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Real-time Data Sharing Comparisons Between NSTX-U, DIII-D, and KSTAR

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As Plasma Control Systems (PCS) grow beyond the resource constraints of single, monolithic computers, the need similarly increases for real-time communication between physical computers. Three experiments sharing a common baseline framework (the General Atomics (GA) PCS) approach the situation with similar high level concepts manifested through different lower level implementations. NSTX-U is building a native PCIe interconnect solution based on Dolphin products. DIII-D recently upgraded to an Infiniband solution. KSTAR is currently using a reflective memory infrastructure. These three approaches have differing characteristics and tradeoffs that affect the real-time system determinism, latency, and overall capability. They similarly have different implementation requirements and difficulties that affect scalability and flexibility of the resulting real-time systems. The Princeton University Plasma Physics Laboratory (PPPL) has gained experience working with these various implementations, and has developed a detailed analysis of appropriate use cases and considerations that affect real-time system design decisions. Additionally, the laboratory is supporting efforts to create real-time safe abstractions on top of the underlying architectures to establish a dynamic set of communication layer features adaptable to the limitations of the enabling technology.

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Yes

Description

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