

Web Application Development

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

Summary

- Employment for the web app development occupational group is expected to **increase by 9% between 2018 and 2023** in the Inland Empire/Desert region (IEDR). A total of **2,779 job openings or 556 annual job openings** will be available over the five-year timeframe.
- The **entry-level wages** (25th percentile) for the web app development occupational group are **above the MIT Living Wage estimate of \$12.39 per hour** for a single adult living in the IEDR.
- **There appears to be an opportunity for program growth** because there are more annual job openings for the web app development occupational group (**556 average annual openings**) than annual credentials issued for the selected community college programs in the region (**64 average community college credentials**).

Introduction

Web application development is the process of creating a computer program that is accessible through the internet. Web application developers apply their fundamental understanding of software programming and development to create solutions for web application problems. The California Community College program most closely associated with web app development is the computer programming (TOP 0707.10) program. This program prepares students for entry-level web app development opportunities by providing students with entry-level programming knowledge, including methods, procedures, symbols, and rules used in planning and writing instructions in computer language for the solution of a problem. Additionally, this program includes programming for the World Wide Web (Taxonomy of Programs, 2012). While there are entry-level positions within computer programming and web app development, the majority of occupations in this field generally require a bachelor's degree to enter employment. For this reason, the web app development 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 **middle-skill** web app development occupational group consists of two entry-level occupations that typically require workers to obtain associate degrees. The occupations included in the middle-skill web app development occupational group are:

- Computer Network Support Specialists
- Web Developers

The **high-skill** web app development occupational group consists of three occupations that typically require workers to obtain a bachelor’s degree. The occupations included in the high-skill web app development occupational group are:

- Computer Programmers
- Software Developers, Applications
- Software Developers, Systems Software

Job Opportunities

In 2018, there was a potential workforce of 6,384 jobs in the web app development occupational group in the Inland Empire/Desert region (IEDR). Jobs in this occupational group are projected to increase by 9% by 2023. Regional employers will need to fill 2,779 job openings over the next five years; this figure includes new jobs and jobs that need to be replaced due to workers permanently leaving (includes occupational transfers and retirements). Middle-skill jobs represent 36% of all job openings in this group over the next five years. Exhibit 1 displays five-year projections for the web app development occupational group in the IEDR.

Please note that traditional labor market data does not identify jobs that work exclusively in web app development. The figures below represent the potential workforce that has the knowledge, skills, and abilities to develop web applications.

Exhibit 1: Five-year projections for the web app development occupational group

Occupational Group	2018 Jobs	5-Yr % Change (New Jobs)	5-Yr Openings (New + Replacement Jobs)	Annual Openings (New + Replacement Jobs)	% of workers age 55+
High-skill	4,128	10%	1,778	356	16%
Middle-skill	2,255	8%	1,001	200	14%
Total	6,384	9%	2,779	556	15%

Source: EMSI 2019.2

Earnings

The entry-level wages for the web app development occupational group are above the MIT Living Wage estimate of \$12.39 per hour for a single adult living in the IEDR (Glasmeier, 2019). These wages are also sufficient for two working adults and one child (\$14.75 per hour, per adult, or \$30,680 annually for each adult). Exhibit 2 displays wage information for the web app development occupational group in the IEDR.

Exhibit 2: Earnings for the web app development occupational group

Occupational Group	Occupation	Entry to Experienced Hourly Wage Range (25 th to 75 th percentile)	Median Wage (50 th percentile)	Average Annual Earnings
High-skill	Software Developers, Systems Software	\$36.01 to \$58.63	\$47.01	\$101,600
	Software Developers, Applications	\$36.32 to \$55.28	\$45.03	\$95,800
	Computer Programmers	\$28.01 to \$43.76	\$34.12	\$74,800
Middle-skill	Computer Network Support Specialists	\$24.77 to \$40.00	\$29.74	\$68,300
	Web Developers	\$18.62 to \$29.80	\$22.61	\$53,800

Source: EMSI 2019.2

Job Postings, Employers, Skills, and Education

Exhibit 3 displays the number of job ads posted during the last 12 months along with the regional and statewide average time to fill for the web app development occupational group in the IEDR. On average, local employers fill online job postings for the web app development occupational group within 47 days. This regional average is four days longer than the statewide average, indicating that it is slightly more difficult for local employers to find qualified candidates than other California employers. Job postings have been limited to positions that specify a need for web application development skills, knowledge, and experience; only 10% of the 4,198 total job postings for the web app development occupational group have been included in this report. Please note, while these postings reflect a desire for web app development skills, knowledge, and experience, the actual positions may not utilize these skills as a primary function of employment. Computer network support specialists has been removed from some exhibits in this section of the report, as none of the 81 job postings mention a need for web app development skills.

Exhibit 3: Job ads and time to fill, May 2018 – Apr 2019

Occupational Group	Occupation	Job Ads	Regional Average Time to Fill (Days)	California Average Time to Fill (Days)
High-skill	Software Developers, Applications	228	47	43
	Computer Programmers	25	45	42
	Software Developers, Systems Software	4	47	43
Middle-skill	Web Developers	170	47	43
	Computer Network Support Specialists	0	N/A	35
Total		427	47	43

Source: Burning Glass – Labor Insights

Exhibit 4 displays the employers posting the most job ads for the web app development occupational group during the last 12 months in the IEDR. Job posting information for *software developers, system software* should be viewed with caution as job posting data is limited to one employer.

Exhibit 4: Employers posting the most job ads, May 2018 – Apr 2019

Occupational Group	Occupation	Employers
High-skill	Software Developers, Applications (n=110)	<ul style="list-style-type: none"> Esri CoStar Group
	Computer Programmers (n=13)	<ul style="list-style-type: none"> San Bernardino County Communications Test Design, Inc.
	Software Developers, Systems Software (n=3)	<ul style="list-style-type: none"> The Thor Group, LLC.
Middle-Skill	Web Developers (n=64)	<ul style="list-style-type: none"> Esri Haven Agency

Source: Burning Glass – Labor Insights

Exhibit 5 displays a sample of specialized, employability, and software and programming skills that employers are seeking when looking for workers to fill positions in the web app development 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 commonly referred to as “soft skills.” The skills requested in job postings may be utilized as a helpful guide for curriculum development.

Exhibit 5: Sample of in-demand skills from employer job ads for the web app development occupational group, May 2018 – Apr 2019

Occupational Group	Occupation	Specialized Skills	Employability Skills	Software and Programming Skills
High-skill	Software Developers, Applications (n=228)	<ul style="list-style-type: none"> • Web Application Development • Software Engineering • Relational Databases 	<ul style="list-style-type: none"> • Communication Skills • Teamwork/ Collaboration • Problem Solving 	<ul style="list-style-type: none"> • JavaScript • SQL • Microsoft C#
	Computer Programmers (n=25)	<ul style="list-style-type: none"> • Web Application Development • Relational Databases • Software Engineering 	<ul style="list-style-type: none"> • Writing • Problem Solving • Communication Skills 	<ul style="list-style-type: none"> • SQL • .NET • Microsoft C#
	Software Developers, Systems Software (n=4)	<ul style="list-style-type: none"> • Business Solutions • Professional Services Marketing • Product Development 	<ul style="list-style-type: none"> • Problem Solving 	<ul style="list-style-type: none"> • SQL • .NET • Microsoft SharePoint
Middle-Skill	Web Developers (n=170)	<ul style="list-style-type: none"> • Software Development • Debugging • Front-end Development 	<ul style="list-style-type: none"> • Creativity • Problem Solving • Teamwork/ Collaboration 	<ul style="list-style-type: none"> • JavaScript • Hypertext Preprocessor (PHP) • AngularJS

Source: Burning Glass – Labor Insights

Exhibit 6 displays the work experience and 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 minimum advertised education requirement from employer job ads. High-skill occupations appear above the line while the two middle-skill occupations appear below. There were too few postings to obtain education requirement information for computer network support specialists. The majority of employers looking for web developers to develop web applications frequently request a bachelor’s degree, while traditionally web developers only require an associate degree.

Exhibit 6: Work experience, typical entry-level education, educational attainment, and minimum advertised education requirements for the web app development occupational group, May 2018 – Apr 2019

Occupation	Typical Entry-Level Education Requirement	Educational Attainment*	Minimum Advertised Education Requirement from Job Ads			
			Number of Job Ads (n=)	High school diploma or vocational training	Associate degree	Bachelor's degree or higher
Software Developers, Applications	Bachelor's degree	13%	150	4%	1%	95%
Computer Programmers	Bachelor's degree	22%	20	-	-	100%
Software Developers, Systems Software	Bachelor's degree	13%	4	-	-	100%
Web Developers	Associate degree	25%	84	5%		95%
Computer Network Support Specialists	Associate degree	41%	0	N/A	N/A	N/A

Source: EMSI 2019.2, Burning Glass – Labor Insights

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

Student Completions and Program Outcomes

This section contains completion and outcome data for the California Community College computer programming (TOP 0707.10) program. Exhibit 7 displays the average annual regional California Community College (CCC) credentials conferred during the three academic years between 2014 and 2017, from the California Community Colleges Chancellor's Office Management Information Systems (MIS) Data Mart, along with the enrollments from the most recent year available on LaunchBoard. Credentials are the combined total of associate degrees and certificates issued during the timeframe, divided by three in this case in order to calculate an annual average. This is done to minimize the effect of atypical variation that might be present in a single year. Enrollments are the count of enrollments in courses assigned to the TOP code in the selected year. The relevant TOP code is from the Taxonomy of Programs manual, and the corresponding program titles used at each college (in *italics*) are sourced from the Chancellor's Office Curriculum Inventory (COCI). Please note, a credential is not always equal to a single person in search of a job opening since a student may earn more than one credential, such as an associate degree in addition to a certificate.

While the computer programming program may provide the fundamental knowledge that will assist individuals to develop web applications, there are currently no colleges specifically offering web application development training in the region. City College of San Francisco (CCSF) is the only California Community College to offer programs that directly related to the development of web application, web *application programming and mobile web app development*. While both programs provide training for web app development, the web application programming program is most closely associated web app development. It may be helpful to analyze this program as a basis for further curriculum development. CCSF's Web Application Programming program description is displayed below:

The program of study for the certificate in Web Application Programming will give students a solid grounding in open source web development skills. Students will learn the fundamentals of working in a Linux environment; developing front-end web pages using HTML and JavaScript; using SQL databases; and server-side programming techniques using Ruby, PHP, Python, C#, ASP.NET and/or Java. The course of study prepares students for entry-level positions developing web applications (Catalog 2018-19, 2019, pg. 202).

City College of San Francisco's Web Application Programming program is one of five programs offered by the college, which are all classified under computer programming (TOP 0707.10).

Exhibit 7: Annual average community college credentials and enrollments for the computer programming program in the Inland Empire/Desert region

0707.10 – Computer Programming	CCC Enrollments, Academic Year 2016-17	CCC Annual Average Credentials, Academic Years 2014-17
Barstow	10	
Chaffey – Programming Foundations	384	
Copper Mountain – Computer Programming	39	
Associate Degree		5
Certificate 30 to < 60 semester units		3
Crafton Hills	21	
Moreno Valley – Computer Programming	361	
Associate Degree		3
Certificate 18 to < 30 semester units		3
Mt. San Jacinto – CIS: Programming	1,381	
Certificate 30 to < 60 semester units		5
Norco – Computer Programming	583	
Associate Degree		7
Certificate 30 to < 60 semester units		3
Certificate 18 to < 30 semester units		4
Certificate 6 to < 18 semester units		7

Riverside – Computer Programming/Java Programming/C++ Programming	523	
Associate Degree		6
Certificate 18 to < 30 semester units		5
Certificate 6 to < 18 semester units		11
San Bernardino – Computer Science	173	
Associate Degree		2
Victor Valley – Programming I/Programming II	271	
Certificate 18 to < 30 semester units		1*
Total CCC Enrollments, Academic Year 2016-17	3,746	
Total Annual Average CCC Credentials, Academic Years 2014-17		64

Source: LaunchBoard, MIS Data Mart, COCI

*Victor Valley issued one certificate in 2014-15.

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 in order 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, 2019a). 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, 2017). Data from the latest academic year for each metric is provided in Exhibit 8.

Exhibit 8: Computer programming program strong workforce outcomes

Strong Workforce Program Metrics: 0707.10 – Computer Programming Academic Year 2015-16, unless noted otherwise	Inland Empire/Desert region	California Median
Course enrollments (2016-17)	3,764	323
Completed 12+ units in one year (2016-17)	314	32
Economically disadvantaged students* (2016-17)	75%	62%
Transferred to a four-year institution (transfers)	292	50

Strong Workforce Program Metrics: 0707.10 – Computer Programming Academic Year 2015-16, unless noted otherwise	Inland Empire/Desert region	California Median
Employed in the fourth fiscal quarter after exit (all exiters)	62%	64%
Median annual earnings* (all exiters)	\$21,068	\$33,995
Job closely related to the field of study (2014-15)	60%	79%
Median change in earnings (all exiters)	60%	51%
Attained a living wage (completers and skills-builders)	42%	62%

Source: LaunchBoard

*Data for these metrics is available in Community College Pipeline. All others are available in Strong Program Workforce Metrics.

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Appendix: Occupation definitions, sample job titles, five-year projections for web app development occupations

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

High-skill Occupations

Computer Programmers (15-1131)

Create, modify, and test the code, forms, and script that allow computer applications to run. Work from specifications drawn up by software developers or other individuals. May assist software developers by analyzing user needs and designing software solutions. May develop and write computer programs to store, locate, and retrieve specific documents, data, and information.

Sample job titles: Analyst Programmer, Application Programmer Analyst, Computer Programmer, Computer Programmer Analyst, Internet Programmer, Java Developer, Programmer, Programmer Analyst, Web Applications Programmer, Web Programmer

Entry-Level Educational Requirement: Bachelor's degree

Training Requirement: None

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

Software Developers, Applications (15-1132)

Develop, create, and modify general computer applications software or specialized utility programs. Analyze user needs and develop software solutions. Design software or customize software for client use with the aim of optimizing operational efficiency. May analyze and design databases within an application area, working individually or coordinating database development as part of a team. May supervise computer programmers.

Sample job titles: Application Developer, Application Integration Engineer, Applications Developer, Computer Consultant, Information Technology Analyst (IT Analyst), Software Architect, Software Developer, Software Development Engineer, Software Engineer, Technical Consultant

Entry-Level Educational Requirement: Bachelor's degree

Training Requirement: None

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 13%



Software Developers, Systems Software (15-1133)

Research, design, develop, and test operating systems-level software, compilers, and network distribution software for medical, industrial, military, communications, aerospace, business, scientific, and general computing applications. Set operational specifications and formulate and analyze software requirements. May design embedded systems software. Apply principles and techniques of computer science, engineering, and mathematical analysis.

Sample job titles: Developer, Infrastructure Engineer, Network Engineer, Publishing Systems Analyst, Senior Software Engineer, Software Architect, Software Developer, Software Engineer, Systems Coordinator, Systems Engineer

Entry-Level Educational Requirement: Bachelor's degree

Training Requirement: None

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 13%

Middle-Skill Occupations

Web Developers (15-1134)

Design, create, and modify Web sites. Analyze user needs to implement Web site content, graphics, performance, and capacity. May integrate Web sites with other computer applications. May convert written, graphic, audio, and video components to compatible Web formats by using software designed to facilitate the creation of Web and multimedia content.

Sample job titles: Designer, Technology Applications Engineer, Web Architect, Web Design Specialist, Web Designer, Web Developer, Web Development Director, Web Development Instructor, Webmaster

Entry-Level Educational Requirement: Associate degree

Training Requirement: None

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 25%



Computer Network Support Specialists (15-1152)

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

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

Entry-Level Educational Requirement: Associate degree

Training Requirement: None

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



Table 1: 2018 to 2023 job growth, wages, education, training, and work experience required for the web app development occupational group, Inland Empire/Desert region (middle-skill occupations appear below the line)

Occupation (SOC)	2018 Jobs	5-Yr Change	5-Yr % Change	Annual Openings (New + Replacement Jobs)	Entry to Experienced Hourly Wage Range (25 th to 75 th percentile)	Median Wage (50 th percentile)	Average Annual Earnings	Typical Entry-Level Education & On-The-Job Training Required	Work Experience Required
Software Developers, Applications (15-1132)	1,960	317	16%	196	\$36.32 to \$55.28	\$45.03	\$95,800	Bachelor's degree & none	None
Software Developers, Systems Software (15-1133)	1,115	92	8%	92	\$36.01 to \$58.63	\$47.01	\$101,600	Bachelor's degree & none	None
Computer Programmers (15-1131)	1,054	3	0%	68	\$28.01 to \$43.76	\$34.12	\$74,800	Bachelor's degree & none	None
Computer Network Support Specialists (15-1152)	1,134	79	7%	100	\$24.77 to \$40.00	\$29.74	\$68,300	Associate degree & none	None
Web Developers (15-1134)	1,121	97	9%	100	\$18.62 to \$29.80	\$22.61	\$53,800	Associate degree & none	None
Total	6,384	588	9%	556	-	-	-	-	-

Source: EMSI 2019.2