Research on visualization of container layout based on embedded computer and microservice environment

Rong Chang¹*, Bangyuan Li¹, Bowen Zheng¹
¹Yunnan Power Grid Co., Ltd, Yuxi Power Supply Bureau

*Corresponding author e-mail: changrong@yunnanpg.org

Abstract. At present, many embedded computers use their microservice environment to require their control systems to have simple human-computer interaction and display interface. The keyboard is used to operate the menu and input parameters, and the display displays the current running status information. These hardware and software facilities enable visual programming technology to be used in the development of visual practical operation interface of embedded computer control container layout. Compared with the traditional visual development programming of symbolic language container layout, it has obvious advantages in saving development time, improving reliability and portability[1].

Keywords: Embedded Computer Container, Arrangement Visualization

1. Problems in visualization of container layout

At present, the visualization system of computer container layout in China can meet the production supply and deployment, but in the actual operation and maintenance, it relies heavily on the assistance of third-party manufacturers, and is still the "workshop" mode of one team for each business. The annual maintenance cost of manpower is very huge, and the efficiency is low. Due to GP failure, insufficient production performance and other problems, since 2015, the visualization time research of container layout has experienced multiple data migration, insufficient storage resources and necessary data retention cycle, which makes it impossible to further optimize. After the embedded computer system starts, it enters the initialization interface and displays the initialization information and function menu options. The initialization interface and four function interfaces are switched by operating the keyboard keys corresponding to the menu options. Each function interface realizes specific functions and sends control commands the operation key panel.

If the host resources of different hosts arranged by containers can be shared, the utilization rate of host resources will be greatly improved. In the production system, each embedded computing cluster is deployed in a special physical machine. After the visualization task of container arrangement is completed, it will be idle, and other computing clusters cannot use the host resources.[2] It is used to display the real-time status information of the system or the information that needs to be refreshed. The position of each level menu remains unchanged, and the content changes with the user's requirements. (Figure 1)
From the structure, the visual display interface of container arrangement can be regarded as a multi-layer menu. Each level of menu has its own menu of the same level and lower level, and each level of menu can be switched through the operation keyboard. The research on visualization of container arrangement of embedded computer and microservice environment fills in the gap that there is no unified containerized resource operation and maintenance platform in China, so that the actual business application can manage the life cycle of business application after stateless, containerization and visualization. Through the existing operation and maintenance mode, unify the operation and maintenance of all business application resources, and organically combine the existing open source technology with the traditional business of Unicom.

2. Design of visual system for embedded computer container arrangement

2.1. Visual management of embedded computer container arrangement
It includes the whole lifecycle management of container choreography, which includes the deployment and creation of container choreography service, the modification and management of container choreography service configuration, the destruction of container choreography service, and the application monitoring of container choreography service. If the graphical conversion program and compilation environment of the stand-alone version are deployed locally, it is easy to have inconsistent versions and poor source code protection. In order to adapt to different users, it should also have access to services. For example, administrators can access all visual instances of container choreography, while a single user can only access the visualized instances of container choreography created by themselves or authorized by the same group.

2.2. Visual framework management of embedded computer container arrangement
It should include the life cycle management of the whole visualization framework, that is, the deployment and creation of framework services, the modification and management of framework services configuration, the destruction of framework services, and the monitoring of framework services. What needs to be distinguished from the visualization of container choreography is that the life cycle of the framework is longer than that of container choreography, and generally it is a relatively complex application, and the delivery method is not only the website port so simple and clear. The client can run on the windows visualization platform, access the cloud directly through LAN or through web server, display the visualization project in the container layout computer, support to lock a processor or application component for editing and debugging, and realize the cross regional parallel cooperation of large-scale projects.
2.3. Visual cluster management of embedded computer container arrangement

Relatively, it also needs to include the whole life cycle management of container arrangement visualization cluster, such as the creation of cluster, the modification management of service configuration such as the number of cluster nodes, the destruction and monitoring of cluster. The job cluster provides source code generation and compilation services, responds to the client's request for code generation and compilation, and supports parallel development and parallel compilation under multi person cooperation. Secondly, it needs to include a complete work order system in the visualization process, including the user and administrator. At the same time, in order to manage more orderly, it is also necessary to group users to achieve more detailed allocation of resources among and within groups.\(^4\) (Figure 2)

![Figure 2. design of container layout visualization system](image)

3. Visualization and technical design of container layout for key modules of embedded computer and microservice environment

3.1. Data center

The core data of container layout visual programming system is logic diagram, which is not suitable to be stored in traditional relational database. In order to improve the visual query efficiency of database container arrangement, the whole database is distributed on several work nodes, and the work nodes are managed by management nodes. The management node is responsible for data distribution, mapping and backup, and the work node is responsible for the local storage and query of data. The visualization of database container layout can be accessed through LAN or web in the factory, which facilitates the cross regional parallel cooperation of large-scale projects and improves the efficiency of development and operation and maintenance. When the framework decides to use its reserved resources, it uses the resources provided from the allocator to start the task.\(^5\) If the task is not suitable for the currently available resources, the agent first evicts some tasks by killing the executor that is using the revocable and uncontrollable resource, so that the container choreography can continue normally.

The storage capacity of the database can be expanded in real time by setting the visual partition of container arrangement, which makes the data storage module of this system have good expansibility. In addition, the redundant backup function of visual database is used to store data in different nodes to prevent data loss due to hardware damage.

3.2. Job cluster

In order to enable a job server to complete multiple visual editing and compilation tasks at the same time and avoid the waste of resources, the job server supports concurrent compilation. Each compilation server can create multiple independent compilation processes. Each process can complete the compilation task independently according to the IP address and port number. When the job cluster
receives the compilation request from the client, it will select the most suitable server to perform the compilation task according to the following load balancing algorithm. The system aims to solve the practical problems of China Unicom through a new generation of cloud computing container layout visualization technology. In the process of solving the problem, relying on open source software, through independent architecture, independent scheme design, part of the core capabilities of independent research and development. In order to improve the stability and reliability of the system, the watchdog process is implemented in each server in the job cluster.

3.3. Client
When the user is in the factory, the client connects with the visualization cloud of container arrangement directly through LAN. When the user is in the field, the client connects to the visualization cloud of container arrangement in the factory through web, which facilitates the cross regional parallel cooperation of large-scale projects, improves the efficiency of development and operation and maintenance, and meets the needs of large-scale engineering projects' in-house R & D and user's homologous distributed development. Thus, a visual system of container layout oriented to production environment is formed to realize the integrated scheduling of resources and the management ability of big data and micro service. (Figure 3)

![Figure 3. key modules of microservice environment](image)

4. Conclusion
A visual cloud programming platform for container layout based on embedded protection and control device and microservice environment is designed and implemented. The platform can separate the operation interface and data processing of the container layout visual programming system, deploy the compilation and storage functions to the cloud, and only retain the user interface locally. The embedded computer server in this design has the characteristics of small size, low cost, high stability and good real-time performance. Due to the use of efficient coding algorithm, it can also get better image quality under low bandwidth, which has a strong practical application value in the visualization practice of container layout.

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