embedded systems software developer

Professionals
Information and communications technology professionals
Software and applications developers and analysts
Applications programmers
ICT application developer
embedded systems software developer

Description

Code

2514.2.1

Description

Embedded systems software developers program, implement, document and maintain software to be run on an embedded system.
Scope note
Excludes people performing managerial activities.

Alternative Labels

embedded software developerl embedded systems engineer
embedded software programmer
embedded systems designer
embedded system software developer
embedded system software programmer
embedded systems software developers

Regulatory Aspect

To see if and how this occupation is regulated in EU Member States, EEA countries or Switzerland please consult the Regulated Professions Database of the Commission.
Regulated Professions Database:
http://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_en

Skills & Competences

Essential Skills and Competences

analyse software specifications | create flowchart diagram | debug software | develop ICT device driver | develop software prototype | interpret technical texts | provide technical documentation | use software design patterns | use software libraries | utilise computer-aided software engineering tools

Essential Knowledge

ICT debugging tools | Internet of Things | computer programming | embedded systems | integrated development environment software | tools for software configuration management

Optional Skills and Competences

adapt to changes in technological development plans | collect customer feedback on applications | design user interface | develop automated migration methods | develop creative ideas | integrate system components | use automatic programming | use concurrent programming | use functional programming | use logic programming | use object-oriented programming

Optional Knowledge

ABAP | AJAX | APL | ASP.NET | Ansible | Apache Maven | Assembly (computer programming) | C# | C++ | COBOL | Common Lisp | Eclipse (integrated development environment software) | Groovy | Haskell | ICT security legislation | Java (computer programming) | JavaScript | Jenkins (tools for software configuration management) | KDevelop | Lisp | MATLAB | ML (computer programming) | Microsoft Visual C++ | Objective-C | OpenEdge Advanced Business Language | PHP | Pascal (computer programming) | Perl | Prolog (computer programming) | Puppet (tools for software configuration management) | Python (computer programming) | R | Ruby (computer programming) | SAP R3 | SAS language | STAF | Salt (tools for software configuration management) | Scala | Scratch (computer programming) | Swift (computer programming) | TypeScript | VBScript | Visual Studio .NET | World Wide Web Consortium standards | Xcode | object-oriented modelling | software anomalies

Concept URI

Concept Uri

http://data.europa.eu/esco/occupation/57af9090-55b4-4911-b2d0-86db01c00b02

Status

released

Change log

From v1.0.8 to v1.1.0:

software analyst

Professionals
Information and communications technology professionals
Software and applications developers and analysts
Software developers
software analyst

Description

Code

2512.1

Description

Software analysts elicit and prioritise user requirements, produce and document software specifications, test their application, and review them during software development. They act as the interface between the software users and the software development team.

Alternative Labels

analyst of software
application analyst
programmer analyst
programming analyst
software analysts
software requirement analyst
software requirements analyst

Regulatory Aspect

To see if and how this occupation is regulated in EU Member States, EEA countries or Switzerland please consult the Regulated Professions Database of the Commission.
Regulated Professions Database:
http://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_en

Skills & Competences

Essential Skills and Competences

analyse business processes | create data models | create software design | define software architecture | define technical requirements | design information system | develop documentation in accordance with legal requirements | develop software prototype | execute feasibility study | identify ICT user needs | interact with users to gather requirements | manage ICT legacy implication | translate requirement concepts into visual design

Essential Knowledge

ICT system user requirements | business requirements techniques | data models | legal requirements of ICT products | software architecture models | software design methodologies

Optional Skills and Competences

analyse ICT system | create project specifications | create prototype of user experience solutions | ensure compliance with company regulations | ensure compliance with legal requirements | identify ICT system weaknesses | manage ICT project | manage system testing | monitor system performance | provide ICT consulting advice | solve ICT system problems

Optional Knowledge

ABAP | AJAX | APL | ASP.NET | Agile development | Agile project management | Assembly (computer programming) | C# | C++ | COBOL | CoffeeScript | Common Lisp | DevOps | Erlang | Groovy | Haskell | Hybrid model | ICT problem management techniques | ICT project management | ICT project management methodologies | Incremental development | Iterative development | Java (computer programming) | JavaScript | LDAP | LINQ | Lean project management | Lisp | MATLAB | MDX | ML (computer programming) | N1QL | Objective-C | Open source model | OpenEdge Advanced Business Language | Outsourcing model | PHP | Pascal (computer programming) | Perl | Process-based management | Prolog (computer programming) | Prototyping development | Python (computer programming) | R | Rapid application development | Ruby (computer programming) | SAP R3 | SAS language | SPARQL | SaaS (service-oriented modelling) | Scala | Scratch (computer programming) | Smalltalk (computer programming) | Spiral development | Swift (computer programming) | TypeScript | VBScript | Visual Studio .NET | Waterfall development | XQuery | computer programming | levels of software testing | object-oriented modelling | query languages | resource description framework query language | service-oriented modelling | unified modelling language

Concept URI

Concept Uri

http://data.europa.eu/esco/occupation/04ba4d6c-957d-417f-bf63-5b9e015a9f86

Status

released

Change log

From v1.0.8 to v1.1.0:

software architect

Professionals
Information and communications technology professionals
Software and applications developers and analysts
Software developers
software architect

Description

Code

2512.2

Description

Software architects create the technical design and the functional model of a software system, based on functional specifications. They also design the architecture of the system or different modules and components related to the business' or customer requirements, technical platform, computer language or development environment.
Scope note
Excludes people performing programming and coding activities.

Alternative Labels

application architect
software architects
software designer

Regulatory Aspect

To see if and how this occupation is regulated in EU Member States, EEA countries or Switzerland please consult the Regulated Professions Database of the Commission.
Regulated Professions Database:
http://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_en

Skills & Competences

Essential Skills and Competences

align software with system architectures | analyse business requirements | analyse software specifications | build business relationships | collect customer feedback on applications | create flowchart diagram | create software design | define software architecture | define technical requirements | design process | oversee development of software | provide cost benefit analysis reports | provide technical documentation

Essential Knowledge

business process modelling | object-oriented modelling | systems development life-cycle | tools for software configuration management | unified modelling language

Optional Skills and Competences

apply ICT systems theory | design database scheme | develop software prototype implement data warehousing techniques | manage staff | perform ICT troubleshooting | perform resource planning | perform risk analysis | provide ICT consulting advice | use markup languages | utilise computer-aided software engineering tools

Optional Knowledge

ABAP | AJAX | APL | ASP.NET | Agile project management | Ansible | Apache Maven Assembly (computer programming) | C# | C++ | COBOL | CoffeeScript | Common Lisp Erlang | Groovy | Haskell | ICT project management methodologies | ICT security legislation | Java (computer programming) | JavaScript | Jenkins (tools for software configuration management) | Lean project management | Lisp | MATLAB | ML (computer programming) | Microsoft Visual C++ | Objective-C | OpenEdge Advanced Business Language | PHP | Pascal (computer programming) | Perl | Process-based management | Prolog (computer programming) | Puppet (tools for software configuration management) | Python (computer programming) | R | Ruby (computer programming) | SAP R3 | SAS language | STAF | Salt (tools for software configuration management) | Scala | Scratch (computer programming) | Smalltalk (computer programming) | Swift (computer programming) | TypeScript | VBScript | Visual Studio .NET | computer programming | systems theory | task algorithmisation | web programming

Concept URI

Concept Uri

http://data.europa.eu/esco/occupation/d0aa0792-4345-474b-9365-686cf4869d2e

Status

released

Change log

From v1.0.8 to v1.1.0:

software developer

Professionals
Information and communications technology professionals
Software and applications developers and analysts
Software developers
software developer

Description

Code

2512.3

Description

Software developers implement or program all kinds of software systems based on specifications and designs by using programming languages, tools, and platforms.
Scope note
Includes people performing software design.

Alternative Labels

application developer
application programmer
applications engineer
application software developer
developer of software
programmer
soft developer
software developers
software engineer
software specialist
solutions developer

Regulatory Aspect

To see if and how this occupation is regulated in EU Member States, EEA countries or Switzerland please consult the Regulated Professions Database of the Commission.
Regulated Professions Database:
http://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_en

Skills & Competences

Essential Skills and Competences

analyse software specifications | create flowchart diagram | debug software | define technical requirements | develop automated migration methods | develop software prototype | identify customer requirements | interpret technical requirements | manage engineering project | perform scientific research | provide technical documentation | use software design patterns | use software libraries | use technical drawing software | utilise computer-aided software engineering tools

Essential Knowledge

ICT debugging tools | computer programming | engineering principles | engineering processes | integrated development environment software | project management | technical drawings | tools for software configuration management

Optional Skills and Competences

adapt to changes in technological development plans | collect customer feedback on applications | design user interface | develop creative ideas | integrate system components | migrate existing data | use automatic programming | use concurrent programming | use functional programming | use logic programming | use object-oriented programming | utilise machine learning

Optional Knowledge

ABAP | AJAX | APL | ASP.NET | Ansible | Apache Maven | Assembly (computer programming) | C# | C++ | COBOL | CoffeeScript | Common Lisp | Eclipse (integrated development environment software) | Erlang | Groovy | Haskell | ICT security legislation | Internet of Things | Java (computer programming) | JavaScript | Jenkins (tools for software configuration management) | KDevelop | Lisp | MATLAB | ML (computer programming) | Microsoft Visual C++ | Objective-C | OpenEdge Advanced Business Language | PHP | Pascal (computer programming) | Perl | Prolog (computer programming) | Puppet (tools for software configuration management) | Python (computer programming) | R | Ruby (computer programming) | SAP R3 | SAS language | STAF | Salt (tools for software configuration management) | Scala | Scratch (computer programming) | Smalltalk (computer programming) | Swift (computer programming) | TypeScript | VBScript | Visual Studio .NET | World Wide Web Consortium standards | Xcode | object-oriented modelling | software anomalies

Concept URI

Concept Uri

http://data.europa.eu/esco/occupation/f2b15a0e-e65a-438a-affb-29b9d50b77d1

Status

released

Change log

From v1.0.8 to v1.1.0:

software manager

Managers
Production and specialised services managers
Information and communications technology service managers
Information and communications technology service managers
ICT operations manager
software manager

Description

Code

1330.5.1

Description

Software managers oversee the acquisition and development of software systems in order to provide support to all organisational units. They also monitor the results and quality of the different software solutions and projects implemented in the organisation.
Scope note
Includes people performing managerial activities. Excludes people performing programming and coding activities.

Alternative Labels

applications manager
ICT applications manager
soft manager
software applications manager
software managers

Regulatory Aspect

To see if and how this occupation is regulated in EU Member States, EEA countries or Switzerland please consult the Regulated Professions Database of the Commission.
Regulated Professions Database:
http://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_en

Skills & Competences

Essential Skills and Competences

analyse software specifications | apply ICT system usage policies | apply system organisational policies | create software design | ensure adherence to organisational ICT standards | evaluate cost of software products | execute analytical mathematical calculations | manage ICT project | manage business knowledge | manage data monitor technology trends | use ICT ticketing system

Essential Knowledge

ICT project management | ICT project management methodologies | data storage organisational policies | quality assurance methodologies | software metrics | systems development life-cycle | unified modelling language

Optional Skills and Competences

analyse ICT technical proposals | apply conflict management | coach employees | give live presentation | identify ICT user needs | interact with users to gather requirements | manage schedule of tasks | manage software localisation | manage staff | manage tender processes | monitor ICT research | negotiate buying conditions provide user documentation | train employees | use different communication channels | utilise methodologies for user centered design

Optional Knowledge

Agile project management | Android (mobile operating systems) | BlackBerry | ICT system user requirements | Lean project management | Process-based management Windows Phone | iOS | mobile operating systems

Concept URI

Concept Uri

http://data.europa.eu/esco/occupation/f31f487b-4ce2-40f3-90e8-7d0011b4ef1d

Status

released

Change log

From v1.0.8 to v1.1.0:

software tester

Professionals
Information and communications technology professionals
Software and applications developers and analysts
Software and applications developers and analysts not elsewhere classified
software tester

Description

Code

2519.6

Description

Software testers perform software tests. They may also plan and design them. They may also debug and repair software although this mainly corresponds to designers and developers. They ensure that applications function properly before delivering them to internal and external clients.
Scope note
Excludes people performing managerial activities.

Alternative Labels

application software tester
application tester
module tester
soft tester
software application tester
software testers
software testing specialist
tester
unit tester

Regulatory Aspect

To see if and how this occupation is regulated in EU Member States, EEA countries or Switzerland please consult the Regulated Professions Database of the Commission.
Regulated Professions Database:
http://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_en
Narrower ISCO groups
- ICT system tester
- digital games tester

- ICT usability tester
- ICT accessibility tester
- ICT integration tester

Skills & Competences

Essential Skills and Competences

address problems critically | execute software tests | perform software unit testing | provide software testing documentation | replicate customer software issues | report test findings

Essential Knowledge

levels of software testing | software anomalies | software architecture models | software metrics

Optional Skills and Competences

conduct ICT code review | debug software | develop ICT test suite | develop automated software tests | execute integration testing | manage schedule of tasks | measure software usability | perform software recovery testing | plan software testing | use scripting programming

Optional Knowledge

ABAP | AJAX | APL | ASP.NET | Agile project management | Assembly (computer programming) | C# | C++ | COBOL | CoffeeScript | Common Lisp | Erlang | Groovy | Haskell | ICT debugging tools | ICT performance analysis methods | ICT project management methodologies | Java (computer programming) | JavaScript | LDAP | LINQ | Lean project management | Lisp | MATLAB | MDX | ML (computer programming) | Microsoft Visual C++ | N1QL | Objective-C | OpenEdge Advanced Business Language | PHP | Pascal (computer programming) | Perl | Process-based management | Prolog (computer programming) | Python (computer programming) | R | Ruby (computer programming) | SAP R3 | SAS language | SPARQL | Scala | Scratch (computer programming) | Smalltalk (computer programming) | Swift (computer programming) | TypeScript | VBScript | Visual Studio .NET | XQuery | application usability | audit techniques | computer programming | hardware components | query languages | resource description framework query language | software components libraries | tools for ICT test automation | unstructured data

Concept URI

Concept Uri

http://data.europa.eu/esco/occupation/106f79e4-6264-45f1-9e7a-297435cd684b

Status

released

Change log

From v1.0.8 to v1.1.0:

user interface developer

Professionals
Information and communications technology professionals
Software and applications developers and analysts
Software developers
user interface developer

Description

Code

2512.4

Description

User interface developers implement, code, document and maintain the interface of a software system by using front-end development technologies.

Alternative Labels

front end developer
UI developer
UI developers
UI programmer
user interface developers
user interface engineer

Regulatory Aspect

To see if and how this occupation is regulated in EU Member States, EEA countries or Switzerland please consult the Regulated Professions Database of the Commission.
Regulated Professions Database:
http://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_en

Skills & Competences

Essential Skills and Competences

analyse software specifications | design graphics | design user interface | develop

software prototype | draw design sketches | interpret technical texts | use software design patterns | use software libraries | utilise methodologies for user centered design

Essential Knowledge

World Wide Web Consortium standards | computer programming | graphics editor software | integrated development environment software | software UI design patterns | style sheet languages | web programming

Optional Skills and Competences

create flowchart diagram | debug software | provide technical documentation | use automatic programming | use concurrent programming | use functional programming | use logic programming | use markup languages | use object-oriented programming | use scripting programming | utilise computer-aided software engineering tools

Optional Knowledge

ABAP | AJAX | APL | ASP.NET | Adobe Illustrator | Adobe Photoshop | Ansible | Apache Maven | Assembly (computer programming) | C# | C++ | COBOL | CSS | CoffeeScript | Common Lisp | Eclipse (integrated development environment software) | Erlang | GIMP (graphics editor software) | Groovy | Haskell | ICT debugging tools | ICT project management | JSSS | Java (computer programming) | JavaScript | Jenkins (tools for software configuration management) | KDevelop | LESS | Lisp | MATLAB | ML (computer programming) | Microsoft Visio | Microsoft Visual C++ | Objective-C | OpenEdge Advanced Business Language | PHP | Pascal (computer programming) | Perl | Prolog (computer programming) | Puppet (tools for software configuration management) | Python (computer programming) | R | Ruby (computer programming) | SAP R3 | SAS language | STAF | Salt (tools for software configuration management) | Sass | Scala | Scratch (computer programming) | SketchBook Pro | Smalltalk (computer programming) | Swift (computer programming) | Synfig | TypeScript | VBScript | Vagrant | Visual Studio .NET | Xcode | human-computer interaction | software interaction design | tools for software configuration management

Concept URI

Concept Uri

http://data.europa.eu/esco/occupation/866c7813-2c03-47d7-9bdc-192cfbace57c

Status

released

Change log

From v1.0.8 to v1.1.0:

O*NET OnLine

Software Developers

15-1252.00

Bright Outlook | Updated 2025

A subset of this occupation's profile is available. Data collection is currently underway to populate other parts of the profile.

Research, design, and develop computer and network software or specialized utility programs. Analyze user needs and develop software solutions, applying principles and techniques of computer science, engineering, and mathematical analysis. Update software or enhance existing software capabilities. May work with computer hardware engineers to integrate hardware and software systems, and develop specifications and performance requirements. May maintain databases within an application area, working individually or coordinating database development as part of a team.

Sample of reported job titles: Application Developer, Application Integration Engineer, Developer, Infrastructure Engineer, Network Engineer, Software Architect, Software Developer, Software Development Engineer, Software Engineer, Systems Engineer

Summary | Details | Custom | Easy Read | Veterans | Español

Contents

Occupation-Specific Information

Tasks

Save Table: XLSX CSV

All 19 displayed

- Analyze information to determine, recommend, and plan installation of a new system or modification of an existing system.
- Analyze user needs and software requirements to determine feasibility of design within time and cost constraints.
- Confer with data processing or project managers to obtain information on limitations or capabilities for data processing projects.
- Confer with systems analysts, engineers, programmers and others to design systems and to obtain information on project limitations and capabilities, performance requirements and interfaces.

- Consult with customers or other departments on project status, proposals, or technical issues, such as software system design or maintenance.
- Coordinate installation of software system.
- Design, develop and modify software systems, using scientific analysis and mathematical models to predict and measure outcomes and consequences of design.
- Determine system performance standards.
- Develop or direct software system testing or validation procedures, programming, or documentation.
- Modify existing software to correct errors, adapt it to new hardware, or upgrade interfaces and improve performance.
- Monitor functioning of equipment to ensure system operates in conformance with specifications.
- Obtain and evaluate information on factors such as reporting formats required, costs, or security needs to determine hardware configuration.
- Prepare reports or correspondence concerning project specifications, activities, or status.
- Recommend purchase of equipment to control dust, temperature, or humidity in area of system installation.
- Specify power supply requirements and configuration.
- Store, retrieve, and manipulate data for analysis of system capabilities and requirements.
- Supervise and assign work to programmers, designers, technologists, technicians, or other engineering or scientific personnel.
- Supervise the work of programmers, technologists and technicians and other engineering and scientific personnel.
- Train users to use new or modified equipment.

Find occupations related to multiple tasks

Technology Skills

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All 66 displayed

- **Access software —** Citrix cloud computing software; PuTTY
- **Administration software —** Software distribution management software
- **Analytical or scientific software** — IBM SPSS Statistics ; SAS ; TensorFlow ; The MathWorks MATLAB ; 6 more
- **Application server software —** Atlassian Bitbucket ; GitLab ; Kubernetes ; Red Hat OpenShift ; 7 more
- **Authentication server software —** Single sign-on SSO
- **Backup or archival software —** Backup and archival software; Veritas NetBackup
- **Business intelligence and data analysis software —** Alteryx software ; IBM Cognos Impromptu; Microsoft Power BI ; Tableau ; 3 more

- **Cloud-based data access and sharing software —** Dropbox; Google Drive; Platform as a service PaaS; Slack
- **Cloud-based management software —** Amazon Web Services AWS CloudFormation ; IBM WebSphere MQ ; Oracle Cloud software ; Splunk Enterprise ; 2 more
- **Clustering software —** VMware
- **Communications server software** — IBM Domino
- **Computer based training software —** Moodle
- **Configuration management software —** Chef ; IBM Terraform ; Perforce Helix software; Puppet ; 6 more
- **Content workflow software —** Atlassian JIRA ; Emerald Software Group Emerald Green Office
- **Customer relationship management CRM software —** Blackbaud The Raiser's Edge; Oracle Eloqua; Salesforce software
- **Data base management system software —** Amazon DynamoDB ; Oracle Database ; Oracle PL/SQL ; Redis ; 21 more
- **Data base reporting software —** Microsoft SQL Server Reporting Services SSRS ; Oracle Business Intelligence Discoverer; SAP Business Intelligence; SAP Crystal Reports; 3 more
- **Data base user interface and query software —** Airtable; Blackboard software; GraphQL ; PyTorch ; 15 more
- **Data mining software —** Google Analytics
- **Desktop communications software —** Skype
- **Desktop publishing software —** Adobe InDesign ; Microsoft Publisher
- **Development environment software —** Apache Kafka ; Apache Maven ; Oracle Java 2 Platform Enterprise Edition J2EE ; Oracle SQL Developer ; 62 more
- **Device drivers or system software —** Microsoft DirectX
- **Document management software —** Adobe Acrobat ; Document management system software; Microsoft SharePoint
- **Electronic mail software —** Google Gmail; IBM Notes; Microsoft Exchange; Microsoft Outlook
- **Enterprise application integration software —** Extensible markup language XML ; IBM InfoSphere DataStage; Jenkins CI ; Microsoft SQL Server Integration Services SSIS ; 5 more
- **Enterprise resource planning ERP software —** Microsoft Dynamics ; Oracle PeopleSoft ; SAP ERP ; Workday software ; 9 more
- **Enterprise system management software** — IBM Power Systems software
- **Expert system software —** Ansible software
- **File versioning software —** Apache Subversion SVN ; Git ; Version control software
- **Filesystem software —** File server software
- **Financial analysis software —** Delphi Technology; Oracle E-Business Suite Financials
- **Graphical user interface development software —** Figma ; Graphical user interface GUI builder software; Graphical user interface GUI design software; Salesforce Visualforce
- **Graphics or photo imaging software —** Adobe Creative Cloud software ; Adobe Illustrator ; JamBoard; Trimble SketchUp Pro ; 4 more
- **Information retrieval or search software —** Apache Avro; LexisNexis

- **Instant messaging software —** Blink; GroupMe
- **Internet directory services software —** Microsoft Active Directory
- **Internet protocol IP multimedia subsystem software —** Voice over internet protocol VoIP system software
- **Map creation software —** ESRI ArcGIS software
- **Metadata management software** — Informatica software ; Quest Erwin Data Modeler; Talend Data Fabric
- **Network conferencing software —** LogMeIn GoToWebinar
- **Network monitoring software —** Nagios; Wireshark
- **Network operation system software** — IBM z/OS operating systems
- **Network security and virtual private network VPN equipment software —** Firewall software; Virtual private networking VPN software
- **Object or component oriented development software —** Apache Spark ; jQuery ; Scala ; TypeScript ; 34 more
- **Object oriented data base management software —** Hibernate ORM ; PostgreSQL
- **Office suite software —** LibreOffice; Microsoft Office software
- **Operating system software —** Apple iOS ; Google Android ; Microsoft Windows Server ; UNIX Shell ; 21 more
- **Platform interconnectivity software —** Migration software
- **Portal server software —** Apache HTTP Server
- **Presentation software —** Google Slides; Microsoft PowerPoint
- **Process mapping and design software —** Microsoft Visio
- **Program testing software —** Hewlett Packard LoadRunner; JUnit ; Selenium ; SonarQube; 21 more
- **Project management software —** Atlassian Confluence ; Microsoft Team Foundation Server ; Microsoft Teams ; Oracle Primavera Enterprise Project Portfolio Management ; 1 more
- **Requirements analysis and system architecture software** — IBM Rational RequisitePro; Requirements management software; Unified modeling language UML
- **Sales and marketing software —** Marketo Marketing Automation
- **Spreadsheet software —** Google Sheets ; Microsoft Excel
- **Storage networking software —** Amazon Simple Storage Service S3 ; Storage area network SAN software
- **Switch or router software —** Border Gateway Protocol BGP
- **Transaction security and virus protection software —** Encryption software; McAfee; NortonLifeLock cybersecurity software
- **Transaction server software —** Customer information control system CICS; IBM Middleware; Microsoft Internet Information Services (IIS); Object Management Group Object Request Broker; 1 more
- **Video conferencing software —** Cisco Webex ; Google Meet; LogMeIn GoToMeeting; Zoom ; 1 more
- **Video creation and editing software —** Adobe After Effects ; Flipgrid; Screencastify; YouTube; 1 more
- **Web page creation and editing software —** Adobe Dreamweaver; Google Sites; Social media sites; WordPress ; 1 more
- **Web platform development software —** Bootstrap ; Eclipse Jersey ; React ; Vue.js ; 31 more

- **Word processing software —** 3M Post-it App; Google Docs 🔥; Microsoft OneNote; Microsoft Word 🔥; 1 more

Hot Technologies are requirements most frequently included across all employer job postings.
See all 149 Hot Technologies for this occupation.

In Demand skills are frequently included in employer job postings for this occupation.
See all 31 In Demand skills for this occupation.

Tools Used

Save Table: XLSX CSV

All 9 displayed

- **Central processing unit CPU processors —** Graphics processing unit GPU; Multi-core central processing unit CPU
- **Computer servers —** Application servers
- **Desktop computers**
- **Digital cameras**
- **Flash memory storage card —** Flash disks
- **High end computer servers —** Directory servers
- **Integrated circuit testers —** In circuit emulators ICE; Logic analyzers
- **Mainframe computers**
- **Notebook computers**

Occupational Requirements

Detailed Work Activities

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All 21 displayed

- Analyze project data to determine specifications or requirements.
- Modify software programs to improve performance.
- Supervise information technology personnel.
- Apply mathematical principles or statistical approaches to solve problems in scientific or applied fields.
- Assess database performance.
- Assign duties or work schedules to employees.
- Collaborate with others to determine design specifications or details.
- Collaborate with others to resolve information technology issues.
- Communicate project information to others.
- Coordinate software or hardware installation.
- Design software applications.

- Develop performance metrics or standards related to information technology.
- Develop testing routines or procedures.
- Document technical specifications or requirements.
- Identify information technology project resource requirements.
- Manage information technology projects or system activities.
- Monitor computer system performance to ensure proper operation.
- Prepare data for analysis.
- Provide recommendations to others about computer hardware.
- Provide technical support for software maintenance or use.
- Teach others to use computer equipment or hardware.

Find occupations related to multiple detailed work activities

Experience Requirements

Job Zone

Save Table: XLSX CSV

Title	Job Zone Four: Considerable Preparation Needed
Education	Most of these occupations require a four-year bachelor's degree, but some do not.
Related Experience	A considerable amount of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified.
Job Training	Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
Job Zone Examples	Many of these occupations involve coordinating, supervising, managing, or training others. Examples include real estate brokers, sales managers, database administrators, graphic designers, conservation scientists, art directors, and cost estimators.
SVP Range	(7.0 to < 8.0)

Training & Credentials

State training	Select a State Go
Local training	ZIP Code Go
Certifications	Find certifications nationwide

State licenses Select a State Go

Apprenticeship Opportunities

All 2 displayed

Example apprenticeship titles for this occupation:

- Application Developer
- Commercial Drone Software Developer

Specific title(s) listed above are vetted by industry and approved by the U.S. Department of Labor for use in a Registered Apprenticeship Program.

Start your career and build your skillset. Visit **Apprenticeship.gov** to learn about opportunities related to this occupation.

Worker Characteristics

Interests

Save Table: XLSX CSV

All 6 displayed

Occupational Interest	Interest
81	**Investigative —** Work involves studying and researching non-living objects, living organisms, disease or other forms of impairment, or human behavior. Investigative occupations are often associated with physical, life, medical, or social sciences, and can be found in the fields of humanities, mathematics/statistics, information technology, or health care service.
74	**Conventional** — Work involves following procedures and regulations to organize information or data, typically in a business setting. Conventional occupations are often associated with office work, accounting, mathematics/statistics, information technology, finance, or human resources.
49	**Realistic —** Work involves designing, building, or repairing of equipment, materials, or structures, engaging in physical activity, or working outdoors. Realistic occupations are often associated with engineering, mechanics and electronics, construction, woodworking, transportation, machine operation, agriculture, animal services, physical or manual labor, athletics, or protective services.

Occupational Interest	Interest
21	**Artistic —** Work involves creating original visual artwork, performances, written works, food, or music for a variety of media, or applying artistic principles to the design of various objects and materials. Artistic occupations are often associated with visual arts, applied arts and design, performing arts, music, creative writing, media, or culinary art.
15	**Enterprising —** Work involves managing, negotiating, marketing, or selling, typically in a business setting, or leading or advising people in political and legal situations. Enterprising occupations are often associated with business initiatives, sales, marketing/advertising, finance, management/administration, professional advising, public speaking, politics, or law.
15	**Social —** Work involves helping, teaching, advising, assisting, or providing service to others. Social occupations are often associated with social, health care, personal service, teaching/education, or religious activities.

Workforce Characteristics

Wages & Employment Trends

Median wages (2024)	$63.98 hourly, $133,080 annual
State wages	Select a State Go
Local wages	ZIP Code Go
Employment (2023)	1,692,100 employees
Projected growth (2023-2033)	■■■■ Much faster than average (9% or higher)
Projected job openings (2023-2033)	125,100
State trends	Select a State Go
Top industries (2023)	Professional, Scientific, and Technical Services (42% employed in this sector) Information (20%) Finance and Insurance (10%)

Source: Bureau of Labor Statistics 2024 wage data and 2023-2033 employment projections. "Projected growth" represents the estimated change in total employment over the projections period (2023-2033). "Projected job openings"

represent openings due to growth and replacement.

Job Openings on the Web

State job openings Select a State Go

Local job openings ZIP Code Go

More Information

Related Occupations

Save Table: XLSX CSV

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- 17-2061.00 Computer Hardware Engineers Bright Outlook
- 15-1241.00 Computer Network Architects
- 15-1251.00 Computer Programmers
- 15-1211.00 Computer Systems Analysts
- 15-1299.08 Computer Systems Engineers/Architects
- 15-1242.00 Database Administrators
- 15-1243.00 Database Architects
- 15-1299.05 Information Security Engineers
- 15-1253.00 Software Quality Assurance Analysts and Testers
- 15-1254.00 Web Developers

Professional Associations

Disclaimer: Sources are listed to provide additional information on related jobs, specialties, and/or industries. Links to non-DOL Internet sites are provided for your convenience and do not constitute an endorsement.

National Associations

5 of 27 displayed

- Association for Computing Machinery
- Association for Information Science and Technology
- Association for Information Systems
- Association for the Advancement of Artificial Intelligence
- Association for Women in Computing

Regional Associations

- Midwest Association for Information Systems
- Southern Association for Information Systems

Accreditation, Certification, & Unions

- CompTIA
- Project Management Institute

O*NET OnLine

Software Quality Assurance Analysts and Testers

15-1253.00

Bright Outlook | Updated 2025

Develop and execute software tests to identify software problems and their causes. Test system modifications to prepare for implementation. Document software and application defects using a bug tracking system and report defects to software or web developers. Create and maintain databases of known defects. May participate in software design reviews to provide input on functional requirements, operational characteristics, product designs, and schedules.

Sample of reported job titles: Automation Tester, Information Technology Analyst (IT Analyst), Quality Assurance Analyst (QA Analyst), Quality Assurance Engineer (QA Engineer), Quality Engineer, Software Quality Assurance Analyst (SQA Analyst), Software Quality Assurance Engineer (SQA Engineer), Software Quality Engineer, Software Test Engineer, Test Engineer

Summary | Details | Custom | Easy Read | Veterans | Español

Contents

Occupation-Specific Information

Tasks

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Importance	Category	Task
93	Core	Identify, analyze, and document problems with program function, output, online screen, or content.
92	Core	Document software defects, using a bug tracking system, and report defects to software developers.
88	Core	Develop testing programs that address areas such as database impacts, software scenarios, regression testing, negative testing, error or bug retests, or usability.
84	Core	Design test plans, scenarios, scripts, or procedures.

Importance	Category	Task
83	Core	Document test procedures to ensure replicability and compliance with standards.
82	Core	Provide feedback and recommendations to developers on software usability and functionality.
82	Core	Install, maintain, or use software testing programs.
80	Core	Test system modifications to prepare for implementation.
79	Core	Create or maintain databases of known test defects.
78	Core	Develop or specify standards, methods, or procedures to determine product quality or release readiness.

Technology Skills

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All 68 displayed

- **Access software —** Citrix cloud computing software; PuTTY
- **Accounting software —** Tax software
- **Administration software —** Software distribution management software
- **Analytical or scientific software** — IBM SPSS Statistics ; Minitab; SAS ; The MathWorks MATLAB ; 5 more
- **Application server software —** Docker ; GitHub ; Red Hat OpenShift ; Spring Boot ; 4 more
- **Backup or archival software —** Backup and archival software; Veritas NetBackup
- **Business intelligence and data analysis software** — IBM Cognos Impromptu; Oracle Business Intelligence Enterprise Edition; Qlik Tech QlikView; Tableau ; 1 more
- **Cloud-based data access and sharing software —** Dropbox; Google Drive; Slack
- **Cloud-based management software —** Amazon Web Services AWS CloudFormation ; IBM WebSphere; Splunk Enterprise
- **Clustering software —** VMware
- **Communications server software** — IBM Domino
- **Computer aided design CAD software —** Autodesk AutoCAD ; Bentley MicroStation ; Dassault Systemes CATIA
- **Computer based training software —** Moodle
- **Configuration management software —** Chef ; Perforce Helix software; Puppet ; Visible Razor; 6 more
- **Content workflow software —** Emerald Software Group Emerald Green Office; Twiki; Workflow software

- **Customer relationship management CRM software —** Blackbaud The Raiser's Edge; Oracle Eloqua; Salesforce software
- **Data base management system software —** Amazon DynamoDB ; Elasticsearch ; MongoDB ; Oracle PL/SQL ; 22 more
- **Data base reporting software —** Microsoft SQL Server Reporting Services SSRS ; Oracle Business Intelligence Discoverer; SAP Business Intelligence; SAP Crystal Reports; 3 more
- **Data base user interface and query software —** Airtable; Apache Hive ; Blackboard software; IBM DB2 ; 12 more
- **Data mining software —** Google Analytics
- **Desktop communications software —** Skype
- **Desktop publishing software —** Adobe InDesign ; Microsoft Publisher
- **Development environment software —** Apache Kafka ; Apache Maven ; Apache Subversion SVN ; Oracle Java 2 Platform Enterprise Edition J2EE ; 61 more
- **Device drivers or system software —** Microsoft DirectX
- **Document management software —** Adobe Acrobat ; Document management system software; Microsoft SharePoint
- **Electronic mail software —** Google Gmail; IBM Notes; Microsoft Exchange; Microsoft Outlook
- **Enterprise application integration software —** Extensible markup language XML ; IBM InfoSphere DataStage; Jenkins CI ; Microsoft SQL Server Integration Services SSIS ; 4 more
- **Enterprise resource planning ERP software —** Microsoft Dynamics ; Oracle JD Edwards EnterpriseOne; Oracle PeopleSoft ; SAP software ; 6 more
- **Enterprise system management software** — IBM Power Systems software
- **Expert system software —** Ansible software
- **File versioning software —** Git ; Version control software
- **Filesystem software —** File server software
- **Financial analysis software —** Delphi Technology; Oracle E-Business Suite Financials
- **Geographic information system —** ESRI ArcGIS software ; Geographic information system GIS software
- **Graphical user interface development software —** Graphical user interface GUI builder software; Graphical user interface GUI design software; Salesforce Visualforce
- **Graphics or photo imaging software —** Adobe Creative Cloud software ; Adobe Illustrator ; JamBoard; Trimble SketchUp Pro ; 4 more
- **Human resources software —** Human resource management software HRMS
- **Industrial control software —** Supervisory control and data acquisition SCADA software
- **Information retrieval or search software —** Apache Avro; LexisNexis
- **Instant messaging software —** Blink; GroupMe
- **Internet browser software —** Apple Safari ; Microsoft Internet Explorer; Mozilla Firefox ; Web browser software
- **Internet protocol IP multimedia subsystem software —** Voice over internet protocol VoIP system software
- **Medical software —** Epic Systems

- **Metadata management software —** Quest Erwin Data Modeler; Talend Data Fabric
- **Network conferencing software —** LogMeIn GoToWebinar
- **Network monitoring software —** Nagios; Wireshark
- **Network operation system software** — IBM z/OS operating systems
- **Network security and virtual private network VPN equipment software —** Firewall software; Network intrusion detection software; Virtual private networking VPN software
- **Object or component oriented development software —** Apache Spark 🔥; jQuery 🔥; Scala 🔥; Swift 🔥; 32 more
- **Object oriented data base management software —** Hibernate ORM 🔥; PostgreSQL 🔥
- **Office suite software —** LibreOffice; Microsoft Office software 📈
- **Operating system software —** Bash 🔥; Microsoft Windows Server 🔥; Red Hat Enterprise Linux 🔥; UNIX Shell 🔥; 22 more
- **Platform interconnectivity software —** Migration software
- **Portal server software —** Apache HTTP Server
- **Presentation software —** Google Slides; Microsoft PowerPoint 🔥
- **Process mapping and design software —** Microsoft Visio 🔥
- **Program testing software —** Hewlett Packard LoadRunner; IBM Rational Robot; JUnit 🔥; Selenium 📈; 36 more
- **Project management software —** Atlassian Confluence 🔥; Atlassian JIRA 📈; Microsoft Team Foundation Server 🔥; Microsoft Teams 🔥; 2 more
- **Requirements analysis and system architecture software** — IBM Rational RequisitePro; Requirements management software; Unified modeling language UML
- **Spreadsheet software —** Google Sheets 🔥; Microsoft Excel 📈
- **Storage networking software —** Amazon Simple Storage Service S3 🔥; Storage area network SAN software
- **Transaction security and virus protection software —** Anti-spyware software; Antivirus software; McAfee; NortonLifeLock cybersecurity software; 1 more
- **Transaction server software —** Customer information control system CICS; IBM Middleware; Microsoft Internet Information Services (IIS); Object Management Group Object Request Broker; 1 more
- **Video conferencing software —** Cisco Webex 🔥; Google Meet; LogMeIn GoToMeeting; Zoom 🔥; 1 more
- **Video creation and editing software —** Adobe After Effects 🔥; Flipgrid; Screencastify; YouTube; 1 more
- **Web page creation and editing software —** Adobe Dreamweaver; Google Sites; LinkedIn; Social media sites
- **Web platform development software —** Django 🔥; Google Angular 🔥; React 🔥; Spring Framework 🔥; 25 more
- **Word processing software —** 3M Post-it App; Google Docs 🔥; Microsoft OneNote; Microsoft Word 🔥; 1 more

🔥 Hot Technologies are requirements most frequently included across all employer job postings.
See all 126 Hot Technologies for this occupation.

📈 In Demand skills are frequently included in employer job postings for this occupation.
See all 18 In Demand skills for this occupation.

Tools Used

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All 11 displayed

- **Central processing unit CPU processors —** Graphics processing unit GPU; Multi-core central processing unit CPU
- **Computer servers —** Application servers
- **Desktop computers**
- **Digital cameras**
- **Flash memory storage card —** Flash disks
- **High end computer servers —** Directory servers
- **Integrated circuit testers** — In circuit emulators ICE; Logic analyzers
- **Mainframe computers —** Mainframe operating systems; Supercomputers
- **Network routers —** Computer network routers
- **Notebook computers —** Laptop computers
- **Personal computers**

Occupational Requirements

Work Activities

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Importance	Work Activity
99	**Working with Computers —** Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.
91	**Getting Information —** Observing, receiving, and otherwise obtaining information from all relevant sources.
86	**Communicating with Supervisors, Peers, or Subordinates —** Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.
85	**Processing Information —** Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data.

Importance	Work Activity
84	**Updating and Using Relevant Knowledge —** Keeping up-to-date technically and applying new knowledge to your job.
82	**Analyzing Data or Information** — Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.
81	**Evaluating Information to Determine Compliance with Standards —** Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards.
81	**Identifying Objects, Actions, and Events** — Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.
77	**Documenting/Recording Information —** Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.
77	**Organizing, Planning, and Prioritizing Work —** Developing specific goals and plans to prioritize, organize, and accomplish your work.

Detailed Work Activities

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- Document operational activities.
- Analyze data to identify or resolve operational problems.
- Troubleshoot issues with computer applications or systems.
- Compile technical information or documentation.
- Report maintenance or equipment problems to appropriate personnel.
- Develop testing routines or procedures.
- Document design or development procedures.
- Recommend changes to improve computer or information systems.
- Install computer software.
- Test computer system operations to ensure proper functioning.
- Create databases to store electronic data.
- Monitor computer system performance to ensure proper operation.
- Develop performance metrics or standards related to information technology.
- Collaborate with others to determine design specifications or details.
- Develop detailed project plans.
- Test software performance.

- Provide customer service to clients or users.
- Manage documentation to ensure organization or accuracy.
- Read documents to gather technical information.
- Collaborate with others to resolve information technology issues.
- Analyze data to identify trends or relationships among variables.
- Evaluate utility of software or hardware technologies.
- Assess database performance.
- Modify software programs to improve performance.
- Prepare data for analysis.
- Provide recommendations to others about computer hardware.

Find occupations related to multiple detailed work activities

Work Context

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- **E-Mail** — How frequently does your job require you to use E-mail?

100%	Every day

- **Face-to-Face Discussions with Individuals and Within Teams —** How frequently does your job require face-to-face discussions with individuals and within teams?

75%	Every day
22%	Once a week or more but not every day

- **Spend Time Sitting —** How much does this job require sitting?

71%	Continually or almost continually
26%	More than half the time

- **Importance of Being Exact or Accurate —** How important is being very exact or highly accurate in performing this job?

50%	Extremely important
44%	Very important

- **Work With or Contribute to a Work Group or Team —** How important is it to work with or contribute to a work group or team in this job?

58%	Extremely important
27%	Very important
15%	Important

- **Freedom to Make Decisions —** How much decision making freedom, without supervision, does the job offer?

24%	A lot of freedom
65%	Some freedom
12%	Limited freedom

- **Indoors, Environmentally Controlled —** How often does this job require working indoors in an environmentally controlled environment (like a warehouse with air conditioning)?

67%	Every day
12%	Once a week or more but not every day
15%	Never

- **Telephone Conversations —** How often do you have telephone conversations in this job?

42%	Every day
42%	Once a week or more but not every day

- **Contact With Others —** How much does this job require the worker to be in contact with others (face-to-face, by telephone, or otherwise) in order to perform it?

29%	Constant contact with others
47%	Contact with others most of the time
18%	Contact with others about half the time

- **Determine Tasks, Priorities and Goals —** How much freedom does the worker have in determining the tasks, priorities, or goals of the job?

12%	A lot of freedom
74%	Some freedom
15%	Limited freedom

Experience Requirements

Job Zone

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Title	Job Zone Four: Considerable Preparation Needed
Education	Most of these occupations require a four-year bachelor's degree, but some do not.
Related Experience	A considerable amount of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified.
Job Training	Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
Job Zone Examples	Many of these occupations involve coordinating, supervising, managing, or training others. Examples include real estate brokers, sales managers, database

administrators, graphic designers, conservation scientists, art directors, and cost estimators.

SVP Range (7.0 to < 8.0)

Training & Credentials

State training Select a State Go

Local training ZIP Code Go

Certifications Find certifications nationwide

State licenses Select a State Go

Apprenticeship Opportunities

Start your career and build your skillset. Visit **Apprenticeship.gov** to learn about opportunities related to this occupation.

Worker Requirements

Skills

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Importance	Skill
75	**Reading Comprehension —** Understanding written sentences and paragraphs in work-related documents.
72	**Active Listening —** Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
72	**Critical Thinking —** Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
72	**Speaking —** Talking to others to convey information effectively.

Importance	Skill
69	**Writing —** Communicating effectively in writing as appropriate for the needs of the audience.
66	**Monitoring —** Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
66	**Programming —** Writing computer programs for various purposes.
60	**Complex Problem Solving** — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
60	**Quality Control Analysis —** Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
56	**Systems Evaluation** — Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.

Knowledge

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Importance	Knowledge
85	**Computers and Electronics —** Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
70	**English Language —** Knowledge of the structure and content of the English language including the meaning and spelling of words, and rules of composition and grammar.
57	**Engineering and Technology —** Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
57	**Mathematics —** Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
50	**Design —** Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.

Importance	Knowledge
47	**Education and Training —** Knowledge of principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects.
42	**Customer and Personal Service —** Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.
36	**Administration and Management —** Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
35	**Administrative —** Knowledge of administrative and office procedures and systems such as word processing, managing files and records, stenography and transcription, designing forms, and workplace terminology.
30	**Telecommunications —** Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems.

Education

How much education does a new hire need to perform a job in this occupation? Respondents said:

50%	Bachelor's degree required
26%	Associate's degree required
9%	Post-secondary certificate required

Worker Characteristics

Abilities

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Importance	Ability
75	**Deductive Reasoning —** The ability to apply general rules to specific problems to produce answers that make sense.

Importance	Ability
75	**Inductive Reasoning —** The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
75	**Oral Comprehension —** The ability to listen to and understand information and ideas presented through spoken words and sentences.
75	**Oral Expression —** The ability to communicate information and ideas in speaking so others will understand.
75	**Problem Sensitivity —** The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing that there is a problem.
75	**Written Comprehension —** The ability to read and understand information and ideas presented in writing.
72	**Written Expression —** The ability to communicate information and ideas in writing so others will understand.
69	**Information Ordering —** The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
66	**Near Vision —** The ability to see details at close range (within a few feet of the observer).
56	**Speech Recognition —** The ability to identify and understand the speech of another person.

Interests

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Occupational Interest	Interest
79	**Investigative —** Work involves studying and researching non-living objects, living organisms, disease or other forms of impairment, or human behavior. Investigative occupations are often associated with physical, life, medical, or social sciences, and can be found in the fields of humanities, mathematics/statistics, information technology, or health care service.

Occupational Interest	Interest
78	**Conventional** — Work involves following procedures and regulations to organize information or data, typically in a business setting. Conventional occupations are often associated with office work, accounting, mathematics/statistics, information technology, finance, or human resources.
47	**Realistic** — Work involves designing, building, or repairing of equipment, materials, or structures, engaging in physical activity, or working outdoors. Realistic occupations are often associated with engineering, mechanics and electronics, construction, woodworking, transportation, machine operation, agriculture, animal services, physical or manual labor, athletics, or protective services.
12	**Artistic** — Work involves creating original visual artwork, performances, written works, food, or music for a variety of media, or applying artistic principles to the design of various objects and materials. Artistic occupations are often associated with visual arts, applied arts and design, performing arts, music, creative writing, media, or culinary art.
10	**Enterprising** — Work involves managing, negotiating, marketing, or selling, typically in a business setting, or leading or advising people in political and legal situations. Enterprising occupations are often associated with business initiatives, sales, marketing/advertising, finance, management/administration, professional advising, public speaking, politics, or law.
9	**Social** — Work involves helping, teaching, advising, assisting, or providing service to others. Social occupations are often associated with social, health care, personal service, teaching/education, or religious activities.

Work Values

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All 6 displayed

Extent	Work Value
67	**Achievement** — Occupations that satisfy this work value are results oriented and allow employees to use their strongest abilities, giving them a feeling of accomplishment. Corresponding needs are Ability Utilization and Achievement.
67	**Independence** — Occupations that satisfy this work value allow employees to work on their own and make decisions. Corresponding needs are Creativity, Responsibility and Autonomy.

Extent	Work Value
67	**Support —** Occupations that satisfy this work value offer supportive management that stands behind employees. Corresponding needs are Company Policies, Supervision: Human Relations and Supervision: Technical.
67	**Working Conditions —** Occupations that satisfy this work value offer job security and good working conditions. Corresponding needs are Activity, Compensation, Independence, Security, Variety and Working Conditions.
61	**Recognition —** Occupations that satisfy this work value offer advancement, potential for leadership, and are often considered prestigious. Corresponding needs are Advancement, Authority, Recognition and Social Status.
56	**Relationships —** Occupations that satisfy this work value allow employees to provide service to others and work with co-workers in a friendly non-competitive environment. Corresponding needs are Co-workers, Moral Values and Social Service.

Work Styles

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Importance	Work Style
98	**Attention to Detail** — Job requires being careful about detail and thorough in completing work tasks.
89	**Analytical Thinking —** Job requires analyzing information and using logic to address work-related issues and problems.
88	**Cooperation —** Job requires being pleasant with others on the job and displaying a good-natured, cooperative attitude.
86	**Integrity —** Job requires being honest and ethical.
84	**Adaptability/Flexibility —** Job requires being open to change (positive or negative) and to considerable variety in the workplace.
84	**Dependability —** Job requires being reliable, responsible, and dependable, and fulfilling obligations.
81	**Persistence —** Job requires persistence in the face of obstacles.

Importance	Work Style
76	**Initiative —** Job requires a willingness to take on responsibilities and challenges.
74	**Self-Control** — Job requires maintaining composure, keeping emotions in check, controlling anger, and avoiding aggressive behavior, even in very difficult situations.
73	**Stress Tolerance —** Job requires accepting criticism and dealing calmly and effectively with high-stress situations.

Workforce Characteristics

Wages & Employment Trends

Median wages (2024)	$49.33 hourly, $102,610 annual
State wages	Select a State Go
Local wages	ZIP Code Go
Employment (2023)	205,000 employees
Projected growth (2023-2033)	■■■■ Much faster than average (9% or higher)
Projected job openings (2023-2033)	15,000
State trends	Select a State Go
Top industries (2023)	Professional, Scientific, and Technical Services (41% employed in this sector) Information (20%) Finance and Insurance (12%)

Source: Bureau of Labor Statistics 2024 wage data and 2023-2033 employment projections. "Projected growth" represents the estimated change in total employment over the projections period (2023-2033). "Projected job openings" represent openings due to growth and replacement.

Job Openings on the Web

State job openings Select a State Go

Local job openings ZIP Code Go

More Information

Related Occupations

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- 15-1299.07 Blockchain Engineers Bright Outlook
- 17-2061.00 Computer Hardware Engineers
- 15-1251.00 Computer Programmers
- 15-1211.00 Computer Systems Analysts
- 15-1299.08 Computer Systems Engineers/Architects
- 15-1243.00 Database Architects
- 15-1299.05 Information Security Engineers
- 15-1299.04 Penetration Testers
- 15-1252.00 Software Developers
- 17-2112.02 Validation Engineers

Professional Associations

Disclaimer: Sources are listed to provide additional information on related jobs, specialties, and/or industries. Links to non-DOL Internet sites are provided for your convenience and do not constitute an endorsement.

National Associations

5 of 9 displayed

- American Society for Quality
- Association for Computing Machinery
- Computing Research Association
- IEEE Computer Society
- IEEE-USA

Accreditation, Certification, & Unions

5 of 6 displayed

- American Software Testing Qualifications Board ALLY
- Association for Testing and Software Quality Assurance ALLY
- CompTIA
- Institute for Certification of Computing Professionals
- International Software Testing Qualifications Board

O*NET OnLine

Information Security Engineers

15-1299.05

Bright Outlook

Updated 2025

A subset of this occupation's profile is available. Data collection is currently underway to populate other parts of the profile.

Develop and oversee the implementation of information security procedures and policies. Build, maintain and upgrade security technology, such as firewalls, for the safe use of computer networks and the transmission and retrieval of information. Design and implement appropriate security controls to identify vulnerabilities and protect digital files and electronic infrastructures. Monitor and respond to computer security breaches, viruses, and intrusions, and perform forensic investigation. May oversee the assessment of information security systems.

Summary Details Custom Easy Read Veterans Español

Contents

Occupation-Specific Information

Tasks

All 20 displayed

- Assess the quality of security controls, using performance indicators.
- Conduct investigations of information security breaches to identify vulnerabilities and evaluate the damage.
- Coordinate documentation of computer security or emergency measure policies, procedures, or tests.
- Coordinate monitoring of networks or systems for security breaches or intrusions.
- Coordinate vulnerability assessments or analysis of information security systems.
- Develop information security standards and best practices.
- Develop or implement software tools to assist in the detection, prevention, and analysis of security threats.
- Develop or install software, such as firewalls and data encryption programs, to protect sensitive information.
- Develop response and recovery strategies for security breaches.

- Identify or implement solutions to information security problems.
- Identify security system weaknesses, using penetration tests.
- Oversee development of plans to safeguard computer files against accidental or unauthorized modification, destruction, or disclosure or to meet emergency data processing needs.
- Oversee performance of risk assessment or execution of system tests to ensure the functioning of data processing activities or security measures.
- Provide technical support to computer users for installation and use of security products.
- Recommend information security enhancements to management.
- Review security assessments for computing environments or check for compliance with cybersecurity standards and regulations.
- Scan networks, using vulnerability assessment tools to identify vulnerabilities.
- Train staff on, and oversee the use of, information security standards, policies, and best practices.
- Troubleshoot security and network problems.
- Write reports regarding investigations of information security breaches or network evaluations.

Find occupations related to multiple tasks

Technology Skills

All 36 displayed

- **Access software** — IBM Tivoli software
- **Application server software** — Docker ; GitHub ; Kubernetes
- **Authentication server software** — Single sign-on SSO
- **Cloud-based data access and sharing software** — Platform as a service PaaS
- **Cloud-based management software** — Amazon Web Services AWS CloudFormation ; Google Cloud software
- **Configuration management software** — Chef ; IBM Terraform ; Puppet
- **Content workflow software** — Atlassian JIRA
- **Data base management system software** — Elasticsearch ; MongoDB ; NoSQL
- **Data base reporting software** — Microsoft SQL Server Reporting Services SSRS ; Reporting software
- **Data base user interface and query software** — Amazon Web Services AWS software ; IBM DB2 ; Microsoft SQL Server ; ServiceNow ; 2 more
- **Development environment software** — Go ; Microsoft Azure software ; Microsoft PowerShell ; Ruby ; 3 more
- **Document management software** — Microsoft SharePoint
- **Electronic mail software** — Microsoft Outlook
- **Enterprise application integration software** — Enterprise application integration EAI software; Jenkins CI ; Microsoft SQL Server Integration Services SSIS
- **Enterprise resource planning ERP software** — Management information systems MIS
- **Enterprise system management software** — Splunk Enterprise ; Tanium software

- **Expert system software** — Ansible software
- **File versioning software** — Git
- **Geographic information system** — Geographic information system GIS systems
- **Graphics or photo imaging software** — Microsoft Visio
- **Internet directory services software** — Active directory software; Microsoft Active Directory ; Network directory services software; Oracle Unified Directory
- **Network monitoring software** — IBM QRadar SIEM; Microsoft Azure Sentinel; Snort; Wireshark; 1 more
- **Network security and virtual private network VPN equipment software** — Firewall software
- **Network security or virtual private network VPN management software** — IBM Resource Access Control Facility RACF; Intrusion detection system IDS
- **Object or component oriented development software** — C# ; Oracle Java ; Perl ; R ; 2 more
- **Office suite software** — Microsoft Office software
- **Operating system software** — Apple iOS ; Microsoft Windows Server ; Red Hat Enterprise Linux ; UNIX Shell ; 7 more
- **Presentation software** — Microsoft PowerPoint
- **Project management software** — Atlassian Confluence ; Microsoft Teams
- **Risk management data and analysis software** — ArcSight Enterprise Threat and Risk Management; McAfee Enterprise Security Manager
- **Spreadsheet software** — Microsoft Excel
- **Switch or router software** — Border Gateway Protocol BGP
- **Transaction security and virus protection software** — Microsoft Defender Antivirus; Microsoft Security Esssentials; Tenable Nessus
- **Transaction server software** — IBM Middleware
- **Web platform development software** — JavaScript ; JavaScript Object Notation JSON ; PHP ; React ; 2 more
- **Word processing software** — Collaborative editing software

Hot Technologies are requirements most frequently included across all employer job postings.
See all 58 Hot Technologies for this occupation.

In Demand skills are frequently included in employer job postings for this occupation.
See all 14 In Demand skills for this occupation.

Occupational Requirements

Detailed Work Activities

All 21 displayed

- Manage information technology projects or system activities.
- Develop software or computer applications.
- Install computer software.
- Analyze security of systems, network, or data.

- Coordinate reporting or editing activities.
- Develop operating strategies, plans, or procedures.
- Develop performance metrics or standards related to information technology.
- Establish work standards.
- Evaluate potential of products, technologies, or resources.
- Evaluate utility of software or hardware technologies.
- Implement security measures for computer or information systems.
- Investigate illegal or suspicious activities.
- Monitor processes for compliance with standards.
- Provide technical guidance to other personnel.
- Read documents to gather technical information.
- Recommend changes to improve computer or information systems.
- Supervise information technology personnel.
- Test computer system operations to ensure proper functioning.
- Train personnel in technical or scientific procedures.
- Troubleshoot issues with computer applications or systems.
- Write reports or evaluations.

Find occupations related to multiple detailed work activities

Experience Requirements

Job Zone

Title	Job Zone Four: Considerable Preparation Needed
Education	Most of these occupations require a four-year bachelor's degree, but some do not.
Related Experience	A considerable amount of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified.
Job Training	Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
Job Zone Examples	Many of these occupations involve coordinating, supervising, managing, or training others. Examples include real estate brokers, sales managers, database administrators, graphic designers, conservation scientists, art directors, and cost estimators.
SVP Range	(7.0 to < 8.0)

Training & Credentials

State training Select a State Go

Local training ZIP Code Go

Certifications Find certifications nationwide

Apprenticeship Opportunities

All 1 displayed

Example apprenticeship titles for this occupation:

- Cyber Defense Incident Responder

Specific title(s) listed above are vetted by industry and approved by the U.S. Department of Labor for use in a Registered Apprenticeship Program.

Start your career and build your skillset. Visit **Apprenticeship.gov** to learn about opportunities related to this occupation.

Worker Characteristics

Interests

All 3 displayed

Interest code: **CIR**

Want to discover your interests? Take the **O*NET Interest Profiler** at My Next Move.

- **Conventional** — Work involves following procedures and regulations to organize information or data, typically in a business setting. Conventional occupations are often associated with office work, accounting, mathematics/statistics, information technology, finance, or human resources.
- **Investigative —** Work involves studying and researching non-living objects, living organisms, disease or other forms of impairment, or human behavior. Investigative occupations are often associated with physical, life, medical, or social sciences, and can be found in the fields of humanities, mathematics/statistics, information technology, or health care service.
- **Realistic —** Work involves designing, building, or repairing of equipment, materials, or structures, engaging in physical activity, or working outdoors. Realistic occupations are often associated with

engineering, mechanics and electronics, construction, woodworking, transportation, machine operation, agriculture, animal services, physical or manual labor, athletics, or protective services.

Workforce Characteristics

Wages & Employment Trends

Median wage data for **Computer Occupations, All Other**.
Employment data for **Computer Occupations, All Other**.
Industry data for **Computer Occupations, All Other**.

Median wages (2024)	$52.39 hourly, $108,970 annual
State wages	Select a State Go
Local wages	ZIP Code Go
Employment (2023)	470,900 employees
Projected growth (2023-2033)	■■■■ Much faster than average (9% or higher)
Projected job openings (2023-2033)	34,800
State trends	Select a State Go
Top industries (2023)	Professional, Scientific, and Technical Services Government

Source: Bureau of Labor Statistics 2024 wage data and 2023-2033 employment projections. "Projected growth" represents the estimated change in total employment over the projections period (2023-2033). "Projected job openings" represent openings due to growth and replacement.

Job Openings on the Web

State job openings	Select a State Go
Local job openings	ZIP Code Go

More Information

Related Occupations

5 of 10 displayed

- 15-1231.00 Computer Network Support Specialists
- 15-1211.00 Computer Systems Analysts
- 15-1212.00 Information Security Analysts
- 15-1244.00 Network and Computer Systems Administrators
- 15-1299.04 Penetration Testers

Professional Associations

Disclaimer: Sources are listed to provide additional information on related jobs, specialties, and/or industries. Links to non-DOL Internet sites are provided for your convenience and do not constitute an endorsement.

National Associations

5 of 19 displayed

- ASIS International
- Association for Computing Machinery
- Computer Professionals for Social Responsibility
- Cybersecurity Collaborative
- Digital Forensic Research Workshop

Regional Associations

- Middle Atlantic-Great Lakes Organized Crime Law Enforcement Network
- Midwest Cyber Security Alliance
- New England Regional Developers
- Northeast Regional Computing Program
- Southwest CyberSec Forum

Accreditation, Certification, & Unions

5 of 7 displayed

- CompTIA ALLY
- EC-Council ALLY
- Cloud Security Alliance
- International Association of Computer Investigative Specialists
- International Secure Information Governance and Management Association