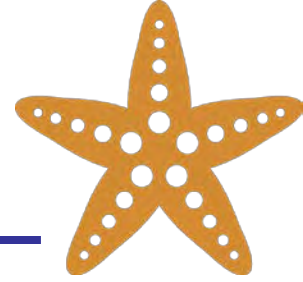


Starfish

A Side-band Database for HPC and Archival Storage Systems

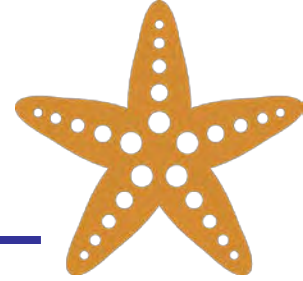
Part of a larger solution for managing the life cycle of scientific research from creation through publication and reuse.

Our Core Technology: Sync File System to Database



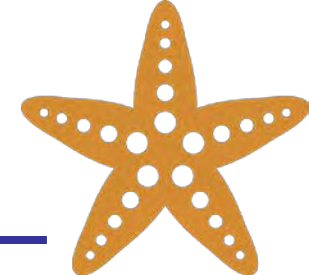
- **Imagine if it were easy to keep your file systems synchronized with a database?**
 - All of the `stat()` metadata that comes off POSIX
 - Additional file system metadata such as in GPFS
- **Imagine if you could add tags or key-value pairs to the records that represent files and directories.**
- **Imagine if the database kept version histories of the directory tree and individual files.**
- **Imagine if the database pre-staged some common aggregate values up and down the directory tree?**
 - Total files, total capacity, etc.

What Would You Use The Database For?



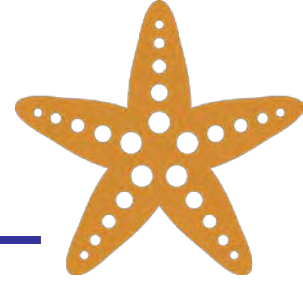
- **Reporting**
 - Better reports enabled by extensible metadata
- **Running Scripts / Feeding batch processes**
- **Data migration workflows**
 - Migration
 - HSM
 - Backup/Restore
 - Check-in / Check-out
 - Move to and from object store
- **Single namespace user portal**
- **Resolving broken links and finding lost files**
- **Calculating and storing hashes**
 - Fixity checking, duplicate file detection, content addressing

What Makes the File System Catalog Awesome?



- **Massively scalable**
 - Handles billions of files
 - Multi-threaded and multi-host for greater parallelization
 - Highly tunable and configurable
- **Agents for specific file systems**
 - Agents capture file system events reducing the need to crawl and compare
 - Agents capture device-specific metadata
- **Metadata persists as files and directories move around**
 - Add tags and key-value pairs to files and directories
 - Directory-level metadata can be inherited down the tree
 - Metadata is retained even when file system objects are moved and renamed.
- **Version histories**
 - We track version changes of individual files
 - We keep a version history of the directory tree

Versioning – Critical Feature



- **Backup/ Restore**
 - Replaces enterprise backup software
- **Permanent Addressing**
 - A digital object has a permanent address in the form of path name + time/date
- **Find missing files**
 - Query the catalog with the “last known address”. Find out where the file is now.
- **Virtual HSM**
 - Individual files can be removed from the POSIX name space and moved to lower cost storage while retaining the file record in the virtual namespace.
- **Checkpoint**
 - Retain a collection of files at a point in time
- **Provenance**
 - Point-in-time representations of file collections provide a foundation for data provenance

The Grand Vision



Publication/Preservation

(Librarians, Archivists, Curators)

- Open Links / DOIs
- Metadata Extraction
- Curation Workflows
- Version Controls
- Access Controls
- Fixity Checks

Content Creation

(Scientists, Engineers, Artists)

- Metadata Tagging
- Workflow Automation
- Data Management Plans
- Open Access
- Data Reusability
- Collaboration



IT Operations

(Storage & Backup Administrators, IT Governance)

Data Movement

- Tiered Storage
- Backup Restore
- Data Migration

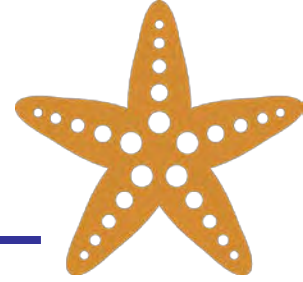
Governance

- Permissions Management
- Auditing
- Chargeback / Show-back

Reporting

- Capacity Planning
- Aging / Utilization
- File System Analysis

Bragging Rights



- **Easy to install - 10 mins for core system**
 - Major components discover themselves.
 - Upgrades invoked by a single command from CLI
- **Largest single installation: 8+ billion files**
- **Scanning at a rate of 2.8 billion files per day**
 - 30,000+ file system events per second
- **51 sites using the software as of May 2017.**
 - Most are top tier data centers and/or household names
- **Multi-phase duplicate checking at 1.7PB/day**