

ISS Cloud

**Cloud-Edge Collaborative Physical Agents
Experimentation Platform**

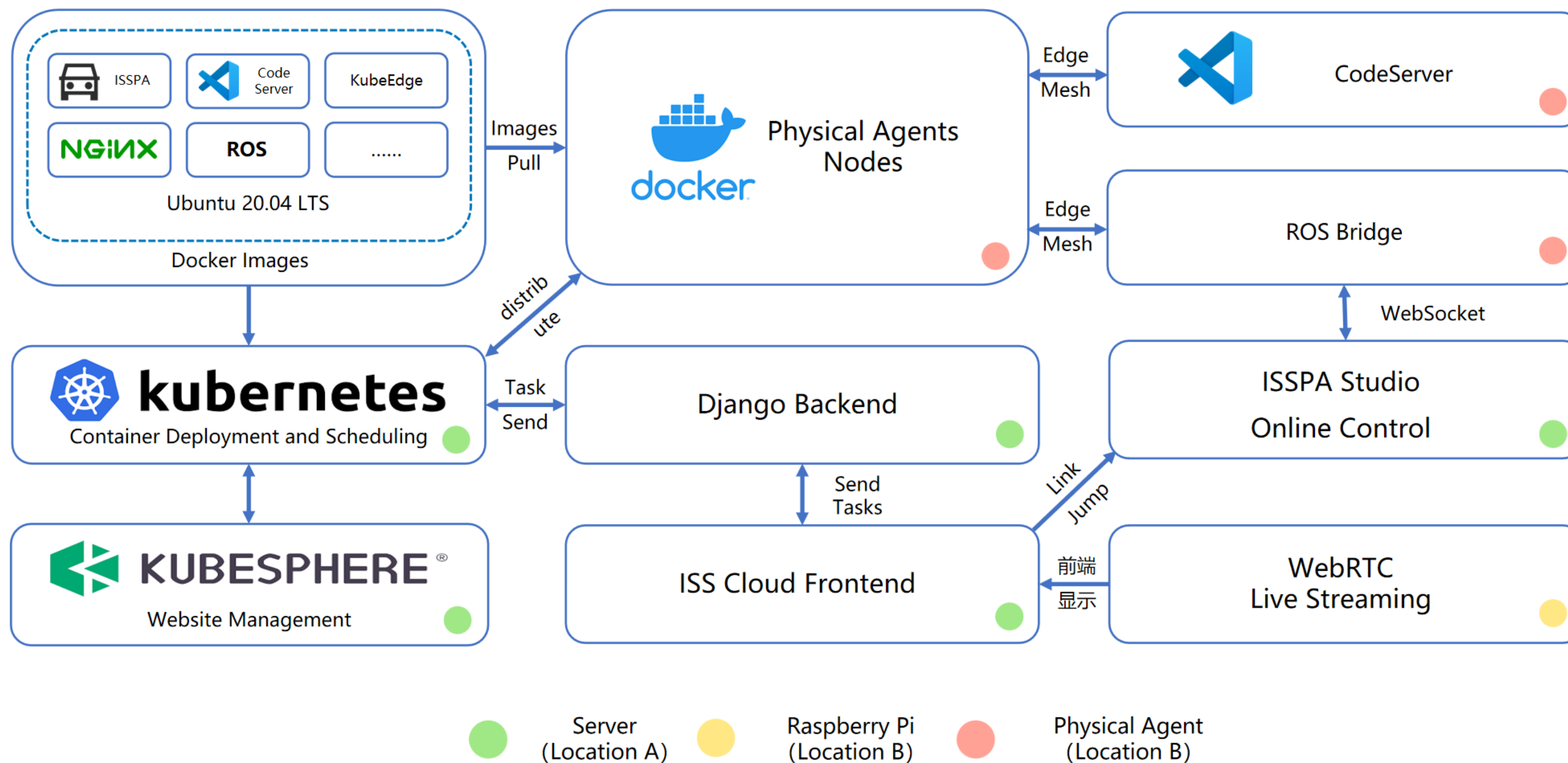
TIS Group <https://tis.ios.ac.cn/>

2024-12-21



Framework Overview

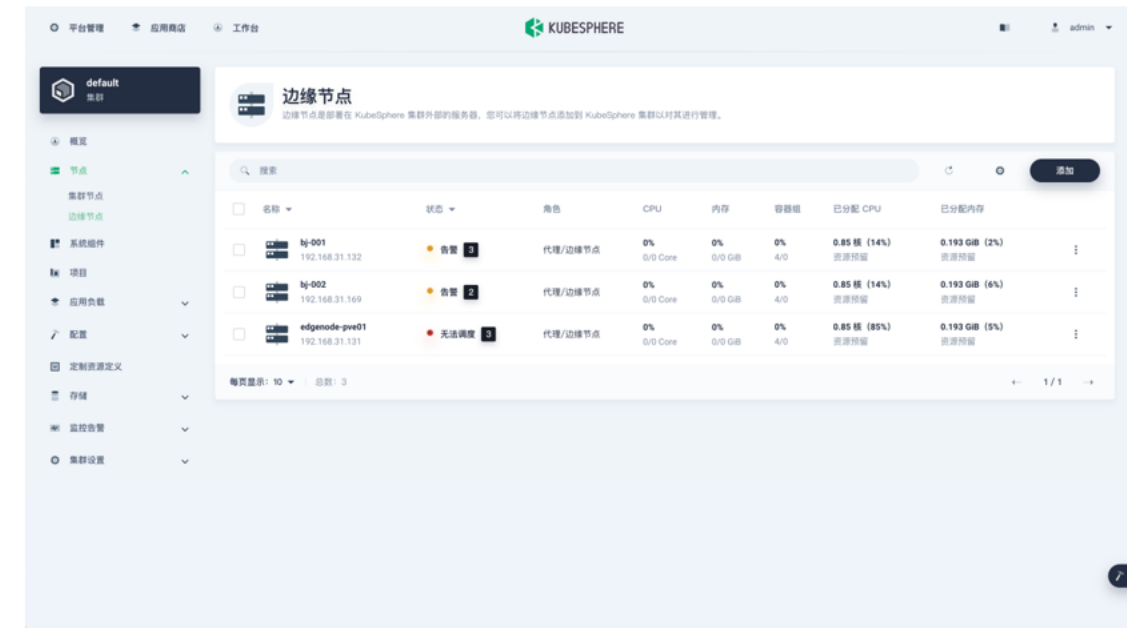
General Framework



Multi-Node Scheduling and Management

Kubernetes-Based Scheduling Solution

- Support for scheduling and managing multiple physical nodes.
- Use Kubernetes to manage edge vehicle nodes
- Schedule containers to specified physical nodes using Pods
- Comprehensive node scheduling rules with custom schedulers ensuring only one user uses a physical vehicle at a time
- Set maximum usage time for each node
- Remote maintenance of vehicles through a visual interface
 - Control nodes and Pods
 - View node resource usage and remotely control nodes



management background

Service Assurance in Complex Network Environments

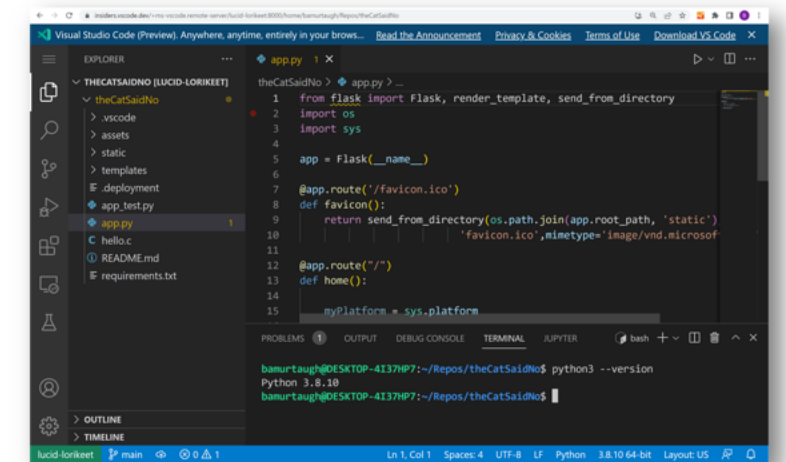
Edge Computing Optimization Based on KubeEdge and EdgeMesh

- Poor network conditions at edge nodes
 - K8s may reschedule Pods from temporarily offline nodes to other nodes
 - KubeEdge-based strategies ensure normal container scheduling in weak network conditions
- Edge nodes (vehicles) typically lack public IP addresses
 - External networks cannot access services provided by vehicles
 - EdgeMesh enables interconnectivity between edge nodes and control nodes through specific network protocols
 - Support for port mapping from edge nodes to control nodes
 - Low latency, good compatibility, no user setup required, automatic port mapping

Custom Container Infrastructure

Freely Add Required Components

- Based on Docker virtualization, containers can be constructed as needed
- ISSPA currently integrates services for remote users:
 - CodeServer
 - Web-based VS Code, usable directly in the browser
 - Supports terminal and port mapping, easier to use than SSH
 - Nginx
 - RosBridge errors after port mapping, preventing further execution
 - Use Nginx to reverse proxy RosBridge port, modify HTTP Header
 - Map RosBridge port to another port



Code Server

ROS Data Visualization

ISS Cloud Studio—Visualization Platform Based on Foxglove

- Web-based visualization operation platform
- Remote linkage with edge nodes
 - Parses data packets sent by RosBridge service on edge nodes
 - View coordinate systems, cameras, radars, etc.
 - Added direct control joystick for vehicles
 - Achieve remote, ultra-low latency direct control of vehicles

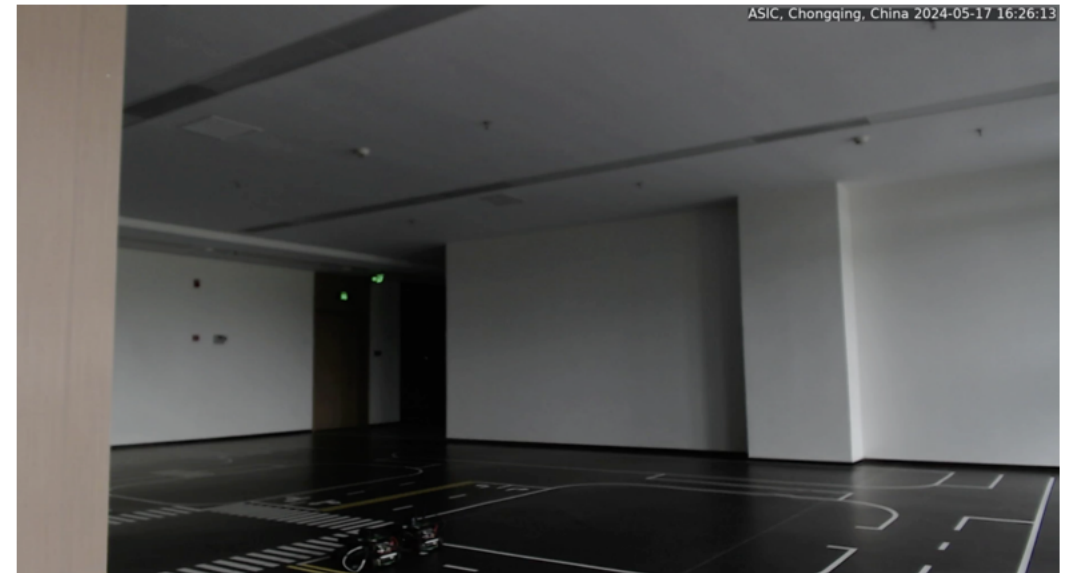


Remote control of nodes movement

Ultra-Low Latency Live Streaming

High-Definition, Low-Latency Live Streaming Solution Based on WebRTC

- Live streaming via WebRTC protocol
 - Live streaming latency of about 500ms
 - Supports various deployment methods
 - Direct camera streaming
 - Raspberry Pi + high-definition network camera
 - Real-time vehicle monitoring
 - OBS streaming

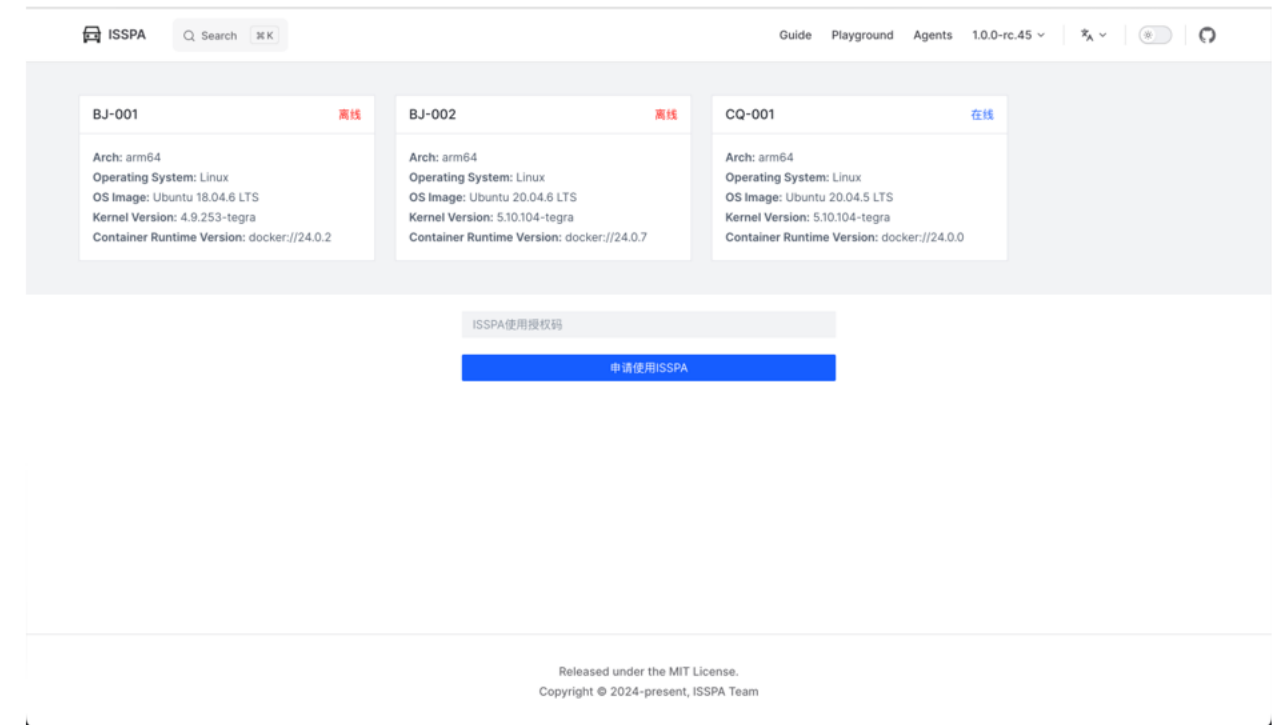


Streaming

User-Friendly Interface

One-Click Application

- Enter authorization code
- Application success:
 - Dialog box pops up with node details:
 - CodeServer address (for control)
 - RosBridge WebSocket (for visualization)
- Real-time live streaming of the venue under the PlayGround page



ISS(PA)Cloud Agents Page