

SENSE

(Orchestration, Visualization, Workflow Services)

TNC21 BoF "Orchestration, Automation and Virtualisation: Focusing on the user"

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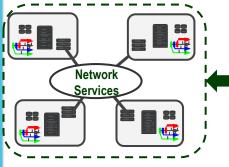






Advanced Scientific Computing Research (ASCR)

SENSE - Filling in the Gaps

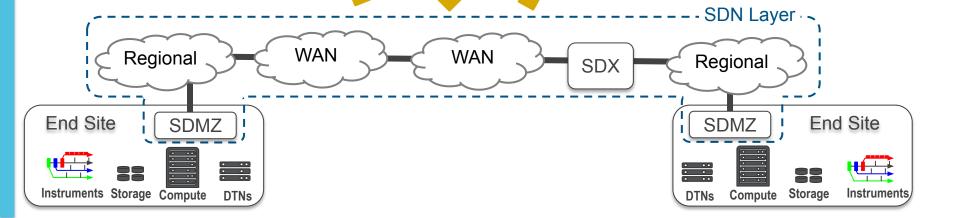


- Science Workflow
- Specific Topology and Services

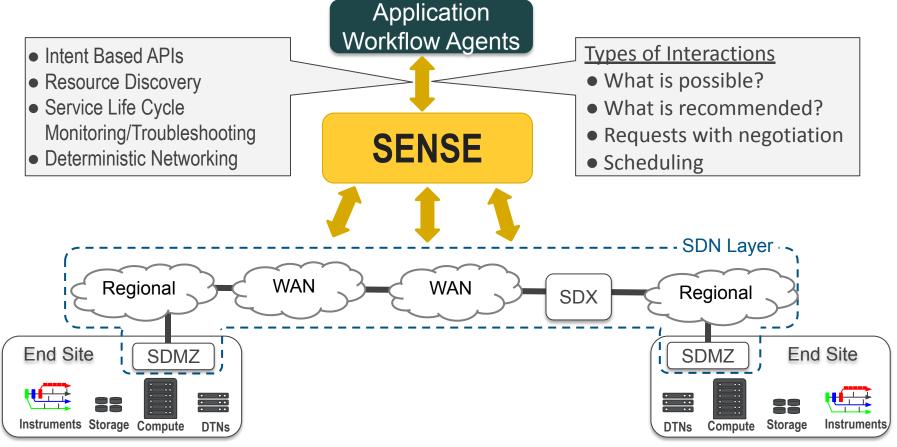
Application
Workflow Agents

SENSE

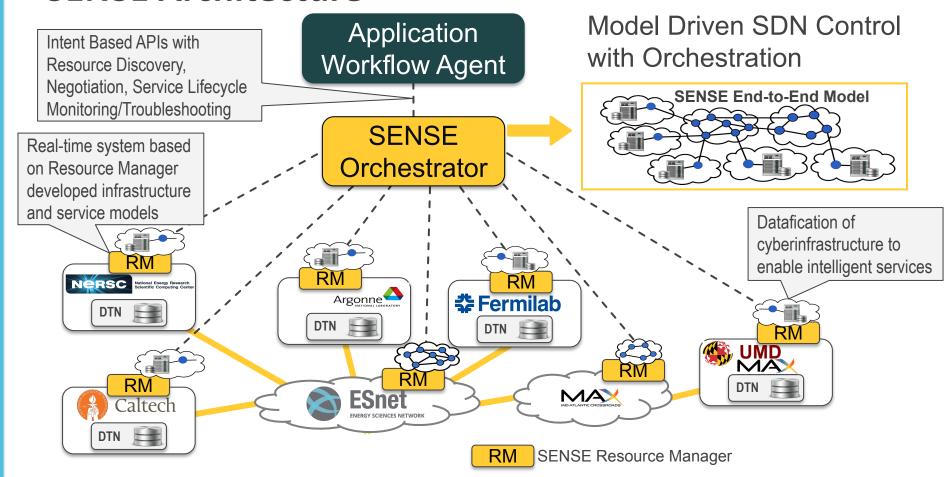
SENSE operates between the automation layer controlling the individual networks/end-site resources, and science workflow agents/middleware



Workflows can "coordinate" with End-to-End Networked Cyberinfrastructure



SENSE Architecture

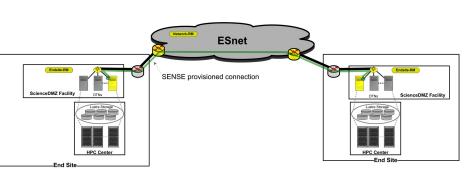


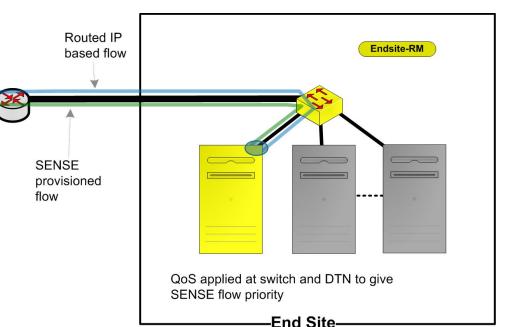
SENSE Enabled DTNs

 SENSE DTNs can be deployed next to production DTNs

No impact to standard DTN operations

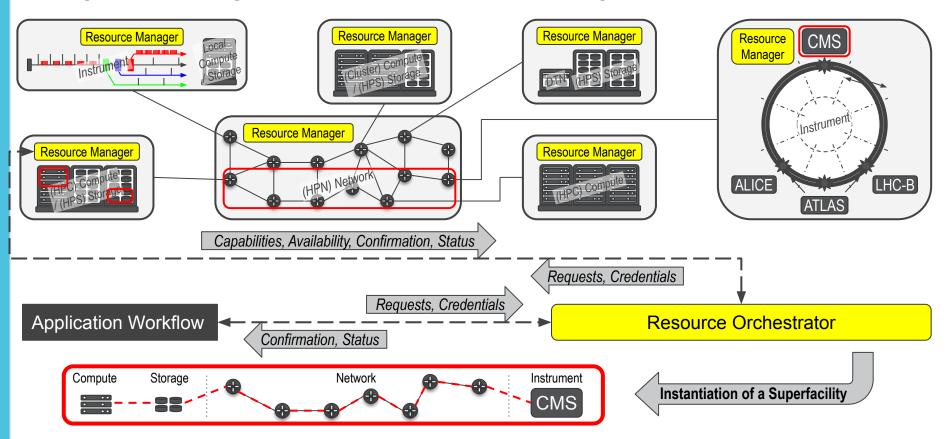
Just adds a "priority flow" feature





- Scheduled and guaranteed resources, network and end system
- Can be included as part of application workflow planning

Superfacility Automation Ideas/Options



SENSE is part of ESnet's collaboration with NERSC as part of their Superfacility project

SENSE Paper

Software-Defined Network for End-to-end Networked Science at the Exascale, Elsevier Future Generation Computer Systems, Volume 110, September 2020, Pages 181-201, https://doi.org/10.1016/j.future.2020.04.018

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



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ARSTRACT

Domain science applications and workflow processes are currently forced to view the network as an opaque infrastructure into which they inject data and hope that it emerges at the destination with an acceptable Quality of Experience. There is little ability for applications to interact with the network to exchange information, negotiate performance parameters, discover expected performance metrics or receive status/troubleshooting information in real time. The work presented here is motivated by a vision for a new smart network and smart application ecosystem that will provide a more deterministic and interactive environment for domain science workflows. The Software-Defined Network for End-to-end Networked Science at Exascale (SENSE) system includes a model-based architecture, implementation, and deployment which enables automated end-to-end network service instantiation across administrative domains. An intent based interface allows applications to express their high-level service requirements, an intelligent orchestrator and resource control systems allow for custom tailoring of scalability and real-time responsiveness based on individual application and infrastructure operator requirements. This allows the science applications to manage the network as a first-class schedulable resource as is the current practice for instruments, compute, and storage systems. Deployment and experiments on production networks and testbeds have validated SENSE functions and performance. Emulation based testing verified the scalability needed to support research and education infrastructures. Key contributions of this work include an architecture definition, reference implementation, and deployment. This provides the basis for further innovation of smart network services to accelerate scientific discovery in the era of big data, cloud computing, machine learning and artificial intelligence.

1. Introduction

Networked systems are evolving at a rapid pace toward programmatic control, driven in large part by the application of software to networking concents and technologies, and evolution of the network as a critical subsystem in global scale systems. This is of interest to major science collaborations that incorporate large scale distributed computing and storage subsystems.

: //doi.org/10.1016/j.future.2020.04.018 0167-739X/Published by Elsevier B.V.

This software-network innovation cycle is important as it includes a vision and promise for improved automated control configuration, and operation of such systems, in contrast to the labor-intensive network deployments of today, However, even the most optimistic projections of software adoption and deployment do not put networks on a path that would make them behave as a truly smart or intelligent system from the application or user perspective, nor one capable of interfacing effectively with facilities supporting highly automated data analysis workflows at sites distributed around the world

Today, domain science applications and workflow processes are forced to view the network as an opaque infrastructure into which they inject data and hone that it emerges at the destination with an acceptable Quality of Experience. There is little ability for

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Thanks

