

Program Endorsement Brief: 0702.00/Computer Information Systems
Virtualization and Cloud Computing
Orange County Center of Excellence, July 2022

Summary Analysis

Program Endorsement:	Endorsed: All Criteria Met <input type="checkbox"/>	Endorsed: Some Criteria Met <input checked="" type="checkbox"/>	Not Endorsed <input type="checkbox"/>
Program Endorsement Criteria			
Supply Gap:	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/> (see comments below)	
Living Wage: (Entry-Level, 25 th)	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Education:	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Emerging Occupation(s)			
Yes <input type="checkbox"/>		No <input checked="" type="checkbox"/>	

The Orange County Center of Excellence for Labor Market Research (COE) prepared this report to provide Los Angeles/Orange County regional labor market supply and demand data related to three middle-skill occupations: *computer network support specialists* (15-1231), *computer network architects* (15-1241), and *network and computer systems administrators* (15-1244), and one above-middle-skill occupation: *computer and information systems managers* (11-3021). Middle-skill occupations typically require some postsecondary education, but less than a bachelor’s degree.¹

Although each of the middle-skill occupations in this report typically require a bachelor’s degree, they are considered middle-skill because approximately one-third of workers in the field have completed some college or an associate degree as their highest level of education. The above middle-skill occupation *computer and information systems managers* is included because it is a pathway occupation for the middle-skill occupations included in this report and is directly related to virtualization and cloud computing. However, program endorsement will be based solely on the labor market information for the three middle-skill occupations. This report is intended to help determine whether there is demand in the local labor market that is not being met by the supply from community college programs that align with the relevant occupations.

Based on the available data there does not appear to be a supply gap for these middle-skill computer and networking occupations in the region. However, computing, software development, and networking educational programs train for numerous occupations that are not included in this report; therefore, supply is overstated for these three middle-skill occupations and the COE is unable to quantify the supply solely for these occupations. Though each of the middle-skill occupations in this report typically require a bachelor’s degree, more than one-third of workers in the field have completed some college or an associate degree as their highest level of education. Furthermore, entry-level wages exceed the living wage in both Los Angeles and Orange counties.

¹ The COE classifies middle-skill jobs as the following:

- All occupations that require an educational requirement of some college, associate degree or apprenticeship;
- All occupations that require a bachelor’s degree, but also have more than one-third of their existing labor force with an educational attainment of some college or associate degree; or
- All occupations that require a high school diploma or equivalent or no formal education, but also require short- to long-term on-the-job training where multiple community colleges have existing programs.

Therefore, due to some of the criteria being met, the COE endorses this proposed program.

Detailed reasons include:

Demand:

- **Supply Gap Criteria** – Over the next five years, there is projected to be **1,503 middle-skill jobs available annually** in the region due to new job growth and replacements, *which is less than the 3,579 awards conferred annually* by educational institutions in the region.
 - However, the educational programs included in this report train for at least 12 other computing, software development, and networking occupations that are not included in this report. Therefore, **the labor supply for the group of middle-skill computer and networking occupations included in this report is overstated.**
- **Living Wage Criteria** – Within Orange County, **all annual job openings** for the group of middle-skill computer and networking occupations **have entry-level wages above the county's living wage** (\$20.63/hour).²
- **Educational Criteria** – Within the LA/OC region, **all annual job openings** for occupations related to virtualization and cloud computing **typically require a bachelor's degree.**
 - However, the national-level educational attainment data indicates **between 37.4% and 40% of workers in the field have completed some college or an associate degree** as their highest level of education.

Supply:

- Though information technology, computer support, and computer software educational programs prepare students for employment within these virtualization and cloud computing occupations, they also train for 12 middle-skill and above middle-skill occupations that are not included in this report. Therefore, **supply for the three middle-skill virtualization and cloud computing occupations included in this report is overstated.**
 - There are **28 community colleges** in the LA/OC region that issue awards related to these virtualization and cloud computing middle-skill occupations, conferring an average of **1,172 awards annually** between 2017 and 2020.
 - Between 2016 and 2019, there was an average of **2,408 awards conferred annually** in related training programs by non-community college institutions, all of which were generated by **31 individual non-community college institutions throughout** the region.

Occupational Demand

Exhibit 1 shows the five-year occupational demand projections for the group of middle-skill virtualization and cloud computing occupations included in this report. In Los Angeles/Orange County, the number of jobs related to these occupations is projected to increase by 1% through

² Living wage data was pulled from California Family Needs Calculator on 6/10/2022. For more information, visit the California Family Needs Calculator website: <https://insightcced.org/family-needs-calculator/>.

2025. There will be more than 1,500 job openings per year through 2025 due to job growth and replacements.

Exhibit 1: Middle-skill occupational demand in Los Angeles and Orange Counties³

Geography	2020 Jobs	2025 Jobs	2020-2025 Change	2020-2025 % Change	Annual Openings
Los Angeles	15,443	15,501	58	0.4%	1,037
Orange	6,581	6,750	169	3%	467
Total	22,025	22,251	227	1%	1,503

Exhibit 2 shows the five-year occupational demand projections for the above middle-skill occupation *computer and information systems managers*. In Los Angeles/Orange County, the number of jobs related to this occupation is projected to increase by 1% through 2025. There will be more than 1,700 job openings per year through 2025 due to job growth and replacements.

Exhibit 2: Above middle-skill occupational demand in Los Angeles and Orange Counties⁴

Geography	2020 Jobs	2025 Jobs	2020-2025 Change	2020-2025 % Change	Annual Openings
Los Angeles	15,921	16,136	215	1%	1,213
Orange	6,887	7,012	125	2%	531
Total	22,808	23,148	340	1%	1,744

Wages

The labor market endorsement in this report considers the entry-level hourly wages for the group of middle-skill computer and networking occupations in Orange County as they relate to the county’s living wage. Los Angeles County wages are included below in order to provide a complete analysis of the LA/OC region. Detailed wage information, by county, is included in Appendix A.

Orange County: All annual openings for the group of middle-skill computer and networking occupations have entry-level wages above the living wage for one adult (\$20.63 in Orange County). Typical entry-level hourly wages are in a range between \$26.33 and \$40.88. Experienced workers can expect to earn wages between \$39.50 and \$70.90, which are higher than the living wage estimate. Orange County’s average wages are below the average statewide wage of \$50.75 for these occupations.

The typical entry-level hourly wages for the above middle-skill occupation *computer and information systems managers* are \$63.57, which is above the living wage for one adult (\$20.63 in Orange County). Experienced workers can expect to earn wages of \$98.34, which is higher

³ Five-year change represents new job additions to the workforce. Annual openings include new jobs and replacement jobs that result from retirements and separations.

⁴ Five-year change represents new job additions to the workforce. Annual openings include new jobs and replacement jobs that result from retirements and separations.

than the living wage estimate. Orange County's average wages are below the average statewide wage of \$94.72 for this occupation.

Los Angeles County: All annual openings for the group of middle-skill computer and networking occupations have entry-level wages above the living wage for one adult (\$18.10 in Los Angeles County). Typical entry-level hourly wages are in a range between \$26.93 and \$41.92. Experienced workers can expect to earn wages between \$40.31 and \$72.80, which are higher than the living wage estimate. Los Angeles County's average wages are below the average statewide wage of \$50.75 for these occupations.

The typical entry-level hourly wages for the above middle-skill occupation *computer and information systems managers* are \$65.63 which is above the living wage for one adult (\$18.10 in Los Angeles County). Experienced workers can expect to earn wages of \$101.61, which is higher than the living wage estimate. Los Angeles County's average wages are below the average statewide wage of \$94.72 for this occupation.

Job Postings

There were 10,207 online job postings related to the group of middle-skill computer and networking occupations listed in the past 12 months. The highest number of job postings were for systems engineers, network engineers, senior network engineers, and network administrators. The top skills were system administration, Cisco, network engineering, Linux, and VMware. The top three employers, by number of job postings, in the region were Anthem Blue Cross, Northrop Grumman, and Raytheon.

There were 2,300 online job postings related to the above middle-skill occupation *computer and information systems managers* listed in the past 12 months. The highest number of job postings were for technical directors, directors of IT, chief technology officers, IT directors and business technology solution directors. The top skills were budgeting, project management, software development, systems engineering, and information systems. The top three employers, by number of job postings, in the region were Northrop Grumman, Anthem Blue Cross, and Raytheon.

Educational Attainment

The Bureau of Labor Statistics (BLS) lists a bachelor's degree as the typical entry-level education for each of the middle-skill computer and networking occupations included in this report. In the LA/OC region, all annual job openings typically require a bachelor's degree. However, the national-level educational attainment data indicates that between 37.4% and 40% of workers in the field have completed some college or an associate degree as their highest level of education. Of the 63% of middle-skill computer and networking job postings listing a minimum education requirement in Los Angeles/Orange County, 15.9% (1,022) requested high school or vocational training, 5.8% (374) requested an associate degree, and 78.3% (4,981) requested a bachelor's degree or higher.

The Bureau of Labor Statistics (BLS) lists a bachelor's degree as the typical entry-level education for the above middle-skill occupation *computer and information systems managers*. Furthermore, the national-level educational attainment data indicates 20.8% of workers in the field have completed some college or an associate degree as their highest level of education. Of the 78% of *computer and information systems manager* job postings listing a minimum education requirement

in Los Angeles/Orange County, 5.6% (100) requested high school or vocational training, 1.1% (20) requested an associate degree, and 93.3% (1,670) requested a bachelor's degree or higher.

Educational Supply

Community College Supply—Exhibit 3 shows the three-year average number of awards conferred by community colleges in the related TOP codes: Information Technology, General (0701.00), Computer Information Systems, General (0702.00, Computer Software Development (0707.00), Computer Programming (0707.10), Computer Infrastructure and Support (0708.00), Computer Networking (0708.10), Compute Support (0708.20), and World Wide Web Administration (0709.00). The colleges with the most completions in the region are: Mt San Antonio, Long Beach and Cypress. Over the past 12 months, there were 20 other related program recommendation requests from regional community colleges.

It is important to note that the information technology, computer support, and computer software educational programs listed in Exhibit 3 may provide students with adequate training to obtain employment within the occupations included in this report. However, these programs also train for 12 other middle-skill and above middle-skill occupations not included in this report. For these reasons, supply for the middle-skill computer and networking occupations in this report is overstated.

Exhibit 3: Regional community college awards (certificates and degrees), 2017-2020

TOP Code	Program	College	2017-2018 Awards	2018-2019 Awards	2019-2020 Awards	3-Year Award Average
0701.00	Information Technology, General	East LA	15	23	10	16
		LA Harbor	6	-	-	2
		LA Mission	1	1	3	2
		Long Beach	25	34	64	41
		Mt San Antonio	79	74	90	81
		Santa Monica	-	39	-	13
		West LA	4	4	5	4
		LA Subtotal	130	175	172	159
Supply Subtotal/Average			130	175	172	159
0702.00	Computer Information Systems	Citrus	7	5	8	7
		Compton	-	1	-	0
		East LA	16	19	15	17
		El Camino	18	14	21	18
		Glendale	-	-	5	2
		LA City	4	1	1	2
		LA Mission	9	5	1	5
		LA Trade	14	8	20	14

TOP Code	Program	College	2017-2018 Awards	2018-2019 Awards	2019-2020 Awards	3-Year Award Average
		Mt San Antonio	-	-	79	26
		Pasadena	1	-	-	0
		Rio Hondo	19	21	10	17
		West LA	6	8	10	8
		LA Subtotal	94	82	170	115
		Cypress	8	5	4	6
		Fullerton	20	15	11	15
		Irvine	-	-	2	1
		Orange Coast	3	4	2	3
		Santa Ana	6	4	2	4
		Santiago Canyon	2	3	4	3
		OC Subtotal	39	31	25	32
		Supply Subtotal/Average	133	113	195	147
0707.00	Computer Software Development	LA City	-	1	-	0
		LA Subtotal	0	1	0	0
		Cypress	1	1	1	1
		Golden West	3	4	2	3
		Orange Coast	7	7	2	5
		Saddleback	3	13	3	6
		OC Subtotal	14	26	8	16
		Supply Subtotal/Average	14	26	8	16
0707.10	Computer Programming	Cerritos	4	-	2	2
		Citrus	-	-	1	0
		East LA	6	8	4	6
		Glendale	2	2	3	2
		LA City	-	-	6	2
		LA Mission	5	6	4	5
		LA Pierce	9	18	4	10
		LA Southwest	1	-	1	1
		LA Valley	10	7	6	8
		Long Beach	2	4	5	4
		Mt San Antonio	62	119	114	98
		Pasadena	8	11	21	13
		Santa Monica	42	44	46	44

TOP Code	Program	College	2017-2018 Awards	2018-2019 Awards	2019-2020 Awards	3-Year Award Average
		West LA	-	1	-	0
		LA Subtotal	151	220	217	196
		Cypress	18	22	20	20
		Fullerton	-	16	28	15
		Irvine	10	8	4	7
		Orange Coast	29	31	157	72
		Santa Ana	1	13	1	5
		Santiago Canyon	30	9	3	14
		OC Subtotal	88	99	213	133
		Supply Subtotal/Average	239	319	430	329
0707.30	Computer Systems Analysis	Cerritos	4	2	3	3
		East LA	-	-	1	0
		LA Mission	-	-	1	0
		LA Subtotal	4	2	5	4
		Cypress	5	2	-	2
		OC Subtotal	5	2	-	2
		Supply Subtotal/Average	9	4	5	6
0708.00	Computer Infrastructure and Support	Cerritos	-	-	4	1
		Glendale	-	-	3	1
		LA City	-	-	3	1
		LA Harbor	1	1	1	1
		LA Mission	-	2	12	5
		LA Valley	8	5	2	5
		Long Beach	1	3	8	4
		Mt San Antonio	20	24	24	23
		Pasadena	-	1	1	1
		Rio Hondo	-	-	9	3
		West LA	-	4	15	6
		LA Subtotal	30	40	82	51
		Coastline	65	49	46	53
		Cypress	1	2	3	2
		Orange Coast	-	-	7	2
		OC Subtotal	66	51	56	58
		Supply Subtotal/Average	96	91	138	108

TOP Code	Program	College	2017-2018 Awards	2018-2019 Awards	2019-2020 Awards	3-Year Award Average
0708.10	Computer Networking	Cerritos	8	11	9	9
		Glendale	6	3	3	4
		LA City	37	23	-	20
		LA Pierce	23	39	20	27
		Long Beach	27	55	47	43
		Mt San Antonio	2	8	11	7
		Rio Hondo	-	5	7	4
		West LA	43	77	48	56
		LA Subtotal	146	221	145	171
		Coastline	12	38	59	36
		Cypress	37	70	95	67
		Irvine	12	11	21	15
		Saddleback	17	10	21	16
		Santa Ana	7	14	12	11
		OC Subtotal	85	143	208	145
Supply Subtotal/Average			231	364	353	316
0708.20	Computer Support	Citrus	-	-	1	0
		Glendale	3	10	7	7
		LA Pierce	7	9	8	8
		Long Beach	1	8	14	8
		Pasadena	3	7	30	13
		LA Subtotal	14	34	60	36
		Cypress	1	3	5	3
		Santa Ana	10	9	-	6
		OC Subtotal	11	12	5	9
Supply Subtotal/Average			25	46	65	45
0709.00	World Wide Web Administration	Glendale	9	6	7	7
		LA Pierce	5	9	-	5
		Long Beach	4	22	24	17
		West LA	24	13	9	15
		LA Subtotal	42	50	40	44
		Saddleback	-	-	2	1
		OC Subtotal	0	0	2	1
Supply Subtotal/Average			42	50	42	45
Supply Total/Average			919	1,188	1,408	1,172

Non-Community College Supply—For a comprehensive regional supply analysis, it is also important to consider the supply from other institutions in the region that provide training programs for Computer Software Development. Exhibit 4 shows the annual and three-year average number of awards conferred by these institutions in the related Classification of Instructional Programs (CIP) Codes: Computer Programming/Programmer(11.0201), Computer Systems Analysis/Analyst (11.0501) Computer Science (11.0701) Computer Systems Networking and Telecommunications (11.0901), Network and Systems Administration/Administrator (11.1001) Computer and information Security/Information Assurance (11.1003) Computer Support Specialist (11.10.06). Due to different data collection periods, the most recent three-year period of available data is from 2016 to 2019. Between 2016 and 2019, non-community college institutions in the region conferred an average of 2,408 awards annually in related training programs.

It is important to note that the information technology, computer support, and computer software educational programs listed in Exhibit 4 may provide students with adequate training to obtain employment within the occupations included in this report. However, these programs also train for 12 other middle-skill and above middle-skill occupations not included in this report. For these reasons, supply for the computer and networking occupations in this report is overstated.

Exhibit 4: Regional non-community college awards, 2016-2019

CIP Code	Program	College	2016-2017 Awards	2017-2018 Awards	2018-2019 Awards	3-Year Award Average
11.0201	Computer Programming/Programmer, General	ABCO Technology	18	23	29	23
		Platt College-Anaheim	-	4	4	3
		University of Phoenix-California	43	27	5	25
Supply Subtotal/Average			61	54	38	51
11.0501	Computer Systems Analysis/Analyst	Brand College	4	2	-	2
		DeVry University-California	94	55	49	66
		University of Phoenix-California	4	4	-	3
Supply Subtotal/Average			102	61	49	71
11.0701	Computer Science	Biola University	17	21	20	19
		California Institute of Technology	67	57	64	63
		California State Polytechnic University-Pomona	198	207	186	197
		California State University-Dominguez Hills	23	33	38	31

CIP Code	Program	College	2016-2017 Awards	2017-2018 Awards	2018-2019 Awards	3-Year Award Average
		California State University-Fullerton	139	195	246	193
		California State University-Long Beach	140	180	201	174
		California State University-Los Angeles	58	101	123	94
		California State University-Northridge	95	141	120	119
		Chapman University	23	32	31	29
		Claremont McKenna College	13	12	15	13
		East San Gabriel Valley Regional Occupational Program	5	16	12	11
		Harvey Mudd College	27	45	42	38
		Occidental College	-	3	20	8
		Pitzer College	4	3	5	4
		Pomona College	39	50	36	42
		Scripps College	5	2	12	6
		Southern California Institute of Technology	1	4	2	2
		Trident University International	59	62	76	66
		University of California-Irvine	425	526	568	506
		University of California-Los Angeles	183	213	242	213
		University of Southern California	174	202	228	201
Supply Subtotal/Average			1,695	2,105	2,287	2,029
11.0901	Computer Systems Networking and Telecommunications	Brand College	2	-	2	1
		DeVry University-California	135	106	86	109
		Mt Sierra College	5	4	-	3
		University of Phoenix-California	27	18	3	16
Supply Subtotal/Average			169	128	91	129

CIP Code	Program	College	2016-2017 Awards	2017-2018 Awards	2018-2019 Awards	3-Year Award Average
11.1001	Network and Systems Administration/Administrator	ABCO Technology	-	13	5	6
		Brand College	2	6	23	10
		California Intercontinental University	-	1	3	1
		University of Phoenix-California	1	12	13	9
Supply Subtotal/Average			3	32	44	26
11.1003	Computer and Information Systems Security/Information Assurance	Azusa Pacific University	3	-	-	1
		Learnet Academy Inc	48	17	-	22
		Mt Sierra College	8	13	-	7
		University of Phoenix-California	71	42	32	48
Supply Subtotal/Average			130	72	32	78
11.1006	Computer Support Specialist	Southern California Institute of Technology	16	26	25	22
		University of Phoenix-California	1	2	-	1
Supply Subtotal/Average			17	28	25	23
Supply Total/Average			2,177	2,480	2,566	2,408

Appendix A: Occupational demand and wage data by county

Exhibit 5. Orange County

Occupation (SOC)	2020 Jobs	2025 Jobs	5-Yr Change	5-Yr % Change	Annual Openings	Entry-Level Hourly Earnings (25th Percentile)	Median Hourly Earnings	Experienced Hourly Earnings (75th Percentile)
Computer Network Support Specialists (15-1231)	1,696	1,762	67	4%	138	\$26.33	\$31.80	\$39.50
Computer Network Architects (15-1241)	1,661	1,692	31	2%	106	\$40.88	\$56.79	\$70.90
Network and Computer Systems Administrators (15-1244)	3,225	3,296	71	2%	223	\$34.54	\$44.67	\$55.59

Occupation (SOC)	2020 Jobs	2025 Jobs	5-Yr Change	5-Yr % Change	Annual Openings	Entry-Level Hourly Earnings (25th Percentile)	Median Hourly Earnings	Experienced Hourly Earnings (75th Percentile)
Middle-Skill Total	6,581	6,750	169	3%	467			
Computer and Information Systems Managers (11-3021)	6,887	7,012	125	2%	531	\$63.57	\$80.00	\$98.34
Above Middle-Skill Total	6,887	7,012	125	2%	531			

Exhibit 6. Los Angeles County

Occupation (SOC)	2020 Jobs	2025 Jobs	5-Yr Change	5-Yr % Change	Annual Openings	Entry-Level Hourly Earnings (25th Percentile)	Median Hourly Earnings	Experienced Hourly Earnings (75th Percentile)
Computer Network Support Specialists (15-1231)	4,029	4,087	58	1%	305	\$26.93	\$32.50	\$40.31
Computer Network Architects (15-1241)	3,494	3,457	(37)	(1%)	207	\$41.92	\$58.30	\$72.80
Network and Computer Systems Administrators (15-1244)	7,920	7,957	38	0%	526	\$35.55	\$45.97	\$57.22
Middle-Skill Total	15,443	15,501	58	0.4%	1,037			
Computer and Information Systems Managers (11-3021)	15,921	16,136	215	1%	1,213	\$65.63	\$82.61	\$101.61
Above Middle-Skill Total	15,921	16,136	215	1%	1,213			

Exhibit 7. Los Angeles and Orange Counties

Occupation (SOC)	2020 Jobs	2025 Jobs	5-Yr Change	5-Yr % Change	Annual Openings
Computer Network Support Specialists (15-1231)	5,725	5,849	124	2%	442

Occupation (SOC)	2020 Jobs	2025 Jobs	5-Yr Change	5-Yr % Change	Annual Openings
Computer Network Architects (15-1241)	5,155	5,149	(6)	(0%)	312
Network and Computer Systems Administrators (15-1244)	11,145	11,253	109	1%	749
Middle-Skill Total	22,025	22,251	227	1%	1,503
Computer and Information Systems Managers (11-3021)	22,808	23,148	340	1%	1,744
Above Middle-Skill Total	22,808	23,148	340	1%	1,744

Appendix B: Sources

- O*NET Online
- Labor Insight/Jobs (Burning Glass)
- Economic Modeling Specialists, International (Emsi)
- Bureau of Labor Statistics (BLS)
- Employment Development Department, Labor Market Information Division, OES
- California Community Colleges Chancellor's Office Management Information Systems (MIS)
- California Family Needs Calculator, Insight Center for Community Economic Development
- Chancellor's Office Curriculum Inventory (COCI 2.0)

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