



Unmet Workforce Demand for Cloud Computing Occupations in LA County:

Labor Market Supply and Demand for Cloud Computing Baccalaureate
of Applied Science (B.A.S.) degree at Santa Monica College

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Key Findings

Demand:

- Employment in cloud computing occupations has grown at a much faster rate over the last 20 years (41.3%) than employment across all occupations (6.9%).
- Employment in cloud computing occupations declined at a much slower rate during the COVID-19 pandemic (-4.5%) than the average across all occupations (-8.3%), demonstrating a higher degree of resilience for cloud computing roles during this time.
- Over the next five years, more than 11,000 cloud computing jobs are projected to be available in Los Angeles County.
 - 87% of these projected job openings (9,561 openings) are for computer occupations that typically require a bachelor's degree for entry.
- Average hourly wages for cloud computing occupations are \$6.50 higher than the average across all occupations at the 10th percentile, \$10.50 higher at the 25th percentile, \$14.00 higher at the median, \$19.00 higher at the 75th percentile, and nearly \$21.00 more per hour at the 90th percentile.

Supply:

- Between 2018 and 2021, Los Angeles community colleges issued an average of 1,129 awards annually in programs related to cloud computing.
- Between 2017 and 2020, non-community college institutions in the region conferred an average of 292 sub-baccalaureate awards from related programs.
 - An average of 1,421 sub-baccalaureate awards (associate degrees and certificates) related to cloud computing are issued annually in Los Angeles County.
- Between 2017 and 2020, educational providers in the region conferred an average of 2,183 bachelor's degrees from programs related to cloud computing.

Gap Analysis:

- With 1,421 average annual sub-baccalaureate awards issued in the county and 1,440 projected annual job openings related to cloud computing roles that require less than a bachelor's degree, the potential supply gap at this level of education is only 19 unfilled jobs.
- With 2,183 average annual bachelor's degrees issued in the county and 9,561 projected annual job openings related to cloud computing that typically require a bachelor's degree for entry, the potential supply gap at this level of education is 7,378 unfilled jobs.

Introduction

Cloud computing

The introduction of cloud computing to the ever-growing world of information technology is introducing significant changes not only to technology processes but to the workforce. Cloud computing allows for the storage, management, and processing of data using internet technologies (“the cloud”). Some of the leading cloud computing providers include Amazon Web Services (AWS), Google Cloud Platform, Microsoft Azure, and IBM. Advantages of this evolving technology include:¹

- Payment for data center and server-type resources on an as needed basis or pay-as-you-go
- Cost savings due to economies of scale
- No more physical infrastructure and associated costs
- Global reach and access
- Deployment of technology services quickly

Uses of cloud computing

Cloud computing is utilized by a wide variety of organizations including small businesses, large global corporations, government agencies, and not-for-profits. Services available through cloud computing include:²

- Creation of new apps and services
- Storage, back up, and recovery of data
- Website and blog hosting
- Audio and video streaming
- Delivery of software on demand
- Analyzation of data for patterns and predictions

Impact on workforce and training

With the introduction and implementation of cloud computing into the information technology workforce, community colleges and other training providers will need to integrate related skills and technologies into the current curricula and training. Local community colleges currently offer several programs that train students in relational databases, programming, Linux, DevOps, quality assurance, and information security. Individual colleges are attempting to stack or

¹ [Amazon Web Services - What is cloud computing?](#)

² [Microsoft Azure – A beginner’s guide to cloud computing](#)

leverage certificates for cloud computing career paths with related disciplines including small business, computer science, web development, business analytics, IT, and mobile developers.

The emergence of cloud computing has preempted incumbent IT workers to upskill based on workforce and employer needs. With the right training, workers with traditional IT skills—such as data engineers, enterprise architects, web developers, and networking engineers—can expand their knowledge, skills, and abilities within the ever-changing field of information technology.

Occupational outlook for cloud computing

Businesses that employ cloud computing workers use various job titles, which are explored in the job posting section beginning on page 12. In the region, major cloud computing employers include Boeing, Northrup Grumman, Robert Half, Anthem Blue Cross, Amazon, Deloitte, Raytheon, and Disney.

The purpose of this study is to determine whether there is demand in the local labor market for cloud computing jobs that is not being met by the supply from relevant training programs. More specifically, this report addresses the labor market component of Assembly Bill 927, which requires evidence of unmet workforce needs related to Santa Monica College’s proposed cloud computing baccalaureate program.³

³ [AB-927 Public postsecondary education: community colleges: statewide baccalaureate degree program](#)

Key Cloud Computing Occupations

The cloud computing occupations analyzed in this report were selected from the 2018 Standard Occupational Classification (SOC) system, and all but one of these occupations belong to the computer and mathematical major occupational group (SOC 15-000). The occupations listed in Exhibit 1 comprise the cloud computing occupations used throughout this report.

Exhibit 1: Cloud computing occupations

SOC Code	Description
11-3021	Computer and Information Systems Managers
15-1211	Computer Systems Analysts
15-1212	Information Security Analysts
15-1231	Computer Network Support Specialists
15-1232	Computer User Support Specialists
15-1241	Computer Network Architects
15-1242	Database Administrators
15-1243	Database Architects
15-1244	Network and Computer Systems Administrators
15-1251	Computer Programmers
15-1252	Software Developers
15-1253	Software Quality Assurance Analysts and Testers
15-1254	Web Developers
15-1255	Web and Digital Interface Designers
15-1299	Computer Occupations, All Other

Source: [2018 Standard Occupational Classification \(SOC\) system](#)

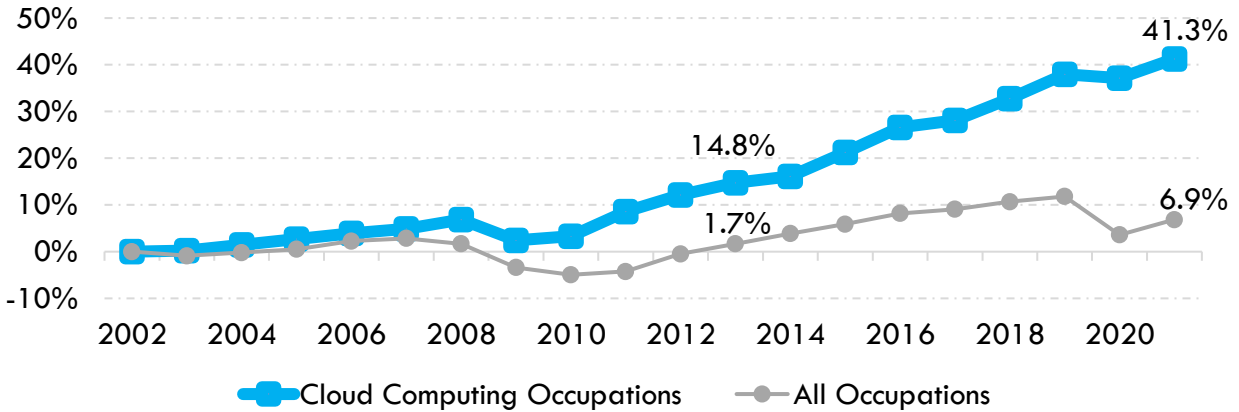
Labor Market Demand for Cloud Computing Occupations

Historical employment in LA County

Look back over the past 20 years and setting 2002 as the base year yields a clear picture regarding employment in cloud computing occupations. Exhibit 2 demonstrates that since 2002, employment in cloud computing occupations has grown by 41.3% while employment across all occupations has only grown by 6.9%. Furthermore, the Great Recession (2007-2009) brought employment across all occupations below the 2002 baseline from 2009 to 2012, and recovered to 1.7% above the baseline level in 2013. Conversely, employment in cloud computing

occupations never dropped below the 2002 baseline level and by 2013 had increased by nearly 15%.

Exhibit 2: Percent change in employment since 2002

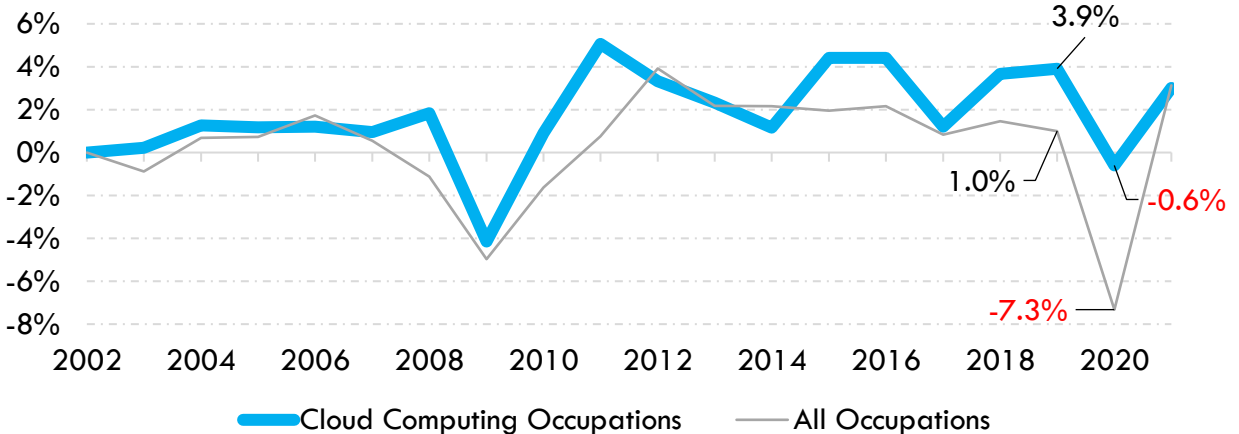


Source: Lightcast, Datarun 2022.3

Using the same data, Exhibit 3 displays the year-over-year change in employment from 2002 to 2021 for cloud computing occupations (thick blue line) and all occupations (thin grey line) in LA County. The location of the line in any given year indicates the percentage by which employment changed from the previous year. For instance, from 2019 to 2020, employment for all occupations plummeted at nearly twice the rate (-8.3%) as employment for cloud computing occupations (-4.5%).

During this 20-year timeframe, the year-over-year percent change in employment for cloud computing occupations peaks higher than for all occupations (see years 2011, 2015-2016, and 2018-2019), and also demonstrates that employment in cloud computing occupations was less adversely impacted by the COVID-19 pandemic than it was across all occupations.

Exhibit 3: Year-over-year employment percent change in LA County from 2002 to 2021



Source: Lightcast, Datarun 2022.3

Exhibits 2 and 3 demonstrate two major points. The first is that employment in cloud computing occupations has grown at a much faster rate over the last 20 years than employment across all occupations. Secondly, while employment in cloud computing occupations is not immune to large scale economic shocks such as the Great Recession and the COVID-19 pandemic, it is more insulated and less prone to job loss at the scale felt across all occupations.

Projected Annual Job Openings, 2021-2026

Exhibit 4 displays detailed 2021 job counts, projected employment figures through 2026, annual job openings, and typical entry-level education requirements for each occupation studied in this report. In Los Angeles County, there will be over 11,000 job openings, with *software developers* projected to have the largest share of those openings, followed by *computer occupations, all other*, and *computer and information systems managers*. Cloud computing occupations that typically require a bachelor's degree account for 87% of the 11,001 projected annual job openings.

Exhibit 4: Cloud computing occupational demand in Los Angeles County

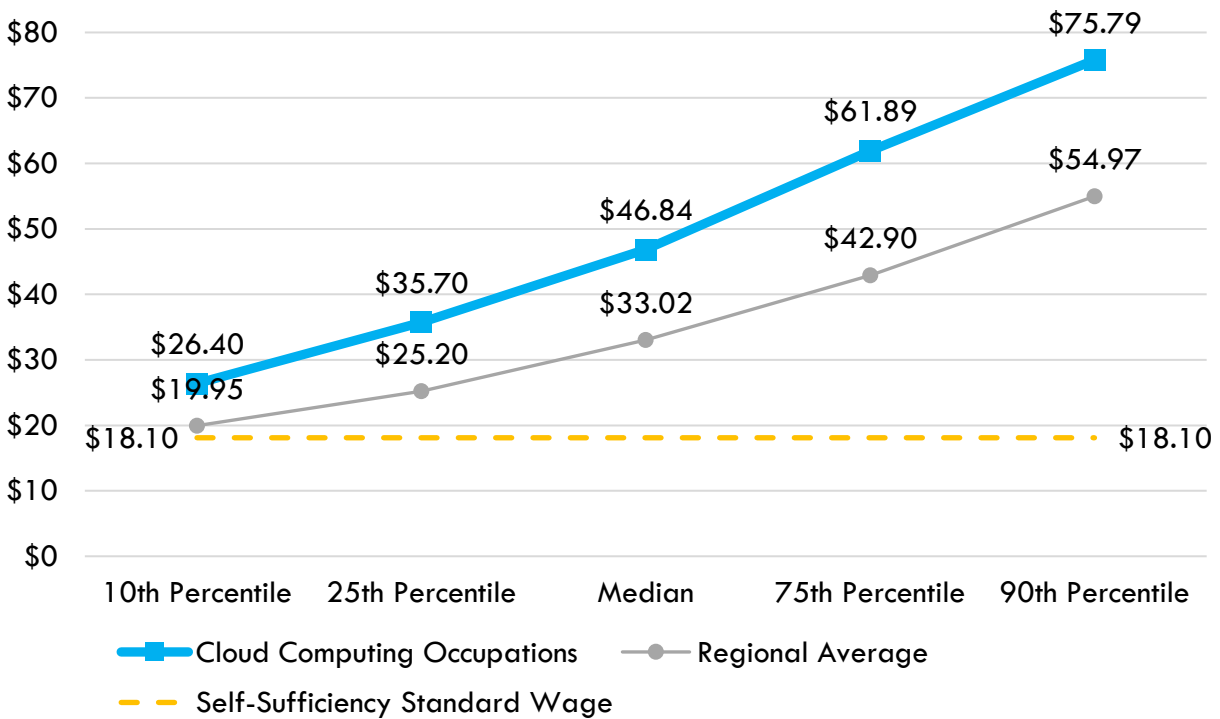
SOC	Occupation	2021 Jobs	2026 Jobs	5-Year % Change	Annual Openings	Typical Entry Level Education
15-1252	Software Developers	35,221	38,662	10%	3,336	Bachelor's degree
15-1299	Computer Occupations, All Other	18,452	18,400	(0%)	1,343	Bachelor's degree
11-3021	Computer and Information Systems Managers	17,744	17,840	1%	1,318	Bachelor's degree
15-1232	Computer User Support Specialists	15,375	15,622	2%	1,165	Some college, no degree
15-1211	Computer Systems Analysts	12,680	12,623	(0%)	888	Bachelor's degree
15-1253	Software Quality Assurance Analysts and Testers	4,977	5,401	9%	457	Bachelor's degree
15-1244	Network and Computer Systems Administrators	6,573	6,562	(0%)	424	Bachelor's degree
15-1254	Web Developers	4,317	4,527	5%	360	Bachelor's degree
15-1255	Web and Digital Interface Designers	3,620	3,876	7%	320	Bachelor's degree
15-1231	Computer Network Support Specialists	3,572	3,650	2%	275	Associate's degree
15-1251	Computer Programmers	4,242	3,949	(7%)	272	Bachelor's degree
15-1212	Information Security Analysts	2,601	2,942	13%	264	Bachelor's degree
15-1241	Computer Network Architects	4,125	4,088	(1%)	242	Bachelor's degree
15-1243	Database Architects	2,402	2,414	0%	176	Bachelor's degree
15-1242	Database Administrators	2,094	2,140	2%	161	Bachelor's degree
	Total	137,994	142,696	3%	11,001	

Source: Lightcast, Datarun 2022.3

Average hourly wages for cloud computing occupations

The average hourly wage for cloud computing occupations in Los Angeles County at the 10th, 25th, median, 75th, and 90th percentile is displayed in Exhibit 5. At the lowest percentile available (i. e., the 10th), workers employed in cloud computing occupations earn approximately \$6.50 per hour more than the regional average across all occupations. This is welcome news by itself, however, the lifelong benefit of being employed in a cloud computing occupation in Los Angeles County is that this gap widens among higher earners in a linear fashion. Progressing to the 25th percentile, workers in cloud computing occupations earn \$10.50 per hour more than the average worker in the region, nearly \$14 more at the median level, nearly \$19 more at the 75th percentile, and nearly \$21.00 more per hour at the 90th percentile, on average.

Exhibit 5: Hourly wage range for could computing occupations



Source: Lightcast, Datarun 2022.3 and the [Self-Sufficiency Standard for California](#)

Detailed median hourly and annual wages by occupation are displayed in descending order in Exhibit 6 for cloud computing occupations, from highest to lowest.

Exhibit 6: Median hourly and annual wages by detailed cloud computing occupations

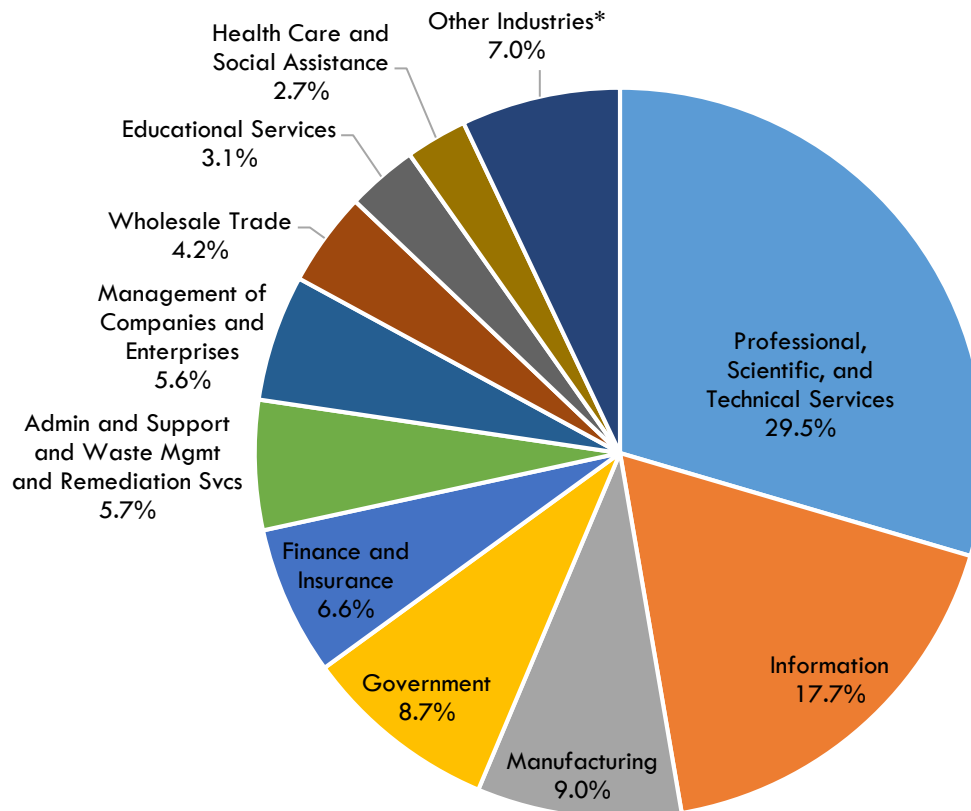
SOC Code	Description	Median Hourly Earnings	Median Annual Earnings
11-3021	Computer and Information Systems Managers	\$78.97	\$164,259
15-1252	Software Developers	\$61.53	\$127,973
15-1212	Information Security Analysts	\$57.85	\$120,337
15-1241	Computer Network Architects	\$54.69	\$113,760
15-1211	Computer Systems Analysts	\$50.12	\$104,255
15-1253	Software Quality Assurance Analysts and Testers	\$48.31	\$100,477
15-1251	Computer Programmers	\$47.97	\$99,774
15-1242	Database Administrators	\$47.72	\$99,249
15-1244	Network and Computer Systems Administrators	\$45.90	\$95,474
15-1299	Computer Occupations, All Other	\$38.49	\$80,066
15-1255	Web and Digital Interface Designers	\$37.43	\$77,859
15-1243	Database Architects	\$36.87	\$76,694
15-1254	Web Developers	\$36.25	\$75,392
15-1231	Computer Network Support Specialists	\$31.14	\$64,779
15-1232	Computer User Support Specialists	\$29.30	\$60,941

Source: Lightcast, Datarun 2022.3

Industry employment of cloud computing occupations

Unlike occupations that are largely concentrated within a single industry (e. g., surgeons in healthcare or police officers working in various levels of government), cloud computing occupations are employed across a wide spectrum of industries. Exhibit 7 displays the portion of cloud computing occupational employment within each industry sector. The two industry sectors with the largest share of cloud computing occupational employment are *professional, scientific, and technical services* (business that primarily provide consulting, legal, accounting, design, computer, and other services) at 29.5%, and *information* (comprised mostly of motion picture and sound recording businesses) at 17.7%. Combined, these two industry sectors account for nearly half of the employment in cloud computing occupations in Los Angeles County.

Exhibit 7: Industry concentration of cloud computing jobs in 2021



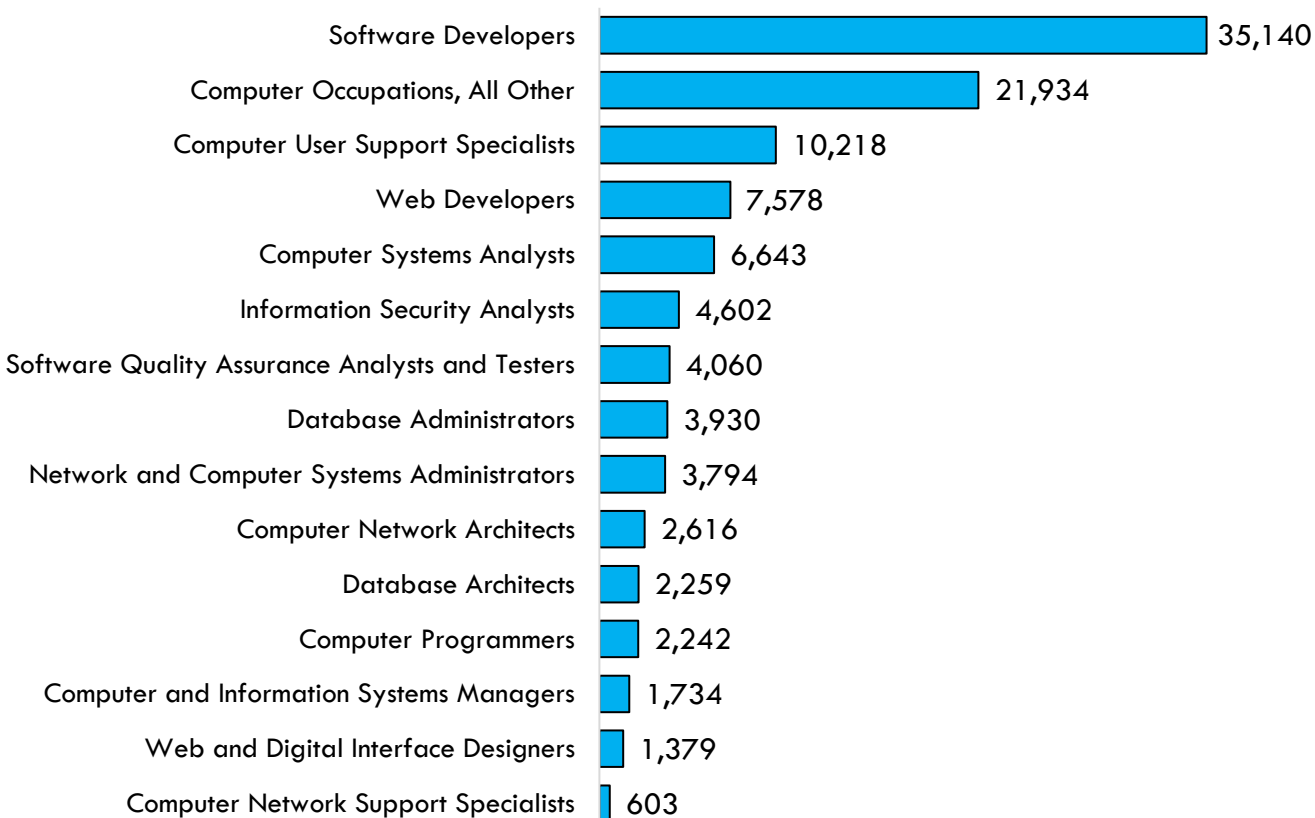
*Other Industries include: Retail Trade (1.9%); Other Services, except Public Administration (1.4%); Transportation and Warehousing (1.3%); Arts, Entertainment, and Recreation (0.7%); Real Estate and Rental and Leasing (0.6%); Construction (0.5%); Utilities (0.4%); Accommodation and Food Services (0.1%); and Mining, Quarrying, and Oil and Gas Extraction & Agriculture, Forestry, Fishing and Hunting (both <0.1%).

Source: Lightcast, Datarun 2022.3

Job Postings for cloud computing

Over the last 12 months (September 2021 through August 2022), there were 108,732 unique online job postings related to cloud computing occupations in Los Angeles County. The occupation with the highest number of online job postings, 35,140, was *software developers* (32% of total), followed by 21,934 job ads for *computer occupations, all other* (20% of total), and 10,218 job ads for *computer user support specialists* (9% of total). The number of job postings by occupation appear in Exhibit 8.

Exhibit 8: Job postings by occupation (Sep 2021 – Aug 2022)



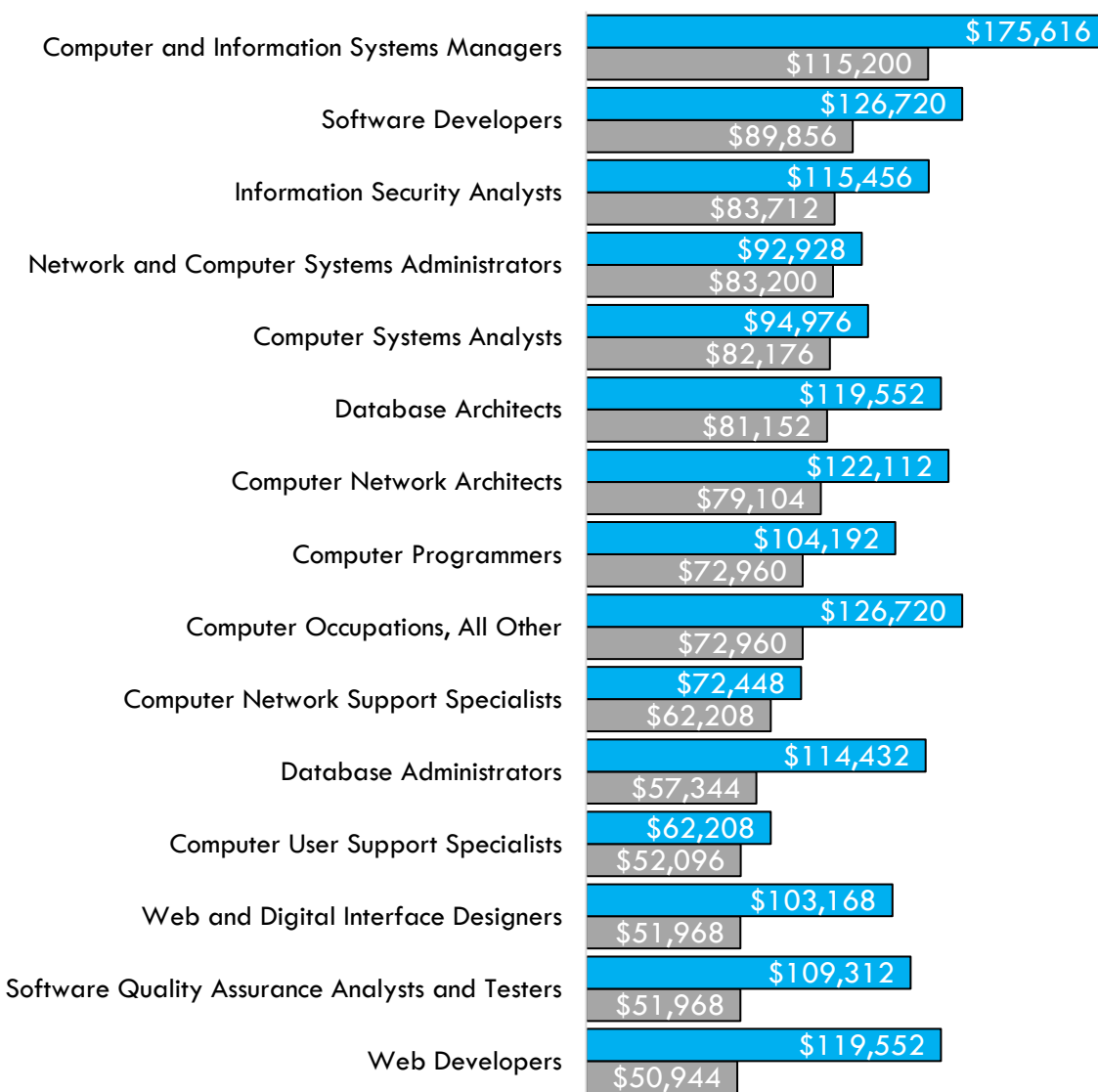
Source: Lightcast, Datarun 2022.3

The most common job titles from job postings were software engineers, systems engineers, data engineers, and DevOps engineers. The employers posting the most job ads during this timeframe were Boeing, Northrup Grumman, Robert Half, Anthem Blue Cross, Amazon, Deloitte, Raytheon, and Disney. The skills sought most frequently in these job ads were related to computer science, agile methodology, SQL, Python, Amazon Web Services, Java, JavaScript, automation, application programming interface, and Microsoft Azure. Beyond security clearances and certifications related to dealing with sensitive information, certifications most frequently sought by employers were project management certifications, Cisco Certified Network Associate, CompTIA Security+, and CompTIA Network+.

Of all the job postings that listed a minimum educational requirement, nearly two-thirds of employers were seeking candidates with a bachelor's degree (63% of total), demonstrating that

employers postings job ads prefer candidates with a bachelor’s degree for these jobs. Taking a closer look at job postings that listed a high school diploma or associate degree as the required level of education versus those postings that listed a bachelor’s degree, employers seeking candidates with a bachelor’s degree for cloud computing jobs are advertising annual salaries that are over \$38,000 higher per year than those seeking candidates with a high school diploma or associate degree. The largest difference was for *web developers*, where employers were advertising salaries over \$68,600 higher for candidates with a bachelor’s degree. Exhibit 9 demonstrates that regional employers posting job ads for these cloud computing occupations are willing to pay significantly more for candidates with a bachelor’s degree than for candidates with a high school diploma or associate degree.

Exhibit 9: Annual median advertised salary by education level



■ BA Annual Median Advertised Salary ■ HS or AA Annual Median Advertised Salary

Source: Lightcast, Datarun 2022.3

Educational Supply: Key Training Programs for Cloud Computing

Community College Enrollment and Awards related to Cloud Computing

There are 17 TOP codes in the California Community College system designed to train students for occupations related to cloud computing. The top programs in Los Angeles County in terms of enrollment are Information Technology, General (0701.00), Computer Programming (0707.10) and Computer Information Systems (0702.00). The average enrollment between 2017 and 2020 in these cloud computing-related programs was 36,415 students in Los Angeles County. Exhibit 10 displays the number of students enrolled in these programs over the last three academic years.

Exhibit 10: Community college students enrolled in programs related to cloud computing

Program (TOP)	2017-18	2018-19	2019-20	3-Year Average
Information Technology, General (0701.00)	15,745	14,317	12,183	14,082
Computer Programming (0707.10)	6,584	6,974	8,274	7,277
Computer Information Systems (0702.00)	5,439	5,732	6,163	5,778
Software Applications (0702.10)	2,907	2,581	2,313	2,600
Computer Science (0706.00)	2,000	2,388	3,001	2,463
Computer Infrastructure and Support (0708.00)	903	1,065	1,331	1,100
Computer Networking (0708.10)	939	975	997	970
Computer Support (0708.20)	421	414	437	424
Database Design and Administration (0707.20)	299	348	485	377
Website Design and Development (0614.30)	291	324	320	312
Computer Systems Analysis (0707.30)	237	201	485	308
World Wide Web Administration (0709.00)	190	182	317	230
Computer Software Development (0707.00)	136	252	179	189
E-Commerce (technology emphasis) (0709.10)	95	142	173	137
Other Information Technology (0799.00)	35	35	290	120
Telecommunications Technology (0934.30)	31	64	35	43
E-Commerce (Business emphasis) (0509.70)	-	17	-	6
Total	36,252	36,011	36,983	36,415

Source: [Cal-PASS Plus LaunchBoard](#)

On average, 1,129 awards were conferred annually to community college students in these 17 programs related to cloud computing (see Exhibit 11). Awards from these programs have increased 19% during this three-year period from 1,028 in the 2018-19 academic year to 1,223 in 2020-21. The program that conferred the largest number of awards was Computer Programming (0707.10), followed by Information Technology (0701.00) and Computer Networking (0708.10). Of these 1,129 awards, 436 were associate degrees and 667 were certificates.

Exhibit 11: Regional community college awards (certificates and degrees), 2018-2021

Program (TOP)	2018-19	2019-20	2020-21	3-Year Average
Computer Programming (0707.10)	220	217	218	218
Information Technology, General (0701.00)	175	172	167	171
Computer Networking (0708.10)	221	145	136	167
Computer Science (0706.00)	112	147	222	160
Computer Information Systems (0702.00)	82	170	88	113
Computer Infrastructure and Support (0708.00)	40	83	118	80
Computer Support (0708.20)	34	60	84	59
World Wide Web Administration (0709.00)	50	40	68	53
Database Design and Administration (0707.20)	16	23	47	29
Software Applications (0702.10)	31	29	12	24
Telecommunications Technology (0934.30)	18	13	23	18
Website Design and Development (0614.30)	12	12	14	13
Other Information Technology (0799.00)	13	15	4	11
Computer Systems Analysis (0707.30)	2	5	9	5
E-Commerce (Business emphasis) (0509.70)	-	4	7	4
Computer Software Development (0707.00)	1	-	5	2
E-Commerce (technology emphasis) (0709.10)	1	1	1	1
Total	1,028	1,136	1,223	1,129

Source: [California Community Colleges Chancellor's Office Management Information Systems Data Mart](#)

In addition to the cloud computing awards issued by the nineteen community colleges in Los Angeles County, there are other educational institutions that issue sub-baccalaureate awards related to cloud computing. Between 2017 and 2020, an average of 292 sub-baccalaureate awards were issued across the 18 program areas listed in Exhibit 12. Awards from these programs have also increased during this three-year period from 295 in the 2017-18 academic

year to 357 in 2019-20, a 21% increase. The program with the most awards was Computer and Information Sciences, General (CIP 11.0101), conferring 145 such awards during the 2019-20 academic year.

Exhibit 12: Regional non-community college awards, 2017-2020

Program (CIP)	2017-18	2018-19	2019-20	3-Year Average
Computer and Information Sciences, General (11.0101)	71	31	145	82
Information Technology (11.0103)	38	57	25	40
Computer Programming/Programmer, General (11.0201)	23	29	46	33
Network and System Administration/Administrator (11.1001)	19	28	34	27
Web/Multimedia Management and Webmaster (11.1004)	17	24	37	26
Computer and Information Sciences, Other (11.0199)	47	6	-	18
System, Networking, and LAN/WAN Management/Manager (11.1002)	7	9	19	12
Computer/Information Technology Services Administration and Management, Other (11.1099)	9	5	15	10
Computer Science (11.0701)	16	12	-	9
Data Modeling/Warehousing and Database Administration (11.0802)	6	7	15	9
Computer Software and Media Applications, Other (11.0899)	14	-	10	8
Computer and Information Systems Security/Auditing/Information Assurance (11.1003)	17	-	5	7
Computer and Information Sciences and Support Services, Other (11.9999)	-	12	-	4
Data Processing and Data Processing Technology/Technician (11.0301)	6	1	-	2
Computer/Computer Systems Technology/Technician (15.1202)	1	-	4	2
Computer Systems Networking and Telecommunications (11.0901)	-	2	2	1
Computer Systems Analysis/Analyst (11.0501)	2	-	-	1
Computer Engineering, General (14.0901)	2	-	-	1
Total	295	223	357	292

Source: [National Center for Education Statistics' Integrated Postsecondary Education Data System](#)

Baccalaureate degrees related to Cloud Computing

In Los Angeles County, awards have been issued in nine programs related to cloud computing at 4-year colleges that award bachelor's degrees (see Exhibit 13). Between 2017 and 2020, there was an average of 2,183 bachelor's degrees awarded. Similar to community college awards related to cloud computing, bachelor's awards from these programs have also increased during this three-year period, from 2,004 in the 2017-18 academic year to 2,414 in 2019-20, a 20.5% increase. The program with the most awards was Computer Science, conferring more than half of the cloud computing-related bachelor's degrees in the county (1,396 awards).

Exhibit 13: Regional non-community college awards, 2017-2020

Program (CIP)	2017-18	2018-19	2019-20	3-Year Average
Computer Science (11.0701)	1,269	1,351	1,569	1,396
Computer Engineering, General (14.0901)	271	259	324	285
Information Technology (11.0103)	182	184	201	189
Computer and Information Sciences, General (11.0101)	123	159	146	143
Computer and Information Sciences, Other (11.0199)	136	142	138	139
Computer Software and Media Applications, Other (11.0899)	8	19	28	18
Computer Engineering Technology/Technician (15.1201)	11	11	4	9
E-Commerce/Electronic Commerce (52.0208)	2	3	4	3
Web/Multimedia Management and Webmaster (11.1004)	2	-	-	1
Total	2,004	2,128	2,414	2,183

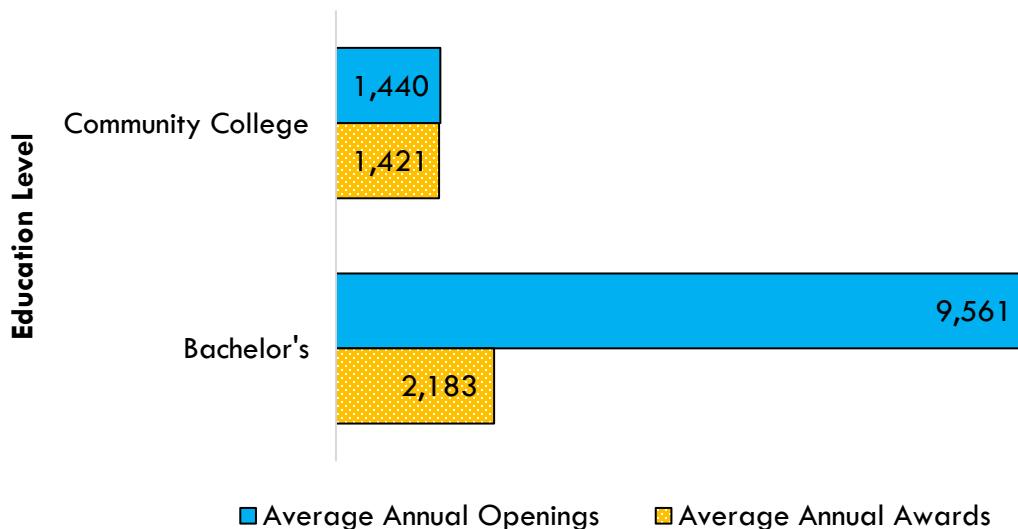
Source: [National Center for Education Statistics' Integrated Postsecondary Education Data System](#)

Gap Analysis

Breaking down the educational supply and occupational demand for cloud computing in Los Angeles County yields a clear pattern (see Exhibit 14). With 1,421 average annual sub-baccalaureate awards issued in the county and 1,440 projected annual job openings related to cloud computing, the potential supply gap at this level of education is only 19 unfilled jobs. For all practical intents and purposes, the supply and demand at this level of education is largely in equilibrium.

With 2,183 average annual bachelor's degrees issued in the county and 9,561 projected annual job openings related to cloud computing that typically require a bachelor's degree for entry, the potential supply gap at this level of education is 7,378 unfilled jobs. This significant projected workforce shortage facing Los Angeles County requires the attention of all regional education and training providers.

Exhibit 14: Supply and demand gap analysis for cloud computing by education level



Source: Lightcast, Datarun 2022.3; [California Community Colleges Chancellor's Office Management Information Systems Data Mart](#); [National Center for Education Statistics' Integrated Postsecondary Education Data System](#)

Recommendations & Discussion

This report demonstrates that while the demand for sub-baccalaureate jobs related to cloud computing is largely being met by related training programs in the region, the supply for baccalaureate jobs related to cloud computing pales in comparison to the number of projected job openings over the next five years. While this is a great starting point to engage in meaningful discussion about the prospects of a community college baccalaureate program helping to bridge the gap between supply and demand in the labor market, it is not sufficient based on legislation.

Therefore, this report can be used as a launch board to validate these findings with regional employers and training providers in an effort to assess that the following are true:

- Evidence that employers are having difficulty filling positions that require a baccalaureate degree.
- Evidence that employers are willing to pay baccalaureate degree holders more than those with a related associate degree or no postsecondary degree.
- Evidence that employers prefer candidates with the proposed baccalaureate degree.
- Evidence of job placement and/or promotion opportunities for candidates with a baccalaureate degree.
- Evidence that the occupation/field the proposed baccalaureate degree is in will provide for higher-wage job opportunities.

Methodology

This report has three primary objectives:

1. Assess and quantify the labor market demand for jobs related to cloud computing in Los Angeles County that typically require a bachelor's degree for entry.
2. Assess and quantify the educational supply for such jobs.
3. Calculate the potential unmet workforce demand for these jobs.

For the first objective, the most recent datarun (2022.3) from Lightcast was analyzed using 2021 as a base year and a five-year projection period through 2026. This five-year period approximates the time it takes for a typical community college training program to be developed, approved, and for the first cohort of students to enroll, complete the program, and enter the workforce. The average annual job openings for each computer occupation involved in cloud computing that typically requires a bachelor's degree for entry was the primary metric analyzed for this objective.

The second objective was calculated using two data sources. The California Community Colleges Chancellor's Office Management Information Systems Data Mart was queried for the number of certificates and associate degrees issued from programs related to cloud computing by the 19 community colleges in Los Angeles County during the most recent three academic years (2018-19, 2019-20 and 2020-21). The California Community Colleges use the Taxonomy of Programs (TOP) to organize and categorize programs. A full list of TOP codes used for this analysis appear in the appendix. Next, the National Center for Education Statistics' Integrated Postsecondary Education Data System (IPEDS) was queried for the number of bachelor's degrees issued from other educational institutions in Los Angeles County during the most recent three academic years available (2017-18, 2018-19, and 2019-20). Reporting in IPEDS is organized by Classification of Instructional Programs (CIP). Community college programs by TOP code were crosswalked to non-community college programs by CIP code utilizing the TOP-CIP-SOC crosswalk maintained by the Centers of Excellence for Labor Market Research.

The third objective was achieved by calculating the difference between the sum of annual job openings related to cloud computing and the number of awards issued from related programs. This calculation determines whether there is demand in the labor market is not being met by the supply from educational programs that align with the relevant occupations.

Appendix

Table A1: Community college awards (certificates and degrees) related to cloud computing

TOP - Program	College	2018-19 Awards	2019-20 Awards	2020-21 Awards	3-Year Average
050970 - E-Commerce (Business emphasis)	Long Beach	0	4	7	4
	Subtotal/Average	0	4	7	4
061430 - Website Design and Development	LA Pierce	3	2	4	3
	Mt San Antonio	9	7	6	7
	Pasadena	0	1	1	1
	Santa Monica	0	2	3	2
Subtotal/Average	12	12	14	13	
070100 - Information Technology, General	East LA	23	10	4	12
	Glendale	0	0	3	1
	LA Harbor	0	0	1	0
	LA Mission	1	3	1	2
	LA Southwest	0	0	2	1
	Long Beach	34	64	106	68
	Mt San Antonio	74	90	49	71
	Santa Monica	39	0	1	13
	West LA	4	5	0	3
Subtotal/Average	175	172	167	171	
070200 - Computer Information Systems	Citrus	5	8	4	6
	Compton	1	0	0	0
	East LA	19	15	23	19
	El Camino	14	21	11	15
	Glendale	0	5	6	4
	LA City	1	1	4	2
	LA Mission	5	1	1	2
	LA Trade	8	20	15	14
	Long Beach	0	0	3	1
	Mt San Antonio	0	79	6	28
	Rio Hondo	21	10	6	12
	West LA	8	10	9	9
Subtotal/Average	82	170	88	113	
070210 - Software Applications	Cerritos	9	6	2	6
	LA City	0	1	1	1
	LA Mission	2	0	3	2
	LA Southwest	1	0	0	0
	Long Beach	0	7	0	2
	Mt San Antonio	1	2	0	1

TOP - Program	College	2018-19 Awards	2019-20 Awards	2020-21 Awards	3-Year Average
070730 - Computer Systems Analysis	East LA	0	1	0	0
	LA City	0	0	1	0
	LA Harbor	0	0	1	0
	LA Mission	0	1	1	1
	LA Pierce	0	0	6	2
Subtotal/Average		2	5	9	5
070800 - Computer Infrastructure and Support	Cerritos	0	4	4	3
	Glendale	0	3	4	2
	LA City	0	3	5	3
	LA Harbor	1	1	1	1
	LA Mission	2	12	17	10
	LA Valley	5	2	4	4
	Long Beach	3	8	8	6
	Mt San Antonio	24	24	24	24
	Pasadena	1	1	24	9
	Rio Hondo	0	10	11	7
West LA	4	15	16	12	
Subtotal/Average		40	83	118	80
070810 - Computer Networking	Cerritos	11	9	8	9
	Glendale	3	3	0	2
	LA City	23	0	4	9
	LA Pierce	39	20	12	24
	Long Beach	55	47	48	50
	Mt San Antonio	8	11	4	8
	Rio Hondo	5	7	2	5
	West LA	77	48	58	61
Subtotal/Average		221	145	136	167
070820 - Computer Support	Citrus	0	1	1	1
	Glendale	10	7	2	6
	LA Pierce	9	8	6	8
	LA Valley	0	0	1	0
	Long Beach	8	14	40	21
	Pasadena	7	30	34	24
Subtotal/Average		34	60	84	59
070900 - World Wide Web Administration	Glendale	6	7	10	8
	LA Pierce	9	0	2	4
	Long Beach	22	24	34	27
	Santa Monica	0	0	16	5
	West LA	13	9	6	9
Subtotal/Average		50	40	68	53

TOP - Program	College	2018-19 Awards	2019-20 Awards	2020-21 Awards	3-Year Average
070910 - E-Commerce (Technology emphasis)	East LA	1	1	1	1
Subtotal/Average		1	1	1	1
079900 - Other Information Technology	Mt San Antonio	13	15	4	11
Subtotal/Average		13	15	4	11
093430 - Telecommunications Technology	LA Pierce	4	3	7	5
	LA Trade	10	5	9	8
	Long Beach	1	1	3	2
	Mt San Antonio	3	4	4	4
Subtotal/Average		18	13	23	18
Grand Total/Average		1,028	1,136	1,223	1,129

Table A2: Non-community college sub-baccalaureate awards issued related to cloud computing

CIP - Program	Institution	2017-18 Awards	2018-19 Awards	2019-20 Awards	3-Year Average
11.0101 - Computer and Information Sciences, General	Brand College	2	0	0	1
	Los Angeles Pacific College	0	0	6	2
	Mount Saint Mary's University	0	0	0	0
	University of the People	69	31	139	80
Subtotal/Average		71	31	145	82
11.0103 - Information Technology	Abraham Lincoln University	1	1	0	1
	Brand College	37	50	13	33
	Platt College-Los Angeles	0	6	12	6
Subtotal/Average		38	57	25	40
11.0199 - Computer and Information Sciences, Other	Antioch University-Los Angeles	47	4	0	17
	Brand College	0	2	0	1
Subtotal/Average		47	6	0	18
11.0201 - Computer Programming/ Programmer, General	ABCO Technology	23	29	46	33
	Platt College-Los Angeles	0	0	0	0
Subtotal/Average		23	29	46	33
11.0301 - Data Processing and Data Processing Technology/ Technician	Premiere Career College	6	1	0	2
Subtotal/Average		6	1	0	2

CIP - Program	Institution	2017-18 Awards	2018-19 Awards	2019-20 Awards	3-Year Average
11.0501 - Computer Systems Analysis/Analyst	Brand College	2	0	0	1
Subtotal/Average		2	0	0	1
11.0701 - Computer Science	East San Gabriel Valley Regional Occupational Program	16	12	0	9
Subtotal/Average		16	12	0	9
11.0801 - Web Page, Digital/Multimedia and Information Resources Design	Los Angeles Pacific College	0	0	0	0
Subtotal/Average		0	0	0	0
11.0802 - Data Modeling/Warehousing and Database Administration	ABCO Technology	6	7	15	9
Subtotal/Average		6	7	15	9
11.0899 - Computer Software and Media Applications, Other	Learnet Academy Inc	14	0	10	8
Subtotal/Average		14	0	10	8
11.0901 - Computer Systems Networking and Telecommunications	Brand College	0	2	2	1
	PCI College	0	0	0	0
Subtotal/Average		0	2	2	1
11.1001 - Network and System Administration	ABCO Technology	13	5	25	14
	Brand College	6	23	9	13
Subtotal/Average		19	28	34	27
11.1002 - System, Networking, and LAN/WAN Management/Manager	ABCO Technology	7	9	19	12
Subtotal/Average		7	9	19	12
11.1003 - Computer and Information Systems Security/Auditing/Information Assurance	Learnet Academy Inc	17	0	5	7
	University of La Verne	0	0	0	0
Subtotal/Average		17	0	5	7
11.1004 - Web/Multimedia Management and Webmaster	ABCO Technology	17	24	37	26
Subtotal/Average		17	24	37	26
11.1099 - Computer/Information Technology Services Administration and Management, Other	ABCO Technology	9	5	15	10
Subtotal/Average		9	5	15	10
11.9999 - Computer and Information Sciences and Support Services, Other	Los Angeles Pacific College	0	12	0	4
Subtotal/Average		0	12	0	4
14.0901 - Computer Engineering, General	Brand College	2	0	0	1

CIP - Program	Institution	2017-18 Awards	2018-19 Awards	2019-20 Awards	3-Year Average
Subtotal/Average		2	0	0	1
15.1202 - Computer/Computer Systems Technology/Technician	Learnet Academy Inc	1	0	4	2
	University of La Verne	0	0	0	0
Subtotal/Average		1	0	4	2
Grand Total/Average		295	223	357	292

Table A3: Non-community college baccalaureate awards issued related to cloud computing

CIP - Program	Institution	2017-18 Awards	2018-19 Awards	2019-20 Awards	3-Year Average
11.0101 - Computer and Information Sciences, General	Azusa Pacific University	26	30	21	26
	Loyola Marymount University	42	32	27	34
	Mount Saint Mary's University	0	0	0	0
	Pacific States University	0	2	0	1
	The Master's University and Seminary	6	7	11	8
	University of La Verne	18	39	23	27
	University of the People	31	49	64	48
Subtotal/Average		123	159	146	143
11.0103 - Information Technology	California State University-Dominguez Hills	1	5	4	3
	California State University-Los Angeles	127	122	166	138
	California State University-Northridge	54	54	29	46
	Platt College-Los Angeles	0	0	0	0
	University of La Verne	0	3	2	2
Subtotal/Average		182	184	201	189
11.0199 - Computer and Information Sciences, Other	California State University-Dominguez Hills	59	55	65	60
	California State University-Northridge	77	87	73	79
Subtotal/Average		136	142	138	139
11.0701 - Computer Science	Biola University	21	20	18	20
	California Institute of Technology	57	64	72	64
	California State Polytechnic University-Pomona	207	186	238	210
	California State University-Dominguez Hills	33	38	57	43

CIP - Program	Institution	2017-18 Awards	2018-19 Awards	2019-20 Awards	3-Year Average
	California State University-Long Beach	179	201	220	200
	California State University-Los Angeles	101	122	119	114
	California State University-Northridge	141	120	160	140
	Claremont McKenna College	12	15	35	21
	Harvey Mudd College	45	42	47	45
	Occidental College	3	20	18	14
	Pitzer College	3	5	10	6
	Pomona College	50	36	34	40
	Scripps College	2	12	11	8
	The Master's University and Seminary	0	0	0	0
	University of California-Los Angeles	213	242	283	246
	University of Southern California	202	228	247	226
Subtotal/Average		1,269	1,351	1,569	1,396
11.0899 - Computer Software and Media Applications, Other	Art Center College of Design	8	12	20	13
	California Institute of the Arts	0	7	8	5
Subtotal/Average		8	19	28	18
11.1003 - Computer and Information Systems Security/ Auditing/ Information Assurance	Azusa Pacific University	0	0	0	0
Subtotal/Average		0	0	0	0
11.1004 - Web/Multimedia Management and Webmaster	Pepperdine University	2	0	0	1
Subtotal/Average		2	0	0	1
14.0901 - Computer Engineering, General	California State Polytechnic University-Pomona	96	85	105	95
	California State University-Long Beach	58	52	64	58
	California State University-Northridge	37	37	41	38

CIP - Program	Institution	2017-18 Awards	2018-19 Awards	2019-20 Awards	3-Year Average
	University of California-Los Angeles	42	55	72	56
	University of Southern California	38	30	42	37
Subtotal/Average		271	259	324	285
15.1201 - Computer Engineering Technology/ Technician	California State University-Long Beach	11	11	4	9
Subtotal/Average		11	11	4	9
52.0208 - E-Commerce/ Electronic Commerce	University of La Verne	2	3	4	3
Subtotal/Average		2	3	4	3
Grand Total/Average		2,004	2,128	2,414	2,182

About the Centers of Excellence for Labor Market Research

The Centers of Excellence (COE) is a statewide initiative supported by the California Community Colleges' Economic and Workforce Development program. The COE research team represents expertise in labor market analysis with a focus on research design, educational and training program mapping, and identifying skill sets for emerging occupations as well as geospatial analysis. The COE maintains strategic alliances with research organizations whose relationships and technical expertise enhance COE research efforts and with industry associations that assist in validating research findings, ensuring that the most recent industry and labor market conditions are captured. COE studies are used to inform policy discussions, industry-wide legislative efforts, and regional workforce and economic development strategies, as well as guide program and resource development efforts by the California Community Colleges. These reports can be accessed at www.coecc.net.