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**Distributed computing - Technical requirements for computing
devices**

分布式计算 计算设备技术要求

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5 Overview

In distributed computing mode, devices typically use the following functions to work together to complete distributed computing tasks.

---Basic Functions. Essential functions required for device access to and management of distributed computing systems, and participation in distributed computing task scheduling and execution. Function.

---Data processing function. The function of the computing unit in the device to process data and generate specific results. Devices with data processing functions... Equipment, such as web servers, model inference servers, edge computing devices, etc.

---Data storage function. The function of the storage unit in the device to store, read, and write data and ensure that the data is not lost. It possesses data storage function. Devices that can perform such tasks, such as network attached storage (NAS) servers and Internet of Things (IoT) devices equipped with storage media.

---Data transmission function. The function of the communication unit in the device to send and receive data. Devices with data transmission function, such as networks... Network switches, wireless routers, etc. This document specifies the technical requirements for devices in a distributed computing environment from the perspective of the above-mentioned functions, and does not cover matters unrelated to distributed computing. General quality requirements for equipment (such as electromagnetic compatibility, noise, etc.). Example. In a data center scenario, a distributed computing system consists of high-performance servers and high-speed network switches, with servers communicating with each other via a wired network at high speed. Interconnectivity; In smart home scenarios, distributed computing systems consist of various embedded devices and wireless routers, with the embedded devices communicating via a wireless local area network. interconnected.

6.1 Basic Functions

6.1.1 Access and Management of Distributed Computing Systems The relevant requirements for managing devices connected to a distributed computing system include.

- a) It should have a software interface for distributed computing systems to discover, connect to, and release this device;
- b) It should have a software interface that allows the distributed computing system to query all functional interfaces provided by the device and the interface calling methods; The call method should include the data types of input and output, data encoding methods, and data units;
- c) A software interface should be provided to allow distributed computing systems to query the device's status in real time, including but not limited to online/offline status and busy status. Idle/busy state, normal/abnormal state, etc.;
- d) A clock synchronization protocol is recommended;
- e) It should have user authentication, access control and operation monitoring modules.

6.1.2 Distributed Computing Task Scheduling and Execution The requirements for devices participating in distributed computing task scheduling and execution include.

- a) It should have a software interface that allows users or other distributed computing nodes to perform tasks on this device, including data processing, data... Storage or data transfer tasks;
- b) It should have a software interface that returns task execution status information after the task is completed, including task execution time and whether the task was successful. For tasks that fail, an error description should be provided.
- c) It should have the capability to distribute and coordinate tasks among nodes using standard distributed computing protocols;
- d) It should have the ability to execute multiple tasks in parallel and support task priority settings;
- e) It should have the function of predicting task execution time;
- f) It should have fault-tolerant technologies (such as hardware redundancy and failover technologies);
- g) It should possess comprehensive security functions such as secure boot, trusted execution, network isolation and protection;

6.2 Data Processing Functions

6.2.1 Hardware The hardware configuration requirements for the device to provide data

processing functions include.

- a) It should have general-purpose or dedicated computing units capable of providing data processing services, such as CPU, GPU, NPU, FPGA, etc. ASIC, etc.;
- b) If there are multiple computing units, a communication module between the computing units should also be provided.

6.2.2 Basic Capabilities The basic capabilities required for data processing include the following.

- a) A software interface should be provided to allow other distributed computing nodes to run and manage computing tasks on this device, including but not limited to. 1) Submit the computation task; 2) Interrupt the computing task; 3) Check the calculation status; 4) Obtain the calculation results.
- b) It should have dynamic energy efficiency management functions (such as dynamic voltage and frequency regulation).
- c) It is advisable to provide a software or hardware interface for obtaining the real-time power value of this device.
- d) It should have virtualization capabilities.

6.2.3 Initial Resource Information Acquisition The device should have a software interface that allows other distributed computing nodes to obtain initial resource information related to the data processing function of this device. Initial resource information includes, but is not limited to, the following.

- a) Computational unit type. 1) If it is a general-purpose computing unit, architecture information should be provided, such as Advanced Reduced Instruction Set Machine (ARM) architecture, fifth-generation ARM architecture, etc. Instruction set architecture (RISC-V), etc.; 2) If it is a dedicated computing unit, the dedicated computing type should be provided, such as graphics processing, neural network training, neural network induction, etc. Reason, etc.
- b) Calculate the number of units.
- c) Supported data types and computational capabilities, such as 32-bit floating-point operations, 8-bit integer operations, and the per-bit capacity of each data type. Operations per second, etc.
- d) Supported compilers, programming languages, programming frameworks, mathematical libraries, computational frameworks, and their respective versions.
- e) Key performance parameters and resource configurations of various types of computing units, including but not limited to. 1) CPU core base frequency, number of cores, cache capacity at each level, and number of threads; 2) GPU memory capacity, memory

bandwidth, clock frequency, and number of stream processors; 3) The number of logic cells, memory capacity, and number of digital signal processing modules in the FPGA; 4) The types of acceleration operators for NPU and ASIC and the operation speed of each type of operator.

6.3 Data storage function

6.3.1 Hardware The hardware configuration requirements for the device to provide data storage functionality include.

- a) It should have non-volatile storage units capable of providing data read and write services to external users;
- b) It should have a standard hardware transmission interface.

6.3.2 Basic Capabilities The basic capability requirements related to data storage include.

- a) It should have file interface and folder interface, and the interface should comply with the provisions of Chapter 7 and Chapter 8 of GB/T 31916.3-2018;
- b) It should have the function of reading and writing data based on standard hardware transmission protocols;
- c) It should have data encryption read/write capabilities, such as software encryption or hardware encryption;
- d) It should have data compression functionality.

6.3.3 Initial Resource Information Acquisition The device should have a software interface that allows other distributed computing nodes to obtain initial resource information related to the data storage function of this device. Initial resource information includes, but is not limited to.

- a) Storage unit hardware type, quantity, and capacity;
- b) File system type;
- c) Storage method (e.g., block storage, file storage, object storage);
- d) Redundant Array of Independent Disks (RAID) level.

6.3.4 Resource Status Inquiry The device should have a software interface that allows other distributed computing nodes to query the status of resources related to data storage in the device in real time. Information. Resource status information includes, but is not limited to.

6.4 Data transmission function

6.4.1 Hardware The hardware configuration requirements for the device to provide data transmission functionality include.