to be confident!

Get a solid knowledge base to build on… structured, complete knowledge you can't get on the job, reading articles or talking to vendors.

This is career-enhancing knowledge that lasts a lifetime, and training that will be repaid many times over in increased accuracy and productivity.

Top-ranked instructor, three days in the classroom, 300-page course book with detailed notes, bonus CVA Online Courses, TCO CVA Certification.

With numerous case studies and class exercises, you will learn

- how a VoIP call is set up and carried end-to-end,
- what SIP is,
- how an organization saves money moving to softswitches and SIP trunking,
- project management,
- best practices

and more.

Web Page

Printable brochure with detailed outline

Private onsite course information

150 IP Call Center Technology

This course covers virtually all aspects of IP in the call center with a complete, unbiased picture and a thorough understanding of IP contact center technologies, benefits, issues, options for solutions, migration and integration strategies and vendor offerings, complete with practical templates and checklists you can put to immediate use. Impossible to find in one place anywhere else, this incredibly comprehensive and up-to-date course will save you hundreds of hours trying to research these topics yourself.

This investment will be repaid many times over, eliminating frustration at buzzword-filled meetings and increasing your efficiency, and helping to ensure you make the right choices. Numerous detailed checklists and templates will ensure you're not missing any critical items… or alternatives vendors might "forget" to mention. IP Contact Center Technology is essential for going forward in the contact center business.

Get up to speed on IP in the contact center

- Build on a solid base
  - What a multimedia IP contact center is
  - New features and services that can be supported
  - The components that are used
  - Why you want to do it
  - How to apply it in your organization
- IP-Based Technologies and Capabilities
  - VoIP and IP telephony overview – filling the gaps
  - Review of classic call center technology
- Mainstream Practical Choices and solutions
  - IP contact centers: components and operations
  - Universal queues and multimedia skills-based routing
  - Remote agents
  - Distributed IVR, CTI-less application integration
  - Cross-channel transaction tracking
  - IP call monitoring
- Implementation, Vendors and Project Management
  - Learn the top 10 technology-oriented actions that should be taken to ensure success
  - Infrastructure upgrade requirements
  - Voice quality, security threats, special analysis, troubleshooting requirements
  - Vendor reviews
  - Formulating an RFP – and dealing with vendors

Find out more information today!

Web Page

160 IP Version 6

Teracom's *IP Version 6* is a comprehensive course on the new version of IP, providing a structured understanding of the IPv6 addressing scheme, the different types of addresses machines will have, how addresses are allocated and used, the impact of IPv6 on other protocols, coexistence with IPv4, plus issues, solutions and current best practices for migrating to and implementing IPv6 in operations, products and services

Taking this course, you will gain a solid, comprehensive understanding of IPv6, its important new characteristics, how the new types of IPv6 addresses will be allocated and used, and the ripple effect on other protocols. This is essential knowledge.

Plus, you will learn about areas that must be addressed when implementing IPv6 in operations, products and services, giving you powerful insight into issues you need to be aware of – and knowledge of current solutions that can be immediately applied in your work.

This training is productivity-, efficiency- and accuracy-improving; an investment in your knowledge base and skill set sure to be repaid many times over.

You will receive high-quality, bound course materials with copies of all diagrams and detailed text notes – sure to be a valuable reference – PLUS checklists of best practices you can put to immediate use.

- IPv6 Address Types and Usage
- IPv6 Header Fields for QoS and Extension Headers
- New/Updated Helper Protocols, Services, Applications
- Planning for Deployment, Migration and Transitioning

Taking this course, you will learn methodologies for deployment, obtain planning lists for migration and transitioning to IPv6, a roundup of issues you need to be aware of, including IPv6 security, and current best practices. IPv6 is a two-day investment in your accuracy and productivity. You will build valuable knowledge skills – essential fundamental knowledge – plus obtain practical tips, best practices and checklists you can put to immediate use. Get a step ahead and eliminate knowledge-gap frustration on the job.

Web Page

Printable brochure with detailed outline

Get more info

Telecommunications Certifications

Teracom is a Gold Training Partner of the Telecommunications Certification Organization, authorized to administer exams for TCO certifications on the myTeracom Learning Management System and award TCO certifications.

TCO certification is proof of your knowledge of telecom, datacom and networking fundamentals, jargon, buzzwords, technologies and solutions. It's backed up with a certificate and a letter of introduction.

Teracom Certification Packages are sets of online courses chosen to give you a solid, comprehensive, up-to-date knowledge base in telecommunications and networking, plus the corresponding Telecommunications Certification Organization (TCO) certification.

You will understand the jargon and buzzwords, technologies, protocols, standards, and most importantly, the underlying ideas and how it all works together - in plain English.

This training is ideal for non-engineers needing to get up to speed, fill in the gaps and master both the fundamentals and the big picture.

When you successfully complete the courses in a certification package, you are awarded the prestigious TCO certification.

Certification is proof of knowledge skills… a valuable asset to you and your employer.

Discounted Package Price

By registering for a certification package, not only will you get a set of courses that have been carefully chosen to provide the training needed for today's environment, you will also benefit from a substantial discount compared to purchasing individual courses and purchasing the certification separately.

Learning Management System

The myTeracom Learning Management System guides you every step of the way, from ordering your certification package to taking the lessons and writing the end-of-course exams. Study at your own pace – and take as long as you want to do the lessons.

Guaranteed to Pass

Our Unlimited Plan means you can repeat courses and course exams at no additional charge – which means guaranteed to pass if you're willing to learn.

Web page

Brochure

Previews and free samples

Register

Benefits of Certification

Benefits of Certification for Individuals

One benefit of TCO certification is differentiating yourself from the rest of the crowd when applying for a job or angling for a promotion.

The knowledge you gain taking Teracom's Online Courses, and confirmed with the TCO Certification is foundational knowledge in telecommunications, IP, networking and wireless: fundamental concepts, mainstream technologies and how it all fits together.

This type of knowledge and preparation makes you an ideal candidate to hire or promote to a task, as you will be able to build on your proven knowledge to quickly get up to speed and work on a particular project - then have the versatility to work on subsequent projects.

TCO certification will help demonstrate to an employer that you have this necessary foundational knowledge... a desirable thought to have in your potential manager's mind.

Benefits of Certification to Employers

Teracom certification packages are an extremely cost-effective way of implementing consistent, comprehensive telecommunications and networking technology fundamentals training, ensuring that existing resources and new hires are up to the same speed, with a common vocabulary, framework and knowledge base.

Based on Teracom's proven instructor-led training courses crafted 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 you need.

Course exams provide concrete measurement of competency in key knowledge areas. Management can view the progress and results of all team members and export it to spreadsheet or PDF.

Team progress reports identify skills deficiencies and strengths, and can also provide tangible proof of Return On Investment and team readiness for year-end reports to upper management.

The scalable, web-based myTeracom Learning Management System is included at no extra charge, facilitating the training of both individuals and groups.

Courses and exams may also be licensed as courseware deployed on an organization's LMS and available to all employees.

List of Available Certifications

Certified IP Telecom Network Specialist (CIPTS)

CIPTS is the same as CTNS, but leaves off the PSTN and Wireless and concentrates on all of the aspects of the IP telecommunications network. This package includes four courses plus your CIPTS certification, certificate, letter of reference and all of the other benefits of TCO Certification:

2212 The OSI Layers and Protocol Stacks
2211 Ethernet, LANs and VLANs
2213 IP Networks, Routers and Addresses
2214 MPLS and Carrier Networks

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.

This package includes these six courses plus your CVA certification, certificate, letter of reference and all of the other great benefits of TCO Certification:

2221 Fundamentals of Voice Over IP
2222 VoIP Architectures and Implementation Choices
2223 Softswitches, SIP, Call Setup and SIP Trunking
2224 Voice Packetization, Codecs and Voice Quality
2225 SIP Trunking & carrier Connections
2226 IP Network Quality: CoS, QoS, MPLS and SLAs

Certified Wireless Analyst (CWA)

The Certified Wireless Analyst (CWA) Certification Package includes three training courses covering the full range of wireless, giving you the knowledge required in the wireless business today - plus certification to prove it!

This package includes these six courses plus your CWA certification, certificate, letter of reference and all of the other great benefits of TCO Certification:

2231 Wireless Fundamentals
2232 Mobile Communications
2233 Fixed Wireless

Certified Telecommunications Analyst (CTA)

The prestigious TCO Certified Telecommunications Analyst (CTA) Certification is proof of your comprehensive knowledge of telecom, datacom and networking, itemized on a personalized Letter of Introduction / Letter of Reference included with your TCO Certification.

This package includes these sixteen courses plus CTA Certification exam.

2401 Fundamentals of Telephony and VoIP
2402 Telecom Equipment
2403 The Telecommunications Industry
2404 Digital
2405 Fiber Optics and Transmission Systems
2406 Wireless Telecommunications
2407 Introduction to Data Communications and Networking

2408 MAC Frames and IP Packets: Datacom Fundamentals
2409 Modems: Representing Bits on Radio and Copper
2410 The Network “Cloud” and Circuit Implementation
2411 LANs, VLANs, Wireless and Optical Ethernet
2412 The OSI Layers and Protocol Stacks
2413 IP Networks, Routers and Addresses
2414 MPLS and Carrier Networks
2415 The Internet
2416 IP Security

Certified Telecommunications Subject Matter Expert (CTSME)

The CTSME Certification Package includes the CTNS, CTA, CWA and CVA Certification Packages, at a discounted price, with unlimited repeats and no time limits. Do the courses and exams to earn these certifications one at a time.

Certified Telecommunications Subject Matter Expert is the most comprehensive telecom, datacom, networking, wireless, VoIP and SIP training and certification available anywhere

CTA, 16 courses covering all major topics in telecom, datacom and networking from POTS to MPLS plus Security.

CVA, 6 courses providing depth on Voice over IP from packetization to SIP trunking.

CWA, 3 courses adding depth on wireless including spectrum, propagation, cellular and mobility, Bluetooth and WiFi.

The internationally-recognized CTNS certification rounds out the package.

Plus, you get a signed, sealed and framed CTSME diploma by mail with free shipping in CONUS upon completion of CTSME.

Certifications Price List

ITEM/PART	DESCRIPTION	NUMBER OF SEATS	PRICE	ADDITIONAL SEATS +6
L3921	CTA CERTIFICATION EXAM ONLY UNLIMITED PLAN	1	$ 93.70	$ 56.22
L4211	CIPTS CERTIFICATION PACKAGE UNLIMITED PLAN	1	$ 167.40	$ 100.44
L4213	CWA CERTIFICATION PACKAGE UNLIMITED PLAN	1	$ 343.61	$ 206.17
L4214	CVA CERTIFICATION PACKAGE UNLIMITED PLAN	1	$ 439.32	$ 263.59
L4215	CTA CERTIFICATION PACKAGE UNLIMITED PLAN	1	$ 856.63	$ 513.98
L4216	CTSME CERTIFICATION PACKAGE UNLIMITED PLAN	1	$ 1,430.90	$ 858.54
L4301	CTNS + CWA CERTIFICATION PACKAGE BUNDLE	1	$ 573.32	$ 343.99
L4302	CTNS + CVA CERTIFICATION PACKAGE BUNDLE	1	$ 630.75	$ 378.45
L4303	CTNS + CVA + CWA CERTIFICATION PACKAGE BUNDLE	1	$ 760.91	$ 456.55
L4304	CTA + CVA CERTIFICATION PACKAGE BUNDLE	1	$ 952.34	$ 571.40
L4305	CTA + CVA + CWA CERTIFICATION PACKAGE BUNDLE	1	$ 1,128.45	$ 677.07

DISCOUNTS AND CONCESSIONS

Unlimited Plan allows unlimited repeats of a courses and/or exams at no charge.
IFF is included in prices.

40% reduction on 5+ seat purchases

T101 Telecom 101 Printed Textbook 50% discount

Please see Online Courses for more course package options.

Certification Descriptions

Certified IP Telecom Network Specialist (CIPTS)

The CIPTS Certification Package includes the four Online Courses related to “IP” Telecommunications.

Taking this set of courses, you will build a solid foundation of structured knowledge, understanding the fundamentals, technologies, jargon and buzzwords, and most importantly, the underlying ideas and how everything fits together.

Students taking this course will be enriched with valuable knowledge skills that are both career-enhancing for the student and productivity-enhancing for the employer… with certification from the Telecommunications Certification Organization to prove it.

The courses and their lessons can be done at your own pace. There are no time limits for completing a lesson and moving to the next one.

Our Unlimited Plan allows you to repeat the courses and/or exams for no additional cost… which means guaranteed to pass if you’re willing to learn.

On the other hand, if you like this discounted package of courses, but don’t need the certification – or don’t feel like writing exams – no problem! Take the package, benefit from the training and the discount and simply skip the exams.

This package includes the following four courses and your CIPTS certification, certificate, letter of reference and all of the other great benefits of TCO Certification:

2212 OSI Layers and Protocol Stacks
2211 LANs, VLANs, Wireless and Optical Ethernet
2213 IP Addresses, Packets and Routers
2214 MPLS and Carrier Networks

The four courses in the CIPTS package are on the “IP” telecommunications network and its three main enabling technologies: Ethernet, IP and MPLS, and beginning with the OSI model and its layers to establish a framework.

This is in effect the same as the CTNS certification package, but skipping the traditional telephony and the wireless telecommunications courses and going directly to the IP telecom courses.

This package is ideal for those who only need to get up to speed on the new areas in telecommunications, and/or up to speed on “the network”, when the network in question is IP-based.

Web page

Brochure

Previews and free samples

Register

Certified VoIP Analyst (CVA)

Get fully up to speed on Voice over IP and SIP technologies and implementations –and TCO CVA Certification to prove it!

Get a complete understanding of Voice over IP and SIP, with CVA Certification to prove it.

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.

The Certified VoIP Analyst Certification Package includes six online courses:

- 2221 Fundamentals of Voice Over IP
- 2222 VoIP Architectures and Implementation Choices
- 2223 Softswitches, SIP, Call Setup and SIP Trunking
- 2224 Voice Packetization, Codecs and Voice Quality
- 2225 SIP Trunking & carrier Connections
- 2226 IP Network Quality: CoS, QoS, MPLS and SLAs

This knowledge enables a CVA to stand out from the rest, with demonstrated broad and deep vendor-agnostic knowledge of VoIP systems and best practices.

This kind of knowledge enables higher-paying positions performing analysis, writing reports, making recommendations and providing effective, value-added contributions in project management, business and product development, software design, sales, marketing and finance.

The CVA Certification Package includes six courses totaling 59 lessons, plus the TCO CVA Certification Exam, TCO Certificate suitable for framing and Personalized Letter of Reference.

You get unlimited repeats of courses and exams, no time limits.
Guaranteed to pass, refresh your knowledge anytime.
30-day 100% money-back guarantee.

You have nothing to lose - and a valuable certification to gain!

These courses build on IP and PSTN fundamentals. If you are completely new to telecom, we recommend you take the CTNS courses first to build a knowledge base, then the CVA courses.

Web Page

Register

Free Previews

Certified Wireless Analyst (CWA)

Get the core technical knowledge needed by anyone serious in the wireless business today - plus TCO Certification to prove it!

TCO Certified Wireless Analyst Certification covers the core technical knowledge needed by anyone serious in the wireless business today.

A Certified Wireless Analyst is knowledgeable of the full range of wireless technologies including radio and spectrum fundamentals, mobile communications concepts and network technologies up to 4G LTE, as well as WiFi and other fixed wireless.

This knowledge enables a CWA to stand out from the rest, perform analysis, write reports, make recommendations and provide effective contributions in project management, business and product development, software design, sales, marketing, finance and many other job functions.

The CWA Certification Package Unlimited Plan includes three CWA online courses and the TCO CWA Certification Exam, both with unlimited repeats – which means guaranteed to pass, and refresh your knowledge anytime.

The coursework for CWA is three high-quality self-paced instructor-led multimedia courses:

2231 Wireless Fundamentals
2232 Mobile Communications
2233 Fixed Wireless

Specifically designed for non-engineers, this certification will get you up to speed on the fundamentals of radio, the jargon and buzzwords, technologies in use and ideas behind them on all major wireless systems in use today from 4G LTE to 700 MHz spectrum, including 802.11 WiFi.

Get up to speed on all major topics, at your own pace. Understand the fundamentals, technologies, jargon, buzzwords and most importantly, the underlying ideas ... and how it all fits together.

Plus, get your Telecommunications Certification Organization (TCO) Certified Wireless Analyst (CWA) Certification to prove it!

Web Page

Register

Free Previews

Certified Telecommunications Analyst (CTA)

The prestigious TCO Certified Telecommunications Analyst (CTA) Certification is proof of your comprehensive knowledge of telecom, datacom and networking, itemized on a personalized Letter of Introduction / Letter of Reference included with your TCO Certification.

TCO CTA Certification is a very strong indication of the strength of your knowledge of telecommunications: the whole story, and the big picture in all of these areas:

2401 Fundamentals of Telephony and VoIP

2402 Telecom Equipment

2403 The Telecommunications Industry

2404 Digital

2405 Transmission Systems and Fiber Optics

2406 Wireless Telecommunications

2407 Introduction to Datacom and Networking

2408 Data Coding, Frames and Packets

2409 Modems: Representing Bits on Radio and Copper

2410 The Network “Cloud” and Service Implementation

2411 Ethernet, LANs and VLANs

2412 The OSI Layers and Protocol Stacks

2413 IP Networks, Routers and Addresses

2414 MPLS and Carrier Networks

2415 The Internet

2416 IP Security

It is accompanied by – a Teracom exclusive – a personalized Letter of Reference you can attach to your résumé explaining the very serious knowledge skills you have and inviting the reader to contact us.

The CTA Certification is also available as an exam-only, without online courses. It is the “final exam” and certification for BOOT CAMP and the Telecom 101 textbook.

Web page

Brochure

Register

Certified Telecommunications Subject Matter Expert (CTSME)

The TCO Certified Telecommunications Subject Matter Expert (CTSME) is the most comprehensive telecom, datacom, networking, wireless, VoIP and SIP training and certification available anywhere.

CTSME includes four TCO Certification Packages: CTA, CVA, CWA and CTNS. Complete each certification at your own pace. Complete all four and you earn CTSME Certification, the ultimate in recognition of telecom knowledge.

Included is a framed hand-signed CTSME Certificate plus a personal Letter of Introduction from the Director of the Institute explaining the very extensive knowledge you have, and inviting the reader to contact Teracom as a reference.

Work at your own pace. There are no time limits or expiration dates. You have unlimited repeats of the courses, and unlimited repeats of exams until you pass.

We are so confident of the quality of the training it comes with a 30-day no questions asked 100% money-back guarantee.

Here's what you get:

- CTA Certification Package Unlimited Plan. 16 courses covering all major topics in telecom, datacom and networking from POTS to MPLS plus the Security module.
- CVA Certification Package Unlimited Plan. Six courses providing depth on Voice over IP from packetization to SIP trunking.
- CWA Certification Package Unlimited Plan. Three in-depth courses on wireless including spectrum, propagation, cellular and mobility, Bluetooth, WiFi and more.
- CTNS Certification Package Unlimited Plan. CTNS is a subset of CTA, six of the sixteen CTA courses and exams - yet recognized as the #1 telecommunications certification worldwide and a valuable credential to add to your résumé.

And on completion of the four certifications, you earn your CTSME Certification, and receive a framed, hand-signed CTSME Certificate.

CTSME Certification will help demonstrate you have wide-ranging knowledge skills suitable for higher-level analysis, planning and design positions, which typically pay more than programmer jobs.

This knowledge and preparation make you an ideal candidate to hire or promote, as you will be able to quickly get up to speed for a current project, and be able to work efficiently on subsequent projects... a desirable thought to have in your employer's mind.

Web Page

Register

Free Previews and Course List

Online Courses

Best-Of-Breed Self-Paced Telecom Training

Get up to speed and build a solid base of knowledge in telecom, datacom, networking, and wireless… with available certification to prove it.

Proven Content – Totally Up-to-Date

Based on Teracom's renowned instructor-led courses developed for organizations including AT&T, Verizon, Bell Canada, Intel, Microsoft, Cisco, Qualcomm, the CIA, NSA, IRS, FAA, US Army, Navy, Marines, Air Force, Bank of America, the SF Giants and hundreds more. Top-notch, top-quality and right up to date with the topics and knowledge you need.

High-Quality Full Multimedia

Interactive lessons, rich with photographs and illustrations make this self-paced learning enjoyable! 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.

Course Completion Certificate & CPE Credits

Every course includes a multiple-choice test at the end and course completion certificate suitable for framing. Register for individual courses or packages as best meet your needs.

Certification

We've partnered with the Telecommunications Certification Organization for certifications. Register for a Certification Package to get a set of courses, complete the courses and exams, and get your TCO Certification, with diploma, personalized Letter Of Reference and all of the other benefits of certification, all at a discounted package price.

Unlimited Plan: Guaranteed to Pass

You can repeat the courses and take the exam as many times as needed… meaning you can take and review lessons as needed, now and in the future. Unlimited exam repeats mean guaranteed to get your certification if you're willing to learn.

Team Training

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. Or, check out the Courseware section of the Teracom catalog for uploading the courses to your organization's LMS.

30-Day 100% Money-Back Guarantee

We're so confident of the quality of the Online Courses, we back them up with a 100% money-back guarantee. Go ahead! You have nothing to lose.

Web page

Brochure

Previews and free samples

List of Available Online Courses

Grouped by Certification

CTNS Courses

2201 POTS and the PSTN

Loops and Trunks • Circuit-Switching • LECs and IXCs • Analog • Voiceband • DTMF • SS7

7 interactive multipart lessons, multiple-choice exam and certificate.

2206 Wireless Telecommunications

Mobile Network Fundamentals • Cellular Principles • Digitized Voice over Radio • Mobile Internet • FDMA, TDMA, CDMA and OFDM • 4G LTE and OFDMA • 5G: New Spectrum, Ultra-Broadband and IoT • Wi-Fi 6 802.11ax • Communication Satellites

10 interactive multipart lessons, multiple-choice exam and certificate.

2211 LANs, VLANs, Wireless and Optical Ethernet

MAC Addresses • MAC Frames • Layer 2 Switches • VLANs • Ethernet on Copper • 1000BASE-T • Power over Ethernet • Cable Categories • Office Wiring Plan • Wireless Ethernet (Wi-Fi) • Optical Ethernet • Ethernet in the Core, MANs and PONs • Fiber Types • SFP Transceivers • Field Installation

8 interactive multipart lessons, multiple-choice exam and certificate.

2212 The OSI Layers and Protocol Stacks

Protocols & Standards • Open Systems • OSI Model • Layers • Protocol Stacks • FedEx Analogy

14 interactive multipart lessons, multiple-choice exam and certificate.

2213 IP Networks, Routers and Addresses

IP Packets • Packet Networks • Routers • Static, Dynamic, Public, Private Addresses • NAT • IPv6

11 interactive multipart lessons, multiple-choice exam and certificate.

2214 MPLS and Carrier Networks

Carrier Packet Networks • Technologies • MPLS • SLAs • CoS • Integration & Aggregation

11 interactive multipart lessons, multiple-choice exam and certificate.

CVA Courses

2221 Fundamentals of VoIP

Jargon & Buzzwords • VoIP Phone System Components and Operation • Voice Packetization • LANs and WANs • VoIP Phones: MAC Address, DHCP, IP, UDP, RTP, QoS • SIP, Softswitches & SIP Trunking • Cloud • The Future

9 interactive multipart lessons, multiple-choice exam and certificate.

2222 VoIP Architecture and Implementation Choices

VoIP over the Internet • VoIP at Carriers • VoIP-Enabled PBX • PBX Replacement • Softswitches • Hosted PBX • Cloud Services • IP Centrex • Asterisk & Open-Source • SO/HO VoIP Phone Features

12 interactive multipart lessons, multiple-choice exam and certificate.

2223 Softswitches, SIP, Call Setup and SIP Trunking

What SIP Is • What It Does • URIs: SIP Phone Numbers • Call Setup Procedure • Call Disposition Rules • How SIP relates to Softswitches and Call Managers

9 interactive multipart lessons, multiple-choice exam and certificate.

2224 Voice Packetization, Codecs and Voice Quality

How Voice is Digitized and Packetized • Voice Quality • Codecs • Delay and Jitter • How Packets Are "Lost" • Packet Loss Sound Samples • RTP • VoIP Protocol Stack: RTP/UDP/IP/MAC

10 interactive multipart lessons, multiple-choice exam and certificate.

2225 SIP Trunking and Carrier Connections

Carrier Interconnect: Switched Access Tariff • Gateways & DSOs • Native VoIP Carrier-Carrier • Session Border Controller • Gateway + PBX/PRI Trunks • SIP Trunking

6 interactive multipart lessons, multiple-choice exam and certificate.

2226 IP Network Quality, CoS, QoS, MPLS, and SLAs

Virtual Circuit Concepts • MPLS Fundamentals & Jargon • Class of Service (CoS) • Service Level Agreement (SLA) • Traffic Profiles • Prioritization • Traffic Policing: "Throttling" • Diff-Serv and MPLS • 802.1P

7 interactive multipart lessons, multiple-choice exam and certificate.

CWA Courses

2231 Wireless Fundamentals

Radio fundamentals • Spectrum • Digital radio • Modems and Modulation • Propagation, Penetration and Fading 5 interactive multipart lessons, multiple-choice exam and certificate.

2232 Mobile Communications

Cellular Principles • Mobility • Handoffs • PSTN Phone Calls • Mobile Internet • FDMA, TDMA, CDMA, OFDM • GSM, UMTS, HSPA • LTE and OFDMA • 5G New Radio • mmWave • IoT

15 interactive multipart lessons, multiple-choice exam and certificate.

2233 Fixed Wireless

Wireless LANs • 802.11 Standards • Wi-Fi • Security • Bluetooth • WiMAX • Point-to-Point Microwave • Satellites 7 interactive multipart lessons, multiple-choice exam and certificate.

CTA Courses

2401 Fundamentals of Telephony and Voice over IP

Loops and Trunks • POTS • Circuit-Switching • LECs, CLECs and IXCs • Analog • Voiceband • DTMF • SS7 • Voice Digitization • Digitized Voice in IP Packets 10 interactive multipart lessons, multiple-choice exam and certificate

2402 Telecom Equipment

We take a practical journey through different types of equipment. We'll review core routers, Layer 2 Optical Ethernet aggregation switches, PBXs, Centrex, copper and Optical multiplexers and cross-connects, as well as ancillary functions like ACD, voice mail and interactive voice response (IVR). 4 interactive multipart lessons, multiple-choice exam and certificate.

2403 The Telecommunications Industry

We'll review the telecommunications industry and understand the main players and competitors, how Local Exchange Carriers connect to Inter-Exchange Carriers or Other LECs like cellular and Cable TV companies, and how CLECs fit into the picture. 6 interactive multipart lessons, multiple-choice exam and certificate.

2404 Digital

We'll give you a real understanding of what "digital" actually means, and how it is implemented. We'll explain what a DS0 and G.711 is, and alternate codec standards like G.729 and AMR. 8 interactive multipart lessons, multiple-choice exam and certificate.

2405 Fiber Optics and Transmission Systems

You will learn the essentials of fiber, fiber optics and fiber cables, how 1s and 0s are communicated over fiber using wavelengths, Optical Ethernet... and how bitrates of 100 Gb/s and more are achieved using Dense Wave Division Multiplexing (DWDM). 9 interactive multipart lessons, multiple-choice exam and certificate.

2406 Wireless Telecommunications

Wireless Telecommunications is a comprehensive up-to-date course on cellular plus Wi-Fi and satellites.

10 interactive multipart lessons, multiple-choice exam and certificate

2407 Introduction to Data Communications and Networking

We'll begin by establishing a model for a data communications circuit, then provide examples and context for each of the components of the model, and review different circuit configurations including LANs and WANs. 8 interactive multipart lessons, multiple-choice exam and certificate.

2408 MAC Frames and IP Packets: Datacom Fundamentals

We'll look at how data is formatted for transmission, beginning with the older concepts of "synchronous" and "asynchronous", then cover the newer ideas of frames and packets, how frames and packets are related, and the addresses on frames and packets, and the structure of IPv4 packets.

8 interactive multipart lessons, multiple-choice exam and certificate.

2409 Modems; Representing Bits on Radio and Copper

How modems change some characteristics of a carrier frequency in discrete steps to represent patterns of 1s and 0s to each other. ASK, FSK, PSK, QPSK, QAM, and OFDM. Baud rate vs. bit rate.

8 interactive multipart lessons, multiple-choice exam and certificate.

2410 The Network “Cloud” and Circuit Implementation

The "Network Cloud", why people use clouds to draw networks, and what is really going on inside that cloud: routers connected with point-to-point Optical Ethernet front-ended with Edge equipment.

3 interactive multipart lessons, multiple-choice exam and certificate.

2411 LANs, VLANs, Wireless and Optical Ethernet

This course is all about Ethernet: the fundamentals, equipment and implementations, including twisted-pair copper cables, wireless Ethernet (Wi-Fi) and Optical Ethernet, in-building, in the network core, in MANs and PONs. These are the “pipes” that move bits from A to B.

7 interactive multipart lessons, multiple-choice exam and certificate.

2412 The OSI Layers and the Protocol Stacks

The OSI 7-Layer Reference Model is used to sort out the many functions that need to be performed, to be able to discuss separate issues separately. The functions are organized into groups called layers, which are stacked one on top of the other.

14 interactive multipart lessons, multiple-choice exam and certificate.

2413 IP Networks, Routers and Addresses

IP Networks, Routers and Addresses is a comprehensive course on IP networking fundamentals: IP packets, IP addressing and IP routers.

11 interactive multipart lessons, multiple-choice exam and certificate

2414 MPLS and Carrier Networks

MPLS and Carrier Networks is a comprehensive training course designed to build a solid understanding

of carrier packet networks and services, the terminology and technologies like MPLS, the components of a service, the equipment involved and how MPLS is used to implement Virtual Private router-to-router point-to-point connections for businesses to build VPNs, how MPLS is used for Integrated Access, saving money, used to prioritize IP packets and used to manage IP packets at the Network Operations Center. In plain English.

11 interactive multipart lessons, multiple-choice exam and certificate.

2415 The Internet

We'll start at the beginning of the story, understanding where the Internet came from and its fundamental principles of operation. Then we'll look at improvements such as the Domain Name System, MIME, HTML and HTTP... which form "the Web". We'll understand what an Internet Service Provider does, and peering and transit services. 11 interactive multipart lessons, multiple-choice exam and certificate.

2416 IP Security

Course 2416 is a reasonably comprehensive overview of security in the IP world. We'll begin with a discussion of risk areas, vulnerabilities and measures. Then we'll examine several areas: computer security and malicious software like viruses and Trojan Horses and the measures to protect against these risks; network security and firewalls, public key and private key encryption, authentication, IPsec and VPNs.

12 interactive multipart lessons, multiple-choice exam and certificate.

3921 CTA Certification Exam Only

The CTA Certification Exam is the set of exam modules needed to obtain the TCO Certified Telecommunications Analyst Certification. The exams are written one after another in sequence.

Online Courses Price List

Please see the Certifications Price List for packages and bundle discounts.

ITEM/PART	DESCRIPTION	NUMBER OF SEATS	PRICE	5+ SEATS, EA
L2201	THE PSTN	1	$ 51.39	$ 30.95
L2206	WIRELESS TELECOMMUNICATIONS	1	$ 51.59	$ 30.95
L2211	ETHERNET, LANS AND VLANS	1	$ 51.59	$ 30.95
L2212	THE OSI LAYERS AND PROTOCOL STACKS	1	$ 51.59	$ 30.95
L2213	IP NETWORKS, ROUTERS AND ADDRESSES	1	$ 51.59	$ 30.95
L2214	MPLS AND CARRIER NETWORKS	1	$ 51.59	$ 30.95
L2221	FUNDAMENTALS OF VoIP	1	$ 113.90	$ 68.34
L2222	VoIP ARCHITECTURE AND IMPLEMETATION CHOICES	1	$ 113.90	$ 68.34
L2223	SOFTSWITCHES, SIP, CALL SETUP AND SIP TRUNKING	1	$ 113.90	$ 68.34
L2224	VOICE PACKETIZATION, CODECS AND VOICE QUALITY	1	$ 113.90	$ 68.34
L2225	SIP TRUNKING AND CARRIER CONNECTIONS	1	$ 113.90	$ 68.34
L2226	IP NETWORK QUALITY; CoS, QoS, MPLS AND SLAs	1	$ 113.90	$ 68.34
L2231	WIRELESS FUNDAMENTALS	1	$ 113.90	$ 68.34
L2232	MOBILE COMMUNICATIONS	1	$ 113.90	$ 68.34
L2233	FIXED WIRELSS	1	$ 113.90	$ 68.34
L2401	THE PSTN	1	$ 113.90	$ 68.34
L2402	TELECOM EQUIPMENT	1	$ 113.90	$ 68.34
L2403	THE TELECOMMUNICATIONS INDUSTRY	1	$ 113.90	$ 68.34
L2404	DIGITAL	1	$ 113.90	$ 68.34
L2405	TRANSMISSION SYSTEMS AND FIBER OPTICS	1	$ 113.90	$ 68.34
L2406	WIRELESS TELECOMMUNICATIONS,	1	$ 113.90	$ 68.34
L2407	INTRODUCTION TO DATACOM AND NETWORKING	1	$ 113.90	$ 68.34
L2408	DATA CODING, FRAMES AND PACKETS	1	$ 113.90	$ 68.34
L2409	MODEMS; REPRESENTING BITS ON RADIO AND COPPER	1	$ 113.90	$ 68.34

L2410	THE NETWORK "CLOUD" AND SERVICE IMPLEMEMTATION	1	$ 113.90	$ 68.34
L2411	ETHERNET, LANS AND VLANS	1	$ 113.90	$ 68.34
L2412	THE OSI LAYERS AND THE PROTOCOL STACKS	1	$ 113.90	$ 68.34
L2413	IP NETWORKS, ROUTERS AND ADDRESSES	1	$ 113.90	$ 68.34
L2414	MPLS AND CARRIER NETWORKS	1	$ 113.90	$ 68.34
L2415	THE INTERNET	1	$ 113.90	$ 68.34
L2416	IP SECURITY	1	$ 113.90	$ 68.34

Prices include IFF

DISCOUNTS AND CONCESSIONS

Unlimited repeats of courses and exams, with no expiry date.

40% discount for 5+ seats purchased

Please see Certifications and Certification Packages for more course package options.

Online Courses

Course List Brochure

Online Course Descriptions

2201 POTS and the PSTN

Loops and Trunks • Circuit-Switching • LECs and IXCs • Analog • Voiceband • DTMF • SS7
8 interactive multipart lessons, multiple-choice exam and certificate.

This course is dedicated to the Public Switched Telephone Network (PSTN) and Plain Ordinary Telephone Service (POTS). Understanding the fundamentals of this technology and network architecture is a starting point for understanding everything else related to telecommunications.

One cornerstone of a full, rounded base of knowledge of telecommunications is the structure and operation of the Public Switched Telephone Network, built over the past 135 years, still in operation in every country on earth – knowledge necessary for connecting the PSTN to, and steadily replacing the PSTN with IP telecom technologies.

You'll gain a solid understanding of the fundamentals of the telephone system: customer premise and Central Office, loops, trunks, remotes, circuit switching and how a telephone call is connected end-to-end. We'll cover LECs and IXCs, sound, analog and the voiceband, twisted pair, DTMF and SS7.

Based on Teracom's famous Course 101, tuned and refined over the course of 20 years of instructor-led training, we'll cut through the jargon to demystify telephony and the telephone system, explaining the jargon and buzzwords, the underlying ideas, and how it all works together… in plain English.

Featuring many photos of actual equipment both inside a Central Office and in the outside plant, this multimedia course is an excellent way to get up to speed on traditional telephony.

Course Lessons

1. Introduction
2. History of Telecommunications
3. The Public Switched Telephone Network (PSTN)
4. Analog Circuits and Sound
5. The Voiceband
6. Plain Ordinary Telephone Service (POTS)
7. Signaling: Pulse Dialing and DTMF
8. Signaling System 7 (SS7)
9. Multiple-Choice Exam

Prerequisites

None.

Course Objective: What You Will Learn

The objective of this course is to understand how the physical telephone network is organized, the characteristics of basic telephone service, how calls are established end-to-end, and to demystify common telephony jargon and buzzwords.

In particular, on completion of this course, you will be able to explain:

- Why telecom networks are divided into local access wiring and long-distance transmission
- The founding, breakup and re-emergence of AT&T in the US; TELUS and Bell in Canada
- A basic model for the PSTN and its main components
- Loops, why they are called loops and why there is a maximum loop length

- The outside plant
- Circuit-switching
- Central Office and Customer Premise
- How and why remotes are used; fiber to the neighborhood
- Plain Ordinary Telephone Service
- What analog is, and how it relates to copper wires, electricity, circuits and sound
- How microphones and speakers work
- The human hearing range
- Whether trees falling in the forest if no-one is there to hear them cause a sound
- The voiceband
- Why and how the telephone system can limit frequencies to the voiceband
- Why two wires are used
- Why they are twisted together (twisted pair)
- Tip and ring, -48 volts
- Supervision, dial tone, ringing, lightning protection
- Dial-up
- Touch-tone and DTMF
- Basics of SS7
- Examples of sophisticated call routing using SS7

Web page

Printable brochure with detailed outline

Preview and free sample

Register

2206 Wireless Telecommunications

Mobile Network Fundamentals • Cellular Principles • Digitized Voice over Radio • Mobile Internet • FDMA, TDMA, CDMA and OFDM • 4G LTE and OFDMA • 5G: New Spectrum, Ultra-Broadband and IoT • Wi-Fi 6 802.11ax • Communication Satellites

10 interactive multipart lessons, multiple-choice exam and certificate.

Wireless Telecommunications is a comprehensive up-to-date course on cellular plus Wi-Fi and satellites for non-engineering professionals.

Taking this course, you will develop a solid understanding of the fundamental principles of radio, mobility and cellular, network components and operation, digital radio, mobile phone calls and mobile Internet access, spectrum-sharing technologies like OFDM, and LTE and 5G. In addition, you will get up to speed on the components, operation and latest standards for Wi-Fi, and the essentials of satellite communications.

We'll cut through the jargon to demystify wireless, explaining the fundamentals of cellular and mobility, the buzzwords, the network, technologies and generations, the underlying ideas, and how it all works together... in plain English.

Course Lessons

1. Introduction
2. Mobile Network Components, Jargon and Operation
3. Cellular Principles
4. PSTN Phone Calls using the Phone App: Voice Minutes
5. Mobile Internet: Data Plan
6. Spectrum-Sharing: FDMA, TDMA, CDMA, OFDM
7. 4G LTE: Mobile Broadband
8. 5G New Radio: Enhanced Mobile Broadband, IoT Communications
9. Wi-Fi: 802.11 Wireless LANs
10. Communication Satellites
11. Multiple-Choice Exam

Prerequisites

None. Course 2201 The PSTN has some relevance, as the mobile networks connect to the wireline Public Switched Telephone Network. Courses 2211 Ethernet and 2213 IP are relevant to Lesson 9.

Course Objective: What You Will Learn

The objective of this course is to develop a solid understanding of mobile cellular communications networks and technologies. After taking this course, you will be up to speed on the fundamental principles of cellular radio networks, components and operation, digital radio, spectrum-sharing technologies and the four generations of mobile cellular technology. An additional objective is a basic understanding of WiFi and satellites.

You'll gain a solid understanding of the key principles of wireless and mobile networks:

- Radio fundamentals
- Mobile network components and operation
- Coverage, capacity and mobility
- Why cellular radio systems are used

- Registration and handoffs
- Digitized voice over radio for PSTN phone calls
- Mobile Internet: "Data Plan"
- Cellular technologies: FDMA, TDMA, CDMA, OFDM
- 4G LTE and OFDMA
- 5G: new spectrum, more b/s, ultra-broadband and IoT
- Wi-Fi: 802.11 wireless LANs, Wi-Fi 6 / 802.11ax, Wi-Fi security
- GEO and LEO satellite communications

Web page

Printable brochure with detailed outline

Preview and free sample

Register

2211 LANs, VLANs, Wireless and Optical Ethernet

MAC Addresses • MAC Frames • Layer 2 Switches • VLANs • Ethernet on Copper • 1000BASE-T • Power over Ethernet • Cable Categories • Office Wiring Plan • Wireless Ethernet (Wi-Fi) • Optical Ethernet • Ethernet in the Core, MANs and PONs • Fiber Types • SFP Transceivers • Field Installation

7 interactive multipart lessons, multiple-choice exam and certificate.

Ethernet LANs are the standard method of implementing Layer 2 of the OSI Model, data links for communications between two machines. Taking this course, you'll gain a solid understanding of LANs: Ethernet and its bus topology, CSMA-CD access control, broadcast domains and MAC addresses; MAC frames, the IEEE 802 standards, evolution of Ethernet from 10BASE-T to Gig-E, hubs and switches, LAN cables, the TIA-568 cable categories, basic cabling design; what "bridging" means, how a LAN switch works, VLANs and finishing with a preview of the next course: using routers to move frames between broadcast domains.

We'll cut through the jargon to demystify Ethernet, MAC addresses, LANs and VLANs, explaining the jargon and buzzwords, the underlying ideas, and how it all works together… in plain English.

Course Lessons

1. Introduction
2. Broadcast Domains, MAC Addresses and MAC Frames
3. LAN Switches a.k.a. Layer 2 Switches
4. VLANs
5. 802 Physical Standards: 802.3 Twisted Pair and 802.11 Wi-Fi
6. Twisted-Pair LAN Cables, Categories, Wiring Plan and Switch Hierarchy
7. Optical Ethernet and Fiber Links
8. Multiple-Choice Exam

Prerequisites

None. Course 2212 The OSI Layers and Protocol Stacks is useful to understand where LANs fit into the overall picture and how LANs and VLANs relate to routers and IP.

Course Objective: What You Will Learn

The objective of taking this course is to become familiar with the standard technology used to implement Layer 2 in IP-based packet networks. After taking this course, you will be up to speed on MAC addresses and MAC frames, broadcast domains, LAN cables and LAN switches, VLANs and Optical Ethernet.

n completion of this course, you will be able to explain:

- The idea of a broadcast domain.
- The idea of a MAC addresses to identify a LAN interface on a station in a broadcast domain.
- What MAC frames are, and what purpose they serve.
- What a LAN switch is, and what it does.
- How VLANs can be used to segregate devices into different broadcast domains.

- The IEEE 802 series of standards: The 802.3 standard and communicating MAC frames at 10 Mb/s on coaxial cables to Gigabit Ethernet on copper and fiber.
- What the code 1000BASE-T means.
- MAC frames over the Ether, a.k.a. Wi-Fi, the 2.4 and 5 GHz unlicensed bands, and the fundamentals of how the bits in MAC frames are communicated using radio carrier frequencies.
- Wiring Ethernet to the work area with Cat 5, Cat 5e and Cat 6 twisted-pair copper-wire cables. Wiring closets and Layer 2 aggregation switches.
- What Optical Ethernet is, and how it is the building block of telecom networks, including Metropolitan Area Networks (MANs), carrier MPLS networks, and Passive Optical Networks (PONs) for fiber to the home.
- The fundamentals of how the bits in MAC frames are communicated using light guided in glass tubes.
- How fiber cables are deployed and connected to equipment at each end.
- What designations like 100GBASE-ER4 mean.

Web page

Printable brochure with detailed outline

Preview and free sample

Register

2212 The OSI Layers and Protocol Stacks

Protocols & Standards • Open Systems • OSI Model • Layers • Protocol Stacks • FedEx Analogy

14 interactive multipart lessons, multiple-choice exam and certificate.

The OSI Layers and Protocol Stacks begins the discussion of IP-based telecom in the Certified Telecommunications Network Specialist (CTNS) certification package. It is the first course in the Certified IP Telecom Network Specialist (CIPTS) package.

This course establishes a framework for all of the subsequent discussions: the OSI 7-Layer Reference Model, which identifies and divides the functions to be performed into groups called *layers*. This framework is required to sort out the many functions that need to be performed, and to be able to discuss separate issues separately.

You'll learn what a layer is, the purpose of each layer, see examples of protocols used to implement each layer, and learn how a protocol stack really works with the famous "FedEx Analogy" presented as an embedded video by our top instructor, Eric Coll.

We'll cut through the jargon to demystify layers, explaining jargon and buzzwords, and most importantly, the underlying ideas, and how it all works together… in plain English.

Course Lessons

1. Introduction
2. Open Systems
3. Protocols and Standards
4. ISO OSI 7-Layer Reference Model
5. The Physical Layer
6. Data Link Layer
7. Network Layer
8. Transport Layer
9. Session Layer
10. Presentation Layer
11. Application Layer
12. Protocol Stacks
13. Protocol Headers
14. Standards Organizations
15. Multiple-choice Exam

Prerequisites

None. This is the best course to begin learning about IP and MPLS.

Course Objective: What You Will Learn

This course can be taken by both those who need simply an overview and introduction to the idea of layers and the OSI model, and by those embarking on a certification and/or planning to take further courses.

If you're in the first group, the objective is not to become an instant expert, but rather to become familiar with the structure that is used to be able to discuss separate issues separately, what a layer is, the basic

functions of each layer, what a protocol stack is and how it works, and where things you've heard of before like Ethernet, IP and TCP fit into the picture… to demystify the jargon and buzzwords, to eliminate frustration and increase your confidence and effectiveness.

If you're in the second group, and your objective is to put in place a structure for subsequent courses, following is a list of concrete objectives. On completion of this course, you will be able to explain:

- The concept of an open system and its advantages
- What a protocol is and what a standard is
- The OSI Model and its purpose
- What a Layer is
- The seven layers of the OSI model
- The name of each layer
- The functions each layer is responsible for
- Examples of actual protocols for each layer
- What a protocol stack is and how it operates
- Examples of standards organizations that publish protocols

Web page

Printable brochure with detailed outline

Preview and free sample

Register

2213 IP Addresses, Packets and Routers

IP Packets • Networks • Routers • Static, Dynamic, Public, Private Addresses • NAT • IPv6

11 interactive multipart lessons, multiple-choice exam and certificate.

IP Networks, Routers and Addresses is a comprehensive course on Layer 3 of the OSI Model, concentrating on IP addresses, routers and packets.

You'll gain a solid understanding of the key principles of packet networks: bandwidth on demand, packet forwarding and packet filtering, how routers work, all of the different types of IP version 4 addresses: static and dynamic, public and private, network address translation plus IP version 6.

Based on Teracom's famous Course 101, tuned and refined over the course of 20 years of instructor-led training, we'll cut through the jargon to clearly explain IP and routers, packets and addresses, the underlying ideas, and how it all works together… in plain English.

Course Lessons

1. Introduction
2. Review: Channelized Time-Division Multiplexing (TDM)
3. Statistical Time-Division Multiplexing: Bandwidth-on-Demand
4. Private Network: Bandwidth on Demand + Routing
5. Routers
6. IPv4 Addresses
7. DHCP
8. Public and Private IPv4 Addresses
9. Network Address Translation
10. IPv6 Overview
11. IPv6 Address Allocations and Assignment
12. Multiple-Choice Exam

Prerequisites

None. Course 2212 The OSI Layers and Protocol Stacks is useful to understand where IP and packets fit into the overall picture. Course 2211 Ethernet, LANs and VLANs complements this course, as IP packets are usually carried on Ethernet.

Course Objective: What You Will Learn

The objective of this course is to develop a solid understanding of IP. After taking this course, you will be up to speed on the fundamental principles of packet networks: bandwidth on demand, also known as overbooking or oversubscription, and packet forwarding. You will know the IP packet format and how IP addresses are allocated, assigned and displayed. You will know the difference between static and dynamic addresses, public and private addresses and how Network Address Translation works. An additional objective is to become familiar with the basics of IPv6.

In particular, on completion of this course, you will be able to explain:

The concept of statistical multiplexing, also known as oversubscription, overbooking and bandwidth on demand, why and how it can be implemented and its benefits.

What a private network is

What a router is and how it implements the network by connecting data links

How routers move packets between broadcast domains, including VLANs

How routers also act as a point of control for traffic, called packet filtering

The basic structure and contents of a routing table

The Customer Edge

IPv4 address blocks: Class A, Class B and Class C, and dotted-decimal notation

Static addresses and dynamic addresses, and how and why DHCP is used to assign both

Public addresses and private addresses, how, why and where each is used

Network Address Translation for interfacing domains where public addresses are used with those where private addresses are used

The improvements and changes between IPv4 and IPv6, and

The types of IPv6 addresses, how IPv6 addresses are allocated to ISPs then assigned to users, and how each residence gets 18 billion billion IPv6 addresses.

Web page

Printable brochure with detailed outline

Preview and free sample

Register

2214 MPLS and Carrier Networks

Carrier Packet Networks • Technologies • MPLS • SLAs • CoS • Integration & Aggregation

11 interactive multipart lessons, multiple-choice exam and certificate.

MPLS and Carrier Networks is a comprehensive training course designed to build a solid understanding of carrier packet networks and services, the terminology, technologies, configuration, operation and most importantly, the underlying ideas … in plain English.

We'll cut through the buzzwords and marketing to demystify carrier packet networks and services, explaining Service Level Agreements, traffic profiles, virtual circuits, QoS, Class of Service, Differentiated Services, integration, convergence and aggregation, MPLS and other network technologies, and how they relate to TCP/IP without bogging down on details.

You will gain career- and productivity-enhancing knowledge of the structure, components and operation of carrier packet networks and services, how they are implemented, packaged and marketed by carriers and how they are used by government, business… and other carriers.

Course Lessons

1. Introduction
2. Carrier Packet Network Basics
3. Service Level Agreements
4. Virtual Circuits
5. QoS Requirement for Voice over IP
6. MPLS
7. TCP/IP over MPLS
8. Differentiated Classes of Service using MPLS
9. Integration and Convergence using MPLS
10. Managing Aggregates of Traffic with MPLS Label Stacking
11. MPLS Services vs. Internet Service
12. Multiple-choice Exam

Prerequisites

Courses 2212 OSI Layers, 2211 LANs and 2213 IP are recommended. Those courses along with this one are included in CIPTS, CTNS, CTA and CTSME certification packages.

Course Objective: What You Will Learn

This course can be taken by both those who need simply an overview and introduction to carrier packet networks and MPLS, and by those who need to build a solid base on all the listed topics.

Without bogging down on details, we'll cut through buzzwords and marketing to demystify:

- Carrier packet networks and services
- Customer Edge (CE) and Provider Edge (PE)
- Service Level Agreements
- Traffic profiles

- Virtual circuits
- QoS, Class of Service and Differentiated Services
- Integration, convergence and aggregation
- MPLS and other network technologies
- How this relates to TCP/IP
- How MPLS is used for business customer VPNs
- How MPLS is used for integrated access:
- How all services are carried together on one circuit
- How MPLS is used to prioritize and manage IP packets
- "MPLS services" vs. the Internet

Web page

Printable brochure with detailed outline

Preview and free sample

Register

2221 Fundamentals of VoIP

Jargon & Buzzwords • VoIP Phone System Components and Operation • Voice Packetization • LANs and WANs • VoIP Phones: MAC Address, DHCP, IP, UDP, RTP, QoS • SIP, Softswitches & SIP Trunking • Cloud • The Future

Fundamentals of Voice over IP is a complete introduction to everything Voice over IP. You'll learn the fundamental ideas and principles of a VoIP telephone system, VoIP, SIP & all the other jargon - what it actually means and how it all works together.

At each step, we'll also cover supporting and related technologies like Ethernet MAC frames and codecs and video over IP.

Course Objectives: What you will learn:

Lesson 1. Introduction
- Course overview, fundamental concepts

Lesson 2. VoIP Phones and Terminals
- Voice over IP phone: computer functions
- MAC address and Ethernet LAN interface
- IP address and DHCP, UDP
- Telephone functions
- Speech digitization and codecs
- Creating IP packets containing voice
- SIP client for call setup: SIP basics
- Minimum requirement for VoIP phone
- Optional: display, video codec, camera, keyboard, …
- QoS and packet classification
- Packet labeling
- Differentiated services: prioritization
- Softphones on computer screens
- 4G cellular is VoIP

Lesson 3. Voice in IP Packets
- Digitizing voice
- Encapsulation in IP packets
- Carried in MAC frames
- Tracing a phone call end-to-end
- Voice quality & jitter buffers

Lesson 4. SIP and Softswitches - SIP Servers / Call Managers
- Visit to a DMS-100 CO switch
- Softswitch vs. traditional PBX / CO switch
- Registration with SIP server
- SIP call disposition rules
- SIP: finding out the called party’s IP address
- How SIP works
- Hosted PBX
- Cloud servers: softswitch as a service

Lesson 5. Media Servers
- Video is where the money is
- Integrated messaging
- Video on demand and Video over IP
- Video server - Netflix server appliance

- DVR as a network service
- Streaming music
- Digital rights management

Lesson 6. Gateways
- Protocol converters
- Traditional DS0 telephony vs. Voice over IP
- Packets - streaming DS0 media format conversion
- SIP - PSTN ISDN signaling conversion
- Media gateway & Media Gateway Control Protocol

Lesson 7. LANs and WANs
- LANs: physical connection and MAC addresses
- Gigabit Ethernet: Cat 5e, 6
- Optical Ethernet in the core
- IP packets carried in MAC frames between devices
- Power over Ethernet (PoE)
- Uninterruptible power supply
- Wiring closets
- LAN switches
- VoIP over WiFi: 802.11
- WiFi Access Point connections

- WAN: between buildings
- Access, network service type, billing agreement
- Fiber, cable, DSL, wireless access
- Legacy WAN services: T1, Frame Relay, ATM
- Current IP WAN services
- Internet and Internet VPNs
- Service Level Agreement (SLA) and MPLS VPNs
- SIP Trunking

Lesson 8. Key VoIP Standards
- IETF RFCs
- SIP and SDP
- RTP: time stamps
- correcting jitter with RTP
- UDP and TCP. How TCP works.
- IP: network addresses for packets
- ITU G.711 voice and H.264 video codecs
- IEEE 802.3 Ethernet, 802.11 WiFi,
- 802.2 MAC addresses & MAC frames
- Cat 5, 5e, 6 cables
- Optical Ethernet

Lesson 9. Where All of This is Headed: IP Dial Tone
- The IP-PSTN
- The Packet-Switched Telecommunications Network
- IP Dial Tone: send an IP packet to anywhere, anything
- Telephone network and Internet become the same thing: the IP-PSTN
- Telephone service = SIP
- Web surfing = DNS

- Value-added services: e.g., SIP Trunking
- Cloud SIP servers: Google Voice
- Underlying technologies: IP, MPLS and Ethernet

This course can be taken by anyone who needs to get up to speed on all things VoIP. You will gain career-enhancing knowledge of the components and operation of Voice over IP systems, and learn what all of the jargon and buzzwords mean. It also serves as a first pass through topics that are covered in greater detail in subsequent lessons.

Web Page

2222 VoIP Architectures and Implementation Choices

VoIP over the Internet • VoIP at Carriers • VoIP-Enabled PBX • PBX Replacement • Softswitches • Hosted PBX • Cloud Services • IP Centrex • Asterisk & Open-Source • SO/HO VoIP Phone Features

VoIP Architectures and Implementation Choices is a comprehensive overview of the many flavors of VoIP, comparing and contrasting the various implementation and architecture choices. Progressing from talking between computers over the Internet through Internet telephony, Managed IP Telephony, PBX enhancement, PBX replacement with call manager / softswitch systems, IP Centrex, Hosted PBX and Cloud Services, you'll gain the knowledge to confidently differentiate VoIP architectures and discuss.

Course Lessons

Intro + Internet Telephony: Computer-Computer VoIP over the Internet

Internet Telephony Example: Skype

VSPs: Internet to Phone e.g., Gmail Client

VSP Phone to Phone over Internet e.g., Vonage

VoIP Becomes The New POTS

VoIP at Carriers

VoIP-Enabled PBX and Migration Options

Premise Softswitch: PBX Replacement

Cloud Services and Hosted PBX: Softswitch as a Service (SaaS)

IP Centrex

Asterisk and Open-Source Softswitch Software

IP Phone Features and Uses

Prerequisites

Courses L2221 Fundamentals is a recommendation.

Course Objective: What You Will Learn

The user and network components for computer to computer VoIP phone calls over the Internet

The user and network components required for computer to POTS line VoIP phone calls over the Internet (e.g. Gmail client, Google Hangouts Dialer)

The user and network components required for phone to phone VoIP phone calls over the Internet (e.g. Vonage)

How and why VoIP will replace POTS

The implementation of VoIP at carriers

How VoIP at a business can be implemented by upgrading an existing PBX, and why this choice would be made

How VoIP at a business can be implemented by replacing an existing PBX with a softswitch / call manager, and why this choice would be made

The pros and cons of cloud-based softswitch services, sometimes called "Hosted PBX"

How the telephone company can provide and manage everything with a service called IP Centrex, and its advantages and disadvantages

What asterisk is, and the risks involved with unsupported open-source software, and

Features available on VoIP phones

Free Lesson 3: Phone Call From Internet to PSTN, e.g. Gmail Client

Web Page

2223 Softswitches, SIP and VoIP Call Setup

What SIP Is • What It Does • URIs: SIP Phone Numbers • Call Setup Procedure • Call Disposition Rules • How SIP relates to Softswitches and Call Managers

Softswitches, SIP and Call Setup is all about how VoIP phone calls are set up using messages and procedures complying with the standard Session Initiation Protocol. In this course, you'll understand what SIP is, how it works, demystify jargon like proxy server and location server, understand how SIP fits in with softswitches and call managers, and trace the establishment of an IP phone call step by step. Based on Teracom's famous Course 130, tuned and refined over the course of over 20 years of instructor-led training, you will gain career- and productivity-enhancing knowledge of how SIP is used to set up a VoIP phone call end-to-end, and how SIP fits in with call managers and softswitches.

Course Lessons

Intro + What SIP Is and What It Can Do

SIP's Relationship to Other Protocols

SIP URIs: Telephone Numbers

Register: Update Your Location

INVITE: Dialing

Location Service: Finding the Far End

The SIP Trapezoid

SIP Messages and the Session Description Protocol

How SIP Relates to Softswitches and Call Managers

Prerequisites

There are no prerequisites but it is recommended that you take L2221 as a fundamental base.

Course Objectives: What You Will Learn

On completion of this course, you will be able to explain

What SIP is and what SIP does

How and why the essential purpose of SIP is to find out the numeric IP address of the called party's telephone, so the telephones can communicate directly thereafter

Relationship between SIP and other protocols like IP and UDP

How SIP relates to softswitches and call managers

How administration, authorization and accounting are implemented

What a SIP "telephone number" is: URIs

What a proxy server is

How a VoIP telephone call is set up using SIP:

Registering with a softswitch and populating a location table

Sending an INVITE message to your proxy server

How your proxy server finds the far-end proxy server

How the far-end proxy server finds the called party

How the far-end indicates it will take a call

The Session Description Protocol, and what crucial information is passed to the caller

How the call is ended

How these steps are explained with a SIP trapezoid diagram

Web Page

Free Previews: Lesson 1 Introduction to SIP

2224 Voice Packetization, Codecs and Voice Quality

How Voice is Digitized and Packetized • Voice Quality • Codecs • Delay and Jitter • How Packets Are "Lost" • Packet Loss Sound Samples • RTP • VoIP Protocol Stack: RTP/UDP/IP/MAC

Voice Packetization, Codecs and Voice Quality is the "nuts and bolts" of Voice over IP: how the voice is digitized and coded, time stamps applied with the RTP protocol, and how the result is carried in UDP, IP packets and MAC frames. You'll learn about codecs and compression, and understand factors like delay, jitter and packet loss, what causes them, and how they affect sound quality. Sample sound clips with lost packets and uncorrected timing variations are included in Lesson 9 so you can hear the effects.

Course Lessons

Voice Packetization

Measuring Voice Quality

Factors Affecting Voice Quality

Codecs: Voice Coding and Compression

Delay

Jitter

RTP

Protocol Stack: RTP, UDP, IP, MAC

Packet Loss and Sound Samples

Tips for Maximizing Voice Quality

Prerequisites

Course L2221 Fundamentals is a recommendation

Course Objective: What You Will Learn

How voice is packetized: digitization, coding and segmentation of the bit stream into ~20 ms segments

How and why RTP is used to put a time stamp on each segment

Why UDP is used to carry the RTP output, and the two critical functions the UDP implements

The full VoIP protocol stack

How sound quality is measured, and the target quality level

The factors that affect sound quality

Different choices for codecs and why G.711 is preferred

What delay and jitter are, how they happen

How packets actually get "lost" in a network

How delay, jitter and packet loss are corrected at the far-end telephone

Basic guidelines for maximizing sound quality

Testing and troubleshooting techniques

Based on Teracom's famous Course 130, tuned and refined over the course of over 20 years of instructor-led training, you will gain career- and productivity-enhancing knowledge of how packetized voice is actually implemented and the factors affecting sound quality.

Free Preview: Lesson 9 - Packet Loss and Sound Samples

Web Page

2225 SIP Trunking & Carrier Connections

Carrier Interconnect: Switched Access Tariff • Gateways & DSOs • Native VoIP Carrier-Carrier • Session Border Controller • Gateway + PBX/PRI Trunks • SIP Trunking

SIP Trunking & Carrier Connections is all about connecting to carriers to communicate VoIP phone calls, both carrier-to-carrier connections and business-to-carrier SIP trunking.

You'll learn how the only way for a competitive carrier to terminate a VoIP phone call on a Local Exchange Carrier for the last mile is currently the switched access tariff, converting to DS0 channels using a gateway.

We'll understand why this will be a native VoIP connection in the future, and the role of Session Border Controllers.

Then we'll understand how a business system can connect to the PSTN using a gateway and PBX trunks, and the advantages of the newer SIP Trunking services for business to PSTN connection.

Course Lessons

Introduction + Carrier-LEC Connection via DS0

Carrier-LEC VoIP Interconnection

Session Border Controllers

Business -LEC PBX Trunks and Gateway

Softswitch Controlling the Gateway

SIP Trunking: Native VoIP Connections

Based on Teracom's famous Course 130, tuned and refined over the course of over 20 years of instructor-led training, you will gain career- and productivity-enhancing knowledge of how connections are made to carriers, both for business-PSTN connections and carrier-carrier connections.

Prerequisites

Course L2221 Fundamentals is a recommendation

Course Objective: What You Will Learn

How currently, the only way for a long-distance carrier to terminate a phone call on a LEC is via the switched-access tariff from the 1980s.

What switched access means: channelized time division multiplexing and DS0 channels

How competitive carriers would prefer to terminate phone calls via native Voice over IP, i.e. in IP packets instead of DS0 channels

What a Session Border Controller is, what they do and why they are used

How channelized DS0 connections implemented with ISDN PRI carrying PBX trunks have been the standard choice for business to LEC connections in the past

How a gateway is used to connect an in-building VoIP system to this kind of legacy channelized interface to the phone company

How the gateway is controlled by the softswitch

What SIP trunking is, and why it is rapidly replacing PBX trunks

How SIP trunking eliminates the need for gateways

How SIP trunking eliminates the need for expensive channelized circuits

Free Preview Lesson 2: Terminating a VoIP Call on a LEC via an IP Connection

Web Page

2226 IP Network Quality: CoS, QoS, MPLS and SLAs

Virtual Circuit Concepts • MPLS Fundamentals & Jargon • Class of Service (CoS) • Service Level Agreement (SLA) • Traffic Profiles • Prioritization • Traffic Policing: "Throttling" • Diff-Serv and MPLS • 802.1P

IP Network Quality CoS, QoS, MPLS and Diff-Serv focuses on the network service provided by carriers to move packets containing voice, and how network traffic is identified, managed and prioritized, resulting in Class of Service offerings to meet Service Level Agreements. You will learn how carriers use virtual circuits to manage flows of IP packets, and how MPLS is used to do this. You will understand the idea of Differentiated Services: different transmission characteristics for different kinds of traffic, and how these are implemented as Classes of Service (CoS). We'll cover Service Level Agreements and how "throttling" some users is sometimes necessary to ensure all users are getting the CoS they are paying for. We'll cover the Quality of Service (QoS) mechanisms MPLS and 802.1P and how Classes of Service are implemented by routers.

Course Lessons

Course Introduction + Virtual Circuit Technologies Carrier-LEC VoIP Interconnection

MPLS

Differentiated Services (Diff-Serv)

Service Level Agreements, Meters, Markers, Shapers and Droppers

Interworking Diff-Serv and MPLS

Using 802.1P for QoS

Implementing CoS: Queuing Techniques

Prerequisites

Course L2221 Fundamentals is a recommendation

Course Objective: What You Will Learn

What a virtual circuit is

How MPLS is used to implement virtual circuits

What a Class of Service (CoS) is

How MPLS is used to implement Differentiated Services, i.e. different Classes of Service for different traffic

Expedited Forwarding

What a Service Level Agreement (SLA) is

How meters, markers, shapers and droppers are used to condition traffic streams and "throttle" or police specific traffic

How 801.2P can also be used as a Quality of Service (QoS) mechanism

Basic ideas how prioritization is actually implemented in a router

Free Preview: Lesson 1 - Introduction and Virtual Circuit Concepts

Web Page

2231 Wireless Fundamentals

Radio fundamentals • Spectrum • Digital radio • Modems and Modulation • Propagation, Penetration and Fading

Wireless Fundamentals is the first course in the CWA Certification Package. We begin with the basics: what radio is, how it's organized and how and it's used to communicate information.

We begin by understanding what radio actually is, and why we use it for communications. We'll understand how radio frequencies are in the Gigahertz range, used within frequency bands measured in the Megahertz wide.

Then we will look at the spectrum, i.e. standardized bands of frequencies, how they are allocated and the need for licenses. You will learn which bands are used for what, from cordless phones to WiFi and cellular, including the new 700-MHz bands.

Next, we'll understand how information is represented using radio. The first stop is a quick review of old-fashioned analog radio and TV, followed by what most systems use today: digital. We'll spend some time understanding digital, how 1s and 0s are communicated by modems and familiarize you with jargon and buzzwords like QAM and QPSK.

We'll finish off with radio transmission issues, including propagation, penetration and fading.

Course Lessons

Radio Fundamentals Cellular

Wireless Spectrum and Radio Bands

Analog Radio

Digital Radio: How Modems Work

Propagation, Penetration and Fading

Prerequisites

Course L2221 Fundamentals is a recommendation

Course Objective: What You Will Learn

What is meant by "radio"

Why we use it

The frequencies and bands that are used

Which services each is used for

How we represent 1s and 0s on these bands, and

Transmission characteristics including propagation, penetration and fading.

This is the second module of Teracom’s CWA Certificate program

Free Preview: Lesson 1 - Course Introduction

Web Page

2232 Mobile Communications

Cellular Principles • Mobility • Handoffs • Digital Voice • Mobile Internet • The Generations: 1G, 2G, 3G, 4G • The Technologies: FDMA, TDMA, CDMA, OFDM • The Systems: GSM, 1X, UMTS, HSPA, LTE

Course 2232 Mobile Communications is the second course in the CWA Certification Package. With a good foundation in place, we'll cover mobile communications from A to Z. This is where the money is! We begin with basic mobile network concepts and mobility terminology including base stations and transceivers, mobile switches and backhaul, handoffs and cellular radio concepts. Then, we cover spectrum-sharing technologies and their variations: FDMA, TDMA, CDMA and OFDM, the generations of technology 1G, 2G, 3G and 4G, and the technologies GSM, 1X, UMTS, HSPA and LTE. We'll understand how mobile Internet access is implemented for a smartphone, and how you can keep kids quiet on car trips by turning your phone into a mobile WiFi base station.

Course Lessons

Mobile Network Components and Operation

Cellular

1G: Analog Frequency-Division Multiple Access

Second Generation: Digital Cellular

Digital Cellular: Voice Communications

Internet Access via Cellular: "Data" Communications

2G: TDMA (IS-136) Time-Division Multiple Access

2G: TDMA (GSM) Time-Division Multiple Access

2G: CDMA Code-Division Multiple Access

Spread Spectrum

CDMA Operation and Patents

3G: CDMA 1X and UMTS

4G: LTE

4G: OFDM

Dynamic Assignment of Subcarriers

Spectrum-Sharing Roundup: FDMA, TDMA, CDMA, OFDM

Prerequisites

Course L2221 Fundamentals is a recommendation

Course Objective: What You Will Learn

Draw a model of a cellular wireless telecommunications network

Identify all of its components and technologies from handset to mobile switch

Explain what "cellular" radio systems are is and why they are used

Explain what a handoff is, and how this implements mobility

Explain the characteristics and operation of FDMA, TDMA, CDMA and OFDMA,

How each was deployed for AMPS, GSM, UMTS and LTE

Explain the difference between what cellphone carriers call "voice" and "data"

Explain mobile internet access via cellular.

Free Preview: Lesson 2 - Bluetooth

Web Page

2401 The PSTN

Loops and Trunks • Circuit-Switching • LECs and IXCs • Analog • Voiceband • DTMF • SS7

8 interactive multipart lessons, multiple-choice exam and certificate.

This course is dedicated to the Public Switched Telephone Network (PSTN) and Plain Ordinary Telephone Service (POTS). Understanding the fundamentals of this technology and network architecture is a starting point for understanding everything else related to telecommunications.

You'll gain a solid understanding of the fundamentals of the telephone system: customer premise and Central Office, loops, trunks, remotes, circuit switching and how a telephone call is connected end-to-end. We'll cover LECs and IXCs, sound, analog and the voiceband, twisted pair, DTMF and SS7.

Based on Teracom's famous Course 101, tuned and refined over the course of 20 years of instructor-led training, we'll cut through the jargon to demystify telephony and the telephone system, explaining the jargon and buzzwords, the underlying ideas, and how it all works together… in plain English.

Featuring many photos of actual equipment both inside a Central Office and in the outside plant, this multimedia course is an excellent way to get up to speed on traditional telephony.

Course Lessons

1. Introduction
2. History of Telecommunications
3. The Public Switched Telephone Network (PSTN)
4. Analog Circuits and Sound
5. The Voiceband
6. Plain Ordinary Telephone Service (POTS)
7. Signaling: Pulse Dialing and DTMF
8. Signaling System 7 (SS7)
9. Multiple-Choice Exam

Prerequisites

None.

Course Objectives: What You Will Learn

The objective of this course is to understand how the physical telephone network is organized, the characteristics of basic telephone service, how calls are established end-to-end, and to demystify common telephony jargon and buzzwords.

In particular, on completion of this course, you will be able to explain:

Why telecom networks are divided into local access wiring and long-distance transmission

The founding, breakup and re-emergence of AT&T in the US; TELUS and Bell in Canada

A basic model for the PSTN and its main components

Loops, why they are called loops and why there is a maximum loop length

The outside plant

Circuit-switching

Central Office and Customer Premise

How and why remotes are used; fiber to the neighborhood

Plain Ordinary Telephone Service

What analog is, and how it relates to copper wires, electricity, circuits and sound

How microphones and speakers work

The human hearing range

Whether trees falling in the forest if no-one is there to hear them cause a sound

The voiceband

Why and how the telephone system can limit frequencies to the voiceband

Why two wires are used

Why they are twisted together (twisted pair)

Tip and ring, -48 volts

Supervision, dial tone, ringing, lightning protection

Dial-up

Touch-tone and DTMF

Basics of SS7

Examples of sophisticated call routing using SS7

Web page

Preview and free sample

Register

2402 Telecom Equipment

We take a practical journey through different types of equipment. We'll review switches, PBXs, Centrex, multiplexers and routers, as well as ancillary equipment like ACDs, voice mail and interactive voice response (IVR) systems.

This course is divided into 4 lessons.

Course Lessons

1. Telephone Switches

2. PBX vs. Centrex

3. Voice VPNs

4. Call Centers

Prerequisites

There is no prerequisite for this course but it is a suggestion that the fundamental course L2401 be taken if there is no prior telecom knowledge.

Course Objective: What you will learn

The objective of this course is to provide a strong understanding of the equipment used in today’s telecom industry. From small business to complicated call center type set up.

This course is the second course in Teracom’s CTA Certification package.

2403 The Telecommunications Industry

We'll review the telecommunications industry and understand the main players and competitors, how Local Exchange Carriers connect to Inter-Exchange Carriers and how CLECs fit into the picture.

This course is divided into 6 lessons.

Course Lessons

US Domestic Telcos

AT&T and Verizon

Canadian Telephone Companies

PSTN Switching Centers Before Competition

Accessing The Interexchange Carriers

Competitive Local Exchange Carriers (CLECs)

Prerequisites

There is no prerequisite for this course but it is a suggestion that the fundamental course L2401 be taken if there is no prior telecom knowledge. The learner will benefit also from taking L2402 with this course.

Course Objective: What you will learn

The objective of this course is to provide an understanding of the telecommunications industry. We will learn where it began, how it has progressed and where it is now.

This course is the third course in Teracom’s CTA Certification package.

2404 Digital

In this course, we drill into the technology a bit, to understand the concepts, standards and technologies for actually transmitting voice calls from one place to another. We'll go over the process of how the voice is deconstructed and reconstructed, the digital hierarchy, and information on digital circuits.

We'll give you a real understanding of what "digital" actually means, and how it is implemented. We'll explain what a DS0 and G.711 is, and take a practical tour of digital circuits, including T1, T3, SONET and ISDN.

This course is divided into 13 lessons.

Course Lessons

Why Digital?

Analog and Digital: What Do We Really Mean?

Continuous Signals, Discrete Signals

Voice Digitization (Analog→Digital Conversion)

Voice Reconstruction (Digital→Analog Conversion)

Voice Digitization Summary

The Digital Hierarchy: Industry Standard Line Speeds

Popular Technologies: Digital Carrier Systems

ISDN BRI and PRI

Digital Circuit Voice Applications

Digital Circuit Data Applications

Digital Video

Integration: Voice, Video, Data

Prerequisites

There is no prerequisite for this course but it is a suggestion that the fundamental course L2401 be taken if there is no prior telecom knowledge. The learner will benefit also from taking L2402-L2403 with this course.

Course Objective: What you will learn

The objective of this course is to develop the concrete knowledge needed to fully understand how digital telecom works. You will understand channelized telecommunication circuits all the way to a full comprehension of data circuits.

This course is the fourth course in Teracom's CTA Certification package.

2405 Transmission Systems and Fiber Optics

You will learn the essentials of fiber, fiber optics and fiber cables, how 1s and 0s are communicated over fiber... and how bitrates of 100 Gb/s and more are achieved using Dense Wave Division Multiplexing (DWDM).

This course is divided into 9 lessons.

Course Lessons

Time Division Multiplexing

T1 Carrier System

T1 Basics: Multiplexers

Framing and Channels

Pulses and Repeaters

How T1 is Provided

Fibers and Cables

SONET and DWDM: Core Networks

International Digital Hierarchies

Prerequisites

There is no prerequisite for this course but it is a suggestion that the fundamental course L2401 be taken if there is no prior telecom knowledge. The learner will benefit also from taking L2402-2404 with this course.

Course Objective: What you will learn

The objective of this course is to provide an understanding the function of transmission systems, how fiber optics work and basic communication through 1s and 0s transmitted over fiber. The learner will develop concrete knowledge of network services.

This course is the fifth course in Teracom's CTA Certification program.

2406 Wireless Telecommunications

Mobility • Cellular Networks • GSM and TDMA • UMTS and 1X CDMA • LTE • WiFi • Satellite

10 interactive multipart lessons, multiple-choice exam and certificate.

Wireless Telecommunications is a comprehensive course on wireless, mobile telecommunications plus wireless LANs and satellites.

You'll gain a solid understanding of the key principles of mobile networks: the objectives of coverage, capacity and mobility, what a cellular radio system is and why they are used, mobile network components and principles of operation including registration and handoffs, digital radio, data over cellular and the cellular technologies and generations: 1G analog FDM, 2G GSM and IS-136 TDMA, 3G UMTS and 1X CDMA and 4G LTE OFDM.

Plus, you'll receive an overview of the radio frequencies and standards for wireless LANs and an overview of satellite communications.

We'll cut through the jargon to demystify wireless, explaining the jargon and buzzwords, the underlying ideas, and how it all works together… in plain English.

Course Lessons

1. Introduction

2. Mobile Network Components, Jargon and Basic Operation

3. Cellular Principles and AMPS (1G)

4. 2G: Digital Radio - Voice Communications

5. Digital Cellular: Data Communications

6. Spectrum-Sharing Technologies: FDMA, TDMA, CDMA, OFDM

7. 3G Cellular: CDMA

8. 4G Mobile Cellular: LTE

9. 802.11 Wireless LANs - WiFi

10. Communication Satellites

11. Multiple-Choice Exam

Prerequisites

None. Course 2401 has some relevance, as the mobile networks connect to the wireline Public Switched Telephone Network. Courses 2411 Ethernet, LANs and VLANs and 2413 IP Networks, Routers and Addresses are relevant to Lesson 9

Course Objectives: What You Will Learn

The objective of this course is to develop a solid understanding of mobile cellular communications networks and technologies. After taking this course, you will be up to speed on the fundamental principles of cellular radio networks, components and operation, digital radio, spectrum-sharing technologies and the four generations of mobile cellular technology. An additional objective is a basic understanding of WiFi and satellites.

In particular, on completion of this course, you will be able to explain:

The principal components of a mobile communication system

Coverage, capacity and mobility

The reason for and basic layout of a cellular radio system

Basic operation of a mobile network including registration and handoffs

How digital cellular is implemented

How digital cellular can be used for data communications, either as a tethered modem or using the phone as a data terminal

The principles and operation of the different spectrum-sharing technologies: first-generation FDMA, second-generation GSM and TDMA, third-generation UMTS and 1X CDMA and fourth-generation LTE and its OFDM

The different radio bands and standards for 802.11 wireless LANs

The two main types of communication satellites and their advantages and disadvantages.

This course is the 6th in Teracom's CTA Certification program.

2407 Introduction to Datacom and Networking

In this course, we'll begin by establishing a model for a data communications circuit, then provide examples and context for each of the components of the model, and review different circuit configurations including LANs and WANs.

This course is divided into 8 lessons.

Course Lessons

Data Circuit Model

Data Terminal Equipment (DTE)

Analog and Digital Data Circuits

Data Circuit Terminating Equipment (DCE)

Configuration Example: Point-to-Point

Multidrop Circuits

LANs

Wide Area Networks

Prerequisites

There is no prerequisite for this course but it is a suggestion that the fundamental course L2401 be taken if there is no prior telecom knowledge.

Course Objective: What You Will Learn

The objective of this course is to provide a strong understanding of a data communications circuit model. This model for communications is essential knowledge and sets up the fundamentals for course L2408 and L2409.

This is the seventh course in Teracom's CTA Certification program.

2408 Data Coding, Frames and Packets

In this course we'll look at how data is formatted for transmission, beginning with the older concepts of "synchronous" and "asynchronous", then cover the newer ideas of frames and packets, how frames and packets are related, and the addresses on frames and packets, and the structure of IPv4 packets.

This course is divided into 8 lessons.

Course Lessons

Data Communications Basics: Bits and Bytes

ASCII Code Set

“Asynchronous”

Frames

Details for Reference: Cyclic Redundancy Check

Packets

Packets vs. Frames

IP Packets

Prerequisites

There is no prerequisite for this course but it is a suggestion that the fundamental course L2401 be taken if there is no prior telecom knowledge.

Course Objective: What You Will Learn

The objective of this course is to develop a concrete understanding of data is formatted. Why it is formatted this way and how it transmits. The learner will be able to explain frames and packets, their differences and how and why each is used.

This is the eighth course in Teracom’s CTA Certification Program.

2409 Modems: Representing Bits on Radio and Copper

This is where the fundamentals of wireless communication begin. This is the course with basic radio concepts, understanding the wireless spectrum and radio bands, analog radio and how modems implement digital radio.

This course is divided into 5 lessons.

Course Lessons

Wireless

Wireless Spectrum and Radio Bands

“Analog Radio

Digital Radio: Modems

Propagation, Penetration and Fading

Prerequisites

There is no prerequisite for this course but it is a suggestion that the fundamental course L2401 be taken if there is no prior telecom knowledge.

Course Objective: What You Will Learn

The objective of this course is to develop a concrete understanding of the fundamentals of wireless. The learner will be able to explain the beginnings of how digital radio communications began and many of the aspects surrounding this topic.

This is the ninth course in Teracom’s CTA Certification Program.

2410 The Network “Cloud” and Service Implementation

In this course, we provide an understanding of the "Network Cloud", why people use clouds to draw networks, and what is really going on inside that cloud.

This course is divided into 3 lessons.

Course Lesson

Anatomy of a Digital Circuit

Common Carriers’ Transmission Networks

Network Equipment: How and Where Each is Used

Prerequisites

There is no prerequisite for this course but it is a suggestion that the fundamental course L2401 be taken if there is no prior telecom knowledge.

Course Objective: What You Will Learn

This course with an understanding of the "Network Cloud", why people use clouds to draw networks, and what is really going on inside that cloud

This is the tenth course in Teracom’s CTA Certification Program.

2411 LANs, VLANs, Wireless and Optical Ethernet

MAC Addresses • MAC Frames • Layer 2 Switches • VLANs • Ethernet on Copper • 1000BASE-T • Power over Ethernet • Cable Categories • Office Wiring Plan • Wireless Ethernet (Wi-Fi) • Optical Ethernet • Ethernet in the Core, MANs and PONs • Fiber Types • SFP Transceivers • Field Installation

7 interactive multipart lessons, multiple-choice exam and certificate.

Ethernet LANs are the standard method of implementing Layer 2 of the OSI Model, data links for communications between two machines. Taking this course, you'll gain a solid understanding of LANs: Ethernet and its bus topology, CSMA-CD access control, broadcast domains and MAC addresses; MAC frames, the IEEE 802 standards, evolution of Ethernet from 10BASE-T to Gig-E, hubs and switches, LAN cables, the TIA-568 cable categories, basic cabling design; what "bridging" means, how a LAN switch works, VLANs and finishing with a preview of the next course: using routers to move frames between broadcast domains.

We'll cut through the jargon to demystify Ethernet, MAC addresses, LANs and VLANs, explaining the jargon and buzzwords, the underlying ideas, and how it all works together… in plain English.

Course Lessons

1. Introduction
2. Broadcast Domains, MAC Addresses and MAC Frames
3. LAN Switches a.k.a. Layer 2 Switches
4. VLANs
5. 802 Physical Standards: 802.3 Twisted Pair and 802.11 Wi-Fi
6. Twisted-Pair LAN Cables, Categories, Wiring Plan and Switch Hierarchy
7. Optical Ethernet and Fiber Links
8. Multiple-Choice Exam

Prerequisites

None. Course 2412 The OSI Layers and Protocol Stacks is useful to understand where LANs fit into the overall picture and how LANs and VLANs relate to routers and IP.

Course Objective: What You Will Learn

The objective of taking this course is to become familiar with the standard technology used to implement Layer 2 in IP-based packet networks. After taking this course, you will be up to speed on MAC addresses and MAC frames, broadcast domains, LAN cables and LAN switches, VLANs and Optical Ethernet.

n completion of this course, you will be able to explain:

- The idea of a broadcast domain.
- The idea of a MAC addresses to identify a LAN interface on a station in a broadcast domain.
- What MAC frames are, and what purpose they serve.
- What a LAN switch is, and what it does.
- How VLANs can be used to segregate devices into different broadcast domains.

- The IEEE 802 series of standards: The 802.3 standard and communicating MAC frames at 10 Mb/s on coaxial cables to Gigabit Ethernet on copper and fiber.
- What the code 1000BASE-T means.
- MAC frames over the Ether, a.k.a. Wi-Fi, the 2.4 and 5 GHz unlicensed bands, and the fundamentals of how the bits in MAC frames are communicated using radio carrier frequencies.
- Wiring Ethernet to the work area with Cat 5, Cat 5e and Cat 6 twisted-pair copper-wire cables. Wiring closets and Layer 2 aggregation switches.
- What Optical Ethernet is, and how it is the building block of telecom networks, including Metropolitan Area Networks (MANs), carrier MPLS networks, and Passive Optical Networks (PONs) for fiber to the home.
- The fundamentals of how the bits in MAC frames are communicated using light guided in glass tubes.
- How fiber cables are deployed and connected to equipment at each end.
- What designations like 100GBASE-ER4 mean.

Web page

Preview and free sample

Register

2412 The OSI Layers and Protocol Stacks

Protocols & Standards • Open Systems • OSI Model • Layers • Protocol Stacks • FedEx Analogy

14 interactive multipart lessons, multiple-choice exam and certificate.

The OSI Layers and Protocol Stacks begins the discussion of IP-based telecom in the Certified Telecommunications Network Specialist (CTNS) certification package. It is the first course in the Certified IP Telecom Network Specialist (CIPTS) package.

This course establishes a framework for all of the subsequent discussions: the OSI 7-Layer Reference Model, which identifies and divides the functions to be performed into groups called *layers*. This framework is required to sort out the many functions that need to be performed, and to be able to discuss separate issues separately.

You'll learn what a layer is, the purpose of each layer, see examples of protocols used to implement each layer, and learn how a protocol stack really works with the famous "FedEx Analogy" presented as an embedded video by our top instructor, Eric Coll.

We'll cut through the jargon to demystify layers, explaining jargon and buzzwords, and most importantly, the underlying ideas, and how it all works together… in plain English.

Course Lessons

1. Introduction
2. Open Systems
3. Protocols and Standards
4. ISO OSI 7-Layer Reference Model
5. The Physical Layer
6. Data Link Layer
7. Network Layer
8. Transport Layer
9. Session Layer
10. Presentation Layer
11. Application Layer
12. Protocol Stacks
13. Protocol Headers
14. Standards Organizations
15. Multiple-choice Exam

Prerequisites

None. This is the best course to begin learning about IP and MPLS.

Course Objective: What You Will Learn

This course can be taken by both those who need simply an overview and introduction to the idea of layers and the OSI model, and by those embarking on a certification and/or planning to take further courses.

If you're in the first group, the objective is not to become an instant expert, but rather to become familiar with the structure that is used to be able to discuss separate issues separately, what a layer is, the basic functions of each layer, what a protocol stack is and how it works, and where things you've heard of before like Ethernet, IP and TCP fit into the picture… to demystify the jargon and buzzwords, to eliminate frustration and increase your confidence and effectiveness.

If you're in the second group, and your objective is to put in place a structure for subsequent courses, following is a list of concrete objectives. On completion of this course, you will be able to explain:

- The concept of an open system and its advantages
- What a protocol is and what a standard is
- The OSI Model and its purpose
- What a Layer is
- The seven layers of the OSI model
- The name of each layer
- The functions each layer is responsible for
- Examples of actual protocols for each layer
- What a protocol stack is and how it operates
- Examples of standards organizations that publish protocols

Web page

Preview and free sample

Register

2413 IP Networks, Routers and Addresses

IP Packets • Networks • Routers • Static, Dynamic, Public, Private Addresses • NAT • IPv6

11 interactive multipart lessons, multiple-choice exam and certificate.

IP Networks, Routers and Addresses is a comprehensive course on Layer 3 of the OSI Model, concentrating on IP addresses, routers and packets.

You'll gain a solid understanding of the key principles of packet networks: bandwidth on demand, packet forwarding and packet filtering, how routers work, all of the different types of IP version 4 addresses: static and dynamic, public and private, network address translation plus IP version 6.

Based on Teracom's famous Course 101, tuned and refined over the course of 20 years of instructor-led training, we'll cut through the jargon to clearly explain IP and routers, packets and addresses, the underlying ideas, and how it all works together… in plain English.

Course Lessons

1. Introduction
2. Review: Channelized Time-Division Multiplexing (TDM)
3. Statistical Time-Division Multiplexing: Bandwidth-on-Demand
4. Private Network: Bandwidth on Demand + Routing
5. Routers
6. IPv4 Addresses
7. DHCP
8. Public and Private IPv4 Addresses
9. Network Address Translation
10. IPv6 Overview
11. IPv6 Address Allocations and Assignment
12. Multiple-Choice Exam

Prerequisites

None. Course 2412 The OSI Layers and Protocol Stacks is useful to understand where IP and packets fit into the overall picture. Course 2411 Ethernet, LANs and VLANs complements this course, as IP packets are usually carried on Ethernet.

Course Objective: What You Will Learn

The objective of this course is to develop a solid understanding of IP. After taking this course, you will be up to speed on the fundamental principles of packet networks: bandwidth on demand, also known as overbooking or oversubscription, and packet forwarding. You will know the IP packet format and how IP addresses are allocated, assigned and displayed. You will know the difference between static and dynamic addresses, public and private addresses and how Network Address Translation works. An additional objective is to become familiar with the basics of IPv6.

In particular, on completion of this course, you will be able to explain:

The concept of statistical multiplexing, also known as oversubscription, overbooking and bandwidth on

demand, why and how it can be implemented and its benefits.

What a private network is

What a router is and how it implements the network by connecting data links

How routers move packets between broadcast domains, including VLANs

How routers also act as a point of control for traffic, called packet filtering

The basic structure and contents of a routing table

The Customer Edge

IPv4 address blocks: Class A, Class B and Class C, and dotted-decimal notation

Static addresses and dynamic addresses, and how and why DHCP is used to assign both

Public addresses and private addresses, how, why and where each is used

Network Address Translation for interfacing domains where public addresses are used with those where private addresses are used

The improvements and changes between IPv4 and IPv6, and

The types of IPv6 addresses, how IPv6 addresses are allocated to ISPs then assigned to users, and how each residence gets 18 billion billion IPv6 addresses.

Web page

Preview and free sample

Register

2414 MPLS and Carrier Networks

Carrier Packet Networks • Technologies • MPLS • SLAs • CoS • Integration & Aggregation

11 interactive multipart lessons, multiple-choice exam and certificate.

MPLS and Carrier Networks is a comprehensive training course designed to build a solid understanding of carrier packet networks and services, the terminology, technologies, configuration, operation and most importantly, the underlying ideas … in plain English.

We'll cut through the buzzwords and marketing to demystify carrier packet networks and services, explaining Service Level Agreements, traffic profiles, virtual circuits, QoS, Class of Service, Differentiated Services, integration, convergence and aggregation, MPLS and other network technologies, and how they relate to TCP/IP without bogging down on details.

You will gain career- and productivity-enhancing knowledge of the structure, components and operation of carrier packet networks and services, how they are implemented, packaged and marketed by carriers and how they are used by government, business… and other carriers.

Course Lessons

1. Introduction
2. Carrier Packet Network Basics
3. Service Level Agreements
4. Virtual Circuits
5. QoS Requirement for Voice over IP
6. MPLS
7. TCP/IP over MPLS
8. Differentiated Classes of Service using MPLS
9. Integration and Convergence using MPLS
10. Managing Aggregates of Traffic with MPLS Label Stacking
11. MPLS Services vs. Internet Service
12. Multiple-choice Exam

Prerequisites

Courses 2412 OSI Layers, 2411 LANs and 2413 IP are recommended. Those courses along with this one are included in CIPTS, CTNS, CTA and CTSME certification packages.

Course Objective: What You Will Learn

This course can be taken by both those who need simply an overview and introduction to carrier packet networks and MPLS, and by those who need to build a solid base on all the listed topics.

Without bogging down on details, we'll cut through buzzwords and marketing to demystify:

- Carrier packet networks and services
- Customer Edge (CE) and Provider Edge (PE)
- Service Level Agreements
- Traffic profiles

- Virtual circuits
- QoS, Class of Service and Differentiated Services
- Integration, convergence and aggregation
- MPLS and other network technologies
- How this relates to TCP/IP
- How MPLS is used for business customer VPNs
- How MPLS is used for integrated access:
- How all services are carried together on one circuit
- How MPLS is used to prioritize and manage IP packets
- "MPLS services" vs. the Internet

Web page

Preview and free sample

Register

2415 The Internet

We'll start at the beginning of the story, understanding where the Internet came from and its fundamental principles of operation. Then we'll look at some details and improvements such as the Domain Name System, MIME, HTML and HTTP... which form "the Web". We'll review how you can connect to the Web from a residence and from an enterprise or organization.

Course Lessons

Internet History

Internet Basics

TCP and UDP

Internet Service Providers

Commonly Used Internet Protocols

Domain Name System

MIME and Base-64 Encoding

World Wide Web

HTML, HTTP, and HTTPS

Accessing the Internet: Home Connections

Accessing the Internet: Organization Connections

Prerequisites

There are no prerequisites for this course but we recommend taking course 2401 The PSTN as a fundamental base.

Course Objective: What You Will Learn

The objective of this course is to have a complete understanding of the Internet. What is the Internet and how it works. Students will learn the basic history, the providers, and be able to define Internet based jargon and buzzwords.

2416 IP Security

We'll make a reasonably comprehensive overview of security in the IP world. We'll begin with a discussion of risk areas, vulnerabilities and measures. Then we'll examine several areas: computer security and malicious software like viruses and Trojan Horses and the measures to protect against these risks; network security and firewalls, public key and private key encryption, authentication, IPsec and VPNs.

Course Lessons

Risk, Measures and Policy

Viruses

Trojan Horses, Denial of Service Attacks, Spyware and Exploits

Network Segmentation and Perimeters

Packet Filtering

Firewall Proxies

Stateful Packet Inspection

Encryption

Authentication

IPsec

Customer-Premise-Based VPN

Carrier VPNs

Prerequisites

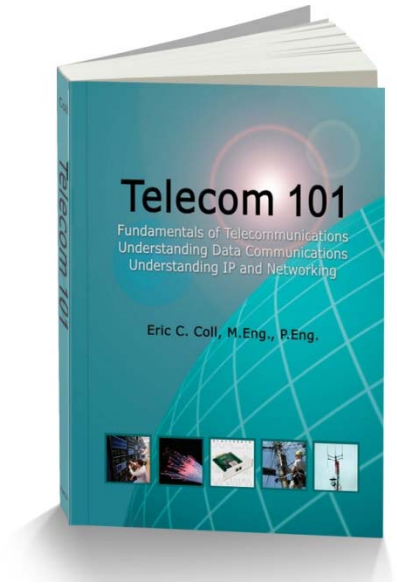
There are no prerequisites for this course. It is recommended that the learner have basic fundamental knowledge. This can be found in course L2401 The PSTN.

Course Objective: What You Will Learn

The objective of this course is to develop a basic comprehension of the issues that are present within the IP and Internet world. The learner will understand what different risks are, what the terms mean, and practical knowledge of computer security, viruses, exploits, network security and firewalls, information security, IPsec and VPNs.

Printed Books

Two kinds of printed books are available from Teracom: reference books and course books.



Reference Books

Teracom's reference books are standard 7" x 9" softcover textbooks with high-quality paper, a laminated cover and professional binding, and make an ideal day-to-day reference.

These professional-quality textbooks are a valuable supplement to instructor-led training, in a convenient format for reference after the course.

A printed study guide is a major upgrade to Online Courses and Certifications in how much you learn, and how much you retain. Certification study guides contain all of the text and graphics from Online Courses.

These books are also used by many as an economical and convenient way to self-study.

List of Printed Books

Reference Books and Study Guides

Telecom 101 Fifth Edition

Course 101 Companion Reference Textbook & CTA Telecommunications Certification Study Guide ISBN 9781894887588 522 pages, full index. Published 2020

Printed Book Price List

PART #	ISBN	DESCRIPTION	Unit	FOB DEST CONUS PRICE
	REFERENCE BOOKS			
T101	9781894887588	TELECOM 101 5th EDITION	Each	178.93

DISCOUNTS AND CONCESSIONS

30% minimum quantity 4, 55% minimum quantity 10 and 60% minimum quantity 25

Prices in table are for quantity 1 shipped to CONUS and include IFF.
Please contact us for higher quantities and/or shipping to other destinations.

Web page

Order

Printed Book Descriptions

Telecom 101 Fifth Edition

Course 101 Companion Reference Textbook & CTA Telecommunications Certification Study Guide

7" x 9" softcover book • printed in color • 522 pages • 5th edition • published 2020

ISBN 9781894887588 (print) ISBN 9781894887595 (eBook)

Based on Teracom's famous Instructor-Led Training Course 101, this standard-format softcover textbook covers telecom, datacom and networking from A-Z, organized in logical chapters covering all major topics, and written in our signature "telecom for Non-Engineering Professionals" style.

This book is ideal for self-study and reference, as a companion reference textbook for Course 101 and as a Study Guide for the prestigious TCO Certified Telecommunications Analyst (CTA) telecommunications certification.

Understand the fundamentals, jargon, buzzwords, technologies and standard practices:

Telecom 101 is composed of four parts: The Fundamentals, Telecommunications Technologies, Equipment, Carriers and Interconnect, and Networking.

PART I FUNDAMENTALS
1 INTRODUCTION TO THE BOOK
2 INTRODUCTION TO TELECOMMUNICATIONS
3 TELECOM FUNDAMENTALS
4 NETWORK FUNDAMENTALS
5 THE INTERNET, CLOUD COMPUTING AND DATA CENTERS
6 TELECOM SERVICES
7 DIGITAL MEDIA: VOICE, VIDEO, IMAGES, QUANTITIES, TEXT
8 FUNDAMENTALS OF VOICE OVER IP

PART 2 TELECOM TECHNOLOGIES
9 WIRELESS
10 FIBER OPTICS
11 COPPER

PART 3: EQUIPMENT, CARRIERS AND INTERCONNECT
12 TELECOM EQUIPMENT
13 CARRIERS AND INTERCONNECT

PART 4: NETWORKING
14 THE OSI LAYERS AND PROTOCOL STACKS
15 ETHERNET, LANS AND VLANS
16 IP NETWORKS, ROUTERS AND ADDRESSES
17 MPLS AND CARRIER NETWORKS
18 WRAPPING UP

Web page

Brochure

Order

Customer Ordering and Contact Information

Customer service, inquiries and telephone orders

Call us toll-free: 1-877-412-2700 (+1 450 923 2700 for international callers).

Email: customerservice@teracomtraining.com

Fax: 1-775-490-6227

Web: teracomtraining.com/contact_us.htm

Ordering Online

Please visit teracomtraining.com for online ordering.

Online access to contract ordering information, terms and conditions, up-to-date pricing, and the option to create an electronic delivery order are also available through GSA Advantage!, a menu-driven database system. GSA Advantage! is reached on the Internet at https://www.gsaadvantage.gov

Ordering by P.O.

Please visit teracomtraining.com for printable order forms.

Remittance and mailing address

USA

Teracom Training Institute, Ltd.
PO Box 3376
Champlain NY 12919-3376

All prices are in US dollars.

1b.The lowest priced model number and lowest unit price for that model for each special item number awarded in the contract is indicated with the symbol λ.

1c. Hourly rates: (not applicable)

2. Maximum order: $1,000,000

3. Minimum order: No minimum.

4. Geographic coverage (delivery area): worldwide.
Shipping / delivery zones are as follows:
Zone 1. Continental USA (CONUS), APO, FPO and Canada 10 provinces.
Zone 2. AK, HI, PR, VI, YT, NU, NT
Zone 3. Western Europe
Zone 4. All other locations

5. Point(s) of production (city, county, and State or foreign country).
Las Vegas, Clark County, NV
Saint-Lambert, Chambly County, Quebec, Canada

6. Prices in this list are net prices.

7. Quantity discounts: see item price lists.

8. Prompt payment terms: none.

9a. Government purchase cards are accepted at or below the micro-purchase threshold.
9b. Government purchase cards might be accepted above the micro-purchase threshold. This will be evaluated on an order-by-order basis. Please contact the contractor by telephone at 1-877-412-2700 or by email at customerservice@teracomtraining.com.

10. Foreign items (list items by country of origin).
T101, Textbooks – Canada

11a. Time of delivery. 2 working days from order, plus shipping time. Shipping time to CONUS is 1 to 5 working days depending on location.

11b. Expedited Delivery.
All items are available for expedited delivery. Please contact the contractor.

11c. Overnight and 2-day delivery. Overnight and 2-day delivery are available. The schedule customer may contact the Contractor for rates for overnight and 2-day delivery.

11d. Urgent Requirements. Contractor’s contract includes the I-FSS-140-B “Urgent Requirements” clause. Agencies may contact the Contractor’s representative to effect a faster delivery.

12. F.O.B. points:
178 West Service Rd
Champlain NY 12919

303 Saint-Denis Avenue
Saint-Lambert QC Canada J4P 2G5

13a. Ordering address:
Teracom Training Institute
PO Box 3376
Champlain NY 12919-3376
13b. Ordering procedures: For supplies and services, the ordering procedures, information on Blanket Purchase Agreements (BPAs) are found in Federal Acquisition Regulation (FAR) 8.405-3.

14. Payment address:
Teracom Training Institute
PO Box 3376
Champlain NY 12919-3376
Electronic payments are encouraged. Please contact us: 1-877-412-2700.

15. Warranty provision.
Defective materials replaced with same within one year.

16. Export packing charges: included.

17. Terms and conditions of Government purchase card acceptance.
Government purchase cards are accepted to the micro-purchase threshold.
Government purchase cards might be accepted above the micro-purchase threshold. This will be evaluated on an order-by-order basis. Please contact the contractor by telephone at 1-877-412-2700 or by email at customerservice@teracomtraining.com.

18. Terms and conditions of rental, maintenance, and repair: not applicable.
19. Terms and conditions of installation: not applicable.
20. Terms and conditions of repair parts indicating date of parts price lists and any discounts from list prices: not applicable.
20a. Terms and conditions for any other services: not applicable.
21. List of service and distribution points: not applicable.
22. List of participating dealers: not applicable.
23. Preventive maintenance: not applicable.
24a. Special attributes such as environmental attributes (e.g., recycled content, energy efficiency, and/or reduced pollutants): none.
24b. Section 508 compliance: not applicable to these items.

25.Data Universal Number System **(DUNS) number: 192486327**
CAGE CODE: 3F7G4

Contractor is registered in the Central Contractor Registration (CCR) database.
Uncompensated Overtime is not used.

Thank you for your patronage. We appreciate your business!