

Technical Description  
**IT Network Systems  
Administration**



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# 1 Introduction

## 1.1 Name and description of the skill competition

### 1.1.1 The name of the skill competition is

IT Network Systems Administration

### 1.1.2 Description of the associated work role(s) or occupation(s)

IT network system administrators work in small to large organisations, in public and private sectors, offering a wide range of IT services which are critical to the daily operations of businesses and institutions. Besides performing user support tasks, troubleshooting, design, installation, upgrading and configuration of operating systems and network devices, they offer advice and guidance on the development of systems and services. They have the responsibility of working professionally and interactively with users to meet their needs and ensure the continuity of the systems and business operations.

IT network system administrators work in diverse environments, including network operations centers, internet service providers, data centers and climate-controlled server rooms. They offer a wide range of services based on user support, troubleshooting, design, installation/upgrading and configuration of operating systems and network devices

IT network system administrators may, at some stage in their careers, specialise in user support, design, installation of operating systems or configuration of networking devices. Attributes such as the capacity to self-organize, self-management, communication and interpersonal skills, problem-solving, a dedication to research and keeping up to date with industry developments and a consistently methodical and investigative approach are the universal attributes of the outstanding IT network system administrator.

In a mobile labour market, the IT network system administrator may work in teams, or alone, or both from time to time. Whatever the structure of the work, the trained and experienced Specialist takes on a high level of personal responsibility and autonomy.

With the fast globalisation of IT systems and the international mobility of people, IT network system administrators face rapidly expanding opportunities and challenges. For the talented Specialist, there are many commercial, public sector and international opportunities that require the need to understand and work with diverse cultures and keep up to date with fast-changing industry developments and standards.

## 1.2 The content, relevance and significance of this document

This document incorporates a Role Description and Occupational Standards which follow the principles and some or all of the content of the WorldSkills Occupational Standards. In doing so WSE acknowledges WorldSkills International's (WSI's) copyright. WSE also acknowledges WSI's intellectual property rights regarding the assessment principles, methods and procedures that govern the competition.

Every Expert and Competitor must know and understand this Technical Description.

In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

## 1.3 Associated documents

Since this Technical Description contains only skill-specific information it must be used in association with the following:

- WSE – Competition Rules
- WSI – WorldSkills Occupational Standard framework
- WSE – WorldSkills Europe Assessment Strategy
- WSE – Online resources as referenced in this document
- WSE – Code of Ethics and Conduct
- Host Country – Health and Safety regulations

## 2 The Occupational Standards

### 2.1 General notes regarding WSOS / WSEOS

Where appropriate WSE has utilised some, or all, of the WorldSkills International Occupational Standards (WSOS) for those Skills Competitions that naturally align between the two international competitions. Where the Skill is exclusive to the EuroSkills Competition, WorldSkills Europe has developed its own Occupational Standards (WSEOS) using the same principles and framework to that used for the development of the WSOS. For the purposes of this document the use of the words “Occupational Standards” will refer to both WSOS and WSEOS.

The Occupational Standards specifies the knowledge, understanding and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business. Helpfully, for the global consultation on the WSOS in 2014-2021, around 50 percent of responses came from European industry and business.

Each Skill Competition is intended to reflect international best practice as described by the Occupational Standards, and to the extent that it is able to. The Occupational Standards is therefore a guide to the required training and preparation for the Skill Competition.

In the Skill Competition the assessment of knowledge and understanding will take place through the assessment of performance. There will not be separate tests of knowledge and understanding.

The Occupational Standards are divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Occupational Standards. The sum of all the percentage marks is 100.

The Marking Scheme and Test Project will assess only those Skills that are set out in the Occupational Standards. They will reflect the Occupational Standards as comprehensively as possible within the constraints of the Skill Competition.

The Marking Scheme and Test Project will follow the allocation of marks within the Occupational Standards to the extent practically possible. A variation of five percent is allowed, provided that this does not distort the weightings assigned by the Occupational Standards.

### 2.2 Occupational Standards

Section		Relative importance (%)
1	<b>Work organization and self-management</b>	5
	<p><b>The individual needs to know and understand:</b></p> <ul style="list-style-type: none"> <li>• Work process planning methods</li> <li>• Tasks decomposition and prioritization methods</li> <li>• The importance of verifying the work performed in each of its aspects</li> <li>• How to work effectively as part of a team</li> <li>• Material demonstration and presentation methods</li> <li>• Current trends in information technology</li> </ul>	

Section		Relative importance (%)
	<ul style="list-style-type: none"> <li>• Modern approaches in IT infrastructure architecture</li> <li>• Modern industry standards, best practices and professional certification systems</li> <li>• Standards of professional communication</li> </ul>	
	<p><b>The individual shall be able to:</b></p> <ul style="list-style-type: none"> <li>• Develop documentation for the existing or planned enterprise IT infrastructure</li> <li>• Give recommendations and requirements based on requests and needs of a customer</li> <li>• Build effective written and oral communication</li> <li>• Apply analytical skills to diagnose and troubleshoot IT infrastructure issues</li> <li>• Accurately describe the incident and document problem solution</li> <li>• Search for information in open sources and work with technical documentation</li> <li>• Select appropriate technologies for a specific use case considering best practices</li> <li>• Introduce various tools and services into the corporate information infrastructure to ensure the internal technological business processes of the organization</li> <li>• Formalize routine operations of IT infrastructure maintenance in the form of scripts in various programming languages</li> <li>• Use modern tools for automation of deployment and configuration management</li> <li>• Describe the infrastructure declaratively (like code)</li> <li>• Effectively implement pipelines for continuous integration, delivery, and deployment of configurations and applications.</li> </ul>	
2	<b>Communication and interpersonal skills</b>	5
	<p><b>The individual needs to know and understand:</b></p> <ul style="list-style-type: none"> <li>• The importance of listening as part of effective communication</li> <li>• The roles and requirements of colleagues and the most effective methods of communication</li> <li>• The importance of building and maintaining productive working relationships with colleagues and managers</li> <li>• Techniques for effective team work</li> <li>• Techniques for resolving misunderstandings and conflicting demands</li> <li>• The process for managing tension and anger to resolve difficult situations</li> </ul>	
	<p><b>The individual shall be able to:</b></p> <ul style="list-style-type: none"> <li>• Demonstrate strong listening and questioning skills to deepen understanding of complex situations</li> <li>• Manage consistently effective verbal and written communications with colleagues</li> </ul>	

Section		Relative importance (%)
	<ul style="list-style-type: none"> <li>• Recognise and adapt to the changing needs of colleagues</li> <li>• Pro-actively contribute to the development of a strong and effective team</li> <li>• Share knowledge and expertise with colleagues and develop a supportive learning culture</li> <li>• Effectively manage tension/anger and give individuals confidence that their problems can be resolved</li> </ul>	
3	<b>Data Transfer Networks</b>	25
	<p><b>The individual needs to know and understand:</b></p> <ul style="list-style-type: none"> <li>• OSI model and the TCP/IP protocols stack</li> <li>• Operational principles of data-link, network and transport protocols</li> <li>• Roles and functions of different network components</li> <li>• Network topology types and usage scenarios</li> <li>• IPv4 and IPv6 network addressing concepts</li> <li>• Routing and switching concepts</li> <li>• Load balancing principles</li> <li>• Common types of attacks on network protocols and mitigation methods</li> <li>• Active network equipment management methods</li> <li>• Network function virtualization concepts and principles</li> <li>• Controller-based and software-defined network management approaches</li> </ul>	
	<p><b>The individual shall be able to:</b></p> <ul style="list-style-type: none"> <li>• Perform basic initialization of active network equipment</li> <li>• Configure access, aggregation and core level switching</li> <li>• Provide enterprise-wide connectivity using internal and external gateway routing protocols</li> <li>• Provide network fault tolerance at routing and switching levels</li> <li>• Apply basic security configuration for control and data plane</li> <li>• Provide network connectivity between remote branches</li> <li>• Effectively use network discovery and traffic analysis tools</li> <li>• Configure access, aggregation and core level switching               <ul style="list-style-type: none"> <li>◦ STP</li> <li>◦ VTP</li> </ul> </li> <li>• Link Aggregation</li> <li>• L2 Security features (Port security, DHCP Snooping, DAI)</li> <li>• QoS</li> <li>• Provide enterprise-wide connectivity using internal and external gateway routing protocols               <ul style="list-style-type: none"> <li>◦ EIGRP</li> <li>◦ OSPF</li> <li>◦ BGP</li> </ul> </li> <li>• Provide network fault tolerance at routing and switching levels               <ul style="list-style-type: none"> <li>◦ HSRP / VRRP</li> </ul> </li> </ul>	

Section		Relative importance (%)
	<ul style="list-style-type: none"> <li>• Apply basic security configuration for control and data plane               <ul style="list-style-type: none"> <li>◦ ACL for data-plane</li> <li>◦ ACL / CoPP for control-plane</li> </ul> </li> <li>• Provide network connectivity between remote branches               <ul style="list-style-type: none"> <li>◦ IPSec</li> <li>◦ GRE</li> </ul> </li> <li>• Effectively use network discovery and traffic analysis tools</li> <li>• SNMP</li> </ul>	
<b>4</b>	<b>Network and System Operations</b>	<b>25</b>
	<p><b>The individual needs to know and understand:</b></p> <ul style="list-style-type: none"> <li>• Principles of common application protocols operations</li> <li>• Client-server application interaction models</li> <li>• Modern application delivery models</li> <li>• Operating systems embedded functionality for applications deployment</li> <li>• Dependencies structure between different groups of services, applications and systems</li> <li>• Enterprise services implementation options using variety of operating system</li> </ul>	
	<p><b>The individual shall be able to:</b></p> <ul style="list-style-type: none"> <li>• Enterprise directory services (ADDS, LDAP)</li> <li>• Domain name services (Windows DNS, BIND)</li> <li>• Dynamic host configuration services</li> <li>• Network address translation services</li> <li>• Network time services</li> <li>• Remote network access services               <ul style="list-style-type: none"> <li>◦ SSH</li> <li>◦ Remote Desktop Services</li> </ul> </li> <li>• Authentication, authorization and accounting services</li> <li>• IT infrastructure resources monitoring systems               <ul style="list-style-type: none"> <li>◦ Icinga2</li> <li>◦ Nagios</li> <li>◦ Cacti</li> <li>◦ Windows Resource Monitor</li> </ul> </li> <li>• E-mail exchange systems using SMTP, IMAP and POP with or without encryption.</li> <li>• Public key infrastructure services               <ul style="list-style-type: none"> <li>◦ Active Directory Certificate Services</li> <li>◦ OpenSSL</li> </ul> </li> <li>• File sharing services               <ul style="list-style-type: none"> <li>◦ SMB</li> <li>◦ DFS</li> <li>◦ NFS</li> </ul> </li> </ul>	



Section		Relative importance (%)
	<ul style="list-style-type: none"> <li>• Web hosting services using modern web servers e.g. Apache, Nginx and IIS.</li> <li>• Terminal access services               <ul style="list-style-type: none"> <li>◦ SSH</li> <li>◦ Remote Desktop Services</li> <li>◦ Telnet</li> </ul> </li> <li>• Backup systems               <ul style="list-style-type: none"> <li>◦ Windows Server Backup</li> <li>◦ rsync</li> <li>◦ Script based backup, e.g. Bash, Batch or PowerShell</li> </ul> </li> <li>• Client workstations deployment systems               <ul style="list-style-type: none"> <li>◦ Windows Deployment Services</li> <li>◦ Group Policy</li> </ul> </li> <li>• Manage file systems               <ul style="list-style-type: none"> <li>◦ Software RAID</li> <li>◦ mdadm</li> <li>◦ LVM/Dynamic disks</li> </ul> </li> <li>• File systems such as NTFS, ReFS, EXT4 and NTFS</li> </ul>	
<b>5</b>	<b>Infrastructure Programmability and Automation</b>	<b>15</b>
	<p><b>The individual needs to know and understand:</b></p> <ul style="list-style-type: none"> <li>• Principles of common application protocols operations</li> <li>• Client-server application interaction models</li> <li>• Modern application delivery models</li> <li>• Operating systems embedded functionality for applications deployment</li> <li>• Dependencies structure between different groups of services, applications and systems</li> <li>• Enterprise services implementation options using variety of operating systems</li> </ul>	
	<p><b>The individual shall be able to:</b></p> <ul style="list-style-type: none"> <li>• Describe and run routine infrastructure maintenance operations using various scripting/programming languages               <ul style="list-style-type: none"> <li>◦ Bash</li> <li>◦ PowerShell</li> <li>◦ Python</li> </ul> </li> <li>• Use modern automation tools for systems deployment and configuration management               <ul style="list-style-type: none"> <li>◦ Git</li> <li>◦ YANG</li> <li>◦ RESTCONF</li> <li>◦ NETCONF</li> </ul> </li> <li>• Describe and implement infrastructure as code               <ul style="list-style-type: none"> <li>◦ Python</li> <li>◦ Ansible</li> </ul> </li> </ul>	

Section		Relative importance (%)
	<ul style="list-style-type: none"> <li>• Interact with IT infrastructure elements using application programming interfaces               <ul style="list-style-type: none"> <li>◦ API calls over HTTP using Python</li> <li>◦ Authentication (basic and token)</li> </ul> </li> </ul>	
<b>6</b>	<b>Troubleshooting</b>	<b>25</b>
	<p><b>The individual needs to know and understand:</b></p> <ul style="list-style-type: none"> <li>• The importance of a calm and focussed approach in solving a problem</li> <li>• The significance of IT systems and the dependency of individuals and organisations on its constant availability</li> <li>• The common types of hardware/software errors which can occur</li> <li>• Diagnostic and analytical approaches to problem solving</li> <li>• Boundaries of own knowledge/skills/authority and sources of support/escalation procedures</li> <li>• Standard resolution times for common problems</li> </ul>	
	<p><b>The individual shall be able to:</b></p> <ul style="list-style-type: none"> <li>• Approach a problem with the appropriate level of confidence to calm the user as necessary</li> <li>• Check work regularly to prevent/ minimise problems at a later stage</li> <li>• Challenge incorrect information to prevent/minimise problems</li> <li>• Demonstrate resilience and persistence when dealing with problems</li> <li>• Recognise and understand problems swiftly and follow a self-reliant and managed process for resolving</li> <li>• Thoroughly investigate and analyse complex problems/ situations and apply fault finding processes</li> <li>• Select and use diagnostic software and tools to identify problems</li> <li>• Support users in resolving problems through advice, guidance and instruction</li> <li>• Seek support when further expertise is necessary and avoid being overwhelmed by the challenge of the problem</li> <li>• Check user satisfaction after a problem has been addressed</li> <li>• Accurately record problems and provide resolution reports</li> </ul>	
	<b>Total</b>	<b>100</b>

## 3 The assessment approach & principles

### 3.1 General guidance

**Note: this Section and Section 4 summarize a great deal of new information and guidance regarding assessment. Please refer to the Competition Rules for greater detail.**

The Competition Committee (CC) establishes the principles and techniques to which assessment at the EuroSkills Competition must conform.

Expert assessment practice lies at the heart of the EuroSkills Competition. For this reason it is the subject of continuing professional development and scrutiny. The growth of expertise in assessment will inform the future use and direction of the main assessment instruments used by the EuroSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

Assessment at the EuroSkills Competition falls into two broad types: measurement and judgement. All assessments will be governed by explicit benchmarks, referenced to best practice in industry and business.

The Marking Scheme must include these benchmarks and follow the weightings within the Occupational Standards. The Test Project is the assessment vehicle for the Skill Competition, and also follows the Occupational Standards. The CIS enables the timely and accurate recording of marks, and has expanding supportive capacity.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed and developed through an iterative process, to ensure that both together optimize their relationship with the Technical Description and the principles for assessment as set out in the WSE Assessment Strategy. They will be agreed by the Experts and submitted to WSE for approval together, in order to demonstrate their quality and conformity with the Occupational Standards.

Prior to submission for approval to WSE, the Marking Scheme and Test Project will be reviewed by the WSE Skill Advisors in order to benefit from the capabilities of the CIS.

## 4 The Marking Scheme

### 4.1 General guidance

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors' work as demonstrated through the Test Project, and the procedures and requirements for marking.

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standard that represents each skill competition, which itself represents a global occupation. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards.

By reflecting the weightings in the Standards, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill competition and its assessment needs, it may initially be appropriate to develop the Marking Scheme in more detail as a guide for Test Project design. Alternatively, initial Test Project design can be based on the outline Marking Scheme. From this point onwards the Marking Scheme and Test Project should be developed together.

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards, if there is no practicable alternative.

For integrity and fairness, the Marking Scheme and Test Project are increasingly designed and developed by one or more Independent Test Project Designer(s) with relevant expertise. In these instances, the Marking Scheme and Test Project are unseen by Experts until immediately before the start of the skill competition, or competition module. Where the detailed and final Marking Scheme and Test Project are designed by Experts, they must be approved by the whole Expert group prior to submission for independent validation and quality assurance. Please see the Competition Rules for further details.

Experts and Independent Test Project Designers are required to submit their Marking Schemes and Test Projects for review, verification, and validation well in advance of completion. They are also expected to work with their Skill Advisor, reviewers, and verifiers, throughout the design and development process, for quality assurance and in order to take full advantage of the CIS's features.

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition. Skill Advisors actively facilitate this process.

### 4.2 Assessment criteria

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived before, or in conjunction with, the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards; in others they may be different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards.

Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). **The Assessment Criteria, the allocation of marks, and the assessment methods, should not be set out within this Technical Description. This is because the Criteria, allocation of marks, and assessment**

methods all depend on the nature of the Marking Scheme and Test Project, which is decided after this Technical Description is published.

The Mark Summary Form generated by the CIS will comprise a list of the Assessment Criteria and Sub Criteria.

The marks allocated to each Criterion will be calculated by the CIS. These will be the cumulative sum of marks given to each Aspect within that Assessment Criterion.

### 4.3 Sub criteria

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a WorldSkills marking form. Each marking form (Sub Criterion) contains Aspects to be assessed and marked by Measurement or Judgement, or both Measurement and Judgement.

Each marking form (Sub Criterion) specifies both the day on which it will be marked, and the identity of the marking team.

### 4.4 Aspects

Each Aspect defines, in detail, a single item to be assessed and marked, together with the marks, and detailed descriptors or instructions as a guide to marking. Each Aspect is assessed either by Measurement or by Judgement.

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it. The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the Standards. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1 refers.)

	CRITERIA								TOTAL MARKS PER SECTION	WSSS MARKS PER SECTION	VARIANCE	
	A	B	C	D	E	F	G	H				
STANDARDS SPECIFICATION SECTION	1	5.00								5.00	5.00	0.00
	2		2.00					7.50		9.50	10.00	0.50
	3								11.00	11.00	10.00	1.00
	4			5.00						5.00	5.00	0.00
	5				10.00	10.00	10.00			30.00	30.00	0.00
	6		8.00	5.00				2.50	9.00	24.50	25.00	0.50
	7			10.00				5.00		15.00	15.00	0.00
TOTAL MARKS	5.00	10.00	20.00	10.00	10.00	10.00	15.00	20.00	100.00	100.00	2.00	

### 4.5 Assessment and marking

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by Judgement, Measurement, or both. The same marking team must assess and mark all Competitors. Where this is impracticable (for example where an action must be done by every Competitor simultaneously, and must be observed doing so), a second tier of assessment and marking will be put in place, with the approval of the Competitions Committee Management Team. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (Section 4.6 refers.)

## 4.6 Assessment and marking using judgement

Judgement uses a scale of 0-3. To apply the scale with rigour and consistency, Judgement must be conducted using:

- benchmarks (criteria) for detailed guidance for each Aspect (in words, images, artefacts, or separate guidance notes). This is documented in the Standards and Assessment Guide.
- the 0-3 scale to indicate:
  - 0: performance below industry standard
  - 1: performance meets industry standard
  - 2: performance meets and, in specific respects, exceeds industry standard
  - 3: performance wholly exceeds industry standard and is judged as excellent

Three Experts will judge each Aspect, normally simultaneously, and record their scores. A fourth Expert coordinates and supervises the scoring, and checks their validity. They also act as a judge when required to prevent compatriot marking.

## 4.7 Assessment and marking using measurement

Normally three Experts will be used to assess each Aspect, with a fourth Expert supervising. In some circumstances the team may organize itself as two pairs, for dual marking. Unless otherwise stated, only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect. To avoid errors in calculation or transmission, the CIS provides a large number of automated calculation options, the use of which is mandated.

## 4.8 Assessment overview

Decisions regarding the choice of criteria and assessment methods will be made during the design of the competition through the Marking Scheme and Test Project.

## 4.9 Skill Assessment Strategy

This is a competition for teams of two competitors working together in the way that they choose. Assessment and results will be based on their joint effort.

The only equipment allowed in the Competitors work area is the equipment used by the competitors to develop the Test Project. Care must be taken to make sure that the competitor's computers contain all the software needed by the experts to perform the assessment. Experts are allowed to transfer to the competitors computers any scripts and or software that are needed to perform the assessment but whenever possible this must be done before the beginning of the competition.

Non-destructive assessment must be done whenever possible and must be the norm. Whenever there is no other option, Experts must consider if it is really worth the risk of doing destructive testing and if they decide to do so they must have a written verification procedure in place to guarantee the undoing of whatever action was performed in order to carry the assessment. As an example of destructive testing, consider that in order to assess a certain aspect one must shutdown an interface. Experts must at all cost find an alternative way to test that aspect and if they cannot find one they must consider if it is really worth the risk of changing the competitor's configuration and if after all this they still decide to go ahead, they must implement a written procedure to guarantee the undo of the shutdown command before leaving the competitor's workstation.

When assessing the competitor's work, the emphasis should be on performing functional testing. For example: viewing the configuration in Cisco equipment, in order to determine if marks should be awarded or not, should be a measure of last resort, used only when no other options are available.

All Experts should be assigned to a module team. With this module organization, the assignment of the Competitor's first day module is done as follows:

- The Competitor will start the first day of the competition in the same module as their compatriot Expert is a part of.
- If the Competitor's compatriot Expert does not belong to or is not a part of a module teams, their Competitor's starting module is by ballot draw as soon as the module teams are formed.

Each module is completed on the assigned day so that progressive marking can take place.

If automated "script marking" determines that an aspect is wrong, the Experts included in the marking group must do a manual check as stated in the "how-to-mark" Marking Scheme.

The automatic marking script must be hashed and encrypted with a two-part password (one part held by the CE and the other part held by the module team leader).

## 4.10 Skill Assessment Procedures - Mark distribution

This section defines the assessment criteria and the number of marks (judgement and measurement) awarded. The total number of marks for all assessment criteria must be 100. The table below is advisory only for the development of the Test Project and Marking Scheme.

Assessment and marking are an intense process that depends upon skilful leadership, management, and scrutiny.

All Experts should be assigned to a module team. With this module organization, the assignment of the Competitor's first day module is done as follows:

- The Competitor will start the first day of the competition at the same module as their compatriot Expert is a part of.
- If the Competitor's compatriot Expert does not belong to or is not part of a module team, their Competitor's starting module is by ballot draw as soon as the module teams are formed.

The Competitor's work may not be altered in any way to facilitate marking unless included in the Marking Scheme.

The Experts attending the Competition are divided into smaller marking groups within their module team to mark each specific section of the marking criteria.

Progressive marking for all sections of the Competition

Each module is completed on the assigned day so that progressive marking can take place.

Marking Scheme:

- Each Competitor is provided with the Mark Summary Form
- A full "how-to-Marking Scheme" will only be seen by the Experts. (Reason: the full Marking Scheme would give the answers to the Competitor.)
- No single aspect can be more than 5% of module/day total marks. That is not more than 1.25 marks.

If automated “script marking” determines that an aspect is wrong, the Experts included in the marking group must do a manual check as stated in the “how-to-mark” Marking Scheme.

The marking automated script must be hashed and encrypted with a two-part password (one part held by the CE and the other part held by the module team leader).



# 5 The Test Project

## 5.1 General notes

Sections 3 and 4 govern the development of the Test Project. These notes are supplementary.

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the skills in each section of the Occupational Standards.

The purpose of the Test Project is to provide full and balanced opportunities for assessment and marking across the Occupational Standards, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme and Occupational Standards will be a key indicator of quality.

The Test Project will not cover areas outside the Occupational Standards, or affect the balance of marks within the Occupational Standards other than in the circumstances indicated by Section 2.1.

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work.

The Test Project will not assess knowledge of the EuroSkills Competition's rules and regulations.

This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standard Specification. Section 2.1 refers.

## 5.2 Format/ structure of the Test Project

- Test Project with separately assessed modules

## 5.3 Test Project design requirements

Each Test Project module must be:

- **At a level of difficulty that a competent Competitor may expect to deal with in normal circumstances with regards to their age and limited work experience.**
- With scope and range that Competitors trained at least to the equivalent of the following certification may expect to recognize as within their capability and potential.
  - Cisco
    - 200-301 CCNA - Implementing and Administering Cisco Solution
    - 350-401 ENCOR - Implementing and Operating Cisco Enterprise Network Core Technologies
    - 300-410 ENARSI - Implementing Cisco Enterprise Advanced Routing and Services
  - Windows
    - AZ-800 - Administering Windows Server Hybrid Core Infrastructure
    - AZ-801 - Configuring Windows Server Hybrid Advanced Services
    - MD-102 - Endpoint Administrator
    - Note that all the above-mentioned exams include Microsoft Cloud Services and hybrid cloud infrastructure that will not be a part of the TP.
  - Linux
    - LPIC-1
    - LPIC-2

## Format of the test project

The Test Project should be constructed in the form of three modules, one for each day of competition. Great care needs to be taken to minimize overlapping between the modules. E.g. if one module requires the competitor to implement routing and switching, this should not be allowed in a great extent in another module. The modules should be doable independent of each other.

## Example of module structure

Below is an example of modules to be used during the competition. The actual modules will be decided on the forum before the start of the Test Project development.

Period	Module	Tasks
Module A	Linux environments	Installation, configuration, automation and troubleshooting
Module B	Microsoft environments	Installation, configuration, automation and troubleshooting
Module C	Data transfer networks	Installation, configuration, automation and troubleshooting

## 5.4 Test Project development

The Test Project MUST be submitted using the templates provided by WSE. Use the Word template for text documents and DWG template for drawings. Please contact [jordy.degroot@worldskillseurope.org](mailto:jordy.degroot@worldskillseurope.org) for guidance.

**If the Test Project is designed by an Independent Test Project designer, then the Test Project must be designed in accordance with the WSE Independent Test Project Guide v1.1.**

**If your Skill wishes to have an Independent Test Project designer, you must ensure that WorldSkills Europe is made aware of this, so that it can be assured that there is proper funding in place, or that the Independent Test Project designer is aware that he/she will do this task free of charge.**

### 5.4.1 Who develops the Test Projects or modules

The Test Project / modules are developed under the supervision of:

- All Experts
- Independent Test Project designer/ Third party

Note: Option 1 (preferred): The Test Project modules are developed by an Independent Test Project Designer with guidance from Chief Expert and Deputy Chief Expert (without CE and DCE knowing the contents of the Test Project). According to the WSE Independent Test Project Guide.

Option 2: One, two or three modules are developed independently while the remaining modules are designed as per option 3 process. According to the WSE Independent Test Project Guide.

Option 3: The SMT (Skill Management Team) selects the module teams and the Test Projects are then developed by each module team. Test Projects may ONLY be submitted by module development teams, no individual submissions, Experts should submit their ideas and work with the module development team.

#### 5.4.2 How and where is the Test Projects or modules developed

The Test Project or modules are developed in the following manner:

- Other:

Note: Please refer to section 5.4.3

#### 5.4.3 When is the Test Project developed

The Test Project is developed according to the following timeline:

TIME	ACTIVITY
~9 months prior to the competition	SMT starts the work of looking for an Independent Designer.
~6 months prior to the Competition	SMT invite one or more Independent Designers to start work on the Test Project. If no Independent Designer is selected at this point, the decision can be made to have some, or all the Test Project Modules developed by the Experts instead.
~6 months prior to the Competition	SMT have follow up meeting with the independent designer to check on the progress of the Test Project. If at this time the SMT is not satisfied by the progress by the Independent Designer, the decision can be made to have some, or all the Test Project Modules developed by the Experts instead.
~3 months (C-90) prior to the Competition	Deadline for the Independent Designer to submit the finished Test Project to EuroSkills Secretariat.

When developed by the Experts in the module teams:

TIME	ACTIVITY
~9 months prior to the competition	SMT contacts the registered Experts to invite them to be part of the Module team (Module A, B and C) that they prefer. After this the SMT choose and asks experienced Experts to be one of the Module Team Leaders.
~6 months prior to the Competition	SMT allocates Experts to the Module teams and under lead by the Module Team Leader they start designing the outlines and collection of activities suitable for the Test Projects for their Module.
~3 months (C-90) prior to the Competition	Deadline for the selection of the Test Project and delivery to WorldSkills Europe. Module Teams sends their Test Project to the SMT who will check the quality and consistency of the Test Project.
~2 months (C-60) prior to the Competition	Marking teams are created, and a team leader nominated, and are assigned the task of verifying the functionality of the Test Project, making suggestions as to improve not only the quality of the Test Project but also speed up the assessment procedure and create a how-to mark.

1 months (C-30) prior to the Competition	Deadline for posting possible 30% changes for the Test Projects. All 30% change proposals must be submitted with the respective marking scheme as well as the impact on the original Test Project and original marking scheme.
At the Competition	The final selection of the 30% changes will be taken from the suggested changes on the C-30 submitted list.

## 5.5 Test Project validation

In the case of Test Project developed by an Independent Designer, the following is not applicable.

The Test Projects modules will be validated by a Test Group of Experts appointed by the Chief and Deputy Chief Expert as described below.

The amended Test Project modules (with 30% changes) will be passed onto a Test Group who will check each of the selected projects on complete Competitor workstations. It must be demonstrated that the Test Project/modules can be completed within the material, equipment and knowledge constraints and that the hardware and software list is correct and is provided for use.

The Test Group must check the 30% changes and/or additions and also the corresponding marking scheme and provide further changes back to the Module team until agreement is reached and the project is in accordance with Test Project design requirements above. See 5.3 above.

## 5.6 Test Project selection

• Other:

Note: Option 1 (preferred). The Test Project id designed by an Independent Test Project designer, therefore there is no selection process.

Option 2: One, two or three modules are developed independently while the remaining modules are designed as per option 3 process.

Option 3: The Test Project are developed by the Experts in the Module Teams, and the Test Project put forward by the Module Team is selected.

## 5.7 Test Project circulation

Please note that if a Test Project is known by the Chief- and/or Deputy Chief Experts, and/or any of the other Experts, it must be shared via the forums before the start of the Competition. This also means that this Test Project is subject to a 30% change before the start of the Competition.

The Test Project is circulated via the website as follows:

• Other:

Note: The selected Test Project modules are sent to EuroSkills forum for circulation on C-90. In this case the Test Project will be subject to 30% changes, that will be validated by the Experts in accordance with 5.5.

Where the Test Project modules are independently designed these are sent to EuroSkills Secretariat and are not released until C1. However, the complete topology, both physical and logical, should be released on C-30 to everyone on the EuroSkills forum.

## 5.8 Test Project coordination (preparation for competition)

Coordination of the Test Project will be undertaken by:

- Skill Management Team
- Other:

Note: When the Test Project is developed by an independent designer, coordination is done by the Skill Management Team.

In other cases each Module Team is allocated a team of Experts. The module team leader will work closely with the Chief Expert and the Deputy Chief Expert to allow for the completion of the module. The team leader is responsible for the completion of each module in line with this document and ensure the modules are true and correct.

## 5.9 Test Project change at the competition

From the proposed 30% changes, experts may choose to change the original Test Project up to 30%. All changes must come from the proposed changes that were submitted by C-30.

As soon as possible, preferably on C-2, the Test Projects with the included 30% change will be given to all Experts who are responsible for sharing the updated Test Project with their Competitors. Summary marking schemes will also be given to the Experts, and the content may also be shared with the Competitors.

## 5.10 Material or manufacturer specifications

Specific material and/or manufacturer specifications required to allow the Competitors to complete the Test Project will be supplied by the Host Organization and are available via the forums. However, note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These items may include those for fault finding modules or modules not circulated.

Not applicable.

## 5.11 Software specifications

Not applicable.

## 6 Skill management and communication

### 6.1 Discussion forum

Prior to the EuroSkills Competition, all discussion, communication, collaboration, and decision making regarding the Skill Competition must take place on the skill specific Discussion Forum, which can be reached via [www.worldskillseurope.org](http://www.worldskillseurope.org). Skill related decisions and communication are only valid if they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be the moderator for this Forum. Refer to Competition Rules for the timeline of communication and competition development requirements.

### 6.2 Competitor information

All information for registered Competitors is available from the WorldSkills Europe website [www.worldskillseurope.org](http://www.worldskillseurope.org). Please contact [jordy.degroot@worldskillseurope.org](mailto:jordy.degroot@worldskillseurope.org) for guidance.

The information includes:

- Competition Rules
- Technical Descriptions
- Test Projects
- Infrastructure List
- EuroSkills Health, Safety, and Environment Policy and Regulations
- Other Competition-related information

### 6.3 Test Projects and Marking Schemes

Circulated Test Projects will be available at the WorldSkills Europe website from [www.worldskillseurope.org](http://www.worldskillseurope.org). Please contact [jordy.degroot@worldskillseurope.org](mailto:jordy.degroot@worldskillseurope.org) for guidance.

### 6.4 Day-To-Day management

The day-to-day management of the Skill Competition during the EuroSkills Competition is defined in the Skill Management Plan that is created by the Skill Management Team led by the Chief Expert. The Skill Management Team comprises the Jury President, Chief Expert and Deputy Chief Expert. The Skill Management Plan is progressively developed in the six months prior to the Competition and finalized at the Competition by agreement of the Experts. The Skill Management Plan can be viewed at [www.worldskillseurope.org](http://www.worldskillseurope.org). Please contact [jordy.degroot@worldskillseurope.org](mailto:jordy.degroot@worldskillseurope.org) for guidance.

## 7 Skill specific safety requirements

### 7.1 Requirements

Refer to Host Country/Region Health and Safety documentation for Host Country/Region regulations. This document will be shared via the forums. One overall Health and Safety document will be published, as well as Skill specific safety requirements.

## 8 Materials and equipment

### 8.1 Infrastructure List

The Infrastructure List details all equipment, materials and facilities provided by the Competition Organizer.

The Infrastructure Lists will be available at the WorldSkills Europe website from [www.worldskillseurope.org](http://www.worldskillseurope.org). Please contact [jordy.degroot@worldskillseurope.org](mailto:jordy.degroot@worldskillseurope.org) for guidance.

The Infrastructure List specifies the items and quantities requested by the Experts for the next Competition. The Host Organization will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items.

At each Competition, the Experts must advise the Competition Manager of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

### 8.2 Competitors toolbox

WorldSkills Europe aims to minimize the sending of toolboxes as much as possible. We therefore ask you to keep this in mind when writing the section below. Please be advised that competitors should bring as little as possible and what they do bring **MUST** be true hand tools. Only items are allowed that would significantly affect their ability to perform the task and deliver the Test Project to a high standard.

No toolboxes are allowed.

### 8.3 Materials, equipment and tools supplied by Competitors in their toolbox

Competitors are allowed to bring:

- Two keyboards in their own language
- Two mice

The keyboards provided for all computers (by the organiser), including laptops, must be in Latin-script, QWERTY, United States (English) layout, according to ISO/IEC 9995. The locale settings on all systems must be set to US international.

### 8.4 Materials, equipment and tools supplied by the Experts

Nothing is to be provided by the Experts.



## 8.5 Materials, equipment and tools prohibited in the Skill area

Regarding the use of electronic equipment within the competition area, devices such as a tablet, cell phones, media players, recorders, etc., are to follow WSE rules and/or by the SMT presented rules for the actual competition. SMT may decide which items are allowed to be used, by whom and when.

## 8.6 Workshop Layout

Workshop layouts from previous competitions are available by contacting the Competition and IT Coordinator at: [jordy.degroot@worldskillseurope.org](mailto:jordy.degroot@worldskillseurope.org). New Workshop Layouts will be communicated via the forums when completed.

Please be advised that you will have the opportunity to discuss your Workshop Layout proposal with the Host Organization during the Skills Development Workshop (SDW) and the Competition Preparation Meetings (CPM).

For workshop layout development, please refer to the forums.

## 9 Skill-specific rules

### 9.1 Introduction

Skill-specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from Skill Competition to Skill Competition. This includes but is not limited to personal IT equipment, data storage devices, Internet access, procedures and workflow, and documentation management and distribution. Breaches of these rules will be solved according to the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System.

### 9.2 Personal laptops – USB – memory sticks – mobile phones

No personal laptops, USB-memory sticks or mobile phones are allowed during the preparation work or when working on the Test Project and Marking Scheme. After preparation work personal laptops may be used inside the expert room but must be locked away when on duty.

### 9.3 Personal photo cameras – video taking devices

Taking photos or video inside the workshop is only allowed after agreement with the Chief Expert or Deputy Chief Expert.

### 9.4 Communication between compatriot experts and competitors

Communication between compatriot Experts and Competitors are allowed at all times except for during the competition time and during troubleshooting.

### 9.5 Other

# 10 Visitor and media engagement

## 10.1 Engagement

Following is a list of possible ways to maximize visitor and media engagement, within the remit of the Competition Rules:

- Video description of trade. For example: “Warriors of the Net”
- Dual displays – the public can observe work being done by competitors in detail
- Test Project descriptions
- Competitor profiles
- Career opportunities
- Daily reporting of competition status

# 11 Sustainability

## 11.1 Sustainability

This Skill Competition will focus on the sustainable practices below:

- Workstations are organized into modules corresponding to the skill sets (day one to three) being tested. Competitors are divided into these groups to reduce the need for a large number of networking devices.
- The usage of virtualization greatly reduces the number of computers needed for the competition.