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Federated PV management and cross-network data archiving framework for distributed EPICS systems in Korea-4GSR

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The Korea-4GSR project involves the development of a distributed EPICS control infrastructure where each subsystem—ranging from the accelerator core to beamlines and utility stations—is independently operated. To enhance unified control and monitoring across these segmented environments, we developed a federated PV management and data archiving framework that integrates metadata synchronization and real-time monitoring capabilities.

Each control domain retains logical independence, supported by basic network segmentation and routing strategies to ensure operational stability. EPICS Gateways are introduced to enable cross-network PVAccess communication, allowing seamless real-time PV lookup between isolated subnets while preserving autonomy and facilitating future scalability.

A centralized ChannelFinder service aggregates PV metadata from each subsystem using secured, API-based batch registration scripts. A custom-built Python GUI enables operators to efficiently search, tag, and manage large numbers of PVs. Integration with the Phoebus interface provides unified visualization and monitoring of PVs across all federated systems.

In parallel, an Archiver Appliance continuously collects selected PV data from all subsystems into a unified time-series database. This supports advanced services such as fault analysis, system performance tracking, and predictive diagnostics.

Footnotes

Funding Agency

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