Fedora 4: Introduction and Overview

Learning Outcomes

Understand the purpose of a Fedora repository

Learn what Fedora can do for you

Understand the key capabilities of the software

Introduction to Fedora 4

What is a Fedora Repository?

Secure software that stores, preserves, and provides access to digital materials

Supports complex semantic relationships between objects inside and outside the repository

Supports millions of objects, both large and small

Capable of interoperating with other applications and services

Exposing and Connecting Content

Flexible, extensible content modeling

Atomic resources with semantic connections using standard ontologies

RDF-based metadata using Linked Data

RESTful API with native RDF response format

Fedora 4 Project Goals

Improved performance

Flexible storage options

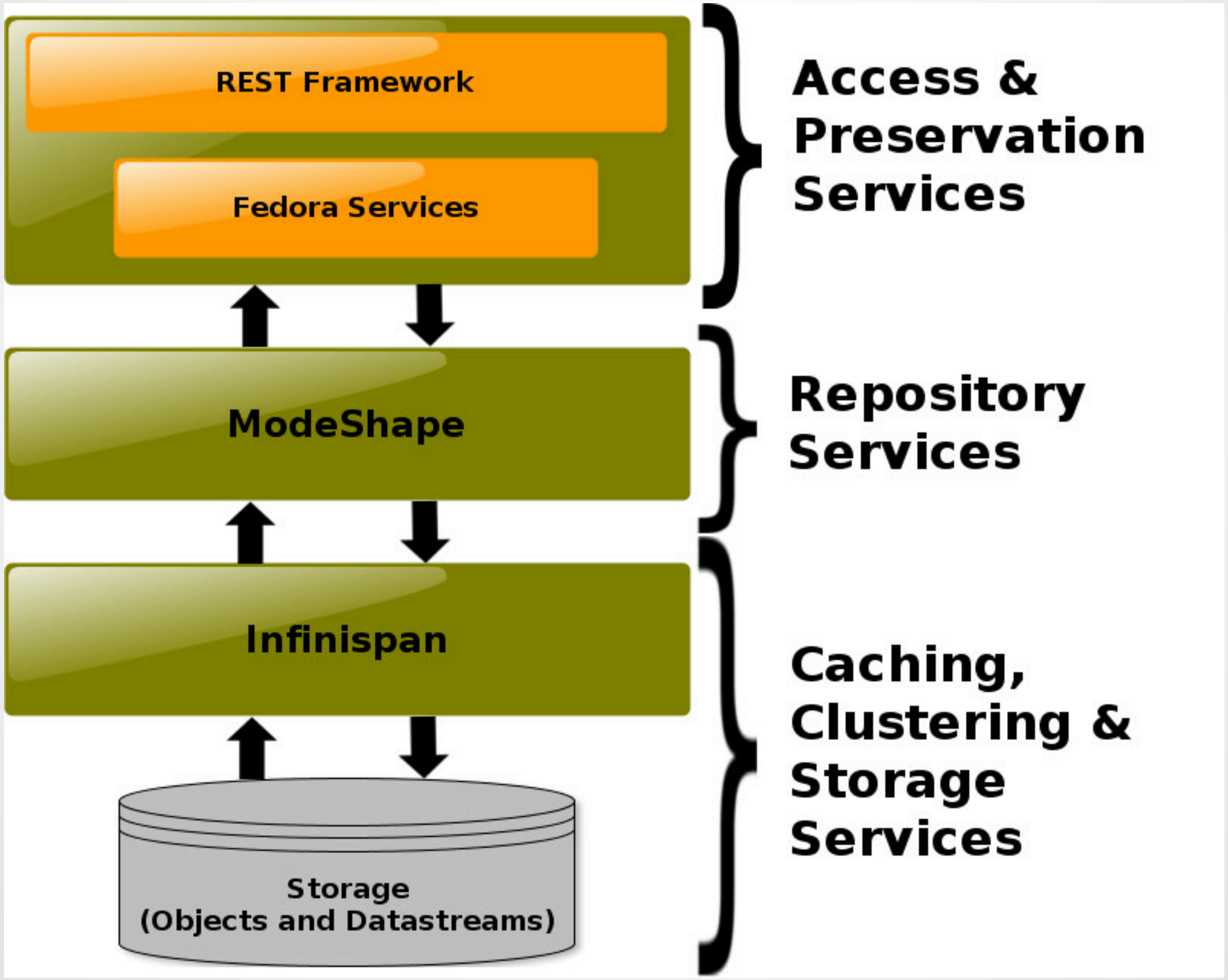
Research data management

Linked open data support

Improved platform for developers

Core Features

Component Stack


REST Framework
Fedora Services
ModeShape
Infinispan
Storage
(Objects and Datastreams)
Access & Preservation Services
Repository Services
Caching, Clustering & Storage Services

Standards

Focus on existing standards

Fewer customizations to maintain

Opportunities to participate in related communities

Core Features and Standards

CRUD - LDP

Versioning - Memento?

Authorization - WebAC?

Transactions

Fixity

Import/Export - RDF export?

Versioning

Versions can be created on resources with an API call

A previous version can be restored via the REST-API

Authorization

The authorization framework provides a plug-in point within the repository that calls out to an optional authorization enforcement module

Currently, three authorization implementations exist: No-op, Role-based and XACML

Role Based Authorization

Role-based authorization compares the user's role(s) with an Access Control List (ACL) defined on a Fedora resource

ACLs can be inherited; if a given resource does not have an associated ACL, Fedora will examine parent resources until it finds one

XACML Authorization

A default policy must be defined for the repository, and each resource can override the default with another policy

An XACML policy referenced by a resource will also apply to all the resource's children, unless they define their own XACML policies that override the parent policy

Transactions

Multiple actions can be bundled together into a single repository event (transaction)

Transactions can be rolled back or committed

Can be used to maintain consistency

Fixity

Over time, digital objects can become corrupt

Fixity checks help preserve digital objects by verifying their integrity

On ingest, Fedora can verify a user-provided checksum against the calculated value

A checksum can be recalculated and compared at any time via a REST-API request

Export and Import

A specific Fedora container, its child containers, and associated binaries can be exported

Exported containers can be serialized in a standard RDF format

An exported container or hierarchy of containers can be imported at any time

Backup and Restore

A full backup can be performed at any time

A full restore from a repository backup can be performed at any time

Non-core Features

Two Feature Types

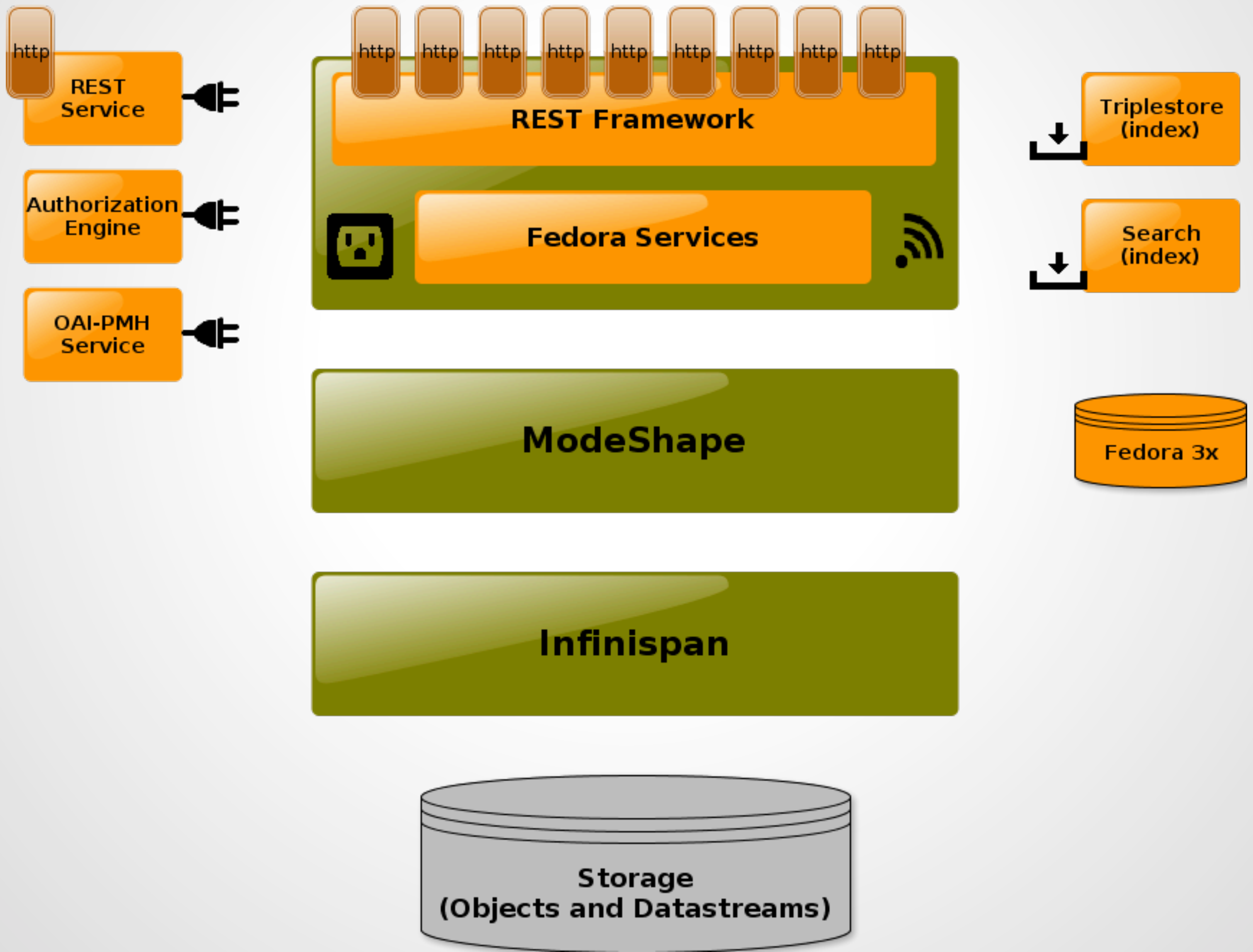
Optional, pluggable components

> Separate projects that can interact with Fedora 4 using a common pattern

External components

> Consume and act off repository messages

Component Architecture



External Component Integrations

Leverages the well-supported Apache Camel project

- Camel is middleware for integration with external systems

- Can handle any asynchronous, event-driven workflow

External - Indexing

Index repository content for search

Content can be assigned the rdf:type property "Indexable" to filter from non-indexable content

Solr has been tested

External - Triplestore

An external triplestore can be used to index the RDF triples of Fedora resources

Any triplestore that supports SPARQL-update can be plugged in

Fuseki and Sesame have been tested

External - Audit Service

Maintains a history of events for each repository resource

Both internal repository events and events from external sources can be recorded

Uses the existing event system and an external triplestore

Pluggable - OAI Provider

fcrepo4-oaiprovider implements Open Archives Protocol Version 2.0 using Fedora 4 as the backend

Exposes an endpoint which accepts OAI conforming HTTP requests

Supports oai_dc out if the box, but users are able to add their own metadata format definitions to oai.xml

Pluggable - SWORD Server

SWORD is a lightweight protocol for depositing content from one location to another

fcrepo4-swordserver implements 2.0 AtomPub Profile, using Fedora 4 as the backend

SWORD v2 includes AtomPub CRUD operations

Data Modeling

Linked Data

Fedora 4 conforms to the LDP 1.0 recommendation

Metadata can be represented as RDF triples that point to resources inside and outside the repository

Many possibilities for exposing, importing, sharing resources with the broader web

Benefits of LDP and Linked Data

Interoperability:

- Between different Fedora implementations
- Between Fedora and LDP clients
- Between Fedora and linked data services

Authority control

Discoverability

New Vocabulary

Fedora 3	Fedora 4
Objects and Datastreams	Resources
Objects	Containers
Datastreams	Binaries

Resources

Both containers and binaries are resources

Container resources can have both containers and binaries as children

The tree structure allows for inheritance of things like security policies

Properties

Resources have a number of properties, expressed as RDF triples

> Name-value pairs; translated to RDF on REST-API responses

Properties can be RDF literals or URIs

Any number of RDF namespaces can be defined and used

Content Models

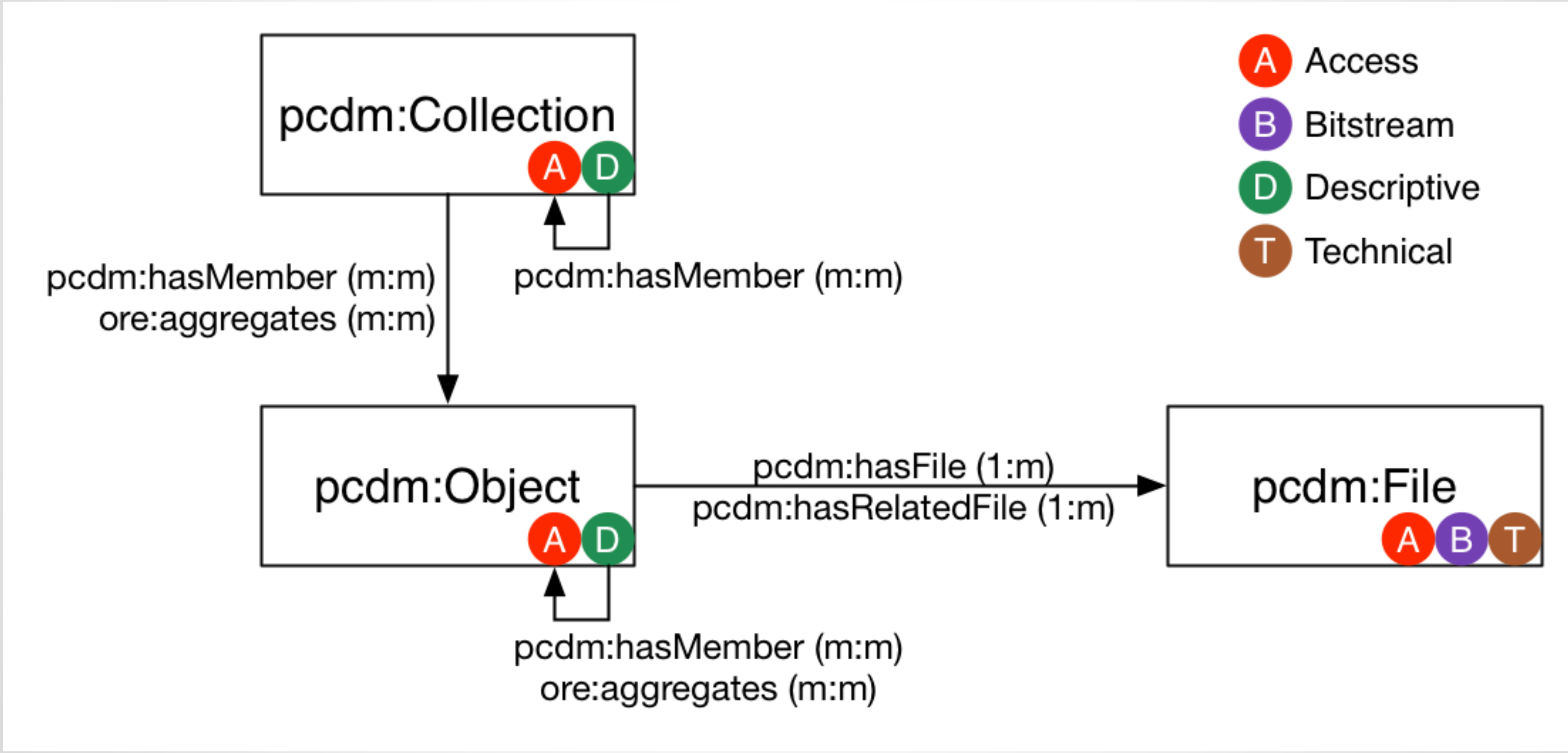
Content can be modeled using properties and types

Cross-community design has produced PCDM

Portland Common Data Model

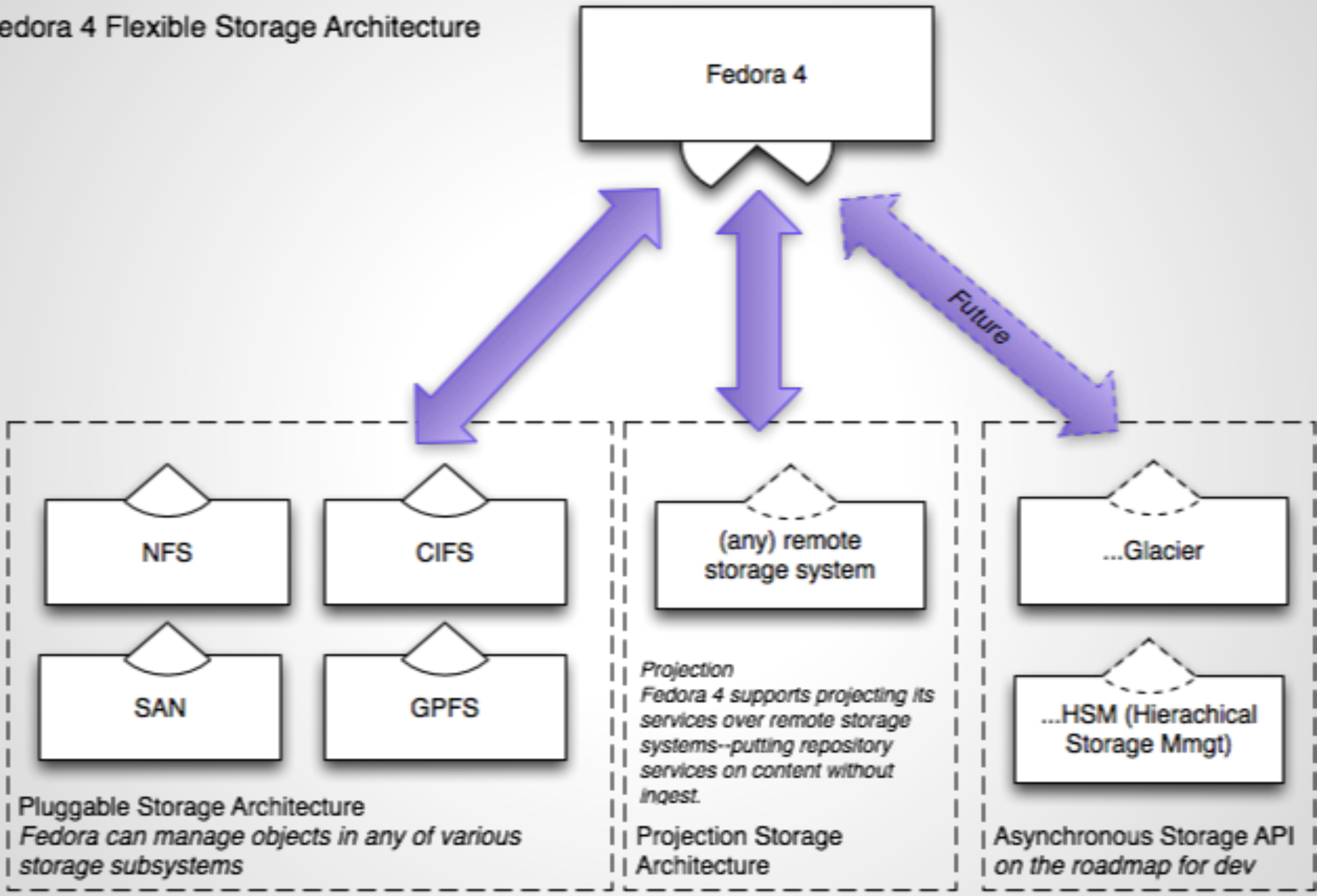
PCDM combines common ontology with LDP interaction model

Portland Common Data Model



Performance and Scalability

Fedora 4 Flexible Storage Architecture



Fedora 4
Future
NFS
CIFS
SAN
GPFS
(any) remote storage system
...Glacier
...HSM (Hierachical Storage Mmgt)

Projection
Fedora 4 supports projecting its services over remote storage systems--putting repository services on content without ingest.

Pluggable Storage Architecture
Fedora can manage objects in any of various storage subsystems

Projection Storage Architecture

Asynchronous Storage API
on the roadmap for dev

Metrics

A number of scalability tests have been run:

Uploaded a 1 TB file via REST API

16 million objects via federation

10 million objects via REST API

Transaction Performance

Multiple actions can be bundled together into a single repository event (transaction)

Transactions offer performance benefits by cutting down on the number of times data is written to the repository filesystem (which tends to be the slowest action)

Clustering

Two or more Fedora instances can be configured to work together in a cluster

Fedora 4 currently supports clustering for high-availability use cases

A load balancer can be setup in front of two or more Fedora instances to evenly distribute read requests across each instance

Next Steps

Where to learn more about Fedora 4

Useful Resources

Fedora 4 documentation

Fedora 4 wiki

Fedora 4 mailing lists