Software and Services for Structured Data
Large Scale Data Management LSDF

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Data @ Karlsruhe

**GridKA**
Grid storage element
10 PB online

**State data storage**
Baden-Württemberg

**Large Scale Data Facility**
2 PB storage and archives
LSDF objectives

- Dedicated for science data
- ExaByte scale data
- To archive data, long term sustainability (10 yrs. – ?)

- To enable scientists to gain better scientific results by providing
  - Data intensive analysis
  - Added value services for data intensive processing
- To provide high performance access, high throughput
- “Barrier free” access (easy-to-use)
- Sustainability and interoperability

“Guidelines”:
- ESFRI Data Management Task Force (2009):
- OAIS (2002):
- High Level Experts Group (2010):
- HLEG-SD (2010?):
- Microsoft Research (2009):

  Strategy for a European Data Infrastructure
  e-IRG Report on Data Management
  Reference Model for an Open Archival Information System
  Riding the Wave – European Commission Report on Scientific Data
  Note on Data Services infrastructure
  The Fourth Paradigm: Data-Intensive Scientific Discovery
Focus: ANKA Image BLs
**a) Unstructured data**
- Harddisk
- “Content” and “Structure” unknown to provider
- User is responsible for data life cycle and curation
- Backup, seldom bit preservation
- Local access

**b) Structured data**
- Data is archived with known meta data and data organization
- Clear separation between storage organization, data organization and project meta data
- Provider is responsible for life cycle, preservation and curation
- World-wide access
Separation

Repository System

Data Organization

Data Grid Middleware

Scientific meta data
(KIT DataBrowser, Fedora repository, dSpace,…)

Content structure and file meta data

Virtualization of storage resources
(dCache, iRODS, Merritt, Active Circle…)

Storage resources, heterogeneous, distributed
DataBrowser for structured data archives

Hierarchical Catalog System for Structured Data (Repository system)

- Sustainable
- Easily extensible
- Independent of data formats
- Enhanced performance: distribution of access
- Safety by redundancy
- Easy-to-use?

CATALOGS

- Meta data scheme repository
- Zebrafish I
- Zebrafish II
- ANKA BL1
- Material research
- Digital objects in Arts and Humanities
- Generic file tree

LOGICAL PROJECT CATALOG

- LPN → LDN, meta data

LOGICAL DIRECTORY CATALOG

- LDN → LDN, LFN

LOGICAL FILE CATALOGS

- LFN → Physical File Name

APIs and Tools

LSDF Systems

Computing

Storage
KIT DataBrowser

Repository system for large scale data
• High-throughput for large data sets

Functions:
• Data management
• Queries in meta data catalogs
• Up-/Download
• Control of data analysis + vis. workflows

• Easy-to-use
• Extensible
• World-wide accessible
• Stable
Data Transfer

Abstract Data Access Layer
Application Programming Interface (ADALAPI)

- Java class library
- Seamless application access to LSDF
- Independent of transfer protocol and location
- Protocols and filesystems
  - local files,
  - gsiftp
  - sftp
  - http(s)
  - hdfs
- Authentifikation: X.509 certificates, user/passwd
- Performance
  up to 210 MB/s, 10 GE, gsiftp
Generic Workflow Execution Framework

DataBrowser

- Data + meta data
- Algorithms + meta data
- Processing directives

LSDF + \(\text{hadoop}\)

- Upload of experiment data (scientist) and algorithms (developer) using DataBrowser
- Connecting data and algorithms to processing directives (administrator)
- Computing infrastructure accesses data via 2 x 10 GE

- Cron job polling for new data sets
- Preparation of processing defined by processing directives
- Processing of data, update of meta data and marking as „processed”

- Environment für arbitrary meta data driven workflows
  - Development
  - Deployment
  - Ingest
- Automatic processing based on “processing directives”
- Monitoring and error processing
- Algorithm database
DataBrowser und Lif2Raw Workflow

Experiment folder: /LSDF/download/simpleLif

Device: Leica microscope (LIF & XML)

Creator: C=DE,O=GermanGrid,OU=KIT,CN=Volker Hartmann

Date: Apr 11, 2011

Note: You can put some free text notes here...

Project: Volker
Protocol: sFTP

Execute Workflow

Workflows
Lif2Raw (v2.0)
DataBrowser und Lif2Raw Workflow Monitoring
Data Management for ANKA

PhD Student Halil Pašić

- Design of the data life cycle management for image BLs
- Transparent connection to LSDF
- LSDF archiving (0.5 PB/a)

- Definition and Implementation of data formats and APIs for BL data access
  → in cooperation with Eugen Wintersberger (DESY) + Tomas Farago (ANKA)
Topics
• Parallel Computing
• Distributed and Network-based Computing
• Data Intensive Computing
• Models and Tools
• Systems and Architectures
• Advanced Algorithms and Applications

Program Chair
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Special Sessions
• Cloud Computing for Compute and Data Intensive Applications
• On-chip Parallel and Network-based Systems
• Energy-aware Systems
• GPU Computing and Hybrid Computing
• Security in Networked and Distributed Systems
• Next Generation of Web Computing
• Modeling, Simulation, and Optimization of Peer-to-peer environments
• Grid, Parallel and Distributed Bio-informatics Applications
• Cross-Fertilisation of Parallel and Metaheuristics Techniques
• Parallel and distributed storage systems

Important Dates
Papers due: July 25, 2011
Acceptance notification: October 10, 2011
Camera-ready versions: November 11, 2011