

TM



EUCIP

European Certification of
Informatics Professionals

EUCIP Telecommunication Architect

Elective Level Profile Specification

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Short Description

A EUCIP Telecommunication Architect is expected to combine telecommunication skills with a specific effectiveness in identifying and implementing IT solutions for digital convergence. This requires a thorough competence on wireless digital communications over analogue media as on transfer of analogue signals over digital networks. Professional consultancy skills and a general competence in systems development are also important.

This profile requires a minimum work experience of **18** months in a compatible job role; if this requirement is not fulfilled, the candidate might be certified as an **Associate** Telecommunication Architect.

Tasks Overview

Supports the identification of organisation needs of data transfer, identifying various kinds of transfer: one way video, voice, both unicasting and broadcasting, two way voice and video, including teleconferences.

Supports the identification of organisation opportunities of wireless telecommunications as point-2-point, WLAN, satellite, identifying the various characteristics and applicability to different transmission needs.

Plans, supervises the building of, and perform acceptance tests for WLAN installation, both in local (company) and in public (Hot-Spot) environment.

Designs point-2-point wireless link, with respect to geographic planning, computing path loss, verifying Fresnel ellipses, also predisposing tests to be performed to evaluate the path.

Supports the identification of satellite based links verifying various parameters and planning what data transfer can use such links both as default and as a backup solution.

Plans, supervises the building of, and perform acceptance testing of infra-red light digital links between different networks.

Supports the planning of different implementations of 'digital convergence', from 'data streaming' (both voice and video), to VoIP (not only 2-way but also audio-video conferences) proposing different architectures, protocols and layouts.

Supports the plan, supervise the building of, and perform acceptance tests on digital broadcasting systems, as new 'Digital Radio' and 'Digital TV', (DRM, DAB)

Collects sample data and uses them to build a significant pilot model of the new system. Proofs the general model through several simulation sessions where managers, process owners and operational users of the information system can fully understand and approve the way the target system shall work.

Produces high quality documents and written reports, describing organisational and/or technical topics in a clear and concise style.

Collaborates with ICT staff both for testing (single new module or entire system) and for data extraction, transformation and loading.

Conducts final simulations with real data and acceptance testing.

Plans and supports end users' training.

In compliance with agreed terms, supports the client organisation in initial usage of the new system and in measuring its benefits through possible post-implementation reviews.

Essential Behavioural Skills [2]¹

The Telecommunication Architect role requires a good general knowledge, excellent oral and written expression, and a very wide range of more specific behavioural skills.

A keen interest in technology innovation, the ability to collect and understand new information, plus organisational and business sensitivity are required to successfully design, deploy and maintain IT architectures.

Analytical and comparative intelligence, imagination and proactivity are required to formulate and validate solutions.

Attention to detail, a logical-minded and goal-driven approach, flexibility, determination, planning and control aptitude, teambuilding and leadership are required to achieve effective results.

¹ numbers in brackets represent EUCIP points

Detailed Skills Required

Deep competence level [24,5]

C5.03 Modulation schemes and characteristics [2]

- Describe the features of the main narrowband modulation schemes
 - o Amplitude modulation, frequency modulation, phase modulation, single sideband modulation
 - o Modulation sensitiveness with respect to: noise, interfering signals, e.m. interferences
 - o Spectral efficiency
- Appreciate the practical meaning of Shannon's Theorem
- Describe spread-spectrum characteristics
 - o Spectrum spreading techniques: frequency hopping vs direct sequence
 - o Sensitiveness with respect to: noise, interfering signals, e.m. interferences
- Recognise spreading sequence coding as CCK
- Understand noise effects
- Interpret "eyes pattern"
- Measure Bit Error Rate

C3.10 Data representation and protocols [2]

- Distinguish the main aspects and standards of image coding
 - o JPEG, MPEG, ..
- Distinguish the main VoIP protocols
 - o H323, SIP
- Distinguish the main voice and video digital broadcasting protocols
 - o DAV, DVB
- Design network requirements and impacts for all these standards
 - o Bandwidth requirements, latency, QOS
 - o Congestion hints

C5.04 Transmission and propagation [2,5]

- Understand radio spectrum usage
 - o UHF, Microwaves, IR
 - o Noise related issues on different bands
 - o Antennas, both directional and non-directional
 - o Gain, directivity, coupling, diversity
- Apply the principles that regulate wave propagation
 - o calculate and measure path loss
 - o compute signal strengths on a given path
 - o path issues as Fresnel's ellipsoid
- Use software that performs path evaluation

C4.04 VOIP/QOS [1,5]

- Distinguish the main VOIP protocols:
 - o H323
 - o SIP
- Manage the main VOIP applications:
 - o videoconferencing

- IP telephony
- Recognise the main problems:
 - delay
 - jitter
 - congestions
- Know how to solve the above problems using QOS or overprovisioning.
- Know how to warrant QOS using MPLS.

C5.01 Wireless networking protocols [1,5]

- Classify the transmission media and techniques for wireless LANs (infrared, spread spectrum, narrowband microwave) and their range of operation:
 - technologies used for wireless communications
 - major wireless standards
 - problems characterising wireless and mobile computing
 - limitations of the wireless technology
 - main components of a Wireless LAN
- Differentiate between 802.11 sub-protocols:
 - 802.11
 - 802.11b
 - 802.11a
 - 802.11g
- Explain the functions of the main wireless communication standard:
 - mobile IP
 - Wireless Application Protocol (WAP)
 - Bluetooth
 - range of applicability of each protocol
- Know how to implement interoperability tips in wireless broadband systems (WiFi standard, Bluetooth, 802.11).
- Know how to use security hints about 802.11 such as WEP40, WEP128.
- Explain European and national wireless LAN regulations (ETSI2).

C3.01 Network principles and standards [2,5]

- Evaluate the basic components of a network, such as server, client, NIC, protocols, Network Operating System (NOS), shared resources.
- Evaluate a Server, its requirements, and function. Also evaluate the basic server components.
- Build or order a server, dimensioning it to cover the network needs.
- Evaluate a client, its requirements, and function. Also evaluate the basic client components.
- Build or order a client, dimensioning it to covers both user's and applications' needs.
- Evaluate the function of a Network Interface Card (NIC). Also be able to choose the appropriate card for a network.
- Differentiate between the basic network topologies:
 - Busnet
 - Ringnet
 - Starnet

- their function, capabilities and limitations
- Differentiate between a Local Area Network (LAN) and a Wide Area Network (WAN).
- "Recognise "de facto" and "de jure" standards in data transmission:
 - the TCP/IP suite
 - the OSI model
 - purpose of the layered reference model (principle of encapsulation and service access points in layer models)
 - main standard organisations, such as CCITT, ITU-TS, IEEE, ISO and IAB and domains they are focusing on
 - aim of the different layers (physical, data link, network, transport, session, presentation, and application"

C3.02 Ethernet [1,5]

- Evaluate an Ethernet system:
 - Data transmission rates
 - Transmission media
 - Maximum lengths and nodes
 - Different types of Ethernet networks such as 10BASE-2, 10BASE-5, 10BASE-T
 - Related standards (such as IEEE 802.3)
- Explain the CSMA/CD operations.
- Explain level 2 operations, MAC address.
- Explain Broadcasting and unicasting.
- Connect a computer to a Ethernet segment.
- Connect in cascade hubs or switches using crossed ports, crossed cables or coax cables.
- Recognise the different Network adapter connectors, Coax/BNC, DIX/AUI/DB15, RJ45 etc. Also know their use
- Install network card driver on different platforms (Windows, Apple, Linux)
- Know how to update NIC drivers.

C3.03 Apparatus and structured cabling [1]

- Describe structured cabling systems (behaviour, use and benefits),
- Describe structured cabling system components (plug, sockets, patch-cords, racks, etc.).
- Describe non-certificated add-ons for structured cabling systems.
- Illustrate the main network topologies (bus, star, ring, tree).
- Distinguish between types of network cables that can be used such as coaxial, twisted pair, fiber optic:
 - their capabilities and limitations
 - structured cabling regulations and warranties
- Differentiate between active components:
 - a hub and a repeater
 - a switch and a bridge
 - a gateway
- Observe installation constraints: health, security, warranty, technical approval.

C3.04 IP communications [2,5]

- Explain the characteristics of Internet Protocol (IP) and other protocols:
 - o ICMP
 - o DHCP
 - o ARP
 - o the IP addressing scheme
 - o the relationship between IP addresses and network classes
- Apply subnetting and CIDR concepts.
- Distinguish logical from physical addresses.
- Evaluate the functions of a router, and those of a layer-3 switch.
- Differentiate between a generic port and a well-known-port.
- Explain the purposes and characteristics of TCP and UDP protocols:
 - o TCP main mechanisms (PAR, flow control, multiplexing, urgent data signalling, etc.)
 - o TCP session opening and closing
 - o features of UDP protocol
 - o differences between TCP and UDP
- Differentiate between PPP and SLIP.
- Explain the purposes and operations of
 - o Network Address translation (NAT)
 - o (address) proxy
 - o a firewall and its functions
 - o Domain Name System (DNS)
 - o naming of Internet hosts
 - o resource descriptor
- Outline how a Domain Name is translated into an IP address.
- Differentiate between the purpose and the working principles of TELNET and FTP protocol.
- Use an FTP program for simple file transfers (connect as normal user or guest, change and list directories on local and remote computer, set passive mode; send / receive one or multiple files using binary and/or ASCII transfer).
- Obtain IP base parameters: IP number, IP Mask, Default gateway, DNS server(s).
- Configure IP base parameters on different platforms (Windows, Apple, Linux), such as IP address, WINS, Gateway and DNS.
- Install, configure and remove network services on a server.

C3.05 Non-IP network protocols [2,5]

- Connect a computer to a token ring network, being aware of:
 - o the token ring architecture (topology, physical layer media and data transmission rates)
 - o the medium access control protocol in a token ring network
 - o pros and cons of a token passing system
- Differentiate between other protocols, i.e. FDDI, ATM and Frame
 - o FDDI network system structure.
 - o data rate and distance limits in a FDDI network system
 - o medium access control in a FDDI system
 - o ATM logical connections (transmission path, virtual path, virtual channel)

- distinguish cells from packets
- the ATM layer functions (switching, multiplexing, routing, congestion management)
- the range of data transmission rates in ATM systems
- Frame Relay logical connections (virtual circuit, permanent virtual circuit, datalink connection identifier, multilink frame relay, aggregated virtual circuit)
- the FR layer functions (switching, multiplexing, routing, congestion management)
- the range of data transmission rates in Frame Relay systems

C3.06 Modem and modulations [2,5]

- Explain the main principles and standards in modulation:
 - properties of analog and digital signals
 - the need for modulation
 - the function of a modem
 - DTE and DCE
 - three basic encoding techniques: ASK, FSK and PSK
 - QPSK and QAM
 - the most common modem protocols such as XMODEM, YMODEM, ZMODEM, KERMIT etc.
 - the most common modem communications standards, such as V.90, V.42 etc.
 - how hardware (RTS/CTS) and software (XON/XOFF) flow control works
 - HAYES standard and its most common commands such as AT, ATZ, ATD, ATH etc.
- Distinguish between communication modes (simplex, half-duplex, full duplex).
- Distinguish between transmission types (asynchronous, synchronous, serial, parallel).
- Explain the following concepts and standard elements:
 - start bit, stop bit, parity and data bit
 - SYNC, STX, ETX, ACK and NACK
 - channels and bandwidths
 - how data is transferred via a modem
 - the difference between BPS and Baud and when they are used
 - what UART does
 - the different types of UART and their features
 - how ISDN-communication works and its benefits
 - the different types of ISDN and the differences between B- and D channel
 - how DSL- technology works and its benefits
 - the different types of DSL, such as ADSL, HDCL, SDSL and VDCL. Also explain the differences between them o RAS & PPP/SLIP negotiation phase hints
- Install and manage modems and WAN links using the above concepts.

C3.07 Routing [2,5]

- Apply routing concepts:
 - o OSI model, addressing and routing
 - o ES and IS protocols
 - o static and dynamic routing, interior and exterior routing
- Describe autonomous systems, their needs and main characteristics.
- Differentiate between the main routing algorithms:
 - o distance vector algorithms
 - o link state algorithms
- Distinguish the main routing protocols:
 - o RIP
 - o EGP
 - o BGP
 - o IGRP, EIGRP
- Explain the characteristics of TCP/IP routing.

Incisive competence level [5,5]

C2.04 Essentials of Operating Systems & resource sharing [2]

- Differentiate between the most widespread operating systems:
 - o Linux/Unix, Windows, MacOS
- Cope with OS conceptual problems:
 - o concurrency management, deadlock and starvation
 - o scheduling, I/O operation and management
 - o file management systems
 - o user and access management
- Analyse network capabilities.
- Start and stop various network services.
- Measure and monitor system load:
 - o CPU (both mono- and multi-processor)
 - o network, memory, virtual memory and storage
 - o processes and threads; usage of shared resources
- Manage user accounts and groups and set up related security policies.
- Apply interoperability tips (file formats, available protocols, etc.)
- Manage RAID technology, NAS e SAN subsystems
- Manage Backup libraries
- Explain and differentiate between different resource sharing principles:
 - o the DAC, MAC, RBAC policies
 - o the purposes of file sharing
 - o different permission levels
 - o the concepts of login and logon-script
 - o different types of shareable objects: files, folders, printers, modems, ...
- Check the available shared resources in a network.
- Control the permissions to shared resources.
- Evaluate the risk associated with a network logical drive.
- Connect a client to a shared resource on a server.
- Distinguish between Peer to Peer and Domain based Networks.

- Use the shared resource manager utilities.
- Access shared objects (disks, directories, modem, printers) using Windows, Apple Macintosh, Linux/Unix.
- Use sharing services through VLAN over the Internet.

C4.01 Network Security [1,5]

- Explain what can be considered good practice in Internet access.
- Distinguish between basic categories of viral software (trojan, virus, worms, etc.).
- Install and operate a network analyser.
- Evaluate the risk of services as access points of servers.
- Set up the minimum and safest set of services that can be enabled on Internet servers.
- Disable the set of services that are usually enabled on non_internet servers only.
- Adopt countermeasures against the main types of wicked usage:
 - o abusive usage
 - o denial of service
 - o data falsification
- Adopt countermeasures against the main points of vulnerability:
 - o usual authentication schemes
 - o weakness of protocols or software on servers
 - o clients that can be as vulnerable as servers
- Know how to limit spoofing in its various flavours (IP, ARP, email,...).
- Recognise good practice in
 - o securing and using a non-internet server
 - o securing and using an internet server.
- Manage network authentication.
- Manage cryptographic key-based network authentication.
- Use domain_based authentication.
- Evaluate a firewall, its limits and potentials, different firewall architectures (gateways, circuits etc.).
- Properly use the term “DeMilitarised Zone” and assist in its implementation.
- Evaluate a proxy and its functionality
 - o to save IP addresses
 - o to secure internal network.
- Explain what a Network Address Translation (NAT) is and how it works.
- Apply IP firewall principles in restricting IP services access.
- Apply proxy firewall principles in restricting and securing protocol handling.
- Use network utilities to configure, manage and trace network usage.
- Know how to create and configure a local proxy.
- Install a firewall and a proxy server and implement a security policy.
- Hide IP-addresses using a firewall.
- Set up NAT on a firewall.
- Set up access control rules on a firewall.
- Evaluate the risk of intrusions and ethical issues:

- basic forms of computer crime
- basic categories of intrusion detection systems
- ethical issues (monitoring in the job, surveillance)
- basic deontology codes and code of Ethics (case studies: ACM, BCS, IEEE, etc)
- basic aspects of hacker ethics
- basic mailing_lists and URLs concerning all above security areas
- ISO17799 standard, its purposes and its implementation process
- Know how to monitor security logs and events.
- Know cookies and how to manage them (enable - disable cookies).
- Install and manage a cookie buster program.
- Comply with legal requirements such as the 2002/58/EC directive on privacy and electronic communication.

C6.02 Network troubleshooting [1]

- Diagnose the reason why a user cannot gain access to the network.
- Locate the source of the problem (server, cable, NIC, drivers, etc).
- Diagnose and troubleshoot user permissions.
- Diagnosing and troubleshoot local and domain user accounts, if any domain is available.
- Diagnose and repair communication problems, such as modem and internet communication problems.
- Troubleshoot problems with hardware.
- Diagnose printing problems.
- Diagnose hardware problems such as problems with the cable, NIC, etc.
- Use heartbeat and related loop led indicators.
- Diagnose and troubleshoot the TCP/IP protocol.
- Diagnose and troubleshoot performance problems.
- Use ICMP to test network.
- Use the "ping" command to test name lookup.
- Use "nslookup" or "dig" to test DNS operations.
- Use the "route" command to verify outgoing packets.
- Use the "tcpdump" to monitor packets.
- Use the "tracert" command to check how packets reach a given server.
- Use the "nslookup" MX query to discover mail servers.
- Use the Telnet program to manually simulate SMTP simple session, verify existence of an account, and send an email.
- Use the Telnet program to simulate a POP3 / IMAP session and get a list of pending messages.
- Use the Telnet program to simulate a HTTP session and download a page to test server operations.
- Measure performance according to appropriate units of measure.
- Monitor the network to analyse traffic.
- Maintain statistical and historical traffic data.

A7.08 Legal aspects of telecommunications [1]

- Evaluate the applicability of different laws and regulations on telecommunications:
 - o European laws (ETSI)
 - o National laws
- Evaluate the applicability of various laws and regulations having an impact on a telecommunications system:
 - o safety laws
 - o building regulations
- Find, analyse and apply specific limitations and obligations deriving from national and international regulations.

External references to SFIA[®] version 3 by the SFIA Foundation

Skill 20: Network Design

“The production of network designs and design policies, strategies, architectures and documentation, covering voice, data, text, e-mail, facsimile and image, to support business requirements and strategy. This may incorporate all aspects of the communications infrastructure, internal and external, mobile, public and private, Internet, intranet and call centres”.

Level 5

Skill 47: Radio frequency engineering

“The deployment, integration, calibration, tuning and maintenance of radio frequency (RF) and analogue elements of IT systems.”

Levels 4 and 5

Skill 11: Systems Architecture

“The specification of systems architectures, identifying the components needed to meet the present and future requirements, both functional and non-functional (such as security) of the business as a whole, and the interrelationships between these components. The provision of direction and guidance on all technical aspects of the development of, and modifications to, information systems to ensure that they take account of relevant architectures, strategies, policies, standards and practices and that existing and planned systems and IT infrastructure remain compatible.”

Level 5

Skill 15: Network Planning

“The creation and maintenance of overall network plans, encompassing the communication of data, voice, text and image, in the support of an organisation's business strategy. This includes participation in the creation of service level agreements and the planning of all aspects of infrastructure necessary to ensure provision of network services to meet such agreements.”

Level 5

Skill 3: Technical Specialism

“The management and provision of expert advice on a specific technical specialism. Examples of specialism can be any technology, technique, method, product or application area.”

Level 5

Skill 4: Research

“The advancement of knowledge in one or more fields of information technology by innovation, experimentation, evaluation and dissemination, carried out in pursuit of a predetermined set of research goals.”

Level 4 and 5

External references to AITTS by the German Government – Arbeitsprozessorientierten Weiterbildung in der IT-Branche

Profil 3.6: Network Developer (Netzplaner/in)

“Network Developer planen und konzipieren komplexe, mittlere bis große IT-Fest- oder Funknetze sowie die Erweiterung und Modernisierung bestehender Netze und Teilnetze unter Berücksichtigung der aktuellen und voraussichtlich zukünftigen Situation und Anforderungen sowie wirtschaftlich vertretbaren Reserven für zukünftige Anforderungen des Auftraggebers. Network Developer kennen den neuesten Stand der Entwicklung von Protokollen, Standards und Technologien im Bereich Übertragungsmedien und aktive Netzwerkkomponenten. Sie haben einen umfassenden Überblick der am Markt operierenden Hersteller und ihrer Produkte.”

External references to Nomenclature 2005 by CIGREF (club informatique des grandes entreprises françaises)

Métier 5.2: Expert réseaux / télécoms

*“L’expert effectue une vielle technologique, il définit l’architecture du réseau de l’entreprise ou de projets spécifiques.
Il est l’interface reconnue des experts externes.
Il assure un rôle de conseil, d’assistance, d’information, de formation et d’alerte. Il peut intervenir directement sur tout ou partie d’un projet qui relève de son domaine d’expertise.”*

(?) Métier 6.3: Responsable télécoms

“Le responsable télécoms et réseaux est chargé de la gestion des infrastructures de télécommunication de l’entreprise. Considéré comme un maître d’ouvrage vis-à-vis des opérateurs et comme un maître d’œuvre et un prestataire de services interne vis-à-vis des autres directions de l’entreprise, ses missions vont de la définition de l’architecture à l’achat des services télécoms, en passant par le contrôle de gestion et la vielle au sens large. Le responsable télécoms et réseaux peut être chargé du déploiement et de l’exploitation de l’infrastructure, ainsi que de la gestion et de l’encadrement d’une équipe télécoms. Son champ d’action recouvre les services voix, données et le services internet de l’entreprise au niveau national et international. Le responsable télécoms est généralement rattaché à la direction des systèmes d’information, au moins sur la partie données. En revanche la téléphonie est souvent gérée dans chaque établissement ou par pays.”

(?) Métier 5.4: Expert en technologie Internet / intranet et multimédia

“Il conçoit l’architecture d’un système multimedia de communication sur différents types de supports. Il conçoit et pilote le déploiement.”