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Cyber Defense Occupations

Inland Empire/Desert Region (Riverside-San Bernardino-Ontario Metropolitan Statistical Area)

Summary

- Employment for the cyber defense occupational group is expected to **increase 10% between 2017 and 2022** in the Inland Empire/Desert Region. Just over **4,450 job openings** will be available over the five-year timeframe.

- The entry-level wage for each occupation in the cyber defense occupational group is **above the MIT Living Wage estimate of $12.30 per hour** for a single adult living in the Inland Empire/Desert Region.

- There appears to be an **opportunity for program growth** based on the average annual number of program completions for the selected community college programs **(120 total combined awards from community college and other regional educators),** and the annual openings for cyber defense occupations in the local region **(891 annual job openings).**

Introduction

The following report details occupations relevant to the computer networking program. Computer networking programs prepare individuals for computer network design, installation, maintenance, and troubleshooting. Computer networking skills are essential to the implementation of cyber defense measures. The following occupations are included in the cyber defense occupational group:

- Computer Network Architects

- Computer Network Support Specialists

- Computer Systems Analysts

- Computer User Support Specialists

- Database Administrators

- Information Security Analysts

- Network and Computer Systems Administrators

Job Opportunities

In 2017, there were more than 9,800 cyber defense jobs in the Inland Empire/Desert Region. This occupational group is projecting to increase employment 10% by 2022. Employers in the region will need to hire more than 4,450 workers over the next five years to fill new jobs and backfill jobs that workers are permanently vacating (includes retirements). Appendix A, Table 1 shows the projected job growth, wages, education, training, and work experience required for each of the occupations in this group.

Exhibit 1: Five-year projections for the cyber defense occupational group in the Inland Empire/Desert Region

| Region	2017 Jobs	5-Yr % Change (New Jobs)	5-Yr Openings (New + Replacement Jobs)	Annual Openings (New + Replacement Jobs)	% of workers age 55+
Inland Empire/Desert	9,803	10%	4,456	891	15%

Source: EMSI 2018.2

Cyber Defense Demand

A real-time search for employers seeking cyber defense professionals was conducted to hone in on the jobs that require cyber defense skills. This search identified job titles, in-demand skills, and certifications required explicitly for cyber defense roles. Subsequent sections summarize the results of this search.

Over the last 12 months (May 2017 to April 2018), there were 452 advertisements (ads) for jobs in the cyber defense occupational group in the Inland Empire/Desert Region. From 2010 to 2017, there was an annual average of 309 job ads per year (Exhibit 2).

Exhibit 2: Number of online job postings for the cyber defense occupational group in the Inland Empire/Desert Region, 2010 to 2017
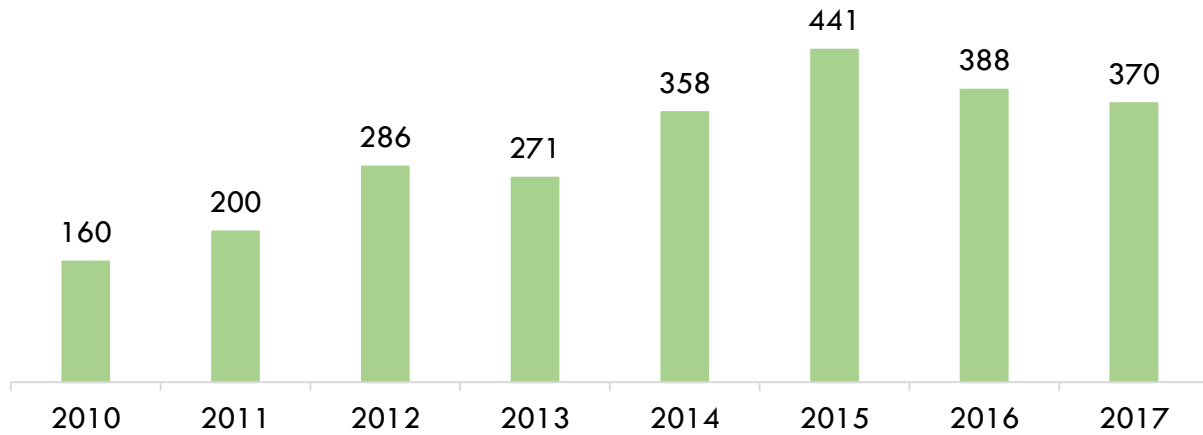
Source: Burning Glass – Labor Insights

On average, online job postings for the cyber defense occupational group are filled within 37 days. Compared to cyber defense occupations throughout the country, it is relatively easier for employers to find qualified candidates to fill their open positions in the Inland Empire/Desert Region, especially for computer systems analysts, which are typically filled two weeks faster locally. Exhibit 3 shows the number of job ads posted during the last 12 months along with the regional and national average time to fill for each occupation.

Exhibit 3: Job ads for each of the cyber defense occupations in the Inland Empire/Desert Region during the last 12 months and time to fill, May 2017 – Apr 2018

Occupation	Job Ads	Regional Average Time to Fill (Days)	National Average Time to Fill (Days)
Information Security Analysts	179	44	43
Computer Network Architects	116	37	43
Network and Computer Systems Administrators	52	32	37
Computer User Support Specialists	49	27	32
Computer Systems Analysts	10	42	56
Computer Network Support Specialists	10	43	37
Database Administrators	9	37	43
TOTAL	**425**	**-**	**-**

Source: Burning Glass – Labor Insights

Earnings

The entry-level hourly wage for each of the occupations in the cyber defense occupational group is above the MIT Living Wage estimate of $12.30 per hour for a single adult living in the Inland Empire/Desert Region. These wages are also sufficient for an adult living in a household with one other working adult and one child ($14.50 per hour, per adult or $30,160 annually for each adult). Exhibit 4 displays wage information for this occupational group in the Inland Empire/Desert Region.

Exhibit 4: Earnings for the cyber defense occupational group in the Inland Empire/Desert Region

Occupation	Entry to Experienced Hourly Earnings Range*	Median Wage*	Average Annual Earnings*
Information Security Analysts	$37.98 to $57.23	$48.45	$96,900
Computer Network Architects	$34.94 to $61.92	$47.12	$103,200
Database Administrators	$28.01 to $48.47	$39.15	$81,200
Computer Systems Analysts	$30.61 to $44.32	$36.63	$77,500
Network and Computer Systems Administrators	$27.59 to $42.43	$33.78	$73,200
Computer Network Support Specialists	$24.25 to $44.09	$30.62	$70,900
Computer User Support Specialists	$19.75 $29.29	$24.62	$52,000

Source: EMSI 2018.2
*Entry Hourly is 25th percentile wage, the median is 50th percentile wage, experienced is 75th percentile wage. Average annual earnings assumes full-time employment.

Work Locations, Employers, Skills, and Education

Exhibit 5 displays the top employers posting job ads as well as the top work locations from job ads during the last 12 months.

Exhibit 5: The top employers and work locations for the cyber defense occupational group in the Inland Empire/Desert Region during the last 12 months, May 2017 – Apr 2018

Occupation	Top Employers	Top Work Locations
Cyber Defense Occupational Group (n=320)	• UnitedHealth Group • San Manuel Indian Bingo Casino • CACI • CGI Group • University of California	• Corona • Riverside • Ontario • San Bernardino • Highland

Source: Burning Glass – Labor Insights

Exhibit 6 lists a sample of in-demand specialized and soft skills that employers are seeking when looking for workers to fill cyber defense positions.

Exhibit 6: Sample of in-demand skills from employer job ads for cyber defense occupations group in the Inland Empire/Desert Region, May 2017 – Apr 2018

Occupation	Specialized skills	Soft skills	Software and Programming skills
Information Security Analysts (n=166)	• Information Systems • Network Security • Cryptography	• Communication Skills • Planning • Research	• Linux • Microsoft Office • Virtual Private Networking (VPN)
Computer Network Architects (n=115)	• Telecommunications • Voice over IP (VoIP) • Technical Support	• Troubleshooting • Communication Skills • Problem Solving	• Cisco • Virtual Private Networking (VPN) • EIGRP
Network and Computer Systems Administrators (n=50)	• System Administration • Technical Support • Hardware and Software Installation	• Troubleshooting • Communication Skills • Problem Solving	• VMware • Linux • UNIX
Computer User Support Specialists (n=49)	• Information Systems • Help Desk Support • Hardware and Software Installation	• Troubleshooting • Communication Skills • Problem Solving	• Microsoft Windows • SQL • Linux
Computer Systems Analysts (n=10)	• Technical Support • Network Troubleshooting • Telecommunications	• Problem Solving • Critical Thinking • Detail-Oriented	• SQL • Microsoft Office • Enterprise Resource Planning (ERP)

Occupation	Specialized skills	Soft skills	Software and Programming skills
Computer Network Support Specialists *(n=9)*	• Information Security • Network Administration • Cisco	• Planning • Troubleshooting • Communication Skills	• Cisco Switching • EIGRP • Voice over IP (VoIP)
Database Administrators *(n=9)*	• SQL Server • SAP Basis • Scheduling	• Communication Skills • Meeting Deadlines • Planning	• SQL • SAP HANA • SAP Security

Source: Burning Glass – Labor Insights

Exhibit 7 displays the entry-level education level education typically required to enter each occupation according to the Bureau of Labor Statistics, educational attainment for incumbent workers with "some college, no degree" and an "associate degree" according to the U.S. Census, and the minimum advertised education requirement requested by employers in online job ads.

Exhibit 7: Educational attainment and online job ads with minimum advertised education requirements for the cyber defense occupational group in the Inland Empire/Desert Region, May 2017 – Apr 2018

Occupation	Typical Entry-Level Education Requirement	Educational Attainment*	Minimum Advertised Education Requirement from Job Ads			
			Number of Job Postings (n=)	High school diploma or vocational training	Associate degree	Bachelor's degree or higher
Information Security Analysts	Bachelor's degree	27%	133	11%	3%	86%
Computer Network Architects	Bachelor's degree	35%	87	5%	5%	90%
Network and Computer Systems Administrators	Bachelor's degree	38%	53	11%	11%	78%
Computer User Support Specialists	Some college, no degree	41%	29	10%	14%	76%
Computer Systems Analysts	Bachelor's degree	21%	8	13%	-	87%

Occupation	Typical Entry-Level Education Requirement	Educational Attainment*	Minimum Advertised Education Requirement from Job Ads			
			Number of Job Postings (n=)	High school diploma or vocational training	Associate degree	Bachelor's degree or higher
Computer Network Support Specialists	Associate degree	41%	6	50%	-	50%
Database Administrators	Bachelor's degree	21%	1	100%	-	-

Source: EMSI 2018.2, Burning Glass – Labor Insights
*Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework

Industry

Staffing patterns show the industries that employ the most workers of a specific occupation. Exhibit 8 displays the industries that hire and are looking for cyber defense occupations in the two-county region. The occupations in this group do not appear to be highly concentrated in any one particular industry, indicating that cyber defense workers could find themselves working across a variety of industries throughout their career.

Exhibit 8: Top industries employing cyber defense occupations in the Inland Empire/Desert Region, May 2017 – Apr 2018

Occupation	Top Industries from Staffing Pattern (NAICS) - % of occupation employed in industry	Industry Classification from Job Ads	
		Number of Job Postings (n=)	Top Industries from Job Ads (NAICS)
Information Security Analysts	• Computer Systems Design and Related Services (5415) 15% • Employment Services (5613) 7%	132	• Insurance Carriers (5241) • Colleges, Universities, and Professional Schools (6113)
Computer Network Architects	• Computer Systems Design and Related Services (5415) 15% • Wired and Wireless Telecommunications Carriers (5173) 10%	34	• Computer Systems Design and Related Services (5415) • Wireless Telecommunications Carriers (except Satellite) (5172)

Occupation	Top Industries from Staffing Pattern (NAICS) - % of occupation employed in industry	Industry Classification from Job Ads	
		Number of Job Postings (n=)	Top Industries from Job Ads (NAICS)
Network and Computer Systems Administrators	• Education and Hospitals (Local Government) (9036) 10% • Computer Systems Design and Related Services (5415) 9%	24	• Computer Systems Design and Related Services (5415) • Depository Credit Intermediation (5221)
Computer User Support Specialists	• Education and Hospitals (Local Government) (9036) 18% • Computer Systems Design and Related Services (5415) 12%	21	• Computer Systems Design and Related Services (5415) • Junior Colleges (6112)
Computer Systems Analysts	• Computer Systems Design and Related Services (5415) 23% • Local Government, Excluding Education and Hospitals (9039) 8%	5	• Computer Systems Design and Related Services (5415)
Computer Network Support Specialists	• Education and Hospitals (Local Government) (9036) 12% • Computer Systems Design and Related Services (5415) 11%	8	• Insurance Carriers (5241) • Computer Systems Design and Related Services (5415)
Database Administrators	• Education and Hospitals (Local Government) (9036) 9% • Local Government, Excluding Education and Hospitals (9039) 8%	1	• Computer Systems Design and Related Services (5415)

Source: EMSI 2018.2, Burning Glass – Labor Insights

Certifications

Approximately 65% of the job ads for the cyber defense occupational group requested or required a certification. Knowing which certifications are currently in demand is useful for program faculty and program completers. Exhibit 9 displays the certifications in greatest demand for each occupation in the cyber defense group.

Exhibit 9: Certification in greatest demand for cyber defense occupations in the Inland Empire/Desert Region, May 2017 – Apr 2018

Occupation	Certification	Number of Job Postings with Certification
Information Security Analysts	• Certified Information Systems Security Professional (CISSP) • Certified Information Security Manager (CISM)	• 51 • 23
Computer Network Architects	• Cisco Certified Network Professional (CCNP) • Cisco Certified Network Associate (CCNA)	• 94 • 73
Network and Computer Systems Administrators	• CompTIA Security+ • Cisco Certified Network Associate (CCNA) • Security Clearance • Security+	• 19 • 19 • 16 • 14
Computer User Support Specialists	• CompTIA Security+ • Security Clearance • Security + • CompTIA Network+	• 22 • 15 • 14 • 13
Computer Systems Analysts	• IT Infrastructure Library (ITL) Certification	• 2
Computer Network Support Specialists	• Security Clearance • Cisco Certified Network Professional (CCNP)	• 5 • 4
Database Administrators	• Security Clearance	• 1

Source: Burning Glass – Labor Insights

Student Completions

Exhibit 10 shows the annual average regional community college awards (associate degrees and certificates) conferred during the three academic years between 2014 and 2017, with the relevant TOP code as well as the program title used at each college, sourced from the Chancellor's Office Curriculum Inventory (COCI). Awards granted from 2013 to 2016 outside of the California Community Colleges are displayed in Exhibit 11, along with the relevant CIP code. Please note, an

award is not equivalent to a single person in search of a job opening since a student may earn more than one award, such as an associate degree in addition to a certificate. Community College student outcome information was obtained from the CTE LaunchBoard based on the selected TOP code(s) and region.

Exhibit 10: Annual average community college student completions for computer networking programs in the Inland Empire/Desert Region

0708.10 Computer Networking	Annual Community College Headcount (2016-17)	Community College Annual Average Awards (2014-17)
Chaffey – *Network Specialist/Cisco Certified Network Professional (CCNP)/Cisco CCNP Examination Preparation Level IX*	173	
Certificate 30 to < 60 semester units		48
Certificate 18 to < 30 semester units		50
Certificate 6 to < 18 semester units		2
Mt. San Jacinto – *CIS: Networking**	103	
Certificate 30 to < 60 semester units		2
Riverside – *Information Security and Cyber Defense*	136	
Certificate 6 to < 18 semester units		15
Victor Valley	28	
Total Community College Headcount (2016-17)	**439**	
Total Annual Average Community College Awards		**117**

Source: LaunchBoard, IPEDS, COCI
*Program listed as inactive

0708.10 Computer Networking program Strong Workforce outcomes in the Inland Empire/Desert Region in the academic year 2015-16 [unless noted otherwise]:

- Number of course enrollments: 618 (California median: 1,393) [2016-17]
- Number of students who transferred to a 4-year institution: 22 (CA: 76)
- Employed in the second fiscal quarter after exit: 74% (CA: 74%)
- Median earnings in the second fiscal quarter after exit: $9,029 (CA:$9,029)
- Employed in the fourth fiscal quarter after exit: 75% (CA: 73%)
- Median annual earnings: $37,575 (CA: $37,643)
- The percentage in a job closely related to the field of study: 74% (CA: 69%) [2014-15]
- Median change in earnings: 35% (CA: 51%)
- The proportion of students who attained a living wage: 61% (CA: 64%)

Exhibit 11: Annual average community college student completions for computer systems networking and telecommunications programs in the Inland Empire/Desert Region

11.0901 Computer Systems Networking and Telecommunications	Other Educational Institutions Annual Average Certificates or Other Credit Awards (2013-16)
University of Redlands	
Award 1 < 2 academic yrs	3
Total annual average other awards	**3**

Source: IPEDS

Sources

O*Net Online

Labor Insight/Jobs (Burning Glass)

Economic Modeling Specialists International (EMSI)

CTE LaunchBoard

MIT Living Wage Calculator

Chancellor's Office Curriculum Inventory (COCI, version 2.0)

The Integrated Postsecondary Education Data System (IPEDS)

Michael Goss, Director
Center of Excellence, Inland Empire/Desert Region
michael.goss@chaffey.edu
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Appendix A: Occupation definitions, sample job titles, five-year projections, and earnings for cyber defense occupations

Occupation Definitions (SOC code), Education and Training Requirement, Community College Education Attainment

Computer Systems Analysts (15-1121)

Analyze science, engineering, business, and other data processing problems to implement and improve computer systems. Analyze user requirements, procedures, and problems to automate or improve existing systems and review computer system capabilities, workflow, and scheduling limitations. May analyze or recommend commercially available software.

Sample job titles: Applications Analyst, Business Analyst, Business Systems Analyst, Computer Analyst, Computer Systems Analyst, Computer Systems Consultant, Information Systems Analyst (ISA), Information Technology Analyst (IT Analyst), System Analyst, Systems Analyst

Entry-Level Educational Requirement: Bachelor's degree
Training Requirement: None
Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework: 21%

Information Security Analysts (15-1122)

Plan, implement, upgrade, or monitor security measures for the protection of computer networks and information. May ensure appropriate security controls are in place that will safeguard digital files and vital electronic infrastructure. May respond to computer security breaches and viruses.

Sample job titles: Computer Security Specialist, Computer Specialist, Data Security Administrator, Information Security Analyst, Information Security Manager, Information Security Officer, Information Security Specialist, Information Systems Security Analyst, Information Technology Security Analyst, Information Technology Specialist

Entry-Level Educational Requirement: Bachelor's degree
Training Requirement: None
Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework: 27%

Database Administrators (15-1141)

Administer, test, and implement computer databases, applying knowledge of database management systems. Coordinate changes to computer databases. May plan, coordinate, and implement security measures to safeguard computer databases.

Sample job titles: Data Architect, Database Administration Manager, Database Administrator (DBA), Database Analyst, Database Coordinator, Database Developer, Database Programmer, Information Systems Manager, Management Information Systems Director (MIS Director), System Administrator

Entry-Level Educational Requirement: Bachelor's degree
Training Requirement: None
Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework: 21%

Network and Computer Systems Administrators (15-1142)

Install, configure, and support an organization's local area network (LAN), wide area network (WAN), and Internet systems or a segment of a network system. Monitor network to ensure network availability to all system users and may perform necessary maintenance to support network availability. May monitor and test Web site performance to ensure Web sites operate correctly and without interruption. May assist in network modeling, analysis, planning, and coordination between network and data communications hardware and software. May supervise computer user support specialists and computer network support specialists. May administer network security measures.

Sample job titles: Information Analyst, Information Systems Manager (IS Manager), Information Technology Specialist (IT Specialist), LAN Specialist (Local Area Network Specialist), Local Area Network Administrator (LAN Administrator), Network Administrator, Network Coordinator, Network Manager, Network Specialist, Systems Administrator

Entry-Level Educational Requirement: Bachelor's degree
Training Requirement: None
Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework: 38%

Computer Network Architects (15-1143)

Design and implement computer and information networks, such as local area networks (LAN), wide area networks (WAN), intranets, extranets, and other data communications networks. Perform network modeling, analysis, and planning. May also design network and computer security measures. May research and recommend network and data communications hardware and software.

Sample job titles: Network Analyst, Network Consultant, Network Engineer, Network Manager, Networking Systems and Distributed Systems Engineer, System Programmer, Systems Analyst, Systems Engineer, Telecommunications Analyst, Telecommunications Engineer

Entry-Level Educational Requirement: Bachelor's degree
Training Requirement: None
Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework: 35%

Computer User Support Specialists (15-1151)

Provide technical assistance to computer users. Answer questions or resolve computer problems for clients in person, or via telephone or electronically. May provide assistance concerning the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems.

Sample job titles: Computer Specialist, Computer Support Specialist, Computer Technician, Desktop Support Technician, Help Desk Analyst, Help Desk Technician, Information Technology Specialist (IT Specialist), Network Technician, Support Specialist, Technical Support Specialist

Entry-Level Educational Requirement: Some college, no degree
Training Requirement: None
Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework: 41%

Computer Network Support Specialists (15-1152)

Analyze, test, troubleshoot, and evaluate existing network systems, such as local area network (LAN), wide area network (WAN), and Internet systems or a segment of a network system. Perform network maintenance to ensure networks operate correctly with minimal interruption.

Sample job titles: Computer Network Specialist, IT Consultant (Information Technology Consultant), Network Engineer, Network Specialist, Network Support Specialist, Network Technical Analyst, Network Technician, Personal Computer Network Analyst, Senior IT Assistant (Senior Information Technology Assistant), Systems Specialist

Entry-Level Educational Requirement: Associate degree
Training Requirement: None
Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework: 41%

Table 1. 2017 to 2022 job growth, wages, education, training, and work experience required for the cyber defense occupational group, Inland Empire/Desert Region

Occupation (SOC)	2017 Jobs	5-Yr Change	5-Yr % Change	Annual Openings (New + Replacement Jobs)	Entry-Experienced Hourly Wage*	Median Hourly Wage	Average Annual Earnings	Typical Entry-Level Education & On-The-Job Training Required	Work Experience Required
Computer User Support Specialists (15-1151)	4,010	374	9%	376	$19.75 to $29.29	$24.62	$52,000	Some college, no degree & None	None
Computer Systems Analysts (15-1121)	2,068	243	12%	186	$30.61 to $44.32	$36.63	$77,500	Bachelor's degree & None	None
Network and Computer Systems Administrators (15-1142)	1,757	166	9%	146	$27.59 to $42.43	$33.78	$73,200	Bachelor's degree & None	None
Computer Network Support Specialists (15-1152)	1,001	94	9%	94	$24.25 to $44.09	$30.62	$70,900	Associate degree & None	None
Database Administrators (15-1141)	447	52	12%	40	$28.01 to $48.47	$39.15	$81,200	Bachelor's degree & None	None
Computer Network Architects (15-1143)	373	42	11%	33	$34.94 to $61.92	$47.12	$103,200	Bachelor's degree & None	5 years or more
Information Security Analysts (15-1122)	147	23	16	15	$37.98 to $57.23	$48.45	$96,900	Bachelor's degree & None	Less than 5 years
Total	9,803	994	10%	891	-	-	-	-	-

Source: EMSI 2018.2
*Entry Hourly is 25th percentile wage, the median is 50th percentile wage, experienced is 75th percentile wage.