

Software design and development



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This leaflet describes the role of software developers and other jobs involved in the design, development and testing of software solutions and software-based products for all sorts of web, mobile and software applications. Most entrants hold degree or equivalent-level qualifications.

Software programs tell a computing system what to do and how to do it. Computer software makes it possible for people to apply for jobs and courses online, check social media on their phone, and play games with someone in another part of the world! Software is increasingly being embedded in everyday items, so it affects everything from the way we shop, to the vehicles we drive. Software is also vital to organisations as their financial management, stock control, sales and marketing systems etc, all depend on it.

Not surprisingly, there's a demand for people with the right software skills. If you're more interested in the electronics and networks side of computing, look at the leaflet on [Network and hardware engineering](#).

Designing and developing software

Different software projects are organised and managed in different ways, but normally involve similar component tasks (if not always in the same order!). The range of people involved in a particular software project depends on its size and complexity. For minor projects, or within a small business, it is possible that all stages can be undertaken by one or two people. For major projects there will usually be a team of specialists, each with their own responsibilities.

An overview of the main stages of work is given below, along with brief descriptions of the key roles. More information on some of these career areas can be found in other leaflets in the system, see the Related Leaflets section.

Understanding and managing the project

Before the work of designing and developing software can begin, the team needs to understand what the project entails. The **business analyst** works with the client to understand what is needed from the software and also serves as the key point of contact between the client and the development team. They are responsible for making sure that the finished software project meets the requirements of the client. If the client's needs involve the development of a whole system, then a **systems analyst** may be involved. Find out more about this role in the leaflet [Careers in digital systems](#).

It's important that the software is delivered on time and within budget. The **project manager** works with the development team to create the plan, set the strategy and support the wider team to make sure that the project goals are met. Find out more about this career in the leaflet [Project management](#). The **project owner** holds an in-depth understanding of the client's needs, the software and the end users. As such they are normally the key decision makers on the project. For more information on management roles in this sector, see [Tech and digital management](#).

The design phase

Once the goals of the project are understood the team can work together to create a solution, which includes agreeing the overall design and architecture of the software. **UX (user experience) and UI (user interface) designers** are consulted to make sure that the final product will be appropriate for the people who will be using the software. Find out more about these roles in the leaflet [Creative and user-focused digital careers](#). In addition to the roles mentioned above, **developers** (see below) are consulted to make sure any plans are feasible. Complex projects may have a **software architect** to take responsibility for the design choices and have a leading role in the development of the code.

Software development

Once the design has been agreed then the software is created. **Programmers** use code (i.e. a set of rules or instructions sometimes known as a programming language) to design and write programs. **Software developers** - who may be known simply as **developers** - also design and write programs, but are usually also involved with the other stages of software development (such as design and testing).

Programmers and developers work out the logical steps that must be taken to do a job. Detailed records of a program are kept, so that it can be adapted later. They need to be patient and thorough people - the kind who like puzzles and solving problems. They usually work in teams, so need to be able to work effectively with others. Increasingly, knowledge of cyber security is important, so that software is designed with minimal vulnerabilities to cyber attacks (see the leaflet on [Cyber and information security](#) for more information on this area).

Software developers may specialise - for example in business systems, financial technology, educational programs, **websites** or **apps** (see the leaflet on [Web and app design](#)) or computer **games** (view [Games design and development](#)). There are also increasing opportunities in the area of **cloud development**.

Full stack developers are programming generalists, with experience of both 'front-end' and 'back-end' software development (e.g. what gets seen by the client and what goes on behind the scenes, such as servers and databases). As such, they know multiple programming languages and can turn their hands to a wide range of tasks.

Systems developers/programmers are concerned with the internal operations of the computer; they write the programs for operating systems that actually run software applications.

Software engineers apply the principles of engineering to software development. They are usually involved in the whole development process, from research to implementation. As such, they need a good understanding of both software and hardware, and a wide range of skills and expertise.

Quality assurance

The **quality assurance engineer** makes sure that the development work is completed to sufficient standards and assesses the final product to ensure it meets the project goals. **Software testers** check the software thoroughly to make sure that it does the job it is meant to do, and there are no 'bugs'. This normally requires people with programming and systems analysis skills.

Software release and maintenance

Once the software has been sufficiently tested then it is released or implemented. This may be done in different stages ('alpha' and 'beta' releases) to allow for final performance testing. Once it is in use, the software must be maintained and kept up to date, with any problems fixed efficiently. It may be necessary for users to be trained in the software or be supported if things go wrong. Members of the development team may be involved with this, or these tasks may pass to a **tech support** team - see the leaflet on [Tech and digital support](#).

What it takes

For working in all areas of software design and development you need to be:

- excellent at problem solving
- logical, methodical, analytical and able to pay attention to detail
- happy to work as part of a team
- good at communicating your ideas to others who may not be technical
- interested in business operations (in order to understand the needs of your clients)
- flexible, adaptable and able to keep up with the latest developments in technology.

Employment options

Some organisations employ their own software staff; others contract this out. Employers include:

- software houses and consultancies that design complete software systems for their clients
- large organisations in industry, the utilities, public services and research
- manufacturers (who also provide 'whole solutions' for systems integration)
- companies involved in telecommunications, electronics and defence
- financial services providers (this specialist area is known as 'fintech')
- specialist consultancies
- tech startups.

Be aware that different employers often use different job titles for the same kind of work. Certain employers may advertise to fill roles within teams (e.g. Agile, DevOps, SysOps etc) that deliver a wide range of tasks (described above), requiring diverse skills and experiences across the team. For all these reasons, when applying for jobs look carefully at the job description to find out what the role actually involves.

Job roles and responsibilities in computing are continually evolving to reflect advances in technology. For instance, AI is already impacting on many areas of the software development process and developers may be increasingly called upon to use and configure AI tools in their work.

Entry, education and training

Some employers prefer to recruit **software developers** and **programmers** with a mathematical or computer-related degree; other employers take a broader view and consider graduates with science, technology, engineering or numerate degrees, or graduates of any discipline. **Systems developers/programmers** are usually graduates who have studied computer science, as a greater technical knowledge is required. Many employers look for applicants who have experience of a particular programming language, such as **Java**, **JavaScript**, **C#**, **Python**, **PHP**, **Rust**, or other emerging languages.

For **software engineering** a degree in software engineering, electronics, computer science or physics is the most likely starting point.

For the non-programming roles in software development, industry experience is valuable, although moving in from a business or management services background is sometimes possible.

Higher education

There is a wide range of relevant **degrees**, **HNC/Ds** and **foundation degrees**. You could take a broad-based course in computer science or computing, for instance, or a more specialist course, e.g. in software development, cloud computing or software engineering.

Course content varies, so you will need to research carefully those that interest you. Find out the destinations of past students, and whether the courses have links with employers, offer training in the latest technology etc. **Sandwich courses** are available; these provide useful work experience.

Some higher education courses are **accredited** by professional bodies such as BCS, The Chartered Institute for IT and The Institution of Engineering and Technology (IET). 'Tech Industry Gold Degrees' are courses that have been developed in partnership with employers; see: <https://techskills.org/careers/how-do-i-get-there/tech-industry-gold-degrees>.

Relevant full- and part-time **postgraduate courses** are available. These are mainly aimed at those with related degrees, but some are suitable for those with an unrelated degree and/or sufficient relevant experience or professional qualifications.

Training in the workplace

Employers may run **graduate training schemes**; a degree in a relevant subject is usually required. However, as mentioned above, some (generally large) employers accept graduates of any discipline and provide the necessary training in-house. Companies often use aptitude tests to assess applicants' suitability. Smaller companies and startups tend to recruit staff with relevant qualifications or experience.

Apprenticeships offer structured training with an employer, and can provide a starting point for entry to the industry. In England, relevant Apprenticeships include:

- level 3 for software development technicians and for IT solutions technicians
- level 4 for software developers, software testers, DevOps engineers and business analysts
- Degree Apprenticeships for digital and technology solutions professionals at levels 6 and 7 (masters degree level); both have specialisms for software engineers and IT business analysts.

In Wales, software developer Apprenticeships are available at levels 3 and 4, and the IT solutions development and support Apprenticeship is offered at levels 3, 4 and 5 (covering careers in areas such as programming, software engineering and web/app development). The digital Degree Apprenticeship in Wales has a pathway in applied software engineering.

To find out more about Apprenticeships, see:

www.apprenticeships.gov.uk

www.careerswales.gov.wales

Other qualifications and courses

There are various initiatives to teach people how to code. For instance, Teach the Nation to Code offers free, one-day interactive workshops; find out more at: www.qa.com/about-qa/teach-the-nation-to-code.

It's possible to achieve various professional qualifications; for instance, **BCS** offers professional certification at various levels in different aspects of the work. Some large computer companies, such as **Microsoft**, have developed their own qualifications.

The **T level** in digital production, design and development is available in certain schools and colleges in England. This may be relevant for roles in, for example, design, development, testing, maintenance of and support for software systems.

For more information about computing qualifications in general, including those that can get you started, see the leaflet *Digital careers - an introduction to the work and training*.

Pay and prospects

There are no set pay scales, and salaries vary widely depending on the location, industry, employer and exact job role. Those with skills that are in demand and/or who are in senior positions can command the highest salaries. Bonuses are sometimes paid.

With experience, employers often offer opportunities for promotion from junior positions to more senior posts. Some software specialists go into management, journalism, training or technical writing. Many software developers are self-employed and work on a contract and consultancy basis.

Further Information

The Institution of Analysts and Programmers (IAP) - works with its members and partners with the aim of improving software for society; raising standards in software engineering and educating new software developers:

www.iap.org.uk

BCS, The Chartered Institute for IT:

www.bcs.org

The Institution of Engineering and Technology (IET):

www.theiet.org/career

Developers Alliance - a global organisation for software developers.

www.developersalliance.org

Trustworthy Software Foundation - an organisation dedicated to sharing information to help ensure that software is safe, reliable, available, resilient and secure. Website has materials and resources to help people learn about trustworthy software:

<http://tsfdn.org>

For other useful websites etc, view the leaflet *Digital careers - an introduction to the work and training*.

Related Leaflets

AA 11 Project management
D 01 Digital careers - an introduction to the work and training
D 02 Tech and digital support
D 03 Web and app design
D 05 Data analysis and management
D 07 Games design and development
D 08 Cyber and information security
D 09 Tech and digital management
D 11 Creative and user-focused digital careers
D 12 AI and machine learning
D 13 Careers in digital systems
E 03 Careers with design and technology
GE 03 Network and hardware engineering
TC 02 Operational research

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