

Cybersecurity

Inland Empire/Desert Region (IEDR, Riverside and San Bernardino counties combined)

This workforce demand report uses state and federal job projection data that was developed before the economic impact of COVID-19. The COE is monitoring the situation and will provide more information as it becomes available. Please consult with local employers to understand their current employment needs.

Summary

- The knowledge, skills, and abilities provided by the community college *computer infrastructure and support* programs lead to four (4) middle-skill occupations and three high-skill occupations, collectively referred to as the *cybersecurity occupational group* in this report.
- IEDR employment for the middle-skill *cybersecurity occupational group* is expected to **increase by 8% between 2019 and 2024**. A total of **689 middle-skill annual job openings** will be available each year over the five-year timeframe.
- The **median, 50th percentile, hourly wages** for the middle-skill occupations in this group are between **\$21.59 and \$35.02 per hour**. These wages exceed the **\$19.94 per hour self-sustainable hourly wage** estimate for a single adult with one child.
- There was **one credential issued** from a regional community college program related to computer infrastructure and support over the last three academic years.
- The Centers of Excellence recommends creating new or expanding existing cybersecurity programs to meet the need for more workers. Please see the [recommendation](#) section for further detail.

Introduction

This report provides data on programs and occupations related to cybersecurity. The California Community College computer infrastructure and support (TOP 0708.00) program provides the training most closely associated with cybersecurity. The computer infrastructure and support program prepares students for employment through the instruction of network and operation systems design and administration, including certification preparation (Taxonomy of Programs, 2012).

The knowledge, skills, and abilities trained by this program lead to direct employment opportunities and provide the foundation for further cybersecurity education. While there are entry-level positions within cybersecurity, most of the occupations working in this field require a bachelor's degree. The cybersecurity occupational group has been split into **middle-skill** occupations and **high-skill** occupations to illuminate the

opportunities available to students with various levels of educational attainment. The recommendations section of this report focuses on **middle-skill employment** since this level of education is closely associated with community college training.

The **middle-skill cybersecurity occupational group** consists of four occupations that typically require workers to obtain an associate degree to enter employment. Although *network and computer systems administrators* and *computer network architects* typically require a bachelor's degree to enter employment, 37% of workers in the field hold a community college-level education as their highest level of educational attainment. This indicates that employers are willing to hire well-qualified community college program completers. The occupations included in the middle-skill cybersecurity occupational group are:

- Computer Network Support Specialists (SOC 15-1231)
- Computer User Support Specialists (SOC 15-1232)
- Computer Network Architects (SOC 15-1241)
- Network and Computer Systems Administrators (SOC 15-1244)

The **high-skill cybersecurity occupational group** consists of three occupations that typically require a bachelor's degree and work experience to enter employment. These occupations are displayed throughout the report to illustrate the job opportunities available to students continuing their education at a four-year university; they are not considered in the final recommendation due to the higher educational attainment requirement. The occupations included in the high-skill cybersecurity occupational group are:

- Computer Systems Analysts (SOC 15-1211)
- Information Security Analysts (SOC 15-1212)
- Database Administrators and Architects (SOC 15-1245)

Definitions, alternative job titles, education, and training requirements for the occupations in the *cybersecurity occupational group* are available in the appendix.

Job Opportunities

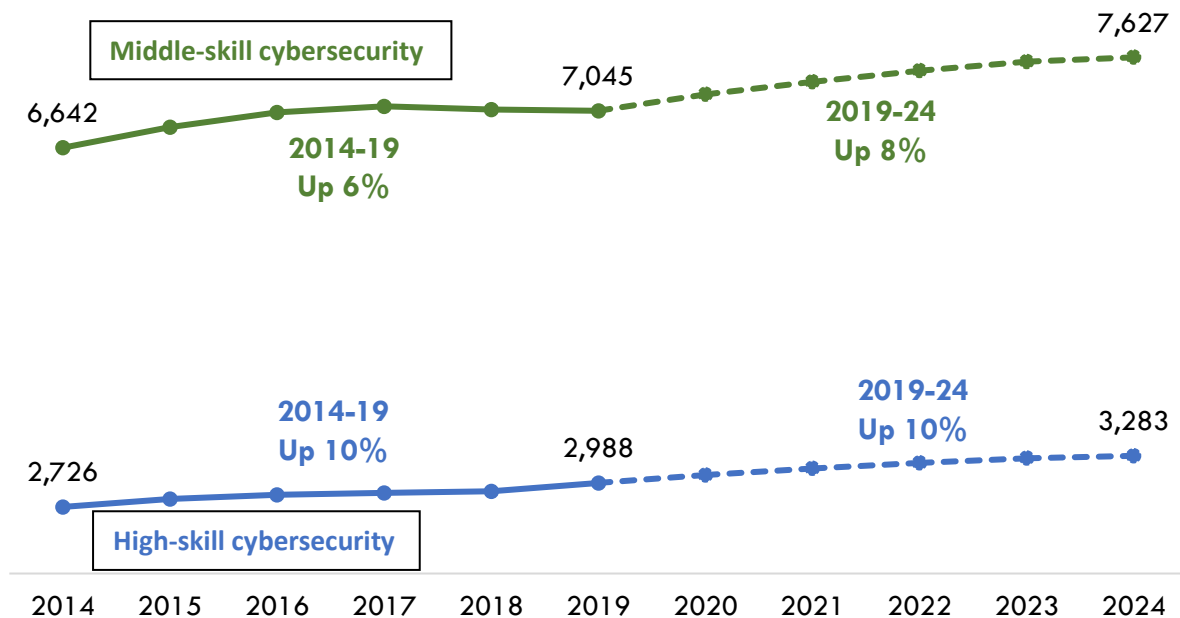
In 2019, there were 7,045 middle-skill jobs in the *cybersecurity occupational group* in the Inland Empire/Desert region (IEDR). The middle-skill occupational group is projected to increase employment by 8% through 2024. Employers are expected to have 3,444 middle-skill job openings over the next five years to fill new jobs and backfill jobs that workers are permanently vacating (includes occupational transfers and retirements). Exhibit 1 displays five-year projected job growth, and Exhibit 2 displays historical (2014 to 2019) and projected (2019-2024) jobs for the *cybersecurity occupational group*.

Exhibit 1: Five-year projections for each occupation in the cybersecurity occupational group, middle-skill (green) and high-skill (blue)

Occupation	2019 Jobs	2024 Jobs	5-Yr % Change (New Jobs)	5-Yr Openings (New + Replacement Jobs)	Annual Openings (New + Replacement Jobs)	% of workers age 55+
Computer User Support Specialists	3,569	3,914	10%	1,877	375	16%
Network and Computer Systems Administrators	1,737	1,861	7%	755	151	14%
Computer Network Support Specialists	1,060	1,148	8%	540	108	16%
Computer Network Architects	678	705	4%	273	55	13%
Middle-Skill Subtotal	7,045	7,627	8%	3,444	689	15%
Computer Systems Analysts	2,130	2,309	8%	979	196	20%
Database Administrators and Architects	558	612	10%	261	52	20%
Information Security Analysts	300	363	21%	179	36	~12%
High-Skill Occupations	2,988	3,283	10%	1,419	284	20%
Total	10,033	10,910	9%	4,863	973	16%

Source: EMSI 2020.3

Exhibit 2: Historical and projected jobs for the cybersecurity occupational groups, 2014 – 2024, middle-skill (green) and high-skill (blue)



Source: EMSI 2020.3

Job Postings

This section of the report aims to determine employer demand for cybersecurity workers by analyzing job posting information. The occupations in the *cybersecurity occupational group* contain a diverse array of work activities that may be unrelated to cybersecurity. To ensure that job posting information reflects cybersecurity-specific jobs, Burning Glass’s cybersecurity filter was applied to this job posting search. Burning Glass’s cybersecurity filter allows for analysis across industries through the selection of job postings with job titles, in-demand skills, and certifications that are specific to cybersecurity (Burning Glass, 2015).

Exhibit 3 displays the number of job ads for the *cybersecurity occupational group* posted over the last 12 months, along with the regional and statewide average time to fill. To ensure that there were enough job postings from which to obtain employer job posting information, the Los Angeles/Orange County (LA/OC) region was included in this job posting search. The LA/OC region contained 14 times more job postings than the IEDR over the last 12 months.

On average, local employers fill online job postings for the *cybersecurity occupational group* within 39 days. This regional average is eight days shorter than the statewide average of 47 days, indicating that local employers face fewer challenges when looking to fill these positions than other employers in California as a whole.

Exhibit 3: Job ads and time to fill for the cybersecurity occupational group, middle-skill (green) and high-skill (blue)

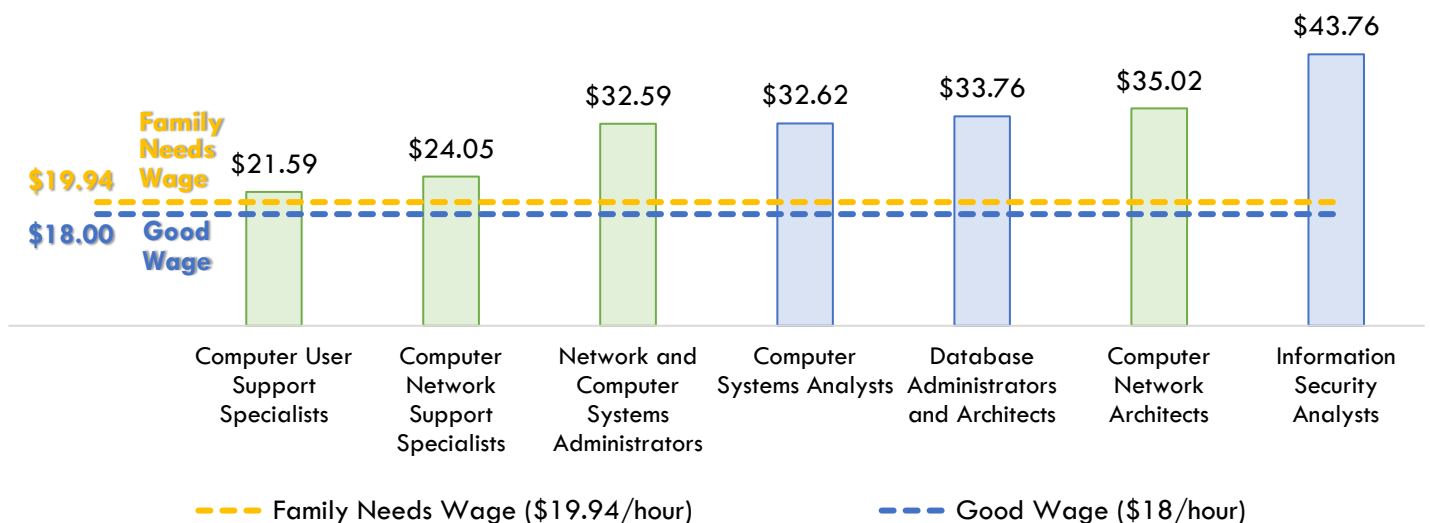
Occupation	Job Ads	Regional Average Time to Fill (Days)	California Average Time to Fill (Days)
Network and Computer Systems Administrators	1,303	39	46
Computer Network Architects	1,096	41	49
Computer User Support Specialists	788	28	33
Computer Network Support Specialists	156	28	33
Middle-Skill Subtotal	3,343	37	43
Information Security Analysts	5,911	41	49
Computer Systems Analysts	4,68	37	44
Database Administrators	278	36	43
High-Skill Subtotal	6,657	41	49
Total	10,000	39	47

Earnings and Benefits

Community colleges should ensure their training programs lead to employment opportunities that provide a self-sustainable level of income. The Brookings Institute in their Advancing Opportunity in California's Inland Empire report found that a "good job" wage in the region is above \$18.00 per hour, or \$37,440 per year (Shearer, Shah & Gootman, p. 25). The Family Needs Calculator estimates that a self-sustainable wage for a single adult with one school-age child is \$19.94 per hour (Pearce & Manzer, 2019).

Entry-level wages for the *cybersecurity occupational group* surpass the Brookings Institute's "good job" wage as well as the Family Needs Calculator self-sustainability rate. Exhibit 4 displays the hourly earnings for each occupation in the IEDR. Middle-skill occupations appear in green and high-skill occupations appear in blue.

Exhibit 4: Entry-Level hourly earnings for the cybersecurity occupational group, middle-skill (green) and high-skill (blue)



Source: EMSI 2020.3

According to the occupational guides developed by the California Labor Market Information Division, benefits for the *cybersecurity occupational group* often include medical, dental, and life insurance as well as vacation, sick leave, and retirement plans (Detailed Occupational Guides, 2020).

Employers, Skills, Education, and Work Experience

Exhibit 5 displays the employers posting the most job ads for the *cybersecurity occupational group* in the LA/OC and IEDR combined region. Middle-skill jobs are displayed in green above the black line, and high-skill jobs are shown in blue below the black line.

Exhibit 5: Employers posting the most job ads for the cybersecurity occupations, middle-skill (green) and high-skill (blue)

Occupation	Employers
Network and Computer Systems Administrators (n=878)	<ul style="list-style-type: none"> • Northrop Grumman • ManTech International • Lockheed Martin Corporation
Computer Network Architects (n=662)	<ul style="list-style-type: none"> • Aerospace Corporation • Lockheed Martin Corporation • IBM • Booz Allen Hamilton Inc.
Computer User Support Specialists (n=500)	<ul style="list-style-type: none"> • General Dynamics • Science Applications International Corporation (SAIC) • ManTech International • University of California, Los Angeles (UCLA)
Computer Network Support Specialists (n=118)	<ul style="list-style-type: none"> • Northrop Grumman • Edison International • The Boeing Company
Information Security Analysts (n=4,490)	<ul style="list-style-type: none"> • Northrop Grumman • Deloitte • The Boeing Company • Disney • KPMG • Raytheon • Aerospace Corporation • ManTech International • City National Bank • IBM
Computer Systems Analysts (n=306)	<ul style="list-style-type: none"> • Northrop Grumman • Raytheon
Database Administrators (n=156)	<ul style="list-style-type: none"> • BRIDG • VSolvit, Inc. • Microsoft Corporation • Disney

Source: Burning Glass – Labor Insights

Exhibit 6 displays a sample of specialized, employability, and software and programming skills that employers are seeking when looking for workers to fill positions in the *cybersecurity occupational group*. Specialized skills are occupation-specific skills that employers are requesting for industry or job competency. Employability skills are foundational skills that transcend industries and occupations; this category is often referred to as "soft skills." The skills requested in job postings may be utilized as a helpful guide for curriculum development. Middle-skill jobs are displayed above the black line, and high-skill jobs are displayed below the black line.

Exhibit 6: Sample of in-demand skills from employer job ads for the cybersecurity occupational group, middle-skill (green) and high-skill (blue)

Occupation	Specialized Skills	Employability Skills	Software and Programming Skills
Network and Computer Systems Administrators (n=1,302)	<ul style="list-style-type: none"> Hardware and Software Configuration Configuration Management Information Security 	<ul style="list-style-type: none"> Troubleshooting Problem Solving Communication Skills 	<ul style="list-style-type: none"> Linux VMware Microsoft Operation Systems Splunk
Computer Network Architects (n=1,096)	<ul style="list-style-type: none"> Network Engineering Network Security Network Infrastructure 	<ul style="list-style-type: none"> Troubleshooting Communication Skills Planning 	<ul style="list-style-type: none"> Border Gateway Protocol Cisco Switching Virtual Private Networking (VPN)
Computer User Support Specialists (n=787)	<ul style="list-style-type: none"> Technical Support Customer Service Information Security Network Security 	<ul style="list-style-type: none"> Troubleshooting Communication Skills Problem Solving 	<ul style="list-style-type: none"> Microsoft Office Virtual Private Networking (VPN) Voice over IP (VoIP)
Computer Network Support Specialists (n=154)	<ul style="list-style-type: none"> System Administration Network Security Network Troubleshooting 	<ul style="list-style-type: none"> Troubleshooting Communication Skills Problem Solving 	<ul style="list-style-type: none"> Linux VMware Virtual Private Networking (VPN)
Information Security Analysts (n=5,697)	<ul style="list-style-type: none"> Information Systems Network Security Cryptography Project Management 	<ul style="list-style-type: none"> Communication Skills Teamwork/ Collaboration Research 	<ul style="list-style-type: none"> Linux Vulnerability Assessment Python
Computer Systems Analysts (n=465)	<ul style="list-style-type: none"> Information Security Project Management Information Systems 	<ul style="list-style-type: none"> Communication Skills Teamwork/ Collaboration Troubleshooting 	<ul style="list-style-type: none"> SQL Oracle SAP Enterprise Resource Planning (ERP)
Database Administrators (n=278)	<ul style="list-style-type: none"> Information Security Cryptography Disaster Recovery Planning 	<ul style="list-style-type: none"> Troubleshooting Planning Communication Skills 	<ul style="list-style-type: none"> SQL Oracle Teradata DBA Python

Source: Burning Glass – Labor Insights

Exhibit 7 displays the entry-level education typically required to enter each occupation according to the Bureau of Labor Statistics (BLS), educational attainment for incumbent workers with "some college, no degree" and an "associate degree" according to the U.S. Census (2016-17) and the real-time minimum advertised education requirement from employer job ads. Middle-skill jobs are displayed above the black line, and high-skill jobs are displayed below the black line.

Exhibit 7: Typical entry-level education, educational attainment, and minimum advertised education requirements for the cybersecurity occupational group, middle-skill (green) and high-skill (blue)

Occupation	Typical Entry-Level Education Requirement	CC-Level Educational Attainment*	Real-Time Minimum Advertised Education Requirement			
			Number of Job Ads	High school diploma or vocational training	Associate degree	Bachelor's degree or higher
Network and Computer Systems Administrators	Bachelor's degree	37%	866	12%	6%	82%
Computer Network Architects	Bachelor's degree	37%	659	5%	2%	93%
Computer User Support Specialists	Some college, no degree	41%	526	36%	15%	49%
Computer Network Support Specialists	Associate degree	41%	121	19%	4%	77%
Information Security Analysts	Bachelor's degree	27%	4,013	9%	2%	89%
Computer Systems Analysts	Bachelor's degree	21%	358	4%	3%	93%
Database Administrators	Bachelor's degree	22%	189	3%	4%	93%

Source: EMSI 2020.3, Burning Glass – Labor Insights

*Percentage of incumbent workers with a Community College Credential or Some Postsecondary Coursework

Exhibit 8 displays the work experience typically required to enter each occupation and the real-time work experience requirements from employer job ads. Middle-skill jobs are displayed above the black line and high-skill jobs are displayed below the black line.

Exhibit 8: Work experience required and real-time work experience requirements for the cybersecurity occupational group, middle-skill (green) and high-skill (blue)

Occupation	Work Experience Typically Required	Real-Time Work Experience			
		Number of Job Ads	0 – 2 years	3 – 5 years	6+ years
Network and Computer Systems Administrators	None	998	11%	40%	49%
Computer Network Architects	5 years or more	892	9%	49%	42%
Computer User Support Specialists	None	627	47%	40%	14%

Occupation	Work Experience Typically Required	Real-Time Work Experience			
		Number of Job Ads	0 – 2 years	3 – 5 years	6+ years
Computer Network Support Specialists	None	134	15%	45%	40%
Information Security Analysts	Less than 5 years	4,436	14%	47%	39%
Computer Systems Analysts	None	381	21%	54%	25%
Database Administrators	None	208	17%	45%	38%

Source: EMSI 2020.3, Burning Glass – Labor Insights

Certifications

Exhibit 9 displays the certifications required by employers posting job ads for the *cybersecurity occupational group* in the LA/OC and IEDR combined region. Nearly half (47%) of the job advertisements with certification information were seeking candidates with their Certified Information Systems Security Professional (CISSP) certification. The CISSP certification is issued by (ISC)², which is a nonprofit organization that aims to provide standardization and certifications for the cybersecurity industry. To qualify for the CISSP certification, an individual must pass the exam as well as have at least five years of cumulative, paid work experience in a related field. For more information regarding the CISSP certification, visit the (ISC)² website ((ISC)²,2020).

Exhibit 9: Certifications most frequently required by employers posting cybersecurity advertisements for the cybersecurity occupational group, middle-skill (green) and high-skill (blue)

Occupations	Certifications
Network and Computer Systems Administrators (n=724)	<ul style="list-style-type: none"> • CompTIA Security+ • Certified Information Systems Security Professional (CISSP) • CompTIA Advanced Security Practitioner (CASP)
Computer Network Architects (n=756)	<ul style="list-style-type: none"> • Cisco Certified Network Professional (CCNP) • Cisco Certified Network Associate (CCNA) • Cisco Certified Internetwork Expert (CCIE)
Computer User Support Specialists (n=384)	<ul style="list-style-type: none"> • Certified A+ Technician • CompTIA Network+ • CompTIA Security+
Computer Network Support Specialists (n=113)	<ul style="list-style-type: none"> • CompTIA Security+ • Certified Information Systems Security Professional (CISSP)

Occupations	Certifications
Information Security Analysts (n=3,400)	<ul style="list-style-type: none"> • Certified Information Systems Security Professional (CISSP) • GIAC Cyber Defense Certification • Certified Information Security Manager (CISM)
Computer Systems Analysts (n=160)	<ul style="list-style-type: none"> • Certified Information Systems Security Professional (CISSP) • Certified Information Systems Security Professional Auditor (CISA)
Database Administrators (n=77)	<ul style="list-style-type: none"> • Certified Information Systems Security Professional (CISSP) • Microsoft Certified Solutions Associate (MCSA)

Source: Burning Glass – Labor Insights

Student Completions and Program Outcomes

Exhibit 10 displays the annual average completion data for the California Community College computer infrastructure and support (0708.00) programs based on the most recent three academic years.

Exhibit 10: 2016-19, Annual average community college credentials for the computer infrastructure and support program in the IEDR

0708.00 – Computer Infrastructure and Support	Certificate requiring 6 to <18 semester units	CCC Annual Average Credentials, Academic Years 2016-19
Chaffey	0	0
Crafton Hills	0	0
Moreno Valley	0	0
Mt. San Jacinto	1	1
Total	1	1

Source: MIS Data Mart

California program outcome data may provide a useful insight into the likelihood of success for the proposed program. Community college student outcome information based on the selected TOP codes and region is provided in Exhibit 11. Dashes indicate that there were too few students to obtain reliable program outcome information. The outcome methodology is available in the appendix section of this report.

Exhibit 11: 0708.00 – Computer infrastructure and support strong workforce program outcomes

Strong Workforce Program Metrics: 0708.00 – Computer Infrastructure and Support Academic Year 2017-18, unless noted otherwise	Inland Empire/Desert Region	California
Unduplicated count of enrolled students (2018-19)	183	5,571
Completed 9+ career education units in one year (2018-19)	54%	42%

Strong Workforce Program Metrics: 0708.00 – Computer Infrastructure and Support Academic Year 2017-18, unless noted otherwise	Inland Empire/Desert Region	California
Perkins Economically disadvantaged students (2018-19)	146	3973
Students who attained a noncredit workforce milestone in a year (2018-19)	-	42%
Students who earned a degree, certificate, or attained apprenticeship (2018-19)	-	225
Transferred to a four-year institution (transfers)	-	286
Job closely related to the field of study (2016-17)	-	69%
Median annual earnings (all exiters)	\$40,978	\$44,496
Median change in earnings (all exiters)	28%	21%
Attained a living wage (completers and skills-builders)	81%	64%

Sources: LaunchBoard Community College Pipeline and Strong Workforce Program Metrics

Other Regional Cybersecurity Programs

The California Community College Taxonomy of Programs does not have a program code specific to cybersecurity. As a result, it is up to the discretion of community colleges as to where their cybersecurity programs are coded. While four regional colleges utilize the computer infrastructure and support (0708.00) program code, there are other cybersecurity programs in the region that utilize different program codes. Exhibit 12 displays regional cybersecurity programs not coded within computer infrastructure and support. Award data is not available for these cybersecurity programs.

Exhibit 12: Colleges and program titles for other regional cybersecurity programs

College	TOP6- Program Description	Local Program Title
Barstow	0702.00-Computer Information Systems	Computer and Cyber Security Specialist (Security+)
Desert	0701.00-Information Technology, General	Security+ Preparatory
Moreno Valley	0708.20-Computer Support	Computer Maintenance and Security
Riverside	0708.10-Computer Networking	Information Security and Cyber Defense

Recommendation

Cybersecurity community college programs lead to four (4) middle-skill occupations, collectively referred to as the *cybersecurity occupational group*. These four *middle-skill cybersecurity occupations* are projected to have 689 combined annual job openings over the next five years, increasing the total number of jobs by 8%. The *computer user support specialist occupation* will have the most annual job openings, 375, and



computer network architects are expected to have the fewest, 55 annual job openings. The entry-level, 25th percentile wages for the *cybersecurity occupational group* are between \$21.59 and \$35.02 per hour, exceeding the \$19.94 per hour self-sustainable wage estimate for a single adult with one child living in this region. The typical entry-level educational requirement for the *computer user support specialist* and the *computer network support specialists* occupations is within the scope of a community college education, some college, no degree, and an associate degree. The other two middle-skill occupations typically require a bachelor's degree and the majority of employers in online job ads are requesting a bachelor's degree or higher to enter employment.

Four IEDR community colleges have cybersecurity programs coded under TOP 0708.00. Other TOPs used for cybersecurity programs include TOPs 0701.00, 0702.00, 0708.10, and 0708.20. Collectively, only one (1) certificate award was identified.

The Centers of Excellence recommends creating new or expanding existing cybersecurity programs to meet the need for more workers. Colleges should focus on the knowledge, skills, and abilities that lead to the *computer user support specialist* and *computer network support specialist* occupations due to the high number of regional job openings, self-sustainable wages, and the level of education required by employers, especially for students wanting to enter employment after completing a community college program. Other cybersecurity occupations are a good investment for four-year transfer programs. Colleges should meet with relevant employers to understand their demand for more workers and the specific skills, licensing, and credentials needed for gainful employment in this field.

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References

- Burning Glass Technologies. (2020). *Labor Insights/Jobs*. Retrieved from <https://www.burning-glass.com/>
- Burning Glass Technologies. (2015). Burning Glass Filter Descriptions. Retrieved from <https://www.burning-glass.com/research-project/cybersecurity/>
- California Community Colleges Chancellor's Office. LaunchBoard. (2020). *California Community Colleges LaunchBoard*. Retrieved from <https://www.calpassplus.org/Launchboard/Home.aspx>
- California Community Colleges Chancellor's Office. LaunchBoard. (2020a). *Strong Workforce Program Metrics Data Element Dictionary*. Pg. 3. Retrieved from <https://www.calpassplus.org/MediaLibrary/calpassplus/launchboard/Documents/SWP-DED.PDF>
- California Community Colleges Chancellor's Office. (2020). *Chancellor's Office Curriculum Inventory (COCI), version 3.0*. Retrieved from <https://coci2.ccctechcenter.org/programs>
- California Community Colleges Chancellor's Office Management Information Systems (MIS) Data Mart. (2020). *Data Mart*. Retrieved from <https://datamart.cccco.edu/datamart.aspx>
- California Community Colleges Chancellor's Office, Curriculum and Instructional Unit, Academic Affairs Division. (2012). *Taxonomy of Programs, 6th Edition, Corrected Version*. Retrieved from <https://www.cccco.edu/-/media/CCCCO-Website/About-Us/Divisions/Digital-Innovation-and-Infrastructure/Research/Files/TOPmanual6200909corrected12513.ashx?la=en&hash=94C709CA83C0380828415579395A5F536736C7C1>
- Carnevale, A. P., Jayasundera, T., & Repnikov, D. (n.d.). Understanding Online Job Ads Data. Retrieved from https://cew.georgetown.edu/wp-content/uploads/2014/11/OCLM.Tech_Web.pdf
- Economic Modeling Specialists International (EMSI). (2020). *Datarun 2020.3*. Retrieved from <https://www.economicmodeling.com/>
- (ISC)². (2020.) *Certifications*. Retrieved from <https://www.isc2.org/Certifications/CISSP#collapse3>
- Labor Market Information Division. Employment Development Department of California. (2020). *Detailed Occupational Guides*. Retrieved from <https://www.labormarketinfo.edd.ca.gov/OccGuides/Search.aspx>
- National Center for O*NET Development. (2020). *O*NET OnLine*. Retrieved from <https://www.onetonline.org/>
- Pearce, D., Manzer, L. Center for Women's Welfare at the University of Washington. (2019). Retrieved from <https://insightcced.org/2018-family-needs-calculator/>
- Shearer, C., Shah, I., Gootman, M. (2019, February). Metropolitan Policy Program at Brookings. Advancing Opportunity in California's Inland Empire. *Defining Opportunity*. (pg. 25). Retrieved from https://www.brookings.edu/wp-content/uploads/2019/02/Full-Report_Opportunity-Industries_Inland-California_Final_Shearer-Shah-Gootman.pdf

Appendix: Occupation definitions, sample job titles, five-year projections for cybersecurity occupations

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

Middle-Skill

Computer Network Support Specialists (15-1231)

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

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 41%

Computer User Support Specialists (15-1232)

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

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 41%

Computer Network Architects (15-1241)

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: Design Engineer, Network Analyst, Network and Security Engineer, Network Consultant, Network Systems Consultant, Networking Systems and Distributed Systems Engineer, Solutions Architect, Telecommunications Analyst

Entry-Level Educational Requirement: Bachelor's degree

Training Requirement: None

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 37%

Network and Computer Systems Administrators (15-1244)

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

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 37%

High-Skill

Computer Systems Analysts (15-1211)

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

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 21%

Information Security Analysts (15-1212)

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: Data Security Administrator, Information Security Officer, Information Security Specialist, Information Systems Security Analyst, Information Systems Security Officer (ISSO), Information Technology Security Analyst (IT Security Analyst), Information Technology Specialist, Network Security Analyst, Security Analyst, Systems Analyst

Entry-Level Educational Requirement: Bachelor's degree

Training Requirement: None

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 27%



Database Administrators and Architects (15-1245)

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

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 22%

Methodology and Data Notes

Exhibit 10 displays the average annual regional California Community College (CCC) credentials conferred during the three academic years between 2016 and 2019, from the California Community Colleges Chancellor's Office Management Information Systems (MIS) Data Mart. Credentials are the combined total of associate degrees and certificates issued during the timeframe, divided by three in this case to calculate an annual average. This is done to minimize the effect of atypical variation that might be present in a single year.

Community college student outcome information is from LaunchBoard and based on the selected TOP code and region. These metrics are based on records submitted to the California Community Colleges Chancellor's Office Management Information Systems (MIS) by community colleges, which come from self-reported student information from CCC Apply and the National Student Clearinghouse. Employment and earnings metrics are sourced from records provided by California's Employment Development Department's Unemployment Insurance database. When available, outcomes for completers are reported to demonstrate the impact that earning a degree or certificate can have on employment and earnings. For more information on the types of students included for each metric, please see the web link for LaunchBoard's Strong Workforce Program Metrics Data Element Dictionary in the References section (LaunchBoard, 2020a). Finally, employment in a job closely related to the field of study comes from self-reported student responses on the CTE Employment Outcomes Survey (CTEOS), administered by Santa Rosa Junior College (LaunchBoard, 2020a).

Job postings data is limited to the information provided by employers and the ability of artificial intelligence search engines to identify this information. Additionally, preliminary calculations by Georgetown Center on Education and the Workforce found that "just 30 to 40 percent of openings for candidates with some college or an associate degree, and only 40 to 60 percent of openings for high school diploma holders appear online" (Carnevale et al., 2014).

Table 1: 2019 to 2024 job growth, wages, education, training, and work experience required for the cybersecurity occupational group, IEDR

Occupation (SOC)	2019 Jobs	5-Yr Change	5-Yr % Change	Annual Openings (New + Replacement Jobs)	Entry-Experienced Hourly Wage Range (25 th to 75 th percentile)	Median Hourly Wage (50 th percentile)	Average Annual Earnings	Typical Entry-Level Education & On-The-Job Training Required	Work Experience Required
Computer User Support Specialists (15-1232)	3,569	345	10%	375	\$21.59 to \$36.62	\$27.81	\$62,700	Some college, no degree & None	None
Network and Computer Systems Administrators (15-1244)	1,737	124	7%	151	\$32.59 to \$50.86	\$41.02	\$87,200	Bachelor's degree & None	None
Computer Network Support Specialists (15-1231)	1,060	88	8%	108	\$24.05 to \$36.45	\$28.68	\$66,500	Associate's degree & None	None
Computer Network Architects (15-1241)	678	27	4%	55	\$35.02 to \$66.40	\$52.82	\$107,300	Bachelor's degree & None	5 years or more
Middle-Skill Subtotal	7,045	582	8%	689	-	-	-		
Computer Systems Analysts (15-1211)	2,130	179	8%	196	\$32.62 to \$52.10	\$41.22	\$91,600	Bachelor's degree & None	None
Database Administrators and Architects (15-1245)	558	54	10%	52	\$33.76 to \$61.27	\$46.69	\$98,700	Bachelor's degree & None	None
Information Security Analysts (15-1212)	300	63	21%	36	\$43.76 to \$69.37	\$55.75	\$114,800	Bachelor's degree & None	Less than 5 years
High-Skill Subtotal	2,988	295	10%	284	-	-	-	-	-
Total	10,033	877	9%	973	-	-	-	-	-

Source: EMSI 2020.3