2022 BRICS Skills Competition

(BRICS Future Skills Challenge)

TECHNICAL DESCRIPTION

Cloud Computing（Offline）

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Technical Description

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Cloud Computing (BRICS International Vocational Skills Competition)

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The cloud computing competition of the 2022 BRICS Vocational Skills Competition adopts the method of offline competition and is oriented to the new generation of information technology majors. The competition is based on the skill requirements of production and jobs， and the core technologies of cloud computing include the following: Construction and operation of cloud platform; Deployment of container cloud applications; Design and Optimization of High Availability and Scalable System Architecture; System performance monitoring, System automatic O&M. The goal of the competition is to cultivate international, high-skilled, and future-skilled talent. The environment and assessment system of this competition are provided by professional cloud platform institutions. Competitors complete the assessment online or offline. This final is an offline competition in China and an online competition abroad, both of which are individual competition.

Cloud computing skills include the following: Configuration and use of cloud hosting; Construction and operation of cloud platform; Container Technology and Application Deployment; High reliability and scalable system design and implementation; Resource management and performance optimization; Load Balancing and Failure Recovery; System performance monitoring and automatic O&M.

The skills required by the contestants are as follows:

(1) Participants should be familiar with the following: hardware configuration of cloud host; installation of operating system; network configuration; construction of common application services (such as: yum, database, WEB service, FTP, NFS, DNS, SSH, etc.).

(2) Participants should master the following: Cloud computing virtualization technology(e.g. KVM); The construction of OpenStack; O&M of OpenStack components(including Keystone, Glance, Nova, Neutron, Cinder, Swift, etc.).

(3) Participants should master the following: Writing shell scripts; The management of cloud host, cloud storage, cloud network, cloud database; Deployment

of cloud application projects; Troubleshooting cloud application projects.

(4) Participants should be familiar with the following: Docker container technology; Deploy the container repository; Docker commands.

(5) Participants should master the following: The construction of Kubernetes; The construction of Kubernetes and the inspection of its running status; Manage Pods, write Yaml template files to deploy orchestrate applications, load balancing, automatic scaling and DevOps integration, etc.; Design and implementation of technical solutions based on container platform; Optimization of cloud computing platform architecture; Improvement of service quality.

(6) Participants should be familiar with the following: Familiar with cloud computing platform; Familiar with cloud computing platform resource management, status monitoring, fault recovery, and the use of automated O&M tools(Ansible, Puppet, zabbix, Prometheus, haproxy, keepaliv, etc.) .

1.2 Relevance and significance of this document

This document contains the criteria required for this skills competition, as well as the evaluation principles, methods and procedures for administering the competition.

Every expert and competitor must read this document, and in the event of any conflict between technical descriptions in different languages, the English version shall prevail.

2. Skill Standards

2.1 General description of skill standards

Skills standards set the knowledge, understanding and specific skills that are best practice internationally in terms of technical and professional performance. Skills standards will reflect a global consensus on what the relevant job role or occupation represents in industry and business.

The purpose of the skills competition is to reflect international best practice and the extent to which this skills standard describes it. Therefore, the standard is a guide to the training and preparation required for skill competitions.

The standard has different sections with titles and reference numbers.

The percentages of total points assigned to each section indicate their relative importance in the standard. This percentage is often referred to as the "weights" and the total score for all percentages is 100. The weights determine the distribution of points in the grading scale.

The grading scheme only evaluates the skills listed in the criteria by the test

project. There will reflect the standard as fully as possible within the constraints of the skill competition.

The scoring scheme will be based on the points assigned in the criteria to the extent practical. 5% variation in the grading scheme is allowed, but must not change the weights assigned by the standard specification.

2.2 Skill description

Parts	Weights (%)
Construction of private cloud platform	**15**
Competitors need to know and understand: – Infrastructure design of cloud platform, including Openstack control, computing, network, storage nodes, etc.; – Various control services, including management support services, basic management services, and extended management services, etc; – Various storage services, including block-level replication, network block device sharing, shared/clustered file systems, object storage, and storage caching solutions, etc.; – How to manage the communication between the private network and the public network, the communication between the virtual machine networks and the firewall on the virtual machine, etc.; – The capabilities and usage of computing services.	
Competitors should be able to: – Configure cloud host, including computer CPU, memory, disk, network, change host IP, Vlan and other related configurations; – Create cloud platform architecture, including updating, deleting, accessing cloud platform resources, and installing related dependency packages; – Evaluate, select and implement various network-related technologies into infrastructure design, such as network communication protocols, VLANs and dynamic routing protocols; – Learn about the functionality and installation of components in the build platform.	
Management and O&M of cloud platform	**15**
Competitors need to know and understand: – The common query and deployment instructions of the cloud platform, as well as the writing and running of scripts; – The functions and usage of common services of the cloud platform; – How to allocate and call resources in the cloud platform to facilitate subsequent management and rational use of resources.	
Competitors should be able to: – Evaluate, select and implement services for underlying cloud computing	

technologies and applications, such as computing, networking and storing; – Manage images of cloud platforms and create cloud hosts; – Configure the cloud hosting network and set up security groups.	
Container construction	**15**
Competitors need to know and understand: – The origin of container technology and the difference between containers and virtual machines; – The concept and advantages of containers. Containers are more lightweight and occupy less resources, and those can be deployed in large numbers on hardware of the same specifications; – The underlying implementation, working process and the deployment process of the container; – The basic image of the container and the operation of image creation.	
Competitors should be able to: – Install and configure containers and use container manipulation instructions; – Image containers and create container networks; – Write script files to manage containers; – specify and implement the database and storage solution that suits the needs of the application.	
Use of container orchestration tools	**15**
Competitors need to know and understand: – Various technical solutions to meet business objectives, such as different relational database solutions, and NoSQL technologies for workloads using transactional data; – The cloud service product technology when creating new applications or redesigning existing ones; – The importance and purpose of network traffic and resource isolation; – Principles and architectures for different availability deployment models such as disaster recovery, high availability, blue-green deployments, global load balancing, and pilotlight deployments.	
Competitors should be able to: – Install container orchestration tools and change their network configuration; – Download images, install and manage components; – Understand the functionality and usage of components; – Develop strategies and procedures for systems and applications to access cloud interfaces and services.	
Use of automated O&M tools	**40**
Competitors need to know and understand: – System and application requirements and maintenance of functional	

availability; – How to define a usable, scalable and flexible architecture by using metrics of application, system and network; – The metrics of system, network and application, and how to improve infrastructure durability, availability and performance; – The response to requirements, protocols, and procedures for a variety of events, including security, availability, and performance-related events.	
Competitors should be able to: – Record, analyze and interpret application, system and network data, taking advantage of scalability and flexibility to meet the variable needs of internal and external users and systems; – implement monitoring solutions to generate alerts and automatically respond to various events, and collect and analyze centralized metrics across systems, networks and applications; – Continuously monitor and review systems and applications for subsequent design and improvement; – continuously test the faults and design forresiliency; – analyze and interpret performance metrics from the compute, storage, network, and application levels for the cloud infrastructure design.	

3. Grading Scheme

3.1 Grading method

The scoring of this competition will be completed online by the referee team. If a player cheats or violates other rules during the competition, the referee will deal with the violation according to the player's violation. If the circumstances are serious, the score will be cancelled.

3.2 Grading rules

1. Ranking according to grades;

2. Those with the same total scores will be ranked in the order of the scores of Module C, Module B, and Module A. For details of each module, please refer to 4.2 of this article.

3.3 Grading basis

During the competition design process, the selection of criteria and evaluation methods will be determined through the scoring scheme and test project. The evaluation basis includes but is not limited to:

- Complete the construction of the cloud platform and verify the running status of the platform;

- Create containers and deploy applications to cloud platforms;
- Realize management and O&M of cloud platform application;
- Complete automatic deployment and O&M of enterprise applications.

4. Test Project

4.1 Common precautions

Whether it is a single module or a series of independent or related modules, the test project can evaluate the application of the knowledge, skills and behaviors defined in the skill specification.

Combined with the scoring scheme, the purpose of the test project is to provide a comprehensive, balanced and realistic opportunity for evaluation and scoring against the criteria. The relationship between test project, scoring schemes and standards will be a key indicator of quality, just as the relationship between standards and performance of actual job.

The test project do not include aspects outside the standards and do not affect the balance of scoring within the standards.

The assessment of knowledge and understanding in test project is solely through its application in real work.

4.2 Test project format/framework

The test project is composed of three relatively independent and related modules:

Module A: Construction and O&M of Private Cloud Platform;

Module B: Orchestration and O&M of Containers;

Module C: Automated Deployment and O&M of Enterprise Applications.

4.3 Time allocation and score weighting of test project

Module	Time（min）	Score weighting（%）
Module A: Construction and O&M of Private Cloud Platform	240	30
Module B: Orchestration and O&M of Containers	240	30

Module C: Automated Deployment and O&M of Enterprise Applications	240	40
Total	720	100

4.4 The contents and requirements of each module

The cloud computing competition consists of three modules, including: Construction and O&M of Private Cloud Platform, Orchestration and O&M of Containers and Automated Deployment and O&M of Enterprise Applications. The competition comprehensively examines the cloud computing practical skills and innovation ability of the contestants, thereby improving the professional quality and employability of the contestants.

Construction and O&M of Private Cloud Platform of Module A: The focus of the assessment is to build and deploy the Openstack private cloud platform, and to operate, maintain and manage multiple service resources of the cloud platform;

Orchestration and O&M of Containers of Module B: The focus of the assessment is to build Docker containers, use Kubernetes orchestration tools, and complete application deployment with highly availability and scalability;

Automated Deployment and O&M of Enterprise Applications of Module C: The focus of the assessment is to use automated operation and maintenance tools for building enterprise-level applications, and to complete the performance monitoring, alarm and fault recovery of cloud resources and cloud services.

Module number	Module name	Scope of module working
A	Construction and O&M of Private Cloud Platform	1 Ensure the normal operation of the system by setting up and managing the operating system of the physical host, including network, storage, virtualization and security, etc.; 2 Test network connectivity; 3 Install and configure Yum source, FTP, NTP, HTTP, RabbitMQ, MariaDB, Memcached, Etcd and other services; 4 Build the private cloud platform by installing script, and check the running status of each component and use the private cloud platform correctly after the building is completed; 5 Complete the O&M of private cloud components, including Keystone, Glance, Nova, Neutron, Cinder, Swift and other components, and write Shell scripts to complete the O&M of Openstack; 6 Call Openstack API by writing a Python script to complete the O&M and management of Openstack; 7 Master the dependencies and corresponding relationships of various services on the private cloud ,eliminate the problems encountered in

		the operation process and ensure the stable and smooth operation of the private cloud environment.
B	Orchestration and O&M of Containers	1 Install Docker services, deploy private container warehouses, and be proficient in using Docker commands; 2 Design the architecture of the Kubernetes platform, prepare the container environment, write the correct template files, and build the Kubernetes container cloud platform; 3 Run various commands of the container cloud platform, check the running status of the container cloud platform and monitor the operation of the container cloud platform; 4 Able to perform container-based O&M operations, including images, containers, warehouses, networks, etc.; 5 Write Dockerfile and use Commit to make container private cloud images; 6 Perform O&M operations of the container cloud Kubernetes platform, including managing Pods, writing Yaml template files to deploy and orchestrate applications, load balancing, automatic scaling, and integration of DevOps.
C	Automated Deployment and O&M of Enterprise Applications	1 Use automated O&M tools such as Ansible to complete operation and maintenance tasks, such as multi-node cluster deployment, cluster O&M, batch running commands, etc.; 2 Operate and manage of common applications, including database services, file storage and sharing, web services, migration, etc.; 3 Use tools such as Prometheus to define the rules of monitoring indicators and alarm, perform performance monitoring and high-availability services on cloud hosts, application systems, and services, and expand services according to business needs, such as automatically recover from faults, improve the security, reliability, and security of application systems; 4 Complete the deployment of application projects on cloud, such as building a private blog system, building an application store website, etc.; 5 Write shell scripts to complete O&M tasks, such as database backup, one-click deployment of applications, and service status detection.

4.5 Test project announced

The test project will be announced on the official website of the competition or approved by the organizing committee.

4.6 Test project changes

The project of the official competition will be changed by 30% on the basis of the test project.

5. Skills Management and Communication

5.1 Expert group

The skills expert group is composed of chief experts, deputy chief experts and expert members, and is responsible for revising the technical documents of this competition and managing daily skills.

5.2 Forum

For questions about software and hardware preparation, test environment deployment, etc. before the competition, participants can enter the forum section of the cloud computing technology training platform for feedback. The communication of the whole process of this event will also be carried out through the forum.

Use WeChat international version for online communication, and use Zoom to hold meetings (alternative: Tencent conference international version).

6. Safety Requirements

Strictly implement the national epidemic prevention policy to cope with emergencies.

Safety is a prerequisite for the smooth development of all skills competitions, and it is the core issue that must be considered in the preparation and holding of the competition. Effective measures must be taken to ensure the personal safety of all personnel during the competition.

6.1 Competition environment

1. Professionals must be organized to review the site before the competition and make clear requirements for safety work. The layout, equipment and equipment of the arena shall comply with relevant national safety regulations. If necessary, field simulation tests can also be carried out to detect possible problems in advance.

2. A cordon should be set up around the arena, all participants must enter the arena with valid certificates, and irrelevant persons are prohibited from entering the arena. Labor protection shall be provided for players in accordance with the requirements of professional positions.

3. If the competition involves high-altitude operations, the risk of falling objects, large power consumption, fire-prone situations, etc., a clear plan must be prepared, and emergency personnel and facilities must be provided.

4. It is strictly forbidden to bring inflammable and explosive materials, school

bags, etc. unrelated to the competition into the arena.

5. A signal shielding device must be equipped to control the signal on the arena to ensure the seriousness, fairness and impartiality of the competition.

6. The host institution shall have a grooming plan. For areas where there are densely populated areas and staggered traffic and people in the arena environment, signs must be set up, personnel must be evacuated, and alternate channels must be opened.

7. During the competition, the host institution must increase security forces on key positions in the arena and establish a security management log.

6.2 Requirements of epidemic prevention

1. According to local epidemic prevention and control regulations, pre-match nucleic acid testing and temperature testing must be done well. If the competitor's body temperature is greater than or equal to 37.3°C, competitor will be suspended from the competition and immediately sent to a designated medical institution for treatment according to the procedures. Competitors may continue to compete if they are diagnosed as free of disease (delayed races will not be extended).

2. Participants must follow the implementation of epidemic prevention measures, such as: wearing masks throughout the process and maintaining a safe distance; self-prepared anti-epidemic items, and after using the masks, they must be discarded into special trash cans.

6.3 Living condition

1. During the competition, in principle, the organizer of the competition will arrange accommodation. The organizer must arrange accommodation of the ethnic minority contestants according to the beliefs and cultures of the ethnic minorities.

2. Hotels should have business license qualifications. If the school dormitory is used as accommodation, the school is responsible for hygiene and food safety.

3. For group outings held during the competition, the host school is responsible for the traffic safety of all personnel.

4. In addition to taking necessary isolation measures, each safety regulation should strictly abide by national laws and regulations to protect personal privacy and personal freedom.

6.4 Team responsibility

1. Schools are required to purchase personal accident insurance for team members.

2. Schools must develop a management system to conduct safety education for all players and instructors.

3. The school must strengthen the safety management of team members and realize the connection with the safety management of the organizer.

6.3 Emergency treatment

In the event of an accident during the game, a plan should be launched immediately to solve it to avoid the situation from escalating. The competition can be suspended in the event of major safety problems, and the decision of whether to suspend the competition will be decided by the competition executive committee. After the event, the host school should report the details to the competition executive committee.

6.4 Penalties

1. If a competitor has a major accident and is prompted by the staff and the warning is invalid, their qualification for the competition may be disqualified.

2. If the staff violates the rules, they should be held accountable in accordance with the corresponding regulations. If the circumstances are serious and cause a major accident, the judicial organ shall pursue its corresponding legal responsibility.

7. Materials and Equipment

7.1 Infrastructure list

The infrastructure list details all the equipment and facilities that the participants need to prepare. Please refer to the "Offline Finals Infrastructure List of Cloud Computing Competition on 2022 BRICS Vocational Skills Competition".

7.2 Competitor's toolbox

Due to safety, the use of your own tools requires technical expert approval. When other special tools are required, the chief specialist of the competition will announce.

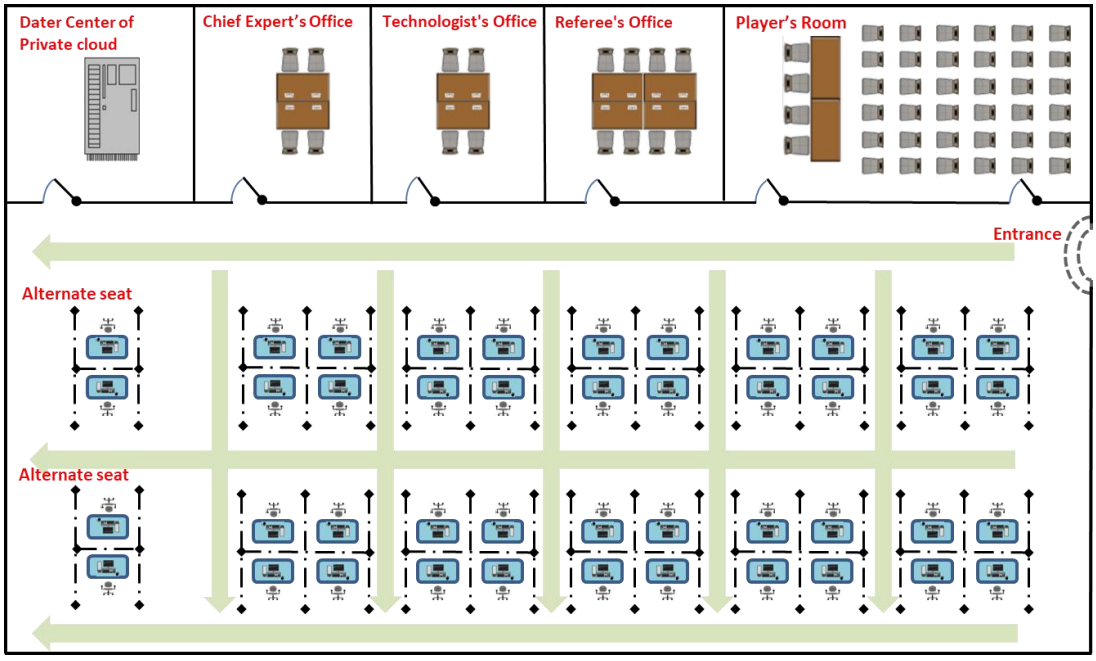
7.3 Materials, equipment and tools brought by the competitor

The identity cards and participation certificates for participating in the competition shall be carried by the contestants, and the others shall be provided by the competition organizer.

7.4 Materials and equipment prohibited in skilled areas

Any materials and equipment carried by the contestants should be declared (presented) to the expert. Experts have the right to prohibit the use of any item that is irrelevant to the performance of the mission or that may give an unfair advantage to competitor.

7.5 Suggestions for playing area and workstation layout



8. Skill Specific Rules

Skill specific rules cannot contradict or take precedence over the rules of the competition. They will provide specific details and clarity on different aspects, which vary by skill competition. They include, but are not limited to, personal computing devices, data storage devices, Internet access, work procedures, and document management and distribution.

Topics/Tasks	Skill specific rules
Storage - USB	Bringing memory cards or any other portable storage devices into the arena is prohibited.
Technology used: personal laptops, tablets and mobile phones	Experts and interpreters have access to personal laptops, tablets and mobile phones. Competitors are not permitted to bring personal laptops, tablets or mobile phones into the field.
Video - Personal ca	Competitors, experts and interpreters may use personal

mera	photographing and video recording equipment on the field only after the completion of the test project or with the consent of the chief expert.
Evaluation of test pr oject	While the contestants completes the test item, the expert with the highest professional level in the field assigned by the chief expert records the completion or non-completion of the test project points, which can only be assessed during the contestants completes the task. The designated experts are solely responsible for the fairness of the entrant's assessment.
Competitors experien ce technical issues d uring mission compl etion	In the event of a technical problem (not due to the fault of contestant) during the implementation of the test project, the contestant will receive additional time equal to the time from the discovery of the defect to the complete elimination of the defect. If the technical problem is found to be caused by the contestant, the contestant will not receive additional time.
PPE (Personal prote ction)	Personal protective equipment such as masks should be prepared by the participants.