Federation Technology in DFC

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Goals of DFC

• Enable scientific collaboration
• Support access to live research data
  – Data Sharing
• Support reproducible data-driven research
  – Workflow Sharing
• Establish national data cyber-infrastructure
  – Persistent and Extensible Architecture
Need for Federation

Paradigm shift
- **Compute-Intensive** to **Data-Intensive**
- **Large Actions** on Small Amounts of Data to **Small Actions** on Large Collections of Data
- **Move Data** to Processing Site (Warehouse Model)
  - Move Process to Data Site (Map-Reduce Model)
- **Function Chaining** (Programs) to **Service Chaining** (Workflows and Web services)

Data, Services and Workflows need to be shared, discovered and seamlessly executed

Federation is the key
And **Federation** is the middle name of DFC

Federation in DFC

- DFC exposes **three** models of Federation
  - **Strong Federation**
    - Full and complete protocol-level federation across grids
    - Seamlessly Move from one grid to another
    - Mu Casa Su Casa
    - Used in DFC to federate Science and Engineering domain grids
  - **Weak Federation**
    - One-way DFC to External Resource/Grid Federation
    - Micro-services and **Workflows**
    - DFC needs to ‘know’ the external protocol - plug-ins & wrappers
    - Still seamless - external access problems hidden from user
    - **Used in DFC**
      - To access THREDDS (netCDF), Sensor system, federal data resources
      - To connect to SEAD and DataONE
      - To access Amazon Web Services (EC2, S3) and External workflows
Federation in DFC

- Asynchronous Federation
  - Defined & Developed to meet needs of DFC
  - Motivation Example: Provision access to indexing services
    - Multiple indexing services – each with its own protocols
    - DFC does not want to federate each separately – access is not seamless
    - Promote a common connectivity - based on message bus
      - Any indexer who can ‘talk’ this common connectivity can play
  - Other examples: Metadata services, Ontologies, Formatting Services, Cloud services, etc.
  - Multiple usage models

Standard-based Architecture in Asynchronous Federation

- Utilizes industry standard integration patterns and services
- Improves scalability and reliability by utilizing asynchronous, distributed architecture that includes load balancing and fault tolerance
- Lowers technical barriers to entry by easy integration with standard libraries and toolkits
Industry Standards/Components used in Asynchronous Federation

- Currently we support
  - OSGi (ServiceMix)
  - AMQP (ActiveMQ, Proton-J)
  - JSON (Jackson, Jansson, JSONSchema2POJO)
  - ElasticSearch
  - RDF (Standard Vocabularies)
  - Apache Aries Blueprint

Three Federations in DFC
Questions?