UNICORE Data Management: Recent Advancements

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Data wave is coming!

The coming years will be marked by an increasing amount of data produced and processed ("wave of data"[1]):

- global, diverse, valuable and complex data
- science is both producer and consumer of this data

[1] "Riding the wave: How Europe can gain from the rising tide of scientific data"

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Examples:

- The Virtual Human Brain: 50 billion neurons, a neuron can possess up to 15,000 synapses

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Examples:

- The Virtual Human Brain: 50 billion neurons, a neuron can possess up to 15,000 synapses
- Medical data amounts to 30 % of the data produced
- 2.5 PB of mammograms are stored in the U. S. alone

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UNICORE

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Question

How UNICORE can handle large amounts of data and support data-oriented scientific processes?

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How UNICORE can handle large amounts of data and support data-oriented scientific processes?

What are the UNICORE capabilities to:

- store,
- transfer,
- and manage large amounts of data.

Data storage

Problem: The data must be stored somewhere

Somewhere is the crucial word here. The user usually doesn't care as long as a seamless access to the data is granted.

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UNICORE solution: Distributed Storage (**dSMS**)

- hides the complexity from the user: well-known SMS abstraction
- single "access point" for the users
- . . . which can be replicated for redundancy and load balancing
- flexibility (in adding new resources)

Data transfer

Problem: How to move the data from one place to the other?

As usually:

- the user doesn't care: she wants to just move the data quickly from one place to the other
- the admin doesn't care: she doesn't want to change anything (on firewall)

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UNICORE solution: **UFTP**

- dynamic firewall port opening using a pseudo FTP connection
- parallel input/output streams

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UNICORE solution: **UFTP**

- dynamic firewall port opening using a pseudo FTP connection
- parallel input/output streams
- new feature in UNICORE: scheduled transfers

Problem: How to organize and manage the data?

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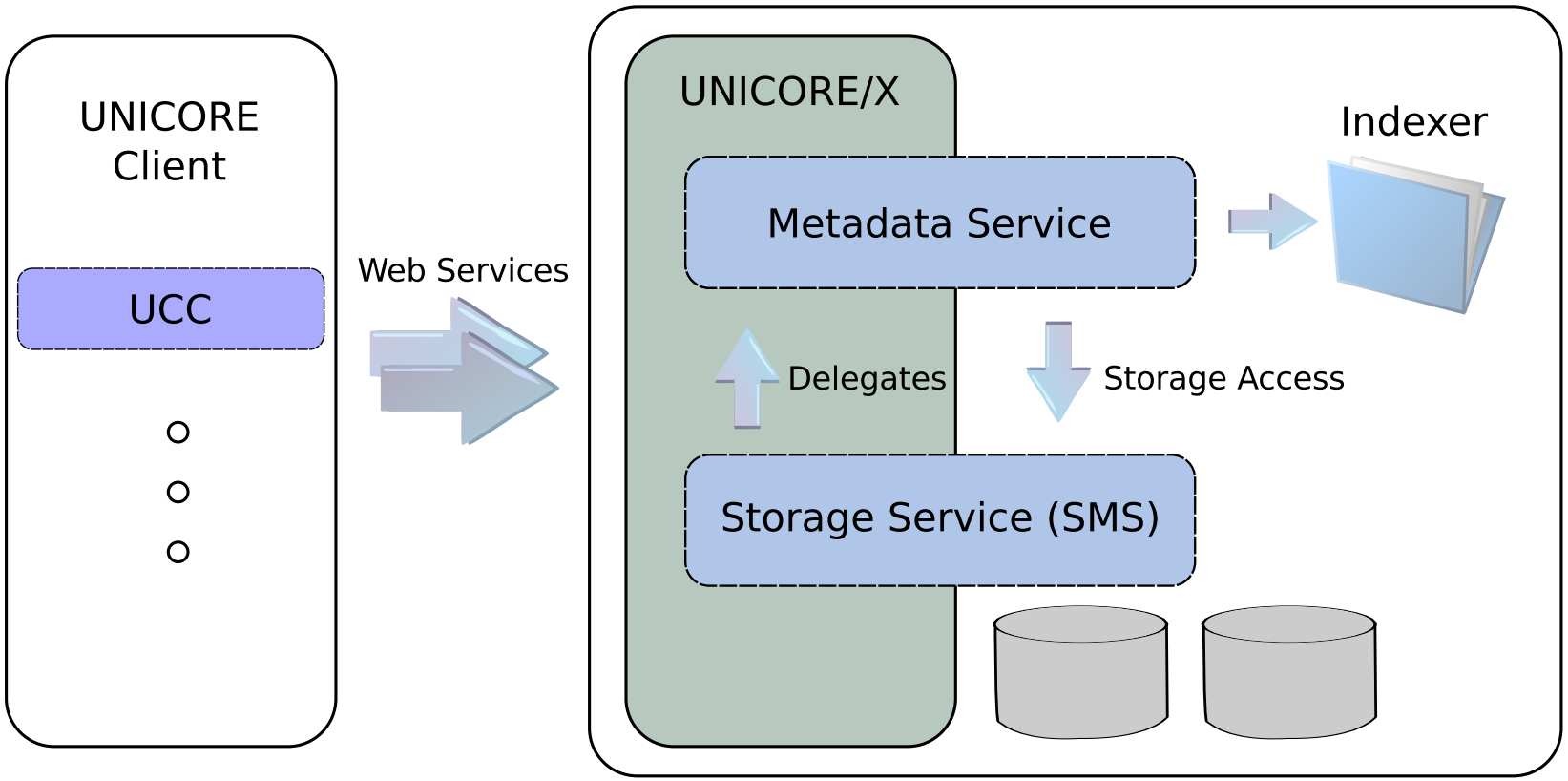
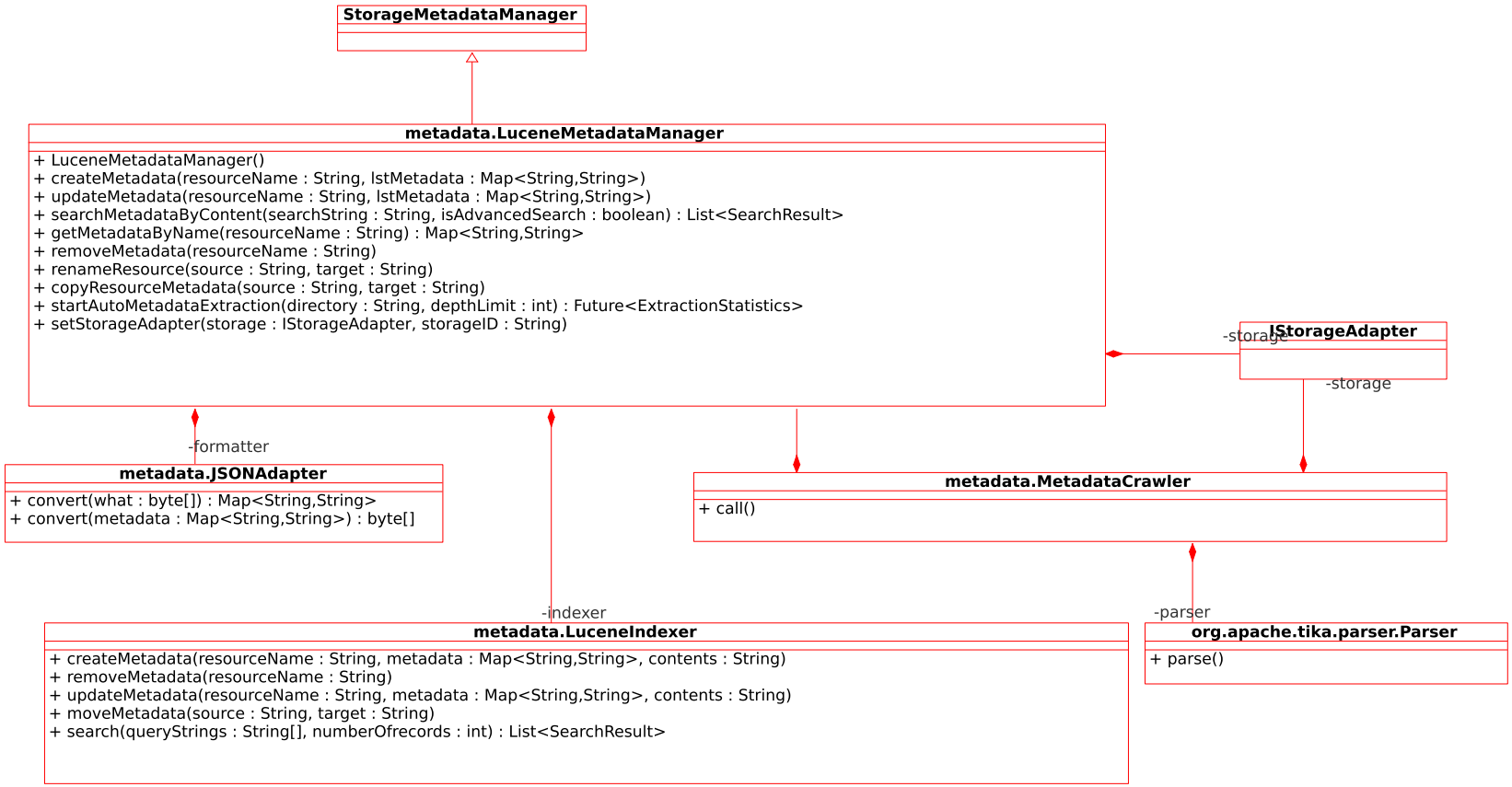
UNICORE solution: Flexible Framework for Metadata Management (**MMF**)

- integrated in the UNICORE Atomic Services
- flexible and extensible
- schemaless
- searchable
- supports automatic extraction

Architecture



Model


StorageMetadataManager
metadata.LuceneMetadataManager
+ LuceneMetadataManager()
+ createMetadata(resourceName : String, lstMetadata : Map<String,String>)
+ updateMetadata(resourceName : String, lstMetadata : Map<String,String>)
+ searchMetadataByContent(searchString : String, isAdvancedSearch : boolean) : List<SearchResult>
+ getMetadataByName(resourceName : String) : Map<String,String>
+ removeMetadata(resourceName : String)
+ renameResource(source : String, target : String)
+ copyResourceMetadata(source : String, target : String)
+ startAutoMetadataExtraction(directory : String, depthLimit : int) : Future<ExtractionStatistics>
+ setStorageAdapter(storage : IStorageAdapter, storageID : String)
IStorageAdapter
-storage
-storage
-formatter
metadata.JSONAdapter
+ convert(what : byte[]) : Map<String,String>
+ convert(metadata : Map<String,String>) : byte[]
metadata.MetadataCrawler
+ call()
-indexer
-parser
metadata.LuceneIndexer
+ createMetadata(resourceName : String, metadata : Map<String,String>, contents : String)
+ removeMetadata(resourceName : String)
+ updateMetadata(resourceName : String, metadata : Map<String,String>, contents : String)
+ moveMetadata(source : String, target : String)
+ search(queryStrings : String[], numberOfrecords : int) : List<SearchResult>
org.apache.tika.parser.Parser
+ parse()

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Demo

Functionality I

UNICORE MetadataService

- whole storage interactions via IStorage interface (integration)
- metadata are stored both in:
  1. Storage (as files with `.metadata` extension)
  2. Lucene Index
- JSON representation without schema

Apache Lucene

- high-performance, full-featured text search engine
- advanced queries: wildcard, range, compound, proximity

Functionality II

Apache Tika

- toolkit for detecting and extracting of metadata and structured text content from various documents
- supports: `html/xml`, `doc/odt`, `pdf`, `rtf`, `zip`, `midi`, `mp3`, `tiff/jpg`, `flc`, `java`, `dwg`, `ttf`
- extensible (very simple interface)

Data Management in UNICORE

- Store in **dSMS**
- Transfer with **UFTP**
- Describe and search with **MMF**

Data Management in UNICORE

- Store in **dSMS**
  - ⇒ proper handling of sensitive data
  - ⇒ keeping data close to computing resources
- Transfer with **UFTP**
  - ⇒ automatic transfer protocol negotiation
  - ⇒ deployments
- Describe and search with **MMF**
  - ⇒ convenient ways to provide own parsers
  - ⇒ URC integration


UNICORE

Thanks

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