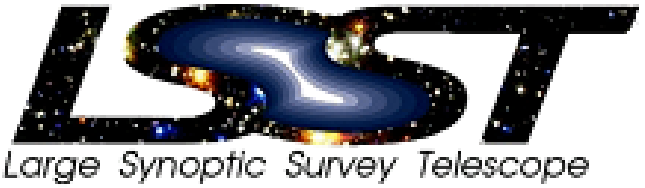


# Extremely Large Databases in Astronomy: LSST

**Extremely Large Databases Workshop**
**SLAC**
**October 25, 2007**

Kian-Tat Lim
Stanford Linear Accelerator Center

# Outline

Large Synoptic Survey Telescope

**Why?**
**What?**
**How?**
**What does this mean?**

# Outline

Large Synoptic Survey Telescope

**Why?**

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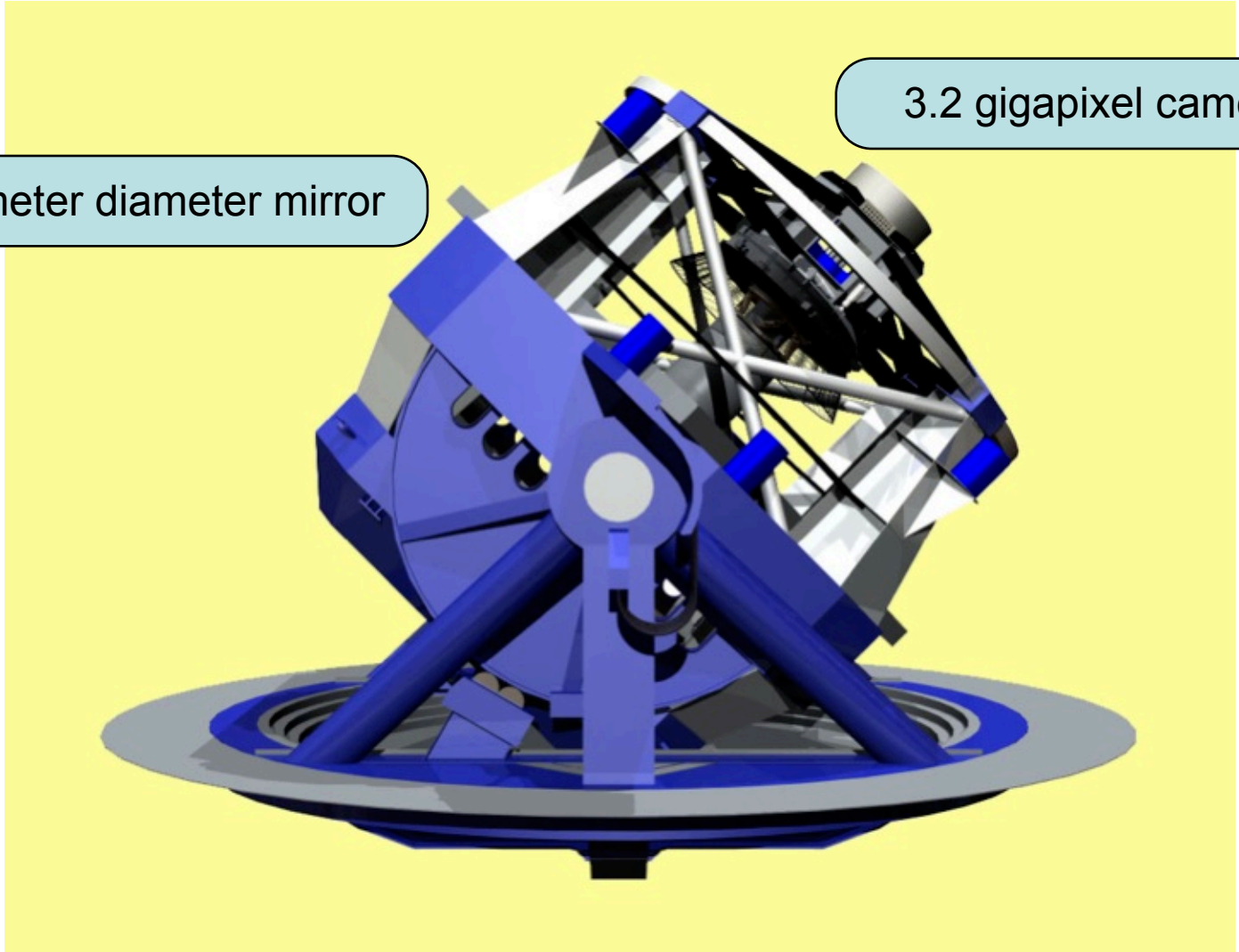
**What does this mean?**

# LSST Overview


**Proposed telescope to be built in Chile**

# Telescope

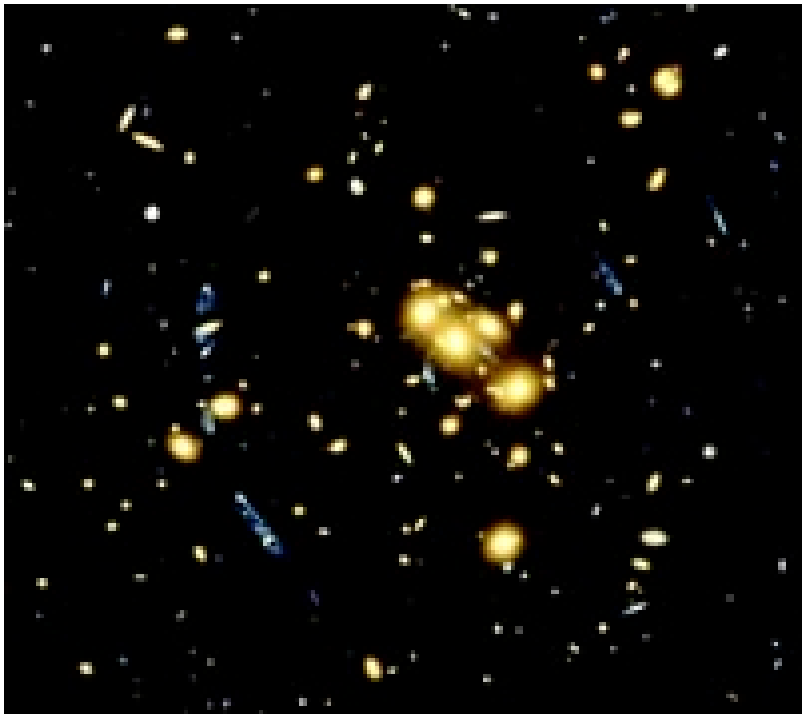


# Survey

Large Synoptic Survey Telescope

**Wide**
**Fast**
**Deep**

# Dark Matter and Energy



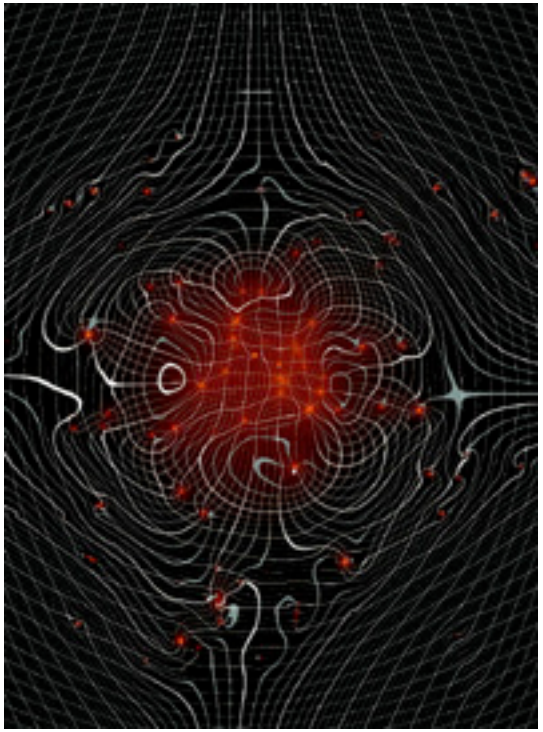
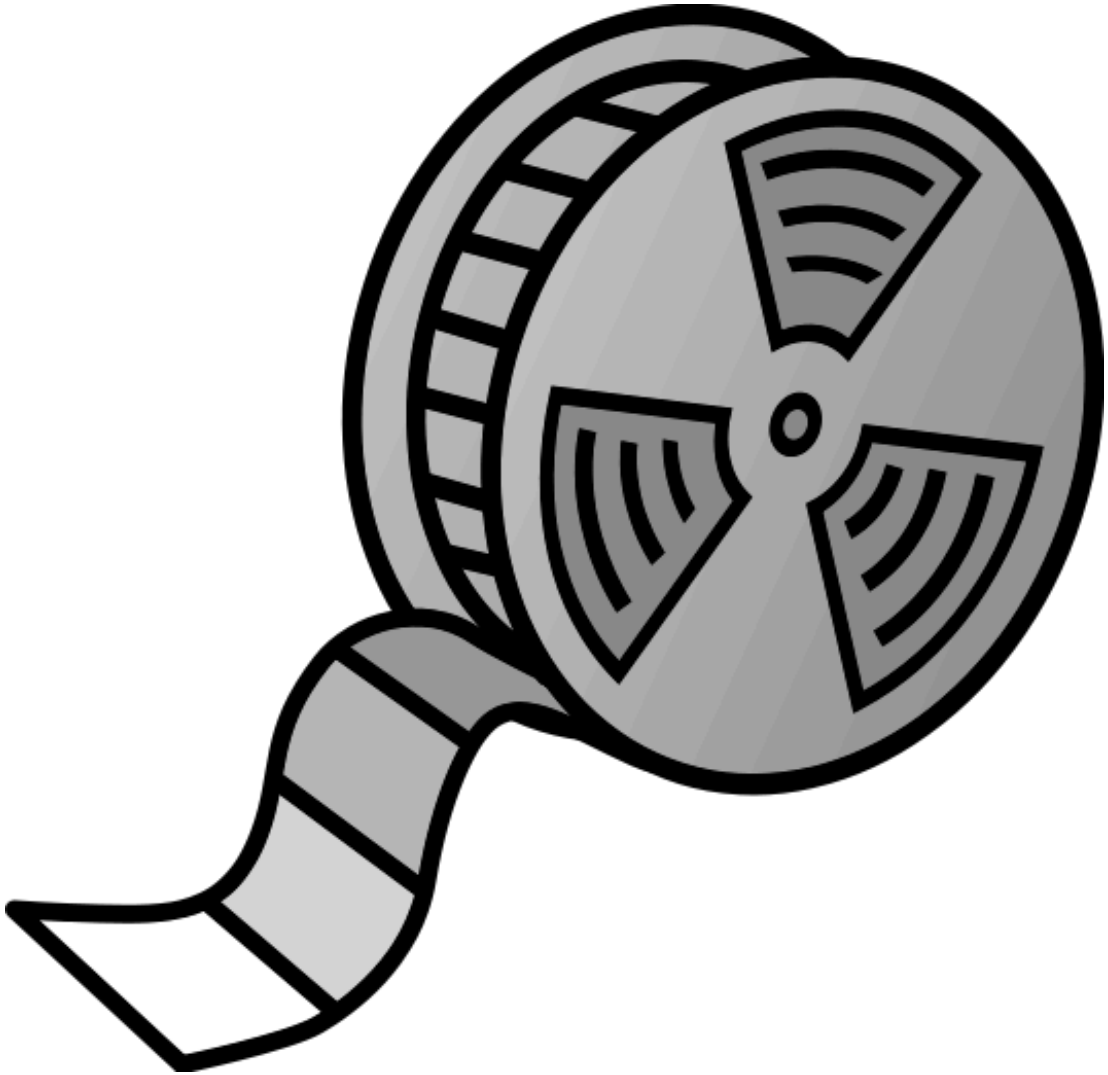
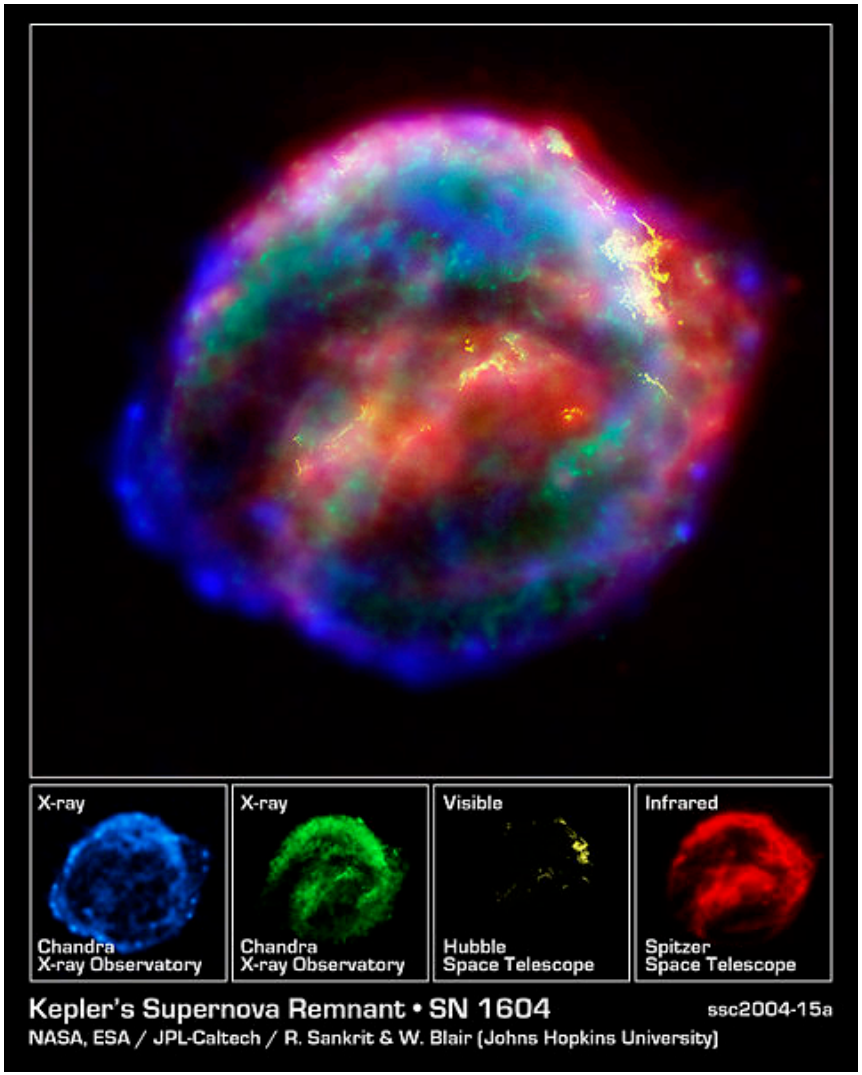


Photo: J. A. Tyson, W. Colley, E. L. Turner, and NASA

# Variable Objects



# Transient Objects



# Moving Objects

Photo: D. Roddy, Lunar and Planetary Institute

# Outline

Large Synoptic Survey Telescope

**Why?**

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# Data Challenge

Large Synoptic Survey Telescope

**Images**

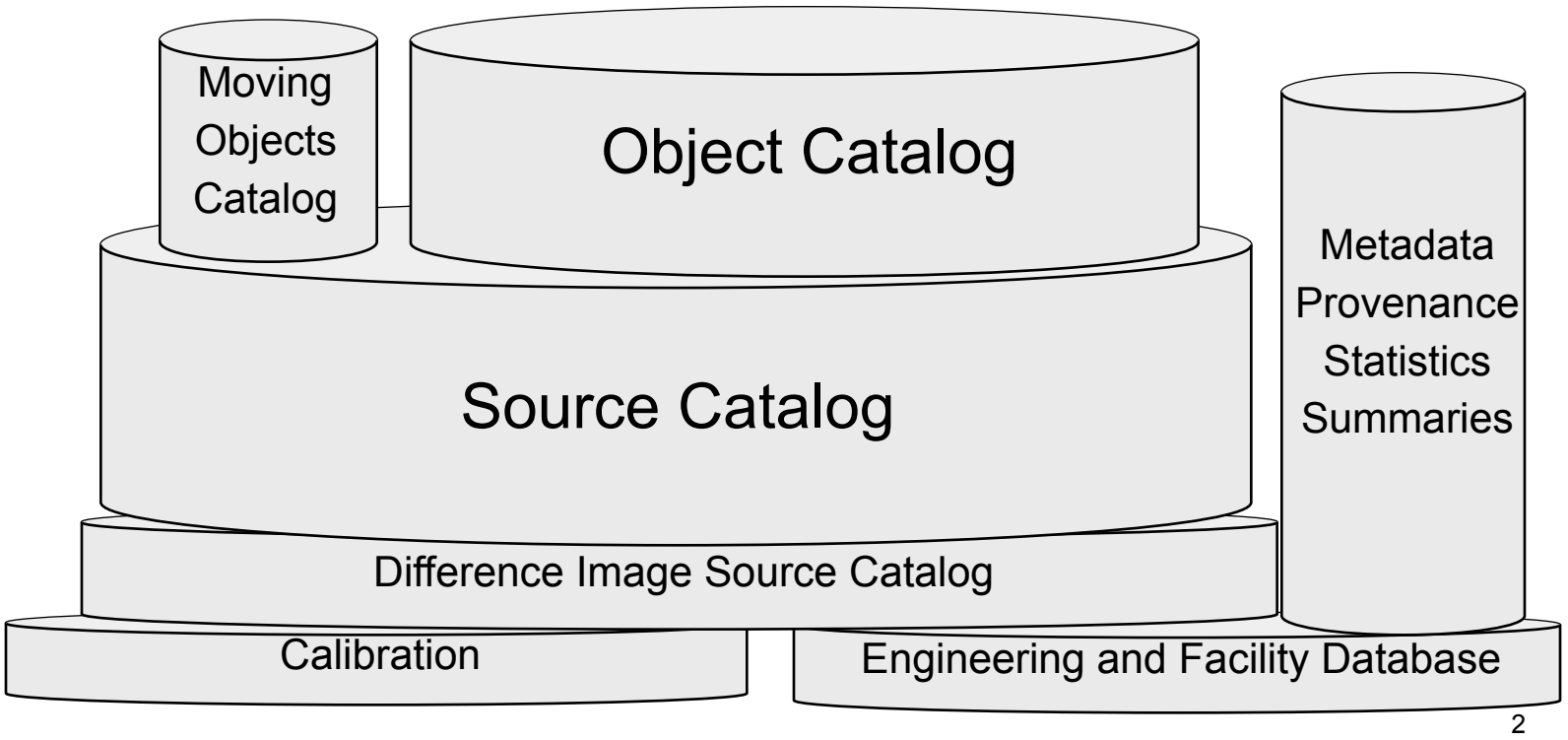
**Database**

# Data Locations

Large Synoptic Survey Telescope

**Mountain**
**Base Camp**
**Archive Center**
**Data Access Center**

# Non-Image Data In Database



# Sagans of Rows

Large Synoptic Survey Telescope

**49 *billion* objects**

**2.8 *trillion* sources**

# Lots of Columns

Large Synoptic Survey Telescope

**269 columns/Object**
**56 columns/Source**

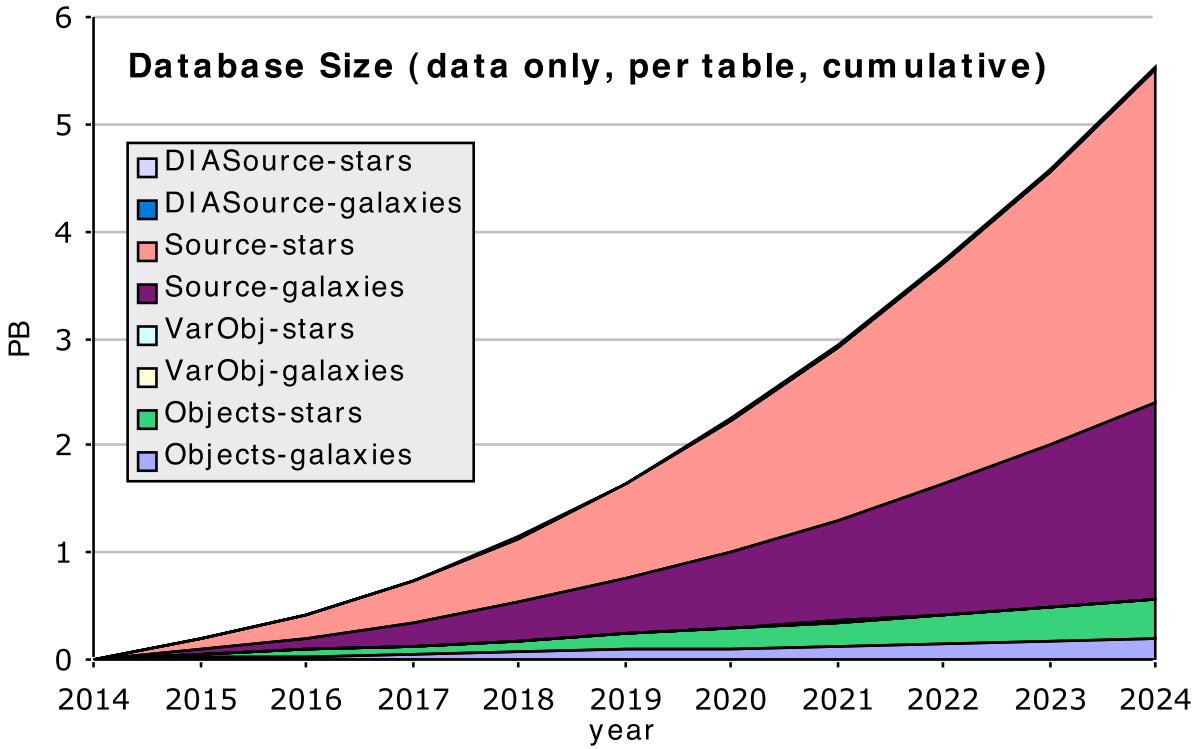
# Denormalization

Large Synoptic Survey Telescope

**Load**

**Query**

# Database Size



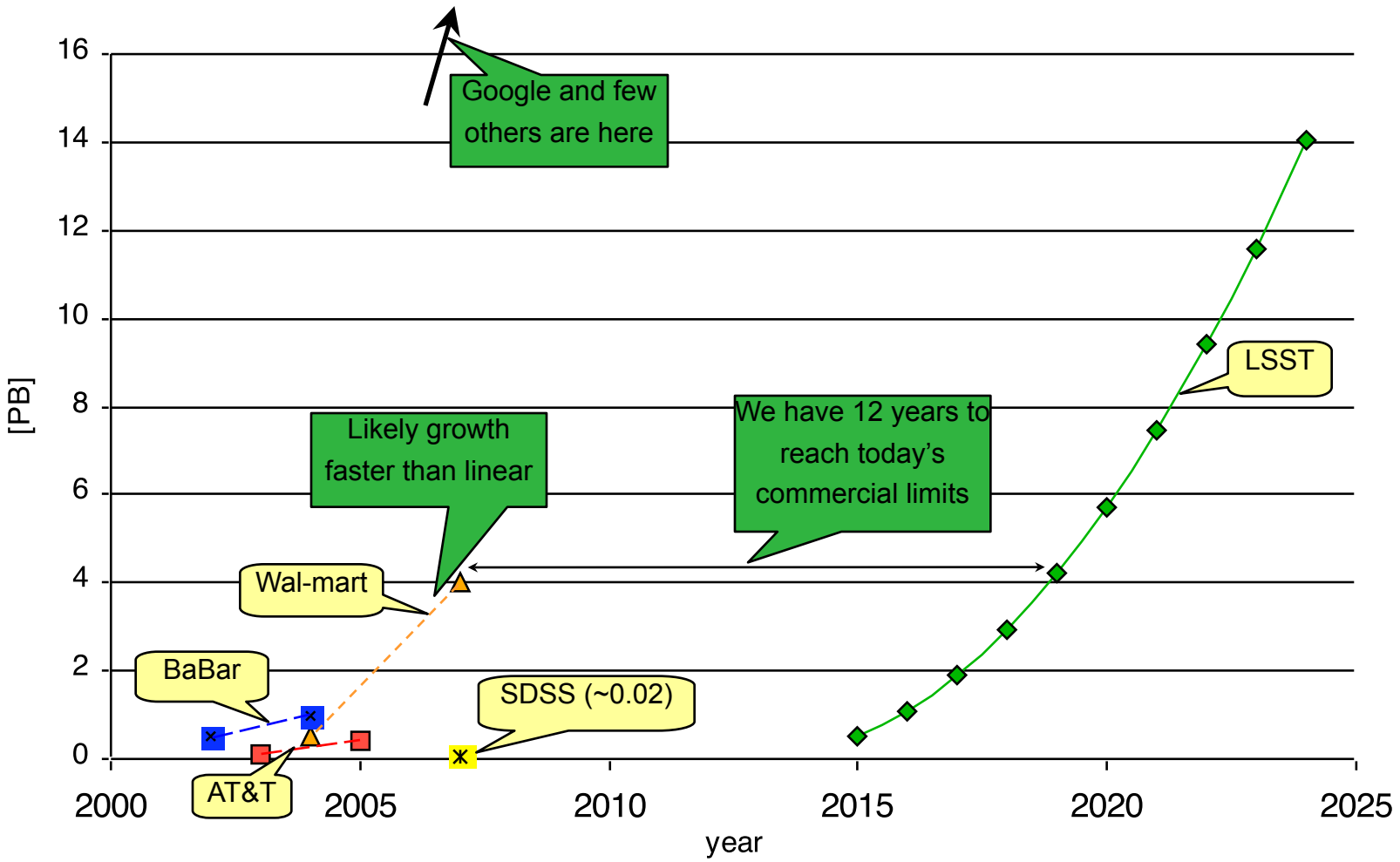

**Grows to 14 PB with indices**

# Managing The Database

Large Synoptic Survey Telescope

**Similar to commercial analytical data warehouses**

# Comparisons




* *All numbers based on publicly available data*

# Outline

Large Synoptic Survey Telescope

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# Reliability

Large Synoptic Survey Telescope

**Duplicate**
**Buffer**
**Replicate**
**Backup**
**Mirror**

# Integrity

Large Synoptic Survey Telescope

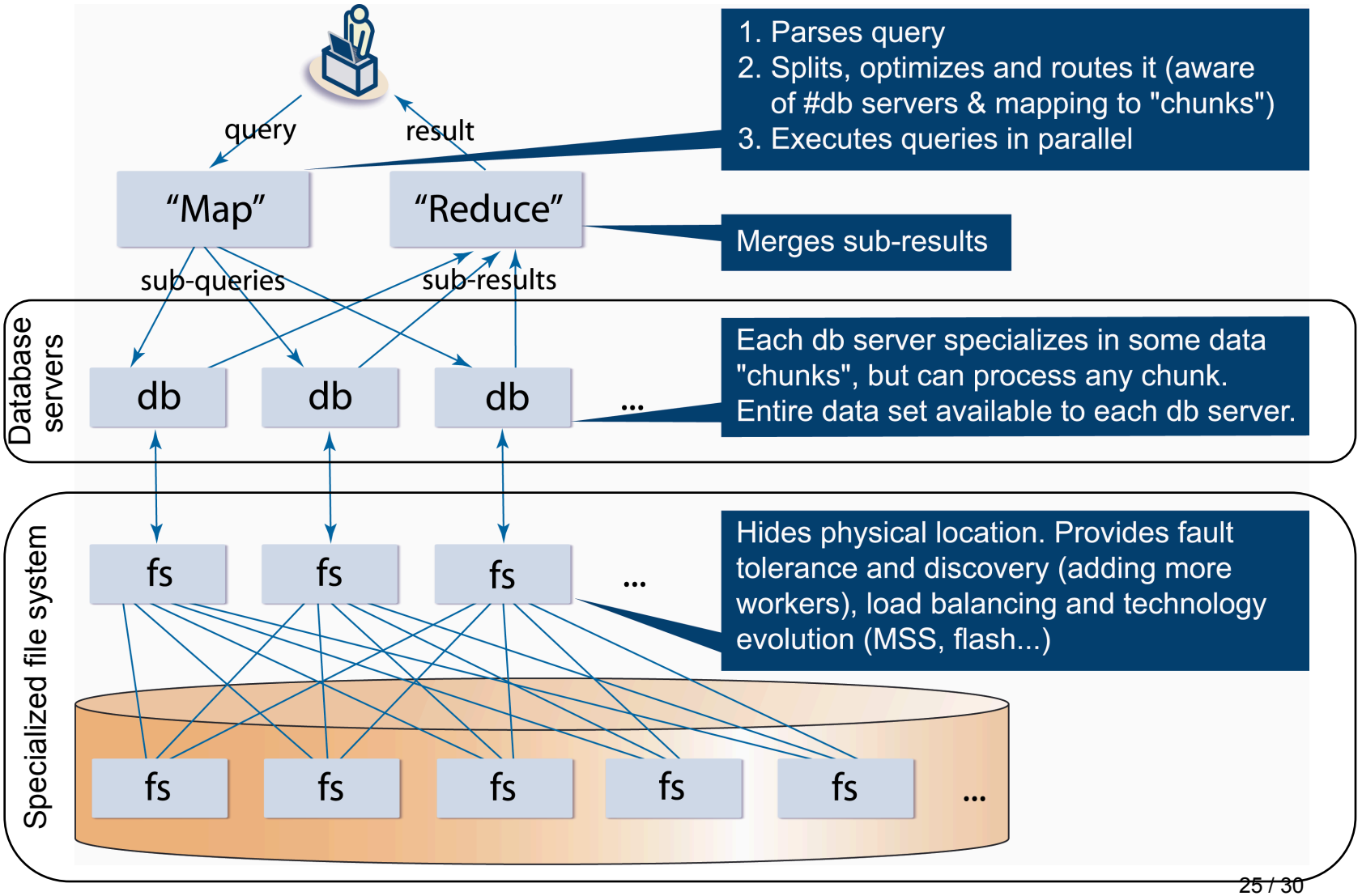
***Never* modify raw data**
**Provenance**
**Reprocessing**

# Scalability

Large Synoptic Survey Telescope

**Horizontally scalable**
**Portable code**

# Map/Reduce + SQL



# Outline

Large Synoptic Survey Telescope

**Why?**
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# What Can Vendors Do?

Large Synoptic Survey Telescope

**Mine!**
**Mining**

# What Can Vendors Do?

Large Synoptic Survey Telescope

**Relax**

**Relax**

# What Can Vendors Do?

Large Synoptic Survey Telescope

**Maintain**
**Maintenance**

# Summary

Large Synoptic Survey Telescope

**Many issues common to extremely large DBs**