Optimization of Rucio-SENSE DMM

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Premise

- Current experiments, such as CMS, generate as much as 20 PB/year
- Future planned experiments, such as the the HL-LHC, will generate 30x more data

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The Problem

- To replicate this volume of data to storage sites, need >=100 Gbps network speeds
  - Estimated 400 Gbps between sites in the U.S.
- Even assuming hardware works, need to optimize network usage
- Currently, just try to push data, and if it fails, push again
  - Networks are dominated by large transfers
  - 100TB - 100PB -> 1PB @ 100 Gbps ~ 1 day
- Need more accountable network usage

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Accountability with Software-Defined Networking (SDN)

- SDN allows for strong end-to-end accountability + ability to manage different priorities of workflows
- SDN integration with current tools would allow:
  - Report much data has been transferred/received
  - Comparison of expected vs. actual transfer rates
  - Identify points of failure

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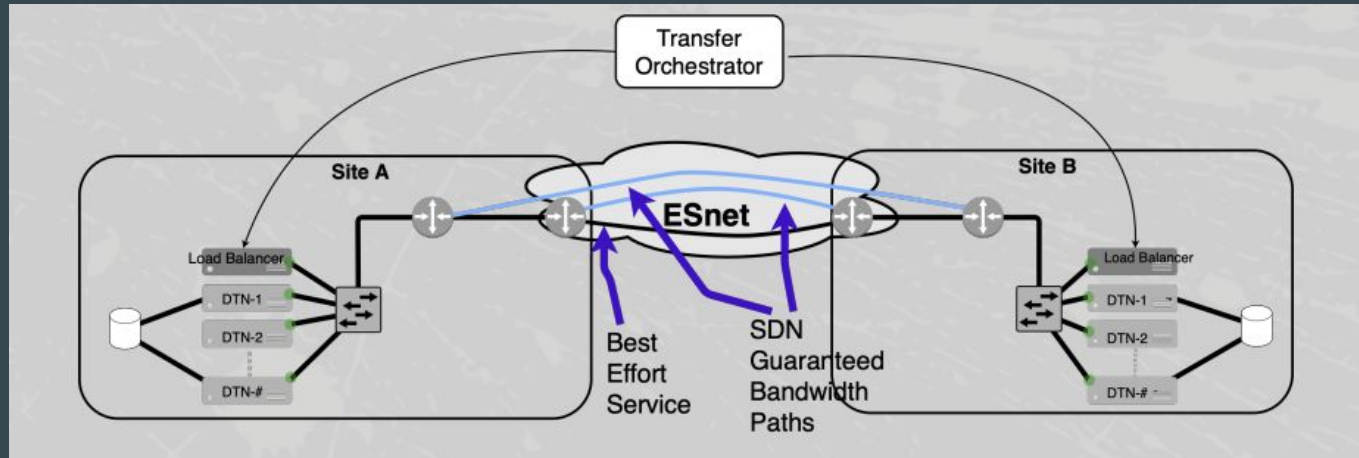
Rucio-SENSE DMM

- SENSE (**S**oftware-Defined Network for **E**nd-to-end **N**etworked **S**cience at the **E**xascale) allows for customizable multi-domain orchestration
  - For use on experiments with individual domain science workflows + requirements
  - Pushes QoS and routing rules
- Rucio - CERN's data management software
  - Provides scalable data storage, transfer, replication, etc. across different physical locations
  - Allows for individualized tagging/tracking of data

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Current DMM Performance

- The Data Movement Manager (DMM) is the interface between SENSE and Rucio
  - From Rucio: source/destination RSE names, number of bytes, priority
  - From SENSE: Constructs P2P VLANs for each set of endpoints
  - Monitors status + performance of all dataflows
- Based on transfer metadata, DMM provisions network bandwidth for each rule
  - Constantly assesses current bandwidth usage and re-allocates depending on rule priority

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Project Goals

- Make DMM more robust
  - Implementation of DMM's monitoring system
    - Correlate FTS monit data with host level information
    - Generate performance reports from combined host/transfer data (transfer rates, point of failures, etc.)
  - Optimization of DMM's interactions with Rucio
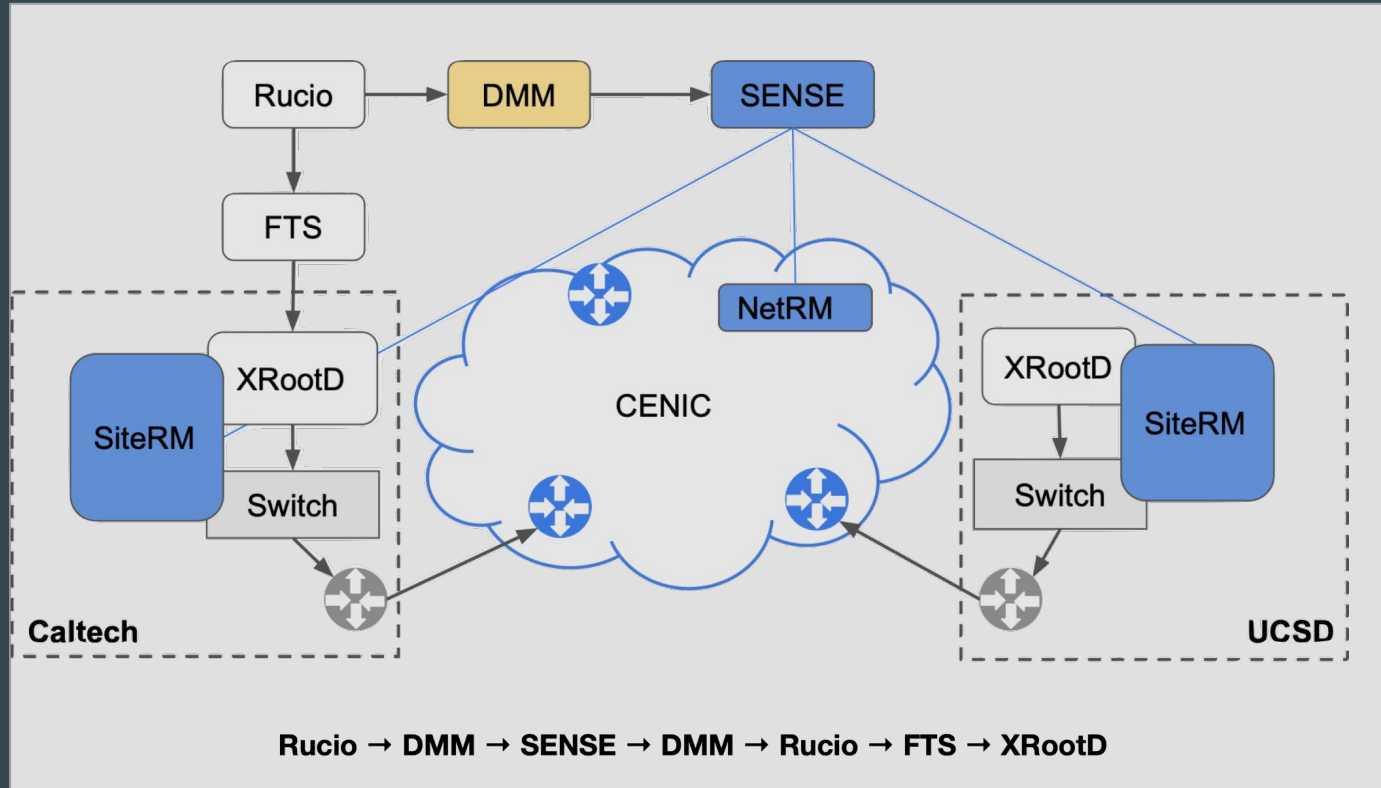 - Optimization of DMM's bandwidth allocation algorithm

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Summary

- Future experiments will generate large amounts of data
- Need to integrate SDN with existing tools to make networks more accountable for data transfers with large amounts of data
- Goal is to make Rucio-SENSE DMM more robust to meet this need

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Thank you!

Backup

Detailed Model

Rucio → DMM → SENSE → DMM → Rucio → FTS → XRootD

Transfer Performance