

Technical Description

Cloud Computing

Information and Communication Technology



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	2
2 THE WORLDSKILLS STANDARDS SPECIFICATION (WSSS)	4
3 THE ASSESSMENT STRATEGY AND SPECIFICATION	10
4 THE MARKING SCHEME	11
5 THE TEST PROJECT	15
6 SKILL MANAGEMENT AND COMMUNICATION	17
7 SKILL-SPECIFIC SAFETY REQUIREMENTS	18
8 MATERIALS AND EQUIPMENT	19
9 SKILL-SPECIFIC RULES	20
10 VISITOR AND MEDIA ENGAGEMENT	22
11 SUSTAINABILITY	23
12 REFERENCES FOR INDUSTRY CONSULTATION	24

Effective 22.08.18



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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

Cloud Computing

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

The positions responsible for the design and implementation of information technology infrastructure in a public cloud environment can span multiple roles including, Systems Administrators/Engineers, Database Administrators, Network Administrators/Engineers, Storage Administrators/Engineers, Systems/Network/Solutions/Enterprise Architects, programmers/developers, and similar technology-driven roles which shoulder the business and functional responsibilities for architecting infrastructure design. Due to the ever-expanding features and capabilities of public cloud providers, this list of associated infrastructure specialists is also expanding.

Infrastructure Architects are responsible for the overall design and direction for system and application deployments. These architects have traditionally created designs that have spanned multiple office locations as well as corporate and collocated data centres. With the growing prevalence of public cloud deployments, they have added IaaS (Infrastructure as a Service) opportunities to their list of deployment tools. This allows these technology specialists to work towards migration solutions, offsite storage solutions, dynamic resource elasticity, and other design paradigms to create solutions that best fit the needs of each organization.

Systems Administrators/Engineers are able to utilize public cloud providers in order to automate, expand, streamline, simplify, and accelerate their deployment models. Utilizing their experience in automation, these technologists can programmatically deploy infrastructure using the command line, language-specific SDK integrations, and infrastructure templating capabilities. This group is able to manage their technology footprint through the use of managed services to offload the administration of tasks such as managing a centralized activity logging by defining permissions and recording events. The ability to define a solution and then replicate that design to multiple environments and locations can be a significant responsibility of the position along with managing the integration of cloud computing offerings into existing technology solution sets.

Database Administrators are increasingly engaging with public cloud providers as it gives them greater control over the details of their deployments. They are able to utilize resources on demand rather than waiting for resources from other departments. Additionally, they can use the advanced features of cloud providers such as managed database services for caching, relational databases, and NoSQL data solutions.

Storage Administrators gain the flexibility to scale their storage needs without concern for hardware availability or capital expense. Using multiple storage offerings from cloud vendors, storage-related technology specialists can build solutions that best fit their storage needs using the tools provided by their vendor, or solutions from the vendor's 3rd party partners to deliver scalable, highly available primary and disaster recovery storage solutions. Implementing backups, deploying shared and clustered storage solutions, system snapshots, and data migrations are just a few examples of activities that can be automated via multiple programming languages using public cloud vendors and 3rd party partner solutions.

1.1.3 Number of Competitors per team

Cloud Computing is a single Competitor skill competition.

1.1.4 Age limit of Competitors

The Competitors must not be older than 25 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 – Competition Rules
- WSI – WorldSkills Standards Specification framework
- WSI – WorldSkills Assessment Strategy
- WSI Online resources as indicated in this document
- WorldSkills Health, Safety, and Environment Policy and Regulations

2 THE WORLDSKILLS STANDARDS SPECIFICATION (WSSS)

2.1 GENERAL NOTES ON THE WSSS

The WSSS 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 (www.worldskills.org/WSSS).

The skill competition is intended to reflect international best practice as described by the WSSS, and to the extent that it is able to. The Standards Specification 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 Standards Specification 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 Specification. This is often referred to as the “weighting”. 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 Standards Specification. They will reflect the Standards Specification 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 Standards Specification to the extent practically possible. A variation of five percent is allowed, provided that this does not distort the weightings assigned by the Standards Specification.

2.2 WORLDSKILLS STANDARDS SPECIFICATION

SECTION		RELATIVE IMPORTANCE (%)
1	Work organization and management	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The relationships between different technologies and areas of expertise used in a public cloud deployment. • Interoperability requirements for each aspect of a systems deployment within a public cloud provider. • The requirements of each group of stakeholders in the design of an IT solution using public cloud services. • Methods of Integrating an organization's best practices and public cloud offerings to create application-specific deployments. • Methods of evaluating, comparing and contrasting the wide range of possible solutions for each IT implementation • Methods of determining which solution is optimal for each organization taking into account internal best practices, business requirements, existing infrastructure, and resource expertise. 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Identify common deployment models with public cloud providers and how those models can apply to organization-specific requirements. • Identify opportunities and create migrations plans to phase-in public cloud deployments and reduce risks. • Create highly available, scalable, and secure IT architectural designs specific to each application, taking into account compute, storage, networking, database management, and deployment requirements. • Take advantage of public cloud provider solutions to reduce operational burden associated with service deployments. 	
2	Communication and interpersonal skills	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • How to communicate across organizational teams to identify infrastructure requirements and architectural opportunities. • How to engage with business units to identify best practices for deployment and create a migration path to the public cloud. • Methods and techniques for working with business stakeholders in meeting organizational and compliance related goals. • The bases for creating department and team-specific infrastructure designs that take advantage of public cloud capabilities and value-add services. 	

	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Discover and document key requirements and how they relate to public cloud offerings. • Discover and document technology-specific opportunities to leverage public cloud offerings. • Translate business goals and objectives into briefs, designs, and plans, and present such documents to stakeholders and management teams. • Clearly map departmental and technology-specific requirements and goals to public cloud solutions. • Using project-specific migration plans, facilitate the implementation of an organizational transition to public cloud resources. 	
3	Problem solving, innovation, and creativity	20
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The role and importance of each layer of infrastructure design including, compute, storage, networking, database, caching, and application. • Various technology solutions to meet business objectives (e.g. different relational database solutions as well the use of NoSQL technologies for transactional data workloads) • Various storage capabilities including block level replication, network block device sharing, shared/clustered file systems, object storage, and storage caching solutions. • Various network architectures to facilitate communication with existing/legacy applications and environments. • Automation methodologies and opportunities commonly used throughout the technical community. 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Evaluate, select and implement foundational cloud computing services such as compute, network, and storage. • Evaluate, select and implement advanced cloud computing services such as managed data services, caching services, and automated scaling and availability features. • Evaluate, select and implement various network-related technologies to infrastructure design such as network communication protocols, sub netting, NAT, DNS, VPN, broadcast networking, and dynamic routing protocols. • Automate infrastructure creation and modification through the use of scripting or programming, and the use of infrastructure templates. 	

4	Security	20
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Best practices for securing systems and networks using authorizations, authentications, and accounting. • Best practices for developing secure deployment and the ongoing monitoring of traffic and assets. • Best practices for deploying, monitoring, and maintaining secure infrastructure. • Best practices for the creation and deployment of secure application designs for public cloud infrastructure. • The demarcation of responsibility for security between the cloud provider and the public cloud customer. • The importance and intent of network traffic and resource isolation. 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Design and implement authentication processes at a departmental and organizational level, controlling access to public cloud administrative capabilities and system access. • Develop policies and procedures for systems and application access to public cloud interfaces and services. • Implement policies and procedures for auditing of public cloud activities and access. • Create internal prescriptive guidance and requirements for procedures necessary to create, update, remove and access public cloud infrastructure and resources. • Implement service and technology specific security controls on resources running within a public cloud environment as well as utilization of services provided by an IaaS vendor. • Engage with business, development, and leadership staff to identify, recommend, and implement security best practices while ensuring an efficient user experience. 	
5	Reliability, scalability, and elasticity	20
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • How business requirements translate to operational objectives in relation to resource constraints addressed by the use of public cloud features and services. • The principles and architectures for different availability/deployment models such as disaster recovery, high availability, blue-green deployments, global load balancing, and pilot light deployments. • Application and service-specific availability requirements and nuances as they relate to systems and application availability. • Network data flow and the corresponding relationship to systems availability. • Organizational and departmental business and technology goals related to system survivability and data durability in the event of different failure scenarios. • How application, system, and network metrics can be used to define the implementation of available, scalable, and elastic architectures. • Different applications, systems, and protocol nuances and requirements necessary to automate the scaling, durability, and availability of infrastructure. 	

	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> Record, analyse, and interpret application, system, and network data to facilitate the recommendation of an appropriate architecture that sufficiently utilizes scalability and elasticity to meet the variable demands of internal and external users and systems. Implement different availability, scalability, and durability models in accordance with application and system design requirements. Design availability models that meet the business requirements of an organization, taking into account allowed recovery time and allowable service interruption parameters. Utilize public cloud services and features to aid the design and deployment of availability, durability, and scalability requirements. Implement protocol, application, and system-specific designs to meet the performance and availability requirements of organizational units. 	
6	Performance and optimization	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> Different infrastructure performance opportunities available through solutions such as caching, resource right-sizing, and vendor-provided services. Performance requirements and possible bottlenecks with infrastructure design. Vendor-specific pricing opportunities as they relate to different public cloud offerings for optimizing costs. Opportunities available during the creation of new applications or redesign of existing applications to take advantage of public cloud offerings such as server-less computing and microservice orchestration. 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> Analyse and interpret performance metrics from compute, storage, network, and application levels for use in public cloud infrastructure design objectives. Utilize performance tuning techniques and packages to ensure optimal resource utilization. Implement a microservice strategy to capitalize on technology advances in areas like container development. Pursue the decoupling of services to allow the separation of application components to facilitate a service-oriented architecture. Recommend and implement database and storage solutions that best fit the needs of an application. 	
7	Operational considerations	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> The requirements of systems and applications in order to maintain functionality and availability. System, network, and application metrics and how they apply to infrastructure durability, availability, and performance. Response requirements, protocols, and procedures for various incidents including, security, availability, and performance-related incidents. 	

	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Implement monitoring solutions to generate alerts and automate responses to various incidents. • Implement centralized metric collection and analysis for systems, network, and application information. • Implement a process to continually improve architectural designs by automating infrastructure configuration updates. • Continuously monitor and review systems and applications for design improvement opportunities. • Continuously test for failure and design for resiliency. • Ensure cloud configurations are kept current and versioned. • Keep up to date with new services, procedures, and technology solutions offered by public cloud providers in order to optimize current and future deployments with the latest technology opportunities and best practices. 	
	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 Specification. The Test Project is the assessment vehicle for the skill competition, and also follows the Standards Specification. 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 Standards Specification and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, in order to demonstrate their quality and conformity with the Standards Specification.

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI 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 standards that represent the skill. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards Specification.

By reflecting the weightings in the Standards Specification, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill 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 Specification, if there is no practicable alternative.

The Marking Scheme and Test Project may be developed by one person, or several, or by all Experts. The detailed and final Marking Scheme and Test Project must be approved by the whole Expert Jury prior to submission for independent quality assurance. The exception to this process is for those skill competitions which use an independent designer for the development of the Marking Scheme and Test Project. Please see the Rules for further details.

Experts and independent designers are required to submit their Marking Schemes and Test Projects for comment and provisional approval well in advance of completion, in order to avoid disappointment or setbacks at a late stage. They are also advised to work with the CIS Team at this intermediate stage, in order to take full advantage of the possibilities of the CIS.

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition using the CIS standard spreadsheet or other agreed methods.

4.2 ASSESSMENT CRITERIA

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived in conjunction with the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards Specification; in others they may be totally 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 Specification.

Assessment Criteria are created by the person(s) developing the Marking Scheme, who are free to define 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). It is advisable not to specify either the Assessment Criteria, or the allocation of marks, or the assessment methods, within this Technical Description.

The Mark Summary Form generated by the CIS will comprise a list of the Assessment 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) specified 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, or instructions for how the marks are to be awarded. Aspects are assessed either by measurement or 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 skill in the Standards Specification. 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)

	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			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	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, in all circumstances. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (See 4.6.)

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)
- 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, with a fourth to coordinate the marking and acting as a judge to prevent compatriot marking.

4.7 ASSESSMENT AND MARKING USING MEASUREMENT

Three Experts will be used to assess each aspect. 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.

4.8 THE USE OF MEASUREMENT AND JUDGEMENT

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

4.9 COMPLETION OF SKILL ASSESSMENT SPECIFICATION

Marking groups will be formed in accordance with the Competition Rules.

The Marking Scheme developed by the external writer will comprise Aspects with clear calculations and/or added detail.

There may be up to five different types of measurement in the Marking Scheme. The table below explains these. Judgement will be used to assess qualitative Aspects.

TYPE	EXAMPLE	MAXIMUM MARKS	CORRECT	NOT CORRECT
Full marks or zero marks	Deployment of MySQL compatible service (i.e. a required service).	1	1	0
Deduct from full marks	Failure to design for high availability	1.0	1.0	0 – 0.9
Add to zero marks	Deployment of suggested but not required service or feature (e.g. CDN, database or HTTP cache)	1.0		
Processed messages	Calculated based upon rate and number of completed processed messages.			
Operational efficiency	Calculated based upon the ability to scale up and down infrastructure (instances) to ensure limited wasted resources.			

4.10 SKILL ASSESSMENT PROCEDURES

A team of Experts will

- Review each Competitor's infrastructure data and
- Orchestrate infrastructure processing and failure requests.

This team will have access to a dashboard with command and control capabilities along with a status display of each Competitor's progress.

At the start of the competition, a designated Expert will explain the purpose of an application design and goals for a deployment. Competitors will be expected to utilize a broad range of technologies and solutions in order to meet the demands of the application requests.

Since the application limitations are not based upon the vertical scalability of resources, each Competitor shall be limited in implementation to cost-effective infrastructure resources

Each Competitor may use any means of infrastructure design, implementation, and deployment with the exception of de-compilation or modification of the supplied application.

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 WSSS.

The purpose of the Test Project is to provide full, balanced and authentic opportunities for assessment and marking across the Standards Specification, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme and Standards Specification 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 Specification, or affect the balance of marks within the Standards Specification other than in the circumstances indicated by Section 2.

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.

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 Specification. Section 2.1 refers.

5.2 FORMAT/STRUCTURE OF THE TEST PROJECT

To be determined by the Experts on the Forum.

5.3 TEST PROJECT DESIGN REQUIREMENTS

To be determined by the Experts on the Forum.

5.4 TEST PROJECT 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 Who develops the Test Project or modules

The Test Project is developed by an Independent Test Project Designer

5.4.2 How and where is the Test Project or modules developed

The Test Project is developed independently.

5.4.3 When is the Test Project developed

The Test Project is developed according to the following timeline:

TIME	ACTIVITY
Three (3) months prior to the Competition	The Test Project is sent to the Director of Skills Competitions three months prior to the Competition.
At the Competition	The Test Project is circulated to both Expert and Competitors at the Competition.

5.5 TEST PROJECT VALIDATION

The Test Project is validated by the Independent Test Project Designer.

5.6 TEST PROJECT SELECTION

The Test Project is selected by the Independent Test Project Designer.

5.7 TEST PROJECT CIRCULATION

The Test Project is circulated via the website as follows:

The Test Project is circulated at the Competition.

5.8 TEST PROJECT COORDINATION (PREPARATION FOR COMPETITION)

The Test Project is coordinated by the Chief Expert and the Independent Test Project Designer.

5.9 TEST PROJECT CHANGE AT THE COMPETITION

The Test Project is not changed at the Competition.

5.10 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.

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 skill specific Discussion Forum (<http://forums.worldskills.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 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 during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team led by the Skill Competition Manager. The Skill Management Team comprises the Skill Competition Manager, 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 in the Expert Centre (www.worldskills.org/expertcentre).

7 SKILL-SPECIFIC SAFETY REQUIREMENTS

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

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 Experts for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Items supplied by the Competition Organizer are shown in a separate column.

At each Competition, the Experts must review and update the Infrastructure List in preparation for the next Competition. Experts 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.

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 required to bring a toolbox.

8.3 MATERIALS, EQUIPMENT, AND TOOLS SUPPLIED BY COMPETITORS IN THEIR TOOLBOX

Competitors are not required to bring any materials, tools, or equipment to the Competition.

8.4 MATERIALS, EQUIPMENT, AND TOOLS SUPPLIED BY EXPERTS

Experts are not required to bring any materials, tools, or equipment to the Competition.

8.5 MATERIALS AND EQUIPMENT PROHIBITED IN THE SKILL AREA

The only materials and equipment allowed in the workshop are those supplied by the Competition Organizer. All other materials and equipment are prohibited.

8.6 PROPOSED WORKSHOP AND WORKSTATION LAYOUTS

Workshop layouts are available at www.worldskills.org/sitelayout.

9 SKILL-SPECIFIC RULES

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 work flow, and documentation management and distribution.

TOPIC/TASK	SKILL-SPECIFIC RULE
Use of technology – USB, memory sticks	<ul style="list-style-type: none"> Experts – Experts are allowed to bring USB/memory sticks into the Expert Meeting Room. USB/memory sticks will be allowed to be taken outside of the meeting room at the end of each day. Competitors – Competitors are not allowed to bring USB/memory into the workshop.
Use of technology – personal laptops	<ul style="list-style-type: none"> Experts – Experts are allowed to bring laptops into the Expert Meeting Room. Laptops will be allowed to be taken outside of the meeting room at the end of each day. Competitors – No laptops are allowed in the workshop.
Use of technology – personal cameras	<ul style="list-style-type: none"> Experts – Experts are allowed to bring cameras into the Expert Meeting Room. Cameras will be allowed to be taken outside of the meeting room at the end of each day. Competitors – No cameras are allowed in the workshop until the completion of competition on day four.
Use of technology – mobile devices	<ul style="list-style-type: none"> Experts – No electronic devices are to be brought to any Competitors workstations under any circumstances unless with the approval of either the Chief or Deputy Chief Experts. Competitors – Electronic devices (Including mobile phones) must stay in Competitor bags (switched off or on silent) within the lockers provided. No electronic devices are to be brought to Competitors workstations under any circumstances unless with the approval of either the Chief or Deputy Chief Experts.
Source file/notes	<ul style="list-style-type: none"> Competitors – No notes may be brought into the workshop under any circumstances. All notes made at the Competitor workstation must remain on the Competitors desk at all times. No notes may be taken outside of the workshop.
Equipment failure	<ul style="list-style-type: none"> Competitors – In the occurrence of equipment failure Competitors must notify Experts immediately by raising their hand. Experts will take note of the time that the Competitor is not able to make use of their equipment. Any time lost due to equipment failure will be provided to the Competitor at the end of the standard Module time. No additional time will be granted for work not saved prior to the equipment failure.
Final Test Projects	<ul style="list-style-type: none"> Competitors - Final Test Projects for all Competitors will be backed up and made available to all Competitors at the conclusion of the competition.

TOPIC/TASK	SKILL-SPECIFIC RULE
Music	<ul style="list-style-type: none"> Competitors - Competitors will be allowed to supply on Familiarization Day a memory stick containing a maximum of 20 un-edited songs. In addition to the memory stick, Competitors may also supply a maximum of three original music CDs. All music will be collated and shared amongst all Competitors.
Familiarization Day	<ul style="list-style-type: none"> Competitors - During Familiarization Day Competitors cannot use the available time to work on or solve any tasks related to the Competition. Prior to completing Familiarization all Competitors need to clean their respective computers removing all the files created/used to test the software. This includes the removal of all databases which have been created.
Breaks	<ul style="list-style-type: none"> Competitors - No extra time will be given to Competitors who stop work during competition time to go to the bathroom or for those who break for a food and/or drink. When time is completed all Competitors must stop all work on their computer immediately.

10 VISITOR AND MEDIA ENGAGEMENT

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

- Two mirrored monitors displayed for the public to view Competitors screens;
- Display screens showing a presentation on what competitors are currently working on;
- Enhanced understanding of Competitor activity;
- Career opportunities.

11 SUSTAINABILITY

This skill competition will focus on the sustainable practices below:

- Recycling – No printing for Competitor workstations;
- No printing of Test Projects. Test Projects will be provided within media files;
- Use of completed Test Projects after Competition;
- Limit the amount of software to be installed on Competitor workstations;
- Open source software.

12 REFERENCES FOR INDUSTRY CONSULTATION

WorldSkills is committed to ensuring that the WorldSkills Standards Specifications 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 Standards Specification 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/)