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CS for MA

Career Pathways and Skills Analysis

Networking and Systems

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Contents

Introduction

This is the result of an effort to document existing opportunities for individuals to enter the computer science field in the state of Massachusetts. The source of analysis was based on both a thorough review of occupational profiles and an analysis of the skills needed to satisfy the requirements. The analysis resulted in five areas of job opportunity.

Networking and Systems is one of the five areas identified as viable roles that offer the greatest opportunities in computer science for those individuals with less than a 4-year degree. This report identifies the opportunities available in the computer science field as they pertain to Networking and Systems. The report identifies the skills and certifications necessary for each career opportunity identified, and maps the potential career pathways that can be realized, and any additional skills or training required for promotion.

Students interested in preparing for the Networking and Systems role, can learn and develop the requisite skills and can also earn relevant certifications. In the sections that follow, the report identifies the top skills and most relevant certifications. It also indicates the projected employment growth of the alternative career paths suitable for the role as well as estimated salary advancement over 2, 5 and more than 6 years in the role.

Job Opportunities in Computer Science for individuals with less than a 4-year degree

- Computer Support
- Cybersecurity
- Data Administration
- Networking and Systems
- Programming and Development

Skill Analysis

Skill analysis is done to show the extent of mastery or expertise needed to match the requirements of a job at three levels: necessary, defining, and distinguishing. Necessary skills are the set of technical abilities needed to do the particular job or something similar. Defining skills represent the sets of tasks that define and are particular to the job. Distinguishing skills are the areas of mastery or expertise that allow an individual to excel at a job. These are specialized skills called upon sporadically.

An occupation's **Distinguishing Skills** are the advanced skills that are called for occasionally. An employee with these skills is likely more specialized and able to differentiate themselves from others in the same role.

An occupation's **Defining Skills** represent the day-to-day tasks and responsibilities of the job. An employee needs these skills to qualify for and perform successfully in this occupation.

An occupation's **Necessary Skills** are specialized skills required for that job and relevant across other similar jobs. An employee needs these skills as building blocks to perform the more complex Defining Skills.

Occupation Profiles

The study of occupation profiles is designed to document the job opportunities for the Networking and Systems role. This 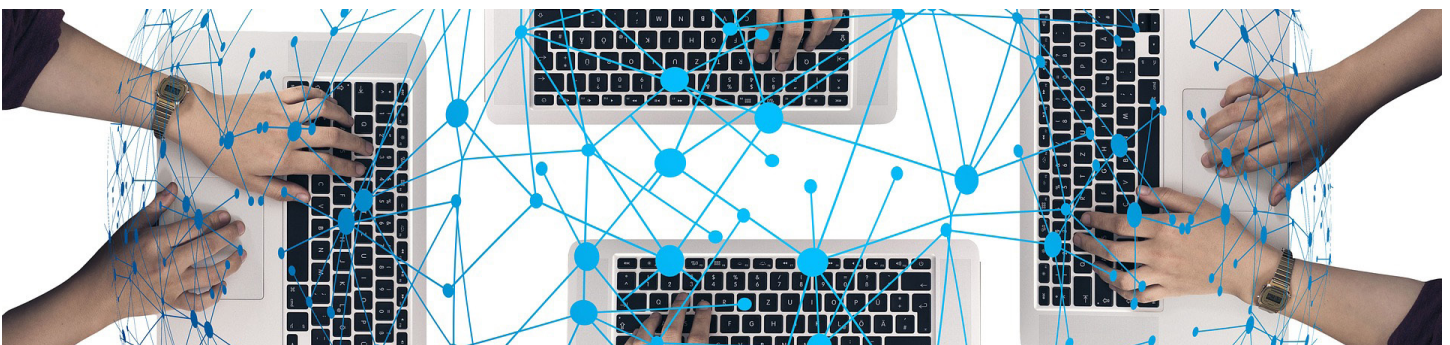role has four starting occupations: Network or Systems Support Specialist, Network or Systems Administrator, Network Engineer or Architect, and Systems Analyst. For each career path emerging from the Network or Systems Support Specialist, Network or Systems Administrator, Network Engineer or Architect, and Systems Analyst occupations, the report presents salary and career advancement estimates, job openings and projected growth. The report also presents top skills and certifications associated with the occupation.

Career Pathways

Career advancement is generally seen as a transition that brings higher compensation and/or responsibility in a role that is similar to that previously held.

In order to understand likely career pathways for each of the four starting occupations of the networking and systems role, likely advancement occupations were examined. This was done following Emsi | Burning Glass' Career Pathways model as well as by examining actual transitions made by individuals through analysis of Emsi | Burning Glass's resume database.

Each set of origin and destina-

tion occupations comes with a predicted salary differential and skill gap between the two occupations.

Methodology

In this analysis, we use an index of similarity or 'similarity scores'. The similarity scores for each pair of occupations have a numeric value between 0 and 1. They can be seen as a proxy measure for the feasibility of transitioning between the two jobs. Job pairs that have a similarity score of 1 can be said to have a perfect fit (and are in fact the same occupation), while job pairs with a similarity score of 0 have the most imperfect fit with no overlapping skills.

Similarity scores only indicate skills overlap and skills gaps, and do not contemplate differentials in educational attainment. While some occupations always require specific degrees or licenses, many occupations may only prefer certain education levels (however strongly) and can offer greater possibility for direct promotion.
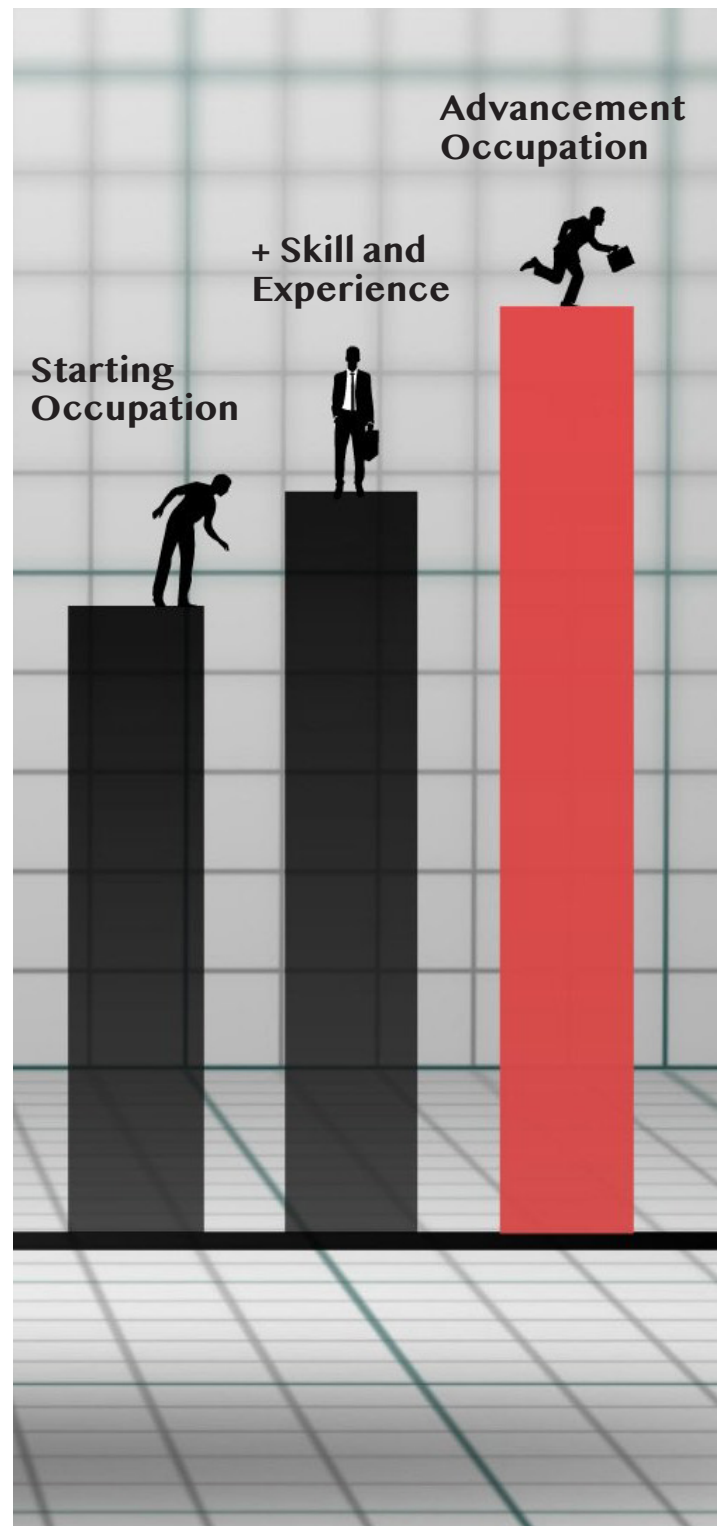
Occupation Profile: Networking and Systems

Occupation: Network / Systems Support Specialist

Occupation Profile: Networking and Systems Occupation: Network / Systems Support Specialist
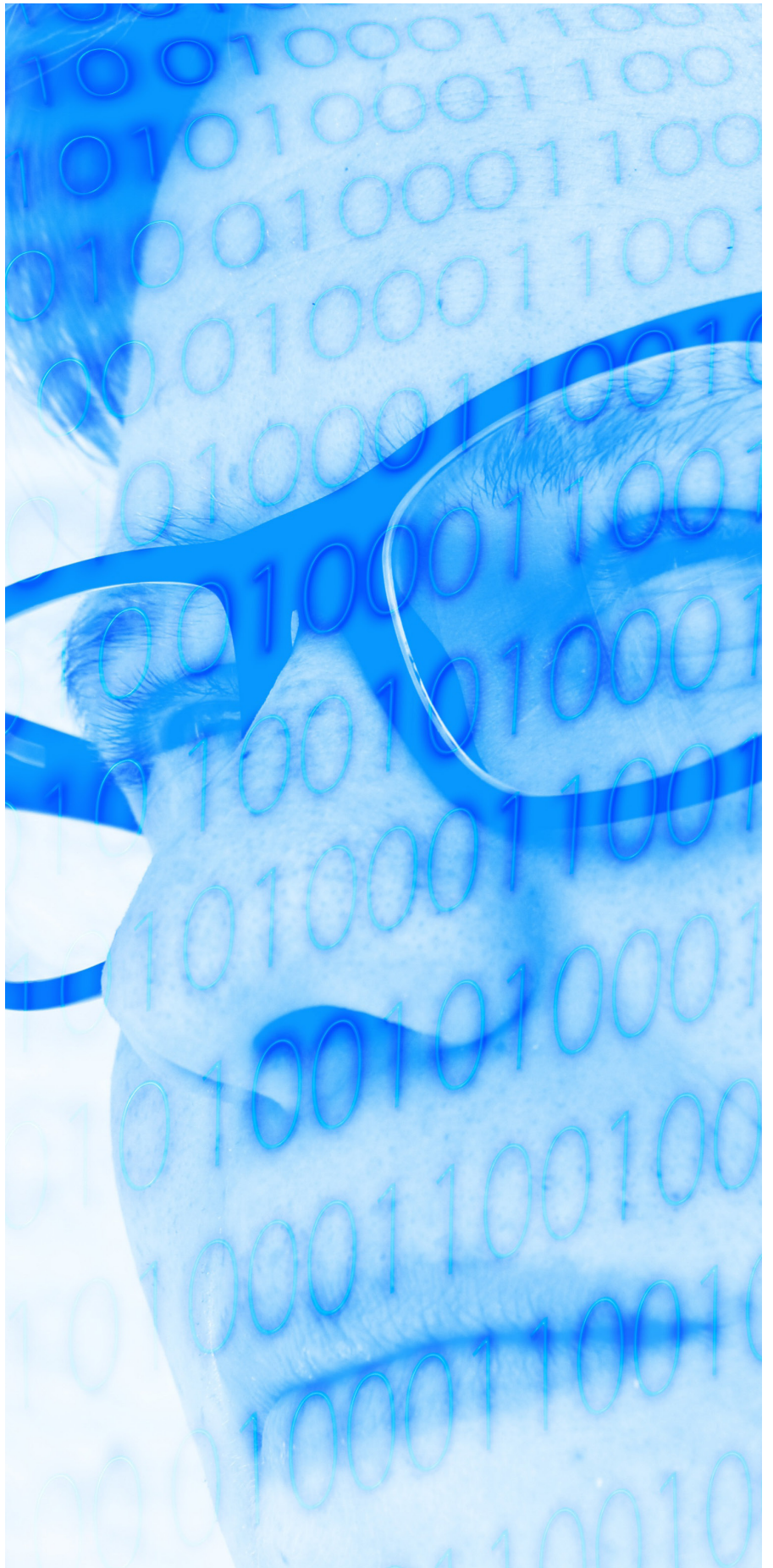
Occupation

Network / systems support specialists analyze, troubleshoot, and evaluate computer network problems. They provide help and advice to computer users and organizations. These specialists either support computer networks or they provide technical assistance directly to computer users. They play an important role in maintaining an organization's network and keeping them safe and secure through both hardware configuration and end-user training. These individuals require expertise in diagnostic and security software as well as in-depth knowledge of networking equipment and infrastructure devices. They are comfortable in problem solving, customer service and prioritizing.

Growth

Network / systems support specialist jobs are projected to have a 0.96% growth in employment. The entry level salary for this occupation is $56,802 with a requirement of less than 2 years of experience. The mid career salary, that is jobs requiring 3 to 5 years of experience is $70,292. The advanced career salary which requests six or more years of experience is $90,012.

Skills

The skills shown in the table below rep-

0.96%
Projected Growth

Estimated five-year growth in employment

$56,802
Entry Level Salary

Salary for jobs requiring less than 2 years of experience

$70,292
Mid Career Salary

Salary for jobs requesting 3 to 5 years of experience

$90,012
Advanced Career Salary

Salary for jobs requesting 6+ years of experience

Occupation Profile: Networking and Systems Occupation: Network / Systems Support Specialist

resent the additional skills likely needed to move from the starting occupation to the advancement occupation. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills include knowledge of project management, Linux, information systems, scheduling, hardware troubleshooting, and customer contact. Defining skills represent the day-to-day tasks and responsibilities of the job. They assume an increase level of technical competency. They include knowledge of customer service, technical support, network support, network administration, repair, and Cisco. Distinguishing skills set a worker apart and come with a salary premium. Note that in this role, the prospects for growth include knowledge of system administration, Local Area Networks (LAN), IT support, Break/Fix, Open Shortest Path First (OSPF), and Network Management Center (NMC).

Certifications

This occupation requests in addition to security clearance and a driver's license, the following certifica-

Certifications

- Security Clearance
- Driver's License
- Cisco Certified Network Associate (CCNA)

tion: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

Necessary Skills	
Skill Name	Percent of Postings Requesting Skill
Project Management	16%
Linux	12%
Information Systems	11%
Scheduling	10%
Hardware Troubleshooting	10%
Customer Contact	9%

Defining Skills	
Skill Name	Percent of Postings Requesting Skill
Customer Service	30%
Technical Support	29%
Network Support	16%
Network Administration	15%
Repair	15%
Cisco	14%

Distinguishing Skills	
Skill Name	Percent of Postings Requesting Skill
System Administration	11%
Local Area Network (LAN)	5%
It Support	4%
Break/Fix	4%
Open Shortest Path First (OSPF)	3%
Network Management Center (NMC)	3%

Potential Career Paths for Network / Systems Support Specialist

For the starting occupation of network / systems support specialist, we identify possible next step occupations. These occupations come with an increase in compensation and require additional skills and in some cases certifications. These skills may be learned on the job at the initial position held or can be learned in advance.

In the pages that follow, we provide for each Advancement Occupation, skill gaps, certifications, salary and workforce information. With this information, students, educators, and policymakers can see the paths a worker could take from the Starting Occupation to the Advancement Occupation.

RF Engineer

Telecommunications Engineering Specialist

Computer Systems Engineer / Architect

Database Administrator

Software Developer / Engineer

Network / Systems Support Specialist
Starting Occupation

Cyber / Information Security Engineer / Analyst

Computer Programmer

Network / Systems Administrator

Network Engineer / Architect

Electronics Engineer

Advancement
Occupation

+ Skill and
Experience

Starting
Occupation

Detailed
Career Pathways:

Network / Systems
Support Specialist

Advancement Occupation

RF Engineers are professional experts known within the electrical engineering arena of IT and Telecommunication sectors. They design, deploy and optimize wireless communication systems. These electrical engineer specialists mainly work for cellular operators where they create network performance models, test the efficiency of existing networks, and ensure that regulatory standards are met. Radio frequency engineers work with equipment that send or receive radio waves, with wireless devices, radios, and mobile phones. Important duties of these individuals are to enhance the performance of wireless networks and to plan or assist in the planning of RF strategies for making new wireless networks.

Growth

The similarity score between RF engineer and the starting occupation is 0.41 and the average salary differential is $31,685. While the projected 5-year employment growth for Network / Systems support specialist is 0.96%, RF engineer's projected 5-year growth is lower at 0.28%. Average salary for the advancement occupation is $56,802 for individuals with up to 2 years of experience; $70,292 for those with 3 to 5 years, and $90,012 for individuals with 6 or more years. There were 275

0.41
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$31,685
Average Salary Differential

0.96%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

0.28%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Network /Systems Support Specialist

Starting Occupation

▶

RF Engineer

Advancement Occupation

$56,802

Average Salary: Advancement

Occupation with 0 - 2 years experience

$70,292

Average Salary: Advancement

Occupation with 3 - 5 years experience

$90,012

Average Salary: Advancement

Occupation with 6+ years experience

279

Starting Occupation Postings

275

Advancement Occupation Postings

postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network/systems support specialist to RF engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for RF engineer are MATLAB, test equipment, systems engineering, physics, and budgeting. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include Radio Frequency (RF) engineering, Radio Frequency (RF) design, simulation, oscilloscopes, and Digital Signal Processing (DSP). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Mapinfo, Code Division Multiple Access (CDMA), Spectrum Analyzer, signal generators, and radio frequencies.

Certifications

The network / systems support specialist occupation requests in addition to security clearance and a driver's license, the following certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco

Network /Systems Support Specialist ▶ RF Engineer

Starting Occupation   *Advancement Occupation*

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
MATLAB	19%	Radio Frequency (RF) Engineering	40%	MapInfo	7%
Test Equipment	18%	Radio Frequency (RF) Design	23%	Code Division Multiple Access (CDMA)	7%
Systems Engineering	16%	Simulation	22%	Spectrum Analyzer	7%
Physics	14%	Oscilloscopes	10%	Signal Generators	6%
Budgeting	13%	Digital Signal Processing (DSP)	10%	Radio Frequencies	6%

Career certification from Cisco Systems.

The RF engineer occupation commonly requests the following certifications. Security clearance, Driver's license, and among others, a certification from an American Board for Engineering and Technology (ABET) accredited program.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **American Board for Engineering and Technology (ABET) Accredited**

Advancement Occupation

Computer systems engineers or architects design and develop solutions to complex applications problems, system administration issues, or network concerns. They perform systems management and integration functions. These individuals develop software engineering, system integration, or distributed system architectures. They also collaborate with software developers to select appropriate design solutions and to ensure the compatibility of system components. These individuals are comfortable with paying attention to detail, using analytical skills and working in an atmosphere of innovation.

Growth

The similarity score between computer systems engineers or architects and the starting occupation is 0.38 and the average salary differential is $42,427. While the projected 5-year employment growth for network or systems support specialist is 0.96%, computer systems engineer or architect's projected 5-year growth is higher at 2.75%. Average salary for the computer systems engineer or architect occupation is $60,813 for individuals with up to 2 years of experience; $83,001 for those with 3 to 5 years, and $99,718 for individuals with 6 or more years. There were 3,259 postings for the advancement occupation.

0.38
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$42,427
Average Salary Differential

0.96%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.75%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$60,813
Average Salary: Advancement

Occupation with 0 - 2 years experience

$83,001
Average Salary: Advancement

Occupation with 3 - 5 years experience

$99,718
Average Salary: Advancement

Occupation with 6+ years experience

279
Starting Occupation Postings

3,259
Advancement Occupation Postings

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems support specialist to computer systems engineer or architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for computer systems engineer or architect are knowledge of Python, software development, SQL, project management, and software engineering. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Systems engineering, Linux, Java, DevOps, and System Architecture. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of UNIX, Windows server, Continuous Integration (CI), firmware, and hardware and software configuration.

Certifications

The network / systems support specialist occupation requests in addition to security clearance and a driver's license, the follow-

Network /Systems Support Specialist
Starting Occupation

▶

Computer Systems Engineer / Architect
Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Python	19%	Systems Engineering	46%	UNIX	8%
Software Development	17%	Linux	20%	Windows Server	6%
SQL	14%	Java	17%	Continuous Integration (CI)	5%
Project Management	11%	DevOps	12%	Firmware	4%
Software Engineering	11%	System Architecture	12%	Hardware and Software Configuration	4%

ing certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

The computer systems engineer or architect occupation commonly requests security clearance and among others, the following top certifications: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career; and Certified Information Systems Security Professional (CISSP), a certification designed to validate information security work experience and a working knowledge of security principles and practices. CISSP is utilized to demonstrate that a security professional is able to design, engineer, implement, and run an information security program.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security clearance**
- **CompTIA Security+**
- **Certified Information Systems Security Professional (CISSP)**

Advancement Occupation

Software developers/ engineers design, and build computer programs. They identify user needs, develop the programs, test out new software, and make improvements. Some develop new applications for mobile or desktop use, while others build underlying systems software such as operating systems. They design each piece of an application or system and plan how the pieces will work together. Software developers / engineers create a variety of models and diagrams showing programmers the software code needed for an application. Working closely with computer programmers, software developers fill crucial roles not only in the computer systems industry, but also in manufacturing, finance, health services and software publishing industries. These individuals are comfortable with the uncertainties surrounding innovation and creativity. They have an ability to focus and concentrate for prolonged time periods addressing numerous and interlocking pieces. Finally, software developers / engineers are problem solvers, as they are responsible for solving the problems that occur during the development process.

Growth

The similarity score between software developer or engineer and the starting occu-

0.35
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$37,957
Average Salary Differential

0.96%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

5.84%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Network /Systems Support Specialist

Starting Occupation

▶

Software Developer / Engineer

Advancement Occupation

$68,768

Average Salary: Advancement

Occupation with 0 - 2 years experience

$84,801

Average Salary: Advancement

Occupation with 3 - 5 years experience

$98,508

Average Salary: Advancement

Occupation with 6+ years experience

279

Starting Occupation Postings

16,139

Advancement Occupation Postings

pation is 0.35 and the average salary differential is $37,957. While the projected 5-year employment growth for network or systems support specialist is 0.96%, software developer or engineer's projected 5-year growth is considerably higher at 5.84%. Average salary for the software developer or engineer occupation is $68,768 for individuals with up to 2 years of experience; $84,801 for those with 3 to 5 years, and $98,508 for individuals with 6 or more years. There were 16,139 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems support specialist to software developer or engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for software developer or engineer are knowledge of Microsoft C#, Linux, .NET, Oracle, and C++. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Java, software engineering, software development, SQL, and JavaScript. Distinguishing skills set a worker apart and come with a

Network /Systems Support Specialist

Starting Occupation

▶

Software Developer / Engineer

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft C#	16%	Java	40%	JavaScript Object Notation (JSON)	7%
Linux	15%	Software Engineering	34%	jQuery	6%
.NET	13%	Software Development	33%	React Javascript	6%
Oracle	12%	SQL	32%	Spring Boot	6%
C++	12%	JavaScript	26%	Ruby	5%

salary or growth premium. For this occupation, the distinguishing skills are knowledge of JavaScript Object Notation (JSON), jQuery, React Javascript, Spring Boot, and Ruby.

Certifications

The network / systems support specialist occupation requests in addition to security clearance and a driver's license, the following certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

The software developer/ engineer occupation commonly requests security clearance, and among others, the following certifications: IT Infrastructure Library (ITIL) Certification. Entry-level certification for IT service management. The second certification is CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **IT Infrastructure Library (ITIL) Certification**
- **CompTIA Security+**

Advancement Occupation

Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by analysts, software developers and engineers into instructions that a computer can follow. Computer programmers also design a graphical user interface (GUI) for an application so that non-technical users can use the software through easy, point-and-click menu options. These individuals tend to be investigative, which means they're intellectual, introspective, and inquisitive. They are curious, methodical, rational, analytical, and logical.

Growth

The similarity score between computer programmer and the starting occupation is 0.336 and the average salary differential is $15,667. While the projected 5-year employment growth for network or systems support specialist is 0.96%, computer programmer's projected 5-year growth is lower at -3.93%. Average salary for the computer programmer occupation is $46,889 for individuals with up to 2 years of experience; $57,102 for those with 3 to 5 years, and $71,592 for individuals with 6 or more years. There were 892 postings for the advancement occupation.

0.336
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$15,677
Average Salary Differential

0.96%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

-3.93%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$46,889
Average Salary: Advancement

Occupation with 0 - 2 years experience

$57,102
Average Salary: Advancement

Occupation with 3 - 5 years experience

$71,592
Average Salary: Advancement

Occupation with 6+ years experience

279
Starting Occupation Postings

892
Advancement Occupation Postings

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems support specialist to computer programmer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for computer programmer are knowledge of software development, Microsoft C#, project management, Oracle, and customer service. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of SQL, Java, JavaScript, .NET, and Python. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of SQL Server, Extensible Markup Language (XML), unit testing, debugging, and C++.

Certifications

The network / systems support specialist occupation requests in addition to security clearance and a driver's license, the following certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

Network /Systems Support Specialist

Starting Occupation

▶

Computer Programmer

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Software Development	16%
Microsoft C#	11%
Project Management	11%
Oracle	11%
Customer Service	8%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
SQL	25%
Java	23%
JavaScript	14%
.NET	10%
Python	9%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
SQL Server	8%
Extensible Markup Language (XML)	7%
Unit Testing	6%
Debugging	6%
C++	6%

The computer programmer occupation commonly requests security clearance, driver's license and the following certification: Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

Certifications

The source occupation commonly requests the following certifications:
- Security Clearance
- Driver's License
- Cisco Certified Network Associate (CCNA)

The Advancement occupation commonly requests the following certifications:
- Security Clearance
- Driver's License
- Project Management Professional (PMP)

Advancement Occupation

Electronics engineers design, develop, test, and supervise the manufacture of electronic equipment such as broadcast and communications systems. Many electronics engineers also work in areas closely related to computers. However, engineers whose work is related exclusively to computer hardware are considered computer hardware engineers. Electronics engineers specialize in areas such as communications, signal processing, and control systems or have a specialty within one of these areas. Basically, an electronics engineer is an engineer with expertise in circuits and devices and the systems and equipment that use them. These individuals are typically thinkers and builders who like working with ideas and prefer a job that demands lots of thinking. They enjoy searching for knowledge, implementing practical solutions and working with machinery.

Growth

The similarity score between electronics engineer and the starting occupation is 0.326 and the average salary differential is $20,852. While the projected 5-year employment growth for network or systems support specialist is 0.96%, electronics engineer's projected 5-year growth is somewhat similar at 0.47%.

0.326
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$20,852
Average Salary Differential

0.96%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

0.47%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$56,802

Average Salary: Advancement

Occupation with 0 - 2 years experience

$70,292

Average Salary: Advancement

Occupation with 3 - 5 years experience

$90,012

Average Salary: Advancement

Occupation with 6+ years experience

279

Starting Occupation Postings

284

Advancement Occupation Postings

Average salary for the electronics engineer occupation is $56,802 for individuals with up to 2 years of experience; $70,292 for those with 3 to 5 years, and $90,012 for individuals with 6 or more years. There were 284 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems support specialist to electronics engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for electronics engineer are knowledge of simulation, systems engineering, physics, MATLAB, and electronics industry knowledge. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of electronic engineering, electronics design and engineering, circuit design, VHSIC hardware description language (VHDL), and digital signal processing. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of digital circuit design, electronic circuits,

Network /Systems Support Specialist

Starting Occupation

▶

Electronics Engineer

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Simulation	19%	Electronic Engineering	16%	Digital Circuit Design	5%
Systems Engineering	14%	Electronics Design and Engineering	12%	Electronic Circuits	5%
Physics	13%	Circuit Design	12%	Mixed-Signal	5%
MATLAB	13%	VHSIC hardware description language (VHDL)	9%	LabVIEW	4%
Electronics Industry Knowledge	12%	Digital Signal Processing (DSP)	9%	Power Supplies	4%

mixed-signal, LabVIEW, and power supplies.

Certifications

The network / systems support specialist occupation requests in addition to security clearance and a driver's license, the following certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

The electronics engineer occupation commonly requests the following certifications. Security clearance, Driver's license, and among others, to have certification from an American Board for Engineering and Technology (ABET) accredited program.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **American Board for Engineering and Technology (ABET) Accredited**

Advancement Occupation

Network or systems administrators are responsible for the day-to-day operation of computer networks. They organize, install, and support an organization's computer systems, including local area networks (LANs), wide area networks (WANs), network segments, intranets, and other data communication systems. Central to their role is the responsibility for maintaining the a functioning network at all times. Since organizations depend on their networks for so much of their work, problems must be corrected quickly . In addition, these individuals make updates to all equipment and software to maintain them current. These individuals are comfortable collaborating with teams, acting as both a team player and a leader, interacting effectively with multiple levels of the organization, and communicating with colleagues.

Growth

The similarity score between network or systems administrator and the starting occupation is 0.711 and the average salary differential is $16,017. While the projected 5-year employment growth for network or systems support specialist is 0.96%, network or systems administrator's projected 5-year growth is considerably lower at -0.60%. Average salary for the network or sys-

0.711
Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1

$16,017
Average Salary Differential

0.96%
Projected 5-Year Growth

Projected employment growth for the Starting Occupation

-0.60%
Projected 5-Year Growth

Projected employment growth for the Advancement Occupation

Network / Systems Support Specialist

Starting Occupation

▶

Network / Systems Administrator

Advancement Occupation

$46,889

Average Salary: Advancement

Occupation with 0 - 2 years experience

$57,102

Average Salary: Advancement

Occupation with 3 - 5 years experience

$71,592

Average Salary: Advancement

Occupation with 6+ years experience

279

Starting Occupation Postings

1,704

Advancement Occupation Postings

tems administrator occupation is $46,889 for individuals with up to 2 years of experience; $57,102 for those with 3 to 5 years, and $71,592 for individuals with 6 or more years. There were 1,704 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems support specialist to network or systems administrator. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for network or systems administrator are knowledge of technical support, Cisco, hardware and software installation, SQL, and software installation. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of system administration, Linux, Microsoft Active Directory, VMware, and Windows Server. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Network infrastructure (Edge POE Devices), group policy, Virtual Private Networking (VPN), network security, and Light-

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Technical Support	19%
Cisco	16%
Hardware and Software Installation	16%
SQL	14%
Software Installation	13%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
System Administration	59%
Linux	32%
Microsoft Active Directory	26%
VMware	25%
Windows Server	18%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Network Infrastructure (Edge POE Devices)	6%
Group policy	6%
Virtual Private Networking (VPN)	6%
Network Security	6%
Lightweight Directory Access Protocol (LDAP)	6%

weight Directory Access Protocol (LDAP).

Certifications

The network / systems support specialist occupation requests in addition to security clearance and a driver's license, the following certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

The network / systems administrator occupation commonly requests security clearance, and among others, the following certifications: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second top certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

Certifications

The source occupation commonly requests the following certifications:
· Security Clearance
· Driver's License
· Cisco Certified Network Associate (CCNA)

The Advancement occupation commonly requests the following certifications:
· Security Clearance
· CompTIA Security+
· Cisco Certified Network Associate (CCNA)

Advancement Occupation

Database administrators set up databases according to a company's needs and make sure they operate efficiently. They also fine-tune, upgrade and test modifications to the databases as needed. For example, they create or organize systems to store and secure a variety of data, such as financial information and customer shipping records. Individuals in this occupation are comfortable resolving complex issues, so attention to detail is an essential trait in this profession, as is a passion for problem-solving. Communication skills are also important since database administrators often work as part of a team with computer programmers and managers. Ongoing maintenance of a database requires being on call.

Growth

The similarity score between database administrator and the starting occupation is 0.434 and the average salary differential is $21,397. While the projected 5-year employment growth for network or systems support specialist is 0.96%, the advancement occupation's projected 5-year growth is lower at 0.17%. Average salary for the advancement occupation is $65,432 for individuals with up to 2 years of experience; $78,590 for those with 3 to 5 years, and $97,463 for individu-

0.434
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$21,397
Average Salary Differential

0.96%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

0.17%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$65,432
Average Salary: Advancement

Occupation with 0 - 2 years experience

$78,590
Average Salary: Advancement

Occupation with 3 - 5 years experience

$97,463
Average Salary: Advancement

Occupation with 6+ years experience

279
Starting Occupation Postings

1,297
Advancement Occupation Postings

als with 6 or more years. There were 1,297 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems support specialist to database administrator. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for this occupation are knowledge of database design, Linux, Python, UNIX, and database management. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of SQL, database administration, Oracle, Teradata DBA, and SQL Server. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Informatica, MySQL, database tuning, database upgrade, and Relational Database Management Systems (RDBMS).

Certifications

The network / systems support specialist occupation requests in addition to security

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Database Design	14%	SQL	50%	Informatica	7%
Linux	14%	Database Administration	34%	MySQL	6%
Python	11%	Oracle	28%	Database Tuning	6%
UNIX	11%	Teradata DBA	26%	Database Upgrade	5%
Database Management	11%	SQL Server	21%	Relational DataBase Management System (RDBMS)	5%

clearance and a driver's license, the following certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

The database administrator occupation commonly requests security clearance, driver's license and among others, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **CompTIA Security+**

Advancement Occupation

Telecommunications engineering specialists design or configure voice, video, and data communications systems to keep users connected. They supervise installation, and post-installation service and maintenance. They also implement controls to provide security for operating systems, software, and data. These individuals are comfortable with starting up and carrying out projects. They like leading people and making many decisions. Sometimes they require risk taking and often deal with business by providing user support through diagnosing network and device problems and implementing technical or procedural solutions.

Growth

The similarity score between telecommunications engineering specialist and the starting occupation is 0.673 and the average salary differential is $8,908. While the projected 5-year employment growth for network or systems support specialist is 0.96%, telecommunications engineering specialist's projected 5-year growth is slightly higher at 2.00%. Average salary for the telecommunications engineering specialist occupation is $46,889 for individuals with up to 2 years of experience; $57,102 for those with 3 to 5 years, and $71,592 for individ-

0.673
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$8,908
Average Salary Differential

0.96%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.00%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Network /Systems Support Specialist

Starting Occupation

▶

Telecommunications Engineering Specialist

Advancement Occupation

$46,889
Average Salary: Advancement

Occupation with 0 - 2 years experience

$57,102
Average Salary: Advancement

Occupation with 3 - 5 years experience

$71,592
Average Salary: Advancement

Occupation with 6+ years experience

279
Starting Occupation Postings

203
Advancement Occupation Postings

uals with 6 or more years. There were 203 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems support specialist to telecommunications engineering specialist. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for telecommunications engineering specialist are knowledge of customer service, repair, technical support, project management, and scheduling. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of telecommunications, Cisco, Voice over IP (VoIP), unified communications, and network engineering. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of network operations & service management, system/network configuration, Cisco switching, data communications, and local Area Networks (LANs).

Certifications

The network / systems support specialist occupation requests in addition to security

Network /Systems Support Specialist
Starting Occupation

▶

Telecommunications Engineering Specialist
Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Customer Service	15%
Repair	13%
Technical Support	12%
Project Management	12%
Scheduling	11%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Telecommunications	59%
Cisco	29%
Voice over IP (VoIP)	24%
Unified Communications	15%
Network Engineering	12%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Network Operations & Service Management	8%
System/Network Configuration	7%
Cisco Switching	5%
Data Communications	4%
Local Area Network (LAN)	4%

clearance and a driver's license, the following certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

The telecommunications engineering specialist occupation commonly requests security clearance, and among others, the following certifications: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification. The second top certification is Cisco Certified Network Professional (CCNP), a certification for individuals in the IT industry who have achieved the professional level of Cisco Career Certification. Both certifications are from Cisco Systems.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Cisco Certified Network Associate (CCNA)**
- **Cisco Certified Network Professional (CCNP)**

Advancement Occupation

Cyber/ Information security engineers/ analysts specialize in network and IT infrastructure security. They understand cyberattacks, malware, and the behavior of cybercriminals, and actively seeks to anticipate and prevent these attacks. Their primary role is to understand company IT infrastructure in detail, monitor it at all times, and evaluate threats that could potentially breach the network, and the access to information assets. They continuously look for ways to enhance company information systems and network security and protect its sensitive information. These individuals are comfortable staying up-to-date with the changing technology world, and are very detailed oriented.

Growth

The similarity score between cyber/ Information security engineer/ analyst and the starting occupation is 0.414 and the average salary differential is $30,557. While the projected 5-year employment growth for network or systems support specialist is 0.96%, cyber/ Information security engineer/ analyst's projected 5-year growth is considerably higher at 8.77%. Average salary for the cyber/ Information security engineer/ analyst occupation is $58,383 for individuals with up to 2 years

0.414
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$30,557
Average Salary Differential

0.96%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

8.77%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Network /Systems Support Specialist

Starting Occupation

▶

Cyber / Information Security Engineer / Analyst

Advancement Occupation

$58,383

Average Salary: Advancement

Occupation with 0 - 2 years experience

$79,154

Average Salary: Advancement

Occupation with 3 - 5 years experience

$95,250

Average Salary: Advancement

Occupation with 6+ years experience

279

Starting Occupation Postings

3,137

Advancement Occupation Postings

of experience; $79,154 for those with 3 to 5 years, and $95,250 for individuals with 6 or more years. There were 3,137 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems support specialist to cyber/ Information security engineer/ analyst. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for cyber/ Information security engineer/ analyst are knowledge of Linux, Python, cryptography, project management, and customer service. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of information security, information systems, network security, NIST Cybersecurity Framework, and information assurance. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of vulnerability analysis, Nessus, threat intelligence and analysis, threat modeling, and cybersecurity assessment.

Network /Systems Support Specialist
Starting Occupation

▶

Cyber / Information Security Engineer / Analyst
Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Linux	19%
Python	14%
Cryptography	13%
Project Management	12%
Customer Service	11%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Information Security	49%
Information Systems	27%
Network Security	18%
NIST Cybersecurity Framework	12%
Information Assurance	12%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Vulnerability analysis	5%
Nessus	5%
Threat Intelligence and Analysis	5%
Threat Modeling	5%
Cybersecurity Assessment	4%

Certifications

The network / systems support specialist occupation requests in addition to security clearance and a driver's license, the following certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

The Cyber / information security engineer / analyst occupation commonly requests security clearance, and among others, the following certifications: Certified Information Systems Security Professional (CISSP), a certification designed to validate information security work experience and a working knowledge of security principles and practices. CISSP is utilized to demonstrate that a security professional is able to design, engineer, implement, and run an information security program. The second top certification is GIAC certifications by the SANS Institute. GIAC provides a set of vendor-neutral computer security certifications.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Certified Information Systems Security Professional (CISSP)**
- **SANS/GIAC Certification**

Advancement Occupation

Network engineers / architects take care of communication networks, such as local area networks (LANs), wide area networks (WANs), and intranets. They design and implement network configurations, troubleshoot performance issues, carry out network monitoring and configure security systems such as firewalls. Among the major skills that these individuals should possess include analytical, problem-solving and communication skills. They should be team-building, detail-oriented leaders with extensive knowledge of various types of computer operating, security and wireless systems.

Growth

The similarity score between network engineer / architect and the starting occupation is 0.667 and the average salary differential is $38,748. While the projected 5-year employment growth for network or systems support specialist is 0.96%, network engineer / architect's projected 5-year growth is higher at 2.86%. Average salary for the network engineer / architect occupation is $58,383 for individuals with up to 2 years of experience; $79,154 for those with 3 to 5 years, and $95,250 for individuals with 6 or more years. There were 2,525

0.667
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$38,748
Average Salary Differential

0.96%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.86%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$58,383
Average Salary: Advancement

Occupation with 0 - 2 years experience

$79,154
Average Salary: Advancement

Occupation with 3 - 5 years experience

$95,250
Average Salary: Advancement

Occupation with 6+ years experience

279
Starting Occupation Postings

2,525
Advancement Occupation Postings

postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems support specialist to network engineer / architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for network engineer / architect are knowledge of Python, routers, project management, Java, and software development. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of network engineering, Cisco, Linux, Wide Area Network (WAN), and VMware. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Microsoft Active Directory, Voice over IP (VoIP), network testing, network hardware, and Citrix.

Certifications

The network / systems support specialist occupation requests in addition to security clearance and a driver's license, the follow-

Network /Systems Support Specialist

Starting Occupation

▶

Network Engineer / Architect

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Python	17%
Routers	14%
Project Management	13%
Java	12%
Software Development	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Network Engineering	28%
Cisco	24%
Linux	16%
Wide Area Network (WAN)	14%
VMware	11%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft Active Directory	7%
Voice over IP (VoIP)	5%
Network Testing	4%
Network Hardware	4%
Citrix	3%

ing certification: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification from Cisco Systems.

The network engineer / architect occupation commonly requests security clearance and, among others, the following certifications: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification. The second top certification is Cisco Certified Network Professional (CCNP), a certification for individuals in the IT industry who have achieved the professional level of Cisco Career Certification. Both certifications are from Cisco Systems.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
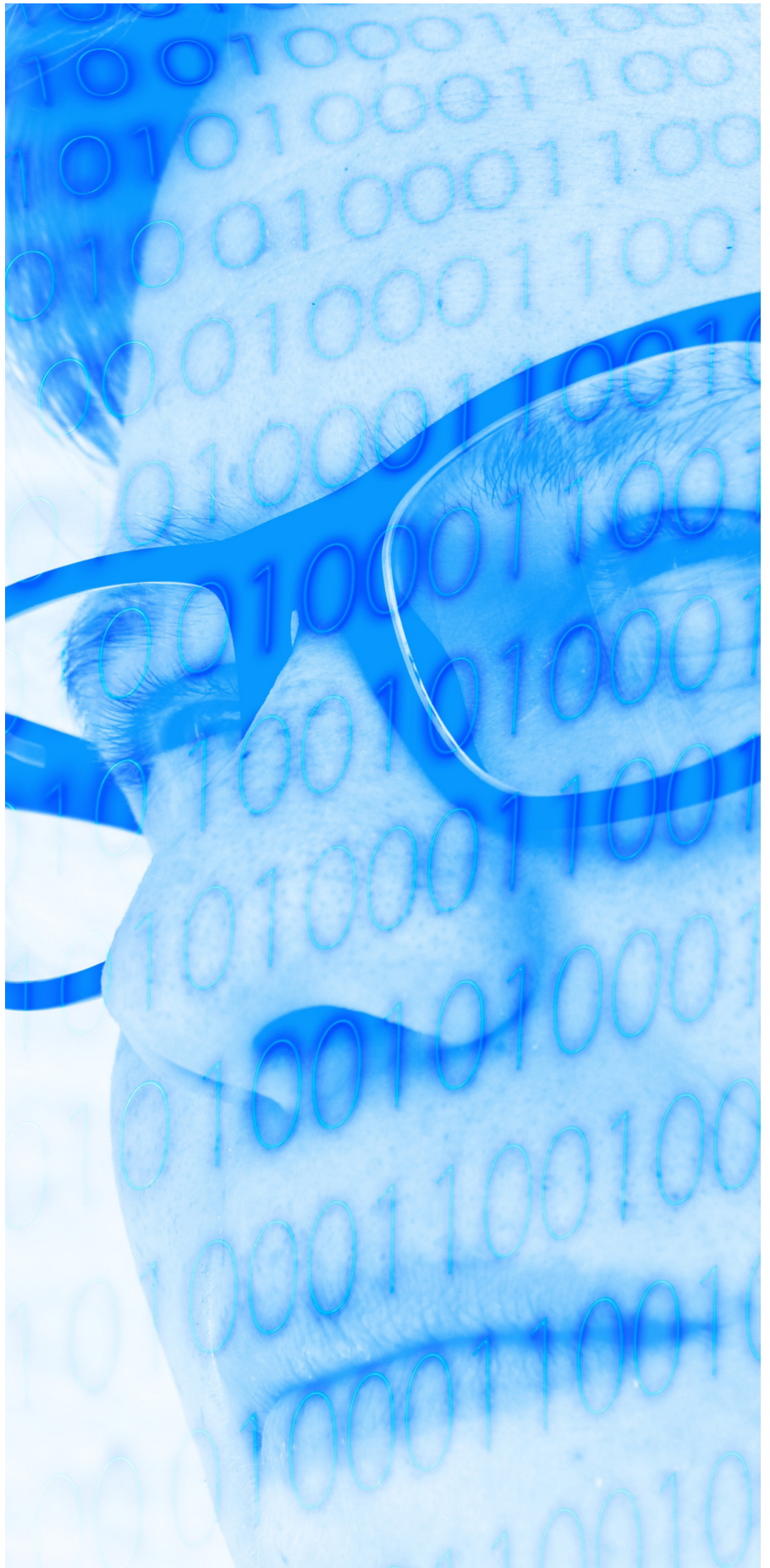- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Cisco Certified Network Associate (CCNA)**
- **Cisco Certified Network Professional (CCNP)**

Occupation Profile: Networking and Systems

Occupation: Network / Systems Administrator

Occupation Profile: Networking and Systems
Occupation: Network / Systems Administrator

Occupation

Network or systems administrators are responsible for the day-to-day operation of computer networks. They organize, install, and support an organization's computer systems, including local area networks (LANs), wide area networks (WANs), network segments, intranets, and other data communication systems. Central to their role is the responsibility for maintaining the a functioning network at all times. Since organizations depend on their networks for so much of their work, problems must be corrected quickly. In addition, these individuals make updates to all equipment and software to maintain them current. These individuals are comfortable collaborating with teams, acting as both a team player and a leader, interacting effectively with multiple levels of the organization, and communicating with colleagues.

Growth

Network or systems administrator jobs are projected to have a -0.60% growth in employment. The entry level salary for this occupation is $67,090 with a requirement of less than 2 years of experience. The mid career salary, that is jobs requiring 3 to 5 years of experience is $78,799. The advanced career salary which requests six or more years of experience is $89,735.

-0.60%
Projected Growth

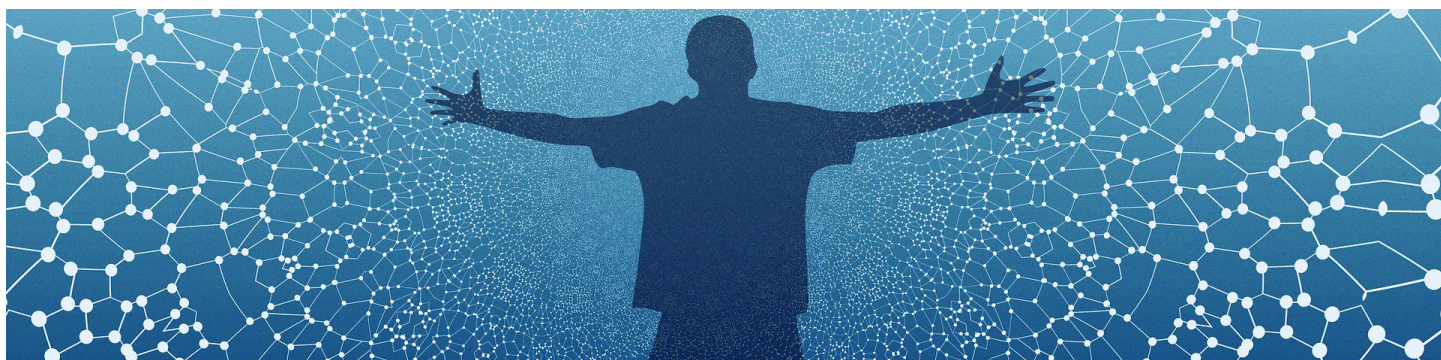*Estimated five-year growth in employment*

$67,090
Entry Level Salary

Salary for jobs requiring less than 2 years of experience

$78,799
Mid Career Salary

Salary for jobs requesting 3 to 5 years of experience

$89,735
Advanced Career Salary

Salary for jobs requesting 6+ years of experience

Occupation Profile: Networking and Systems
Occupation: Network / Systems Administrator

Skills

The skills shown in the table below represent the additional skills likely needed to move from the starting occupation to the advancement occupation. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for network or systems administrator include knowledge of technical support, hardware and software installation, Cisco, information systems, hardware and software configuration, and software installation. Defining skills represent the day-to-day tasks and responsibilities of the job. They assume an increase level of communication and direct user support. For this occupation the defining skills include knowledge of system administration, Linux, Microsoft Active Directory, VMware, and network administration. Distinguishing skills set a worker apart and come with a salary premium. In this occupation, the distinguishing skills are knowledge of Network Infrastructure (Edge POE Devices), group policy, Network security, Virtual Private Networking (VPN), Lightweight Directory Access Protocol (LDAP), and performance tuning.

Certifications

- **Security Clearance**
- **CompTIA Security+**
- **Cisco Certified Network Associate (CCNA)**

Certifications

This occupation commonly requests in addition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

Necessary Skills

Skill Name	Percent of Postings Requesting Skill
Technical Support	21%
Hardware and Software Installation	19%
Cisco	18%
Information Systems	17%
Hardware and Software Configuration	15%
Software Installation	15%

Defining Skills

Skill Name	Percent of Postings Requesting Skill
System Administration	62%
Linux	33%
Microsoft Active Directory	26%
VMware	26%
Windows Server	19%
Network Administration	18%

Distinguishing Skills

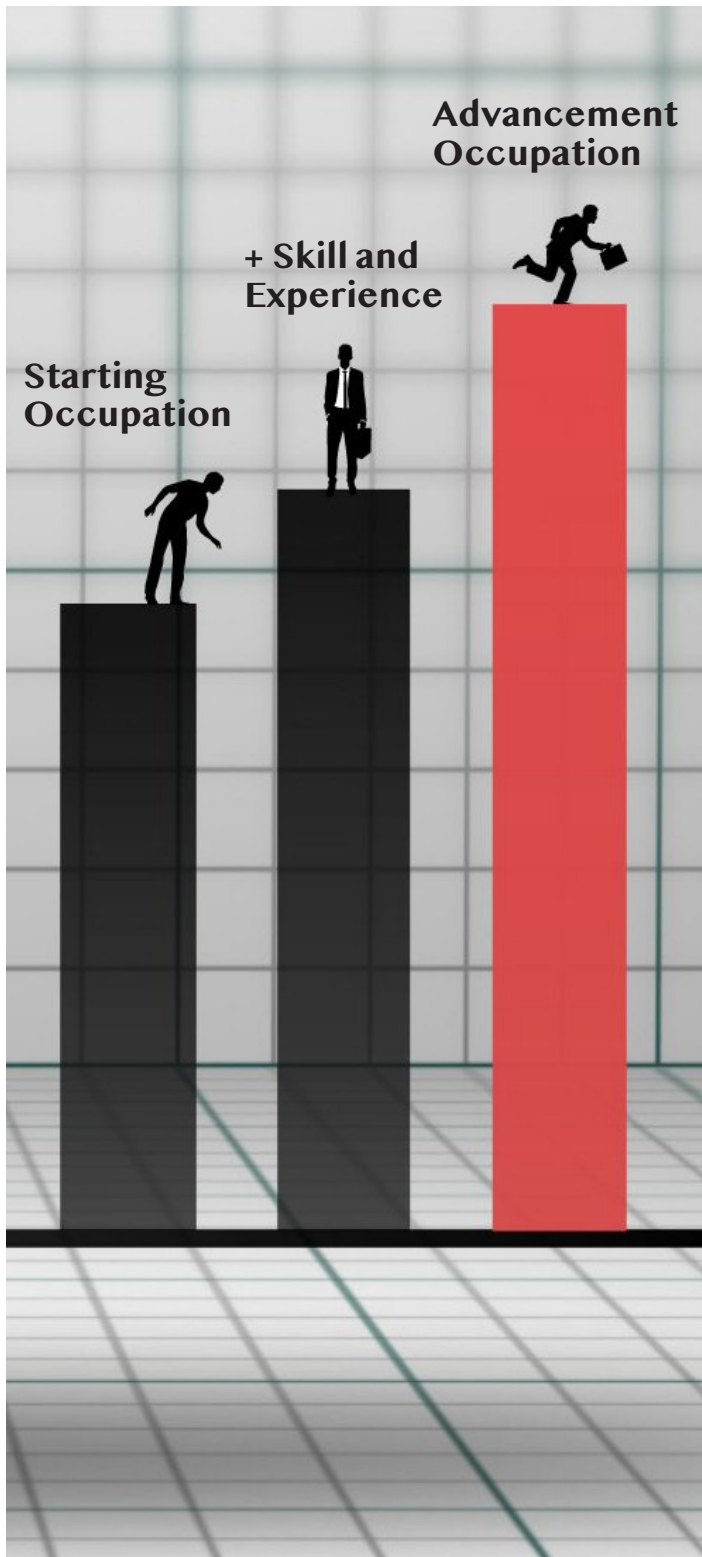| Skill Name	Percent of Postings Requesting Skill
Network Infrastructure (Edge POE Devices)	7%
Group policy	7%
Network Security	7%
Virtual Private Networking (VPN)	6%
Lightweight Directory Access Protocol (LDAP)	6%
Performance tuning	5%

Potential Career Paths for Network / Systems Administrator

For the starting occupation of network or systems administrator, we identify possible next step occupations. These occupations come with an increase in compensation and require additional skills and in some cases certifications. These skills may be learned on the job at the initial position held or can be learned in advance.

In the pages that follow, we provide for each Advancement Occupation, skill gaps, certifi-cations, salary and workforce information. With this information, students, educators, and policymakers can see the paths a worker could take from the Starting Occupation to the Advancement Occupation.

Detailed
Career Pathways:

Network / Systems
Administrator

Advancement Occupation

Computer Systems Engineers or Architects design and develop solutions to complex applications problems, system administration issues, or network concerns. They perform systems management and integration functions. These individuals develop software engineering, system integration, or distributed system architectures. They also collaborate with software developers to select appropriate design solutions and to ensure the compatibility of system components. These individuals are comfortable with paying attention to detail, using analytical skills and working in an atmosphere of innovation..

Growth

The similarity score between computer systems engineer or architect and the starting occupation is 0.591 and the average salary differential is $26,410. While the projected 5-year employment growth for network or systems administrator is -0.60%, computer systems engineer or architect's projected 5-year growth is considerably higher at 2.75%. Average salary for the computer systems engineer or architect occupation is $60,813 for individuals with up to 2 years of experience; $83,001 for those with 3 to

0.591
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$26,410
Average Salary Differential
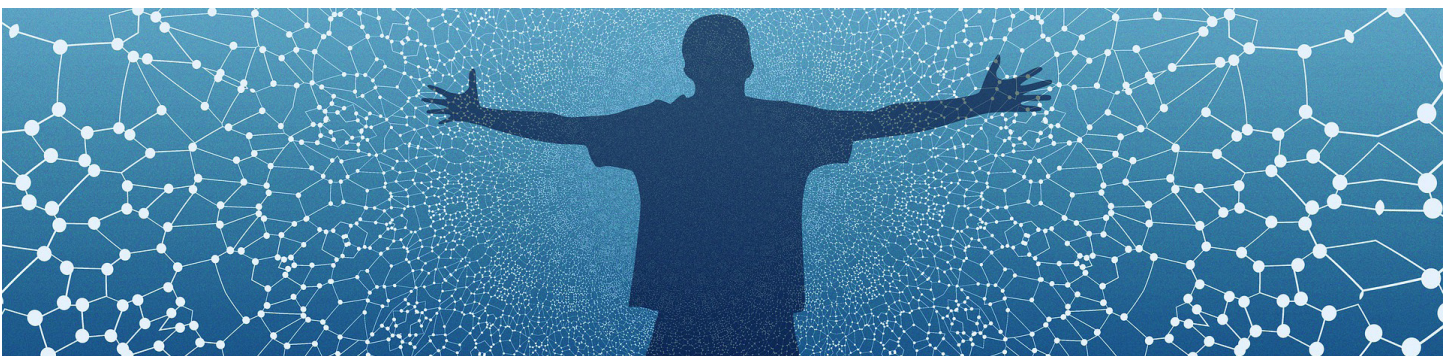
-0.60%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.75%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Network / Systems Administrator

Starting Occupation

▶

Computer Systems Engineer / Architect

Advancement Occupation

$60,813
Average Salary: Advancement

Occupation with 0 - 2 years experience

$83,001
Average Salary: Advancement

Occupation with 3 - 5 years experience

$99,718
Average Salary: Advancement

Occupation with 6+ years experience

1,704

Starting Occupation Postings

3,259

Advancement Occupation Postings

5 years, and $99,718 for individuals with 6 or more years. There were 3,259 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to computer systems engineer or architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for computer systems engineer or architect are knowledge of Python, software development, SQL, project management, and software engineering. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of systems engineering, Linux, Java, DevOps, and System Architecture. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of UNIX, Windows server, Continuous Integration (CI), firmware, and hardware and software configuration.

Network /
Systems
Administrator

Starting Occupation

▶

Computer Systems
Engineer /
Architect

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Python	19%	Systems Engineering	46%	UNIX	8%
Software Development	17%	Linux	20%	Windows Server	6%
SQL	14%	Java	17%	Continuous Integration (CI)	5%
Project Management	11%	DevOps	12%	Firmware	4%
Software Engineering	11%	System Architecture	12%	Hardware and Software Configuration	4%

Certifications

The network or systems administrator occupation commonly requests in addition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The computer systems engineer or architect occupation commonly requests security clearance, and among others, the following top certifications: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career; and Certified Information Systems Security Professional (CISSP), a certification designed to validate information security work experience and a working knowledge of security principles and practices. CISSP is utilized to demonstrate that a security professional is able to de-

Certifications

The source occupation commonly requests the following certifications:
• **Security Clearance**
• **CompTIA Security+**
• **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
• **Security Clearance**
• **CompTIA Security+**
• **Certified Information Systems Security Professional (CISSP)**

sign, engineer, implement, and run an information security program.

Advancement Occupation

Software developers/ engineers design, and build computer programs. They identify user needs, develop the programs, test out new software, and make improvements. Some develop new applications for mobile or desktop use, while others build underlying systems software such as operating systems. They design each piece of an application or system and plan how the pieces will work together. Software developers / engineers create a variety of models and diagrams showing programmers the software code needed for an application. Working closely with computer programmers, software developers fill crucial roles not only in the computer systems industry, but also in manufacturing, finance, health services and software publishing industries. These individuals are comfortable with the uncertainties surrounding innovation and creativity. They have an ability to focus and concentrate for prolonged time periods addressing numerous and interlocking pieces. Finally, software developers / engineers are problem solvers, as they are responsible for solving the problems that occur during the development process.

Growth

The similarity score between software developer or engineer and the starting occupation is 0.567 and the average salary

0.567
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$21,939
Average Salary Differential

-0.60%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

5.84%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$68,768

Average Salary: Advancement

Occupation with 0 - 2 years experience

$84,801

Average Salary: Advancement

Occupation with 3 - 5 years experience

$98,508

Average Salary: Advancement

Occupation with 6+ years experience
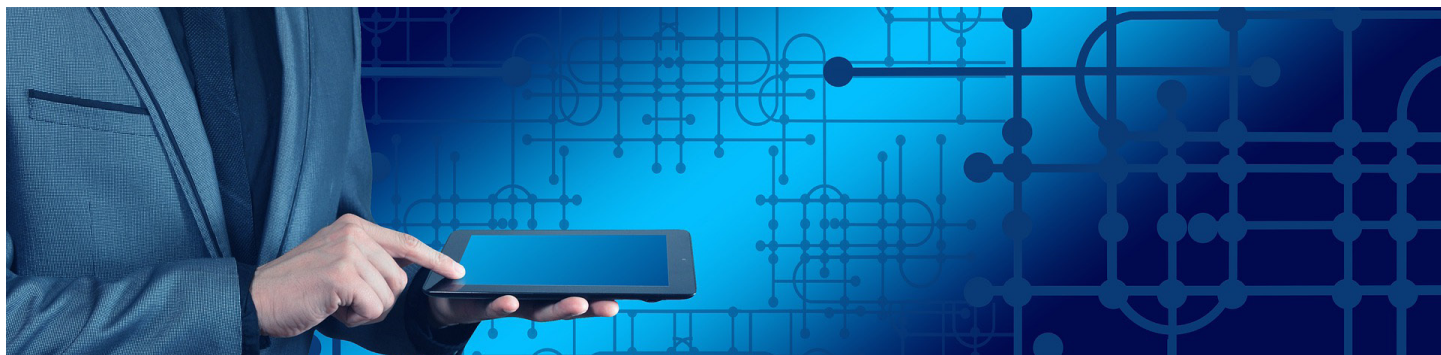
1,704

Starting Occupation Postings

16,139

Advancement Occupation Postings

differential is $21,939. While the projected 5-year employment growth for network or systems administrator is -0.60%, software developer or engineer's projected 5-year growth is considerably higher at 5.84%. Average salary for the software developer or engineer occupation is $68,768 for individuals with up to 2 years of experience; $84,801 for those with 3 to 5 years, and $98,508 for individuals with 6 or more years. There were 16,139 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to software developer or engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for software developer or engineer are knowledge of Microsoft C#, Linux, .NET, Oracle, and C++. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Java, software engineering, software development, SQL, and JavaScript. Distinguishing skills set a worker apart and come with a

Network / Systems Administrator

Starting Occupation

▶

Software Developer / Engineer

Advancement Occupation

Necessary Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft C#	16%
Linux	15%
.NET	13%
Oracle	12%
C++	12%

Defining Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation
Java	40%
Software Engineering	34%
Software Development	33%
SQL	32%
JavaScript	26%

Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation
JavaScript Object Notation (JSON)	7%
jQuery	6%
React Javascript	6%
Spring Boot	6%
Ruby	5%

salary or growth premium. For this occupation, the distinguishing skills are knowledge of JavaScript Object Notation (JSON), jQuery, React Javascript, Spring Boot, and Ruby.

Certifications

The network or systems administrator occupation commonly requests in addition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The software developer/ engineer occupation commonly requests security clearance, and among others, the following certifications: IT Infrastructure Library (ITIL) Certification. Entry-level certification for IT service management. The second certification is CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills

Certifications

The source occupation commonly requests the following certifications:
- Security Clearance
- CompTIA Security+
- Cisco Certified Network Associate (CCNA)

The Advancement occupation commonly requests the following certifications:
- Security Clearance
- IT Infrastructure Library (ITIL) Certification
- CompTIA Security+

necessary to perform core security functions and pursue an IT security career.

Advancement Occupation

Cyber/ Information security engineers/ analysts specialize in network and IT infrastructure security. They understand cyberattacks, malware, and the behavior of cybercriminals, and actively seeks to anticipate and prevent these attacks. Their primary role is to understand company IT infrastructure in detail, monitor it at all times, and evaluate threats that could potentially breach the network, and the access to information assets. They continuously look for ways to enhance company information systems and network security and protect its sensitive information. These individuals are comfortable staying up-to-date with the changing technology world, and are very detailed oriented.

Growth

The similarity score between cyber/ Information security engineer/ analyst and the starting occupation is 0.535 and the average salary differential is $14,540. While the projected 5-year employment growth for network or systems administrator is -0.60%, cyber/ Information security engineer/ analyst's projected 5-year growth is considerably higher at 8.77%. Average salary for the cyber/ Information security engineer/ analyst occupation is $58,383 for individuals with up to 2 years

0.535
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$14,540
Average Salary Differential
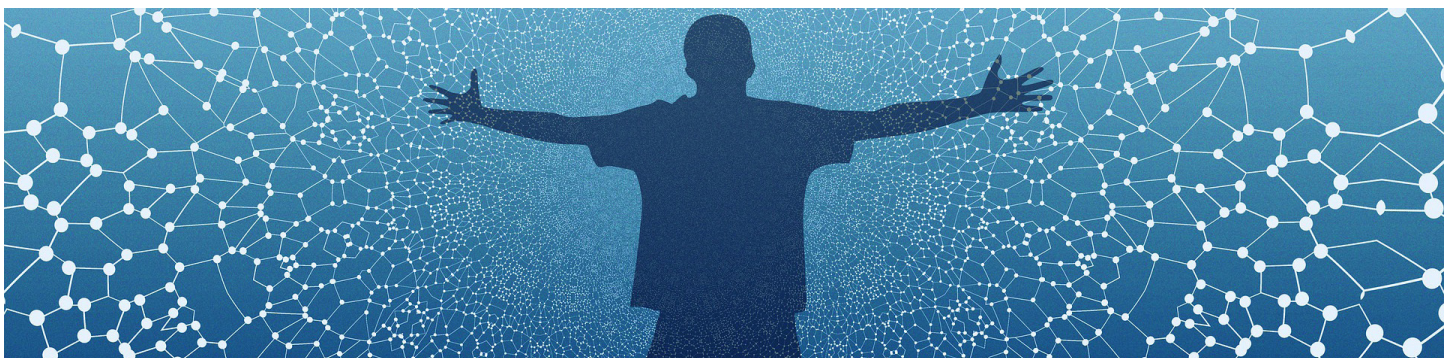
-0.60%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

8.77%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Network / Systems Administrator

Starting Occupation

▶

Cyber / Information Security Engineer / Analyst

Advancement Occupation

$58,383

Average Salary: Advancement

Occupation with 0 - 2 years experience

$79,154

Average Salary: Advancement

Occupation with 3 - 5 years experience

$95,250

Average Salary: Advancement

Occupation with 6+ years experience

1,704

Starting Occupation Postings

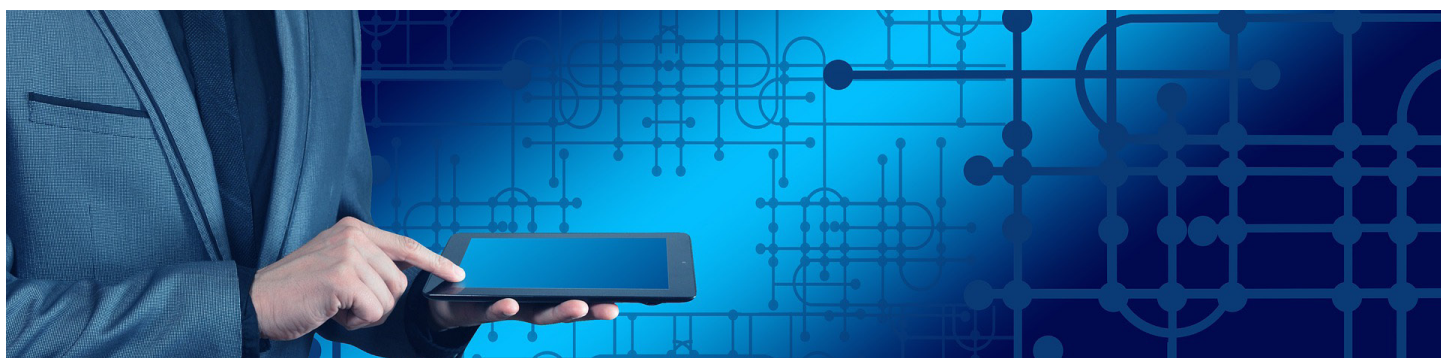## 3,137

Advancement Occupation Postings

of experience; $79,154 for those with 3 to 5 years, and $95,250 for individuals with 6 or more years. There were 3,137 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to cyber/ Information security engineer/ analyst. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for cyber/ Information security engineer/ analyst are knowledge of Linux, Python, cryptography, project management, and customer service. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of information security, information systems, network security, NIST Cybersecurity Framework, and information assurance. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are vulnerability analysis, Nessus, threat intelligence and analysis, threat modeling, and cybersecurity assessment.

Network / Systems Administrator		Cyber / Information Security Engineer / Analyst
Starting Occupation	▶	*Advancement Occupation*

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Linux	19%
Python	14%
Cryptography	13%
Project Management	12%
Customer Service	11%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Information Security	49%
Information Systems	27%
Network Security	18%
NIST Cybersecurity Framework	12%
Information Assurance	12%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Vulnerability analysis	5%
Nessus	5%
Threat Intelligence and Analysis	5%
Threat Modeling	5%
Cybersecurity Assessment	4%

Certifications

The network or systems administrator occupation commonly requests in addition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The Cyber / information security engineer / analyst occupation commonly requests security clearance, and among others, the following certifications: Certified Information Systems Security Professional (CISSP), a certification designed to validate information security work experience and a working knowledge of security principles and practices. CISSP is utilized to demonstrate that a security professional is able to design, engineer, implement, and run an information security program. The second top certification is GIAC certifications by the SANS In-

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **CompTIA Security+**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Certified Information Systems Security Professional (CISSP)**
- **SANS/GIAC Certification**

stitute. GIAC provides a set of vendor-neutral computer security certifications.

Advancement Occupation

Database architects design strategies for company-wide large databases, data warehouse systems, and multidimensional networks. They set standards for database operations, programming, query processes, and security. Database architects model, design, and construct large relational databases or data warehouses. Create and optimize data models for warehouse infrastructure and workflow. They also integrate new systems with existing warehouse structure and refine system performance and functionality. These individuals are comfortable structuring complex problems through deductive reasoning, and can communicate their recommendations in simple business-like language. But most of all, they expose significant oral and reading comprehension.

Growth

The similarity score between database architect and the starting occupation is 0.515 and the average salary differential is $21,316. While the projected 5-year employment growth for network or systems administrator is -0.60%, database architect's projected 5-year growth is higher at 2.99%. Average salary for the database architect occupation is $69,185 for individuals with up to 2 years of experience; $85,231 for those with 3 to 5 years, and $98,672 for individuals

0.515
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$21,316
Average Salary Differential

-0.60%
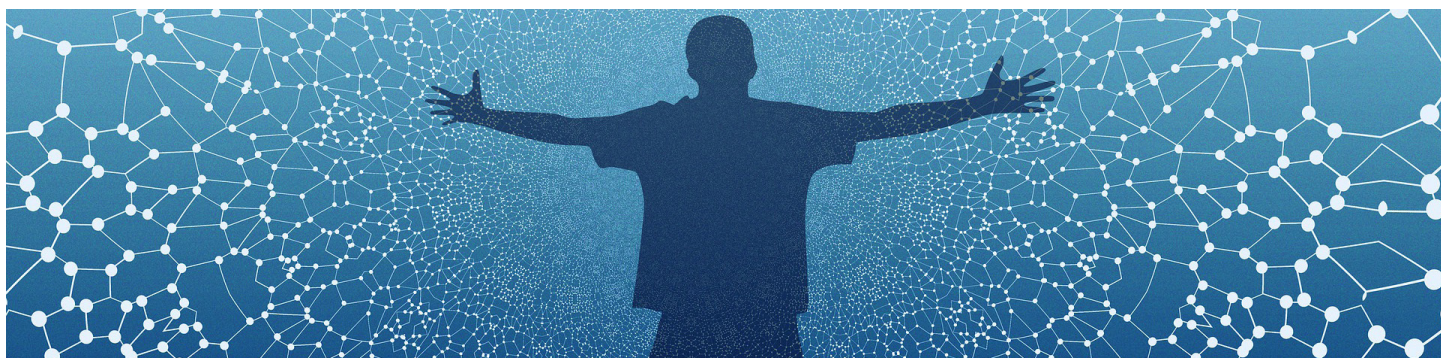**Projected 5-Year Growth**
Projected employment growth for the Starting Occupation

2.99%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$69,185
Average Salary: Advancement

Occupation with 0 - 2 years experience

$85,231
Average Salary: Advancement

Occupation with 3 - 5 years experience

$98,672
Average Salary: Advancement

Occupation with 6+ years experience

1,704
Starting Occupation Postings

870
Advancement Occupation Postings

with 6 or more years. There were 870 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to database architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for database architect are knowledge of data analysis, Oracle, data quality, project management, and SQL Server. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of SQL, data architecture, data warehousing, data modeling, and Extraction, Transformation and Loading (ETL). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of ERwin, database architecture, Teradata, Master Data Management (MDM), and virtualization.

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Data Analysis	19%	SQL	43%	ERwin	6%
Oracle	18%	Data Architecture	33%	Database Architecture	6%
Data Quality	16%	Data Warehousing	26%	Teradata	6%
Project Management	12%	Data Modeling	23%	Master Data Management (MDM)	5%
SQL Server	12%	Extraction Transformation and Loading (ETL)	23%	Virtualization	5%

Certifications

The network or systems administrator occupation commonly requests in addition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The database architect occupation commonly requests security clearance, and among others, the following top certifications: IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management. The second is the Certified Scrum Trainer (CST), a certification offered by the Scrum Alliance that enables people to teach CSM (Certified Scrum Master) and CSPO (Certified Scrum Product Owner) courses.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **CompTIA Security+**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **IT Infrastructure Library (ITIL) Certification**
- **Certified Scrum Trainer (CST)**

Network /
Systems
Administrator
Starting Occupation

▶

Business Intelligence
Architect /
Developer
Advancement Occupation

Advancement Occupation

Business intelligence architects/ developers are responsible for designing and developing BI solutions, overseeing the implementation of the these types of systems and also their ongoing maintenance. They are in charge of developing, deploying, and maintaining BI interfaces. Those include query tools, data visualization and interactive dashboards, ad hoc reporting, and data modeling tools. These individuals are comfortable working with large amounts of data and deriving insights from their analysis. Some individuals may be more comfortable presenting and communicating results to others. But in either case, they are good at examining multiple sources of data and then making accurate conclusions about them. These individuals are naturally inquisitive and over time, develop a great deal of forward-thinking vision.

Growth

The similarity score between business Intelligence architect / developer and the starting occupation is 0.479 and the average salary differential is $26,628. While the projected 5-year employment growth for network or systems administrator is -0.60%, business Intelligence architect / developer's projected 5-year growth is considerably higher at 6.30%.

0.479
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$26,628
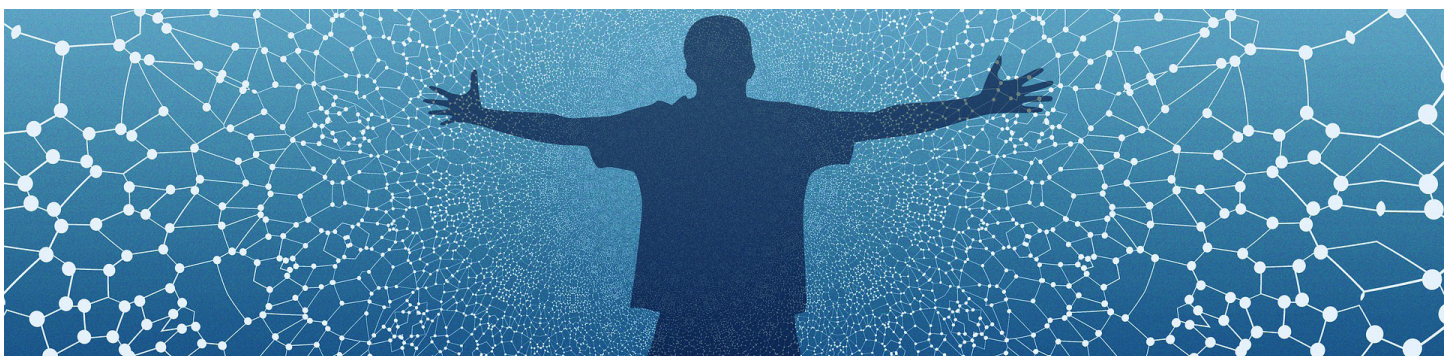**Average Salary Differential**

-0.60%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

6.30%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Network / Systems Administrator	▶	Business Intelligence Architect / Developer
Starting Occupation		*Advancement Occupation*

$70,639

Average Salary: Advancement

Occupation with 0 - 2 years experience

$87,647

Average Salary: Advancement

Occupation with 3 - 5 years experience

$101,639

Average Salary: Advancement

Occupation with 6+ years experience

1,704

Starting Occupation Postings

855

Advancement Occupation Postings

Average salary for the business intelligence architect/ developer occupation is $70,639 for individuals with up to 2 years of experience; $87,647 for those with 3 to 5 years, and $101,639 for individuals with 6 or more years. There were 855 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to business Intelligence architect / developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for business Intelligence architect / developer are knowledge of JavaScript, software development, business process, Oracle, and Microsoft Power BI. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Salesforce, Salesforce development, SQL, Salesforce Visualforce, and Salesforce Lightning. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Microsoft SQL Server Integration Services (SSIS), SQL Serv-

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
JavaScript	18%
Software Development	15%
Business Process	15%
Oracle	13%
Microsoft Power BI	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Salesforce	49%
Salesforce Development	39%
SQL	34%
Salesforce Visualforce	24%
Salesforce Lightning	19%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft Sql Server Integration Services (SSIS)	5%
SQL Server Reporting Services (SSRS)	5%
Informatica	5%
Data Architecture	5%
Oracle PL/SQL	4%

er Reporting Services (SSRS), informatica, data architecture, and Oracle PL/SQL.

Certifications

The network or systems administrator occupation commonly requests in addition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The business intelligence architect/ developer occupation commonly requests security clearance, and among others, the following certifications: Certified Salesforce Platform Developer. With this credential, individuals use programmatic and declarative skills to extend and customize Salesforce applications. The second is the Certified Salesforce Administrator. This certification focuses on the features and functionality used to maintain a Salesforce implementation.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **CompTIA Security+**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Certified Salesforce Platform Developer**
- **Certified Salesforce Administrator**

Network /
Systems
Administrator

Starting Occupation

▶

Web Developer

Advancement Occupation

Advancement Occupation

Web developers create and maintain websites. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site. They evaluate code to ensure that it is properly structured, meets industry standards, and is compatible with browsers and devices. These developers optimize website performance, scalability, and server-side code and processes. They may develop website infrastructure and integrate websites with other computer applications. These individuals are comfortable working with technology as the core of their responsibilities, but over time, must develop a good understanding of consumer behavior, as well as collaboration skills and project management.

Growth

The similarity score between web developer and the starting occupation is 0.449 and the average salary differential is $19,733. While the projected 5-year employment growth for database administrator is -0.60%, web developer's projected 5-year growth is higher at 2.18%. Average salary for the web developer occupation is $70,021 for individuals

0.449
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$19,733
Average Salary Differential
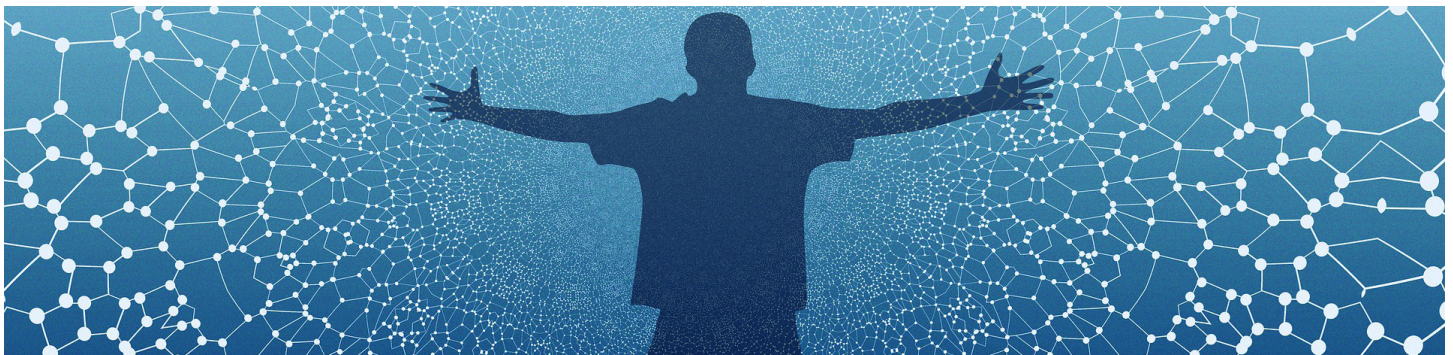
-0.60%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.18%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Network / Systems Administrator ▶ Web Developer

Starting Occupation *Advancement Occupation*

$70,021

Average Salary: Advancement

Occupation with 0 - 2 years experience

$86,093

Average Salary: Advancement

Occupation with 3 - 5 years experience

$98,621

Average Salary: Advancement

Occupation with 6+ years experience

1,704

Starting Occupation Postings

2,947

Advancement Occupation Postings

with up to 2 years of experience; $86,093 for those with 3 to 5 years, and $98,621 for individuals with 6 or more years. There were 2,947 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to web developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for web developer are knowledge of Microsoft C#, Python, MySQL, Ruby, and unit testing. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of JavaScript, web development, front-end development, Java, and SQL. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Flask, Joomla, AJAX, User Interface (UI) Design, and Objective C.

Certifications

The network or systems administrator occupation commonly requests in ad-

Network / Systems Administrator
Starting Occupation

▶

Web Developer
Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Microsoft C#	18%	JavaScript	59%	Flask	7%
Python	17%	Web Development	39%	Joomla	6%
MySQL	16%	Front-end Development	32%	AJAX	6%
Ruby	16%	Java	28%	User Interface (UI) Design	6%
Unit Testing	16%	SQL	28%	Objective C	6%

dition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The web developer occupation commonly requests security clearance, driver's license and the following certification: CompTIA Security+ as described in the above paragraph.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **CompTIA Security+**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **CompTIA Security+**

Advancement Occupation

Data engineers are responsible for finding trends in data sets and developing algorithms to help make raw data more useful. This role requires a significant set of technical skills, but data engineers also need communication skills to work across departments to understand what organization leaders want to gain from existing large datasets. These individuals are comfortable with the use of mathematical or statistical skills to develop, test or validate models from available datasets. But they also have the ability to convey the results of their data analysis in visual or summary form. Most importantly, data engineers are skilled database programmers who can develop efficient data pipelines, that is, services or actions to process heterogeneous data in several useful steps.

Growth

The similarity score between data engineer and the starting occupation is 0.362 and the average salary differential is $33,677. While the projected 5-year employment growth for network or system administrator is -0.60%, data engineer's projected 5-year growth is higher at 2.56%. Average salary for the data engineer occupation is $80,464 for individuals with up to 2 years of experience; $97,186 for those with

0.362
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$33,677
Average Salary Differential
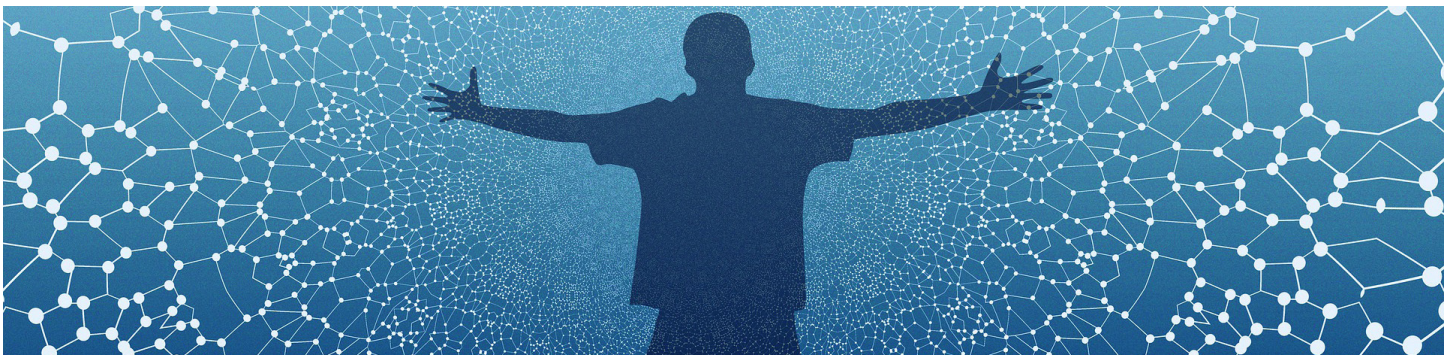
-0.60%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.56%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$80,464

Average Salary: Advancement

Occupation with 0 - 2 years experience

$97,186

Average Salary: Advancement

Occupation with 3 - 5 years experience

$109,854

Average Salary: Advancement

Occupation with 6+ years experience

1,704

Starting Occupation Postings

731

Advancement Occupation Postings

3 to 5 years, and $109,854 for individuals with 6 or more years. There were 731 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to data engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for data engineer are knowledge of software development, Apache webserver, relational databases, data quality, and Tableau. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Python, SQL, big data, Extraction, Transformation and Loading (ETL), and Pipeline (Computing). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Amazon Web Services (AWS), Relational Database Management Systems (RDBMS), data warehouse processing, PIG., and AWS Elastic MapReduce (EMR).

Network / Systems Administrator
Starting Occupation

▶

Data Engineer
Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Software Development	17%
Apache Webserver	16%
Relational Databases	15%
Data Quality	14%
Tableau	13%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Python	67%
SQL	66%
Big Data	47%
Extraction Transformation and Loading (ETL)	43%
Pipeline (Computing)	38%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Amazon Web Services (AWS)	7%
Relational DataBase Management System (RDBMS)	6%
Data Warehouse Processing	6%
PIG	6%
AWS Elastic MapReduce (EMR)	5%

Certifications

The network or systems administrator occupation commonly requests in addition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The data engineer occupation commonly requests security clearance, and among others, the following two certifications: Certified Scrum Trainer (CST), a certification offered by the Scrum Alliance that enables people to teach CSM (Certified Scrum Master) and CSPO (Certified Scrum Product Owner) courses. The second certification is the Microsoft Certified Solutions Associate (MCSA). This is a certification program intended for people who seek entry-level jobs in an information technology (IT) environment. Microsoft retired the MCSA program on January 31, 2021 in favor of role-

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **CompTIA Security+**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Certified Scrum Trainer (CST)**
- **Microsoft Certified Solutions Associate (MCSA)**

based training and certifications. However, MCSA holders will be allowed to keep it.

Network /
Systems
Administrator

Starting Occupation

▶

IT Project
Manager

Advancement Occupation

Advancement Occupation

IT project managers are individuals charged with overseeing the process of planning, executing and delegating responsibilities around an organization's information technology (IT) pursuits and goals. Specifically, they help determine the systems and technology needed for specific IT projects; create detailed schedules; build a budget; identify staffing needs; and hire and manage the project staff. These individuals are comfortable in both, the technical as well as the organizational environment of the project, making them very effective as liaison between business and technical aspects of projects. They are good communicators and over time, develop an effective sense for negotiation.

Growth

The similarity score between IT project manager and the starting occupation is 0.413 and the average salary differential is $14,533. While the projected 5-year employment growth for network or systems administrator is -0.60%, IT project manager's projected 5-year growth is considerably higher at 3.12%. Average salary for the IT project manager occupation is $70,136 for individuals with up to 2 years of experience; $84,972 for those with 3 to 5 years, and $98,182 for individuals

0.413
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$14,533
Average Salary Differential

-0.60%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

3.12%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Manager

$70,136

Average Salary: Advancement

Occupation with 0 - 2 years experience

$84,972

Average Salary: Advancement

Occupation with 3 - 5 years experience

$98,182

Average Salary: Advancement

Occupation with 6+ years experience

1,704

Starting Occupation Postings
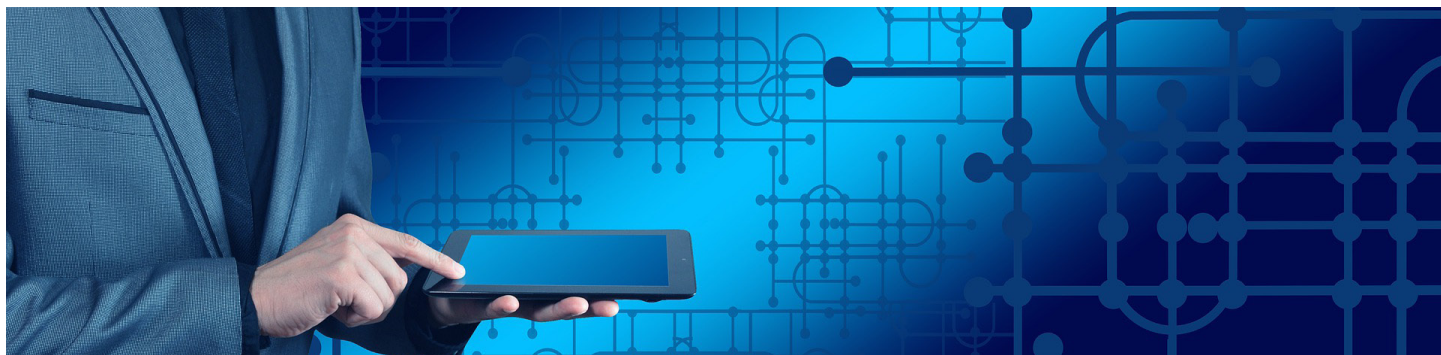
3,760

Advancement Occupation Postings

with 6 or more years. There were 3,760 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to IT project manager. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for IT project manager are knowledge of scheduling, project planning and development skills, customer service, SQL, and quality assurance and control. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of project management, budgeting, Scrum, software development, and Scrum Master. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are product owner, IT management, DevOps, business analysis, and agile coaching.

Certifications

The network or systems administrator occupation commonly requests in addition to security clearance, the follow-

Network / Systems Administrator

Starting Occupation

▶

IT Project Manager

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Scheduling	19%	Project Management	58%	Product owner	7%
Project Planning and Development Skills	19%	Budgeting	29%	IT Management	6%
Customer Service	9%	Scrum	27%	DevOps	6%
SQL	9%	Software Development	20%	Business Analysis	5%
Quality Assurance and Control	8%	Scrum Master	18%	Agile coaching	5%

ing certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The IT project manager occupation commonly requests among others, the following certifications: The first is Project Management Certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second certification is the Project Management Professional (PMP). This certification offered by the Project Management Institute (PMI) validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams. The third certification is Certified Scrum Master (CSM) The Certified Scrum Master (CSM) certification, available through the Scrum Alliance, is an entry-level certification aimed at providing professionals with an aware-

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **CompTIA Security+**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Project Management Certification**
- **Project Management Professional (PMP)**
- **Certified ScrumMaster (CSM)**

ness of the methodologies and values of Scrum, including team performance, accountability, and iterative progress.

**Network /
Systems
Administrator**

Starting Occupation

▶

**Network Engineer /
Architect**

Advancement Occupation

Advancement Occupation

Network engineers / architects take care of communication networks, such as local area networks (LANs), wide area networks (WANs), and intranets. They design and implement network configurations, troubleshoot performance issues, carry out network monitoring and configure security systems such as firewalls. Among the major skills that these individuals should possess include analytical, problem-solving and communication skills. They should be team-building, detail-oriented leaders with extensive knowledge of various types of computer operating, security and wireless systems.

Growth

The similarity score between network engineer / architect and the starting occupation is 0.752 and the average salary differential is $22,731. While the projected 5-year employment growth for network or systems administrator is -0.60%, network engineer / architect's projected 5-year growth is higher at 2.86%. Average salary for the network engineer / architect occupation is $58,383 for individuals with up to 2 years of experience; $79,154 for those with 3 to 5 years, and $95,250 for individuals with 6 or more years. There were 2,525 post-

0.752
Similarity Score
*Measure of relatedness
between occupations on a
scale of 0 to 1*

$22,731
**Average Salary
Differential**

-0.60%
Projected 5-Year Growth
*Projected employment growth for
the Starting Occupation*

2.86%
Projected 5-Year Growth
*Projected employment growth for
the Advancement Occupation*

**Network /
Systems
Administrator**

▶

**Network Engineer /
Architect**

Starting Occupation

Advancement Occupation

$58,383

Average Salary: Advancement

Occupation with 0 - 2 years experience

$79,154

Average Salary: Advancement

Occupation with 3 - 5 years experience

$95,250

Average Salary: Advancement

Occupation with 6+ years experience
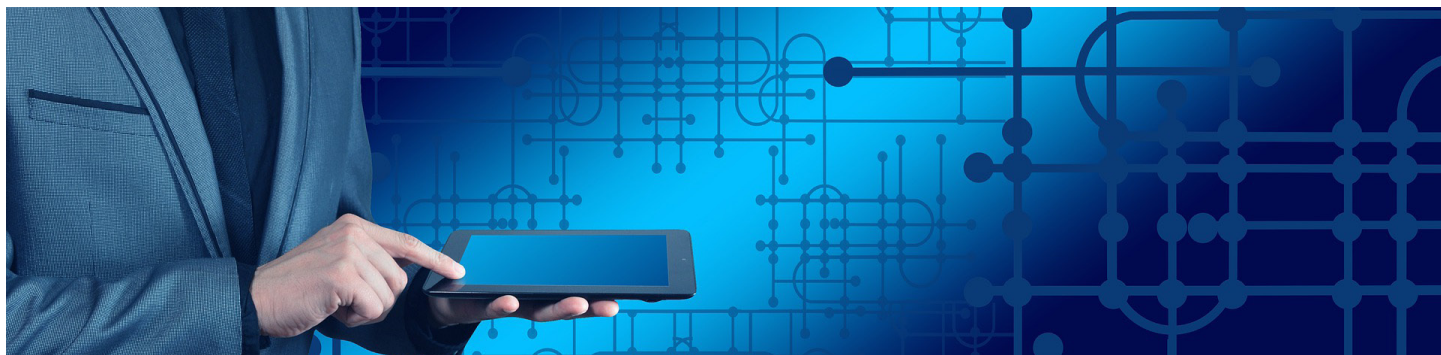
1,704

Starting Occupation Postings

2,525

Advancement Occupation Postings

ings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to network engineer / architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for network engineer / architect are knowledge of Python, routers, project management, Java, and software development. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of networking engineering, Cisco, Linux, Wide Area Network (WAN), and VMware. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Microsoft Active Directory, Voice over IP (VoIP), network testing, network hardware, and Citrix.

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Python	17%	Network Engineering	28%	Microsoft Active Directory	7%
Routers	14%	Cisco	24%	Voice over IP (VoIP)	5%
Project Management	13%	Linux	16%	Network Testing	4%
Java	12%	Wide Area Network (WAN)	14%	Network Hardware	4%
Software Development	12%	VMware	11%	Citrix	3%

Certifications

The network or systems administrator occupation commonly requests in addition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The network engineer/ architect occupation commonly requests security clearance, and, among others, the following certifications: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification. The second top certification is Cisco Certified Network Professional (CCNP), a certification for individuals in the IT industry who have achieved the professional level of Cisco Career Certification. Both certifications are from Cisco Systems.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **CompTIA Security+**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Cisco Certified Network Associate (CCNA)**
- **Cisco Certified Network Professional (CCNP)**

Advancement Occupation

A mobile applications developer is a software engineer who works primarily with mobile devices, creating, programming, testing, and maintaining apps and mobile platforms across devices like smartphones, tablets and laptops. Mobile developers write programs inside of a mobile development environment using a specific programming language such as Objective C or Java. A mobile app developer will typically develop an app for a specific operating system, such as Google Android or Apple iOS, and apply the programming languages and software development environment for that platform. These individuals are usually curious, imaginative, and value variety. They are methodical, reliable and generally plan things in advance. These individuals are comfortable with the fast pace of change in the underlying development technologies.

Growth

The similarity score between mobile applications developer and the starting occupation is 0.357 and the average salary differential is $28,314. While the projected 5-year employment growth for network or systems administrator is -0.60%, mobile applications developer's projected 5-year growth is considerably higher at 5.63%. Average salary for the mobile applications developer occupation is $70,826

0.357
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$28,314
Average Salary Differential
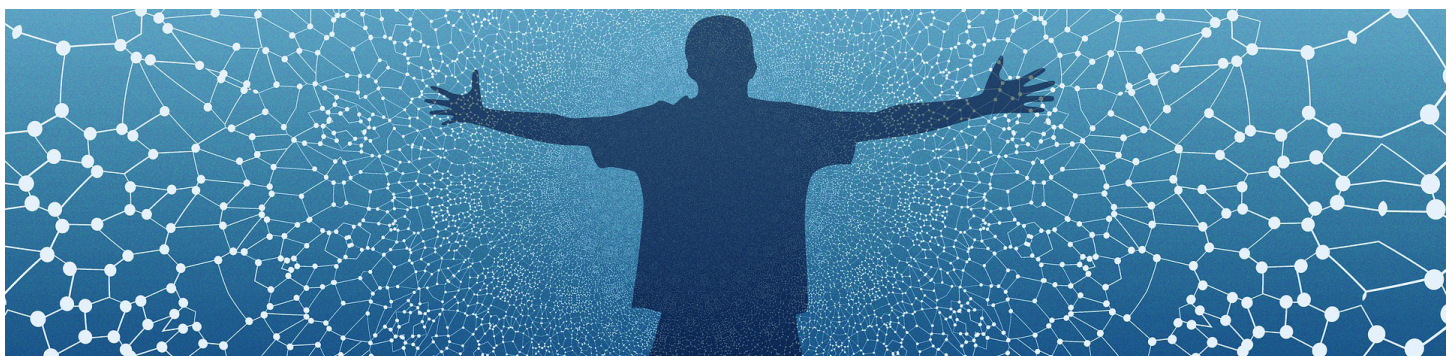
-0.60%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

5.63%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$70,826

Average Salary: Advancement

Occupation with 0 - 2 years experience

$89,272

Average Salary: Advancement

Occupation with 3 - 5 years experience

$102,130

Average Salary: Advancement

Occupation with 6+ years experience
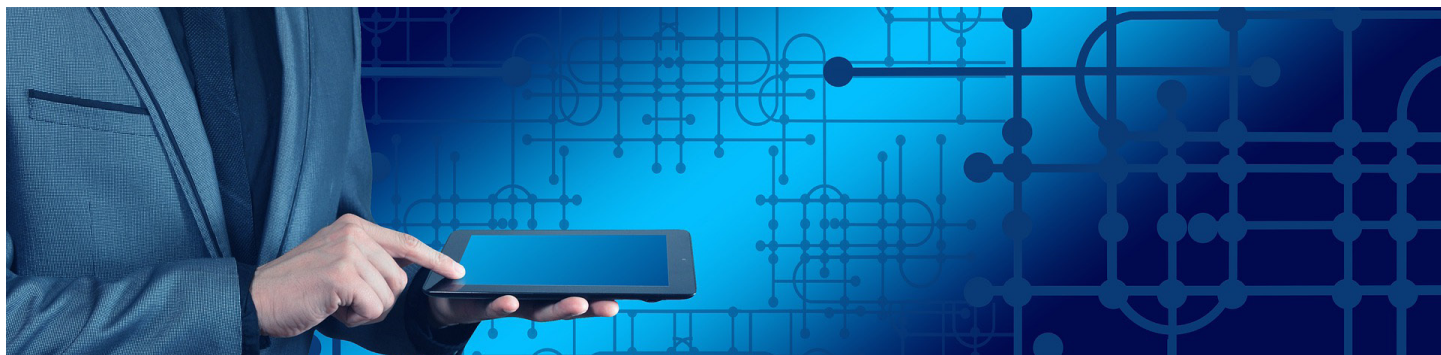
1,704

Starting Occupation Postings

558

Advancement Occupation Postings

for individuals with up to 2 years of experience; $89,272 for those with 3 to 5 years, and $102,130 for individuals with 6 or more years. There were 558 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network or systems administrator to mobile applications developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for mobile applications developer are knowledge of unit testing, Object-Oriented Analysis and Design (OOAD), JavaScript Object Notation (JSON), debugging, and Scrum. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Java, Swift (programming language), Android, software development, and Objective C. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Test Driven Development (TDD), User Interface (UI) Design, Gradle, React Javascript, and Microsoft Xamarin.

Network / Systems Administrator

Starting Occupation

▶

Mobile Applications Developer

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Unit Testing	17%
Object-Oriented Analysis and Design (OOAD)	14%
JavaScript Object Notation (JSON)	14%
Debugging	14%
Scrum	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Java	43%
Swift (Programming Language)	38%
Android	36%
Software Development	31%
Objective C	29%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Test Driven Development (TDD)	7%
User Interface (UI) Design	7%
Gradle	6%
React Javascript	6%
Microsoft Xamarin	6%

Certifications

The network or systems administrator occupation commonly requests in addition to security clearance, the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification.

The mobile applications developer occupation commonly requests security clearance, driver's license and the following certification: TOGAF certification. The Open Group Architecture Framework (TOGAF) is a certification for IT professionals and architects that verifies their ability to simplify complex technical processes in four architecture domains: business, data, applications and technical.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **CompTIA Security+**
- **Cisco Certified Network Associate (CCNA)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **TOGAF Certification**

Occupation Profile: Networking and Systems

Occupation: Network Engineer / Architect

Occupation Profile: Networking and Systems
Occupation: Network Engineer / Architect

Occupation

Network engineers / architects take care of communication networks, such as local area networks (LANs), wide area networks (WANs), and intranets. They design and implement network configurations, troubleshoot performance issues, carry out network monitoring and configure security systems such as firewalls. Among the major skills that these individuals should possess include analytical, problem-solving and communication skills. They should be team-building, detail-oriented leaders with extensive knowledge of various types of computer operating, security and wireless systems.

Growth

Network engineers / architects jobs are projected to have a 2.86% growth in employment. The entry level salary for this occupation is $79,581 with a requirement of less than 2 years of experience. The mid career salary, that is jobs requiring 3 to 5 years of experience is $99,693. The advanced career salary which requests six or more years of experience is $114,351.

Skills

The skills shown in the table below represent the additional skills likely needed

2.86%
Projected Growth

Estimated five-year growth in employment

$79,581
Entry Level Salary

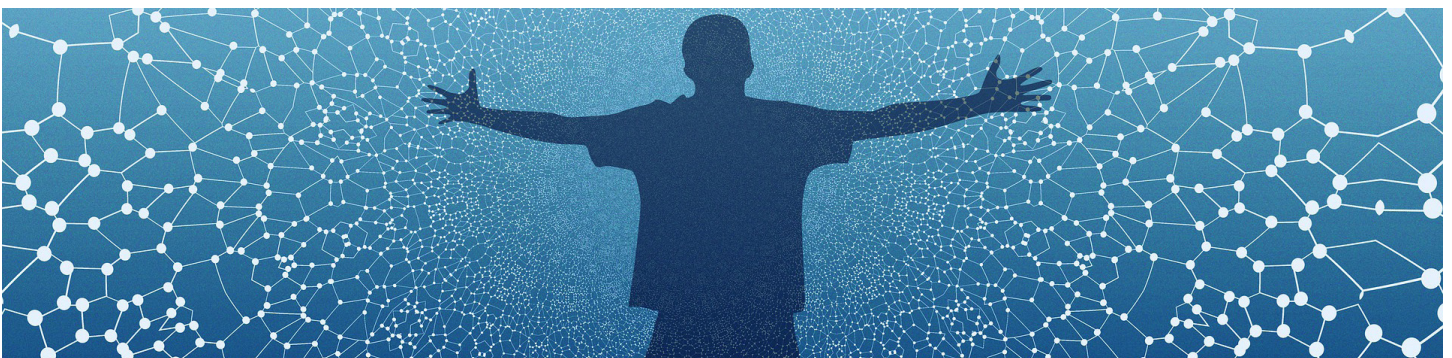*Salary for jobs requiring less than 2 years of experience*

$99,693
Mid Career Salary

Salary for jobs requesting 3 to 5 years of experience

$114,351
Advanced Career Salary

Salary for jobs requesting 6+ years of experience

Occupation Profile: Networking and Systems
Occupation: Network Engineer / Architect

to move from the starting occupation to the advancement occupation. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for network engineer / architect include knowledge of Python, project management, routers, software development, Java, and DevOps. Defining skills represent the day-to-day tasks and responsibilities of the job. They assume an increase level of communication and direct user support. For this occupation the defining skills include knowledge of network engineering, Cisco, Linux, Wide Area Network (WAN), System / Network configuration, and VMware. Distinguishing skills set a worker apart and come with a salary premium. In this occupation, the distinguishing skills are knowledge of Microsoft Active Directory, Voice over IP (VoIP), network, hardware, network testing, Network Management Center (NMC), and Citrix.

Certifications

This occupation commonly requests security clearance, and, among others, the following certifications: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification. The second

Certifications

- **Security Clearance**
- **Cisco Certified Network Associate (CCNA)**
- **Cisco Certified Network Professional (CCNP)**

top certification is Cisco Certified Network Professional (CCNP), a certification for individuals in the IT industry who have achieved the professional level of Cisco Career Certification. Both certifications are from Cisco Systems.

Necessary Skills

Skill Name	Percent of Postings Requesting Skill
Python	17%
Project Management	17%
Routers	15%
Software Development	14%
Java	12%
DevOps	12%

Defining Skills

Skill Name	Percent of Postings Requesting Skill
Network Engineering	29%
Cisco	25%
Linux	17%
Wide Area Network (WAN)	16%
System/Network Configuration	13%
VMware	12%

Distinguishing Skills

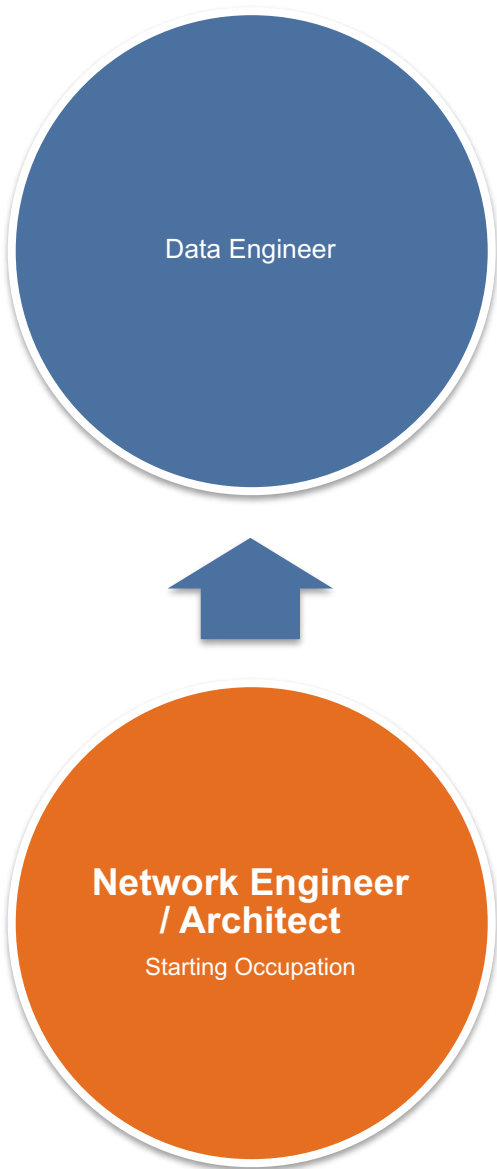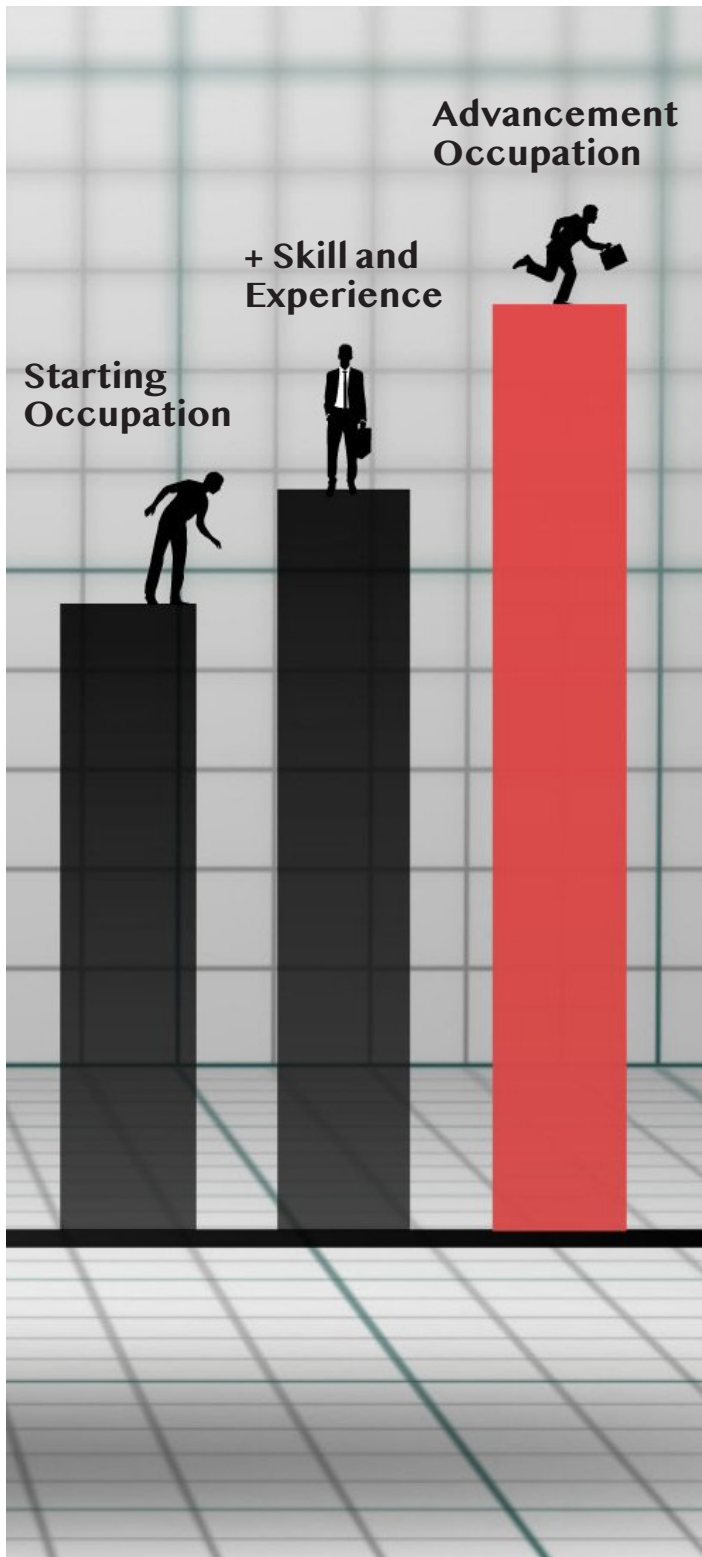| Skill Name	Percent of Postings Requesting Skill
Microsoft Active Directory	7%
Voice over IP (VoIP)	6%
Network Hardware	5%
Network Testing	5%
Network Management Center (NMC)	4%
Citrix	3%

Potential Career Paths for Network Engineer / Architect

For the starting occupation of network engineer/ architect, we identify possible next step occupations. These occupations come with an increase in compensation and require additional skills and in some cases certifications. These skills may be learned on the job at the initial position held or can be learned in advance.

In the pages that follow, we provide for each Advancement Occupation, skill gaps, certifications, salary and workforce information. With this information, students, educators, and policymakers can see the paths a worker could take from the Starting Occupation to the Advancement Occupation.

Data Engineer

Network Engineer / Architect

Starting Occupation

Detailed
Career Pathways:

Network Engineer/
Architect

Advancement Occupation

Data engineers are responsible for finding trends in data sets and developing algorithms to help make raw data more useful. This role requires a significant set of technical skills, but data engineers also need communication skills to work across departments to understand what organization leaders want to gain from existing large datasets. These individuals are comfortable with the use of mathematical or statistical skills to develop, test or validate models from available datasets. But they also have the ability to convey the results of their data analysis in visual or summary form. Most importantly, data engineers are skilled database programmers who can develop efficient data pipelines, that is, services or actions to process heterogeneous data in several useful steps.

Growth

The similarity score between data engineer and the starting occupation is 0.462 and the average salary differential is $10,946. While the projected 5-year employment growth for network engineer or architect is 2.86%, data engineer's projected 5-year growth is slightly lower at 2.56%. Average salary for the data engineer occupation is $80,464 for individuals with

0.462
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$10,946
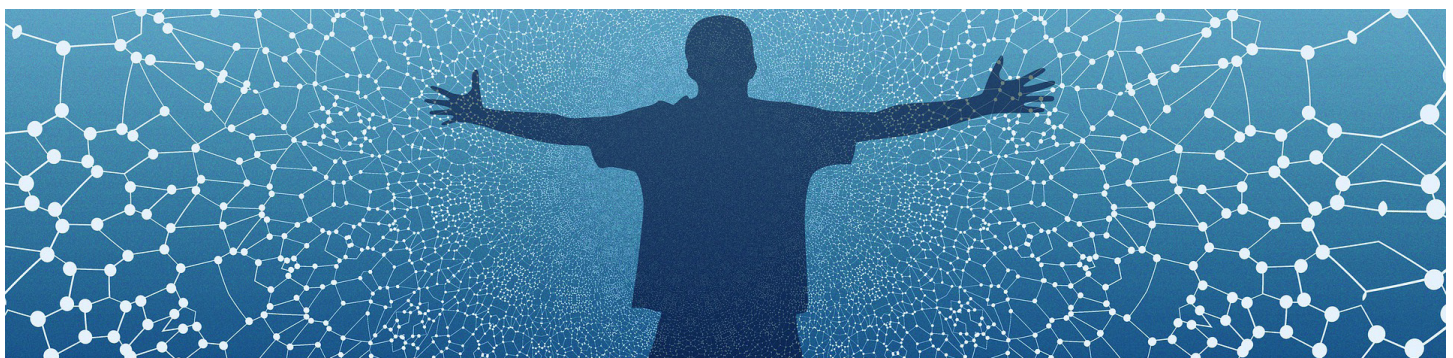**Average Salary Differential**

2.86%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.56%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$80,464
Average Salary: Advancement

Occupation with 0 - 2 years experience

$97,186
Average Salary: Advancement

Occupation with 3 - 5 years experience

$109,854
Average Salary: Advancement

Occupation with 6+ years experience

2,525
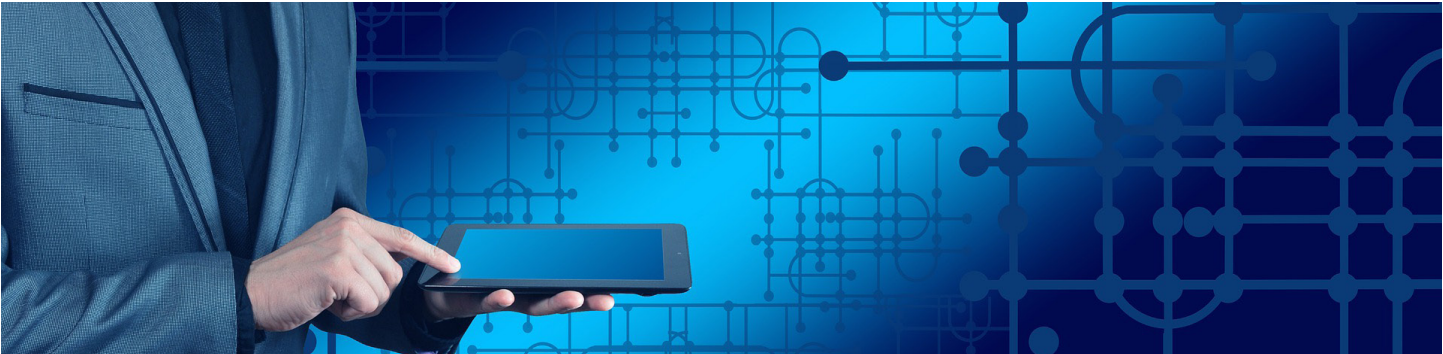*Starting Occupation Postings*

731
Advancement Occupation Postings

up to 2 years of experience; $97,186 for those with 3 to 5 years, and $109,854 for individuals with 6 or more years. There were 731 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from network engineer or architect to data engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for data engineer are knowledge of software development, Apache webserver, relational databases, data quality, and Tableau. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Python, SQL, big data, Extraction, Transformation and Loading (ETL) and Pipeline (computing). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Amazon Web Services (AWS), Relational Database Management Systems (RDBMS), data warehouse processing, PIC, and AWS Elastic MapReduce (EMR).

Network Engineer / Architect ▶ Data Engineer

Starting Occupation   *Advancement Occupation*

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Software Development	17%	Python	67%	Amazon Web Services (AWS)	7%
Apache Webserver	16%	SQL	66%	Relational DataBase Management System (RDBMS)	6%
Relational Databases	15%	Big Data	47%	Data Warehouse Processing	6%
Data Quality	14%	Extraction Transformation and Loading (ETL)	43%	PIG	6%
Tableau	13%	Pipeline (Computing)	38%	AWS Elastic MapReduce (EMR)	5%

Certifications

The network engineer or architect occupation commonly requests security clearance, and, among others, the following certifications: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification. The second top certification is Cisco Certified Network Professional (CCNP), a certification for individuals in the IT industry who have achieved the professional level of Cisco Career Certification. Both certifications are from Cisco Systems.

The data engineer occupation commonly requests security clearance, and among others, the following two certifications: Certified Scrum Trainer (CST), a certification offered by the Scrum Alliance that enables people to teach CSM (Certified Scrum Master) and CSPO (Certified Scrum Product Owner) courses. The second certification is the Microsoft Certified Solutions Associate (MCSA). This is a certification program intended for people who seek entry-level jobs in an information technology (IT) environment. Microsoft retired the MCSA pro-

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Cisco Certified Network Associate (CCNA)**
- **Cisco Certified Network Professional (CCNP)**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Certified Scrum Trainer (CST)**
- **Microsoft Certified Solutions Associate (MCSA)**

gram on January 31, 2021 in favor of role-based training and certifications. However, MCSA holders will be allowed to keep it.

Occupation Profile: Networking and Systems

Occupation: Systems Analyst
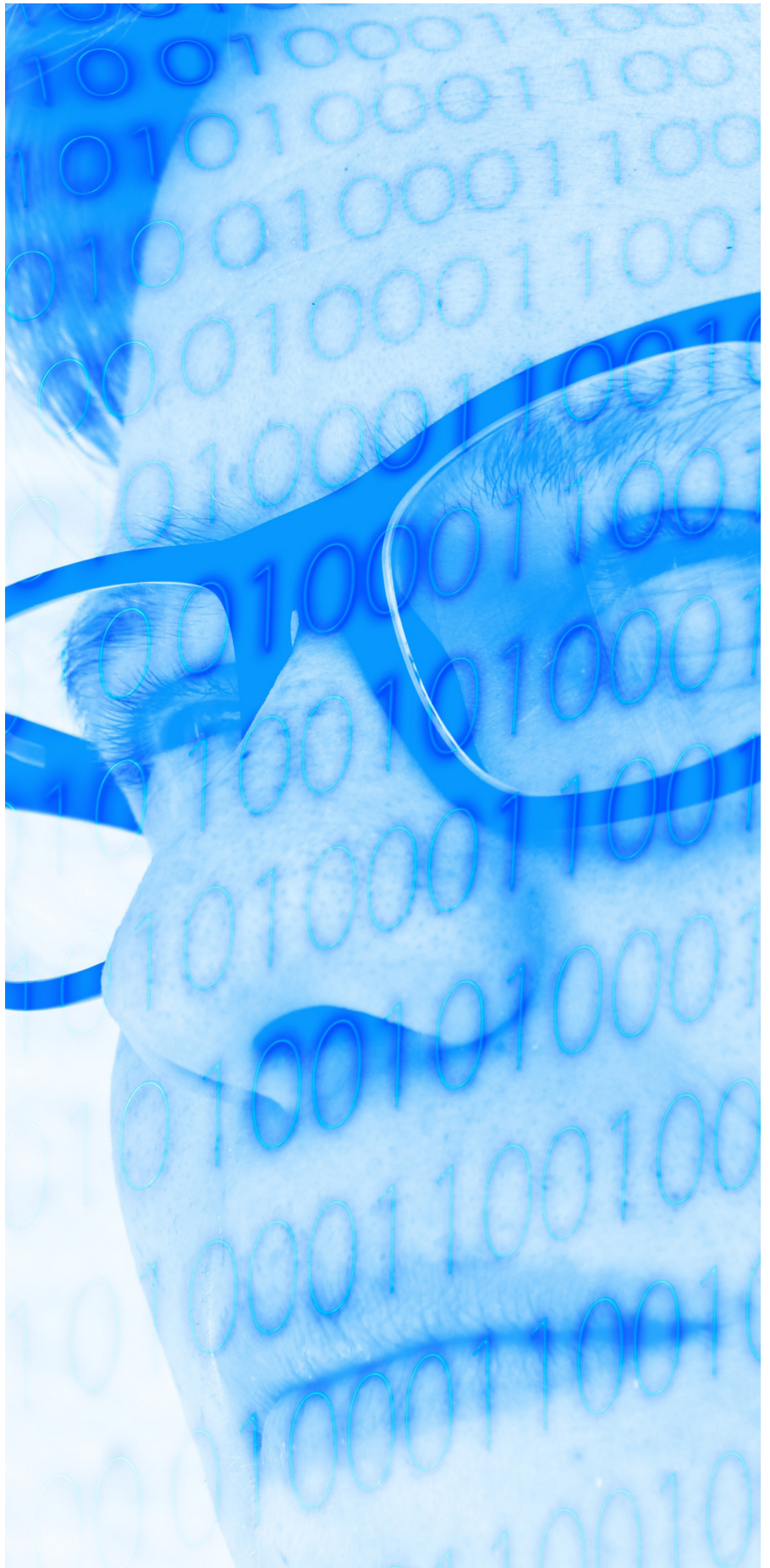
Occupation Profile: Networking and Systems
Occupation: Systems Analyst

Occupation

Systems analysts implement, maintain, and support IT and information systems to meet the business needs of organizations. They analyze and create tests, and develop specifications for developers and programmers to follow. One of the most important duties of systems analysts is collecting and analyzing the requirements for a new system. These individuals are normally responsible for generating documentation of various types, helping in software selection, and monitoring systems once they're in place. Central to their job is the ability to use analytical skills, project management techniques, communication skills and creativity.

Growth

Systems analyst jobs are projected to have a 0.79% growth in employment. The entry level salary for this occupation is $74,144 with a requirement of less than 2 years of experience. The mid career salary, that is jobs requiring 3 to 5 years of experience is $86,799. The advanced career salary which requests six or more years of experience is $100,317.

Skills

The skills shown in the table below represent the additional skills likely needed

0.79%
Projected Growth

Estimated five-year growth in employment

$74,144
Entry Level Salary

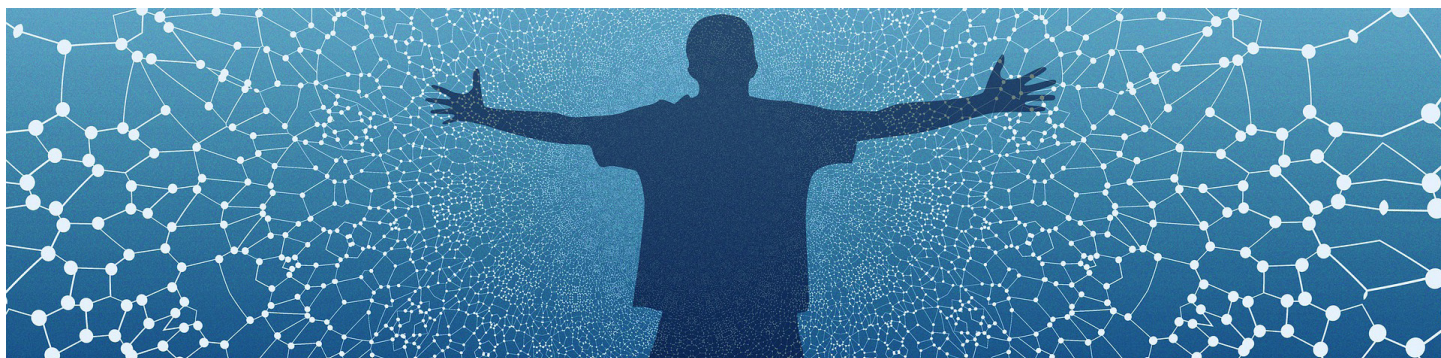*Salary for jobs requiring less than 2 years of experience*

$86,799
Mid Career Salary

Salary for jobs requesting 3 to 5 years of experience

$100,317
Advanced Career Salary

Salary for jobs requesting 6+ years of experience

Occupation Profile: Networking and Systems
Occupation: Systems Analyst

to move from the starting occupation to the advancement occupation. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for systems analyst include knowledge of information systems, software development, customer service, Oracle, technical support, and scheduling. Defining skills represent the day-to-day tasks and responsibilities of the job. They assume an increase level of communication and direct user support. For this occupation the defining skills include knowledge of project management, systems analysis, business process, SQL, business analysis, and business systems analysis. Distinguishing skills set a worker apart and come with a salary premium. In this occupation, the distinguishing skills are knowledge of User Acceptance Testing (UAT), systems development, hardware and software configuration, systems integration, and data mapping.

Certifications

This occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from

Certifications

- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

Necessary Skills	
Skill Name	Percent of Postings Requesting Skill
Information Systems	18%
Software Development	16%
Customer Service	14%
Oracle	13%
Technical Support	12%
Scheduling	10%

Defining Skills	
Skill Name	Percent of Postings Requesting Skill
Project Management	27%
Systems Analysis	27%
Business Process	27%
SQL	25%
Business Analysis	23%
Business Systems Analysis	21%

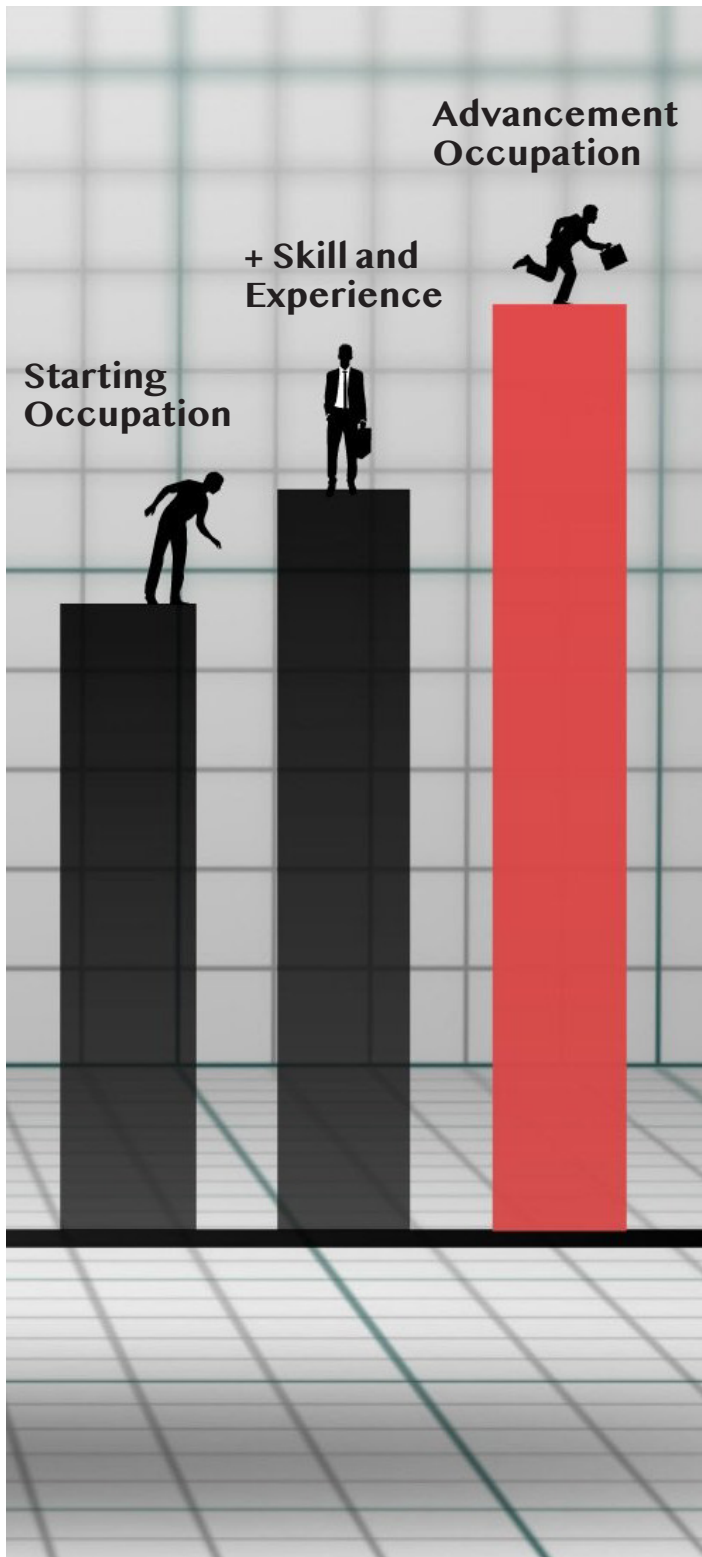| Distinguishing Skills	
Skill Name	Percent of Postings Requesting Skill
User Acceptance Testing (UAT)	6%
Systems Development	6%
Hardware and Software Configuration	5%
Systems Integration	4%
Data Mapping	3%

Potential Career Paths for Systems Analyst

For the starting occupation of systems analyst, we identify possible next step occupations. These occupations come with an increase in compensation and require additional skills and in some cases certifications. These skills may be learned on the job at the initial position held or can be learned in advance.

In the pages that follow, we provide for each Advancement Occupation, skill gaps, certifications, salary and workforce information. With this information, students, educators, and policymakers can see the paths a worker could take from the Starting Occupation to the Advancement Occupation.

Advancement
Occupation

+ Skill and
Experience

Starting
Occupation

Detailed
Career Pathways:

Systems Analyst

Systems Analyst ▶ UI / UX Designer / Developer

Starting Occupation   *Advancement Occupation*

Advancement Occupation

U I/UX (user interface / experience) designers / developers gather user requirements, design graphic elements and build application navigation components. Specifically, they develop and test layouts, interfaces, functionality, and navigation menus to ensure compatibility and usability across browsers or devices. They may design and test interfaces that facilitate the human-computer interaction and maximize the usability of digital devices, websites, and software with a focus on aesthetics and design. These individuals have strong interpersonal, collaborative and communication skills and are comfortable working in teams and putting themselves in the shoes of their clients.

Growth

The similarity score between UI / UX designer or developer and the starting occupation is 0.402 and the average salary differential is $9,279. While the projected 5-year employment growth for systems analyst is 0.79%, UI / UX designer or developer's projected 5-year growth is higher at 3.39%. Average salary for the UI / UX designer or developer occupation is $70,214 for individuals with up to 2 years of experience; $87,187 for those with 3 to

0.402
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$9,279
Average Salary Differential

0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

3.39%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

UI / UX Designer / Developer

Advancement Occupation

$70,214
Average Salary: Advancement

Occupation with 0 - 2 years experience

$87,187
Average Salary: Advancement

Occupation with 3 - 5 years experience

$101,109
Average Salary: Advancement

Occupation with 6+ years experience

2,694
Starting Occupation Postings

1,170
Advancement Occupation Postings

5 years, and $101,109 for individuals with 6 or more years. There were 1,170 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to UI / UX designer or developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for UI / UX designer or developer are knowledge of Adobe Illustrator, Adobe Acrobat, Adobe Creative Suite, process design, and web application development. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of JavaScript, UX Wireframes, User Interface (UI) Design, Adobe Photoshop, and user research. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Bootstrapping, TypeScript, Typesetting, Syntactically Awesome Style Sheets (SASS), and cross-browser.

Systems Analyst ▶ UI / UX Designer / Developer

Starting Occupation — *Advancement Occupation*

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Adobe Illustrator	15%	JavaScript	31%	Bootstrapping	8%
Adobe Acrobat	14%	UX Wireframes	29%	TypeScript	5%
Adobe Creative Suite	13%	User Interface (UI) Design	25%	Typesetting	5%
Process Design	11%	Adobe Photoshop	24%	Syntactically Awesome Style Sheets (SASS)	4%
Web Application Development	11%	User Research	22%	Cross-browser	4%

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The UI/UX designer or developer occupation commonly requests security clearance, driver's license, and among others a project management certification as described in the above paragraph.

Certifications

The source occupation commonly requests the following certifications:
· **Security Clearance**
· **Project Management Certification**
· **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
· **Security Clearance**
· **Driver's License**
· **Project Management Certification**

Advancement Occupation

Database architects design strategies for company-wide large databases, data warehouse systems, and multidimensional networks. They set standards for database operations, programming, query processes, and security. Database architects model, design, and construct large relational databases or data warehouses. Create and optimize data models for warehouse infrastructure and workflow. They also integrate new systems with existing warehouse structure and refine system performance and functionality. These individuals are comfortable structuring complex problems through deductive reasoning, and can communicate their recommendations in simple business-like language. But most of all, they expose significant oral and reading comprehension.

Growth

The similarity score between database architect and the starting occupation is 0.473 and the average salary differential is $19,051. While the projected 5-year employment growth for systems analyst is 0.79%, database architect's projected 5-year growth is higher at 2.99%. Average salary for the database architect occupation is $69,185 for individuals with up to 2 years of experience; $85,231 for those with 3 to

0.473
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$19,051
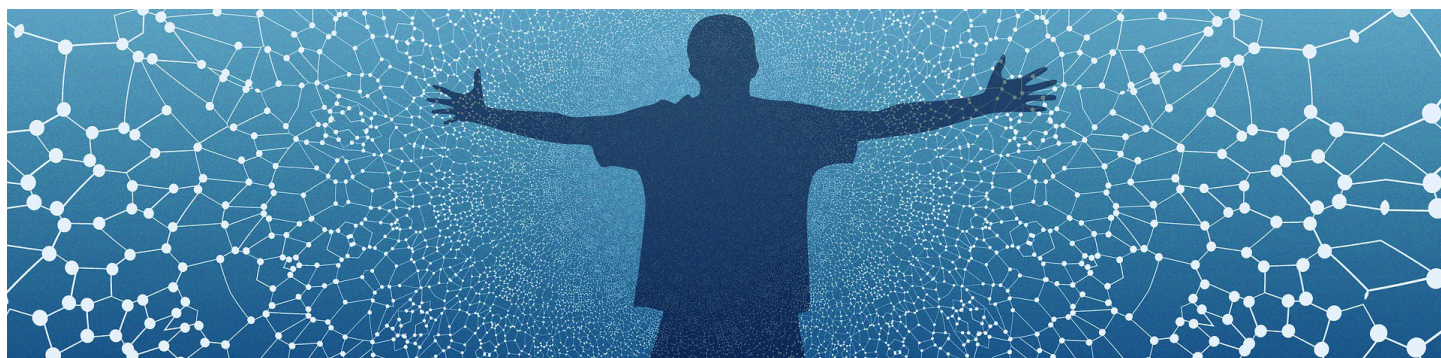**Average Salary Differential**

0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.99%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

▶

Starting Occupation

Advancement Occupation

$69,185

Average Salary: Advancement

Occupation with 0 - 2 years experience

$85,231

Average Salary: Advancement

Occupation with 3 - 5 years experience

$98,672

Average Salary: Advancement

Occupation with 6+ years experience
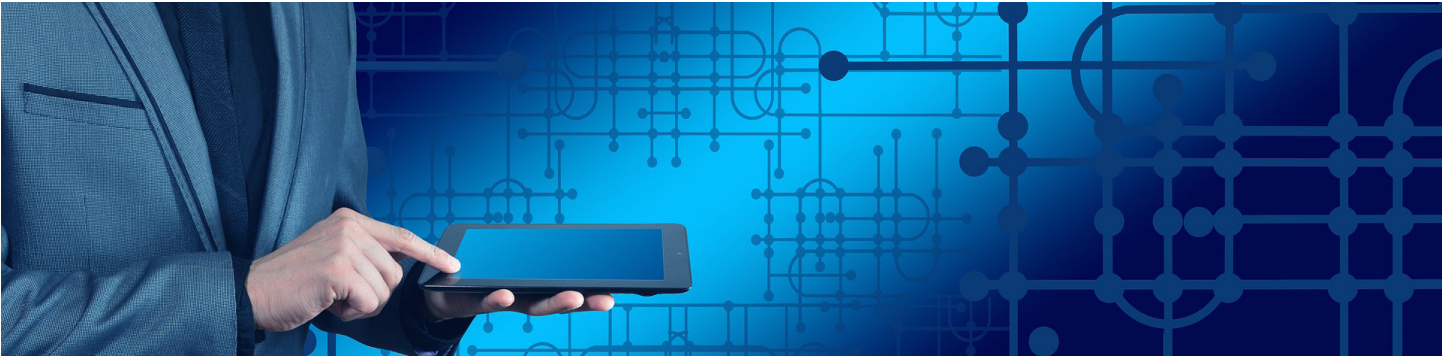
2,694

Starting Occupation Postings

870

Advancement Occupation Postings

5 years, and $98,672 for individuals with 6 or more years. There were 870 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to database architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for database architect are knowledge of data analysis, Oracle, data quality, project management, and SQL Server. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of SQL, data architecture, data warehousing, data modeling, and Extraction, Transformation and Loading (ETL). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of ERwin, database architecture, teradata, Master Data Management (MDM), and Virtualization.

Systems Analyst ▶ Database Architect

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Data Analysis	19%
Oracle	18%
Data Quality	16%
Project Management	12%
SQL Server	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
SQL	43%
Data Architecture	33%
Data Warehousing	26%
Data Modeling	23%
Extraction Transformation and Loading (ETL)	23%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
ERwin	6%
Database Architecture	6%
Teradata	6%
Master Data Management (MDM)	5%
Virtualization	5%

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The database architect occupation commonly requests security clearance, and among others, the following top certifications: IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management. The second is the Certified Scrum Trainer (CST), a certification offered by the Scrum Alliance that enables people to teach CSM (Certified Scrum Master) and CSPO (Certified Scrum Product Owner) courses.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **IT Infrastructure Library (ITIL) Certification**
- **Certified Scrum Trainer (CST)**

Advancement Occupation

Business Intelligence Architects/ Developers are responsible for designing and developing BI solutions, overseeing the implementation of the these types of systems and also their ongoing maintenance. They are in charge of developing, deploying, and maintaining BI interfaces. Those include query tools, data visualization and interactive dashboards, ad hoc reporting, and data modeling tools. These individuals are comfortable working with large amounts of data and deriving insights from their analysis. Some individuals may be more comfortable presenting and communicating results to others. But in either case, they are good at examining multiple sources of data and then making accurate conclusions about them. These individuals are naturally inquisitive and over time, develop a great deal of forward-thinking vision.

Growth

The similarity score between business intelligence architect/ developer and the starting occupation is 0.616 and the average salary differential is $24,362. While the projected 5-year employment growth for systems analyst is 0.79%, business intelligence architect/ developer's projected 5-year growth is considerably higher at 6.30%. Average salary for the business intelligence

0.616
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$24,362
Average Salary Differential
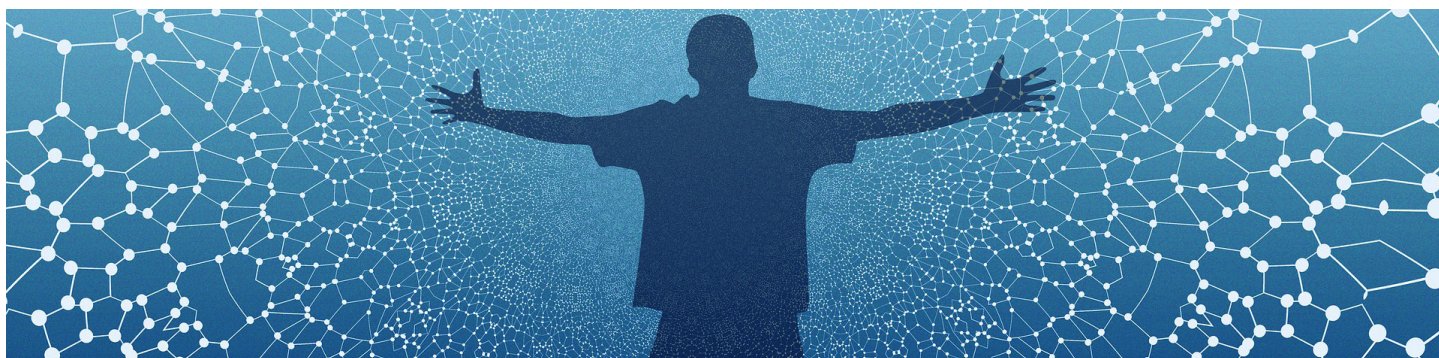
0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

6.30%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Systems Analyst ▶ Business Intelligence Architect / Developer

Starting Occupation

Advancement Occupation

$70,639
Average Salary: Advancement
Occupation with 0 - 2 years experience

$87,647
Average Salary: Advancement
Occupation with 3 - 5 years experience

$101,639
Average Salary: Advancement
Occupation with 6+ years experience

2,694
Starting Occupation Postings

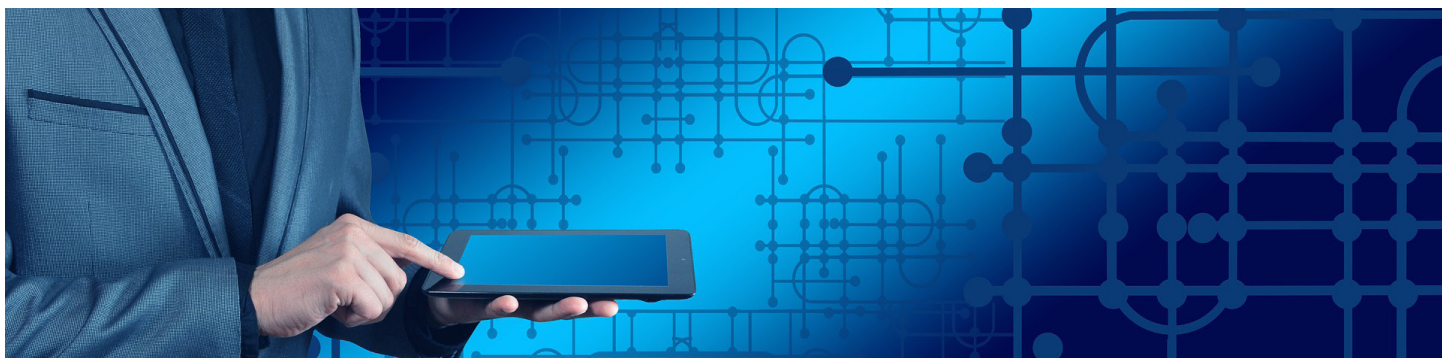## 855
Advancement Occupation Postings

architect/ developer occupation is $70,639 for individuals with up to 2 years of experience; $87,647 for those with 3 to 5 years, and $101,639 for individuals with 6 or more years. There were 855 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to business intelligence architect/ developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for business intelligence architect/ developer are knowledge of JavaScript, software development, business process, Oracle, and Microsoft Power BI. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Salesforce, Salesforce Development, SQL, Salesforce Visualforce, and Salesforce Lightning. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Microsoft SQL Server Integration Services (SSIS), SQL Server Reporting Services (SSRS), Informati

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
JavaScript	18%
Software Development	15%
Business Process	15%
Oracle	13%
Microsoft Power BI	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Salesforce	49%
Salesforce Development	39%
SQL	34%
Salesforce Visualforce	24%
Salesforce Lightning	19%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft Sql Server Integration Services (SSIS)	5%
SQL Server Reporting Services (SSRS)	5%
Informatica	5%
Data Architecture	5%
Oracle PL/SQL	4%

ca, Data Architecture, and Oracle PL/SQL.

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The business intelligence architect/ developer occupation commonly requests security clearance, and among others, the following certifications: Certified Salesforce Platform Developer. With this credential, individuals use programmatic and declarative skills to extend and customize Salesforce applications. The second is the Certified Salesforce Administrator. This certification focuses on the features and functionality used to maintain a Salesforce implementation.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
- **Certified Salesforce Platform Developer**
- **Certified Salesforce Administrator**
- **Security Clearance**

Advancement Occupation

Computer systems engineers or architects design and develop solutions to complex applications problems, system administration issues, or network concerns. They perform systems management and integration functions. These individuals develop software engineering, system integration, or distributed system architectures. They also collaborate with software developers to select appropriate design solutions and to ensure the compatibility of system components. These individuals are comfortable with paying attention to detail, using analytical skills and working in an atmosphere of innovation.

Growth

The similarity score between computer systems engineer or architect and the starting occupation is 0.611 and the average salary differential is $24,145. While the projected 5-year employment growth for systems analyst is 0.79%, computer systems engineer or architect's projected 5-year growth is higher at 2.75%. Average salary for the computer systems engineer or architect occupation is $60,813 for individuals with up to 2 years of experience; $83,001 for those with 3 to 5 years, and $99,718 for individuals with

0.611
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$24,145
Average Salary Differential

0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.75%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Systems Analyst

▶

Computer Systems Engineer / Architect

Starting Occupation

Advancement Occupation

$60,813
Average Salary: Advancement

Occupation with 0 - 2 years experience

$83,001
Average Salary: Advancement

Occupation with 3 - 5 years experience

$99,718
Average Salary: Advancement

Occupation with 6+ years experience

2,694
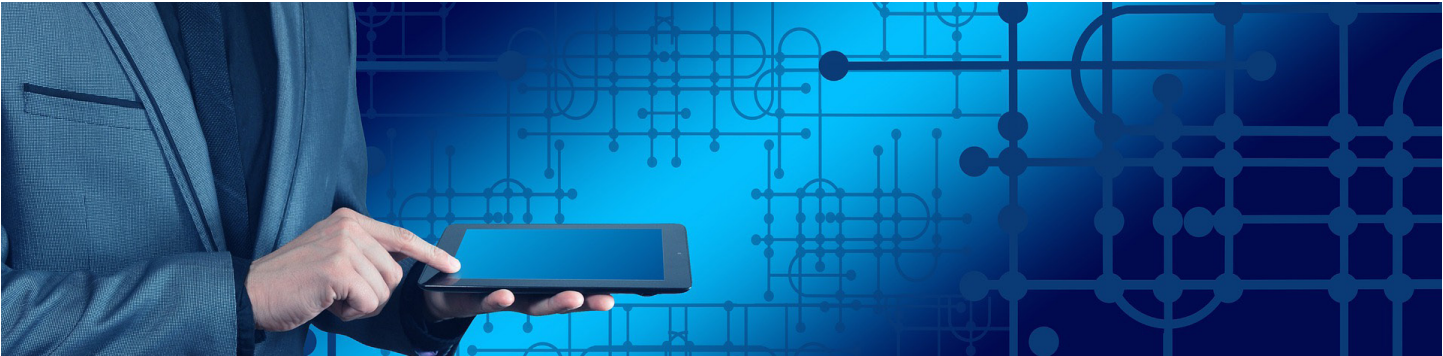*Starting Occupation Postings*

3,259
Advancement Occupation Postings

6 or more years. There were 3,259 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to computer systems engineer or architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for computer systems engineer or architect are knowledge of Python, software development, SQL, project management, and software engineering. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of systems engineering, Linux, Java, DevOps, and system architecture. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of UNIX, Windows Server, Continuous Integration (CI), firmware, and hardware and software configuration.

Systems Analyst ▶ Computer Systems Engineer / Architect

Starting Occupation   *Advancement Occupation*

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Python	19%	Systems Engineering	46%	UNIX	8%
Software Development	17%	Linux	20%	Windows Server	6%
SQL	14%	Java	17%	Continuous Integration (CI)	5%
Project Management	11%	DevOps	12%	Firmware	4%
Software Engineering	11%	System Architecture	12%	Hardware and Software Configuration	4%

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The computer systems engineer or architect occupation commonly requests security clearance and, among others, the following certifications: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career. The second certification is Certified Information Systems Security Professional (CISSP), a certification designed to validate information security work experience and a working knowledge of security principles and practices.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **CompTIA Security+**
- **Certified Information Systems Security Professional (CISSP)**

CISSP is utilized to demonstrate that a security professional is able to design, engineer, implement, and run an information security program.

Advancement Occupation

Software developers/ engineers design, and build computer programs. They identify user needs, develop the programs, test out new software, and make improvements. Some develop new applications for mobile or desktop use, while others build underlying systems software such as operating systems. They design each piece of an application or system and plan how the pieces will work together. Software developers / engineers create a variety of models and diagrams showing programmers the software code needed for an application. Working closely with computer programmers, software developers fill crucial roles not only in the computer systems industry, but also in manufacturing, finance, health services and software publishing industries. These individuals are comfortable with the uncertainties surrounding innovation and creativity. They have an ability to focus and concentrate for prolonged time periods addressing numerous and interlocking pieces. Finally, software developers / engineers are problem solvers, as they are responsible for solving the problems that occur during the development process.

Growth

The similarity score between software developer or engineer and the start-

0.525
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$19,674
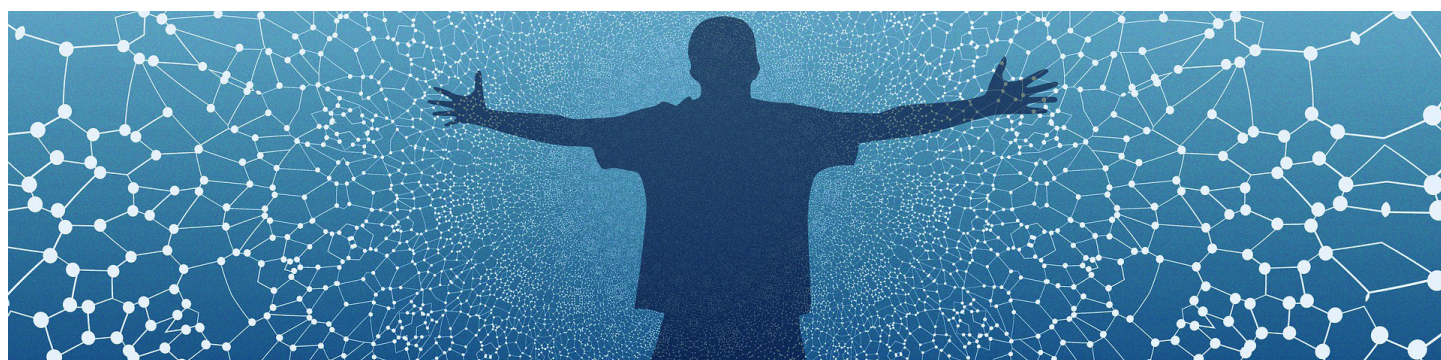**Average Salary Differential**

0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

5.84%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Starting Occupation　　　*Advancement Occupation*

$68,768
Average Salary: Advancement

Occupation with 0 - 2 years experience

$84,801
Average Salary: Advancement

Occupation with 3 - 5 years experience

$98,508
Average Salary: Advancement

Occupation with 6+ years experience
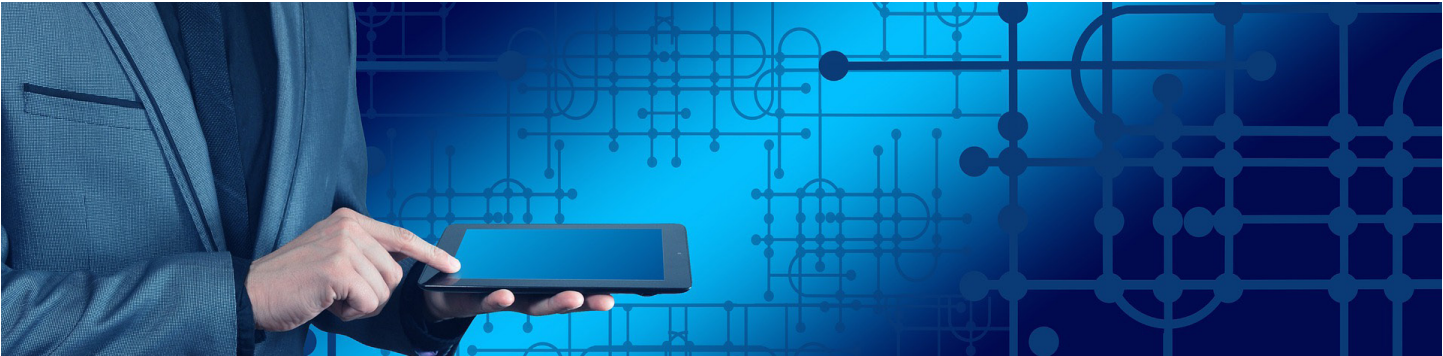
2,694
Starting Occupation Postings

16,139
Advancement Occupation Postings

ing occupation is 0.525 and the average salary differential is $19,674. While the projected 5-year employment growth for systems analyst is 0.79%, software developer or engineer's projected 5-year growth is considerably higher at 5.84%. Average salary for the software developer or engineer occupation is $68,768 for individuals with up to 2 years of experience; $84,801 for those with 3 to 5 years, and $98,508 for individuals with 6 or more years. There were 16,139 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to software developer or engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for software developer or engineer are knowledge of Microsoft C#, Linux, .NET, Oracle, and C++. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Java, software engineering, software development, SQL, and JavaScript. Distinguishing skills

Systems Analyst

Starting Occupation

▶

Software Developer / Engineer

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Microsoft C#	16%	Java	40%	JavaScript Object Notation (JSON)	7%
Linux	15%	Software Engineering	34%	jQuery	6%
.NET	13%	Software Development	33%	React Javascript	6%
Oracle	12%	SQL	32%	Spring Boot	6%
C++	12%	JavaScript	26%	Ruby	5%

set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of JavaScript Object Notation (JSON), jQuery, React Javascript, Spring Boot, and Ruby.

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The software developer/ engineer occupation commonly requests security clearance, and among others, the following certifications: IT Infrastructure Library (ITIL) Certification. Entry-level certification for IT service management. The second certification is CompTIA Security+, a globally trusted, vendor-neutral certifi-

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **IT Infrastructure Library (ITIL) Certification**
- **CompTIA Security+**

cation that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

Advancement Occupation

Technology Consultants advise clients on how to best use information technology (IT) practices to achieve their organizational goals. Traditionally, technology consultants have been engaged by organizations in projects geared towards improving business processes, reducing costs, and maximizing use of technology opportunities. Today, these projects also involve initiatives that range from digital strategy to technology change projects. As technology rapidly evolves, this area of work is becoming increasingly important to ensure the effectiveness and future growth of organizations. These individuals like to be at the forefront of technology developments. They develop a broad-base of knowledge and understanding of key technologies that organizations need and that they are able to support. They are comfortable working under pressure and can provide training on their project deliverables.

Growth

The similarity score between technology consultant and the starting occupation is 0.766 and the average salary differential is $9,261. While the projected 5-year employment growth for systems analyst is 0.79%, technology consultant's projected 5-year

0.766
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$9,261
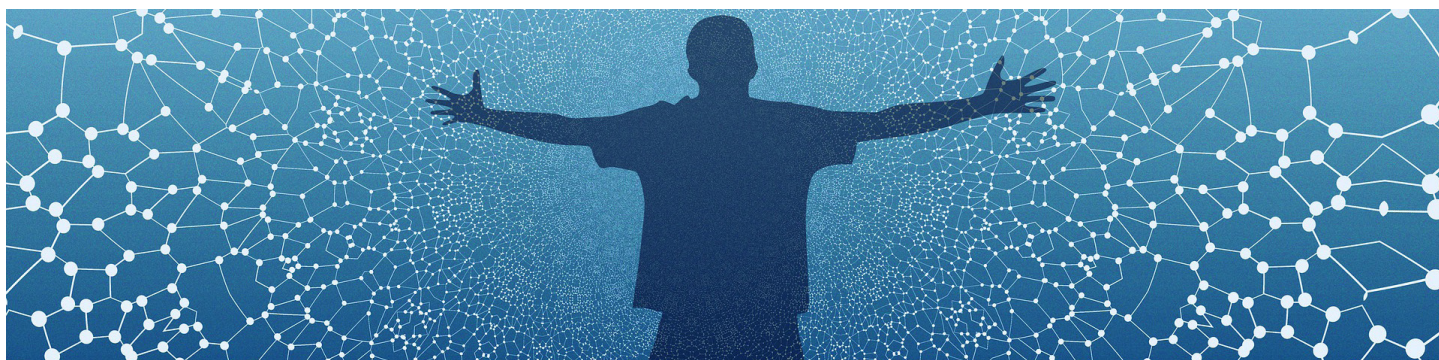**Average Salary Differential**

0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

1.86%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Systems Analyst ▶ Technology Consultant

Starting Occupation — *Advancement Occupation*

$70,367
Average Salary: Advancement
Occupation with 0 - 2 years experience

$84,526
Average Salary: Advancement
Occupation with 3 - 5 years experience

$100,060
Average Salary: Advancement
Occupation with 6+ years experience

2,694
Starting Occupation Postings

637
Advancement Occupation Postings

growth is slightly higher at 1.86%. Average salary for the technology consultant occupation is $70,367 for individuals with up to 2 years of experience; $84,526 for those with 3 to 5 years, and $100,060 for individuals with 6 or more years. There were 2,694 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to technology consultant. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for technology consultant are knowledge of customer service, customer contact, business development, SQL, and information systems. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of SAP, project management, business process, Enterprise Resource Planning (ERP), and business solutions. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of SAP Success Factors, SAP implementation, SAP S/4HANA, Reengineering, and full life cycle.

Systems Analyst ▶ Technology Consultant

Starting Occupation   *Advancement Occupation*

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Customer Service	15%
Customer Contact	13%
Business Development	12%
SQL	12%
Information Systems	11%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
SAP	27%
Project Management	24%
Business Process	19%
Enterprise Resource Planning (ERP)	10%
Business Solutions	7%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
SAP SuccessFactors	8%
SAP Implementation	8%
SAP S/4HANA	6%
Reengineering	4%
Full Life Cycle	4%

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The technology consultant occupation commonly requests, among other, the following certifications: Certified Information Systems Auditor (CISA). This is the standard of achievement from ISACA for those who audit and assess an organization's information technology. The second is Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The third most common certification is Certified Information Systems Security Professional (CISSP), a certification de-

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
- **Certified Information Systems Auditor (CISA)**
- **Project Management Certification**
- **Certified Information Systems Security Professional (CISSP)**

signed to validate information security work experience and a working knowledge of security principles and practices. CISSP is utilized to demonstrate that a security professional is able to design, engineer, implement, and run an information security program.

Advancement Occupation

Cyber/ Information security engineers/ analysts specialize in network and IT infrastructure security. They understand cyberattacks, malware, and the behavior of cybercriminals, and actively seeks to anticipate and prevent these attacks. Their primary role is to understand company IT infrastructure in detail, monitor it at all times, and evaluate threats that could potentially breach the network, and the access to information assets. They continuously look for ways to enhance company information systems and network security and protect its sensitive information. These individuals are comfortable staying up-to-date with the changing technology world, and are very detailed oriented.

Growth

The similarity score between cyber/ Information security engineer/ analyst and the starting occupation is 0.609 and the average salary differential is $12,275. While the projected 5-year employment growth for systems analyst is 0.79%, cyber/ Information security engineer/ analyst's projected 5-year growth is considerably higher at 8.77%. Average salary for the cyber/ Information security engineer/ analyst occupation is $58,383 for individuals with

0.609
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$12,275
Average Salary Differential
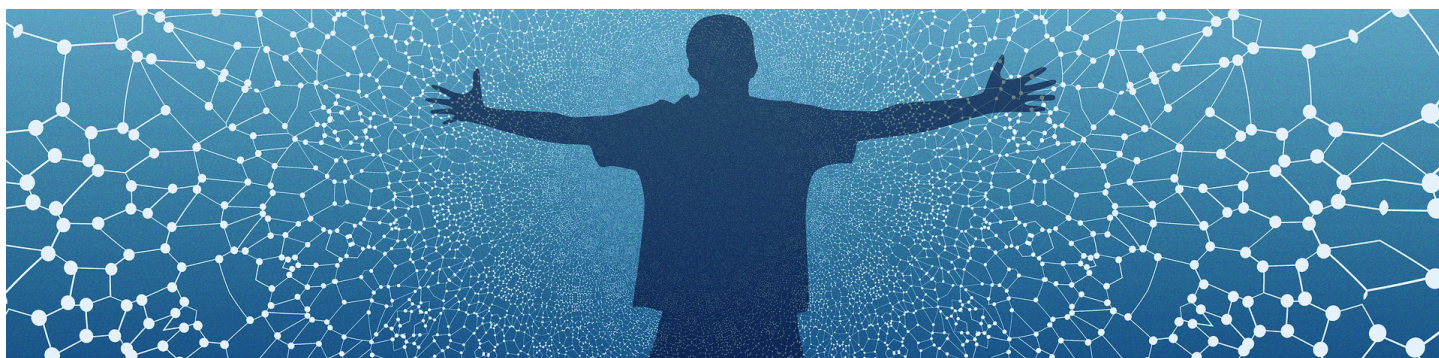
0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

8.77%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

$58,383

Average Salary: Advancement

Occupation with 0 - 2 years experience

$79,154

Average Salary: Advancement

Occupation with 3 - 5 years experience

$95,250

Average Salary: Advancement

Occupation with 6+ years experience

2,694

Starting Occupation Postings

3,137

Advancement Occupation Postings

up to 2 years of experience; $79,154 for those with 3 to 5 years, and $95,250 for individuals with 6 or more years. There were 3,137 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to cyber/ Information security engineer/ analyst. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for cyber/ Information security engineer/ analyst are knowledge of Linux, Python, cryptography, project management, and customer service. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of information security, information systems, network security, NIST Cybersecurity Framework, and information assurance. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of vulnerability analysis, Nessus, threat intelligence and analysis, threat modeling, and cybersecurity assessment.

Systems Analyst

Starting Occupation

▶

Cyber / Information Security Engineer / Analyst

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Linux	19%	Information Security	49%	Vulnerability analysis	5%
Python	14%	Information Systems	27%	Nessus	5%
Cryptography	13%	Network Security	18%	Threat Intelligence and Analysis	5%
Project Management	12%	NIST Cybersecurity Framework	12%	Threat Modeling	5%
Customer Service	11%	Information Assurance	12%	Cybersecurity Assessment	4%

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The cyber / information security engineer / analyst occupation commonly requests security clearance, and among others, the following certifications: Certified Information Systems Security Professional (CISSP), a certification designed to validate information security work experience and a working knowledge of security principles and practices. CISSP is utilized to demonstrate that a security professional is able to design, engineer, implement, and run an information security program. The second top certification is GIAC certifications by the SANS In-

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Certified Information Systems Security Professional (CISSP)**
- **SANS/GIAC Certification**

stitute. GIAC provides a set of vendor-neutral computer security certifications.

Advancement Occupation

IT project managers are individuals charged with overseeing the process of planning, executing and delegating responsibilities around an organization's information technology (IT) pursuits and goals. Specifically, they help determine the systems and technology needed for specific IT projects; create detailed schedules; build a budget; identify staffing needs; and hire and manage the project staff. These individuals are comfortable in both, the technical as well as the organizational environment of the project, making them very effective as liaison between business and technical aspects of projects. They are good communicators and over time, develop an effective sense for negotiation.

Growth

The similarity score between IT project manager and the starting occupation is 0.574 and the average salary differential is $12,268. While the projected 5-year employment growth for systems analyst is 0.79%, IT project manager's projected 5-year growth is higher at 3.12%. Average salary for the IT project manager occupation is $70,136 for individuals with up to 2 years of experience; $84,972 for those with 3 to

0.574
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$12,268
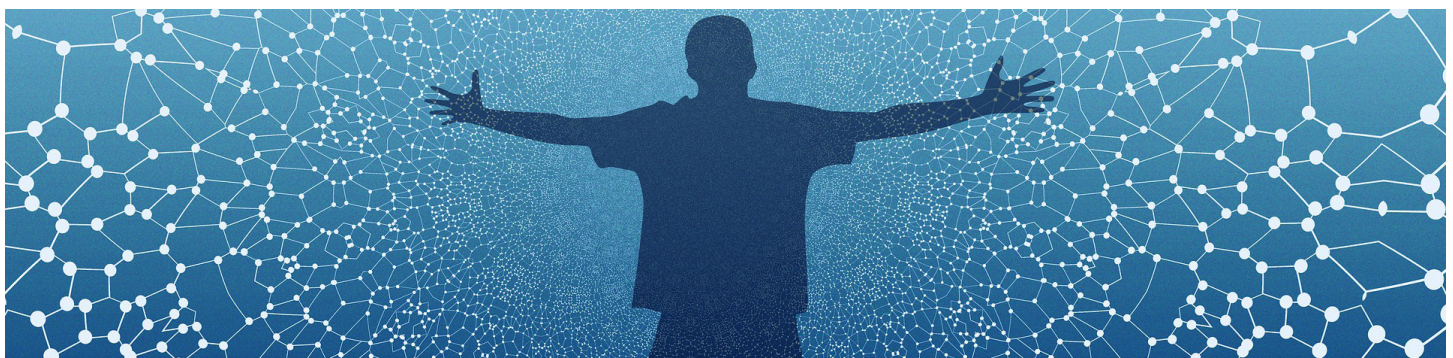### Average Salary Differential

0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

3.12%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Systems Analyst ▶ IT Project Manager

Advancement Occupation

$70,136
Average Salary: Advancement

Occupation with 0 - 2 years experience

$84,972
Average Salary: Advancement

Occupation with 3 - 5 years experience

$98,182
Average Salary: Advancement

Occupation with 6+ years experience

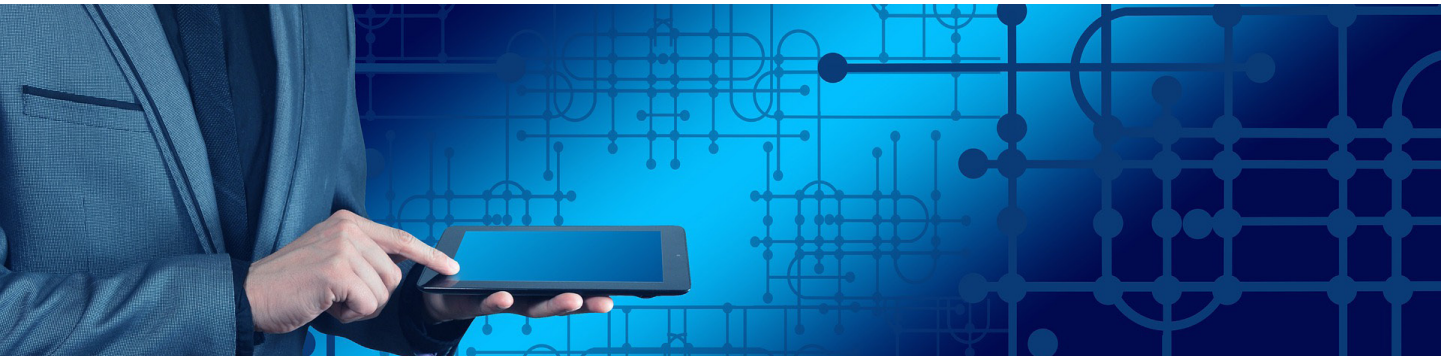## 2,694
Starting Occupation Postings

3,760
Advancement Occupation Postings

5 years, and $98,182 for individuals with 6 or more years. There were 3,760 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to IT project manager. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for IT project manager are knowledge of scheduling, project planning and development skills, customer service, SQL, and quality assurance and control. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of project management, budgeting, Scrum, software development, and Scrum Master. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of product owner, IT management, DevOps, business analysis, and agile coaching.

Systems Analyst ▶ IT Project Manager

Starting Occupation   *Advancement Occupation*

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Scheduling	19%	Project Management	58%	Product owner	7%
Project Planning and Development Skills	19%	Budgeting	29%	IT Management	6%
Customer Service	9%	Scrum	27%	DevOps	6%
SQL	9%	Software Development	20%	Business Analysis	5%
Quality Assurance and Control	8%	Scrum Master	18%	Agile coaching	5%

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The IT project manager occupation commonly requests among others, the following certifications: The first is Project Management Certification. As indicated above, the Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second certification is the Project Management Professional (PMP). This certification offered by the Project Management Institute (PMI) validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams. The third certi-

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
- **Project Management Certification**
- **Project Management Professional (PMP)**
- **Certified Scrum Master (CSM)**

fication is Certified Scrum Master (CSM) The Certified Scrum Master (CSM) certification, available through the Scrum Alliance, is an entry-level certification aimed at providing professionals with an awareness of the methodologies and values of Scrum, including team performance, accountability, and iterative progress.

Advancement Occupation

Network engineers / architects take care of communication networks, such as local area networks (LANs), wide area networks (WANs), and intranets. They design and implement network configurations, troubleshoot performance issues, carry out network monitoring and configure security systems such as firewalls. Among the major skills that these individuals should possess include analytical, problem-solving and communication skills. They should be team-building, detail-oriented leaders with extensive knowledge of various types of computer operating, security and wireless systems.

Growth

The similarity score between network engineer or architect and the starting occupation is 0.535 and the average salary differential is $20,466. While the projected 5-year employment growth for systems analyst is 0.79%, network engineer or architect's projected 5-year growth is higher at 2.86%. Average salary for the network engineer or architect occupation is $58,383 for individuals with up to 2 years of experience; $79,154 for those with 3 to 5 years, and $95,250 for individuals with 6 or more years. There were 2,525 postings for the advancement occupation.

0.535
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$20,466
Average Salary Differential

0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.86%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Systems Analyst ▶ Network Engineer / Architect

$58,383
Average Salary: Advancement
Occupation with 0 - 2 years experience

$79,154
Average Salary: Advancement
Occupation with 3 - 5 years experience

$95,250
Average Salary: Advancement
Occupation with 6+ years experience

2,694
Starting Occupation Postings

2,525
Advancement Occupation Postings

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to network engineer or architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for network engineer or architect are knowledge of Python, routers, project management, Java, and software development. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of network engineering, Cisco, Linux, Wide Area Network (WAN), and VMware. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Microsoft Active Directory, Voice over IP (VoIP), network testing, network hardware, and Citrix.

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifications: Project management certification. The Certified Associate in Project Management (CAPM) from the Project

Systems Analyst ▶ Network Engineer / Architect

Starting Occupation   *Advancement Occupation*

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**	**Skill Gap**	**Skill Recall Percentage in Advancement Occupation**
Python	17%	Network Engineering	28%	Microsoft Active Directory	7%
Routers	14%	Cisco	24%	Voice over IP (VoIP)	5%
Project Management	13%	Linux	16%	Network Testing	4%
Java	12%	Wide Area Network (WAN)	14%	Network Hardware	4%
Software Development	12%	VMware	11%	Citrix	3%

Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The network engineer/ architect occupation commonly requests security clearance, and, among others, the following certifications: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification. The second top certification is Cisco Certified Network Professional (CCNP), a certification for individuals in the IT industry who have achieved the professional level of Cisco Career Certification. Both certifications are from Cisco Systems.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Cisco Certified Network Associate (CCNA)**
- **Cisco Certified Network Professional (CCNP)**

Advancement Occupation

Web developers create and maintain websites. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site. They evaluate code to ensure that it is properly structured, meets industry standards, and is compatible with browsers and devices. These developers optimize website performance, scalability, and server-side code and processes. They may develop website infrastructure and integrate websites with other computer applications. These individuals are comfortable working with technology as the core of their responsibilities, but over time, must develop a good understanding of consumer behavior, as well as collaboration skills and project management.

Growth

The similarity score between web developer and the starting occupation is 0.365 and the average salary differential is $17,468. While the projected 5-year employment growth for systems analyst is 0.79%, web developer's projected 5-year growth is higher at 2.18%. Average salary for the web developer occupation is $70,021 for individuals with up to 2 years of experience;

0.365
Similarity Score
Measure of relatedness between occupations on a scale of 0 to 1

$17,468
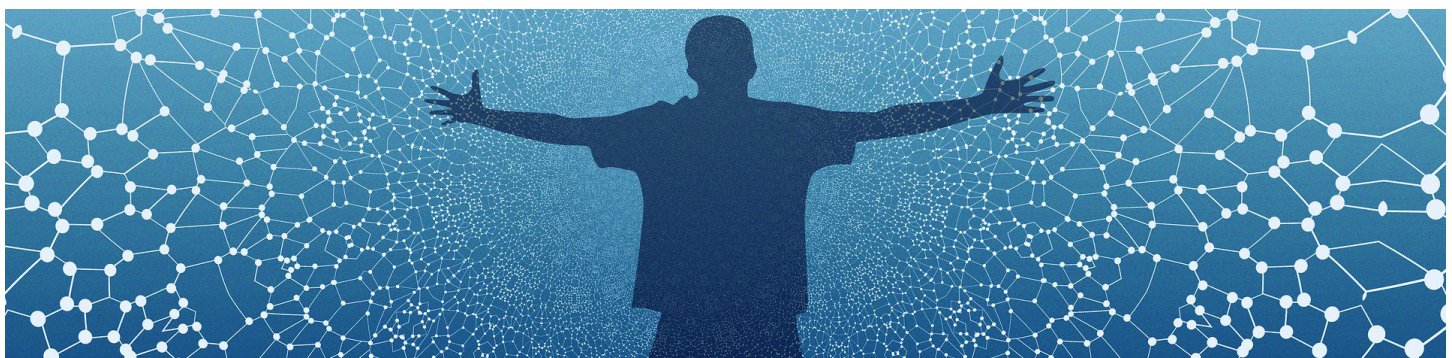**Average Salary Differential**

0.79%
Projected 5-Year Growth
Projected employment growth for the Starting Occupation

2.18%
Projected 5-Year Growth
Projected employment growth for the Advancement Occupation

Systems Analyst ▶ Web Developer

Starting Occupation   *Advancement Occupation*

$70,021
Average Salary: Advancement
Occupation with 0 - 2 years experience

$86,093
Average Salary: Advancement
Occupation with 3 - 5 years experience

$98,621
Average Salary: Advancement
Occupation with 6+ years experience

2,694
Starting Occupation Postings

2,947
Advancement Occupation Postings

$86,093 for those with 3 to 5 years, and $98,621 for individuals with 6 or more years. There were 2,947 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to web developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for web developer are knowledge of Microsoft C#, Python, MySQL, Ruby, and unit testing. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of JavaScript, web development, front-end development, Java, and SQL. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Flask, Joomla, AJAX, User Interface (UI) Design, and Objective C.

Certifications

The systems analyst occupation commonly requests security clearance, and among others, the following certifi-

Systems Analyst ▶ Web Developer

Starting Occupation   *Advancement Occupation*

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft C#	18%
Python	17%
MySQL	16%
Ruby	16%
Unit Testing	16%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
JavaScript	59%
Web Development	39%
Front-end Development	32%
Java	28%
SQL	28%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Flask	7%
Joomla	6%
AJAX	6%
User Interface (UI) Design	6%
Objective C	6%

cations: Project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second top certification is the IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management.

The web developer occupation commonly requests security clearance, driver's license and the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

Certifications

The source occupation commonly requests the following certifications:
- **Security Clearance**
- **Project Management Certification**
- **IT Infrastructure Library (ITIL) Certification**

The Advancement occupation commonly requests the following certifications:
- **Security Clearance**
- **Driver's License**
- **CompTIA Security+**

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Indeed.com
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Springboard.com
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TheBalanceCareers.com
Workable.com
ZipRecruiter.com

For Certifications
Accounting Education   (accounting-education.org/cpa-requirements/Massachusetts/)
American Society for Quality (https://asq.org/cert/catalog)
Axelos   (axelos.com/certifications/itil-service-management)
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