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EUCIP

European Certification of
Informatics Professionals

EUCIP X-Systems Engineer

Elective Level Profile Specification

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Short Description

A EUCIP X-Systems Engineer is expected to have a specific competence on various operating systems and related troubleshooting methods, performance tuning, system-level programming and cross-platform integration; diagnosing and problem solving attitudes are required in order to provide support both on proprietary and open systems, including hybrid configurations.

This profile requires a minimum work experience of **36** months in a compatible job role; if this requirement is not fulfilled, the candidate might be certified as an **Associate** X-Systems Engineer.

Tasks Overview

Takes care of the computing requirements, managing the provision of agreed quality of services and support, keeping in touch with client/user representatives to ensure that requirements (particularly computer performance, recovery, and security needs) are reflected in the overall configurations. Identifies potential risk exposures of all components of computing systems and defines prioritised actions to address the potential exposures to a level approved by the organisation's senior management.

Where service is provided by an external supplier, supports contract negotiation to provide the service level required, establishing problem resolution procedures and defining consequences of non-compliance. Interfaces with designers and planners from external suppliers and application service providers and works within the team which administers the procurement of equipment, software, transmission services, and other services, including remedy action on non-compliance.

Working alone on moderately complex computer installations, or with consultants on larger or more complex systems (i.e.: clusters), defines system architectures and criteria, specifies user/system interfaces, documenting all work using required standards, methods and tools and plays a leading role in scheduling installation work, liaising with all concerned to ensure that installation priorities are met and disruption to the organisation is minimised.

Takes responsibility for installing and upgrading of computer systems carrying out routine configuration/installation and reconfiguration of hardware and software utilising the appropriate tools and test equipment.

Diagnoses and solves problems (e.g. poor performance) and faults (e.g. system failure) occurring in the operation of hardware and software, ensuring that account is taken of agreed levels of service and the needs for quality, security, availability and safety.

Uses system tools to investigate, diagnose and solve problems and to determine system load and model performance statistics, creating proposals for improvement.

Responds to enquiries by help desk staff, specialists or others and deals effectively with a broad range of problems of moderate complexity, ensuring that documentation of the supported systems and software is available and in an appropriate form.

Investigates and reconciles violation reports and loggings generated by automated policing mechanisms. Interviews offenders and provides recommendations for management follow-up. In touch with security consultants, devises new or revised procedures relating to security control of all system related environments, products or services in order to foster continual improvement in control.

Evaluates general enhancements, capacity changes, contingency and recovery arrangements as required and is aware of operational requirements especially in terms of service levels, systems availability, response times, security and repair times. Reviews systems costs against external service providers, new developments and new services, initiating proposals to change system architecture and components where appropriate cost reductions and benefits can be achieved.

Obtains and evaluates proposals from suppliers of equipment, software, and other network service providers.

Essential Behavioural Skills [3]¹

The X-Systems Engineer role requires initiative, flexibility and a rational mental attitude capable of conceptual and analytical thinking, even under stressful conditions: a persistent goal-oriented approach in a long term perspective has to be combined with strong attention to detail.

Another essential set of skills is the ability to communicate and interact effectively (in both oral and written form) with colleagues and clients, including people not having a technical background: this shall include a good organisational and cross-functional awareness, determination, efficiency in information acquisition, as much as the ability to plan in a clean-headed way, organise, make decisions, provide direction and follow-up.

Last but not least, the capacity to compare different technologies and products in respect to specific needs is a must.

¹ numbers in brackets represent EUCIP points

Detailed Skills Required

Deep competence level [15]

C2.01 Operating Systems [4]

- Differentiate between the most widespread operating systems:
 - o Linux/Unix
 - o Windows
 - o MacOS
- Install and upgrade the above OSs.
- Cope with OS conceptual problems:
 - o concurrency management, deadlock and starvation
 - o scheduling
 - o I/O operation and management
 - o file management systems
 - o user and access management
- Analyse network capabilities.
- Configure network interfaces.
- Configure various network protocols and services (including http, SMTP, POP, IMAP, DNS).
- Start and stop various network services.
- Publish resources on the network (e.g. shared printers and folders).
- Measure and monitor system load:
 - o CPU (both mono- and multi-processor)
 - o network
 - o memory and virtual memory
 - o storage
 - o processes and threads
 - o usage of shared resources
- Tune the system to reach required performances.
- Manage user accounts and groups and set up related security policies.
- Apply interoperability tips (file formats, available protocols, etc.).
- Set up systems to reach the needed level of interoperability between heterogeneous OSs.
- Use performance boosting techniques such as clustering.
- Set up clustering.
- Perform troubleshooting.
- Perform system recovery.

C2.02 Resource sharing [3,5]

- 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, ...

- the principle of operations, main features and differences of NetBIOS, NETBEUI, SMB and CIFS protocols,
- the server browsing operation,
- the master browser elections and operations,
- main principles of Apple sharing services (AFP, ...),
- main principles of Novell IPX/SPX protocols.
- Compare the different protocols and their interoperability.
- Check the available shared resources in a network.
- Know how to create shared resources, such as folders and printer.
- Know how to check which users use shared resources at any one time.
- Control the permissions to shared resources.
- Know how to remove shared resources.
- Know how to disconnect users from a shared resource.
- Evaluate the risk associated with a network logical drive.
- Connect a logical network drive to a shared resource.
- Connect a client to a shared print resource, using a logical print port.
- Connect a client to a shared resource on a server.
- Distinguish between Peer to Peer and Domain based Networks.
- Establish a policy on permissions for shared resources available through the operating system.
- Set up a validation level (user vs share).
- Set, remove and modify permissions for a user or a group.
- Use the shared resource manager utilities.
- Check users' login and know how to force a user to log out from the network.
- Maintain users/groups in a domain both with Windows, MacOS, and Unix/Linux systems.
- Configure access to Novell network from Windows systems.
- Install Novell IP tunnelling.
- Install Ethernet and IP encapsulated sharing services on Windows and Linux/Unix platforms.
- Know how to install a network printer.
- Know how to connect and use a shared printer and control permissions.
- Know how to cancel or pause a print job. Also know how to reorder it if possible.
- Access shared objects (disks, directories, modem, printers) using Windows, Apple Macintosh, Linux/Unix.
- Stop network printing.
- Activate and deactivate auto-mounting of shared objects using Windows or Apple Macintosh.
- Use sharing services through VLAN over the Internet.
- Setup VLAN to share services over the Internet.

C2.03 Operating System tailoring [4]

- Manage OS kernel:
 - determine what kernel options are needed for a particular job
 - configure kernel options
 - compile kernel with given options
- Manage drivers and modules:

- know basic concepts
- know principle of operations of kernel modules (drivers)
- know pros and cons of monolithic kernel vs. loadable drivers
- compile and install kernel modules
- manage modules and drivers
- Manage programs and libraries:
 - identify binary formats
 - know use and limits of programs, static libraries, dynamic libraries
 - compile to obtain programs, static libraries, dynamic libraries
- Manage mass memories:
 - concepts of Physical and Logical Volumes
 - principles of Journaling operations
 - principle of RAID operations
 - RAID levels
 - HW and/or SW RAID implementations
 - recovery management
 - Hot Swap and spare disks
- Manage wired Network Interface Cards:
 - Client side: static, dynamic (DHCP, BOOTP)
 - Server side: offering DHCP and BOOTP
- Manage wireless Network Interface Cards:
 - different modes (infrastructure, ad-hoc, AP)
 - security implementation
- Tailor the OS
 - backup and restore implementation
 - perform simple shell programming
- Make some OS performance tunings:
 - measure the performances of a given system
 - modify HW/SW components and configurations in order to obtain performances level needed for a given job
- Troubleshoot OS operations:
 - read system logs to individuate problems
 - increase/reduce the system log output
 - identify and solve hardware-related problems
 - identify and solve network-related problems

C4.02 World Wide Web [3,5]

- Configure clients and support users in understanding:
 - the definition of Universal Resource Locator (URL),
 - the WWW as a client-server application,
 - the role of the server,
 - the role of the client and the configuration of its browser,
 - the operations of HTTP and S-HTTP protocols,
 - http content-type headers vs MIME standard,
 - the aim of main markup languages (HTML, SGML, XML, CSS, XSL) and style sheet,
 - the concept of the Common Gateway Interface (CGI),
 - the concept of an applet,
 - cookies, their benefits and dangers.
- Perform main browser setup (proxy, plug-in, etc.).
- Install configure and manage a simple web service.

- Explain how to distinguish a secure connection from an insecure one and when it is necessary to use a secure transaction.
- Enable and disable cookies, ActiveX, Java, and JavaScript. server etc.
- Apply and support users in understanding the common rules of Netiquette.
- Verify and explain how to verify correct implementation of standards in web pages.
- Know the accessibility guidelines and the tools used to evaluate them.
- Know standard bodies such as W3C (World Wide Web Consortium).

Incisive competence level [14]

C3.01 Network principles and standards [1,5]

- 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:
 - o Busnet
 - o Ringnet
 - o Starnet
 - o 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:
 - o the TCP/IP suite
 - o the OSI model
 - o purpose of the layered reference model (principle of encapsulation and service access points in layer models)
 - o main standard organisations, such as CCITT, ITU-TS, IEEE, ISO and IAB and domains they are focusing on
 - o aim of the different layers (physical, data link, network, transport, session, presentation, and application).

C3.06 Modem and modulations [1,5]

- Explain the main principles and standards in modulation:
 - o properties of analog and digital signals
 - o the need for modulation
 - o the function of a modem
 - o DTE and DCE
 - o three basic encoding techniques: ASK, FSK and PSK
 - o QPSK and QAM
 - o the most common modem protocols such as XMODEM, YMODEM, ZMODEM, KERMIT etc.
 - o the most common modem communications standards, such as V.90, V.42 etc.
 - o how hardware (RTS/CTS) and software (XON/XOFF) flow control works
 - o 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:
 - o start bit, stop bit, parity and data bit
 - o SYNC, STX, ETX, ACK and NACK
 - o channels and bandwidths
 - o how data is transferred via a modem
 - o the difference between BPS and Baud and when they are used
 - o what UART does
 - o the different types of UART and their features
 - o how ISDN-communication works and its benefits
 - o the different types of ISDN and the differences between B- and D channel
 - o how DSL- technology works and its benefits
 - o 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.

C3.04 IP communications [1,5]

- 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.

C4.03 E-Mail principles and management [2]

- Install and use mail client software, supporting other users to understand:
 - o e-mail addresses structure
 - o RFC822 standard
 - o POP3 protocol
 - o IMAP protocol
 - o SMTP protocol
 - o SMTP and its components (sender, protocol, receiver)
 - o relaying and related problems
 - o data transmission limitation with SMTP
 - o MIME standard
 - o ASCII, ANSI and UNICODE standards, the ASCII limits on national languages (concept of character set), computers internal data encoding (binary files vs. text files, test files EOL encoding in DOS/Windows, Apple and Unix/Linux system), and computers internal number encoding (high end vs. low end, canonical representation)
 - o Different compressed formats (HQX, BIN), the purposes of file compression and the main standards for known platforms (ZIP, GZ, ARC for DOS/Windows; SIT, CPT for Macintosh; GZ, Z, TAR, ZIP for Unix)
 - o chat and messaging systems
 - o the purposes and uses of mailing lists
 - o the purposes, uses, and working of Usenet and newsgroups
 - o the purposes, uses and working principles of forums
 - o the purpose of Netiquette
- Configure the mail software, such as POP3, IMAP, HTTP, News server etc.
- Configure e-mail accounts and related items (POP or IMAP server, SMTP server, etc.).
- Configure e-mail automatic handling rules.
- Setup coding rules (HTML vs text).
- Access and use webmail applications.
- Install, configure and manage a simple mail server on different platforms (Linux, Windows, Apple).

B1.12 Defining a solution architecture [1]

- Gather and analyse:
 - o user requirements,
 - o operational requirements,
 - o system requirements for hardware, software, and network infrastructure.

- Transform requirements into functional specifications: considerations include performance, maintainability, extensibility, scalability, availability, deployability, security, and accessibility.
- Transform functional specifications into technical specifications: considerations include performance, maintainability, extensibility, scalability, availability, deployability, security, and accessibility.
- Select the appropriate technologies for the physical design of the solution.
- Create the physical design for:
 - o the solution,
 - o deployment,
 - o maintenance,
 - o the data model.
- Create specifications for auditing and logging.
- Validate the physical design.

B2.07 Database creation and maintenance [1]

- Describe the main architectural components of a DBMS.
- Start-up the DBMS server process.
- Manage a DB instance.
- Create a new DB.
- Analyse and maintain Data Dictionary content.
- Analyse and maintain the Control File.
- Analyse and maintain Redo Log /Journaling files.
- Analyse and manage Tablespaces and Data files.
- Manage storage structure and relationships.
- Manage Undo Data.
- Manage Tables and Indexes.
- Know how to assure Data Integrity.
- Load Data into a DB.
- Import and export data: methods include the bulk copy.

B3.02 Languages [2,5]

- Write effective source code in a specific procedural programming language.
- Example: Basic, Pascal, C, Cobol, etc.
- Use a specific OO programming language.
- Example: C++, Java, Delphi, etc.
- Use a scripting language.
- Example: PERL, Python, PHP, Ruby, etc.
- Define the principles of Mark-up Languages.
- Use Extensible Mark-up Language (XML), use provided tools to execute XML-friendly database queries, employ XML technology in programs and applications, know XSLT and how to use it to transform a document.

A1.02 Requirements engineering [1]

- Distinguish between Functional and Non-Functional requirements.
- Use What, Why, How questioning to elicit requirements.
- Differentiate between requirements and project constraints.

- Identify the Actors in the Requirements Management process: Domain Expert, End User, Requirements Engineer, and Developer.
- Perform requirements elicitation.
- Perform Problem and Business understanding activities.
- Understand the needs and constraints of stakeholders.
- Use Creative thinking and related techniques (e.g. interviews and scenarios, observation, prototyping, workshops, generic requirements for industry sector).
- Prioritise Requirements (e.g. 80/20, MoSCoW, Needs and Musts).
- Resolve overlapping requirements.
- Judge whether a problem is a cause or symptom.
- Resolve conflicting requirements.
- Reduce ambiguity of requirements .
- Ensure Testability of requirements.
- Support requirements validation via reviews and prototyping.
- Achieve Requirement Refinement.
- Manage the requirements definition process.
- Differentiate between stable and volatile requirements.
- Apply versioning principles to requirements documents.
- Establish traceability and ownership of requirements.
- Use CASE Tools for requirements management.
- Act as an effective member of a team involved in eliciting and recording user requirements for an Information System.
- Apply a range of elicitation techniques effectively.

A5.03 Project coordination [1]

- Coordinate a software development project: planning, control, organisation, configuration management, version control, quality assurance, metrics.
- Establish standards applying to development documentation, coding, code review, UI, and testing.
- Establish processes: processes include reviewing development documentation, reviewing code, creating builds, tracking issues, managing source code, managing change, managing release, and establishing maintenance tasks.
- Contribute to establishing quality and performance metrics to evaluate project control and organisational performance.
- Report actual progress of activities against an agreed plan.

A6.02 Develop in a collaborative environment [1]

- Use tools for team work in a collaborative environment.
- Cope with primary issues related to a team work.
- Manage Version Control, Technical Documents, and Distribution tools.
- Manage Build and Test.
- Use messaging tools such as IM, Mailing List, discussion boards.
- Facilitate a collaborative environment.
- Apply procedures for team work.
- Acknowledge the importance of an established set of documentation and coding standard.

- Exploit detailed knowledge and troubleshooting hints available through virtual communities of developers.

Annexes

Sample Learning Modules	EUCIP Points
EUCIP CORE PLAN	X
EUCIP CORE BUILD	X
EUCIP CORE OPERATE	X
EUCIP IT ADMINISTRATOR	
1. Hardware	C 1/5
2. Operating Systems	C 4/5
3. LAN & Network Services	D 4/9
	E 1/6
4. Network expert use	E 5/6
5. IT Security	B 1/6
	D 2/9
Univ. Information Systems	A 2/3
	D 2/9
Univ. SW Engineering	A 1/3
	B 4/6
Univ. Telecommunication Networks	E 4/6
	D 2/9
Univ. Operating Systems	D 5/9
Cisco Networking Academy	
CCNA1 + CCNA2	E 6/6
IBM Test 141: XML and Related Technologies	B 1/6
IBM Test 154: Web Developer	B 3/6
IBM Test 285: Developing with IBM WebSphere Studio v5	B 3/6
IBM AIX Admin	C 5/5
IBM System Expert pSeries HACMP	D 5/9
Microsoft Certified Solution Developer (MCSD)	
MS 70-300: Analyzing Requirements and Defining Solution Architectures for Microsoft .NET	A 1/3
MS 70-305: Developing and Implementing Web Applications with Microsoft Visual Basic .NET and Microsoft Visual Studio® .NET OR 70-315: Developing and Implementing Web Applications with Microsoft Visual C# .NET and Microsoft Visual Studio .NET	B 3/6
MS 70-306: Developing and Implementing Windows-based Applications with MS Visual Basic .NET and MS Visual Studio .NET OR 70-316: Developing and Implementing Windows-based Applications with MS Visual C# .NET and MS Visual Studio .NET	B 3/6
MS 70-310: Developing XML Web Services and Server Components with Microsoft Visual Basic .NET and the Microsoft .NET Framework OR 70-320: Developing XML Web Services and Server Components with Microsoft Visual C# .NET and the Microsoft .NET Framework	B 3/6
MS 70-229: Designing and Implementing Databases with MS SQL Server 2000 Enterprise Edition (or equivalent*)	B 1/6
Microsoft Certified Systems Administrator (MCSA*)	
MS 70-270: Installing, Configuring, and Administering Microsoft Windows XP Professional	C 5/5
MS 70-290: Managing and Maintaining a Microsoft Windows Server 2003 Environment	D 5/9
MS 70-291: Implementing, Managing, and Maintaining a Microsoft Windows Server 2003 Network Infrastructure	E 6/6

Sample Learning Modules	EUCIP Points
1Z0-031: Oracle9i Database Administration Fundamentals I	B 1/6
1Z0-141: Oracle Forms Developer - Build Internet Applications	B 2/6
Sun Certif. System Administrator for the Solaris OS	C 5/5
	D 5/9
Sun Certif. Developer for the Java2 Platform	B 3/6
Sun Certif. Network Administrator for the Solaris OS	E 6/6

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

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 12: Emerging technology monitoring

“The identification of new and emerging hardware, software and communication technologies, products, methods and techniques and the assessment of their relevance and potential value to the organisation. The promotion of emerging technology awareness among staff and business management.”

Level 5

Skill 19: Systems design

“The specification and design of information systems, their components and architecture to meet defined business needs.”

Levels 4 and 5

Skill 33: Systems installation/decommissioning

“The installation, testing, implementation or decommissioning and removal of cabling, wiring, equipment, hardware and appropriate software, following plans and instructions and in accordance with agreed standards. The testing of hardware and software components, resolving malfunctions found and recording the results. The reporting of details of hardware and software installed so that configuration management records can be updated.”

Levels 4 and 5

Skill 45: System software

“Specialist technical expertise in the installation and maintenance of system software such as operating systems, data management products, office automation products and other utility software.”

Levels 4 and 5

(?) Skill 52: Management and operations

“The management and operation of the IT infrastructure (typically hardware, software and communications) and the resources required to plan for, develop, deliver and support properly engineered IT services and products to meet the needs of a business. Includes preparation for new or changed services, management of the change process and maintenance of regulatory, legal and professional standards, management of performance of systems and services in relation to their contribution to business performance and management of bought-in services including, for example, public network, virtual private network and outsourced services.”

Levels 4 and 5

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

Profil 5.2: IT Systems Administrator (IT-Systemadministrator/in)

“IT Systems Administrator konfigurieren, betreiben, überwachen und pflegen vernetzte Systeme sowie System- und Anwendungssoftware.”

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

Métier 3.6: Intégrateur d’exploitation

“À la demande du maître d’ouvrage et sous la conduite du responsable d’exploitation du SI, il intègre dans l’environnement de production la solution logicielle livrée par l’intégrateur d’applications et en assure le déploiement.”

Métier 5.1: Expert système d’exploitation

“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.

L’expert système d’exploitation effectue une veille technologique, il participe aux études de l’architecture technique générale et de son évolution ainsi qu’à la qualification des plates-formes informatiques.

Il est l’interface reconnue des experts externes.”