

# Voice over IP, SIP, Security, 5G and the Internet of Everything

**Voice over IP, SIP, Security, 5G and the Internet of Everything** is a two-day vendor-independent training course for non-engineers, concentrating on Voice over IP and SIP, plus Security, and finishing with 5G wireless and the Internet of Things (IoT), more accurately called the Internet of Everything.

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

Communication and security go hand-in-hand, so a comprehensive overview of security, the different threats to networks, information and systems, the measures that can be taken, and best practices.

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

Taking this course, you'll obtain a solid vendor-independent foundation, understanding technologies, products and implementation choices... the jargon and buzzwords, and most importantly, the underlying ideas... knowledge you can't get reading trade magazines or talking to salespeople.

This is career-enhancing knowledge that lasts a lifetime. Register today!

## Key Course Features

- ✓ **Build a Solid Understanding of VoIP**
    - Demystify jargon and buzzwords
    - Fundamental ideas, components, implementations
    - Voice packetization, codecs, softswitches, gateways
  - ✓ **Learn All About SIP**
    - Understand how SIP works and IP call setup
    - How SIP fits in with soft switches and call managers
    - SIP Trunking services
  - ✓ **Understand VoIP Systems and Services**
    - Softswitch / Call Manager vs. Cloud Services
    - Hosted PBX vs. IP Centrex
    - Connection to carriers, QoS, Service Level Agreements
  - ✓ **Security: Risks and Measures**
    - Identify threats to networks, systems and information
    - Understand security measures and best practices
  - ✓ **The swiftly-approaching Next Generation**
    - 5G wireless
    - The Internet of Everything online
    - Applications, opportunities and changes
- Bonus chapter: Project management**
- VoIP System requirements analysis, RFPs, running trials, selecting a vendor, rollout, maintenance
  - Practical templates and checklists you can use

## More Reasons To Attend

- ✓ **Designed for Non-Engineers**

Understand the jargon, buzzwords and technologies, underlying ideas and how it all works together, without bogging down on details.
- ✓ **Vendor Independent**

Core foundation knowledge that can be applied to any related project or system.
- ✓ **Value Pricing**

This two-day course is value priced at only \$995. Compare to \$1499 for lower quality elsewhere.
- ✓ **BOOT CAMP option**

Combine with core training Course 101 Telecom, Datacom and Networking for Non-Engineers for a full week of training. Covering everything from A-Z, you'll build a solid foundation and really get up to speed... while saving \$395!
- ✓ **High-quality course materials**

You will get a 300-page high-quality course book with copies of all diagrams plus detailed notes, sure to be a valuable reference for years.
- ✓ **Certification included**

Bonus CTNS Certification Package included with every registration.

## Who Should Attend

- Professionals who need to get up to speed on VoIP and SIP. Managers and planners. Telecom system administrators. Finance, tax and accounting personnel. Software and support system developers.
- Decision-makers and project managers who need to understand what the "techies" are saying.
- Anyone who wants to eliminate buzzword frustration, understand VoIP concepts and how it all fits together.
- Anyone who needs a comprehensive overview of security risks, measures and best practices.
- Anyone interested in the swiftly-approaching next generation telecom, including 5G wireless and all of the different aspects of the Internet of Everything.
- Anyone willing to invest two days to obtain career-enhancing training, with certification and reference book.

Coverage of all major topics, high-quality course materials, certification and certificate suitable for framing... don't miss this opportunity to invest in yourself and your career!

## Here's What Seminar Attendees Are Saying

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

*"Outstanding! The instructor had an outstanding knowledge and presentation."*  
- Larry Byrnes, NAVAIR, US Navy

*"The instructor was very knowledgeable and made sure you understood the subject matter."*  
- G.M., Naval Undersea Warfare Center Newport

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

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

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

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

*"The instructor was very knowledgeable and explained things at a level that I could understand."*  
- K.J., Novozymes NA

*"New technology - installing in new sites soon, and I needed to know everything that was taught. Lots of new/good information, and it was presented in an understandable format."*  
- Sharon H. Eastman, Kentucky Dept. of Labor

*"The instructor was excellent and presented a good, entertaining approach to the subject."*  
- John P. Spinks, Lockheed Martin

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

*"Made clear that which had previously been muddy."*  
- Nick Whittier, EPA

## Why 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 understand how it all fits together.

1. Eliminate uncertainty and frustration in not knowing terms and technologies with a clear understanding of VoIP fundamentals, components, systems, standards, jargon and buzzwords:
  - a. How voice is digitized and packetized; RTP time stamps;
  - b. What does it sound like when packets are lost? QoS and sound quality;
  - c. Softswitches, gateways, servers, call managers, hosted, cloud services;
  - d. How SIP works, and more.
2. Get a 300-page high-quality bound student manual / textbook with detailed text notes, up-to-date and bringing together all of this information, impossible to find in one place anywhere else.
3. Get a free VoIP Service Quality Metrics and Thresholds poster.
4. Cut through the jargon and vendor hype to get unbiased explanations of all of the mainstream choices for implementing VoIP, allowing you to make meaningful comparisons and informed decisions.
5. Get a broad overview of security: network security, machine security, OS security, app security, information security, communication security, the risks, measures and best practices.
6. Get an advance on the swiftly-approaching "Next Generation" of technologies. Find out what 5G wireless is going to be and how it will be used. Explore all the ways that everything will be online in the future, in the Internet of Everything, from toasters to self-driving transport trucks.
7. This course is specifically designed for non-engineers: learn the fundamentals, concepts and underlying ideas – in plain English – and fill the gaps in your knowledge, without bogging down on details.
8. Learn from the best. Not only do Teracom's instructors consistently receive highest ratings on student evaluations and specific praise of their ability to get *ideas* across, our instructors hold Bachelor of Engineering degrees or equivalent and have decades of experience working in the field.
9. Get a certification. The online CTNS Certification Package Unlimited Plan is included.
10. Bonus section! Get a comprehensive template for managing a VoIP project written by a Systems Engineer: how to do it the "right" way, from analyzing requirements to running trials, evaluating and selecting a vendor, rollout, acceptance testing and more. Packed with practical tips and checklists you can use immediately.

Without bogging down on unnecessary details, understand the ideas, concepts, technologies and solutions, increasing your confidence and allowing you to make informed choices and meaningful comparisons – knowledge you can't get on the job, reading trade magazines or talking to vendors.

## Tuition Fees

This high-quality, up-to-date course is value priced at only \$995, including bonus CTNS Certification Package, course completion certificate and 300-page course book. Compare to \$1499 and up for lower quality courses elsewhere.

## BOOT CAMP Option

This course is the last two days of BOOT CAMP. BOOT CAMP is a full week of training for non-engineers, covering the whole telecom and networking picture from fundamentals to future trends.

The week begins with three days of core training for non-engineers: The PSTN, wireless telecom, data communications, the Cloud, Ethernet and LANs, IP and networking, MPLS, and the Internet.

Then this course: Voice over IP, SIP and SIP Trunking, VoIP systems, Security, and finishing Friday afternoon with Next Generation, including 5G wireless and the Internet of Everything: how everything, from toasters to self-driving trucks to human brain implants will be online.

**Save \$395:** BOOT CAMP is only \$1995 for the full week, a \$395 savings. You may register for just the first three days (Course 101, \$1395) or just the last two days (Course 130, \$995) as best meets your needs. But with the low incremental cost and wall-to-wall training, BOOT CAMP is a great opportunity. [details](#)

## Detailed Course Description

### 1. VOIP COMPONENTS, SYSTEMS, STANDARDS, JARGON AND BUZZWORDS

We will start with VoIP jargon and buzzwords, basics of communicating voice in IP packets, what the components of VoIP systems are and what each does: soft switches, media servers, gateways and terminals, plus the main standards and protocols used in VoIP systems. The last lesson is “where this is headed”, what will people have as basic “telephone” service 50 years from now.

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

### 2. VOIP ARCHITECTURES AND IMPLEMENTATION CHOICES

“Voice over IP” can happen in many different ways. One by one, we’ll review the many flavors of VoIP, comparing and contrasting the various implementations and architecture choices. Starting with different flavors of Internet telephony, we will then understand VoIP at the telephone company, how it merges with the existing base, and the new services like SIP Trunking. We will compare and contrast choices for a VoIP system: getting it from the phone company; buying a Call Manager / softswitch; renting a Hosted PBX; and Softswitch as a Service / Cloud solutions. You’ll gain the knowledge to confidently differentiate VoIP architectures and discuss pros and cons of options.

- A. Internet Telephony: Computer-Computer VoIP over Internet
  - 1. Internet Telephony Example: Skype
- B. VSP: Internet to Phone, e.g. Gmail “make a call”, Hangouts dialer
- C. VSP: Phone to Phone over Internet, e.g. Vonage
- D. VoIP Becomes The New POTS
- E. SIP Trunking and VoIP at Carriers
- F. VoIP for Businesses and Organizations
- G. VoIP-Enabled PBX and Migration Options
- H. Premise Softswitch: PBX Replacement
- I. Cloud Services and Hosted PBX: Softswitch as a Service (SaaS)
- J. IP Centrex
- K. Asterisk and Open-Source Softswitch Software
- L. IP Phone Features and Uses

### 3. SIP AND CALL FLOW IN THE IP WORLD

SIP is the open, standard protocol for setting up Voice over IP telephone calls. All VoIP systems that purport to be “compatible” must adhere to the Session Initiation Protocol. It defines the procedure and messages to set up a phone call – or any other kind of communication. In this chapter, you’ll understand what SIP is, how it works, demystify jargon like proxy server, registration 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. At the end of this, you’ll understand call flow in IP telephone systems – maybe worth attending the course all by itself!

- A. What SIP is and What it Can Do
- B. Relationship to Other Protocols
- C. SIP URIs: “Telephone Numbers”
- D. Registration and Location
- E. Outbound Proxy
- F. Finding the Far End
- G. The SIP Trapezoid
- H. SIP Message Example
- I. How SIP Relates to Softswitches and Call Managers
- J. ENUM: relating SIP to NPA-NXX-XXXX phone numbers

#### **4. THE NUTS AND BOLTS OF PACKETIZED VOICE**

In this chapter, you'll understand what exactly packetized voice is, how it happens and the standards and protocols used. You'll learn about codecs and compression, and the factors affecting sound quality. We'll listen to sound clips of impairments, and provide you with a practical checklist of tips and recommendations for ensuring success.

- A. Voice Packetization
- B. Measuring Voice Quality
- C. Factors Affecting Voice Quality
- D. Codecs, Compression and the G.729 codec
- E. Network Delay and Jitter
- F. RTP and UDP
- G. IP Networks: Layers 1-3
- H. Protocol Stack: RTP, UDP, IP, MAC
- I. Packet Loss and Sound Samples – In-Class Demo
- J. Testing and Troubleshooting Voice Quality
- K. Tips for Maximizing Voice Quality

#### **5. SIP TRUNKING, CARRIER NETWORKS, SERVICES AND INTERCONNECT**

We round out the Voice over IP technology overview with connecting a VoIP system to the world, via a carrier like AT&T. We'll begin MPLS, used by carriers for traffic management, as a Quality of Service (QoS) mechanism to meet Class of Service (CoS) performance guarantees in Service Level Agreements (SLAs). We'll sort out VPN backbones vs. Internet VPNs. You'll learn about native VoIP services from carriers, and the significant savings in costs compared to connecting at the DS0 level. We'll finish with legacy system integration. The final three lessons are bonus detailed reference material for those who need it.

- A. MPLS and Quality of Service
- B. Differentiated Services (Diff-Serv)
- C. IP VPNs and Secure Call Paths
- D. Carrier MPLS VPNs
- E. SIP Trunking
- F. Session Border Controllers
- G. Carrier IP Interconnection
- H. DS0 Interconnect with the Telephone Network
- I. Megaco (H.248/RFC2885) and MGCP
- J. Co-Existence with a Legacy PBX
- K. Gateway Configuration and Options
- L. Fallback to PSTN Options
- M. Selecting a Carrier

#### **6. READINESS ASSESSMENT**

This chapter wraps up the Voice over IP part of the course, listing a number of practical issues that must be considered when planning a VoIP system. Not only might these lessons help avoid hidden issues becoming career-limiting surprises, they also serve as a good excuse to review the material covered so far.

- A. Implications for the Organizational Structure
- B. VoIP's Implications for the LAN
- C. LAN Cabling
- D. Phone Powering: AC, PoE, UPS
- E. Recommended LAN Configuration for VoIP
- F. VoIP's Implications for the WAN: Comparing Transmission Choices
- G. Redundancy and Disaster Recovery
- H. IPv6
- I. End-user Equipment

## 7. SECURITY

The more things that are connected, the more ways there are for criminals to make money. In this extensive chapter, you'll get a comprehensive overview of security, and an understanding of the tools and techniques used to implement security. We'll begin with an overview, then identify the valuable targets. Next, we'll explore the measures taken and best practices in the different areas of security – network security: filtering and firewalls; computer / operating system security: passwords, viruses, PCI compliance; information and communication security: public and private key encryption, digital signatures, digital certificates, IPsec; application security – examine an attack from the web to an SQL database step-by-step; and finally voice and video over IP security, including how yes, your microwave oven could be watching you.

- A. Security Areas, Risks and Policies
- B. Attacker Objectives
  - 1. Credit Card Numbers
  - 2. Personal Information and Identity Theft
  - 3. Ransom
  - 4. Fraud
  - 5. Emails and Confidential Information
  - 6. Defense Systems & Civil Infrastructure
- C. Network Security
  - 1. Network Segmentation
  - 2. Packet Forwarding vs. Packet Filtering
  - 3. Port Filtering & Open Ports
  - 4. UNIX: csf and iptables
  - 5. Firewalls & Firewall Proxies
  - 6. Stateful Packet Inspection Firewalls
  - 7. Distributed Denial of Service (DDoS) Attacks
- D. Computer Security & OS Security
  - 1. Passwords
  - 2. Two-Factor Authentication
  - 3. Viruses and Worms
  - 4. Exploits and Zero-Day Exploits
  - 5. Trojan Horses and Spyware
  - 6. Payment Card Industry Vulnerabilities Database
  - 7. Scanning and Patching
  - 8. Server Lockdown, Intrusion Detection
- E. Information Security & Communication Security
  - 1. Private Key Encryption
  - 2. Public Key Encryption
  - 3. Authentication and Digital Signatures
  - 4. Digital Certificates and SSL
  - 5. IPsec for Internet VPNs
- F. Application Security
  - 1. Web Application Vulnerabilities
  - 2. Example of Attack, Step-by-Step
- G. VoIP Security
  - 1. Risk Areas
  - 2. VoIP Security Measures and Solutions

## 8. NEXT-GENERATION: 5G AND THE INTERNET OF EVERYTHING

We complete the course with discussion of upcoming technologies. First up is 5G wireless. We'll understand how 5G is different than 4G – promising gigabits per second for many people, and how it will be deployed and used, including traffic control systems and driverless transport trucks, bandwidth for everyone at stadiums, and free ultra-fast WiFi from Google and Facebook in cities.

Second up is the IoT. Non-technical people who write articles have been using the term “Internet of Things”... but this is missing the bigger picture. In the future, EVERYTHING will be connected, the Internet of Everything. We'll identify things that will be connected, then split into groups to identify the associated benefits and risks, and who is going to make money. Then we'll cover some practical issues: discussing how everything can get a computer, an operating system and an application inside it, plus a communication link... and power. We'll finish off with medical applications, home automation and the Software Defined Telecom Network.

- A. What's Next
- B. 5G Wireless
  - 1. Highway Applications for 5G
  - 2. Urban Applications for 5G
  - 3. Piconets
- C. Urban WiFi
- D. The Internet of Everything – Group Discussion
  - 1. Categories of Things to Connect
  - 2. Benefits of Connecting
  - 3. Risks of Connecting
  - 4. Business Opportunities
- E. Communications for Everything
  - 1. Available Communication Technologies
  - 2. Client-Server vs. “Push” Technology
  - 3. Communicating to Private Addresses
- F. A Computer in Everything
  - 1. UNIX + IP + MAC on a chip
- G. Power for Everything
  - 1. Solar Cells & Ambient Light
- H. Ultra-Low-Power Medical Applications
- I. Home Automation
- J. Software-Defined Telecom Network

## APPENDIX A: VOIP VENDOR PROFILES

A survey of “hardware” vendors, softswitch vendors and service providers, chosen to be representative of all of the vendors in their category is included as a bonus section. You'll learn about the different philosophies of major players, their key products, latest trends and developments.

- A. Hardware Vendors
  - 1. Avaya, Nortel and Cisco
- B. Soft-switch Vendors
  - 1. Broadsoft
  - 2. ShoreTel
- C. Service Providers
  - 1. AT&T, Verizon, Qwest
  - 2. McLeod USA
  - 3. Vonage et al.

## **APPENDIX B: BONUS SECTION - VOIP PROJECT MANAGEMENT**

A comprehensive template for managing a VoIP project is included as a bonus section in the course book. You'll learn how to do it the "right" way, from analyzing requirements to running trials, evaluating and selecting a vendor, rollout, acceptance testing and more. This project management guide is packed with practical tips and checklists that can be put to immediate use. If you are about to embark on a VoIP deployment, this might well be worth the price of the course all on its own.

- A. The Need for a Process
  - 1. Requirements before design before product purchase
- B. Dealing with Vendors
  - 1. Who is in charge here?
  - 2. Sales techniques to beware of
- C. Step 1: Internal Requirements Specification
- D. Step 2: Identify Potential Vendors
  - 1. Generating a Request for Information (RFI)
  - 2. Checklist: Who is providing what?
- E. Step 3: Qualify Vendors
- F. Step 4: Evaluate Qualified Vendors
  - 1. Setting up a captive test environment
  - 2. Trial their system
  - 3. Procedure: How to run tests and evaluate the results
- G. Step 5: Vendor Selection
  - 1. Generating a Request for Quote (RFQ)
  - 2. Reconciling the RFQ and the responses
  - 3. Dealing with unwanted features
- H. Step 6: Close the Deal
  - 1. Checklist: Core contract clauses and items that must be specified
  - 2. Negotiating the price
- I. Step 7: Roll Out the System
  - 1. Structured roll-out
  - 2. Leaving room for a roll-back
- J. Step 8: Maintenance
  - 1. Template: Trouble categories and response standards

### **Our Goal**

Our goal is to bust the buzzwords, demystify jargon, understand technologies and mainstream solutions and - most importantly - the ideas underlying all of this, and how it all works together... knowledge you can't get on the job, talking to vendors or reading trade magazines.

### **How You Will Benefit**

You'll gain a long-lasting, solid base of unbiased career-enhancing knowledge you can build on, an investment sure to be repaid many times over, increasing your confidence and productivity and eliminating jargon- and buzzword-related frustration.

Plus, you will receive a high-quality 300-page workbook – a valuable reference packed with detailed notes, diagrams and practical explanations, with experience, tips and templates you can put to immediate use, as well as a certificate attesting to your IP telecom knowledge skills.

### **Don't Miss This Opportunity!**

If you've read this far, you know by now that this is the training you've been looking for to fill the gaps and get on top of IP Telecom. Coverage of all major topics, high-quality course materials, certification and certificate suitable for framing, bonus free textbook and value pricing... don't miss this opportunity. Invest in yourself and your career and [register](#) for this course now.



## How to Register

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 teracomtraining.com](http://teracomtraining.com)
- Register by phone at 1-877-412-2700

Once you register online or call us, we'll send your registration package by email, including a confirmation letter for you to sign and fax back to complete your registration. There is no obligation until you return the signed confirmation letter and you can cancel anytime up to two weeks before the course with no penalty.

We accept Visa, MasterCard and American Express, as well as checks and purchase orders.

## Bring This Course To Your Location

In addition to scheduled public seminars, 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, TELUS, Cap Gemini, ComSec Establishment, MicroCell, TDS Telecom, Western Wireless... to name a few.

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 a detailed workbook / textbook that will be a valuable reference for years to come.

We have built a solid reputation for delivering high-quality team-training programs that are a resounding success. Please contact us at 1-877-412-2700 or visit our web site for information on [onsite training](#).

## About the Author



Eric Coll is an international expert in telecommunications, data communications and networking and has been actively involved in the industry since 1983. He holds Bachelor's and Master of Engineering (Electrical) degrees.

Mr. Coll has taught telecommunications technology training seminars to wide acclaim across North America since 1992, and has broad experience working as an engineer in the telecommunications industry.

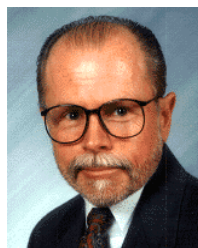
He has worked for Nortel's R&D labs as a design engineer on projects including digital voice and data communications research and digital network equipment design; on satellite radar systems; Wide Area Network design, and many other projects in capacities ranging from detailed design and implementation to systems engineering, project leader and consultant.

## Course Instructors



**Richard Olsen, B.S.E.E., P.E.** Richard Olsen holds a B.S. in Electrical Engineering and has over 36 years of professional engineering and teaching experience. Richard held senior management and engineering positions at Southwestern Bell for over 20 years. He has served as an instructor for numerous major companies as well as being an Adjunct Professor and Executive-in-Residence in the Master of Science in Telecommunications Management degree program, Oklahoma State University. Richard is a member of the MSTM Industry Advisory Board, Oklahoma State University, the National Society of Professional Engineers, the Oklahoma Society of Professional Engineers and the IEEE. Richard consistently receives

excellent ratings across the board on student evaluations, with many comments specifically praising his knowledge and thoroughness in making sure everyone understands the topics.



**Jay McGuire, M.Eng.** Jay D. McGuire holds advanced degrees in engineering and specializes in delivering instructor-led technical 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.