Birds of a Feather: Enabling Data Services for HPC

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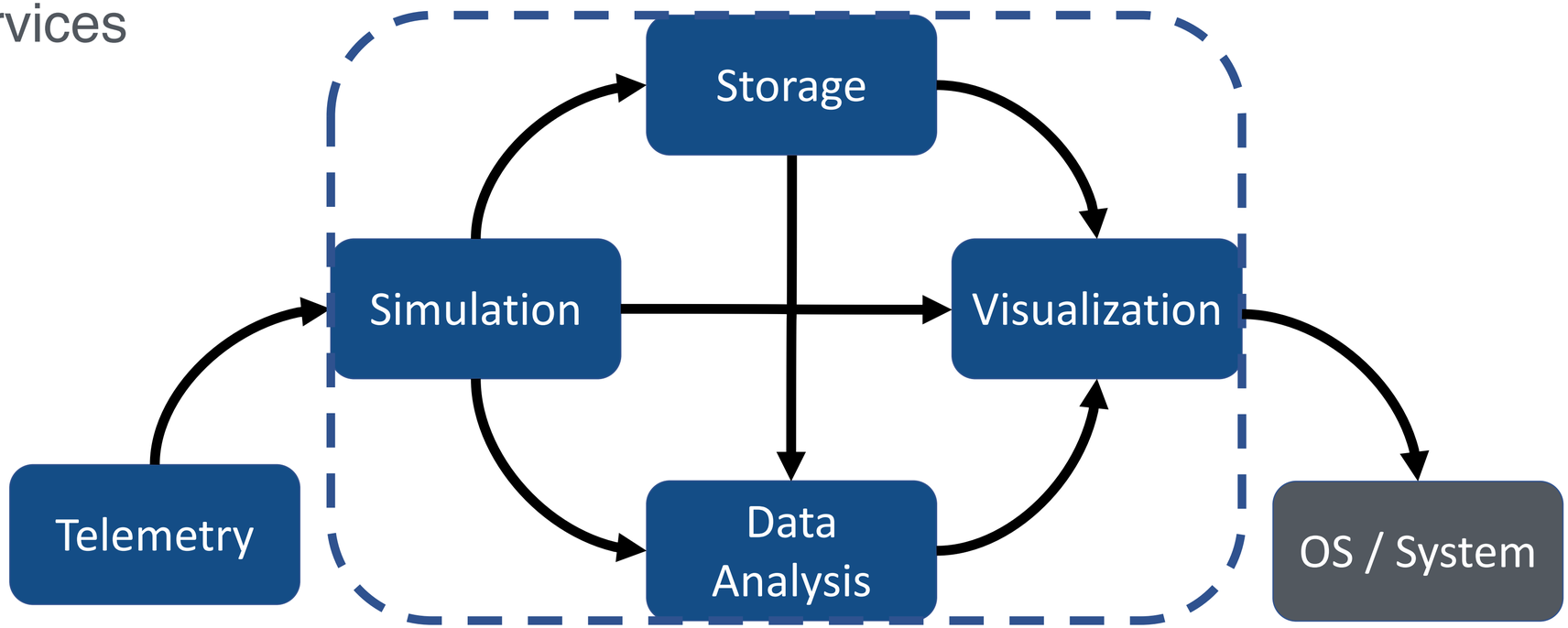
Introduction

- **Data services become essential to HPC workflow and productivity**
  - Storage services
  - Data analysis and Visualization services
  - Telemetry services
  - etc



Objective

- **Several frameworks already exist and/or are being developed**
  - DAOS / DeltaFS / UnifyCR / Dataspaces / ParaView / Visit / SOS / Faodel

- **Any HPC data service must face similar challenges**
  - Communication between applications
  - Resilience and fault tolerance
  - Deployment
  - Security

- **How can we help service developers/integrators and share knowledge?**

Questions

- **How to deploy data services in HPC?**
  - Scheduler integration
  - Wire-up and bootstrapping
  - Negotiation of resources with end-user application
- **How to handle resiliency?**
  - How can the application recover from a service fault?
- **How is security provided?**
  - Does it matter or just single user?
  - What kind of security do we need?
- **Extras**
  - How to handle communication?
  - How to earn trust from application users?

Format

- **Series of Talks**
  - Mochi and Mercury – Matthieu Dorier (Argonne National Laboratory) and Jerome Soumagne (The HDF Group)
  - DAOS – Johann Lombardi (Intel Corporation)
  - SOS – Chad Wood (University of Oregon)
  - Dataspaces – Philip Davis and Manish Parashar (Rutgers University)

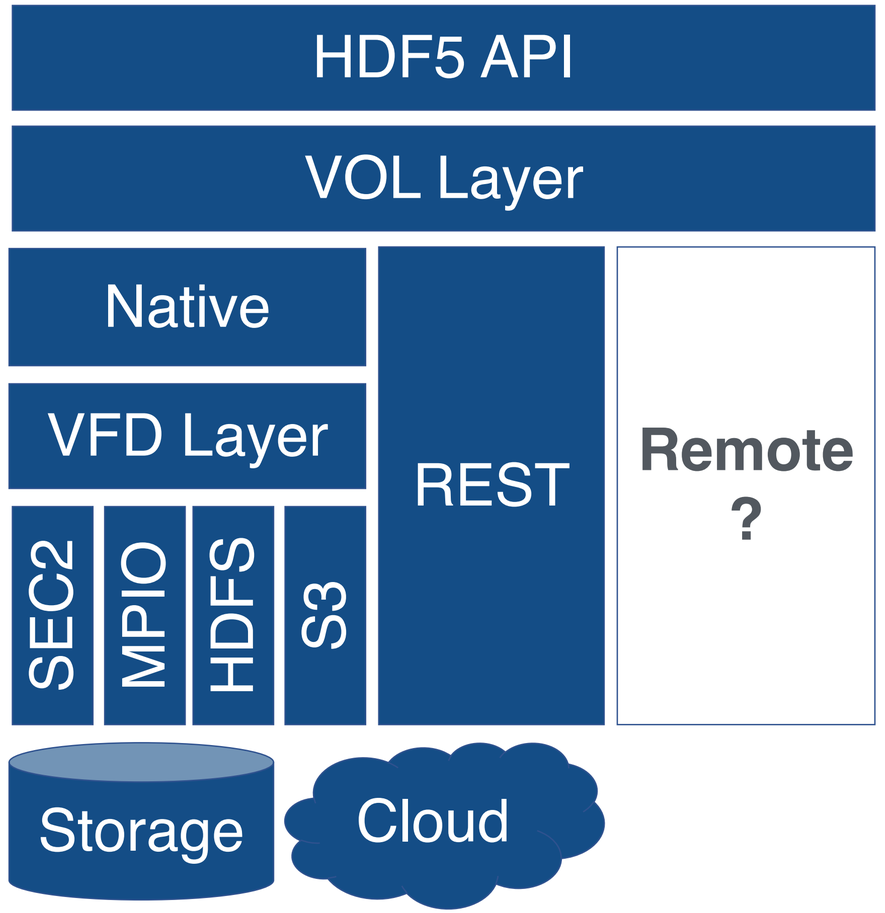
- **Discussion and Q&A**

- **Material will be posted online**
  - http://mercury-hpc.github.io/news/2018/10/17/data-services-bof.html

From Mercury to Mochi

Original Motivation – HDF5

- **Widely used by HPC community**
- **Provide access to storage systems**
  - VFD (through MPI-IO and ROMIO)
  - VOL
- **Access HDF5 files remotely or on separate HPC nodes?**
  - Execute HDF5 calls on remote nodes
  - Remote procedure call



RPC for HPC

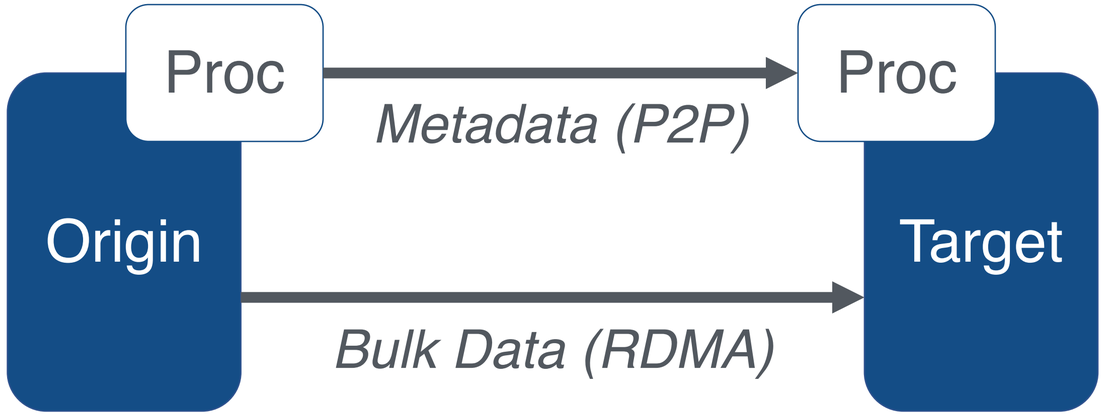
- **RPC (Remote Procedure Call)**
- **Widely used technique to create web services (e.g., gRPC, etc)**
- **Problem: web services frameworks are not designed for HPC**
  - Typically built around TCP/UDP protocols
  - Do not handle large data transfers efficiently
  - Can potentially introduce a lot of jitter (extra threads / memory used / etc)
  - Must be able to run in userspace

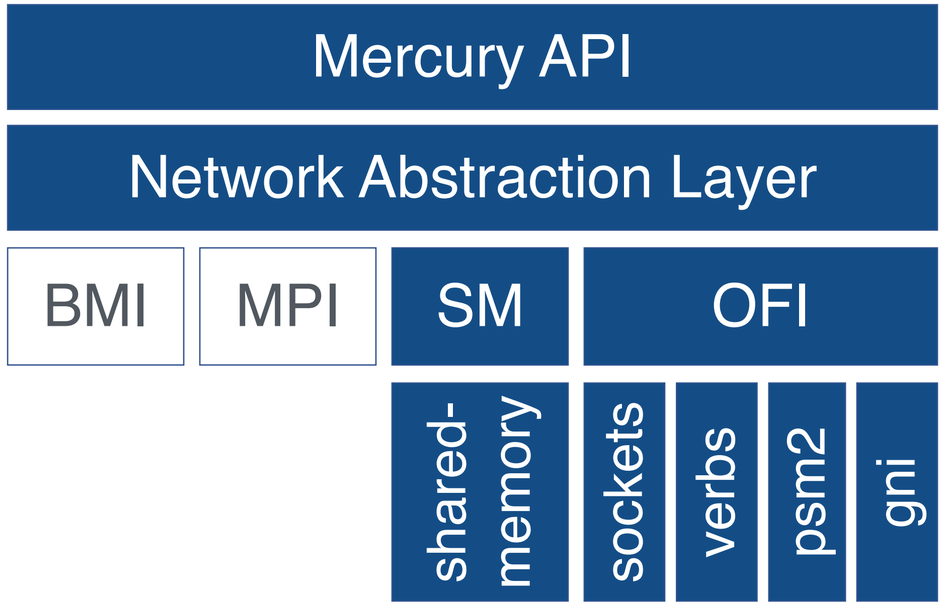
- **Initially developed as part of Exascale FastForward effort w/Intel**
- **Continued through ASCR Mochi project**
- **Mercury (http://mercury-hpc.github.io) / 1.0.0 release yesterday!**

Mercury RPC

- **Data service building block**
  - Origin and Target definitions
  - Input / output arguments = metadata
  - Large data arguments = bulk data

- **Network abstraction layer**
  - Intranode (SM) / internode (OFI)
  - Non-blocking callback-based model





Mercury RPC

- **Deployment**
  - Portability
  - Lightweight / small dependencies
  - Not tied to any threading model
  - Does not provide any notion of group or collectives
  - Require out-of-band mechanism to gather peer information

- **Resiliency**
  - Not resilient on its own but provides building blocks like cancelation

- **Security**
  - Can pass authorization keys down to fabric layer (job granularity)