Collaborative Data Life-cycle Management (CDLM) for Petascale Projects

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Agenda

- Introductions
- LSST as use case
- CDLM
- Attributes of CDLM

History behind the story

- **MDAS (Massive Data Analysis System)**
  - Support data-intensive applications that manipulate very large data sets by building upon object-relational database technology and archival storage technology
  - 1995 by DARPA
- **SDSC SRB (Storage Resource Broker)**
- **iRODS**
  - Flexible license for our community
  - Flexible rules for users
  - Flexible data management

My role in iRODS Community

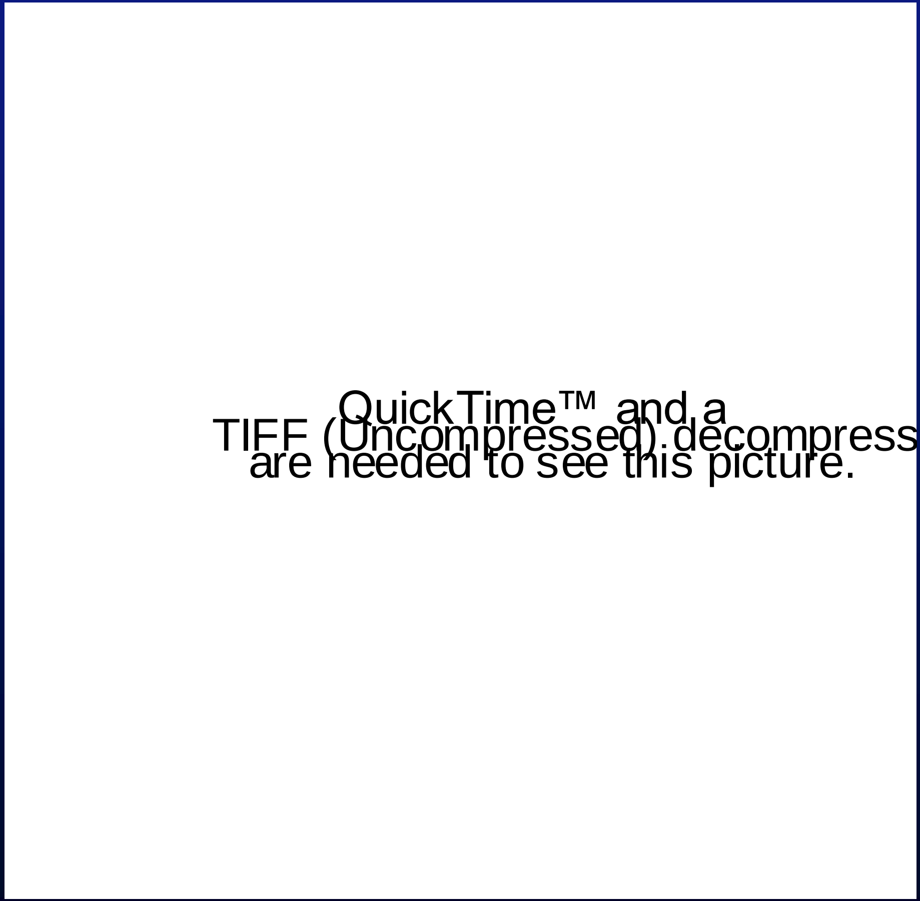
- Large-scale usage and adoption of iRODS
  - Research and Analysis of large-scale use-cases
  - Design requirements for large-scale users
  - Consult on iRODS-based storage infrastructure
- Community Growth
  - Tutorials, dissemination
  - iROD-Chat (2006), SRB-Chat (2003)
  - Academic and Industrial users

Large Scale Synoptic Survey

- Survey entire sky every 3 nights
- Dark Energy, Dark Matter, Near Earth Asteroids, and more
- World’s largest digital camera (3 billion pixels)
- Images 3000 times wider than Hubble
- Data from Chile to US and rest of the world
- 15 TB/night, over hundred(s) petabytes

- www.youtube.com/watch?v=LtMJ_WwvBb8

Data Products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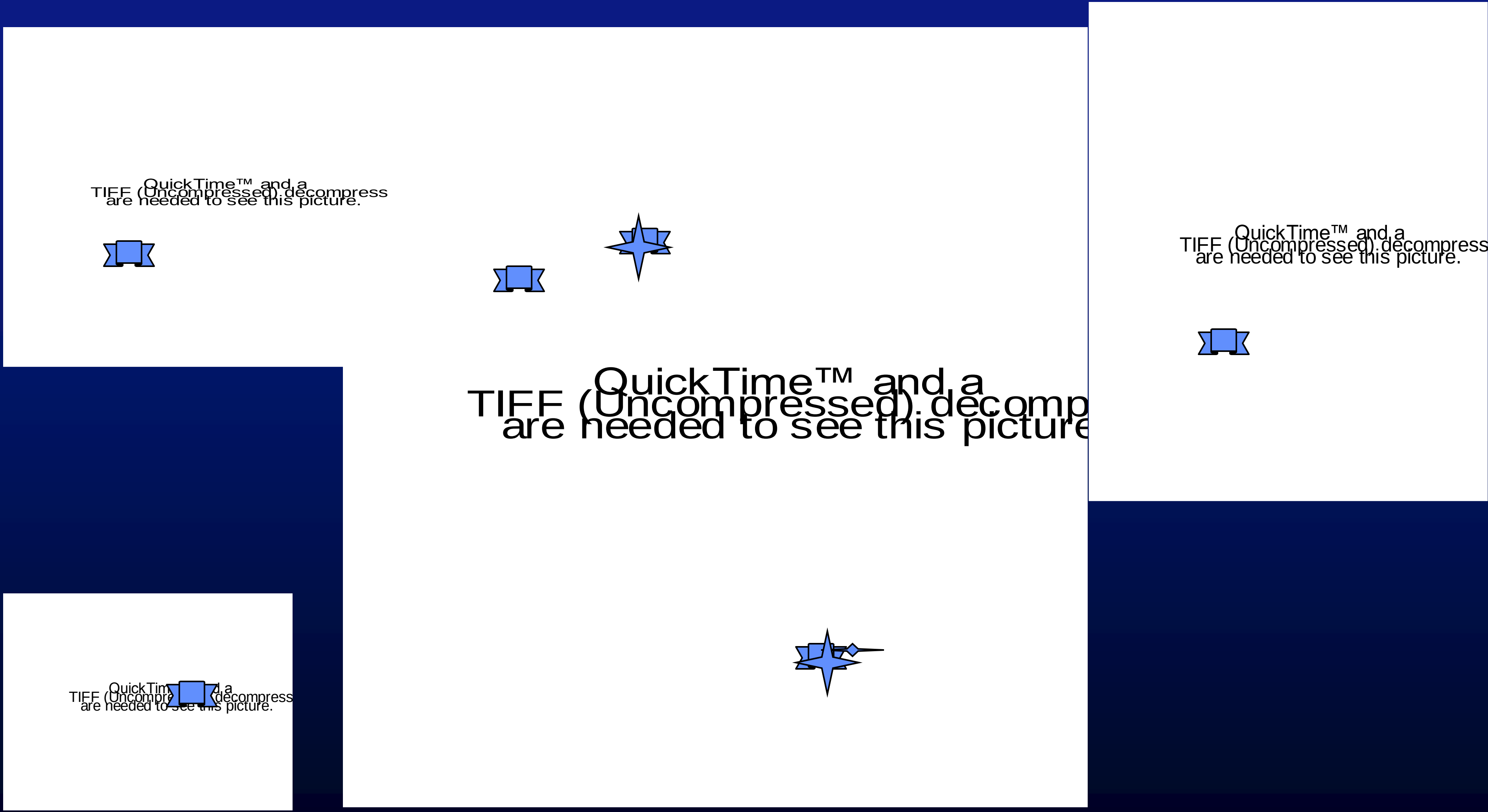
- Releases
- Cataloged database
- Provenance Info
- Metadata
- Processed Data Sets
- Raw Images

LSST Data Infrastructure Layout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LSST Data Train and iRODS

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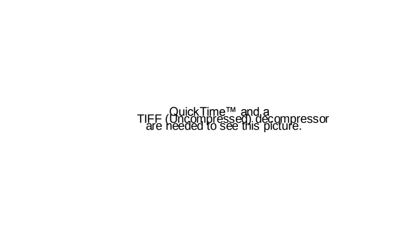
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LSST CDLM Problem Statement

- **LSST data-lifecycle management infrastructure for:**
  - Performance oriented data storage sub-systems
  - Capacity oriented data storage sub-systems
  - Data (usage oriented) distribution networks
  - [Provenance and archive storage systems]
- **Confluence of three major storage dimensions**
  - HPC data processing (pipelines to produce our data)
  - Datacenter sharing   (data centers that host our data)
  - Data delivery and distribution (usage of our data)

CDLM

- **Collaborative Data Lifecycle Management**
  - Multiplexing of a single data life-cycle amongst more than one autonomous partner
  - Attributes of data-lifecycle is shared
  - Varying levels of autonomy and inter-dependence

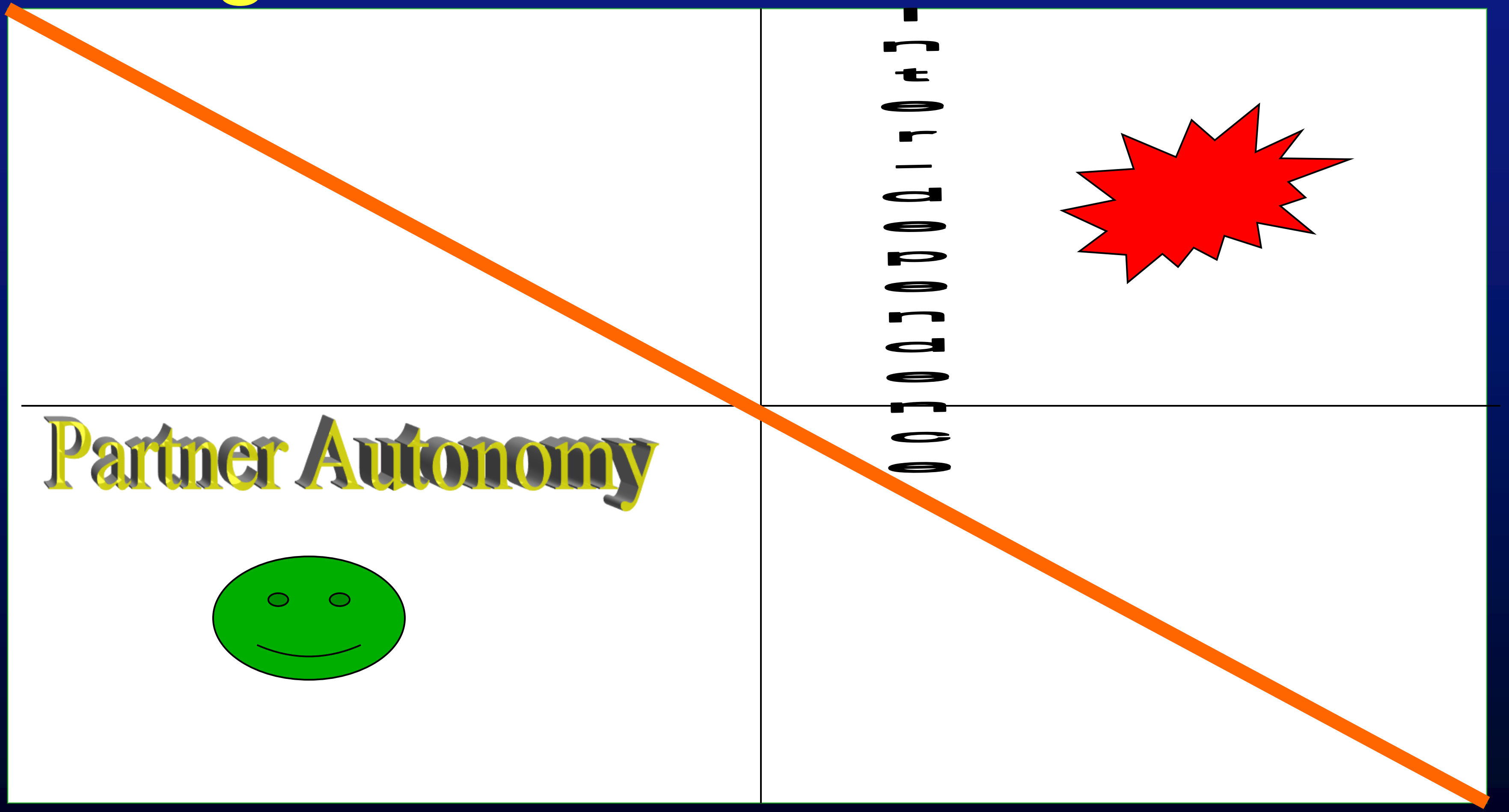
Multiplexing a Data Life-cycle

- Data Creation (Raw data)
- Data Processing (Derived data)
- Data Analysis (Data warehouse, ..)
- Data Namespace
- Data Dissemination
- Data Provenance
- Data Archival

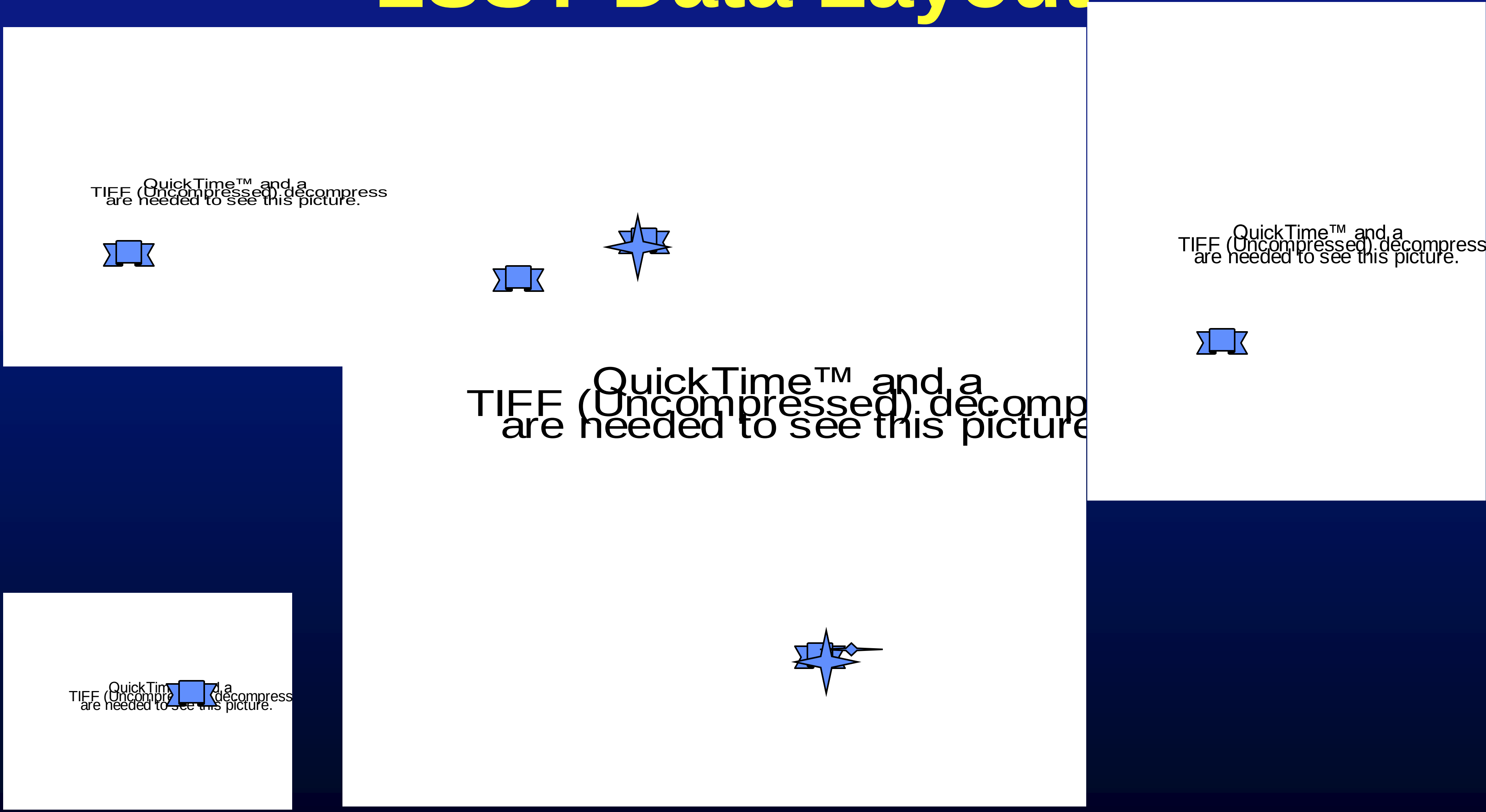
Levels of Collaboration

- **Collaboration on Data Life-cycle not necessarily mean collaboration of businesses**
- **Some types of CDLM**
  - Symbiotic - All partner businesses benefit from CDLM
  - Neutral - No effect on businesses due to CDLM
  - Competitive - partners of CDLM are actually competitors of the resulting business process (forced to have a common platform to compete)
  - Hybrid - Multiple or transient partner relationships

Autonomy & Inter-dependence at right levels for CDLM to work



LSST Data Layout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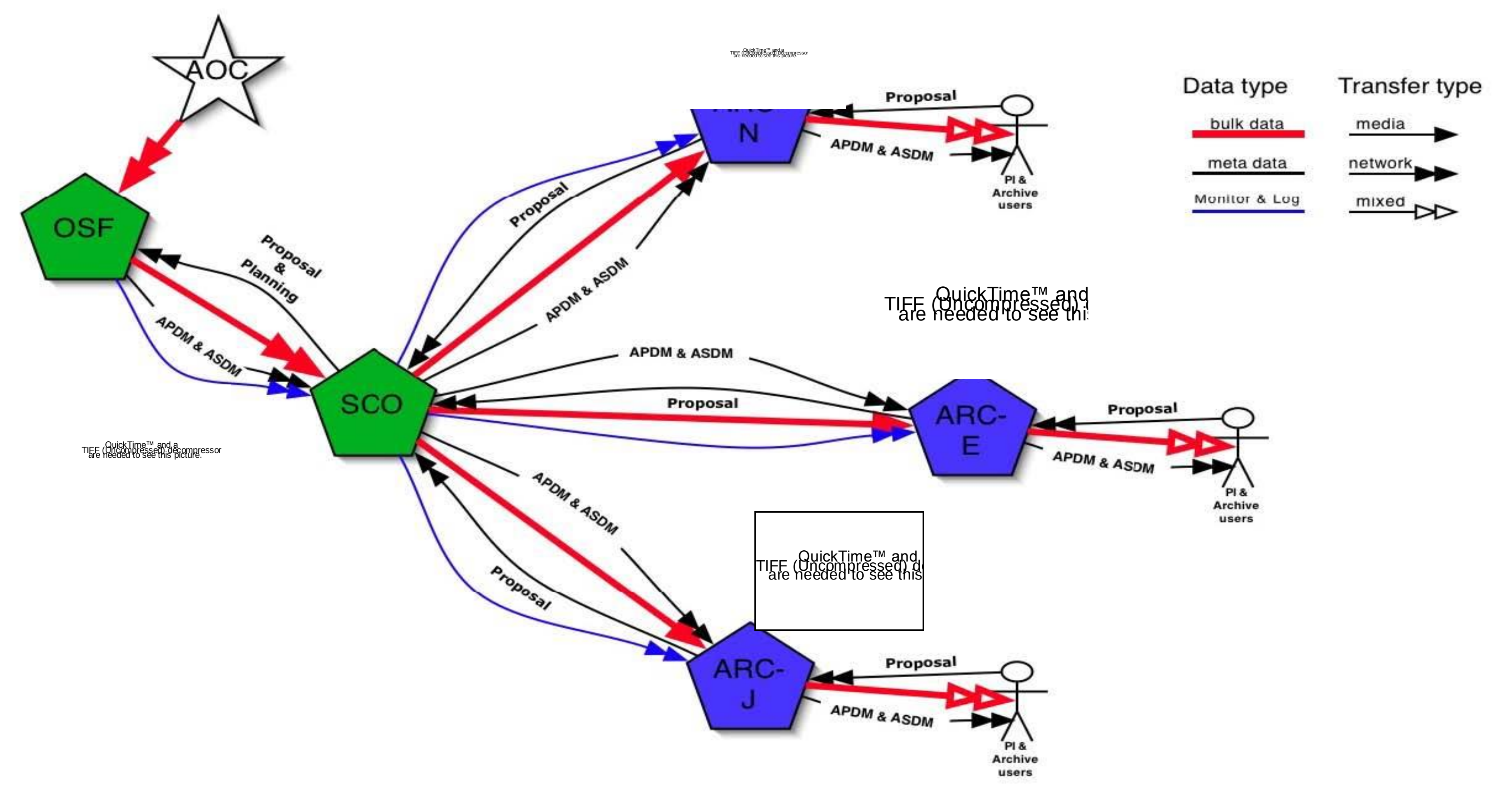
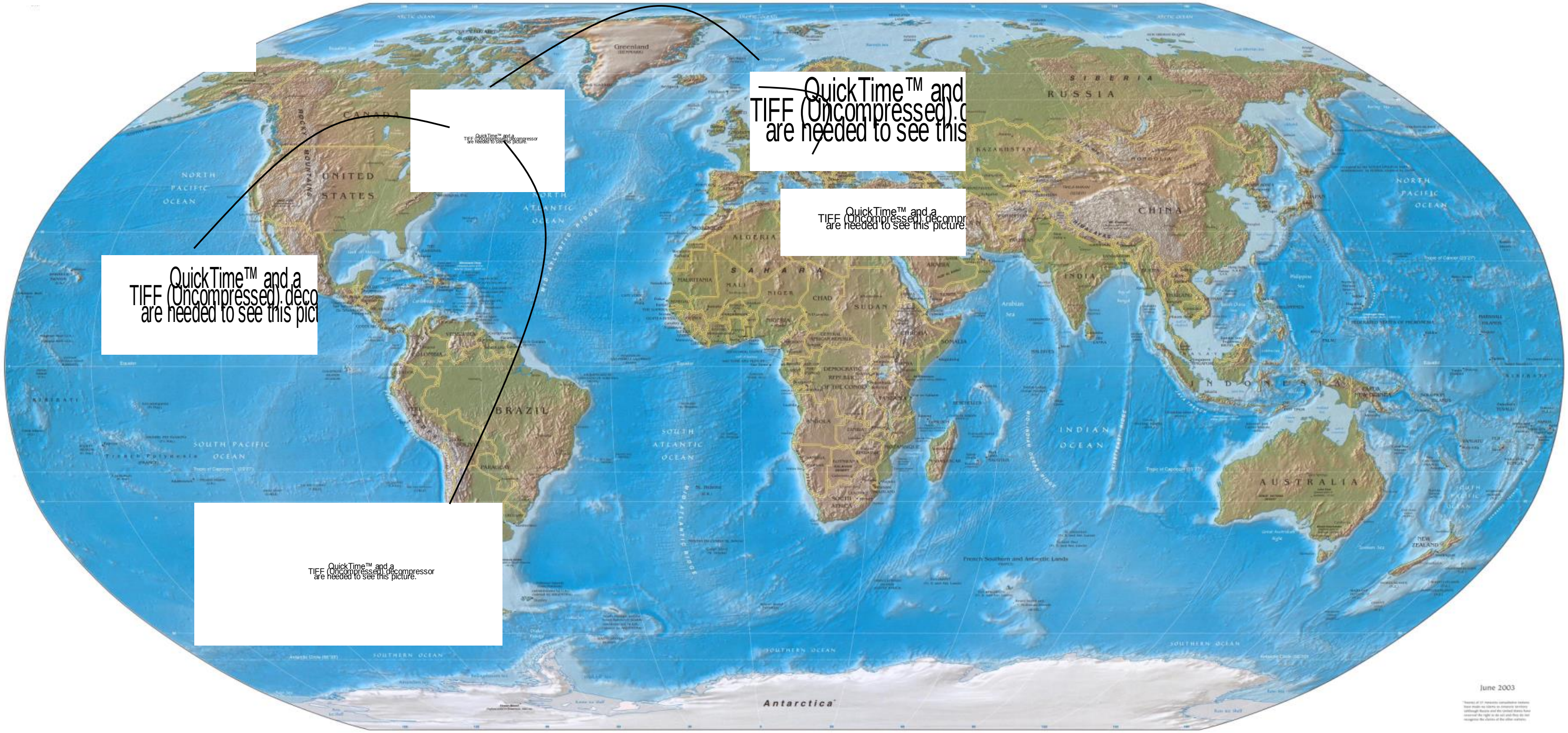
ALMA data flow



LSST SC-2008 Prototype



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CDLM Infrastructure Design

- Requirements, Expectations and Performance Management
- Minimize dependencies (without affecting cost)
- Reduce individual autonomy into hierarchical groups (that can remain autonomous)
- Hierarchical rules and community rules

iRODS enabling CDLM

- Global Namespace
- Resource allocation and service levels as policies/rules
- Hierarchical rules and access controls
- Highly Flexible System

Similar projects? Let’s talk

- The power of the community
- Not necessarily “large” scale
- Symbiotic
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