worldskills

Technical Description

IT Network Systems Administration

Skill 39

WorldSkills International, by a resolution of the Competitions Committee and in accordance with the Constitution, the Standing Orders, and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

The Technical Description consists of the following:

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)

An IT Network Systems Administrator works in small or large organizations in the commercial and public sectors, offering a wide range of IT services which are critical for the operation of daily business. Any ‘downtime’ is costly for an organization therefore the IT Network Systems Administrator has a responsibility to work professionally and interactively with users in order to meet their needs and ensure the continuous systems and service levels they require to perform their roles effectively. The IT Network Systems Administrator also offers advice and guidance on the development of systems and services to take the organization forward.

The IT Network Systems Administrator works in diverse environments including network operations centres, internet service providers, data centres, e.g. Amazon, 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.

The IT Network Systems Administrator may at some stage in their career specialize in user support, design, installation of operating systems or configuration of networking devices. Irrespective of this, work organization and self-management, communication, and interpersonal skills, problem-solving, a dedication to research/keeping up to date with industry developments, and a consistently methodical and investigative approach are the universal attributes of the outstanding IT Network Systems Administrator.

In a mobile labour market, the IT Network Systems Administrator may work in teams, or alone, or both from time to time. Whatever the structure of the work, the trained and experienced IT Network Systems Administrator takes on a high level of personal responsibility and autonomy. From ensuring businesses remain consistently in operation, with limited IT systems breakdowns, to contributing to the design of new systems, every process matters and mistakes cost the business money.

With the fast globalization of IT systems and the international mobility of people IT Network Systems Administrators face rapidly expanding opportunities and challenges. For the talented IT Network Systems Administrator there are many commercial, public sector and international opportunities; however, these carry with them the need to understand and work with diverse cultures, and to keep up to date with fast changing industry developments. The diversity of skills associated with IT network systems administration is therefore likely to expand.

1.1.3 Number of Competitors per team

IT Network Systems Administration is a single Competitor skill competition.

1.1.4 Age limit of Competitors

The Competitors must not be older than 22 years in the year of the Competition.

1.2 The relevance and significance of this document

This document contains information about the standards required to compete in this skill competition, and 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:

- WSI – Code of Ethics and Conduct
- WSI – Competition Rules
- WSI – WorldSkills Occupational Standards framework
- WSI – WorldSkills Assessment Strategy
- WSI online resources as indicated in this document
- WorldSkills Health, Safety, and Environment Policy and Regulations
- WorldSkills Standards and Assessment Guide (skill-specific)

2 The WorldSkills Occupational Standards (WSOS)

2.1 General notes on the WSOS

The WSOS specifies the knowledge, understanding, skills, and capabilities that underpin international best practice in technical and vocational performance. These are both specific to an occupational role and also transversal. Together they should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

The skill competition is intended to reflect international best practice as described by the WSOS, to the extent that it can. The Standard 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 only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standard is 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 Standards. This is often referred to as the “weighting”. The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

Through the Test Project, the Marking Scheme will assess only those skills and capabilities that are set out in the WorldSkills Occupational Standards. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, if this does not distort the weightings assigned by the Standards.

2.2 WorldSkills Occupational Standards

Section		Relative importance (%)
1	**Work organization and management**	**5**
	The individual needs to know and understand: • Health and safety legislation, obligations, regulations, and documentation • The situations when personal protective equipment (PPE) must be used, e.g. for ESD (electrostatic discharge) • How and why to seek assistance from peers when lacking in experience or knowledge in a particular area • The importance of integrity and security when dealing with user equipment and information • The importance of safe and secure disposal of waste for re-cycling • The techniques of planning, scheduling, and prioritizing	

Section		Relative importance (%)
	• The significance of accuracy, checking, and attention to detail in all working practices • The importance of methodical working practices • Collaboration and research methods and techniques • The value of managing own continuing professional development • The speed of IT systems change and the need to maintain currency.	
	The individual shall be able to: • Follow health and safety standards, rules, and regulations • Maintain a safe working environment • Identify and use the appropriate Personal Protective Equipment for ESD • Select, use, clean, maintain, and store tools and equipment safely and securely • Plan the work area to maximize efficiency and maintain the discipline of regular tidying • Regularly schedule, re-schedule, and multi-task according to changing priorities • Work efficiently and check progress and outcomes regularly • Undergo various certification requirements, such as: Cisco, Microsoft, and Linux, specializing in at least one specific area • Use thorough and efficient research methods to support knowledge growth • Be enthusiastic to try new methods, systems, and embrace change • Collaborate effectively with work colleagues to maximize efficiency and learning • Work effectively as a member of a project team.	
2	**Communication and interpersonal Skills**	**5**
	The individual needs to know and understand: • The importance of listening as part of effective communication • The roles and requirements of colleagues and the most effective methods of communication • The importance of building and maintaining productive working relationships with colleagues and managers • Techniques for effective teamwork • Techniques for resolving misunderstandings and conflicting demands • The process for managing tension and anger to resolve difficult situations.	
	The individual shall be able to: • Use strong listening and questioning skills to deepen understanding of complex situations	

Section		Relative importance (%)
	• Maintain consistently effective verbal and written communications with colleagues • Recognize and adapt to the changing needs of colleagues • Pro-actively contribute to the development of a strong and effective team • Share knowledge and expertise with colleagues and help develop a supportive learning culture • Manage tension/anger and give confidence that problems can be resolved.	
3	**Data Transfer Networks**	**25**
	The individual needs to know and understand: • OSI model and the TCP/IP protocols stack • Operational principles of data-link, network and transport protocols • Roles and functions of different network components • Network topology types and usage scenarios • Network segmentation with VLAN • Security protocols to secure local and wide area networks • IPv4 and IPv6 network addressing concepts • Routing and switching concepts • Load balancing principles • Common types of attacks on network protocols and mitigation methods • Methods for actively managing network equipment • concepts and principles for network function virtualization • Controller-based and software-defined network management approaches.	
	The individual shall be able to: • Perform basic initialization of active network equipment • Configure access, aggregation and core level switching • Provide enterprise-wide connectivity using internal and external gateway routing protocols such as OSPF, BGP and EIGRP • Provide network load balancing & fault tolerance at routing and switching levels by using GLBP, HSRP, VRRP, LACP, PAgP, etc. • Apply basic security configuration for control and data plane • Provide network connectivity between remote branches using VPN technologies such as IPSec, SSL VPN, Direct Access, OpenVPN, DMVPN, GRE, etc. • Use network discovery and traffic analysis tools such as CDP, NetFlow, Syslog, SNMP and tcpdump.	
4	**Network and System Operations**	**25**
	The individual needs to know and understand: • Principles of common application protocols operations	

Section		Relative importance (%)
	• Client-server application interaction models • Modern application delivery models • Operating systems embedded functionality for applications deployment • Dependencies structures between different groups of services, applications and systems • Options for implementing enterprise services using a variety of operating systems.	
	The individual shall be able to: • Install and manage enterprise directory services (ADDS, LDAP) • Install and manage domain name services (Windows DNS, BIND) • Install and manage dynamic host configuration services • Install and manage network address translation services • Install and manage network time services • Install and manage remote network access services ◦ SSH ◦ Remote Desktop Services • Install and manage authentication, authorization and accounting services • Install and manage IT infrastructure resources monitoring systems ◦ Icinga2 ◦ Nagios ◦ Cacti ◦ Windows Resource Monitor • Install and manage e-mail exchange systems using SMTP, IMAP and POP with or without encryption. • Setup public key infrastructure services ◦ Active Directory Certificate Services ◦ OpenSSL • Install and manage sharing services ◦ SMB ◦ DFS ◦ NFS ◦ FTP • Install and manage web hosting services using modern web servers e.g. Apache, Nginx and IIS. • Install and manage terminal access services ◦ SSH ◦ Remote Desktop Services ◦ Telnet • Install and manage backup systems ◦ Windows Server Backup ◦ rsync ◦ Script based backup, e.g. Bash, Batch or PowerShell	

Section		Relative importance (%)
	• Install and manage client workstations deployment systems ◦ Windows Deployment Services ◦ Group Policy • Manage file systems ◦ Software RAID ◦ mdadm ◦ LVM/Dynamic disks ◦ File systems such as NTFS, ReFS, EXT4 and NTFS.	
5	**Infrastructure Automation**	**15**
	The individual needs to know and understand: • Continuous integration and continuous delivery\deployment pipelines concepts • Capabilities of various automation tools • Importance of code version control • Behaviour of infrastructure automation tools.	
	The individual shall be able to: • Setup and run routine infrastructure maintenance operations using various scripting\programming languages ◦ Bash ◦ PowerShell • Use modern automation tools for systems deployment and configuration management ◦ Git • Identify and implement infrastructure as code ◦ Ansible.	
6	**Troubleshooting**	**25**
	The individual needs to know and understand: • The range of operating systems and their abilities to match particular user requirements, given the user budget requirements • The process for selecting the appropriate driver for different kinds of hardware • The basic functions of the hardware and the process for setting-up • The importance of following instructions and the consequences/ costs of not adhering to them • The precautions that need to be actioned before an installation or an up-grade • The purpose of documenting the completion of the installation or up-grade • Troubleshoot computer systems using the appropriate tools and techniques.	

Section		Relative importance (%)
	The individual shall be able to: • Closely listen, translate, and accurately identify user needs to ensure expectations are met • Select the operating system: proprietary/open source, total cost of ownership in relation to customer resources • Accurately identify the hardware and appropriate software driver required to match user/manufacturer specifications • Consistently check manufacturers' guidance for up-grading regarding “workflow” • Select the roles and/or features of the operating/server system e.g. Active Directory Domain Services (role) and Window Server Back-up (feature) • Discuss the proposed solution(s) for role/feature and agree with relevant parties e.g. users, colleagues, and managers • Prepare a technical document reflecting the solution in detail for agreement and sign-off • Configure the appropriate role/feature following manufacturers' instructions or best practice within the organization • Test and rectify any problems and re-test as appropriate • Gain user acceptance and record • Use system logs to find and identify issues • Use network package inspection, connectivity checking tools etc to troubleshoot and identity problems in a network.	
	Total	**100**

3 The Assessment Strategy and Specification

3.1 General guidance

Assessment is governed by the WorldSkills Assessment Strategy. The Strategy establishes the principles and techniques to which WorldSkills assessment and marking must conform.

Expert assessment practice lies at the heart of the WorldSkills 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 WorldSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

Assessment at the WorldSkills Competition falls into two broad types: Measurement and Judgement. For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

The Marking Scheme must follow the weightings within the Standards. The Test Project is the assessment vehicle for the skill competition, and therefore also follows the Standards. The CIS enables the timely and accurate recording of marks; its capacity for scrutiny, support, and feedback is continuously expanding.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed, developed, and verified through an iterative process, to ensure that both together optimize their relationship with the Standards and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, to demonstrate their quality and conformity with the Standards.

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI Skill Advisors for quality assurance and to benefit from the capabilities of the CIS.

4 Assessment Design and Practice

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
STANDARDS SPECIFICATION SECTION		A	B	C	D	E	F	G	H			
	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 The use of Measurement and Judgement

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 and procedures

WorldSkills is committed to continuous improvement including reviewing past limitations and building on good practice. The following skill assessment strategy and procedures for this skill competition take this into account and explain how the marking process will be managed.

The ITPD or SCM will conduct a briefing to the Assessment Team on the strategy and procedures of assessment for each module before assessment.

The following is not a definitive list but is an example of possible aspects that are assessed:

- Installation and configuration of Windows/Linux opeating systems
- Installation and configuration of network services
- Access control for resouces and services
- Troubleshooting network and operating system faults
- Network and operating system automation

Procedures:

The Competitor's work may not be altered in any way to facilitate marking unless defined in the Marking Scheme such as running an automation script.

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

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
- 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 not correct, the Experts included in the marking team must do a manual check as stated in the “how-to-mark” Marking Scheme to validate the results.

The marking automated script must be hashed and encrypted with a two-part password. The password shall be kept as secret by the SCM and ITPD and only release before the marking.

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 applied knowledge, skills, and behaviours set out in each section of the WSOS.

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

The Test Project will not cover areas outside the Standards or affect the balance of marks within the Standards other than in the circumstances indicated by Section 2. This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standards. Section 2.1 refers.

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 WorldSkills rules and regulations.

Most Test Projects and Marking Schemes are now designed and developed independently of the Experts. They are designed and developed either by the Skill Competition Manager, or an Independent Test Project Designer, normally from C-12 months. They are subject to independent review, verification, and validation. (Section 4.1 refers.)

The information provided below will be subject to what is known at the time of completing this Technical Description, and the requirement for confidentiality.

Please refer to the current version of the Competition Rules for further details.

5.2 Format/structure of the Test Project

The Test Project is a series of four (4) standalone modules.

	Module	Tasks
Module A	Linux environments	Installation, configuration, and automation
Module B	Microsoft environments	Installation, configuration, and automation
Module C	Data transfer networks	Installation, configuration, and automation
Module D	Troubleshooting	-

5.3 Test Project design requirements

Test Projects should reflect the purposes, structures, processes, and outcomes of the occupational role they are based on. They should aim to be a small-scale version of that role. Before focusing on practicalities, SMTs should show how the Test Project design will provide full, balanced, and

authentic opportunities for assessment and marking across the Standards, as set out in Section 5.1.

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. (Please note that this list is purely indicative, since the Marking Scheme and Test Project must reflect current best practice in IT.)
  - Cisco Certified Network Associate (CCNA)
  - The Competitors knowledge and skills related to network fundamentals, network access, IP connectivity, IP services, security fundamentals, and automation and programmability.
  - Implementing Cisco Enterprise Advanced Routing and Services (ENARSI)
  - The Competitors knowledge for implementation and troubleshooting of advanced routing technologies and services including Layer 3, VPN services, infrastructure security, infrastructure services, and infrastructure automation.
  - Advanced Level Linux Certification LPIC-2 or equivalent skill set;
  - Microsoft Windows Server and Microsoft client operating systems.
  - Red Hat Certified Specialist in Ansible Network Automation exam
  - Red Hat Certified Specialist in Developing Automation with Ansible Automation Platform exam

Notes:

Whenever a certification is replaced by a newer and equivalent one, we will use the oldest certification for which an exam can still be taken on C1.

All certification levels are discussed and revised via a vote of all Experts at the end of each competition cycle.

Designed using a standard cover sheet for each section on the WorldSkills International template available on the website.

Self-explanatory requiring minimal translation (Competitor instructions containing a minimum of text).

Each Test Project should have a detailed physical topology image followed by a detailed logical topology image.

Be accompanied by a Marking Scheme that is finalized at the Competition in accordance with the Technical Description.

All operating systems and other software used in the competition are to be in English language versions.

All required sofware and versions defined by the Independent Test Project Designer (ITPD), including the source to download it will be shared with Experts via the Disussion Forum. Where appropriate a repository of this software will be created and made public, including the respective integrity hashes.

5.4 Test Project coordination and development

The Test Project MUST be submitted using the templates provided by WorldSkills International (www.worldskills.org/expertcentre). Use the Word template for text documents and DWG template for drawings.

5.4.1 Test Project coordination (preparation for Competition)

Coordination of the Test Project/modules will be undertaken by the Skill Competition Manager.

5.4.2 Who develops the Test Project/modules

Option 1: Test Project being developed by an ITPD: The Test Project/modules are developed and selected by an Independent Test Project Designer in collaboration with the Skill Competition Manager.

Option 2: Test Project being developed by Experts: The Skill Competition Manager and the Chief Expert select 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.

The Test Project/modules are selected by the Expert module team leaders for each module A, Module B, and Module C. Regarding module D, the troubleshooting and secret challenges should be developed by external companies under supervision by the QA team (CE, ESR for CIS and ESR for skill development). The external company (e.g. Cisco, Microsoft, LPI, or VMware) must be related to the software or hardware used during the competition, at least to the level of being a partner organization.

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

As of WSC2026 an Independent Test Project Designer will have to develop the Test Project, there will not be the option for Experts to develop the Test Project.

5.4.3 When is the Test Project developed

The Test Project/modules are developed according to the following timeline:

Option 1: Test Project being developed by an ITPD:

Time	Action
Fifteen (15) months prior to the Competition	The ITPD is identified and a Confidentiality Agreement between WSI and the ITPD is organized.
Three (3) months prior to the Competition	Information about the complete topology, both physical and logical, is circulated via the WorldSkills website, without any technical or detailed information.
No later than two (2) months prior to the Competition	The Test Project documents are sent to the WorldSkills International Skills Competitions Administration Manager.
At the Competition on C1	The Test Project/modules are presented to Competitors and Experts.

Option 2: Test Project being developed by Experts:

Time	Activity
Twelve (12) months prior to the Competition**	Skill Competition Manager and Chief Expert contact the registered Experts to invite them for the upcoming work with regards to the Test Project.

Time	Activity
Nine (9) months prior to the competition**	Skill Competition Manager and Chief Expert contact the registered Experts to invite them to be part of the Module team (Module A, Module B, and Module C) that they prefer. After this the Skill Competition Manager and Chief Expert choose and ask experienced Experts to be one of the module team leaders.
Six (6) months prior to the Competition**	Skill Competition Manager and Chief Expert allocate 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. However, in cases where the teams are unbalanced, the Chief Expert may recommend and decide that an Expert should join or move to another team.
Three (3) months (C-90 days) prior to the Competition	Each Module team sends their Test Project to the Skill Competition Manager and Chief Expert who will check the quality and consistency and send them to the WorldSkills Skills Competitions Administration Manager. The Test Projects are then circulated on the WSI website.
Two (2) months (C-60 days) prior to the Competition	A list of possible 30% changes for the Test Projects should be submitted on the WorldSkills Discussion Forum by the module teams.
One (1) month (C-30 days) prior to the Competition	Module teams submit the corresponding Marking Scheme for their Test Projects.
At the Competition	The final selection of the 30% changes is taken from the suggested changes on the C-60 submitted list.

** The mentioned twelve (12), nine (9), and six (6) months in the timeline are recommended and may change due to reasons that WorldSkills and the Competition Organizer cannot control.

Test Project module team leaders

The Team Leader should be an Expert with previous experience from at least one WorldSkills competition (whenever possible) and be nominated by the Chief Expert after consultation with the Skill Competition Manager.

It is the team leader's responsibility to ensure that each module conforms to the Technical Description, complete with proof of testing and a Marking Scheme.

Twelve (12) months prior to the Competition

- Chief Expert will – in consultation with the registered Experts – prepare an up-to-date hardware and software request list for the Country/Region hosting the Competition.
- This list is forwarded to the Host Country/Region not less than six (6) months prior to the start of the Competition.
- The Skill Competition Manager will have unrestricted access to this process and database of outlines and activities.

It is the responsibility of all Experts as a member of a module team to access and be an active part in the development of their own modules Test Project and in case of voting, cast their votes on the

WorldSkills Discussion Forum. The active work on the module teams Test Projects will and must be done in the closed forum that they are specifically assigned to.

As of WSC2026 an Independent Test Project Designer will have to develop the Test Project, there will not be the option for Experts to develop the Test Project.

5.5 Test Project initial review and verification

The purpose of a Test Project is to create a challenge for Competitors which authentically represents working life for an outstanding practitioner in an identified occupation. By doing this, the Test Project will apply the Marking Scheme and fully represent the WSOS. In this way it is unique in its context, purpose, activities, and expectations.

To support Test Project design and development, a rigorous quality assurance and design process is in place (Competition Rules sections 10.6-10.7 refer.) Once approved by WorldSkills, the Independent Test Project Designer (ITPD) is expected to identify one or more independent expert(s), and trusted individuals initially to review the Independent Test Project Designer's ideas and plans, and subsequently to verify the Test Project, prior to validation.

A Skill Advisor will ensure and coordinate this arrangement, to guarantee the timeliness and thoroughness of both initial review, and verification, based on the risk analysis that underpins Section 10.7 of the Competition Rules.

5.6 Test Project validation

The Skill Competition Manager coordinates the validation of the Test Project/modules and will ensure that it can be completed within the material, equipment, knowledge, and time constraints of Competitors.

5.7 Test Project circulation

The Test Project/modules are not circulated prior to the Competition. The Test Project/modules are presented to Experts and Competitors on C1.

5.8 Test Project change

Due to the Test Project being developed by an Independent Test Project Designer (ITPD), there is no change required to be made to the Test Project/modules at the Competition. Exceptions are amendments to technical errors in the Test Project documents and according to infrastructure limitations.

5.9 Material or manufacturer specifications

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and are available from www.worldskills.org/infrastructure located in the Expert Centre. 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.

The Competition Organizer must provide a US QWERTY keyboard for all PCs.

6 Skill management and communication

6.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the WorldSkills skill-specific Discussion Forum. (http://forums.worldskills.org). Skill related decisions and communication are only valid if they take place on the WorldSkills Discussion Forum. The Chief Expert (or an Expert Lead appointed by the Skill Management Team) will be the moderator for this Discussion Forum. Refer to the Competition Rules for the timeline of communication and competition development requirements.

6.2 Competitor information

All information for registered Competitors is available from the Competitor Centre (www.worldskills.org/competitorcentre).

This information includes:

- Competition Rules
- Technical Descriptions
- Mark Summary Form (where applicable)
- Test Projects (where applicable)
- Infrastructure List
- WorldSkills Health, Safety, and Environment Policy and Regulations
- Other Competition-related information

6.3 Test Projects and Marking Schemes

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).

6.4 Day-to-day management

The day-to-day management of the skill competition during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and the Expert Leads. The Skill Management Plan is progressively developed in the six (6) months prior to the Competition and finalized at the Competition. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).

6.5 General best practice procedures

General best practice procedures clearly delineate the difference between what is a best practice procedure and skill-specific rules (section 9). General best practice procedures are those where Experts and Competitors CANNOT be held accountable as a breach to the Competition Rules or skill-specific rules which would have a penalty applied as part of the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System. In some cases, general best practice procedures for Competitors may be reflected in the Marking Scheme.

Topic/task	Best practice procedure
Competitors - Experts	• ALL questions and Test Project clarification from the Competitors are to be written and then provided to the Independent Test Project Designer for review and reply. If it is identified that there is an error or unclear parts in the competition documents an errata is to be provided to each Competitor to clarify or amend the error in the Test Project.
Competitors' internet station	• Competitors can make use of the internet workstation twice a day, allocations reset each day and can not be carried over • A maximum of ten minutes is allocated to each session and any unused time cannot be re-allocated. • Competitor Internet workstation sessions are not to be used consecutively; a minimum of one session must separate the use of the Internet workstation. • All internet accesses will be monitored by a non-compatriot Expert or screen recording software may be used record the screen at all times. • The intention is to do research only.

7 Skill-specific safety requirements

7.1 Personal Protective Equipment

Refer to WorldSkills Safety Policy and Regulations for Host country or region regulations.

Task	Sturdy shoes with closed toe and no heel
General PPE for safe areas	√
All processes at the workstation	√

8 Materials and equipment

8.1 Infrastructure List

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

The Infrastructure List is available at www.worldskills.org/infrastructure.

The Infrastructure List specifies the items and quantities requested by the Skill Management Team for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. 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.

At each Competition, the Skill Management Team must review and update the Infrastructure List in preparation for the next Competition. The Skill Competition Manager must advise the Director of Skills Competitions 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 for the upcoming WorldSkills 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

Competitors are not allowed to send a toolbox to the Competition. All tools are provided by the Competition Organizer.

8.3 Materials, equipment, and tools supplied by Competitors

It is not applicable for Competitors to bring materials, equipment, and tools to the Competition. However, Competitors are allowed to bring three (3) keyboards and three (3) mouses on the morning of C-2 (Familiarization Day). It is recommended that these tools be brought in the luggage of the Competitor or purchased locally.

Furthermore, Competitors are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

8.4 Materials, equipment, and tools supplied by Experts

Experts are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

Experts are responsible that Interpreters bring their own PPE.

8.5 Materials and equipment prohibited in the skill area

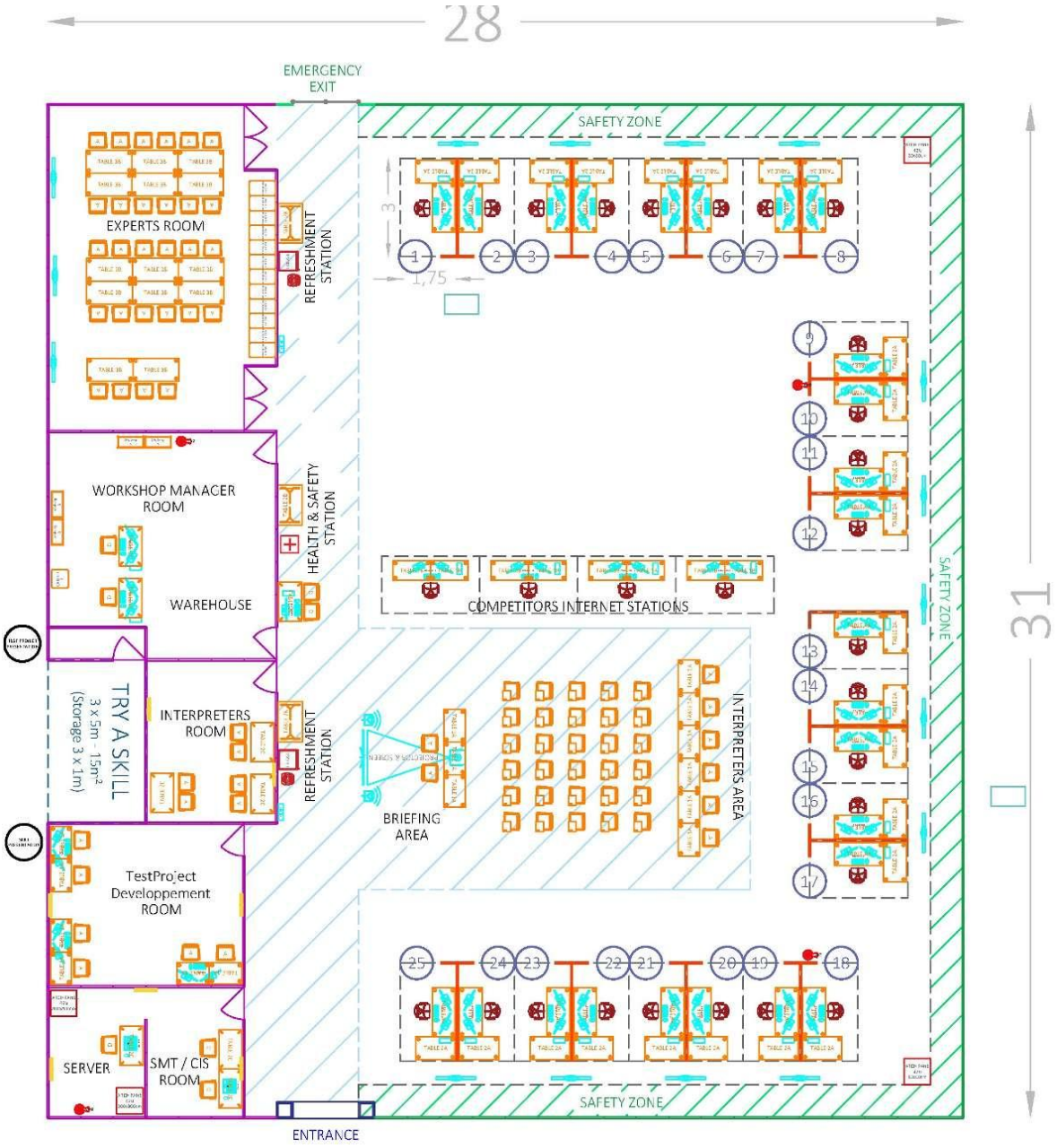
Competitors and Experts are prohibited to bring any materials or equipment not listed in section 8.3 and section 8.4.

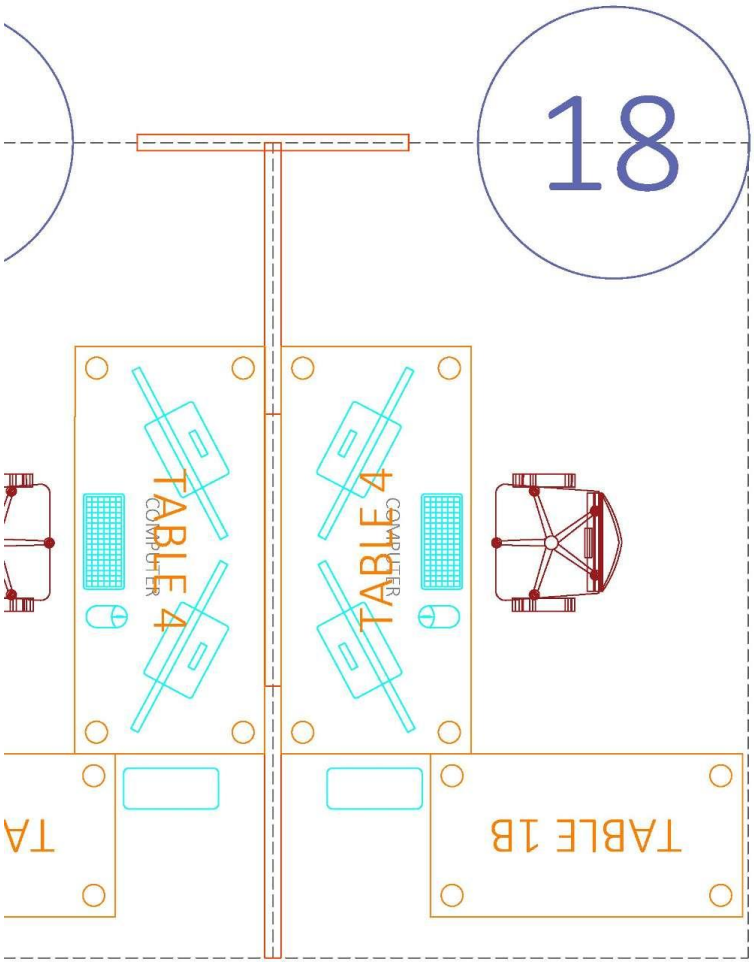
Regarding the use of electronic equipment within the competition area: Devices such as tablet, cell phones, media players, recorders, etc. are to follow WSI rules and/or by the Skill Competition Manager and Chief Expert presented rules for the actual Competition.

8.6 Proposed workshop and workstation layouts

Workshop layouts from previous competitions are available at www.worldskills.org/sitelayout.

Example workshop layout





9 Skill-specific rules

9.1 General notes

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 Skill-specific rules

Topic/task	Skill-specific rule
Competitors - Experts	• Experts are NOT to enter their compatriot Competitor's workstation alone at any time. • Experts are NOT to touch their compatriot Competitor's equipment. • A minimum of two experts and or the Workshop Manager must be present if a Competitors workstation is to be touched during competition time, for example when checking an IT issue. • Experts are NOT to talk to their compatriot Competitor on their own during the competition time, if communication is necessary it is to be approved by the Skill Competition Manager or Chief Expert, a second Expert must be present and communication must be in a language that both Experts understand. • Competitors are NOT allowed to leave the skill competition workshop without permission (e.g. toilet etc.). In this case one Expert will follow them and wait outside. If anyone leaves without permission it is deemed they have ended that competition day.
Competitors' internet station	• No notes can be taken and no files transferred to or from the Internet station. • No external communication is allowed.
Use of technology – USB pen drives and portable storage devices	• Chief Expert, Competitors, Experts, and Interpreters - Only USB pen drives or other portable storage devices that are supplied by the Competition Organizer and the Skill Competition Manager and Chief Expert for the skill preparation and competition tasks are allowed in the workshop from C-4 until the end of C4. The Skill Competition Manager and Independent Test Project Designer is exempt from this rule to facilitate the deployment of the competition environment. • Skill Competition Manager, Chief Expert, Competitors, Experts, and Interpreters given a USB pen drive or other portable storage device in any form as "give-aways" etc. to or from other participants must store this in their own locker immediately or as we strongly recommend, give them in the morning or evening outside of the workshop area.

Topic/task	Skill-specific rule
Use of technology – personal laptops	• Chief Expert and Experts - No personal laptops are allowed for the preparation work. The Competition Organizer will supply laptops for this work. These are required to stay in the workshop in the locker during lunchtime and after each working day. If you bring your own laptop with you for personal use during lunch or free time, it must be placed in the locker when on duty in the workshop. These can be taken at the end of the day. The Skill Competition Manager is exempt from this rule. • Interpreters - Personal laptops without wireless functions enabled, used for the translation work are allowed to be brought into the workshop however they are required to stay in the workshop in the locker during lunch-time and after each working day. It is a requirement that these laptops have all wireless functions (Wi-Fi, Bluetooth, 3G, 4G and so on) disabled. These can be taken at the end of the day.
Use of technology – mobile phones and tablets	• Experts and Interpreters - No mobile devices (smart watches, phones, or tablets) are allowed for personal use while working with Test Projects or Marking Schemes. • Competitors – No mobile devices (smart watches, phones, or tablets) or music-players are allowed in the workstation. If these are brought into the workshop, then they should be locked in the locker and only removed at lunch time and at the end of the day.
Use of technology – personal photo and video taking devices	• Taking photos or video inside the workshop with mobile phones, tablets, or personal cameras is only allowed after agreement with Chief Expert.

10 Expert knowledge and experience

10.1 Requirements

Experts appointed for this skill competition must have the following knowledge and experience for the appropriate occupation or work role as documented in **section 1.1.2**.

The IT Network Systems Administration competition covers a broad number of topics including:

- Linux client and server configuration
- Windows client and server configuration
- Cisco routing and switching
- Network and server automation
- Troubleshooting

An Expert for the IT Network Systems Administration skill should have knowledge of each of these topics and will often be a subject matter Expert in one or more.

Experts may have either practical industry experience or be a teacher/lecturer in one or more of the following IT disciplines:

- Systems Administrator
- Network Administrator
- Infrastructure Engineer
- DevOps Engineer
- Cloud Engineer
- Help Desk / Desktop Support Technician
- Cisco Certified System Instructor (CCSI)

Relevant industry qualifications held by an Expert may include:

- Cisco Certified Network Associate (CCNA)
- Implementing Cisco Enterprise Advanced Routing and Services (ENARSI)
- Linux LPIC-2 or equivalent
- Red Hat Certified Specialist in Ansible Network Automation
- Red Hat Certified Specialist in Developing Automation with Ansible Automation Platform
- Microsoft Windows Server and Microsoft Windows Client certification

11 Visitor and media engagement

11.1 Engagement methods

Following is a list of possible ways to maximize visitor and media engagement:

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

12 Sustainability

12.1 Sustainable practices

This skill competition will focus on the sustainable practices below:

The competition should use Virtualisation Technology (e.g. VMWare) and Network Emulators (Cisco CML) for the purpose of reducing the need for a large number of networking devices.

13 References for industry consultation

13.1 General notes

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Occupational Standards on a two-yearly cycle.

In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (http://www.ilo.org/public/english/bureau/stat/isco/isco08/)
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.onetonline.org/)

13.2 References

This WSOS (Section 2) appears most closely to relate to Network and Computer Systems Administrators:
https://www.onetonline.org/link/summary/15-1142.00

and ICT Network Technician:
http://data.europa.eu/esco/occupation/64c7d461-152c-477f-a8e2-c2c537e9d617 ILO 3513

Adjacent occupations can also be explored through these links.

ILO 3513.

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Occupational Standards in place for WorldSkills Shanghai 2026.

Oranization	Contact name
Ridgeon Network Ltd	Chris Ridgeon, Director
SystemEngineer360 Pte Ltd	Bai Qing, CEO

14 Appendix

14.1 Appendix information

Not applicable.