GENERIC SKILLS PROFILES

for the ICT Industry in Europe

www.career-space.com

This project is an initiative of seven major ICT companies in Europe, IBM Europe, Nokia Telecommunications, Philips Semiconductors, Thomson CSF, Siemens AG, Microsoft Europe and British Telecommunications PLC, and is supported by the European Commission.

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CAREER SPACE

future skills for tomorrow's world

ADDRESSING THE SKILLS SHORTAGE IN THE INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) INDUSTRY IN EUROPE

THE ISSUE

The ICT industry in Europe is experiencing a severe shortage of skilled personnel. It is conservatively estimated that there were some 500,000 ICT job vacancies at the end of 1998 and that if action is not taken the number could reach 1,600,000 by 2002 - nearly a three-fold increase .

This situation, paradoxical as it is given the high level of unemployment in the EU (over 18 millions unemployed) represents a major threat not only to the development of the ICT industry in Europe but also to the competitiveness of the whole European economy.

THE PILOT PROJECT

With the support of the European Commission seven major ICT companies in Europe, IBM Europe, Nokia Telecommunications, Philips Semiconductors, Thomson CSF, Siemens AG, Microsoft Europe, and British Telecommunications Plc have embarked on a pilot project to explore new ways of addressing the skills shortage.

OBJECTIVE

The objective of the project is to put in place a clear framework for students, education and training institutions and Governments, that describes the skills and competencies required by the ICT industry in Europe.

To achieve that objective the sponsor companies:

- have developed Generic Job Profiles relevant to their main activities, and
- created a dedicated Website, www.career-space.com

The goal is that these job profiles will:

- attract more students into ICT courses and employment by providing attractive, plain language profiles of the jobs, roles and opportunities in the industry today,
- provide higher education ICT curriculum designers with clear up-to-date and easily accessible information on the skills needed by the industry, and
- assist Governments in developing policies to foster the growth of ICT skills in Europe.

THE GENERIC JOB PROFILES

The ICT industry in Europe is at a forefront of technology. We need different types of people to help us:

- Technical People who can do the things which need to be done
- Project Managers who make sure we do things as and when intended
- Consultants to help clients decide how to best use our products
- Salesmen to make people understand why they should buy something
- Educators to teach people
- Business Managers to direct our businesses
- Entrepreneurs to start their own businesses

We need people who are:

- Creative and artistic
- Are excited by technology
- Have a liking for science and mathematics
- Possess good communications skills
- Like dealing with people
- Would like to work as part of a team

Thirteen generic job profiles have been developed to-date in the following areas:

Telecommunications
- Radio Frequency (RF) Engineering
- Digital Design
- Data Communications Engineering
- Digital Signal Processing Applications Design
- Communications Network Design

Software & Services
- Software & Applications Development
- Software Architecture and Design
- Multimedia Design
- IT Business Consultancy
- Technical Support

Products & Systems
- Product Design
- Integration & Test / Implementation & Test Engineering
- Systems Specialist

The profiles provide a comprehensive description of:

- the types of jobs in the industry,
- the tasks and technologies associated with each job,
- the skills and competencies required, and
- the career opportunities available to those who join the industry.

Eventually it is hoped that with the support of other industry partners, the European Commission, Member State Governments and the education sector, the number of job profiles will be increased to reflect those areas not adequately covered at the moment and that they will be expanded to describe the specific qualifications and training required, and to identify where such qualifications can be obtained.

THE WEBSITE

We have established a dedicated website: http://www.career-space.com to provide you with more information about the ICT industry and our skills requirements.

This website will be up-dated on a regular basis and expanded to provide you with information about our skills requirements and job opportunities and latest developments in the industry.

Please take the time to view the website and mention it to your friends and colleagues

NEXT STEP - PUBLIC & PRIVATE PARTNERSHIP

This pilot project is a small but significant step to addressing the skills shortage. It is hoped however that it will encourage greater dialogue, collaboration and action between the key European players and stakeholders.

The nature of the ICT business requires a collective global outlook and this approach applies equally to resourcing Europe's skills needs.

It also requires quick cost-effective responses. The 'ICT Consortium' calls therefore for immediate, effective and concerted action by the European Commission, the Member States, industry and the educational institutions to address the skills shortage and to establish -

A NEW PARTNERSHIP TO CLOSE EUROPE'S INFORMATION AND COMMUNICATION TECHNOLOGY SKILLS GAP

RECOMMENDATIONS

The 'ICT Consortium' recommends action on a number of fronts to address both the immediate shortage and long-term availability of skilled people.

Proposals to increase long-term availability of skilled workers

The 'ICT Consortium' recommends:

- The establishment of a Task Force comprising of industry, educational institutions, the European Commission and the Member States to examine how the educational infrastructure can meet the ICT needs of European industry and to implement appropriate actions.

  That is, to put in place a clear framework that describes the skills and competencies required, the ladder for career progression, the qualifications and training required and to identify where such qualifications can be obtained. The ICT Consortium initiative known as the 'Generic Skills Pilot Project' should form the basis for work in this area.
- The appointment of a dedicated team within the European Commission under the direct responsibility of a Commissioner to co-ordinate all Community action in this area.
- Encouraging Electrical Engineering and Computer Science University departments to combine in order to recognise communications convergence and remove both duplication and historic differences in approach and culture.
- That IT literacy should be treated as a core part of school curricula in the same way as reading and writing and to be taught not as an option, but as a set of key skills and the key to ongoing learning.
- That educators at all levels, but especially those with career guidance responsibilities must actively work to attract students, especially girls into science, engineering and ICT relevant courses and positively present the opportunities available within the ICT sector.
- That all teachers, lecturers and education officials should be IT literate and actively encourage the use of ICT across curricula and non-curricula activities.
- That all investment, individual or business, in ICT learning and education should be tax-exempt. This should include the provision of free services and of ICT kit to staff.
- That professional institutions responsible for curricula development and accreditation should be much more flexible on course and entry criteria to meet the needs of the rapidly changing ICT industry. ICT professionals and companies are less concerned with professional membership than abilities, approach and motivation.
- Access and format of ICT tertiary education should be much more open and flexible to encourage the entry of people who did not follow traditional routes.
- Governments and the private sector should work together to provide ICT training through public / private partnership programmes.

  A number of programmes of this kind have been undertaken with impressive results and these should be carefully evaluated as possible models for more general application.
- Consideration should be given to opening-up higher level engineering education in Europe to the private sector.
- Increased capital investment in learning centers and networks as well as investment in materials is needed.
- Just-in-time cross training is needed to give new skills to already experienced professionals.
- Promoting ICT/technical studies by reducing the tuition fees or providing other financial incentives for these studies.

Proposals to increase the current resource availability / mobility

- Work permit and Visa restrictions should be made easier for non-Europeans with key ICT skills.
- Pensions / National Insurance / Personal tax arrangements for cross border working within the EU should be radically simplified to promote the mobility of skilled people.

Europe is in the midst of a revolution that requires much more than incremental change. We have the challenge of high unemployment levels coupled with the opportunity of unfilled ICT job vacancies.

Urgent action across all sectors must be taken in order to harness the potential of the information and communication technologies.

The ICT Consortium wishes to express its readiness to co-operate with all concerned to address this problem.

Software Architecture and Design

BROAD JOB AREA

EXAMPLES OF JOB TITLES

Software Programmer

Systems Developer

Systems Architect

Systems Architecture & Design Scientist

Systems Integrator
(creates specific products by putting components together)

Computer Scientist

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Microsoft, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

JOB DESCRIPTION

THE VISION: The dramatic performance advances of hardware, calls for software systems development to keep pace, to enable it to be exploited for commercial benefit. Software Architects conceive the operating software which brings hardware to life, then specify the overall structure which will support sustainable developments on it. These are the foundations of the software technology and solutions, which make up software technological solutions. This is a deep technological role, which involves software complexity but also the ability to work as a member of a team. Entry to a career is usually via programming in a specialist, software development environment, though understanding of basic hardware functions is also important . Career development can lead to increasing technological specialism in chosen fields and, or team and project management.

THE ROLE: People in these jobs work on software technologies and solutions which are the fundamental blocks on which computer applications and telecommunications networks are built. Depending on their particular role individuals may be called upon to carry out research, determine the structure (architecture), design, build, test, implement or maintain such software. This is a very technical job, which is basically concerned with programming or program design. However, it requires understanding of both hardware and the software because, at this level, the software solutions are influenced by the nature of the hardware (e.g. microchips, computers, telecommunications equipment, individual devices such as a computer controller in a car).

This solution could be unique to one company or be intended to sell to many different customers. Examples of products worked on in this type of job are:

- *Operating systems (e.g. Windows)*
- *Programming languages (e.g. Java)*
- *Software controlling specific devices (e.g. minidisk systems or a part of a motor car)*
- *Telecommunications network controllers*

THE LIFESTYLE: Most people in this type of job tend to work in software development laboratories as part of a highly capable team. The size of the team would not only depend on the product, but also on its stage of development. For instance, the development of the initial concepts of a product require much smaller teams than the actual programming stage. More experienced people, who are often recognised experts in a product or technological area, could find themselves visiting customers to make sales calls, give presentations or solve problems; alternatively they might represent their company at large industry events.

TASKS ASSOCIATED WITH THE JOB

- Establishing market requirements or enterprise needs.
- Building architecture.
- Designing solutions.
- Designing & testing prototypes.
- Defining detailed specifications.
- Creating & testing solutions.
- Creating maintenance and implementation plans.
- Enhancing products.

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills
- Software Engineering
- Computing Systems Design
- Mathematics
- Computer Programming
- Systems Design and Architecture
- Systems Development Methods
- Technical Documentation
- Applications Design Concepts
- Database Concepts
- Networking Concepts

Behavioural Skills
- Technical Orientation and Interest
- Analytical
- Creative
- Teamwork
- Professional Attitude
- Attention to Detail

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Operating systems (e.g. Windows)
- Programming languages (e.g. Java)
- Embedded systems (e.g. Control functions of a mobile phone)
- Software to control specific devices like a minidisk system or the management of a motor car.
- Database management systems to allow for creation, retrieval and management of large amounts of data (e.g. DB2)
- Systems for controlling large computer systems and networks
- Software to control the operation of games machines (excluding the games)
- Software to enable the use of the internet (e.g. Netscape)
- Application development tools
- Software to control the operation of a telecommunications network

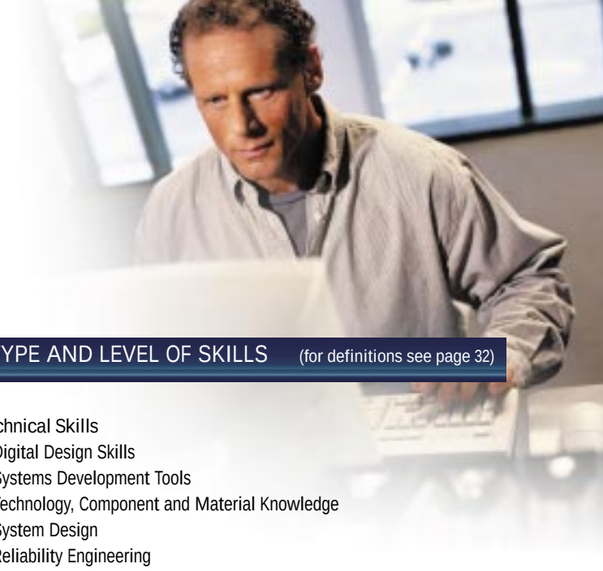
DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

Probably starting as a programmer either developing or enhancing a specific component on product, the professional can develop into building the design and possibly the architecture of products or even families of products. At this stage the person would be a recognised authority on a particular product within the company and possibly even within the industry.

With some experience in this type of work there are also possibilities of developing a career along other lines such as:

- Understanding how to satisfy customer needs in the market place and developing requirements for new capabilities and products. Experienced people in this field could end up setting overall directions for the development of product families or even a whole industry sector.
- Project Management. This involves managing and controlling a team of developers. For successful individuals the size of projects being managed would increase and could end up directing the activities of a whole development laboratory.

Digital Design



BROAD JOB AREA

EXAMPLES OF JOB TITLES

Hardware (Digital) Designer

Development Engineer in Digital Baseband Processing

JOBS OF THIS TYPE ARE TYPICAL IN

IBM, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

JOB DESCRIPTION

THE VISION: In the next few years the sum total of human knowledge will be digitized and made accessible via the Internet. Together with the convergence of communications and computing onto common digital components, these will spur the contemporary desire to communicate information anywhere, anytime, faster, cheaper and more reliably. These trends push the frontiers of digital design forward remorselessly. Digital designers conceive information processing architectures, then translate them into circuits and components, which integrate, to deliver the overall aims from processor chips to satellite communications. This is a deep technological role for those who wish to develop careers in one of the key technologies which enables the information age.

THE ROLE: The Digital Designer specifies, designs, implements and verifies/tests digital circuits used in telecom products, terminals and network elements. He/she simulates integrated circuits and evaluates engineering samples. The major future challenges in digital design are the increasing complexity, the packaging density as well as high speed, low cost and reliability requirements.

THE LIFESTYLE: Due to the technical complexity working in teams is essential usually on an international and multi-site level. This means the Digital Designer needs to play an active role in preparing and exchanging information via up to date communication tools like e-mail, telephone and video conferencing. Joint team meetings are held on a regular basis, which involve national and international travel. The Digital Designer has direct contacts with suppliers and customers for training, introduction of technical products and solutions, problem solving and support purposes.

TASKS ASSOCIATED WITH THE JOB

- Participation in the definition of architectures, translating the digital part into circuit diagrams as input for the design and development of printed circuit boards. Putting the initial boards in operation and testing them.
- Using these boards for verification and system integration and lower layer test software and driver software as hardware platform.
- Keeping in close contacts with designers involved with development of circuits having interfaces with his solution.
- Documenting the results of his/her work and creating user documentation.
- Supporting users in the design-in phase starting with training, answering questions and giving technical support.
- Using state of the art measuring and test equipment and support tools.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Board design
- System emulators
- Complementary Metal Oxide Silicon Circuits (CMOS)
- Mixed signal circuits
- Microprocessors
- Digital Signal.Processers (DSP)
- Free Programmable Gate Arrays (FPGA.s)
- Printed Circuit Boards (PCBs)
- Standard integrated circuits

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills
- Digital Design Skills
- Systems Development Tools
- Technology, Component and Material Knowledge
- System Design
- Reliability Engineering
- Testing
- Hardware Knowledge
- Application Design Concepts
- Technical Documentation

Behavioural Skills
- Problem Solving
- Analytical
- Creative
- Attention to Detail
- Teamwork
- Communication
- Technical Orientation and Interest
- Professional Attitude

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

The career path would normally start with the position of assisting Digital Designers, developing to a Digital Design Specialist. Digital Designers can also develop technical competencies to extend into neighboring domains e.g. digital signal processing, applications design, a Software architect or they develop their organizational and administrative strengths and progress to Project/Team Leader. With a stronger focus towards customers and sales, progressing towards Technical Account Manager would be a possible career development.

BROAD JOB AREA

Systems Specialist

EXAMPLES OF JOB TITLES

Product Specialist or Consultant

Systems Engineer

Information Technology *(IT)*/ Specialist

Customer Systems Specialist

Solution Specialist

JOB DESCRIPTION

THE VISION: Clients' commercial information needs change quickly, as business develops to respond to competition and new markets. The Systems Specialist works with customers to enhance their systems, to support emerging business requirements. Often specifications are worked up in competition against other suppliers. Systems Specialists have to be aware of how to exploit hardware and software in a cost effective manner to satisfy customer requirements. There is a need to inform potential clients of new facilities that technology affords, to develop novel products and services which could expand their operations. This is a hybrid role, knowledge of the business context and how to deal with customers is as important as technical know-how. Career development can follow either an increasing business oriented route to helping set IT strategy, or deeper into the hardware and software as a technological specialist. Some companies offer training programmes to graduates of all disciplines to enable them to work in this domain.

THE ROLE: The Systems Specialist designs computer system solutions for customers from existing hardware and software products. The solution is designed to meet the customers requirements and since often the customer is seeking proposals from more than one supplier the Systems Specialist needs to ensure the design is cost effective and produced to tight time scales.

Computer systems often comprise many diverse products such as processors, networks, system software and application software. The Systems Specialist will be a recognised expert in a subset of these products and will often work in a team with experts in other areas to produce a complete IT solution for a customer. For complex projects this team may be technically led by an IT Architect or Systems Integration Specialist. The Systems Specialist will often use tools and methodologies to manage and design these solutions to help insure a quality design.

THE LIFESTYLE: By meeting with customers and seeking to understand their requirements the Systems Specialist will often learn much about how different industries and customers operate. As an expert the Systems Specialist is often called upon to educate others via presentations and workshops. Maintaining these high levels of expertise requires frequent self study, training and reading of computing magazines.

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Microsoft, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

TASKS ASSOCIATED WITH THE JOB

- Analysing the customers information technology requirements to determine the best product selection and configuration. The best solution will be based on providing the required features and performance at an acceptable cost and available to meet the customers time scales.
- Responding to customer requirements by giving presentations and preparing formal proposals.
- Providing advice and guidance on the use, operation and design of systems or solutions using specific products. This could be by writing papers or reports, answering questions or demonstrating how a program works.
- Designing and running benchmarks to prove systems capability. A benchmark is a measure of system performance on a given, repeatable workload.
- Using sizing and designing tools to determine appropriate product configurations.
- Planning, configuring, customising, and tuning these products for customers.
- Designing, organising and delivering product awareness, skills transfer and product education sessions to other technical specialists in your company and your business partners.
- Working with Sales Specialists to assist in meeting your own companies' business objectives.
- Working with Integration and Implementation Specialists and software and Application Developers to appropriately size work efforts.
- Working with Project Managers to derive appropriate time scales and costs.

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills
- Computing System Design
- Computer Systems
- Systems Management Concepts
- Database Concepts
- Networking Concept
- Systems Design
- Integration Concepts
- Applications Design Concepts
- Hardware Knowledge
- Software Engineering
- Mathematics
- Statistical Analysis

Behavioural Skills
- Analytical
- Creative
- Flexibility and Self Learning
- Leadership
- Commitment to Excellence
- Communication
- Teamwork
- Relationships
- Planning and Organisation
- Technical Orientation and Interest
- Persuasiveness

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

The Systems Specialist will have an in depth understanding of products, offerings and services within their speciality. Some of the major specialities are:
- Commercial computer systems e.g. UNIX, or NT based
- Parallel High Performance computers e.g. Cray Super Computers
- Technical Workstations e.g. graphical visualisation
- Sub-systems such as disk, processors, memory, adapters for input and output devices
- Local Area Networking e.g. routers bridges, and protocols such as transmission control protocol(TCP) internet protocol(IP)
- Wide Area Networking e.g. X25, packet switched networks
- Operating Systems e.g. NT, UNIX
- Databases e.g. Relational such as Oracle, or Hierarchical
- Middleware such as message queuing and transaction processing
- Internet application enablers such as web servers, fire walls
- Applications such as e-business and e-commerce, Human Resources, Manufacturing Planning, Customer relationship Management, Decision Support, Call Centre, Computer Aided Engineering.

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

As a young Systems Specialist the world of information technology is at your feet. It is one of the most varied and exciting roles within IT and enables a wealth of career opportunities depending on your personal mix of technology interests, business interests and personal skills.

If the lure of technology as an end in itself is your goal, moves into Systems Integration and Implementation or Software Development is a well established option. If using information technology to solve business problems is more exciting then Consultancy, Business Analysis, or Project Management will appeal. If your vision is more global and you are keen to direct product development or identify new markets then your Systems Specialist training and experience will be extremely valuable in Product Management and Marketing. Lastly some Systems Specialists find the excitement of winning a major order gives them such a buzz that there is no alternative but Sales - and having a good understanding of the product you are selling is a great help.

DSP (Digital Signal Process ing) Applications Design

BROAD JOB AREA

EXAMPLES OF JOB TITLES

Digital Hardware and Software Engineer

Algorithm Designer

Information and Communication Theory Specialist

Scientist

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Microsoft, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

JOB DESCRIPTION

THE VISION: Although the world is becoming wired up, it involves many different National, International, Regulatory and Service Provider Bodies. Digital Signal Processing Designers have to combine deep technological knowledge - modulation, coding, algorithms with the statutory environment in which they have to operate. This is a deep challenging engineering career for those who wish to specialise in one of the fast moving technologies which underpin worldwide communications. Entry is usually through one of the supporting domains, e.g. algorithm design then progressing to increasing technical complexity and scope across the supporting techniques.

THE ROLE: One of the key challenges of the DSP is to keep up with the ever changing regulations set to the various standardization bodies with respect to signal processing. He/ she will then assist with requirement studies , simulations and performance analysis at proposed systems. Development will lead to participation in the design and optimization at algorithms for signal modulation and detection. Channel coding: decoding, testing and software integration and maintenance and other integral roles.

THE LIFESTYLE: The technical complexity of DSP means a great deal of team work is needed usually on an international and multi-site level within the company and together with customers or competitors. It also involves participating in international committees. This means the D.S.P. Applications Designer is involved in an active exchange of well-prepared information via modern communication tools like e-mail, telephone and video conferencing. Team meetings are held regularly which involve national and international travel. Due to the importance of algorithms and their strong contribution to the overall system performance, highly innovative work is done constantly.

TASKS ASSOCIATED WITH THE JOB

- Being up-to-date with the technical development in his field, monitoring the standardisation work with respect to algorithms and keeping close contact with research in universities.
- Using simulation tools efficiently to check performance and the behaviour of the signals.
- Generating requirements and specifications.
- Designing Software for signal processors and digital filters depending on the application in Assembler or C.
- Coding the Software and implementing it.
- Preparing the system integration and making the testing.
- Delivering new inputs for the specification of new Digital Signal Processing cores.
- Using standard computing Hardware and Software development tools like configuration management etc.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Digital Signal Processing
- Embedded systems
- Real-time applications
- Wireless communication technology.

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills

Comprehensive understanding of the physical layer and specifications of communication systems. Understanding the nature of speech and audio signals and respective codecs, systems and standards.

- Digital Design Skills
- System Design
- Hardware Knowledge
- Testing
- System Development Tools
- Applications Design Concepts
- Technical Documentation

Behavioural Skills

- Creative
- Analytical
- Attention to Detail
- Teamwork
- Communication
- Problem Solving
- Flexibility and Self Learning
- Commitment to Excellence
- Professional Attitude
- Planning and Organisation

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

The career path of the D.S.P. Applications Designer normally starts assisting a Specialist in a special domain, progressing through positions of increasing technical responsibility such as Algorithm Designer, Signal Path Expert, Core Architect and then Specialist on D.S.P. System Level. With an increasing part of organisational and administrative content it may develop towards Project/Team Leader or Platform Manager. With a stronger focus towards customers a position of Technical Support Manager is possible.

Communications Network Design

BROAD JOB AREA

EXAMPLES OF JOB TITLES

Data (e.g. Internet, private data networks) Network Designer

Mobile Network Designer

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

JOB DESCRIPTION

THE VISION: This area is for those who wish to work with clients to help them formulate, then specify and design their communications needs onto viable networks. Communications Network Designers need to understand current and emerging technologies and how they can be exploited to satisfy client needs, from wiring up a single site, to a world-wide network, supported by different technologies. The role demands that designers know enough about business needs to be able to assist clients to create their communications requirements, then derive technical solutions. Network design is fiercely competitive and fast developing, with client expectations rising all the time; this is a career for those who relish working with clients to develop technological solutions in a challenging commercial environment. Entry usually requires some technical communications experience or a relevant degree.

THE ROLE: He/She designs the network using various suppliers' products. The Communications Network Designer will need to analyse and interpret customer needs and then deliver detailed solutions. The needs are usually complex, and teamworking is essential for meeting them. In many cases, this can be with international partners, who may include other telecom companies and suppliers of both equipment and solutions. Competitor threats demand that the solutions delivered are low cost and high quality. It is important that the designer keeps abreast of the latest technologies and understands the commercial drivers for their work.

Some of the solutions that a designer produces are:

- *An internet network.*
- *A mobile network that can offer voice, fax and data services.*
- *Enhancements to existing networks to take advantage of new technologies, new functionality or capacity extension.*
- *Networks that enable value-added services, such as multi-media or charge-card services.*
- *A network that will allow different networks to link (interconnect) and operate together. This could include networks in different countries.*

THE LIFESTYLE: Working with a range of suppliers and customers means working closely with others, for example attending meetings to discuss and resolve issues. These meetings will often involve the designer in having to give presentations of proposed designs. The work involves national and international travel, although meetings frequently take place by telephone or videoconference to minimise the cost and time of travel. The role needs to assimilate and analyse information coming from a variety of sources, including meetings, technical specifications, e-mail and telephone. The designer will be office based working with colleagues, who may be geographically remote, producing the design solutions and using computer programs to assist in design and modelling.

TASKS ASSOCIATED WITH THE JOB

- Working with the customer to analyse their communication requirements and to determine the most cost-effective solution.
- Working closely with suppliers to build an awareness of their products and to give them an awareness of the future products that the designer will need.
- Working with colleagues from sales and marketing to develop the customer relationship and meet your company's business objectives.
- Responding to customer requirements by giving presentations and preparing formal proposals.
- Providing advice and guidance on the use, operation and design of systems or solutions using specific products.
- Designing, building and running prototypes to test and demonstrate functionality.
- Using computer aided design tools to optimise design efficiency.
- Sizing of networks to meet the volume/capacity demands of customers.
- Designing, organising and delivering product awareness, skills transfer and product education sessions to other technical specialists in your company and your business partners e.g. suppliers.
- Supporting and working with integration and test engineers so that they understand the design.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

The Communication Network Designer will perform planning work for the following technologies:

- Mobile networks
- Wireless data networks
- IP (internet provider) technologies.
- SDH (Synchronous Digital Hierarchy) & PDH (Pleusiochronous Digital Hierarchy) (transmission) technologies
- Microwave radio links
- Switching and intelligent networks

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills

Many of the technical skills required are developed and enhanced while performing the role. When embarking on this career, companies will be looking for a demonstrable enthusiasm and a fundamental aptitude for engineering in the individual applying for the job i.e. an ability to invent, solve technical problems, logical thought and reasoning, attention to detail.

A foundation and awareness of electronic engineering and/or of software/ computing are important. Skills that will be developed and enhanced include:

- Telecom Technology in Network Element Level
- Electronics Theory and Know-how (analogue /digital)
- Computer Programming
- Radio Technology
- Cost Modelling
- Statistics
- Design Methods

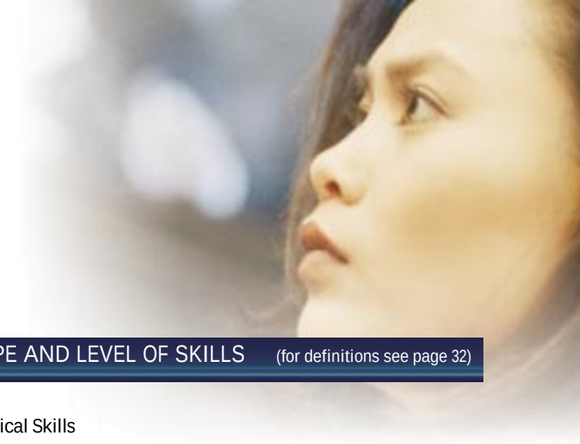
Behavioural Skills

- Relationships
- Analytical
- Creative
- Attention to Detail
- Teamwork
- Communication
- Problem Solving
- Information Handling
- Initiative
- Planning and Organisation
- Leadership
- Flexibility and Self Learning

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

There is no pre-defined career path but roles and opportunities lead to: Design Specialist, System Specialist, Project/Programme Manager, and Platform Manager. Sales and marketing, technical consultancy, business strategy - assessing technical capabilities of other companies for potential mergers / acquisitions and to manage the design project and lead the people in the project team.

Multimedia Design



BROAD JOB AREA

EXAMPLES OF JOB TITLES

Multimedia Programmer

Multimedia Network Designer

Web Designer

Human Interface Designer

Multimedia Architect

Internet/Intranet, audio, video Engineer

JOB DESCRIPTION

THE VISION: The continuing rapid development of technology to present information in novel forms is creating vibrant, dynamic, new multimedia enterprises. Most information can now be digitised; text, sound, image (still and moving), touch and presented in exciting, innovative, artistic forms. The Multimedia Designer helps clients comprehend what information can now be created, how it can be accessed, including interactively, then builds and implements software systems to deliver them. As this field is developing rapidly, part of the Designer's role is to explain to clients, facilities and services that they might not have imagined possible, then help them to investigate how they could exploit them for business goals. Multimedia is one of the key growth areas of the next decade and will increasingly embrace entertainment and education, as well as business, as the world gets wired up. We can only surmise how careers will develop, but it will be an exciting growth area combining media knowledge with technical skills. Entry is possible through either media design or software experience and creativity is important.

THE ROLE: Having identified the available medium and proposed a solution, the designer then manages with customers, team members and external agents, the human factors and uses interfaces to visual impact.

The designer may create prototypes, simulations on virtual environments with various multimedia technologies to represent the proposed system. Alternatives they may re-design or adapt existing products to satisfy the multimedia requirements.

The designer may produce graphics, animation, audio, tactile or video interfaces depending on instruments.

Planning, co-ordinating and overseeing acceptance testing, as well as integration and installation at the customer's site, could all the best of the designer's role, as may he training and customer's support.

THE LIFESTYLE: Most people in this type of job tend to work in software development facilities as part of a highly capable team, but this kind of job also offers possibilities of tele-work via network facilities. Multimedia designers are very creative team members who give another vision to the customers' needs.

A high level of interaction is needed with the customers and the software communities (teams, universities). They must be willing to keep up-to-date on the state-of-the-art in human computer interaction and in audio, video, internet areas (e.g. by attending conferences or working with universities).

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Microsoft, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

TASKS ASSOCIATED WITH THE JOB

- Analysing enterprise or customer's needs.
- Identifying, interpreting and evaluating requirements and specific constraints.
- Identifying available media .
- Designing user interfaces.
- Managing - with customers, team members and external agencies- interactive developments and integrating human factors and user interface for visual design.
- Creating prototypes, simulations or virtual environments with various multimedia technologies.
- Redesigning and adapting existing products to fit into multimedia systems.
- Creating or/and integrating media elements.
- Producing graphics, animation, audio, tactile, video contents.
- Identifying time and other constraints.
- Integrating, planning and co-ordinating acceptance testing, installation at the customer site with training and support.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Human computer interaction technologies (e.g. touch screen)
- Graphics, video, audio technologies
- Specific language for multimedia applications (e.g. HTML, Lingo, Java)
- Specific tools for multimedia applications (e.g. FrontPage, Visual Tools, Illustrator...)
- Operating systems, user interface design conventions and web client design conventions (e.g. Windows 95 style guideline)
- Software to enable the use of internet (e.g. Netscape)
- Email software (e.g. Exchange)

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills

- Artistic Knowledge
- Software Engineering
- Embedded Systems Knowledge
- Systems Design Methodology
- Applications Design Concepts
- Networking Concept
- End User Interface

Behavioural Skills

- Creative
- Analytical
- Relationships
- Communication
- Flexibility and Self Learning
- Technical Orientation and Interest

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

To develop a career a graduate would need a few years of experience and also need a great deal of ability to:

- innovate, to create in a perpetually changing technical environment;
- to take a broad view of technologies and to use them in a project, and/or
- willingness to keep up to date technically.

This is a booming area where creativity will always be needed.

The technical aspect of the career path progress might be:

- Multimedia Programmer who is able to develop and implement elements in specific languages (e.g. HTML, Lingo, Java..) and use specific tools (FrontPage, Visual Tools, Illustrator...),
- Multimedia Designer, Multimedia Analyst who is able to gather data to identify various customers requirements, Multimedia Architect who is able to use Software and Hardware technologies (including networks, mainframe and PC client server, internet.) and Multimedia Project Manager. Another step could be to provide technical support for other functions in the enterprise like communication and marketing to open up new market areas. A move into management could be another career development e.g. to become a Design Manager. A move into marketing or communication or training jobs would be yet another possibility.

Software & Applic ations Development

BROAD JOB AREA

EXAMPLES OF JOB TITLES

Application Programmer

Software (SW) Engineer

System Developer

Technical System Designer

Software Architect

Maintenance & Support Specialist

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Microsoft, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

JOB DESCRIPTION

THE VISION: Many of the exciting new IT offerings rely on software to deliver the product or service. Specifying, creating, testing, installing and maintaining it is now the dominant area of development in bringing new IT systems to the market. Applications Developers have to be capable of working with colleagues to specify customer's requirements in software terms, then translate them into efficient, reliable code. Technological expertise in one of the many development environments and application domains (from computer games to electronic payments) is vital, but the ability to understand client requirements is just as important. Programming is one of the best overall groundings for a career in IT. It opens the possibilities of moving into more specialist fields, analysis, design, project/team management. It is a good entry point for development into all these domains. Some companies offer training programmes to graduates of all disciplines to enable them to work in this area.

THE ROLE: In this kind of position the Software Applications Developer designs, builds, tests, implements and maintains applications to meet specific customer requirements using existing languages, D.B.M.S. (database management system), development tools etc. They also include the development of methodologies to carry out these activities. The Software Applications Developer understands a range of applications and how to transfer the customers needs into real and robust applications.

Applications developed include enterprise applications, e-commerce applications, management and enterprise information applications, embedded software applications in e.g. mobile phones and Enterprise Resource Planning (E.R.P.) systems in the business and industrial environments. The customer requirements must be understood, as well as the tools to transfer this into a robust application and develop the application in the most effective way. When developing business applications, the developer must gain a thorough understanding of the business processes and constraints. Examples of applications are: Internet ticket reservations; Corporation Management Information Systems which include all aspects of the business; the technology to transfer graphics or video pictures to a mobile device, and telephone billing systems.

THE LIFESTYLE: Although in most cases the work is carried out in teams and in one location, it is also possible that teams work on multiple-sites and communicate via modern media-devices. In the initial period this job requires a lot of technical tasks with the rest of the team. With time, there is more involvement with the business and customer environment is needed to show and implement the developed solution/application. Also, a lot of interaction is needed with other Software communities (companies, institutes and universities) to stay ''up-to-date'' with the technology.

Attending conferences and doing extra study courses might require travelling and people working in this area should also cultivate a stimulating ''personal network''.

TASKS ASSOCIATED WITH THE JOB

- Specifying user and functional requirements.
- Drawing up the plan of action for the structural design, the code development and other phases of the Software development cycle.
- Applying modern design methods and associated development tools.
- Developing the code and test algorithms and/or real-time control aspects in a modular way of working that follows the planned structure.
- Analysing system routines/modules, performance, memory size, etc. of (embedded) technical systems (when applicable).
- Supporting project management.
- Building the System and the Sub-systems according to the design and the developed structure and modular set-up .
- Building prototypes of (parts of) the system.
- Co-operating with the Systems Architect and/or System Designer.
- Designing the module test(s), assisting in the design of the integration and installation test. Executing the system integration, integration testing and installation.
- Developing and/or applying a version control procedure, installation procedure and make a full documentation set. Adding relevant documents like release bulletins.
- Executing the technical introduction, the installation, final testing, system.
- Evaluating and arranging the Maintenance & Support

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Operating systems (for e.g. PC, Workstations and Consumer Devices.)
- Programming languages (Assembler, C, JAVA, etc.)
- Embedded Systems (e.g. in Disc-players, TV's, Game-players)
- Enterprise IT systems (e.g. Enterprise Resource planning)
- Internet applications (like E-commerce)
- Administrative and Financial systems
- Technical systems for machine control and other industrial automation
- Development tools for system and application software
- Database systems for data-exchange with the applications
- Network technology in real-time systems as well as multi-site environments
- Software engineering
- Software components technology
- Enhance and maintain the application

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills
- Computer Programming
- Software Engineering
- Embedded Systems
- Business Requirements
- Systems Designs
- Project Management
- Testing
- Quality Assurance
- Technical Documentation
- System Development Methods
- System Development Tools

Behavioural Skills
- Analytical
- Technical Orientation and Interest
- Communication
- Teamwork
- Flexibility and Self Learning
- Attention to detail
- Commitment to excellence
- Planning & Organisation
- Problem Solving

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

With experience the role could involve more intensive customer requirements analysis and user interface aspects (become e.g. a full Multimedia Designer/Developer), or extend towards the more scientific side to fulfil computer science roles in e.g. research environments.

A broadening of experience could lead to project manager/leader with a wider overview. This would be supported by extensive (project) management training. Also in the technical area positions like Systems Developer/Designer and Software-Architect would be career path development opportunities. These would also be based on the broader experience from various projects. A wide range of experience in the business is also a way to move into commercial functions in the IT area or become a Manager and/or an Entrepreneur.

Radio Frequency (RF) Engineering

BROAD JOB AREA

EXAMPLES OF JOB TITLES

RF Designer

RF Engineer

RF Architect

RF System Integrator

JOBS OF THIS TYPE ARE TYPICAL IN

Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

JOB DESCRIPTION

THE VISION: A feature of the global information revolution is the demand for people to be in instant communication anywhere, anytime, on the move, at fixed points. Radio waves are the medium, which provide instant, flexible mobile communications. The RF designer has to keep up with fast developing and emerging technologies in order to deliver reliable services at low cost, as this is a fiercely competitive, international area of endeavour. The nineties were the era of personal computing; the next decade will be the era of interpersonal computing. The next generation of personal communications devices will be much more than up graded mobile phones, they will include a palm top computer, a camera, a note book; the Radio Engineer will be at the forefront of these developments.

THE ROLE: The RF Engineer specifies, simulates, designs, implements, tests, integrates and/or maintains RF sub-systems used in e.g. mobile phones, base stations and microwave radios. He/she needs to know the system architecture and specifications as well as available components, master RF design methods and simulation tools, layout rules and tools as well as testing techniques and instruments.

THE LIFESTYLE: To be able to keep up with the latest technologies, the RF Engineer needs to actively participate in training and other developmental activities. The design of a RF sub-system requires both independent and team working. The persons the RF Engineer most often communicates with are other RF Engineers (who are specifying/designing closely related parts of the system), baseband designers (whose design will be interfacing with the RF sub-system), project managers and production managers (to ensure manufacturability).

TASKS ASSOCIATED WITH THE JOB

- Participation/monitoring in system/architecture specification in order to understand how the system operates and how the RF's own sub-system (signal input/output) relates to the whole system.
- Sub-system specification in order to translate the requirements derived from upper level (system specification) into more detailed technical specification of how the sub-system should function internally to create the required responses (outputs) to certain input signals.
- Material/component selection to ensure that the most suitable (technologically advanced, reliable, compatible and possibly low cost) components are used. Also manufacturability has to be taken into account.
- Simulation of designs with the help of computer models before building physical prototypes.
- Sub-system circuit design: this is often in parallel with the simulation.
- Ensuring that reliability requirements are met in the design: these include EMC (electromagnetic compatibility), safety, manufacturability and thermal design aspects.
- Layout design: designing the physical layout of the circuit and components on the printed circuit board or other component base.
- Test specification to define the required test methods, cases and results. This is done by reflecting the original specifications.
- Unit testing: testing the unit according to the test specifications, finding causes for possible failures and solving the problems.
- Participation in design reviews to ensure the design work is proceeding according to agreed processes and quality requirements.
- Participation in the specification and support of engineering processes and tools.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Receivers
- Transmitters
- Transceivers
- Power supply
- Synthesizers
- Oscillators
- Analogue Digital converters
- Digital circuit design
- ASIC technology

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills
- Technology, Component and Material Knowledge
- Radio Frequency Theory
- Testing
- Reliability Engineering
- RF Design Tools
- Electronics Theory and Know-how (analogue/digital)
- Radio Frequency Circuit Design
- Radio Frequency Design Methods
- Thermal Design

Behavioural Skills
- Creative
- Analytical
- Teamwork
- Communication
- Professional Attitude
- Problem Solving
- Initiative
- Managing Risks
- Flexibility and Self Learning
- Quality Assurance
- Commitment to Excellence
- Customer Orientation

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

The career of an RF Engineer would normally start as a designer for small sub-systems. The next step could include tasks in both the specification and design of sub-systems. If choosing the technical expert career path, it could lead to the position of a specialist in a particular domain, which requires building up an extensive knowledge as well as problem solving skills in a certain area. Another possibility would be Radio System Specialist, which in turn requires a wide technological base and holistic view of radio systems. Somewhat less technology development -oriented career moves could be the ones of Project/Team Leader or Technical Account Manager, who are responsible for customer interface.

Data Communicat ions Engineering

BROAD JOB AREA

EXAMPLES OF JOB TITLES

Communications Software Development Engineer

Network Architect

Network Product Architect

Communications Product Test Engineer

JOBS OF THIS TYPE ARE TYPICAL IN

BT, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF IBM

JOB DESCRIPTION

THE VISION: Access to the Information Age depends on data communications working across all frontiers, technologies and applications. Voracious user demand calls for faster transmission at greater bandwidth with enhanced security, and as this is a competitive market, at lower cost. Voice, moving image and text have all to be handled seamlessly. The Data Communications Engineer has to understand current protocols, network devices and components, software engineering, emerging theory and practice, to work with colleagues to design cost effective technical solutions to exponentially growing traffic requirements. This is a technical career for people who wish to exploit technology to create innovative architectures to support information transmission and management systems. A desire for lifetime learning and technical challenge, and to apply knowledge to create practical solutions, is a prerequisite for people who wish to enter Data Communications as a career.

THE ROLE: The Data Communications Engineer specifies, designs, implements, tests, integrates, supports, and maintains switches and network management systems used to implement data communications networks. The Data Communications Engineer works with customers to determine requirements for equipment and services (such as Mobility, Internet Protocol Telephony, Video Conferencing, Fax, and Security); develops network architectures to satisfy the requirements; simulates and analyses architectural solutions; makes decisions to build or buy the necessary equipment; and designs, develops, tests, and integrates new products to fill gaps in existing product lines.

THE LIFESTYLE: The development of a data communications system or product requires very close collaboration with colleagues, but it also requires reliable and timely fulfillment of individual responsibilities. Engineering teams must communicate effectively to develop a common understanding of the product they are implementing and coordinate the many individual activities it will take to complete the effort successfully. Individuals must follow through by producing architectures, designs and software that meets requirements on schedule so that the overall effort stays on track. The final stages of a product development effort can be very exciting as many engineers come together to integrate their software and work out the final problems in time for promised deliveries to customers.

TASKS ASSOCIATED WITH THE JOB

- Working with customers to determine requirements for equipment and services (such as Mobility, I.P. Telephony, Video Conferencing, Fax, and Security).
- Developing network architectures to satisfy the customer's requirements.
- Simulating and analysing architectural solutions.
- Identifying opportunities for development of new internet products.
- Assisting in the specification of suitable hardware architectures as the basis of new products.
- Developing software architectures that are tailored to the proposed hard-ware platform and which meet customer requirements.
- Deciding whether to build or buy decisions for the necessary software components.
- Designing, developing, testing, and integrating software for the new product.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Embedded processors
- Hardware architectures
- Transmission media (wired and wireless) and hardware interfaces
- Real-time operating systems
- Internet Protocols
- Distributed algorithms
- Parallel computing
- World Wide Web (e.g., Hyper Text Transfer Protocol (http), browsers, servers),
- UNIX
- Network simulation and analysis

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills
- Telecom Product Knowledge
- Electronics Theory and Know-how (analogue/digital)
- Systems Design and Architecture
- Networking Concepts and Networking Architecture
- Computer Programming
- Troubleshoot Technical Problems
- Integration Concepts
- Project Management

Behavioural Skills
- Analytical
- Creative
- Teamwork
- Communication
- Professional Attitude
- Problem Solving
- Initiative
- Managing Risks
- Flexibility and Self Learning
- Commitment to Excellence
- Customer Orientation

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

The Career path usually involves working with designers of the various components or subsystems at a data communications network. Then designing components and in time designing complete network.

Some people will choose to concentrate on software leading to software design and architect. Others will develop organizational and management skills leading to Project and Programme management.

IT Business Consultancy

BROAD JOB AREA

EXAMPLES OF JOB TITLES

Enterprise Wide Information Specialist

Business Analyst

Business Architect

Application Specialist

Information Technology Strategy Consultant

Strategic Information Management Consultant

Information Management

JOB DESCRIPTION

THE VISION: The Business Consultant is a person with good overall commercial experience, who helps clients develop IT solutions to further their business goals. Knowledge of business context, imperatives and drivers is as important as the potential of IT to address them. This is a hybrid role combining business acumen with technological experience. Initial positions are usually through positions in business systems analysis, gaining practice in understanding business processes, whilst learning how technology can be exploited to satisfy business needs. Some companies offer training programmes to graduates of all disciplines to enable them to work in this domain.

THE ROLE: The IT Business Consultant is responsible for ensuring that business needs are met when developing and implementing IT solutions. He/she has understanding of the business strategy and the IT solutions required to support it. The person entering this type of job also requires understanding of IT industry directions and technologies and demonstrates this in ways which can be used to build the required IT solutions. He/she ensures the solutions are implemented as required by the business.

The IT Business Consultant is focused on analysing, planning and developing IT solutions that support the business needs of the firm. He/she also participates in business planning, business needs analysis and business risk assessment. The IT Business Consultant also acts as an in-house consultant working with the various functional areas of an organisation, providing advice and guidance on how to support the business operations through the effective use of IT.

THE LIFESTYLE: Most people in this type of job work in the information management or application development department of a business organisation. They typically work in teams, in short-term or in longer-term projects providing application development and support services to the business. The work involves a great deal of interaction with various parts of the organisation, negotiating, solving problems, defining and configuring optimum solutions, and communicating these to business managers. In the initial phase of the career, most people in this kind of job have a supporting role in a project, but with increasing experience they get to play the leading role in various projects.

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Microsoft, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

TASKS ASSOCIATED WITH THE JOB

- Defining business requirements for the IT solution.
- Defining IT strategy for the business, participating in business needs planning & strategy process.
- Identifying and defining opportunities to simplify, improve or redesign business processes using IT solutions.
- Analysing, planning, configuring and developing IT solutions.
- Overseeing and co-ordinating various aspects of the solution including information flow, data security, business recovery, system implementation, and change management.
- Defining and ensuring implementation of standards and processing across the organisation in support of the solutions.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Modeling (e.g. Business, Data, Process)
- Hardware technology (Computing/Terminals/Middleware)
- Application platforms (e.g. SAP R/3, Lotus Notes/Domino, Microsoft SQL Server, Oracle)
- Networking Wide Area Networking (WAN), Metropolitan Area Networking (MAN), Local Area Networking (LAN)
- Service Solution building/creation & integration (per application service)
- Service Solution deployment
- Service Delivery (operations/support)

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

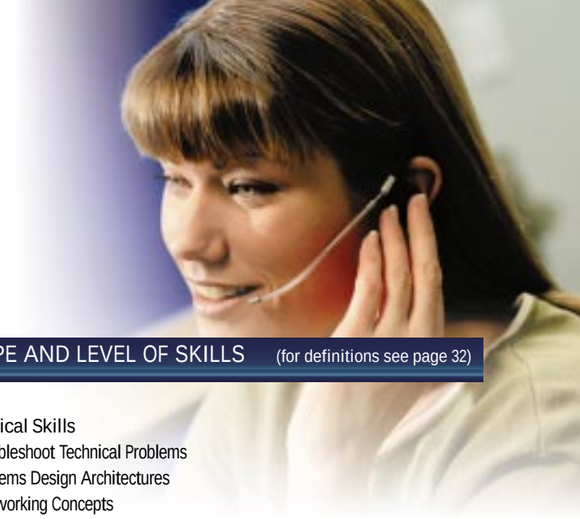
Technical Skills
- Business Strategy Planning
- Business Requirements Analysis
- Process Improvement and Change Management
- Software Engineering
- Knowledge of Rollout issues

Behavioural Skills
- Flexibility and Self Learning
- Analytical
- Creative
- Communication
- Negotiation
- Persuasiveness
- Teamwork
- Communication
- Strategy and Planning
- Problem Solving

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

The entry position in this career may typically be that of a Business Analyst. More experience with the business and process work leads to positions which focus on developing the business (Business Development Consultant). Some years' experience in various business related IT projects is required for Project Manager's position. A broadening experience leads to work with IT on the strategic level (IT Strategy Consultant).

Technical Support



BROAD JOB AREA

EXAMPLES OF JOB TITLES

Computer Operator

Operations Analyst

Help Desk Operator

Problem Manager

Trouble-shooter

Network Management Specialist

Configuration Management Specialist

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Microsoft, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

JOB DESCRIPTION

THE VISION: Just about everyone today in work, and increasingly for leisure and pleasure, relies on accessing information via computers. With increasing complexity of computer systems, build up of inter-connected hardware and software modules, systems sometimes fail. Occasionally it is a genuine systems failure, more often it is user mis-understanding or mis-operation; whatever the situation has to be resolved and access restored. Technical Support Staff specialise in identifying, analysing and fixing "faults" which prevent users connecting with their systems. And as new facilities develop, Technical Support Staff train users in the enhancements and how to maximise their potential and usability. Customer handling and good inter-personal skills are as important as technical know how and the desire to investigate and resolve problems. Careers starting in Technical Support can form a sound basis for either enhanced business or technical development. This is a useful entry point for those who wish to enter IT, but have no previous experience.

THE ROLE: Depending on their particular role, people in these jobs may be answering customer questions and concerns over the phone, or in person, either resolving the issues with the customer or referring the problem to other technical personnel. They may be responsible for the monitoring and tuning of the computer and telecommunication systems, for installing upgrades, and ensuring the day to day availability of any type of user applications, or computer and telecommunication systems or networks. They may be responsible for the operation of the computers, immediate problem solving and maintaining the service to the agreed levels. In some capacities they may be expected to contribute to user training and make recommendations about system upgrades.

THE LIFESTYLE: Most people in this type of job tend to work as part of a Technical Support team. They relate to vendors to assess technical products and to resolve technical issues. They also relate to customers with varying levels of technical skills and understanding. They are often under pressure to manage multiple requests with varying levels of importance and criticality. More experienced people are often recognised as experts in specific products or technology areas, and are called upon by management to give input to technology strategic decisions.

TASKS ASSOCIATED WITH THE JOB

- Installing, configuring and testing new operating software, software applications and software upgrades.
- Monitoring and maintaining computer systems and networks.
- Document installation and configuration procedures, and maintenance schedule.
- Troubleshooting system and network problems.
- Interacting with users to assess technical problems and needs.
- Interacting with vendors to assess technology products and resolve technical issues.
- Managing system resolution with users.
- Researching technical solution alternatives and implementing solutions.
- Operating the computer system and networks.
- Running network applications to support system and users.
- Answering, or forwarding to appropriate personnel, user questions and feedback.
- Documenting user issues and make recommendations for user training.
- Making recommendations for system improvement.
- Taking part in technical reviews, staff meetings and perform appropriate communication functions.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Workstation operating systems
- Mainframe systems
- Mainframe operating systems
- Network systems
- Network operating systems
- Internet software (Application downloads)
- Office software applications
- E-mail software
- Troubleshooting software
- System peripherals
- Telecommunication networks

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills
- Troubleshoot Technical Problems
- Systems Design Architectures
- Networking Concepts
- Software Engineering
- Hardware Knowledge
- Technical Documentation
- Computer Programming

Behavioural Skills
- Communication
- Relationships
- Problem Solving
- Flexibility and Self Learning
- Technical Orientation and Interest
- Attention to Details
- Analytical
- Initiative

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

Many Technical Support personnel start in technical call centres, answering user questions or referring them to more specialised technical departments. As they gain experience, they may move to specialised help desk areas where they deal with more complex technical questions. As they continue to gain experience, they become more closely involved with the system, installing, configuring and troubleshooting hardware and software: starting with user applications and progressively moving towards system operations. As they gain expertise, they are involved with more of the planning and optimising of the system. With further education, they may choose to move towards careers such as network design and implementation specialists.

As the Technical Support person develops expertise and a professional network of business contacts, some will choose to become consultants. Many consultants tend to specialise in one or two vendor systems and will often obtain certifications from these vendors to increase their demand in the computer Technical Support market.

Some people with Technical Support background will choose to migrate in the area of user training.

Product Design

BROAD JOB AREA

EXAMPLES OF JOB TITLES

Design Engineer

Hardware Design Engineer

Hardware Development Engineer

Product Development

Computer Designer

System Integrator

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Microsoft, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

JOB DESCRIPTION

THE VISION: The power and functionality of contemporary hardware and software means that IT products are becoming increasingly sophisticated and complex. The Product Designer works with colleagues to specify, design and build new artefacts which range from next generation hand held personal information appliances, to new generation computers. In some cases the work is carried out in a research or experimental environment. Team working and the ability to model and simulate novel situations are important. This is a deep technological role for those engineers who wish a career at the forefront of technology, to exploit it for novel product development.

THE ROLE: The Product Design Engineer often uses highly sophisticated computer based simulation systems to prototype new hardware devices and may also be involved in the design of software to enable the simulation or to enable the hardware devices to work in a complete system. Programming at this level requires a much deeper understanding of the architecture of electronic devices than say an Applications and Software Developer who would concentrate more on implementing business processes or user interaction.

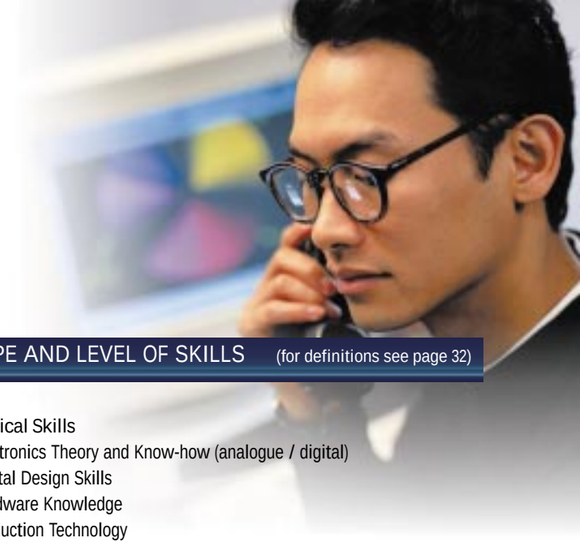
THE LIFESTYLE: The Product Design Engineer has a collective responsibility as a member of a group. He/she is responsible for the quality of his/her own work. Since the Product Design Engineer work is highly technical, contact with customers is not so frequent at the beginning of the career.

TASKS ASSOCIATED WITH THE JOB

- The work includes planning of hardware, both prototypes and specific parts. Further, the work also includes design and testing of subsystems and prototypes.
- A Product Design Engineer is as a member of a group responsible for testing and integration of new products.
- The work requires good knowledge of how to select the proper materials and components.
- Identification of model performance requirements and specific constraints is also a important task in product design.
- As a new Product Design Engineer it is very important to continously train and build-up the required expertise.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Analogue / digital circuit design
- Dignal processing
- High frequency planning
- Analogue / digital electronics



TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills
- Electronics Theory and Know-how (analogue / digital)
- Digital Design Skills
- Hardware Knowledge
- Production Technology
- Quality Assurance
- Systems Development Tools

Behavioural Skills
- Creative
- Analytical
- Teamwork
- Flexibility & Self Learning
- Commitment to Excellence
- Communication
- Problem Solving
- Decision Making
- Professional Attitude

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

A Product Design Engineer has many career opportunities. One of the opportunities is to work in the highly technical field as a theorist, researcher or inventor. The work is often done in multi-discipline projects. In Product Design there is also the opportunity to advance into a managerial or project leadership position. Many Product Design Engineers decide later in their careers to be independent consultants or even start their own consulting firms.

Integration & Test/Implementation & Test Engineering

BROAD JOB AREA

EXAMPLES OF JOB TITLES

Systems Integrator

System Implementation Engineer

Integration System Engineer

Integration Engineer

Implementation and Test Specialist

Integration and Test Specialist

JOBS OF THIS TYPE ARE TYPICAL IN

BT, IBM, Microsoft, Nokia, Philips Semiconductors, Siemens AG, Thomson CSF

JOB DESCRIPTION

THE VISION: We are all embarking on an information revolution, driven by the convergence of computing and communications technologies onto common components; the international telephone network is the largest, most complex artefact, ever devised by man. Telecommunications are a key component, developing at unprecedented rates; testing existing and emerging technologies to ensure fitness for purpose are vital tasks. The Integration and Test and Implementation and Test Engineer is a pivotal figure in these developments and has opportunities to specialise in computing, telecom equipment and testing techniques.

THE ROLE: The Integration Engineer works very closely with the design and development teams to gain an excellent understanding of the product or system that is being created. Throughout integration and test, a close relationship will be maintained with the Designers / Developers or Suppliers of the various component parts as the Integration Engineer will need to ensure that changes are made in the various components that will allow them to work together as intended. The Integration Engineer also understands the customer requirements in order to design a set of test scenarios to check that the product /system meets these requirements.

The Implementation Engineer fulfils a similar role, but, whereas the Integration Engineer proves the system works as intended at the end of it's the product or solution development, the Implementation Engineer ensures that it functions at the operational site through its installation and commissioning. This requires the Implementation Engineer to be good at understanding complex systems and solving technical and non technical problems. There is also the need to provide support while the people who will be ultimately responsible for operating the product / system learn about it.

This means that the Implementation Engineer will be responsible for undertaking the hands-on-training of these people and may be responsible for managing the training programme of the operational staff.

Examples of products or systems for integration and test / implementation and test include:

- *A new telecom billing system into an existing telecom network, which will include systems that manage the operation of the network and systems that are used to take customer orders. A new platform to provide telemarketing services*
- *A new platform to provide multi-media services*
- *A new platform to provide Internet services*
- *A new platform to provide mobile telephony*

THE LIFESTYLE: People work in highly capable teams with members specialising in different technology areas. There is then increasing involvement with the customer as a major part of the work is to implement the solution in the customer's environment to ensure that the product / system meets the customers requirements. This is an excellent hybrid role working with developers, suppliers and customers. Much of the work will be at the customer's premises and visits to suppliers, often overseas, will be required for both product education and problem solving.

TASKS ASSOCIATED WITH THE JOB

- Organising, managing and producing the solution on the development and operational sites.
- Organising, managing and executing migration tests on the development and operational sites.
- Configuring the product / system to meet customer needs.
- Designing and running performance tests to prove capability.
- Estimating the amount of work required of the integration/implementation team.
- Co-ordinating the actions of the different specialists participating in the project.
- Proving and assuring that the product / system functions as defined.
- Participating to transfer knowledge to the production process.
- Educating the customer in the use of the system.
- Specifying the end-to-end tools for performing the system integration.

TECHNOLOGY AREAS ASSOCIATED WITH THE JOB

- Operating Systems
- Skills relevant to the business area where the system is being deployed e.g. in telecommunications he/she will need to have an understanding of telecom standards and networks.
- Database management systems (e.g. Oracle)
- Network protocols (e.g. HTTP, X25, internet, TCP/IP)
- Test tools and methods
- System engineering methodology and tools.

TYPE AND LEVEL OF SKILLS (for definitions see page 32)

Technical Skills

This is a complete list, people will start with a few of these skills, others will be developed in the role. Skill requirements will also depend on the type on the work/business area involved.

- Basic Electronics Theory and Know-how (analogue / digital)
- Software Engineering
- Computing System Design Fundamentals
- Hardware Knowledge
- Hardware Development Processes
- Integration Concepts
- Reliability Engineering
- System Design System Architecture
- Systems Management Concepts
- Testing
- Computer Programming

Behavioural Skills

- Relationships
- Analytical
- Attention to Detail
- Teamwork
- Communication
- Problem Solving
- Information Handling
- Initiative
- Planning and Organisation
- Leadership
- Flexibility and Self Learning
- Commitment to Excellence

DESCRIPTION OF CAREER PATH/FUTURE OPPORTUNITIES

Often people aim to become an Integration Specialist because of their like to see a total product coming together. Within Integration the scale of projects can vary from a few people for a few weeks to hundreds of people for many months or years. These larger projects require the highest levels of technical, personal and business competence and people leading these projects are often Directors or Vice Presidents of their companies.

Because of the breadth of experience open to the Integration Specialist there are also many opportunities to move into Project Management, People Management or Sales and Marketing or for those wishing to specialise more in the technology opportunities would include Technical Consultancy or Systems Specialist. Other roles and opportunities include Integration Engineer, Team Leader, Project Manager, Technical Consultancy, Sales and Marketing.

A/D Analogue/Digital - Information can be exchanged either in a digital format or in analogue format. Typical analogue sources of information are our voice, radio waves, films. More and more information is being handled digitally, for example mobile phones have moved from analogue to digital and radio and TV broadcasts will become digital in the future. The reason for this is two fold. You can transmit more information in the same space if you use a digital form rather than an analogue, and you can ensure the quality of the information is exactly the same when received as when transmitted. So for example you don't get any crackles , pops or hisses when listening to a CD (digital) when compared to a vinyl record (analogue). Since we receive information in an analogue form (sound sight etc) there is a need to provide converters between analogue and digital forms of the information.

Artistic Knowledge - The ability of modern computers to handle multimedia, i.e. audio, voice, still images, moving images and video has created a new range of opportunities for people who understand the effect of colour and tone and other artistic elements on peoples behaviour. A strong artistic capability and sound understanding of artistic principles will enable you to create designs that will bring knowledge and processes to life for a business customer.

ASIC - Application Specific Integrated Circuit, is similar to FPGA but the interconnection is done by fixed metal masks. Still speedy but not that flexible, normally used in stable development phases and for mass production

Business Requirements Analysis - For most businesses IT is not their core function, it is a means to an end. Business managers know what they want to achieve. IT specialist know what can be done with computer and telecommunication systems. The person that can translate these business processes and requirements into an IT specification that enables IT systems to be developed to meet these business needs is the essential missing link in the process. This is a difficult skill to acquire as it requires a good understanding of the major business processes such as order processing or customer relationship management, as well as an understanding of how companies are organised combined with an appreciation of what IT can and can't do. Frequently there are tradeoffs between what can be produced in the time scales and budgets required and what the customer would ideally like. Excellent communication skills are required to ensure effective understanding between the technical experts and the business managers.

Business Strategy Planning - Understand, build or modify the strategy of a business to reflect its overall goals. Assess a strategy and understand the implications in terms of required solutions using technology and/or business process changes.

Computer Programming - There is hardly a job in the IT industry that isn't either easier to do, or easier to be successful in, with an understanding of programming. For many Software Developers it is of course the core skill and comprises an understanding of the software development process including program design, coding and testing. Programming is a skill that must be used to be of value and practical experience of writing programmes in languages such as C, C++, Fortran, ADA or Smalltalk will often be required and it is useful to know both a procedural language as well as Object Orientated Analysis and Design methods. For software development opportunities relating to Internet enabled applications and the development of Web sites HTML, XML, Lingo and Java are popular languages. In addition to the language itself there will be a range of tools designed to speed up the development process such as visual design tools and debuggers and knowledge of these would be useful. For example in Multimedia development these could be Frontpage, Visual tools or Illustrator.

Computing Systems Design - At the heart of all computer systems is a processor. A sound understanding of the functional components of the processor and how the processor interfaces to other system components such as memory, systems busses and disks is essential to many jobs in IT. Whilst the functional characteristics of computer systems are not difficult to grasp the performance characteristics of these components (disks, memory etc) are often complex but are also equally important to appreciate in designing successful systems.

Cost modelling - Where large numbers of different devices are required it can become quite complex working out the most cost-effective solution. By producing a financial model of the proposed solution it becomes possible to test alternative designs quickly and efficiently.

Database Concepts - Whenever large volumes of data need to be stored, or an ability to search or access part of the data is required, then a database will be used. Understanding database concepts means understanding the theory and practice of database systems, the different ways of storing and accessing large volumes of data, the different types of database management systems and the performance trade-offs in their selection and design. The ability to create a simple database and to be able to write queries and reports would be very useful.

Digital Design Skills - Ability to design fast and complex digital circuits. As well as understanding design principles an understanding of Computer Aided Engineering (CAE) techniques that are used in circuit design and layout would be useful. Tools such as Caeds, Mentor and Catia.

DSP - Digital Signal Processing

Electronics Theory and Know-how (analogue/digital) - This is the core technical skill in any hardware design or development role. Understand electronics theory and apply it in design work. Knowledge of and ability to use different components in design. Ability to design electronic (analogue/digital) circuits. Basic understanding of signal processing. Since the purpose of hardware design is to lead to a manufactured device an ability to estimate the cost of the device and an understanding of the different stages of both design and manufacture is useful. Frequently designing electronic devices have to conform to standards, e.g. so an adapter will operate successfully in say a PC. This means the ability to read, understand and evaluate design specifications is a must.

Embedded Systems - Embedded systems are where electronic systems use programmed microprocessor based technology The user probably does not know that they are interacting with the computer. Devices such as TVs, Cars and mobile phone make extensive use of embedded computers, controllers and software.

Understand the particular requirements of embedded systems their control through software and knowledge about the particular techniques that are needed such as having to respond in real time to an event.

End User Interface - Understand the factors involved in building a successful human/machine interface. Bring to bear creative and technical skills to design and build multimedia systems using a variety of media (screen, touch, voice, video…).

FPGA - Field Programmable Gate Array, is a logic IC (integrated circuit) consisting out of gates. The interconnection between the gates is determining the functionality of the IC. This interconnection is programmable via SW and can be changed in a flexible way. FPGAs are normally used in early development phases for fast prototyping.

Hardware Knowledge - Understanding of hardware systems and how they are constructed. Understanding of basic technologies of the hardware and also how the hardware functions. Understand the purpose of controllers or adapters and interface standards such as PCI used in PCs to allow peripheral devices such as disks drives to be connected. Understand the purpose of common computer peripherals such as disk and tapes and appreciate the significance of their different performance characteristics. Be able to match specifications to customer requirements. It is also useful to have a general understanding of the hardware development process, not in detail, but just to be able to appreciate issues such as time to market and engineering changes.

HTML - Hypertext Mark-up Language - HTML is the set of "mark-up" symbols or codes inserted in a file intended for display on a World Wide Web browser. The mark-up tells the Web browser how to display a Web page's words and images for the user. The individual mark-up codes are referred to as elements (but many people also refer to them as tags). It is a standard recommended by the World Wide Web Consortium (W3C) and adhered to by the major browsers, Microsoft's Internet Explorer and Netscape's Navigator.

HTTP - The Hypertext Transfer Protocol (HTTP) is the set of rules for exchanging files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web. Relative to the TCP/IP suite of protocols (which are the basis for information exchange on the Internet), HTTP is an application protocol.

Essential concepts that are part of HTTP include (as its name implies) the idea that files can contain references to other files whose selection will elicit additional transfer requests. Any Web server contains, in addition to the HTML and other files it can serve, an HTTP program that is designed to wait for HTTP requests and handle them when they arrive. Web browsers are HTTP clients, sending requests to server machines. When the browser user enters file requests by either "opening" a Web file (typing in a Uniform Resource Locator or URL) or clicking on a hypertext link, the browser builds an HTTP request and sends it to the Internet Protocol address indicated by the URL. The HTTP program in the destination server machine receives the request and, after any necessary processing, the requested file is returned.

Integration Concepts - Whoever you buy your music CD from you expect it to work in your hi-fi system, your car and your personal music system. When you use your mobile phone to make a call from another country you expect it to work. When you take money out of your bank by using a cash machine belonging to another bank you expect it to work.

These are consumer-orientated examples of systems integration in action. The common theme is that they involve technology from multiple manufactures having to conform to common specifications or standards. Specifications and standards are necessary to allow companies to co-operate . They can be industry wide, international, or just agreed for a specific development.

Where the fun and excitement starts is that everyone has their own interpretation of these specifications and if it is your job to show that the complete system works together you will need to know how to minimise these misunderstandings and how to resolve them effectively when they do occur.

Understand mathematical principals and appreciate the power and limitations of mathematics in solving computing and engineering problems. Able to accurately apply mathematical principles appropriate to computing such as methods of proof, logic and modelling methods.

Be confident in applying mathematical formulae, performing arithmetic with large numbers and in manipulating large volumes of numbers.

LAN, WAN, MAN - Local, Wide and Metropolitan Area Networks - Increasingly to allow people to work together and share information and ideas our computers need to communicate and share data. In the world of communications the greater the distance the more it costs to transfer data at very high speeds. The larger the network of computers and other devices that need to share data the more challenging become the network management, security and addressing problems. Different technologies have evolved to solve these problems in different ways and to help the Computer and telecommunications industry understand which solutions are appropriate where the industry has given labels to the different types of communication networks. The network connection a collection of computing devices together in a single department or building is called a Local Area Network (LAN), If the network covers a University Campus or a town it is called Metropolitan and if it covers a whole country or many countries it is called a Wide Area Network.

Mathematics - Understand Mathematical principals and appreciate the power and limitations of mathematics in solving computing and engineering problems. Able to accurately apply mathematical principles appropriate to computing such as methods of proof, logic and modelling methods. Be confident in applying mathematical formulae, performing arithmetic with large numbers and in manipulating large volumes of numbers.

MS - Abbreviation for Microsoft.

Networking Concepts and Architectures - Understand the reason for the different network layers and how addressing, routing, data integrity and performance requirements are achieved. Understand the need for and the use of Bridges, Routers, Hubs and Switches.

PCB - Printed Circuit Board - When the electronic industry was just starting individual electronic components would be connected together with wires. This was a time consuming manual operation and a faster method was invented which had the wires already in place as copper strips on a plastic board with holes for the leads of the components to be inserted and soldered on. As the industry matured these boards became multilayed so many circuits could be established and as the demands for miniaturisation grew the boards evolved into thin flexible sheets that could for example be fitted inside cameras or mobile phones.

Process improvement and change management - Understand the need to establish new business processes quickly and therefore phase in improvements and enhancements. Know how to manage and match changing requirements, with specifications and implemented solutions.

Project Management - Understands the requirements of working as part of a team to achieve a specific goal. This includes what has to be done as a team member and as a team leader. Should cover basic project management activities such as planning and scheduling, estimating, project management and control, risk issues and change management, status and progress reporting. There are a wide range of programs available to assist the project manager with this task and whilst it is useful to have experience of these, a good grasp of the basic concepts is more valuable.

Quality Assurance - Understand the quality development process the industry standards and approaches to ensuring improving product quality. Understand why companies have quality standards and check for conformance. Understand the main industry quality standards.

Radio Frequency (RF) Circuit Design - Being able to Design standard RF circuits. Have knowledge of passive and active RF circuits, amplifiers, oscillators, mixer, filter.

Radio Frequency (RF) Design Methods - Being able to: Implement known theories and develop new ones for RF circuit simulation. Have knowledge of: circuit simulation theory, circuit simulation tools, analogue circuit design, digital circuit design.

Radio Frequency (RF) Design Tools - Knowledge of and ability to use the relevant RF design tools in schematics entry, circuit simulating, layout design, PCB design etc.

Radio Frequency (RF) Theory - Knowledge of RF theory: microwave components, antennas, radiowave progress, radio transmitters and receivers, radio technology applications, basic structure of a radio system etc.

Radio Technology - Understanding of radio spectra and the impact of climatic and geographical restrictions. Radio interference and security.

Reliability Engineering - The electronic components that will be used to realise a specified circuit design are subject to and affect the physical environment. For example, voltage and temperature changes will affect their reliability. The circuits will generate electromagnetic radiation and this will affect the operation of other electronic devices. Reliability Engineering is the discipline of designing devices with these factors in mind to produce reliable long-lived devices. You will need knowledge and know-how about component and material characteristics, thermal design, electrical and magnetic cross-talk, leakage, EMC and design rules like de-rating.

Rollout Issues - Understand issues associated with replicating a system in a large number of locations, e.g. installing a computer system in every store of a major high street retailer. This involves the project management of issues such as conducting site surveys, logistics and staff training.

SDH & PDH - Synchronous Digital Hierarchy and Plesiochronous Digital Hierarchy - SDH (Synchronous Digital Hierarchy) is a standard technology for synchronous data transmission on optical media such as fibre optic cables. It provides faster and less expensive networkinterconnection than traditional PDH (Plesiochronous Digital Hierarchy) equipment which predates it.

In digital telephone transmission, "synchronous" means the bits from one call are carried within one transmission frame. "Plesiochronous" means "almost (but not) synchronous," or a call that must be extracted from more than one transmission frame.

Software Engineering - Knowledge of the software technologies on which modern systems are based (e.g. operating systems, programming languages). Able to architect, design and develop individual components or major products. Understands the theories underlying these components. Understand how applications use the services of operating systems and concepts such as processors, working storage, message passing, and transactions processing. Unix and NT are the dominant operating systems in the computer industry today.

SQL - Structured Query Language is a standard interactive and programming language for getting information from and updating a database. Queries take the form of a command language that lets you select, insert, update, find out the location of data, and so forth. There is also a programming interface. Database are used to store and manage data can have a wide variety of structures depending on how they are to be accessed. A personal organiser or address book has a simple structure of a series of entries or records with different types of information such as name and telephone number, stored in the same relative place in each record. SQL is a standard which allows many different programs to access information in databases and is widely used in commercial applications.

Statistical Analysis - Is confident and accurate in applying basic statistics and queuing theory.

Systems Design and Architecture - Before a system can be designed to meet a customer's requirement one needs to have a clear understanding of those requirements. The first skill therefore in Systems Design and Architecture is Requirements Analysis, the critical reading of customer requirement documents and questioning and testing for understanding. To do this requires an understanding of good system design, the role of systems architectures and how performance, availability, security and usability requirements are incorporated. Understand the issues involved in integrating multiple components, the need for and variability of Standards. Have experience of software - hardware compatibility problems and application integration issues.

Systems Development Methods - Know and be able to use formal methods in the design and building of computer systems. Understand the importance of standards in systems development and be aware of some common examples. Understand the different stages of systems development, e.g. requirements analysis, specification, design, implementation, etc.

Systems Development Tools - Understand the use that can be made of tools in all stages of computer systems development. Make use of specific tools to support specific activities. Understand different verification methods.

Systems Management Concepts - Understand the need for the major systems management concepts of change control, security, capacity planning, backup and recovery, and data management.

TCP/IP - Transmission Control Protocol/Internet Protocol is the basic communication language or protocol of the Internet. It can also be used as a communications protocol in the private networks called Intranets. When you are set up with direct access to the Internet, your computer is provided with a copy of the TCP/IP program just as every other computer that you may send messages to or get information from also has a copy of TCP/IP.

TCP/IP is a two-layered program. The higher layer, Transmission Control Protocol, manages the assembling of a message or file into smaller packets that are transmitted over the Internet and received by a TCP layer that reassembles the packets into the original message. The lower layer, Internet Protocol, handles the address part of each packet so that it gets to the right destination.

Each gateway computer on the network checks this address to see where to forward the message. Even though some packets from the same message are routed differently than others, they'll be reassembled at the destination.

Technical Documentation - Able to organise documents and reports and to express complex technical subjects in an understandable manner.

Technology, Component and Material Knowledge - Knowledge and know-how to select new component, PCB (Printed Circuit Board) etc. technologies. Understanding principles of selecting components, materials and suppliers.

Technology Trends - Understand the directions in which technology is changing and able to formulate some personal views in this regard. Is able to understand the implications of these trends for business and for the development of specific solutions when appropriate.

Telecom Product Knowledge - Knowledge about telecommunications networks, network types and structures and network element types and functions. Also basic knowledge about telecom principles such as protocols, traffic theory and the principles and effects of load and congestion.

Telecom Technology In Network Element Level - Understanding about how different types of network elements operate and how these elements (or some specific product) are usually constructed. Also knowledge about network element parameters and control. Architecture level understanding of the structure and function of the system.

Testing - Understand the different levels of testing such as module, functional, systems and integration testing. Appreciate the different types of testing such as functional, performance, usability, recovery, volume tests.

Know how good testing is done and how testability can be designed into products and components. Understand how to evaluate the quality of testing. Able to perform test planning and test case design and to use different test case design methods in black box testing, such as boundary-value analysis, equivalence partitioning, error guessing etc…

Good documentation skills are also required as test plans, problem records and test reports have to be produced and reviewed.

TECHNICAL SKILLS & DEFINITIONS

Troubleshoot Technical Problems - This is the ability to use software or hardware diagnostic tools and procedures to gain an in depth understanding of why a system is behaving the way it is. Such tools for example include LAN analysers that can monitor the address and data packets being sent down a cable, or a software debugger that allows you to step through the execution of a program instruction by instruction.

UNIX - is an Operating System as is Windows. Windows allows you to run programmes and manage a PC without having to write programmes yourself to make the hardware do what you want. Windows has provided a universal common look and feel and set of productivity tools (word processors etc). UNIX is another very popular operating system and where as you will find Windows on many Personal Computers, UNIX is used predominately in business and industry. It is used either to provide very high function and performance workstations used to design cars aeroplanes, electronic circuits etc or in businesses to run commercial applications such as accounting, e-business, customer and supplier relationship management or to manage very large databases. The largest computers in the world use UNIX as their operating system.

Use Computer Systems - Be competent in the use of common productivity tools such as word processor, spreadsheet, email and presentation Software, be able to administer PC systems, be familiar with the command line interface of common computer systems. Many technical professionals within the ICT industries develop their hardware or software on either Microsoft's NT Operating System or on UNIX and experience of either or both of these environments would be useful.

Work Estimation and Scheduling - Be able to break down an activity into different task, be able to identify the types of skill required to perform the tasks, how long the tasks will take and what the dependencies between the tasks are.

X25 - is a communications protocol that allows computers and telephone exchanges to send information in packets across a network. The packets as well as containing data contain addressing information to enable the data to reach the required destination and the protocol can also handle network failures and data corruption by finding alternative routes and re-sending corrupted data. It is widely used throughout Europe. X25's function is similar to the TCP/IP protocol but designed for use with telephone lines rather than Local area Networks.

BEHAVIOURAL SKILLS & DEFINITIONS

Analytical - Able to acquire information and identify missing information. Able to look logically at a technical situation to solve problems and create new and innovative solutions. Prepared to use facts, data, measurements and a logical process to carry out a job. Often tools and methodologies will exist to assist with this analytical work and a high degree of proficiency would be expected in the use of these.

Attention to Detail - Able to produce accurate work, even when under pressure. For critical information checks the accuracy of information before using it or passing on to others.

Commitment to Excellence - Has a passion for succeeding in assigned tasks and to produce work of the highest quality. Will adjust working time to meet the demands of the business. Meets own commitments and ensures the completion of own tasks. Is responsible and can be relied upon.

Communication - Able to communicate effectively face to face, on the phone, in writing and via presentations. Knows when to abstract complex technical concepts and describe in terms meaningful and relevant to technical and business managers and to other non-technical people. Also knows how to obtain the maximum understanding from other people. Is able to build a network of contacts who can provide information and assistance.

Creative - The ability to create images and visions to help explain concepts and put ideas across in exciting and thought provoking ways.

Customer Orientation - Is focused on what is best for the customer, always lets customer needs, consistent with business profitability, drive actions and decisions.

Decision Making - The ability to make timely decisions based on adequate but often incomplete information.

Flexibility and Self Learning - The ICT industry today is one of the fastest changing industries of all time. This makes it both an exhilarating and demanding environment to work. Products that everyone was using two years ago are replaced with alternative products. Ways of working that are common today will disappear tomorrow. To survive, and enjoy the experience, you will have a flexibility attitude, be willing to acquire and learn new skills, new knowledge and new ways of working. Sometimes this will be achieved by formal education and sometimes by self-study and research.

Information Handling - With email, the World Wide Web and company Internets the volume of information available significantly exceeds anyone persons capability to absorb it. Information handling skills are therefore needed to identify what is important and what is urgent and to be able to categorize information for easy retrieval.

Initiative - Able to recognize when action is required, will take control of the situation and implement or propose a course of action. Does not wait to be prompted.

Leadership - At the personal level capable of making decisions and recognizing and managing conflict situations. Able to command the support of a team and carry out their decisions to completion. Willing to challenge existing processes and proposals. Able to create and sell a vision of the future which others are keen to follow.

Managing Risk - Considers the possible consequences of action or inaction and puts contingency plans in place to minimize negative consequences. Ensures appropriate levels of management are aware of major areas of risk.

Negotiation - Can communicate with others to come up with a course of action which meets the needs and objectives of all parties. Not concerned with ëwinningí an argument for its own sake but producing a solution which meets the needs of the situation and the individuals involved.

Persuasiveness - Able to convince others of the effectiveness of the proposals presented in a friendly and constructive way. Demonstrates other necessary attributes simultaneously (e.g. teamwork).

Planning and Organisation - When given a task, is able to determine and document, the best approach and the time required to carry it out. Approaches the task in an organised and professional way and highlights revisions to the plan in timely manner, based on the work already done and new factors. Ensures that the work is carried out in a way that conforms to the rules of the organisation. Delivers on time and works equally effectively on multiple tasks when necessary.

Problem Solving - We are all faced with problems every day. Problem Solving in this context relates specifically to technology or process related problems and is not just the ability to analyze the cause of the problem, design an appropriate workable solution and implement the solution but also to be able to anticipate potential problems and prevent them form occurring. To be skillful in this area you will be proficient in gathering relevant information but also in assessing the quality and accuracy of the information.

Professional Attitude - Approaches tasks and colleagues in a responsible and professional manner demonstrating attributes which are considered appropriate to the situation and job. Understands what is required in this respect and is able to modify attitudes to meet varying situations. Can be relied upon to produce quality results efficiently that bring credit to themselves, their team and their company. Takes ownership and responsibility for work items and is tenacious in work through or round problems. Works efficiently and effectively to produce a quality result.

Relationships - Every job in the Information Technology and Telecomms industry requires an ability to work effectively with our people. In general the more senior the position the more the need to work with a wider range and type of person. For some job roles junior roles only require effectively relationships with a small team of colleagues, e.g. some Product Design roles. In other roles such as IT Business Consultancy the ability to form relationships quickly and easily with a wide range of customer people including managers, financial analysts, personnel specialists as well as technical practitioners If ìRelationships ì is identified as a core expertise for the role then you will be expected to be able to establish effective business relationships with team members, customers and other colleagues. You will have good communication skills, be able to listen effectively to others and be confident in seeking advice when appropriate. You will quickly develop a network of contacts and be ready to share information and ideas.

Strategy and Planning - Able to take a broad and long-term view of what needs to be done in a particular situation and translate it into detailed actions.

Teamwork - Demonstrates a strong desire to see the team achieve its agreed goals. Prepared to support team members and team decisions at expense of own goals. Recognizes the value of having diverse attitude, skills, experiences and views and prepared to ensure they are harnessed when appropriate.

Technical Orientation and Interest - Is excited by finding out how things work. Applies technical understanding to solve business problems. Willing and excited by performing technical and analytical tasks in the IT and telecommunications areas.

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