# Design Considerations for a DECADE SDT
## draft-kutscher-decade-protocol-00

Dirk.Kutscher@neclab.eu
Martin Stiemerling@neclab.eu
Jan Seedorf@neclab.eu

IETF-82, Taipei
DECADE WG

# Background

- DECADE architecture describes DECADE protocols **conceptually**
  - Assumption: will need one or more concrete protocol specs at some point

- Standard Data Transport
  - Conceptual data transport protocol

- DECADE Resource Control Protocol
  - Resource tokens for authorization, resource control

# DECADE Architecture Elements

- Standard Data Transport: conceptual data transport protocol
  - Expected to leverage existing transport / application protocols
- DECADE Resource Control Protocol: resource tokens for authorization, resource control
  - Not an actual protocol
  - Intended to be used with an SDT instantiation
- Naming
  - Want to name resources globally uniquely
  - Same name for all replicas of a resource (on different servers)

# draft-kutscher-decade-protocol-00

- Some considerations on
  - Conceptual DECADE protocols
  - Naming – leveraging NI URI scheme
  - Authentication and access control
  - General SDT considerations
  - CDMI as an SDT instantiation
- Distilled those into a list of recommendations in the draft
- Motivation: have a basis for discussion and re-charting

# Conceptual DECADE Protocols

- SDT and DRP split

- We assume that we would need exactly one DRP scheme
  - That can then be used for different (all) SDT instantiations
  - Issue: some SDT candidates may be more amenable to token-based approach than others

- SDT: There should be one mandatory baseline implementation

# Naming

- DECADE architecture requirements:
  - Globally unique names
  - Application-independent
  - Name-content binding through hashes

- Proposing adoption of NI scheme
  - Key function: representing object hashes, with hash identifier
  - Support for different hash algorithms
  - Extensibility mechanism for application-specific URI parameters
  - Defined mapping from NI URIs to HTTP URIs

```
ni:///sha-256;B_K97zTtFuOhug27fke4_Zgc4Myz4b_lZNgsQjy6fkc
```

```
ni://example.com/sha-256;B_K97zTtFuOhug27fke4_Zgc4Myz4b_lZNgsQjy6fkc?ct=image/jpeg
```

# How to use NI Names in DECADE

- Equality testing works on algorithm identifier and actual hash value
  - All other elements (including authority) are not considered
  - **DECADE should not require an authority field**

```
ni://example.com/sha-256;B_K97zTtFuOhug27fke4_Zgc4Myz4b_lZNgsQjy6fkc
```

```
http://example.com/.well-known/ni/sha-256/B_K97zTtFuOhug27fke4_Zgc4Myz4b_lZNgsQjy6fkc
```

- Mapping to HTTP
  - NI defines one specific mapping
  - Clearly only useful for HTTP-based SDTs
  - May impose some constraints on server configurations

# Other NI Functions for DECADE

- Locator specification
  - Useful for referring client to a specific DECADE server
  - Implementable using an extension parameter

```
ni:///sha-256;B_K97zTtFuOhug27fke4_Zgc4Myz4b_lZNgsQjy6fkc
     ?decade-loc=http://example.com/decade/NAME
```

- Content type: already in NI params spec

- Authentication token

```
ni:///sha-256;B_K97zTtFuOhug27fke4_Zgc4Myz4b_lZNgsQjy6fkc
     ?decade-auth=dhek4nd2kj2j
```

# Other NI Functions for DECADE

- Locator specification
  - Useful for referring client to a specific DECADE server
  - Implementable using an extension parameter

```
ni:///sha-256;B_K97zTtFuOhug27fke4_Zgc4Myz4b_lZNgsQjy6fkc
      ?decade-loc=http://example.com/decade/NAME
```

- Content type: already in NI params spec

DECADE NI profile

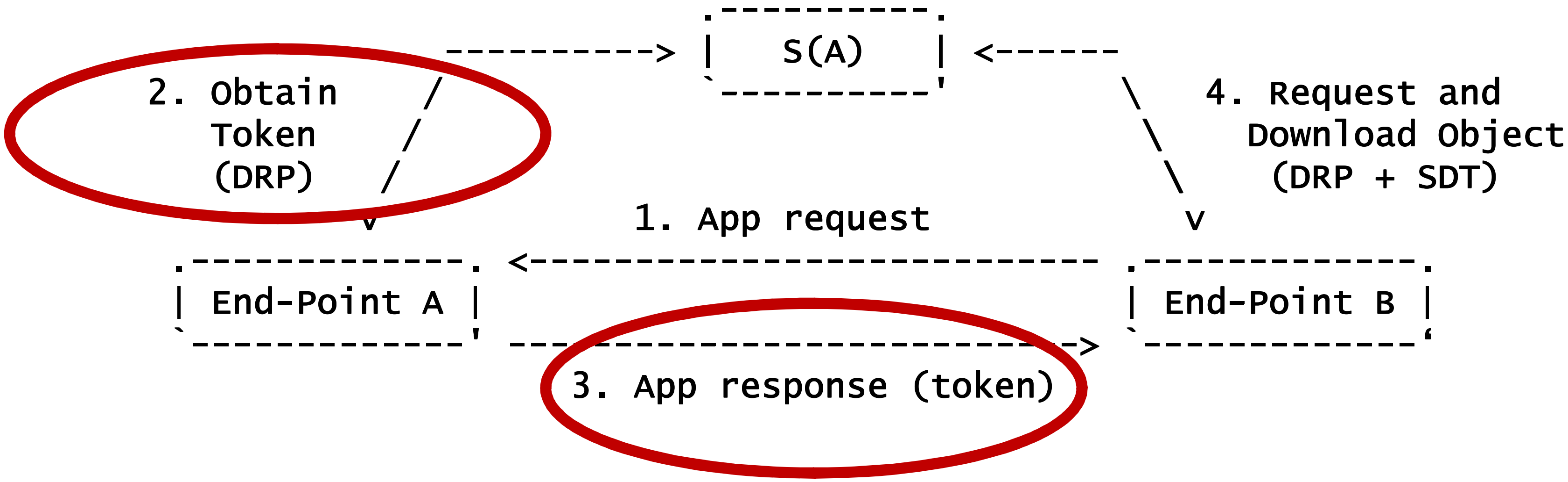
- Authentication token

```
ni:///sha-256;B_K97zTtFuOhug27fke4_Zgc4Myz4b_lZNgsQjy6fkc
      ?decade-auth=dhek4nd2kj2j
```

# Authentication and Access Control

```
                          .----------.
              ----------> |   S(A)   | <------
2. Obtain    /            `----------'        \   4. Request and
   Token    /                                  \    Download Object
   (DRP)   /                                    \    (DRP + SDT)
          v            1. App request            v
 .-------------. <---------------------------  .-------------.
 | End-Point A |                               | End-Point B |
 `-------------' ---------------------------> `-------------'
                    3. App response (token)
```

# Authentication and Access Control



```
                         .-----------.
            ----------> |    S(A)    | <------
  2. Obtain       /      `-----------'         \    4. Request and
     Token       /                              \     Download Object
     (DRP)      /                                \     (DRP + SDT)
               v             1. App request       v
 .-------------.  <---------------------------- .-------------.
 | End-Point A |                                | End-Point B |
 `-------------'  ----------------------------> `-------------'
                    3. App response (token)
```

- In general, two options for carrying authentication tokens
  - When referring a user to a DECADE server

1. In the native application protocol
2. In the object name
   - Seems preferable, since protocol-independent

# Authentication and Access Control

```
                           .----------.
              ---------->  |   S(A)   | <------
2. Obtain     /            `----------'        \   4. Request and
   Token     /                                  \    Download Object
   (DRP)    /                                    \    (DRP + SDT)
           v           1. App request             v
 .-------------. <----------------------------- .-------------.
 | End-Point A |                                | End-Point B |
 `-------------' ----------------------------->  `-------------'
                    3. App response (token)
```

- Downloading the object
  - SDT-instantiation-specific embedding of token in protocol fields
  - E.g., OAuth in HTTP

# Application Contexts, Resource Collections

- Different servers, different file transfer protocols, and different remote file system protocols may provide different capabilities for organizing resources in hierarchical structures
  - Collections, file system directories etc.

- Question: should this be exposed in a DECADE SDT?
  - For instance: collecting all chunks of a larger object into one collection

- Our view: **NO**
  - It‘s a server implementation thing – SDT does not want to know about
  - DECADE has unique naming feature
  - Can structure objects on application layer by listing them in an index file (think torrent files)

- This would imply that SDT does not need to support any operation on collections
  - **Simpler implementations – better interoperability!**

# Server-to-Server

```
.=============.         DRP          .=============.
|   DECADE    | <------------------> |   DECADE    |
|   Server    | <------------------> |   Server    |
`============='         SDT          `============='
```

- DECADE architecture has concept of server-to-server communication
  - Servers to redistribute objects to other servers
- Would need an SDT mechanism
  - Would  like to specify a set of target servers
- Caveat: HTTP-based servers do normally not support „DISTRIBUTE“ method
  - Would be nice to find a way around this
  - Would prefer not to loose interoperability with vanilla  servers

# CDMI as an SDT

- Goal: enable use of existing CDMI infrastructure in DECADE
  - Also: don‘t raise the bar too high for minimal DECADE implementations

- CDMI in a nutshell
  - RESTful HTTP-based access to cloud storage
  - JSON as a representation format for describing resources, configurations – also for object (optionally)
  - Quite comprehensive, but with a profiling concept
  - More: http://www.ietf.org/mail-archive/web/decade/current/msg00598.html (David Slik)

# CDMI Content Type Operations

- CDMI provides two alternative mechanisms for uploading/downloading objects:

1. CDMI Content Type Operations
   - Using JSON to encode objects (and meta data)
   - Might be difficult for non CDMI clients

2. Non-CDMI Content Type Operations
   - Objects in message bodies (vanilla HTTP-like)
   - More efficient and better for backwards-compatibility

# CDMI Content Type Operations

- CDMI provides two alternative mechanisms for uploading/downloading objects:

1. CDMI Content Type Operations
   - Using JSON to encode objects (and meta data)
   - Might be difficult for non CDMI clients

2. Non-CDMI Content Type Operations
   - Objects in message bodies (vanilla HTTP-like)
   - More efficient and better for backwards-compatibility

# Broad Range of CDMI Features

- discovering capabilities of a cloud storage provider;
- creating a new container;
- creating a new data object;
- listing the contents of a container;
- reading the contents of a data object;
- reading the value of a data object; and
- deleting a data object.
- queue object resource operations, providing first-in, first-out access for storing and retrieving data;
- capability query operations, allowing a client to find out about the subset of CDMI features that a server supports;
- exporting (and configuring the exporting of) data objects to other protocol domains such as NFS, iSCSI, WebDAV etc.;
- serialization and de-serialization of data;
- configure access control through ACLs;
- retention and hold management;
- scope specifications to allow clients to select data objects based on filter/search expressions;
- results specifications (to enable a client to specify subsets of data objects to be returned);
- logging;
- notification queues (for example for notifying clients about changes to a file system or to certain objects); and
- query queues (enabling clients to requests data objects based on meta data or content search expressions).

# Broad Range of CDMI Features

- discovering capabilities of a cloud storage provider;
- creating a new container;
- cr
- lis
- re ob
- re ar
- de
- queue object resource operations, providing first-in, first-out access for storing and retrieving data;
- capability query operations, allowing a client to find out about the subset of CDMI features that a server supports;

- exporting (and configuring the exporting of) data objects to other protocol domains such as NFS, iSCSI, WebDAV etc.;
- f data;
- CLs;
- s to search
- lient to be returned);
- logging;
- notification queues (for example for notifying clients about changes to a file system or to certain objects); and
- query queues (enabling clients to requests data objects based on meta data or content search expressions).

- SDT only needs a small subset
- CDMI has modularity concept
- DECADE should define a minimal profile

# CDMI Containers

- Quite a fundamental concept in CDMI
  - Comprehensive support for operations on containers
  - Required feature for cloud data management
  - Not so for DECADE

- Naming scheme (see earlier discussion) and DECADE SDT should be oblivious to structure, hierarchy etc.
  - Can be done on the application layer
  - CDMI-SDT would use CDMI (largely) without using containers

# CDMI Object Identifiers (1)

- Fundamentally compatible to DECADE naming ideas so far (globally unique, potentially leveraging content hashes)
- Specific format not directly compatible to NI format
  - There may be ways to map names

```
http://decade.example.com/root/cdmi_objectid/647284746393
```

```
|   0    | 1 | 2 | 3|   4    |  5   |6|7| 8| 9|10|..|38|39|
|Reserved|Enterprise|Reserved|Length|CRC| opaque data     |
| (zero) |  Number  | (zero) |      |   |                 |
-----------------------------------------------------------
```

# CDMI Object Identifiers (2)

- Creating object identifiers in CDMI
  - – Done by the server
  - – In DECADE, it would be better (more efficient, better workflow) if the client did it
  - – Have to find out about the options

# Security

- Need to work on access control, token-based authentication
- DoS attack vectors: server-to-server communication can be a risk
- Name-content integrity: need to specify the details (hash algorithms, requirements for servers and clients)
  - DECADE NI profile could perhaps do that

# Conclusions

- NI URIs in DECADE
  - Want to specify the DECADE NI profile
  - With extensions for locators
- General SDT guideline: KISS
  - Keep application layer features to application (re: collections)
  - Try not to break interoperability with existing gear
- CDMI
  - Goal: do not exclude leveraging CDMI by design – ideally requiring only minimal changes
  - SDT with CDMI can probably be done – have to do it carefully
  - Quesition is whether this should be the baseline SDT spec
  - Proposed way forward: enable SDT implementation leveraging CDMI implementations