

Collaborative Data Intensive Science

Arun Jagatheesan

San Diego Supercomputer Center

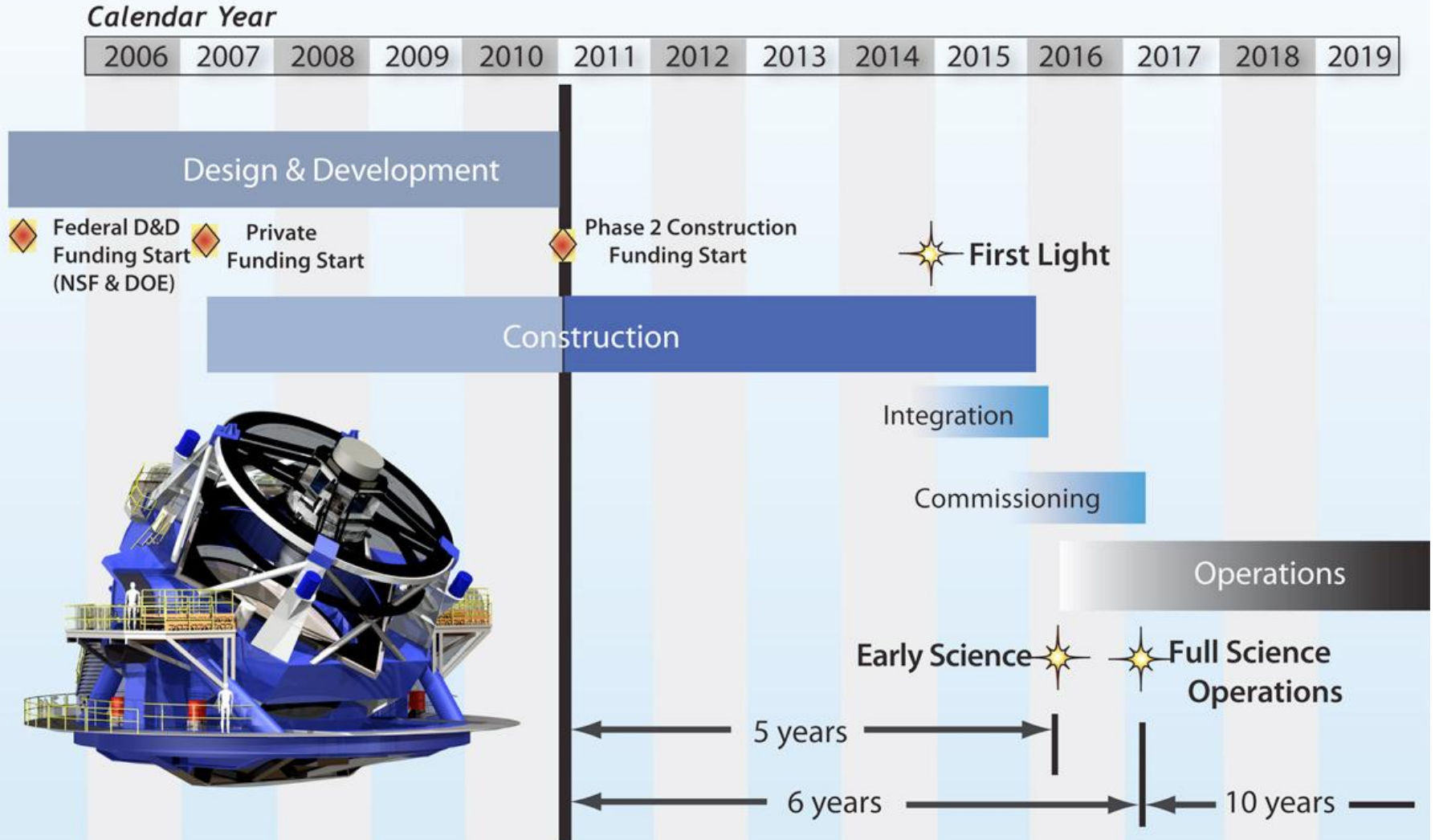
and

iRODS.org / DiceResearch.org

Agenda (10 min!)

- Use case: LSST
- Collaborative Data-life cycle Management
 - Scale-up and Scale-out
- Current efforts
 - DASH, iRODS
- We need more
 - Data I/O protocols with control channels
 - Storage Time Machine (if there is time for this)
- Q&A

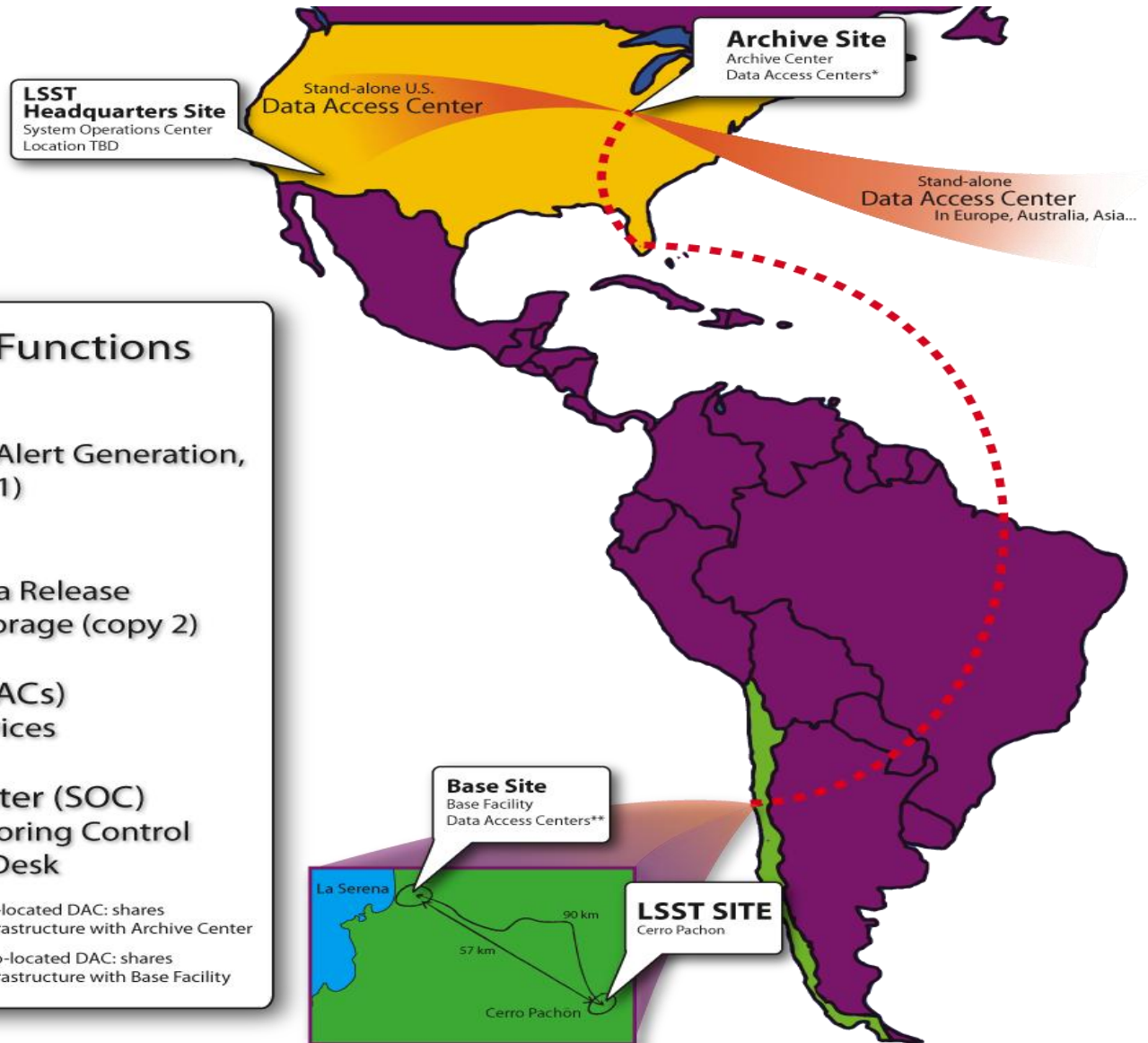
How many of you know what is LSST?



LSST

- Large Synoptic Survey Telescope (LSST)
 - Survey entire sky every 3 nights
 - Dark Energy, Dark Matter, Near Earth Asteroids, ...
 - Largest digital camera in the world (3 billion pixels)
 - Images 3000 times wider than Hubble
- LSST Data Management
 - Data from Chile to US and rest of the world
 - 15 TB/night, over hundred(s) petabytes
 - Multiple data centers around the world
 - Trillions of rows database (~ 15 PB)
 - Hundreds of millions of files ($\sim 80 \times 3 = \sim 240$ PB)

LSST current sites



Site Roles and their Functions

- **Base Facility**
Real-time Processing and Alert Generation,
Long-term storage (copy 1)
- **Archive Center**
Nightly Reprocessing, Data Release
Processing, Long-term Storage (copy 2)
- **Data Access Centers (DACs)**
Data Access and User Services
- **System Operations Center (SOC)**
System Supervisory Monitoring Control
& End User Support/Help Desk

* Co-located DAC: shares infrastructure with Archive Center

** Co-located DAC: shares infrastructure with Base Facility

LSST and CDLM

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



LSST and CDLM

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

\\i\exp\file1.fits

\\i\exp\file2.fits

/euro/exp/file2.fits

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



/res/chile/exp/file1.fits

/exp/file1.fits

/exp/file2.fits

Topic and current problems (related to this talk)

- Collaborative Data-lifecycle Management
 - “Data by itself is a process”
 - Data has to be social and “collaborate” with many including producer(s), consumer(s)
- Scale-out
 - Data Grid or Data Cloud or ?
 - iRODS.org
- Scale-up
 - IO latency (CPU cycle >>>> IO cycle)
 - SDSC DASH

iRODS: Logical File System

Scale out to multiple data centers

- iRODS
 - Data Grid Management System for Digital Libraries, Persistent Archives and Data Grids
 - Open Source BSD
 - Version 2.1

SDSC DASH

(one small step for byte,
one giant leap for a petabyte)

- Prototype effort for data intensive computer
 - Scale-up is EXPENSIVE (supercomputer)
 - Reduce IO latency with more memory (cheap) and SSD
- vSMP node
 - Aggregate multiple nodes into a single powerful node using software : Global memory as commodity
- SSD
 - 4TB of SSD
 - 3 IO nodes

If I had a billion bucks...

- IO latency
 - Smarter storage with CPU attached (just for storage control) and new protocols that can get control messages about h/w at a very low-level.
- Inter-processor and Inter-data center IO
 - IO for scale-up and scale-out
 - Improvements in CPU or data management software are handling the symptoms rather than the cause
- Data to Knowledge Communities
 - Data, Information, Knowledge
 - People, Communities

Storage Time Machine

- Capacity : Infinite
- I/O latency: Almost None
- Persistence of data: 10,000 years ++;
- TCO : Almost Zero
- Scalability: Few exabytes
- Start-up time: TBA (its ok don't need to perfect)

Agenda (10 min!)

- Use case: LSST
- Collaborative Data-life cycle Management
 - Scale-up and Scale-out
- Current efforts
 - DASH, iRODS
- We need more
 - Data I/O protocols with control channels
 - Storage Time Machine (if there is time for this)
- Q&A