** Routing** **and Switching (Cisco) Occupations**

**Labor Market Information Report**

**City College of San Francisco**

Prepared by the San Francisco Bay Center of Excellence

for Labor Market Research

December 2019

# Recommendation

Based on all available data, there appears to be a significant undersupply of Routing and Switching (Cisco) workers compared to the demand for this cluster of occupations in the Bay region and in the Mid-Peninsula sub-region (San Francisco and San Mateo Counties.) There is a projected annual gap of about 5,731 students in the Bay region and 2,318 students in the Mid-Peninsula Sub-Region.

This report also provides student outcomes data on employment and earnings for programs on TOP 0708.10 - Computer Networking in the state and region. It is recommended that these data be reviewed to better understand how outcomes for students taking courses on this TOP code compare to potentially similar programs at colleges in the state and region, as well as to outcomes across all CTE programs at City College of San Francisco and in the region.

# Introduction

This report profiles Routing and Switching (Cisco) Occupations in the 12 county Bay region and in the Mid-Peninsula sub-region for the review and modification of an existing program at City College of San Francisco.

|  |
| --- |
| * **Computer Network Support Specialists (SOC 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. Excludes “Network and Computer Systems Administrators” (15-1142) and “Computer Network Architects” (15-1143). |
| Entry-Level Educational Requirement: Associate's degree |
| Training Requirement: None |
| Percentage of Community College Award Holders or Some Postsecondary Coursework: 41% |
| * **Computer Network Architects (SOC 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. Excludes “Information Security Analysts” (15-1122), “Network and Computer Systems Administrators” (15-1142), and “Computer Network Support Specialists” (15-1152). |
| Entry-Level Educational Requirement: Bachelor's *degree* |
| Training Requirement: None |
| Percentage of Community College Award Holders or Some Postsecondary Coursework: 35*%* |
| * **Information Security Analysts (SOC 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. Excludes “Computer Network Architects” (15-1143). |
| Entry-Level Educational Requirement: Bachelor's *degree* |
| Training Requirement: None |
| Percentage of Community College Award Holders or Some Postsecondary Coursework: 27*%* |
|  |
|  |
| * **Network and Computer Systems Administrators** **(SOC 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. Excludes “Information Security Analysts”(15-1122), “Computer User Support Specialists” (15-1151), and “Computer Network Support Specialists” (15-1152). |
| Entry-Level Educational Requirement: Bachelor's *degree* |
| Training Requirement: None |
| Percentage of Community College Award Holders or Some Postsecondary Coursework: 38*%* |
| * **Computer Occupations, All Other (SOC 15-1199):** All computer occupations not listed separately. Excludes “Computer and Information Systems Managers” (11-3021), “Computer Hardware Engineers” (17-2061), “Electrical and Electronics Engineers” (17-2070), “Computer Science Teachers, Postsecondary” (25-1021), “Multimedia Artists and Animators” (27-1014), “Graphic Designers” (27-1024), “Computer Operators” (43-9011), and “Computer, Automated Teller, and Office Machine Repairs” (49-2011). |
| Entry-Level Educational Requirement: Bachelor's *degree* |
| Training Requirement: None |
| Percentage of Community College Award Holders or Some Postsecondary Coursework: 35*%* |

# Occupational Demand

**Table 1. Employment Outlook for Routing and Switching (Cisco) Occupations in Bay Region**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Occupation | 2018 Jobs | 2023 Jobs | 5-Yr Change | 5-Yr % Change | 5-Yr Open-ings | Average Annual Open-ings | 25% Hourly Wage | Median Hourly Wage |
| Computer Network Support Specialists | 6,558 | 7,464 | 905 | 14% | 3,401 | 680 | $29.28 | $38.92 |
| Computer Network Architects | 7,692 | 8,531 | 839 | 11% | 3,394 | 679 | $48.45 | $64.71 |
| Information Security Analysts | 3,298 | 4,169 | 871 | 26% | 2,073 | 415 | $41.35 | $55.30 |
| Network and Computer Systems Administrators | 14,165 | 15,762 | 1,597 | 11% | 6,126 | 1,225 | $38.24 | $49.06 |
| Computer Occupations, All Other | 34,144 | 37,249 | 3,105 | 9% | 14,791 | 2,958 | $40.95 | $55.84 |
| **Total** | **65,858** | **73,175** | **7,317** | **11%** | **29,786** | **5,957** | **$40.10** | **$53.71** |

*Source: EMSI 2019.3*

**Bay Region** includes Alameda, Contra Costa, Marin, Monterey, Napa, San Benito, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano and Sonoma Counties

**Table 2. Employment Outlook for Routing and Switching (Cisco) Occupations in Mid-Peninsula Sub-Region**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Occupation | 2018 Jobs | 2023 Jobs | 5-Yr Change | 5-Yr % Change | 5-Yr Open-ings | Average Annual Open-ings | 25% Hourly Wage | Median Hourly Wage |
| Computer Network Support Specialists | 2,227 | 2,686 | 459 | 21% | 1,326 | 265 | $33.32 | $42.29 |
| Computer Network Architects | 2,427 | 2,887 | 460 | 19% | 1,284 | 257 | $51.67 | $65.39 |
| Information Security Analysts | 1,222 | 1,648 | 426 | 35% | 883 | 177 | $47.55 | $61.05 |
| Network and Computer Systems Administrators | 4,470 | 5,282 | 812 | 18% | 2,272 | 454 | $41.38 | $51.93 |
| Computer Occupations, All Other | 12,658 | 14,399 | 1,741 | 14% | 6,139 | 1,228 | $42.44 | $55.57 |
| **TOTAL** | **23,004** | **26,901** | **3,897** | **17%** | **11,904** | **2,381** | **$42.59** | **$54.90** |

*Source: EMSI 2019.3*

**Mid-Peninsula Sub-Region** includes San Francisco and San Mateo Counties

### Job Postings in Bay Region and Mid-Peninsula Sub-Region

**Table 3. Number of Job Postings by Occupation for latest 12 months (December 2018 - November 2019)**

| Occupation | Bay Region | Mid-Peninsula |
| --- | --- | --- |
| Computer Systems Engineers/Architects | 25,341 | 8,989 |
| Information Technology Project Managers | 16,841 | 6,887 |
| Software Quality Assurance Engineers and Testers | 14,464 | 4,556 |
| Business Intelligence Analysts | 13,800 | 5,714 |
| Information Security Analysts | 9,459 | 3,888 |
| Network and Computer Systems Administrators | 8,000 | 2,669 |
| Computer Network Architects | 6,119 | 1,947 |
| Database Architects | 3,753 | 1,387 |
| Data Warehousing Specialists | 2,501 | 930 |
| Computer Occupations, All Other | 2,456 | 1,055 |
| Document Management Specialists | 1,450 | 541 |
| Computer Network Support Specialists | 1,330 | 457 |
| Video Game Designers | 1,295 | 676 |
| Search Marketing Strategists | 1,173 | 676 |
| Geospatial Information Scientists and Technologists | 801 | 302 |
| Telecommunications Engineering Specialists | 476 | 147 |
| Web Administrators | 394 | 203 |
| Geographic Information Systems Technicians | 137 | 46 |
| **Total** | **109,790** | **41,070** |

*Source: Burning Glass*

**Table 4a. Top Job Titles for Routing and Switching (Cisco) Occupations for latest 12 months (December 2018 - November 2019) Bay Region**

|  |  |  |  |
| --- | --- | --- | --- |
| Common Title | Bay | Common Title | Bay |
| Data Analyst | 4,999 | Machine Learning Engineer | 1,039 |
| Systems Engineer | 4,379 | Sap Consultant | 975 |
| Solutions Architect | 3,617 | Project Manager | 958 |
| Quality Assurance Engineer | 3,307 | Business Intelligence Analyst | 782 |
| Network Engineer | 3,027 | Software Quality Assurance Engineer | 777 |
| Software Development Engineer | 2,480 | Quality Assurance Analyst | 777 |
| Security Engineer | 2,265 | Security Analyst | 773 |
| Systems Administrator | 1,732 | Quality Assurance Tester | 720 |
| Senior Systems Engineer | 1,466 | Software Test Engineer | 642 |
| Firmware Engineer | 1,374 | Architect | 560 |
| Data Architect | 1,225 | Technical Architect | 546 |
| Information Technology Project Manager | 1,211 | Java Architect | 532 |
| Technical Project Manager | 1,161 | Scrum Master | 526 |
| Information Technology Manager | 1,079 | Business Data Analyst | 521 |

**Table 4b. Top Job Titles for Routing and Switching (Cisco) Occupations for latest 12 months (December 2018 - November 2019) Mid-Peninsula Sub-Region**

|  |  |  |  |
| --- | --- | --- | --- |
| Common Title | Mid-Peninsula | Common Title | Mid-Peninsula |
| Data Analyst | 2,378 | Firmware Engineer | 371 |
| Solutions Architect | 1,533 | Quality Assurance Analyst | 370 |
| Systems Engineer | 1,150 | Project Manager | 369 |
| Security Engineer | 1,033 | Business Intelligence Analyst | 323 |
| Quality Assurance Engineer | 934 | Security Analyst | 308 |
| Network Engineer | 907 | Enterprise Architect | 272 |
| Software Development Engineer | 836 | Technology Manager | 255 |
| Systems Administrator | 628 | Scrum Master | 246 |
| Information Technology Project Manager | 504 | Architect | 223 |
| Machine Learning Engineer | 498 | Quality Assurance Tester | 221 |
| Information Technology Manager | 498 | Java Architect | 213 |
| Data Architect | 453 | Technical Architect | 209 |
| Senior Systems Engineer | 450 | Sap Consultant | 208 |
| Technical Project Manager | 422 | Infrastructure Engineer | 196 |

*Source: Burning Glass*

# Industry Concentration

**Table 5. Industries hiring Routing and Switching (Cisco) Workers in Bay Region**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Industry – 6 Digit NAICS (No. American Industry Classification) Codes | Jobs in Industry (2018) | Jobs in Industry (2022) | % Change (2018-22) | % in Industry (2018) |
| Custom Computer Programming Services (541511) | 13,018 | 15,079 | 16% | 20% |
| Computer Systems Design Services (541512) | 7,831 | 8,690 | 11% | 12% |
| Internet Publishing and Broadcasting and Web Search Portals (519130) | 3,997 | 5,062 | 27% | 6% |
| Software Publishers (511210) | 3,511 | 4,291 | 22% | 6% |
| Data Processing, Hosting, and Related Services (518210) | 3,266 | 4,307 | 32% | 5% |
| Corporate, Subsidiary, and Regional Managing Offices (551114) | 2,911 | 3,104 | 7% | 4% |
| Federal Government, Civilian, Excluding Postal Service (901199) | 2,097 | 2,042 | -3% | 3% |
| Other Computer Related Services (541519) | 1,846 | 2,216 | 20% | 3% |
| Electronic Computer Manufacturing (334111) | 1,729 | 1,846 | 7% | 3% |
| Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology) (541715) | 1,103 | 1,184 | 7% | 2% |
| Local Government, Excluding Education and Hospitals (903999) | 1,084 | 1,122 | 4% | 2% |
| Temporary Help Services (561320) | 1,032 | 1,080 | 5% | 2% |
| Wired Telecommunications Carriers (517311) | 880 | 788 | -10% | 1% |
| Colleges, Universities, and Professional Schools (State Government) (902612) | 782 | 802 | 3% | 1% |
| Colleges, Universities, and Professional Schools (611310) | 728 | 787 | 8% | 1% |
| Engineering Services (541330) | 696 | 752 | 8% | 1% |
| Administrative Management and General Management Consulting Services (541611) | 663 | 790 | 19% | 1% |
| Research and Development in Biotechnology (except Nanobiotechnology) (541714) | 626 | 831 | 33% | 1% |

*Source: EMSI 2019.3*

**Table 6. Top Employers Posting Routing and Switching (Cisco) Occupations in Bay Region and Mid-Peninsula Sub-Region (December 2018 - November 2019)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Employer | Bay | Employer | Bay | Employer | Mid-Peninsula |
| Python | 23,727 | UNIX | 7,076 | Machine Learning | 5,276 |
| SQL | 18,973 | Scheduling | 6,959 | Big Data | 5,228 |
| Project Management | 18,826 | JavaScript | 6,887 | Tableau | 5,203 |
| Linux | 16,161 | Cisco | 6,767 | Product Management | 5,086 |
| Java | 15,402 | Systems Engineering | 6,760 | Network Engineering | 5,002 |
| Quality Assurance and Control | 13,860 | Atlassian JIRA | 6,671 | Project Planning and Development Skills | 4,949 |
| Software Development | 13,575 | System Administration | 6,479 | Software as a Service | 4,874 |
| Data Analysis | 9,965 | Business Process | 6,443 | Data Warehousing | 4,826 |
| Software Engineering | 9,449 | DevOps | 6,204 | Product Development | 4,790 |
| Customer Service | 8,496 | Information Systems | 5,927 | PERL Scripting Language | 4,744 |
| Oracle | 8,117 | Information Security | 5,910 | Extraction Transformation and Loading (ETL) | 4,689 |
| Budgeting | 7,680 | Debugging | 5,895 | Git | 4,634 |
| Scrum | 7,429 | VMware | 5,881 | Salesforce | 4,615 |
| C++ | 7,240 | Virtualization | 5,719 | Transmission Control Protocol / Internet Protocol ( | 4,418 |
| SAP | 7,142 | Technical Support | 5,326 | Apache Hadoop | 4,412 |
| Python | 23,727 | UNIX | 7,076 | Machine Learning | 5,276 |
| SQL | 18,973 | Scheduling | 6,959 | Big Data | 5,228 |

*Source: Burning Glass*

# Educational Supply

There are 15 community colleges in the Bay Region issuing 226 awards on average annually (last 3 years) on TOP 0708.10 - Computer Networking. There are two colleges in the Mid-Peninsula Sub-Region issuing 63 awards on average annually (last 3 years) on this TOP code.

**Table 7. Awards on TOP 07081.0 - Computer Networking in Bay Region**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| College | Sub-Region | Associates | Certificate 18+ units | Certificate Low unit | Total |
| Cabrillo College | Santa Cruz-Monterey | 3 |  |  | 3 |
| City College of San Francisco | Mid-Peninsula |  | 1 | 48 | 49 |
| Contra Costa College | East Bay | 3 |  | 13 | 16 |
| De Anza College | Silicon Valley | 13 | 3 | 8 | 24 |
| Diablo Valley College | East Bay | 7 | 2 | 0 | 9 |
| Foothill College | Silicon Valley | 1 |  |  | 1 |
| Gavilan College | Santa Cruz-Monterey | 4 | 2 |  | 6 |
| Las Positas College | East Bay | 4 | 1 |  | 5 |
| Los Medanos College | East Bay | 8 | 5 | 3 | 16 |
| Mission College | Silicon Valley | 14 | 6 | 9 | 29 |
| Monterey Peninsula College | Santa Cruz-Monterey |  | 1 | 1 | 2 |
| Ohlone College | East Bay | 3 | 4 | 12 | 19 |
| San Jose City College | Silicon Valley | 8 | 6 | 2 | 16 |
| Santa Rosa Junior College | North Bay |  |  | 23 | 23 |
| Skyline College | Mid-Peninsula | 7 | 1 |  | 8 |
| **Total Bay Region** | | **75** | **31** | **120** | **226** |
| **Total Mid-Peninsula Sub-Region** | | **24** | **11** | **28** | **63** |

# *Source: Data Mart*

Note: The annual average for awards is 2015-16 to 2017-18.

# Gap Analysis

Based on the data included in this report, there is a large labor market gap in the Bay region with 5,957 annual openings for the Routing and Switching (Cisco) occupational cluster and 226 annual (3-year average) awards for an annual undersupply of 5,731 students. In the Mid-Peninsula Sub-Region, there is also a gap with 2,381 annual openings and 63 annual (3-year average) awards for an annual undersupply of 2,318 students.

# Student Outcomes

**Table 8. Four Employment Outcomes Metrics for Students Who Took Courses on TOP 0708.10 - Computer Networking**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 2015-16 | Bay  (All CTE Programs) | City College of San Francisco (All CTE Programs) | State (07081.0) | Bay (0708.10) | Mid-Peninsula (0708.10) | City College of San Francisco (0708.10) |
| % Employed Four Quarters After Exit | 74% | 72% | 72% | 74% | 73% | 74% |
| Median Quarterly Earnings Two Quarters After Exit | $10,550 | $10,170 | $26,672 | $28,862 | $12,411 | $12,482 |
| Median % Change in Earnings | 46% | 31% | 40% | 45% | 38% | 38% |
| % of Students Earning a Living Wage | 63% | 65% | 70% | 74% | 70% | 70% |

*Source: Launchboard Pipeline (version available on 12/2/19)*

# Skills, Certifications and Education

**Table 9. Top Skills for Routing and Switching (Cisco) Occupations in Bay Region (December 2018 - November 2019)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Skill | Postings | Skill | Postings | Skill | Postings |
| Python | 23,727 | UNIX | 7,076 | Machine Learning | 5,276 |
| SQL | 18,973 | Scheduling | 6,959 | Big Data | 5,228 |
| Project Management | 18,826 | JavaScript | 6,887 | Tableau | 5,203 |
| Linux | 16,161 | Cisco | 6,767 | Product Management | 5,086 |
| Java | 15,402 | Systems Engineering | 6,760 | Network Engineering | 5,002 |
| Quality Assurance and Control | 13,860 | Atlassian JIRA | 6,671 | Project Planning and Development Skills | 4,949 |
| Software Development | 13,575 | System Administration | 6,479 | Software as a Service (SaaS) | 4,874 |
| Data Analysis | 9,965 | Business Process | 6,443 | Data Warehousing | 4,826 |
| Software Engineering | 9,449 | DevOps | 6,204 | Product Development | 4,790 |
| Customer Service | 8,496 | Information Systems | 5,927 | PERL Scripting Language | 4,744 |
| Oracle | 8,117 | Information Security | 5,910 | Extraction Transformation and Loading (ETL) | 4,689 |
| Budgeting | 7,680 | Debugging | 5,895 | Git | 4,634 |
| Scrum | 7,429 | VMware | 5,881 | Salesforce | 4,615 |
| C++ | 7,240 | Virtualization | 5,719 | Transmission Control Protocol / Internet Protocol (TCP / IP) | 4,418 |
| SAP | 7,142 | Technical Support | 5,326 | Apache Hadoop | 4,412 |

*Source: Burning Glass*

**Table 10. Certifications for Routing and Switching (Cisco) Occupations in Bay Region (December 2018 - November 2019)**

Note: 84% of records have been excluded because they do not include a certification. As a result, the chart below may not be representative of the full sample.

|  |  |  |  |
| --- | --- | --- | --- |
| Certification | Postings | Certification | Postings |
| Project Management Certification | 3,509 | Certified ScrumMaster (CSM) | 1,065 |
| Certified Information Systems Security Professional (CISSP) | 3,067 | CompTIA Security+ | 862 |
| Project Management Professional (PMP) | 2,272 | ITIL Certification | 645 |
| IT Infrastructure Library (ITIL) Certification | 2,231 | Microsoft Certified Solutions Expert (MCSE) | 607 |
| Cisco Certified Network Associate (CCNA) | 1,674 | Microsoft Certified Solutions Associate (MCSA) | 593 |
| Certified Information Systems Auditor (CISA) | 1,527 | Information Systems Certification | 563 |
| Cisco Certified Network Professional (CCNP) | 1,519 | Certified in Risk and Information Systems Control | 508 |
| SANS/GIAC Certification | 1,382 | GIAC Certified Incident Handler (GCIH) | 355 |
| Security Clearance | 1,346 | Certified A+ Technician | 340 |
| Cisco Certified Internetwork Expert (CCIE) | 1,237 | Cisco Certified Security Professional | 323 |
| Driver's License | 1,226 | GIAC Security Essentials (GSEC) | 290 |
| Certified Information Security Manager (CISM) | 1,210 | Certified Scrum Professional (CSP) | 289 |

*Source: Burning Glass*

**Table 11. Education Requirements for Routing and Switching (Cisco) Occupations in Bay Region**

Note: 44% of records have been excluded because they do not include a degree level. As a result, the chart below may not be representative of the full sample.

|  |  |  |
| --- | --- | --- |
| Education (minimum advertised) | Latest 12 Mos. Postings | Percent 12 Mos. Postings |
| High school or vocational training | 2,180 | 4% |
| Associate Degree | 1,203 | 2% |
| Bachelor’s Degree or Higher | 53,486 | 94% |

*Source: Burning Glass*

# Methodology

Occupations for this report were identified by use of skills listed in O\*Net descriptions and job descriptions in Burning Glass. Labor demand data is sourced from Economic Modeling Specialists International (EMSI) occupation data and Burning Glass job postings data. Educational supply and student outcomes data is retrieved from multiple sources, including CTE Launchboard and CCCCO Data Mart.

# Sources

O\*Net Online

Labor Insight/Jobs (Burning Glass)

Economic Modeling Specialists International (EMSI)

CTE LaunchBoard [www.calpassplus.org/Launchboard/](http://www.calpassplus.org/Launchboard/)

Statewide CTE Outcomes Survey

Employment Development Department Unemployment Insurance Dataset

Living Insight Center for Community Economic Development

Chancellor’s Office MIS system

# Contacts

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