Teracom Training Institute
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Best of breed: telecom training - since 1992

COURSE 116

IPv6

A two-day comprehensive course on IPv6: what it is, how it works, how it will be deployed, co-existence with IPv4, with full coverage of issues and current best practices for IPv6 in operations, products and services.

Teracom's *IPv6* 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, co-existence 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.

Register for this essential course today!

Register online at www.teracomtraining.com or call 1-877-412-2700

What You Will Learn

IPv6 Address Types and Usage

The 128-bit IPv6 address is totally different from IPv4. There are currently fourteen different types of IPv6 address layouts, and more may be defined in the future. Each type is used for different purposes, and a single machine typically has four to six types actively employed or available at any one time!

For example, there are four types used for local communications, three used for global communications, five used to support transitioning between IPv4 and IPv6 and two special address formats for use when testing networks and for general documentation purposes.

Some of these addresses are created automatically by the machine itself, while others will be assigned with an IPv6 DHCP server.

What these addresses are, how they are used in operation, and when which kind of address is used for source and destination is fundamental IPv6 knowledge you will learn in this course.

You will also learn appropriate methods and standard practices for an organization-wide addressing plan, including defining subnets and address type considerations.

Whether you are a team leader, developer, manager or administrator, you must be at least familiar with the new address types and how they are used… and this course will give you the necessary knowledge and understanding, in plain English.

IPv6 Header Fields for QoS and Extension Headers

The basic IPv6 header has different fields than the IPv4 header with new uses. You will learn about the new fields Traffic Class and Flow Label, and how these relate to MPLS and Diff-Serv for the implementation of a Quality of Service (QoS) mechanism to guarantee service levels and transmission characteristics for different kinds of traffic.

In addition, a packet can include up to seven different types of extension headers. These extensions are used to enhance the functionality of the IP, adding new features like encryption and authentication at the network level to directly implement VPNs.

You will learn the purpose, structure and usage of the extension headers, and get up to speed on mainstream practices and implementations.

New/Updated Helper Protocols, Services and Applications

IPv4-related protocols, helper applications, basic architectures and services including ICMP, DNS, DHCP, ARP, multicast and mobile IP have all been modified and enhanced for IPv6.

Taking this course, you'll get a complete overview of the changes and updates to all of these related protocols.

Of particular interest is **multicast** and how it is implemented in IPv6, as this will of course be the basis for broadcast television and IPTV.

Mobile IP is another area you will get up to speed on. As the number of mobile devices skyrockets – and as services become seamless across platforms and changing locations, the question of assigning, coordinating and registering a device's IP address(es) will become more and more important. This is directly related to SIP and device- and location-independent services.

IPv6 also brings with it new protocols, new service functions and new uses of existing protocols. You'll learn about the Neighbor Discovery Protocol, Stateless Address Autoconfiguration, how multicast is now used for network operations and administration functions like replacing ARP, and Path Maximum Transmission Unit discovery to eliminate packet fragmentation… and why this is an important improvement!

Planning for Deployment, Migration and Transitioning

There are many options, procedures and planning steps required for deploying IPv6, co-existence with IPv4, and transitioning to an all-IPv6 network. You will learn the different choices and strategies, and in-classroom discussions and networking with peers will help you understand the current best practices.

For example, there is a large and growing list of choices for converting IPv4 to IPv6 addresses that need to be understood. You will gain familiarity with tunnel brokers, ISATAP, Teredo, 6to4, 6in4, 6rd, NAT(44,444,464,66,46), SLB664, dual stack, dual stack lite, proxy servers, DNS64 and other things that go bump in the night – in plain English, and learn what others are doing.

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.

Here's What Seminar Attendees Like You Are Saying

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

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

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

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

"The seminar delivered exactly what was advertised, at a very high quality. Truth in advertising!" - Gary Lundberg, Copper Mountain Networks

Whether you work for an organization that produces telecom, datacom or networking products or services; or you buy these products and services - or just have to get up to speed on what all the rest of them are talking about…

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

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

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

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

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

"Outstanding! The best I've encountered, and I've attended many seminars."
- Bob Gibbons, WMX Technologies

Seven Reasons to Take This Course

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

1. Cut through the buzzwords, jargon and vendor hype to gain the big-picture view of IPv6 you can put to use today ... and into the future.
2. Build career-enhancing knowledge tools you need to succeed in the fast-changing world of the Internet, IP networks and telecommunications.
3. Build a structural understanding of IPv6 and IP networking, allowing you to make meaningful comparisons and informed decisions.
4. Understand mainstream solutions, areas to watch out for and best practices. Obtain checklists, planning guides and templates you can put to immediate use.
5. Obtain detailed workbooks / textbooks that will serve as a valuable reference for years.
6. Eliminate knowledge-gap frustration on the job
7. Understand how it all fits together.

Develop a structured, comprehensive understanding of IPv6 technology and practices, allowing you to make informed choices and useful contributions – fundamental and practical knowledge you can't get on the job, reading trade magazines or talking to vendors.

How to Register

To see the latest schedule, please visit our web site at www.teracomtraining.com. Space in our seminars is limited, and may sell out, so please register as early as possible to reserve your place. You can register online or by phone:

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

You'll immediately get a registration package with all of the details, costs and instructions, including a confirmation letter for you to sign and return to complete your registration. You can pay with Visa, MasterCard, American Express, check or Purchase Order.

Tuition Fees

Course 116: IPv6	**2 days $995**

Your Course Materials: An Invaluable Reference

Every course comes complete with a high-quality comprehensive workbook / textbook that's been called the best on-the-job reference tool around. Written in plain English, this easy-to-use reference includes copies of all graphics PLUS extensive detailed accompanying text.

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

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

Detailed Course Outline

1. The New IP

A. IPv6 development rationale
B. Advantages over IPv4
C. IPv4 feature comparison
D. World address authorities
E. Regional Internet registries

2. IPv6 Header Structure

A. Header overview
B. Header fields layout
C. Compared to IPv4 header
D. Extension headers
    1. Header extension order
    2. Next header values
E. Quality of service capabilities
    1. IP header field use
    2. Header extension use
F. Security support

3. IPv6 Address Field

A. Address syntax
    1. Hex representation
    2. Short form notation
B. General assignment
    1. Network/Prefix notation
    2. Prefix types
    3. Interface ID format
    4. Alternative interface identifier
C. Assigned global routing prefixes

4. Address Types

A. Multiple addresses required per interface/machine
B. Unicast addresses
    1. Global unicast
    2. Unique local unicast
    3. Link local unicast
C. Special addresses
    1. Unspecified
    2. Loop back
    3. Transitional
    4. Reserved
D. Anycast address
E. Multicast

5. Multicast Protocols and Usage

A. IPv6 multicast overview
   1. Host support
   2. Router support
   3. New usage – network operations and broadcast applications

B. Address format and fields
   1. Prefix
   2. Flags
   3. The new scope concept
   4. Multicast scope example
   5. Group identifier

C. Permanent ‘well known’ addresses

D. Solicited node multicast addresses

E. Extended multicast address

F. Multicast protocols:
   1. Multicast Listener Discovery (MLD) and MLDv2
   2. MLD message layout
   3. Listener query messages
   4. Listener report messages

G. Creating routes and trees
   1. Protocol Independent Multicast (PIM)
   2. Sparse Mode and Dense Mode PIM
   3. Source Specific Multicast – SSM
   4. Embedded rendezvous point address
   5. Multicast payload forwarding
   6. Multicast Router Discovery (MRD)

H. Host and router requirements
   1. Addresses to be supported
   2. Protocols to be supported

I. Multicast security ramifications

6. IPv6 Mobility

A. Goals of protocol – improvements over IPv4

B. Definitions and components

C. Structure and flow

D. Home agent and correspondent nodes

E. Locating the home address

F. Bidirectional tunneling method

G. Route optimization method

H. Binding relationships
   1. Mobile device registration and security

I. Mobile IPv6 extension header

J. IP mobility protocol extensions

K. Network mobility – moving among networks
   1. Hierarchical mobility management
   2. Fast handover for mobile IP

7. IPv6 Services

A. Internet Control Message Protocol (ICMPv6)
B. Neighbor discovery protocol
C. Path Maximum Transmission Unit (MTU) discovery
D. Autoconfiguration – automatic address assignment
E. DHCPv6
F. DHCPv6 message exchange
G. DNS extensions
H. Name resolution
    1. Source and destination address selection
I. IPv6 routing process overview

8. Business Applications and Implementations

A. Supporting IPv6 in MPLS networks
B. IPv6 in access technologies
    1. xDSL network access components
    2. PPP Over Ethernet (PPPoE)
    3. Delivering multimedia services (IPoE)
C. IPTV implications
    1. IPv6 advantages
    2. Supporting multicast IPTV
    3. IPTV over MPLS/VPLS
D. IPv6 VPNs Vs BGP-MPLS IP VPNs

9. Migration Planning

A. Transition criteria
B. IPv6 application client development
    1. IPv4/IPv6 interoperability options
    2. Dual protocol stack application support
    3. IPv4-mapped-IPv6 address usage
    4. Proxy and translation methods
    5. Windows support for IPv6 literal addresses
    6. Socket interface extensions for IPv6
C. Tunneling methods
    1. Manual Vs automatic tunnels
    2. Encapsulation
    3. Tunnel brokers
    4. Configured tunneling
    5. Automated tunneling and ISATAP usage
    6. 6to4 method and addresses
    7. Teredo method and addresses
    8. Large scale carrier grade NAT solution
D. IPv6 impact on networking
    1. Routing protocol changes
    2. RIPng, OSPFv3, BGP-4
    3. Hierarchical aggregation model
    4. Modification to data link protocols – PPP, Ethernet
    5. Multi-homing considerations and issues

E. Implementation challenges – tackling the unknowns
    1. Operating system support
    2. Need for good IPv6 network management tools
    3. Structuring policies
    4. Other systems affected
F. IPv6 migration planning - 13 step checklist
G. Deploying IPv6 – 8 step checklist
H. Security recommendations – 25 point checklist
I. Management and troubleshooting tools

10. Appendix

A. Important RFCs
B. Network management tools and products
C. Windows OS IPv6 support summary

Who Should Attend

- Anyone willing to invest two days to develop a structured, comprehensive fundamental and practical understanding of IPv6 — knowledge you can't get on the job, reading trade magazines or talking to vendors.
- Managers who need to understand what IPv6 is, how it works, how it will be deployed and how it will affect them.
- Technical people needing to efficiently put a solid foundation in the fundamentals and current best practices in place before embarking on designs and implementations.
- Planners who need to understand the full breadth of issues IPv6 brings with it, particularly in terms of implementation of IPv6 alongside IPv4 in products, services and applications.
- Administrators responsible for a migration to a mixed IPv4-IPv6 environment will benefit from the numerous best-practices checklists and templates for migration and deployment, ensuring they have the full picture.

Bring This Course To Your Location

Since 1992, we have provided high-quality on-site training at 3Com, Qualcomm, Intel, Cisco, Nortel, AT&T, Alcatel, Kyocera, T-Mobile, Ericsson/Hewlett-Packard, Verizon, MindSpring, APEX Telecom, Equifax, Transamerica Insurance, CNA Insurance, the US Air Force, Bell Canada, Bell Mobility, Cap Gemini, ComSec Establishment, MicroCell, TDS Telecom, Western Wireless and the NSA... to name a few. This IPv6 Course was originally developed for and taught as a private onsite course for AT&T Bell Labs!

Onsite training has special advantages:

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

We have built a solid reputation for delivering high-quality onsite private team-training programs that are a resounding success. Please contact us at 1-877-412-2700 or visit the “Onsite Training” section of our web site for information on bringing this training to you.

About the Author

Jay D. McGuire is the author and lead instructor for this course. Mr. McGuire holds Bachelor’s and Master’s degrees in Engineering and has been a professional trainer since 1982.

Jay specializes in delivering instructor-led training covering the fields of telecommunications, data communications and networking, local area networks, and call center and customer care technologies.

Jay has held past positions as a telecommunications manager for a Fortune 100 insurance company and as a digital design engineer.

Jay’s courses and training manuals use a highly graphical approach to teaching technical concepts to professionals from a wide range of environments. Join him to get this valuable fundamental and practical knowledge upgrade!