

e-Science powered by Wide-area Distributed File System

This is a sub-project of the RENKEI (REsources liNKage for E-science) project sponsored by MEXT of Japan. RENKEI aims at research and development of new middleware to federate(=renkei) e-Science communities.

RENKEI website: <http://www.e-sciren.org/index-e.html>

e-Science case study: Data Analysis in Observational Astronomy

Observational astronomers need to use large variety¹⁾ and huge amount²⁾ of public Astronomical Data;

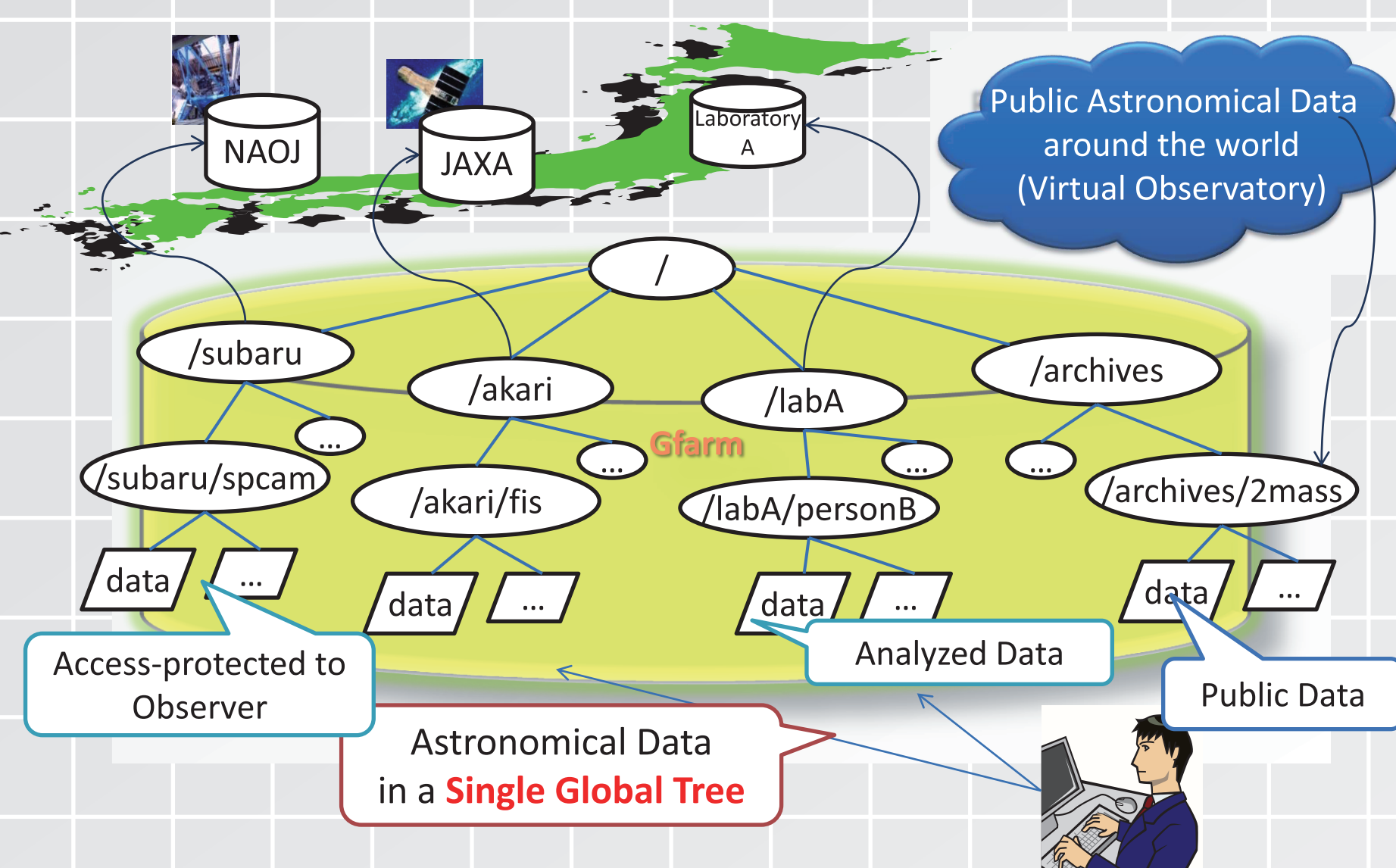
1) $\sim 10^4$ services registered in Virtual Observatories

2) ~ 27 TB image data in SDSS + 2MASS archives solely

Therefore, efficient file sharing among astronomers is one of key issues in Astronomical Data Analysis.

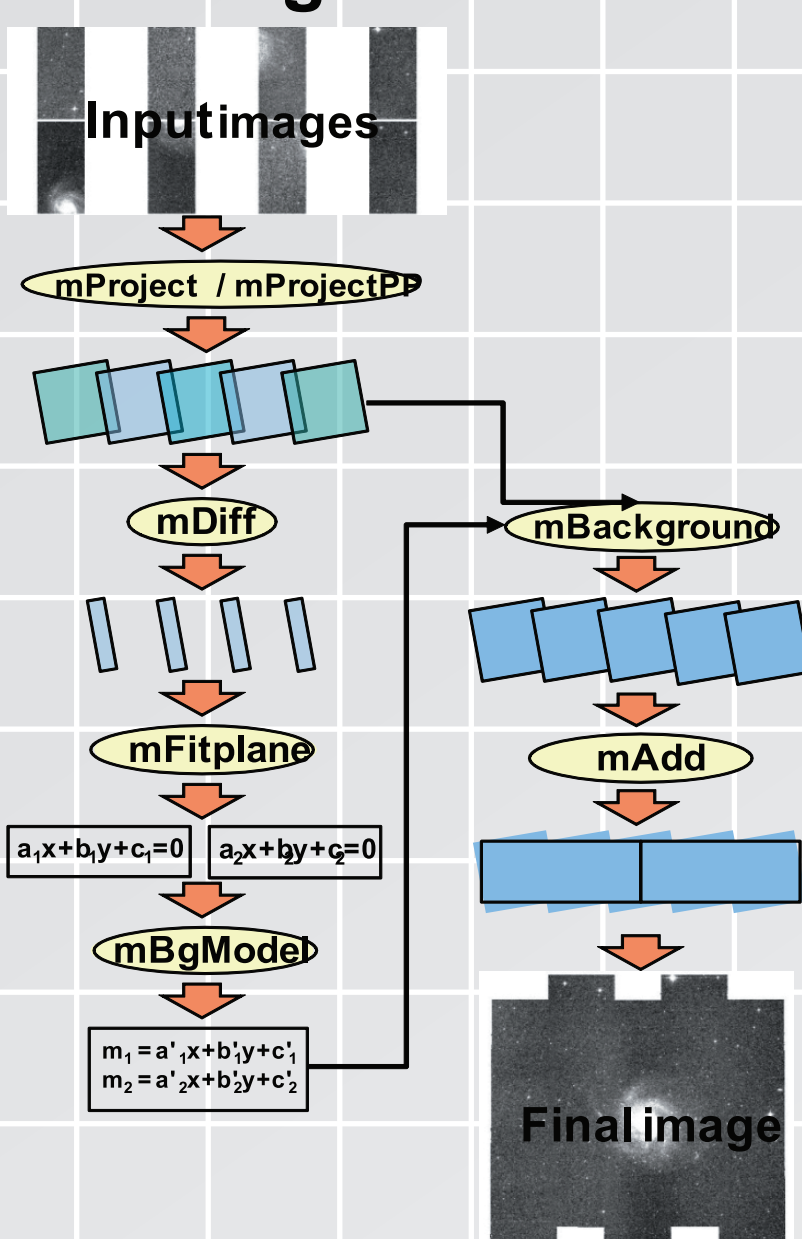
We thus apply **Gfarm** (<http://datafarm.apgrid.org/>), a wide-area distributed file system to practical Astronomical Data Analysis. Research issues include;

- Performance evaluation of Astronomical Data Analysis
- Staging method for public Astronomical Data
- Metadata query for Astronomical Data

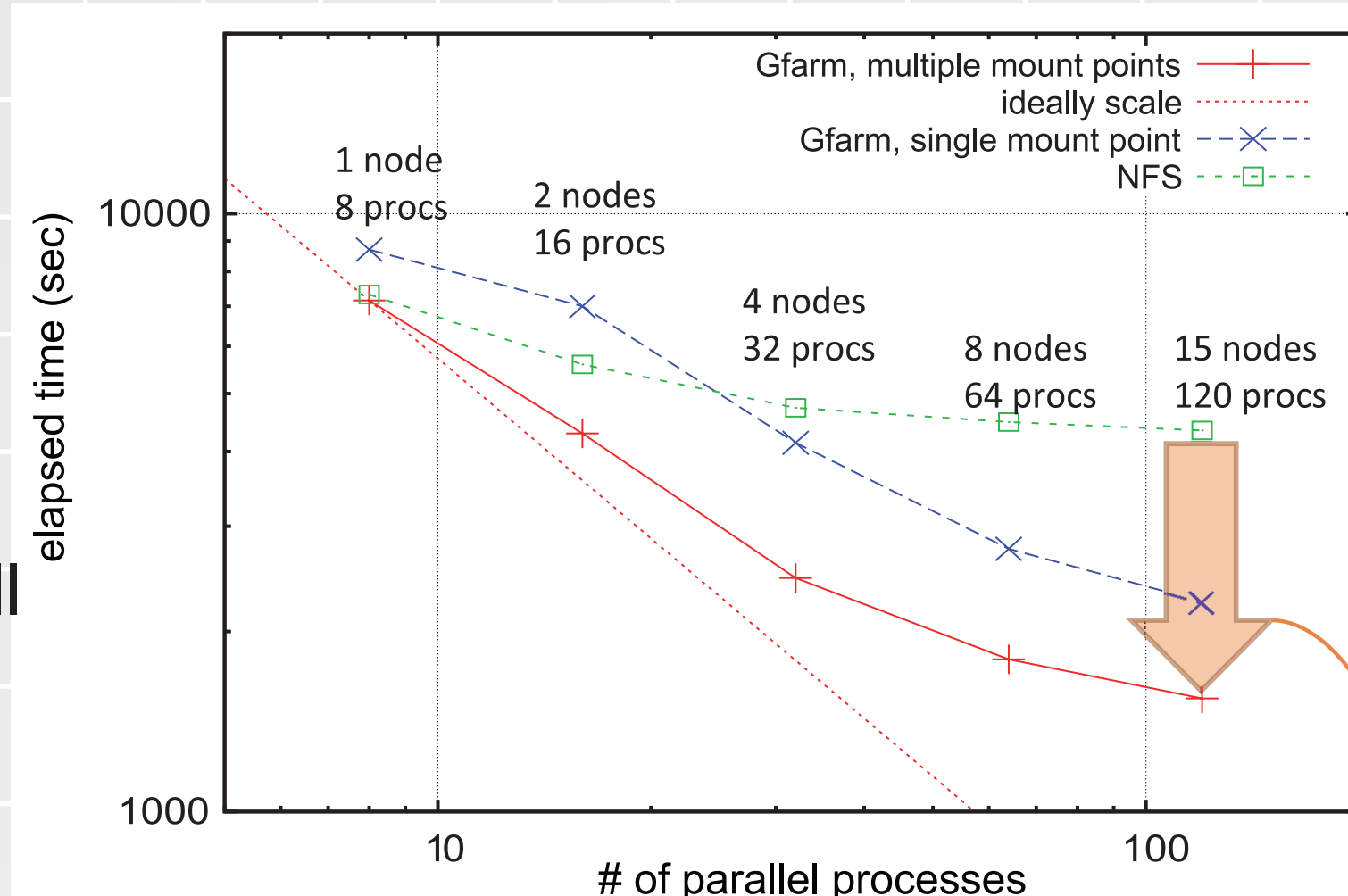


Performance of Astronomical Data Analysis with Gfarm File System

Montage Workflow



- Data Analysis tool: **Montage**, a tool for composing multiple shots of images
- Input images: 2MASS 6,669 image files, ~ 2 MB/file
- Measurement platform: **InTrigger**, Tsukuba 15 nodes, 8 cores/node
- Workflow executor: **GXP**, Grid&Cluster Shell
- Workflow format: versatile Makefile
- Workflow execution time using **120 cores**
 - ▶ NFS : 4,339 sec
 - ▶ Gfarm : **1,545 sec** (multiple mount points)→ **2.8 times** speedup by distributed file system.



2.8 times speedup by Gfarm

Researches on Wide-area Distributed File System

In order to accelerate e-Science, research and development of wide-area distributed file system are ongoing. Research topics include;

File Replica management:

- Optimal automatic placement of file replicas
- Fault-tolerant selection of file replicas
- Efficient file replication between clusters, considering network throughput and disk I/O performance

Distributed Metadata Server (MDS):

(to avoid overhead of communication with MDS)

- Metadata management that ensures eventual consistency

Gfarm new features in this year include;

- Automatic reconnection to MDS
- XML extended attribute searchable by XPath
- Group management by VOMS

Gfarm website : <http://datafarm.apgrid.org/>

