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Software-Defined Network for End-to-end Networked Science at Exascale

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Science domains often view the network as an opaque infrastructure, lacking real-time interaction capabilities for control, status information, or performance negotiation. The Software-Defined Network for End-to-end Networked Science at Exascale (SENSE) system is motivated by a vision for a new smart network and smart application ecosystem that will provide a more deterministic and interactive environment for science domains. SENSE's model-based architecture enables automated end-to-end network service instantiation across multiple administrative domains, allowing applications to express high-level service requirements through an intent-based interface.

SENSE aims to empower National Labs and Universities to request and provision intelligent network services for their workflows. This comprehensive approach includes deploying SDN infrastructure across multiple labs and WANs, focusing on usability, performance, and resilience. Key features include policy-guided orchestration, auto-provisioning, scheduling of network devices, and Site Resources. Additionally, real-time full life-cycle network monitoring, measurement, and feedback provide resilience and efficiency for science domains.

In this talk, we will cover SENSE and its key components, including the Orchestrator, Network Resource Manager (NetworkRM), and Site Resource Manager (SiteRM). We will discuss the capabilities of these components and explore several use cases, including NRP Kubernetes Operator, QoS, Real-Time monitoring and debugging, and L2/L3VPN. These examples will illustrate how SENSE can enable intelligent, end-to-end network services, enhancing the performance and efficiency of science applications.

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