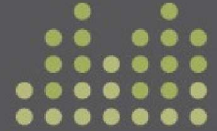


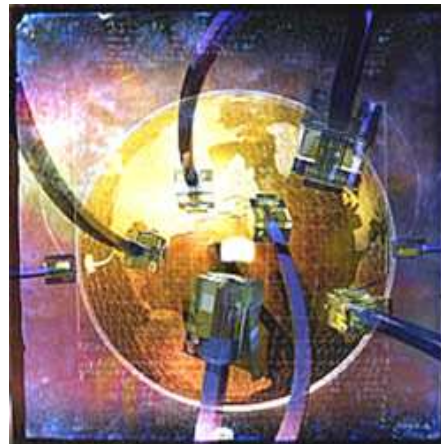


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# Environmental Scan Report Information and Communications Technology Industry

Orange County  
July 2008



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**THE CONVERGENCE/INTEGRATION OF TECHNOLOGY IS DRIVING THE GROWTH OF THE INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) INDUSTRY. OCCUPATIONS IN THIS INDUSTRY ARE PREDICTED TO GROW 56% AND ADD 1,500 NEW JOBS TO THE ORANGE COUNTY REGION OVER THE NEXT TEN YEARS** SOURCE: EDD LABOR MARKET INFORMATION

## **Executive Summary**

The Information and Communications Technology (ICT) industry is growing very rapidly due to the advances in technology that now make it possible to integrate networking (data) and communications equipment (voice). This integration is fueling the growth of telecommunication companies, which are investing billions of dollars to build the infrastructure necessary to provide bundled services (phone, internet, cable) to consumers and services for businesses, and also network equipment manufacturers and resellers that provide services to the growing number of small and medium sized businesses (SMBs) integrating their computer networks and telecommunications to IP (Internet Protocol) systems. Companies in these industries need employees who understand this convergence of technology in order to install, sell and maintain equipment.

The Center of Excellence chose to study the industry because:

- The industry has the fastest growing occupation statewide and in Orange County<sup>1</sup>
- Companies in this industry need employees who are knowledgeable in the convergence/integration of computer networks and communications technology
- There is a lack of local community college programs providing ICT specific instruction
- Occupations within the industry require technician level training, which could be provided by community colleges

This report provides an overview of the industry, identifies industry workforce and training needs, summarizes key research findings and recommends possible college responses. Community colleges have an opportunity to be the training providers for the current and future workforce of the ICT industry by developing coursework that includes both computer networking and communications technology, and by working with companies in need of industry certification for their employees.

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<sup>1</sup> EDD Labor Market Information: <http://www.labormarketinfo.edd.ca.gov/>

## Introduction

The California Community Colleges System has charged the Centers of Excellence, one of the ten initiatives of the Economic and Workforce Development (EWD) Network, with identifying industries and occupations with unmet employee development needs and partnering potential for the colleges' programs.

In this report, we cover the Information and Communications Technology (ICT) industry. Growth in this industry has been fueled by the convergence/integration of previously separate technologies in network and telecommunications, which is providing telecommunication companies with the opportunity to offer more services and at the same time increase their revenue. Network equipment manufacturers and resellers are also benefitting from this growth as they provide services to the growing number of small and medium sized businesses, which are integrating their computer networks and telecommunications to IP systems.

## Industry Overview

The U.S. Department of Commerce's Bureau of Economic Analysis defines ICT's producing industries as those consisting of computer and electronic products within durable-goods manufacturing; publishing, including software, and information and data processing services within information; and computer systems design and related services within professional and business services.<sup>2</sup> Some of these industries include:

- Wired and wireless telecommunication carriers (e.g. Verizon, AT&T, etc)
- Cable operators (e.g. Comcast, Time Warner cable)
- Computer systems design and related services (e.g. Cisco, Avaya, etc)
- Telecommunication resellers

Companies in these industries are currently going through a transformation due to the convergence of technologies that now make it possible for companies to provide a variety of different services to both business and residential customers. For example, telecommunication companies that used to concentrate on providing only phone service are now providing bundled packages or "Triple Play" packages, which include phone, cable, and internet service. Some companies are even providing "Quadruple Play" packages that also include wireless service. Cable companies that used to provide only cable television services are now also providing Triple Play packages.

The movement to provide more services has been facilitated by the advances and integration of technology, and companies willing to invest in infrastructure

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<sup>2</sup> Bureau of Labor Analysis: [www.bea.gov](http://www.bea.gov)

that will support these new technologies. For example, "AT&T intends to spend \$6 billion dollars to bring optical fiber further into neighborhoods and use high speed VDSL (very high bit-rate) technology to deliver packages of converged voice, video and data services to consumers, competing directly with cable television companies"<sup>3</sup>.

Verizon President and Chief Operating Officer Dennis Strigl had this to say during his speech at the NXTcomm conference held in Las Vegas, June 16-19, 2008:

"In our landline business, we began about four years ago to build a fiber-optic network called FiOS all the way to customers' homes. By the end of this year, we will pass some 12 million homes, and we're expanding at a rate of 3 million homes per year".

Companies such as AT&T and Verizon are investing in their infrastructure because of the profitability potential of getting businesses and residential customers to pay for these bundled services. According to the Telecommunications Industry Association (TIA)<sup>4</sup>, "82% of U.S. voice customers will receive service through a bundle in 2011, compared to 40% in 2007". The growth in these industries has also benefitted network equipment manufacturing companies, which make the routers, switches and equipment used by telecommunication carriers and cable companies. In addition to being vendors of telecommunication equipment, network equipment manufacturing companies are also targeting the growing needs of small and medium size businesses that are transitioning to Internet Protocol (IP) communications.

According to a new study by AMI-Partners, the total U.S. communications and managed services market was estimated to be over \$30 billion in 2007, and will grow at a compound annual growth rate of 15.6 percent out to 2010<sup>5</sup>. This growth has been helped along by telecommunication carriers that are now offering expanded bundles of complementary managed services like Web hosting, e-commerce, and hosted applications and databases, all of which are increasingly important for small and medium sized businesses with constrained technology budgets. In order not to burden their IT staff with additional duties, many small and medium sized businesses are outsourcing their IP communications (installation and maintenance) to network equipment manufacturing companies like Avaya, Cisco, Nortel Networks or third party vendors that sell and install equipment from these manufacturing companies.

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<sup>3</sup> ICONS: <http://www.ccsf.edu/Resources/ICONS/index.htm>

<sup>4</sup> Telecommunications Industry Association: [www.tiaonline.org](http://www.tiaonline.org)

<sup>5</sup> AMI Partners: [www.ami-partners.com](http://www.ami-partners.com)

## **INDUSTRY CHALLENGES**

Telecommunication companies, cable companies, network equipment manufacturers, and telecommunication resellers need employees who have the technical and management skills necessary for the design, installation, sales, operation and/or maintenance of computer and telecommunication networking systems. As businesses integrate their data and voice systems, they will need either in house or contract employees who can maintain and operate these new integrated systems. While the knowledge of both systems is required by the ICT industry, community colleges for the most part continue offering traditional programs that do not integrate data and voice technologies, particularly voice over IP.

To identify employer needs and industry trends, personal conversations and interviews were conducted with representatives from various ICT companies as well as community college faculty involved in Business Advisory Groups for the Information and Communications Technology Industry. The following issues emerged as a result of these interviews:

- Individuals with data and voice systems experience are in demand.
- The evolving nature of the industry requires employees to be up to date with new technology and certifications. Some of these certifications include Nortel and Cisco VoIP.
- The small and medium sized business market is growing as more businesses are deploying integrated systems of voice, video, and data networks over wire and wireless local area networks (LANs) and wide area networks (WANs).
- In addition to technical skills, employers are looking for soft skills that are often missing among job applicants.

Community colleges can be the ideal training providers for those companies interested in obtaining certifications/training for their current employees, and to start training technicians who are knowledgeable in integrating data and communication systems.

## **Occupational Overview**

The merging of data and communication networks has created a need for individuals who can understand and manage both systems. In the past, these individuals were trained separately and worked in different departments<sup>6</sup>; however, many companies have created job titles that include both set of skills. Companies such as Verizon have job titles that include Tech Specialist – Installation & Maintenance – Cisco, and Tech Specialist – Nortel Options<sup>7</sup>. AT&T has Field Service Representatives, which install and service Nortel VoIP and

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<sup>6</sup> Please see Appendix B for more information

<sup>7</sup> Verizon: <https://www22.verizon.com/about/careers/>

PBX (private branch exchange) technologies<sup>8</sup>. The Employment Development Department (EDD) has grouped jobs that require both skills set under the occupational title “Network and Data Communication Analyst”, defined as:

“Analyze, design, test, and evaluate network systems, such as local area networks (LAN), wide area networks (WAN), Internet, Intranet, and other data communication systems. Perform network modeling, analysis and planning. Research and recommend network and data communications hardware and software. Include telecommunications specialists who deal with the interfacing of computer and communications equipment”.<sup>9</sup>

Some examples of other job titles reported by industry include:<sup>10</sup>

- Network Technician
- Network Engineer
- Systems Engineer
- Systems Administrator
- Systems Programmer
- Telecommunications Manager
- Systems Specialist
- Network Consultant
- Network Manager
- Networking Systems and Distributed Systems Engineer

According to the Employment Development Department, Network Systems and Data Communications Analyst is the fastest growing occupation statewide and in Orange County:

**Table 1: 2004-2014 State and Orange County Occupational Projections<sup>11</sup>**

Area	Estimated	Projected	New Jobs	Replacement Jobs	Total Job Openings	Annual Avg. Openings	Percentage Growth
California	24,200	38,500	14,300	2900	17,200	1,720	59.1
Orange County	2,680	4,180	1,500	320	1820	182	56

The occupation also offers a very high paying salary. For 2007, the median hourly occupational wages for this occupation were \$32.74 statewide and \$31.38 for Orange County.<sup>12</sup>

<sup>8</sup> AT&T: <http://www.att.jobs/>

<sup>9</sup> EDD Labor Market Information: <http://www.labormarketinfo.edd.ca.gov/>

<sup>10</sup> O\*NET Online: <http://online.onetcenter.org/>

<sup>11</sup> Source for Table 1, 2, and 3 - EDD Labor Market Information: <http://www.labormarketinfo.edd.ca.gov/>

<sup>12</sup> EDD Labor Market Information: <http://www.labormarketinfo.edd.ca.gov/>

Related occupations include<sup>13</sup>:

- Computer Systems Analyst
- Computer Support Specialist

These related occupations are also growing statewide and in Orange County:

**Table 2: 2004-2014 State Occupational Projections**

Occupation	Estimated	Projected	New Jobs	Replacement Jobs	Total Job Openings	Annual Avg. Openings	Percentage Growth
Computer Systems Analyst	55,400	72,800	17,400	6,300	23,700	2,370	31.4
Computer Support Specialist	58,300	73,200	14,900	7,200	22,100	2,210	25.6

**Table 3: 2004-2014 Orange County Occupational Projections**

Occupation	Estimated	Projected	New Jobs	Replacement Jobs	Total Job Openings	Annual Avg. Openings	Percentage Growth
Computer Systems Analyst	5,090	6,650	1,560	580	2,140	214	30.6
Computer Support Specialist	6,570	8,010	1,440	810	2,250	225	21.9

### **CAREER PATHWAYS**

Computer related jobs are anticipated to grow significantly over the next ten years. Five out of the first ten fastest growing occupations in Orange County are in computer related jobs (Appendix C). Students who receive ICT training have the advantage of learning both computer and telecommunication skills; as a result, they have the option of working in various industries and occupations:

- Voice/Data Technicians for wired and wireless telecommunication carriers
- Installation and Maintenance Technicians, and Sales representatives for network equipment manufacturing companies and third party vendors (telecommunication equipment resellers)
- Computer Support Specialist positions for public and private sector companies
- Independent Owner/Contractor to do contract work for any of the above industries

Due to the continuous evolution of the ICT industry, employees need to be up to date with required industry certifications. Employees who obtain these certifications have a better chance to advance their careers within their respective organizations. This presents an opportunity for community colleges to

<sup>13</sup> O\*NET Online: <http://online.onetcenter.org/>

provide training through Contract Education or Community Education departments to ICT employers interested in getting their employees certified.

## Community Support and Resources

There are excellent opportunities for regional colleges and Economic and Workforce Development (EWD) initiatives to partner with employers, industry associations, and workforce agencies to meet the workforce needs of ICT employers. Well-developed partnerships can help to meet the current training needs of employers through a variety of resources and assistance. The table below summarizes existing and potential partnerships that can be leveraged.

Partner	Type of Organization	Contribution to Partnership
Convergence Technology Center <a href="http://www.convergencetechnologycenter.org">www.convergencetechnologycenter.org</a>	Education & Industry Consortium	Industry-defined education & training solutions Curriculum Development Resources and Technical assistance
National Center for Telecommunications Technologies (NCTT) <a href="http://www.nctt.org">www.nctt.org</a>	Education & Industry Consortium	Industry-defined education & training solutions Curriculum Development Resources and Technical assistance
Institute for Convergence of Optical and Network Systems (ICONS) <a href="http://www.ccsf.edu/Resources/ICONS">www.ccsf.edu/Resources/ICONS</a>	Community College Program	Industry-defined education & training solutions
Institute for Telecommunications Technology (IT2) <a href="http://it2.cuyamaca.edu/">http://it2.cuyamaca.edu/</a>	Community College Program	Industry-defined education & training solutions
Telecommunications Industry Association <a href="http://www.tiaonline.org/">http://www.tiaonline.org/</a>	Trade Organization	Industry advocacy and Certification
Computer Technology Industry Association (CompTIA) <a href="http://www.comptia.org">www.comptia.org</a>	Trade Organization	Industry advocacy and Certification
Workforce Investment Boards (WIBs) and One-Stop Centers (Anaheim, Santa Ana and Orange County WIBs) <a href="http://www.anaheimwib.com">www.anaheimwib.com</a> <a href="http://www.santaanawib.com">www.santaanawib.com</a> <a href="http://www.ocwib.com">www.ocwib.com</a>	Public Workforce Development	Access to Job Seekers Access to Employers Training Funds Employment Resources
Regional Colleges and LA/OC Community College Consortium (LOWDL) <a href="http://www.laocrc.com">www.laocrc.com</a>	Workforce Training and Development	Education and Training (Associate Degrees, Certificates, Basic Skills; Incumbent Worker Training via Contract Education) Grant Funding and Assistance

Orange County Business Council <a href="http://www.ocbc.org">www.ocbc.org</a>	Business Advocacy Group	Access to employers Partnership Development
Centers of Excellence (COE) (Orange County and L.A. Regions)	Community College EWD Program	Forecasts Industry Workforce needs Industry Research Partnership Development

## College Response and Issues

A search of Taxonomy of Programs code 708.10 (Computer Networking) revealed 3 current programs in Orange County:

COLLEGE	PROGRAM TITLE
Coastline Community College	Computer Networking
Irvine Valley College	Local Area Networks (CISCO)
Saddleback College	Network Administrator

Computer Networking contained the closest related coursework to Information and Communications Technology; however, most of the programs listed still lacked courses in Telecommunications and Voice over IP. The only program that contained such courses in Orange County was found at Orange Coast College, which offers a Convergence Technology certificate. Two other excellent programs were found at City College of San Francisco and Cuyamaca College in San Diego. These 3 colleges are partners of the National Center for Telecommunications Technology, which strives to train technicians in the ICT field and assist partner colleges with program development and improvement.

In short, local college response is still mostly aligned along the traditional boundaries of data and communications. Local community colleges have an excellent opportunity to work with some of these organizations to develop or revise computer science programs that can cover both data and telecommunications.

In Appendix D, curriculum examples from City College of San Francisco, Cuyamaca College, and Orange Coast College are presented, as well as information about the Convergence Technology Center and the National Center for Telecommunications Technology.

## Conclusion and Recommendations

The Information and Communications Technology Industry is growing very rapidly and will need a workforce that is trained on the integration of computer data networks and telecommunications technology. Telecommunication companies are investing billions of dollars in order to get more customers to buy their bundled services, and network equipment manufacturers and resellers have a growing market in small and medium sized businesses that are integrating their data and telecommunications to IP systems. Companies in these industries need employees who understand this convergence of technology in order to install, sell and maintain equipment.

Community colleges are in an excellent position to train the workforce needed for the Information and Communications Technology Industry. This could be accomplished in the following manner:

1. Develop coursework in Voice over IP and Telecommunications
  - Review the Associate's Degrees and/or certificates in ICT offered by City College of San Francisco, Cuyamaca College, and Orange Coast College. These are three excellent programs which are currently providing training in this industry, and that have made valuable partnerships with businesses and industry partners. Upfront facility investment is not required as students can use existing computer labs; thus keeping start up costs low.
  - Colleges that already have computer networking degrees/certificates in place should continue adjusting their current programs to include Voice over IP and telecommunication classes
2. Create partnerships with organizations that can provide mentorship programs for colleges interested in replicating current programs in ICT
  - Partner with the Convergence Technology Center. The Center mentors up to 6 colleges per year and provides:
    - Lead faculty member to assist mentored colleges
    - Administrative point of contact from the center
    - Training for faculty
    - Equipment list
    - Recruitment plans and event details
  - Partner with the National Center for Telecommunications Technology. The center currently partners with 9 community colleges throughout the United States, and is always looking for new partners looking to train technicians for the ICT field
3. Work with Contract Education and Community Education departments to develop training opportunities for companies interested in obtaining industry certifications as well as soft skills training
4. Create partnerships with businesses, Workforce Investment Boards, and industry associations to create internship/work experience programs, and to be up to date with the workforce needs of the industry
  - Partner with the Orange County Business Council (OCBC). OCBC is a recognized business advocate organization in Orange County that can assist community colleges with forming business advisory boards and to connect with businesses in various industries. Businesses can provide valuable input for curriculum validation and can also provide students with realistic job previews via internship, job shadowing, or part time employment.

- Partner with the three Workforce Investment Boards in Orange County (Anaheim, Santa Ana, and Orange County) to leverage resources that can facilitate the employment of students graduating with degrees or certificates in ICT. Through their one One-Stop Careers Centers, the Workforce Investment Boards provide incentives for businesses in need of hiring employees such as On the Job Training (OJT) that can reimburse participating businesses up to 50% of the hourly wage paid to employees.
5. Create partnerships with ROPs, high schools, and tech prep programs to increase awareness about the employment opportunities available in this industry, and to spark the interest of students in the ICT field

## Data Limitations

EDD has assigned Network Systems and Telecommunications Analyst as an occupational title to include occupations in the Information and Communications Technology industry; however, this job title is not very well known in the industry. As a result, there are a number of different job titles that apply or fall under this occupational title. In addition, the occupation is listed as requiring a Bachelor's degree; however, information obtained from Career Infonet<sup>14</sup> revealed a substantial number of jobs that require less than a Bachelor's degree education:

### Distribution of Educational Attainment

Occupation	Percent of employees aged 25 to 44 in the occupation whose highest level of educational attainment is-		
	High School or Less	Some College	Bachelor Degree or More
Network systems and data communications analysts	8.1%	34.8%	57.1%

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<sup>14</sup> Career Infonet: [www.careerinfonet.org](http://www.careerinfonet.org)

## References

AMI Partners: [www.ami-partners.com](http://www.ami-partners.com)

AT&T: <http://www.att.jobs>

Bureau of Labor Statistics: [www.bls.gov](http://www.bls.gov)

California State EDD LMID: [www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov)

Career Infonet: [www.careerinfonet.org](http://www.careerinfonet.org)

ICONS: [www.ccsf.edu/resources/ICONS](http://www.ccsf.edu/resources/ICONS)

O\*Net Online: <http://online.onetcenter.org>

Telecommunications Industry Association: [www.tiaonline.org](http://www.tiaonline.org)

Verizon: <https://www22.verizon.com/about/careers>

## **Appendix A: How to Utilize this Report**

### ***About Us - Description of BWPI***

The Business and Workforce Performance Improvement (BWPI) initiative is focused on building the capacity of the colleges in the area of economic and workforce development to enhance their ability to deliver education and training services to businesses and workers in high growth industries, new technologies, and other clusters of opportunities.

The Centers of Excellence (COE) within BWPI provide information regarding workforce trends, increasing awareness and visibility about the colleges' economic and workforce development programs and services, and building partnerships with business and industry.

The goal is to position the colleges as THE workforce partners of choice to business and industry and ensure that college programs are current and responsive. This will contribute to the overall economic vitality of the communities in which they serve.

### ***How to Use This Report***

The Centers of Excellence within the Business and Workforce Performance Improvement Initiative of the California Community College Economic and Workforce Development Program have undertaken Environmental Scanning to provide targeted and valuable information to community colleges on high growth industries and occupations.

This report is intended to assist the decision-making process of California community college administrators and planners in addressing local and regional workforce needs and emerging job opportunities in the workplace as they relate to college programs. The information contained in this report can be used to guide program offerings, strengthen grant applications, and support other economic and workforce development efforts. This report is designed to provide current industry data that will:

- Define potential strategic opportunities relative to an industry's emerging trends and workforce needs
- Influence and inform local college program planning and resource development
- Promote a future-oriented and market responsive way of thinking among stakeholders.

This Environmental Scan included a review of the California Regional Economies Project reports and Employment Development Department (EDD) Labor Market Information (LMID) projections that cover the communities in this region, as well as many other sources as referenced.

***Important Disclaimer:***

All representations included in this Environmental Scan product/study have been produced from a secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings. The purpose of the Environmental Scan is to assist the California Community Colleges to respond to emerging market needs for workforce performance improvement. However, neither the Business nor Workforce Performance Improvement Centers of Excellence, COE host college or California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon this study including components or recommendations.

**Additional Information**

The Business and Workforce Performance Improvement Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The total grant amount (grant number 07-305-012 for \$205,000) represents compensation for multiple documents or written reports through the Center of Excellence.

Our mission is to strengthen California's workforce and advance economic growth through education, training and job development.

## Appendix B: How Data and Communication Networks Work

### *Communication Networks*

Existing phone systems are driven by a method of connecting calls called circuit switching. Circuit switching is a very basic concept that has been around for more than 100 years. When a call is made between two parties, the connection maintained for the duration of the call is called a circuit. A typical phone call would work in the following manner:

1. Caller picks up the phone and gets a dial tone. A dial tone signifies that there is a connection to the local telephone carrier
2. Caller dials a phone number
3. The call is routed through the switch of the local telephone carrier to the party being called
4. A connection is made between the two telephones by using several interconnected switches
5. The phone at the other end rings and the other party answers the call
6. The connection opens the circuit
7. Conversation begins and is maintained until someone hangs up
8. Once someone hangs up, the circuit is closed thus freeing both phone lines.

This is the foundation of the Public Switched Telephone Network (PSTN). The Public Switched Telephone Network is an international telephone system based on copper wires carrying analog voice data at a rate of 64 kilobits per second (64 Kbps). When people started wanting computers to communicate with each other across distances, at first they used modems, which converted digital computer language to analog, audible signals that could be carried across 64 Kbps voice circuits. This system was inefficient because it tied up the circuits for the entire duration of the call. For example, callers would get a busy signal if they tried calling someone who was connected online. As a result, a packet-switched network emerged as an alternative to circuit switching.

While circuit switching keeps the connection open and constant, packet switching opens a brief connection, just long enough to send a piece of data called a packet from one system to another. Instead of routing data over a dedicated line, data packets flow through a network along thousands of multiple paths. Because packet switching considers alternate routes, and allows multiple transmissions to share the same route, it results in a more efficient use of telecommunications capacity as packets are routed along less congested routes.<sup>15</sup>

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<sup>15</sup> Bureau of Labor Statistics: [www.bls.gov](http://www.bls.gov)

## ***Data Networks***

Computer technology evolved separately and much later than telephone communications, and it was designed with systems that were independent from the existing telephone networks. Computing equipment took a lot of space (mainframes), required special environment conditions, was very expensive and needed very specialized staff to operate it. Specialized cabling was required for computer to computer communications, and it was the user's responsibility to have the right cabling installed and maintained for computer networks. Because these systems were completely different from and independent of telephone systems, they required separate staff that was specialized in working with computer equipment.<sup>16</sup>

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<sup>16</sup> ICONS: <http://www.ccsf.edu/Resources/ICONS/index.htm>

## Appendix C: Fastest Growing Occupations in Orange County and California

### Fastest Growing Occupations 2004-2014 Santa Ana-Anaheim-Irvine Metropolitan Division (Orange County)

SOC Code	Occupational Title	Annual Average Employment		Percent Change	Median Hourly Wage [1]
		2004	2014		
15-1081	Network Systems and Data Communications Analysts	2,680	4,180	56.0	\$31.38
31-1011	Home Health Aides	3,710	5,780	55.8	\$10.01
25-2041	Special Education Teachers, Preschool, Kindergarten, and Elementary School	760	1,100	44.7	[2]
17-2031	Biomedical Engineers	520	740	42.3	\$37.08
25-2042	Special Education Teachers, Middle School	520	740	42.3	[2]
27-1022	Fashion Designers	410	580	41.5	\$27.40
15-1031	Computer Software Engineers, Applications	11,750	16,600	41.3	\$34.40
15-1061	Database Administrators	1,030	1,440	39.8	\$34.39
15-1032	Computer Software Engineers, Systems Software	3,810	5,280	38.6	\$40.80
15-1071	Network and Computer Systems Administrators	3,410	4,710	38.1	\$31.27
25-2043	Special Education Teachers, Secondary School	580	800	37.9	[2]
29-2056	Veterinary Technologists and Technicians	1,000	1,370	37.0	\$14.87
51-3022	Meat, Poultry, and Fish Cutters and Trimmers	440	600	36.4	\$8.77

**Fastest Growing Occupations\***  
**2004-2014**  
**(California)**

SOC Code	Occupational Title	Annual Average Employment		Percent Change	Median Hourly Wage [1]
		2004	2014		
15-1081	Network Systems and Data Communications Analysts	24,200	38,500	59.1	\$32.74
31-1011	Home Health Aides	41,200	60,900	47.8	\$9.12
15-1031	Computer Software Engineers, Applications	84,400	123,600	46.4	\$42.84
15-1032	Computer Software Engineers, Systems Software	51,100	74,500	45.8	\$44.28
15-1071	Network and Computer Systems Administrators	29,600	42,000	41.9	\$33.11
29-2021	Dental Hygienists	19,900	28,200	41.7	\$38.93
15-1061	Database Administrators	11,300	16,000	41.6	\$34.88
31-9091	Dental Assistants	41,300	58,200	40.9	\$15.38
39-3011	Gaming Dealers	9,100	12,600	38.5	\$8.10
29-1071	Physician Assistants	5,900	8,100	37.3	\$39.72

## **Appendix D: Curriculum Examples and Existing ICT Programs**

### City College of San Francisco

Courses required for a Major in Computer Networking and Information Technology:

Core courses

CNIT 103 Computer Hardware

CNIT 106 Introduction to Networks

or CNIT 106C Introduction to Network Convergence

or CNIT 201E Network Fundamentals

CNIT 131 Internet Basics and Beginning HTML

CNIT 120 Network Security

Option in Computer Technical Support

Required

CNIT 104 Operating Systems Technologies

CNIT 105 Computer Technical Support

CNIT 335 Windows Vista Technical Support

CNIT 103L Computer Hardware Lab

or CNIT 104L Operating Systems Tech Lab

or CNIT 105L Computer Tech Support Lab

Option in Internet and Web Development Techniques

Required

CNIT 132 Intermediate HTML and XHTML

CNIT 133 Interactive Web Pages, Java Script, and AJAX

CNIT 134 Server Side Technologies: ASP.NET

Option in Network Security

Required

CNIT 121 Computer Forensics

CNIT 122 Firewalls

CNIT 123 Ethical Hacking and Network Defense

Option in Wireless Networks

Required

CNIT 107 Wireless LANs

CNIT 108 Wireless Networks Advanced

CNIT 212 Cisco Wireless

Option in Cisco Networking

Required

CNIT 202E Routing Protocols and Concepts

CNIT 203E LAN Switching and Wireless

## CNIT 204E Accessing the WAN

Option in Microsoft Windows

Electives

CNIT 335 Windows Vista Technical Support

CNIT 340 Managing and Maintaining Windows Server

CNIT 341 Windows Server Infrastructure

### Cuyamaca College

Courses required for a Major in Telecommunications Networking Technology:

CIS 120 Computer Maintenance and A+ Certification

CIS 121 Network Cabling Systems

CIS 161 Fundamentals of Telecommunications

CIS 162 Network Diagramming Using MS Visio 1

CIS 190 Windows Operating System

or

CIS 191 Linux Operating Systems

CIS 201 Cisco Networking Academy I Exploration

CIS 202 Cisco Networking Academy II

or

CIS 125 Network+ Certification

CIS 261 Telecommunications and Convergence Technologies

CIS 262 Fundamentals of Wireless LANs

CIS 263 Fundamentals of Network Security

ENGR 270 Digital Systems

ET 110 Introduction to Basic Electronics

MATH 180 Analytic Geometry and Calculus I

Select one of the following:

CS 119 Program Design and Development

CS 180ABCD Introduction to Visual Basic Programming

CS 182 Introduction to Java Programming

### Orange Coast College

Courses required for the certificate in Convergence Technology:

CIS A110 PC Concepts: A+ Certification

CIS A197 Networking Essentials

CIS A198 Routing and Router Configurations

CIS A260 Convergence Technologies

A choice of one of the following:

CIS A261 Fundamentals of Wireless Networking

CIS A262 Fundamentals of Voice over IP

CIS A263 Home Technology Integration

Additional information can be obtained at [www.orangecoastcollege.edu/academics/course\\_cat/Computer+Information+Systems+Certificate.htm](http://www.orangecoastcollege.edu/academics/course_cat/Computer+Information+Systems+Certificate.htm)

### City College of San Francisco – Computer Networking and Information Technology (CNIT) Department

In addition to providing a degree in Computer Networking and Information Technology, the CNIT department also offers certificates of completion in Convergence Technology and Digital Home Technology Integration.

The CNIT department has also been awarded \$750,000 over 3 years by the National Science Foundation to develop the Institute for Convergence of Optical and Network Systems (ICONS). Among the Institute's many goals are to develop new certificates and new courses, and to utilize college network and Information Technology infrastructure to give students real world experience in modern convergence technologies.

For more information on the CNIT department or the ICONS program, please go to <http://www.ccsf.edu/Resources/ICONS/index.htm>

### Cuyamaca College – Institute for Telecommunications Technology

The Institute for Telecommunications Technology (IT2) at Cuyamaca College was awarded funds by the National Science Foundation to develop programs comprised of telecommunications and networking curriculum, multimedia and web-based delivery, "hands on" teaching and learning labs, teacher training workshops, and success strategies for women in Information Technologies and Telecommunications.

In addition to providing a degree in Telecommunications Networking Technology, IT2 also offers a Telecommunications Networking Technician Certificate of Achievement. Additional information on the IT2 program can be found at <http://it2.cuyamaca.edu/>

### Convergence Technology Center

The Convergence Technology Center was awarded funds by the National Science Foundation and was launched in August 2004. The Center was established to meet the growing need for skilled specialists in the area of Convergence Technology and Home Technology Integration.

The Center pulls together the strengths of regional and national educational institutions and business and industry partners to create a pool of qualified convergence technicians who can design, build, test, secure and troubleshoot

communication infrastructure and devices in the convergence technology arena, for both the enterprise and home markets.

The Center, based out of Frisco, Texas, partnered with three local community college districts to create Associate's Degrees and Certificates in Convergence Technology. The Center also has a Community College Mentor Program that can provide a community college with the tools necessary to start a program in the Convergence Technology field.

Additional information on the Convergence Technology Center can be accessed at [www.convergencetechnologycenter.org](http://www.convergencetechnologycenter.org)

### National Center for Telecommunications Technology

The National Center for Telecommunications Technology at Springfield Technical Community College in Massachusetts is an Advanced Technological Education Center for Excellence in the instruction of Telecommunications Engineering Technologies.

The Center's mission is to provide appropriately skilled technicians and technologists for the Information and Communication Technology industry, and to contribute to scientific and technological innovation in telecommunications education with a primary thrust in two areas: Curriculum Development and Program Improvement.

The Center currently has 9 regional community college partners throughout the United States. More information on the National Center for Telecommunications Technology can be accessed at [www.nctt.org](http://www.nctt.org)