DuraCloud

Introduction

DuraCloud is a hosted service and open technology developed by DuraSpace that makes it easy for organizations and end users to use cloud services. DuraCloud leverages existing cloud infrastructure to enable durability and access to digital content.

DuraCloud is particularly focused on providing preservation support services and access services for academic libraries, academic research centers, and other cultural heritage organizations.

The service builds on the pure storage from expert storage providers by overlaying the access functionality and preservation support tools that are essential to ensuring long-term access and durability. DuraCloud offers cloud storage across multiple commercial and non commercial providers, and offers compute services that are key to unlocking the value of digital content stored in the cloud. DuraCloud provides services that enable digital preservation, data access, transformation, and data sharing. Customers are offered "elastic capacity" coupled with a "pay as you go" approach. DuraCloud is appropriate for individuals, single institutions, or for multiple organizations that want to use cross-institutional infrastructure.

DuraCloud has been in a pilot phase since the beginning of Fall 2009 and will be released as a service of the DuraSpace not-for-profit organization in early 2011.

To see press releases, presentations, logos, and more, see the DuraCloud resources page

Source Code

- The DuraCloud 0.4.1 release (latest release)
    - Source can be download from Subversion: https://svn.duraspace.org/duracloud/tags/duracloud-0.4.1
    - Source can be viewed here: https://svn.duraspace.org/view/duracloud/tags/duracloud-0.4.1
    - JavaDocs for can be viewed here: http://duracloud.org/0.4.1/docs/javadoc
- The DuraCloud trunk (ongoing development)
    - Can be download from Subversion: https://svn.duraspace.org/duracloud/trunk/
    - Can be viewed here: https://svn.duraspace.org/view/duracloud/trunk/
- The DuraCloud software license can be seen here: http://duracloud.org/license
- We welcome code contributions, though we do request that all contributors submit a Contributor License Agreement

User Documentation

The most current DuraCloud release is 0.4.1. The following documentation pertains to release 0.4.1:

- Release Notes 0.4.1
- DuraCloud REST API
- DuraCloud Sync Tool
- DuraCloud Chunker Tool
- Logging Configuration
- Building DuraCloud from Source

Documentation and release notes for each of the previous releases of DuraCloud.

- Release 0.3
- Release 0.2
- Release 0.1

Design Documentation

- DuraCloud Architecture
- DuraCloud Security
- Services

Accessing DuraCloud

1. If you are part of the DuraCloud pilot program, you will be notified when your DuraCloud instance has been provisioned and is ready to use.
    - Your instance will be available at a URL similar to the following:

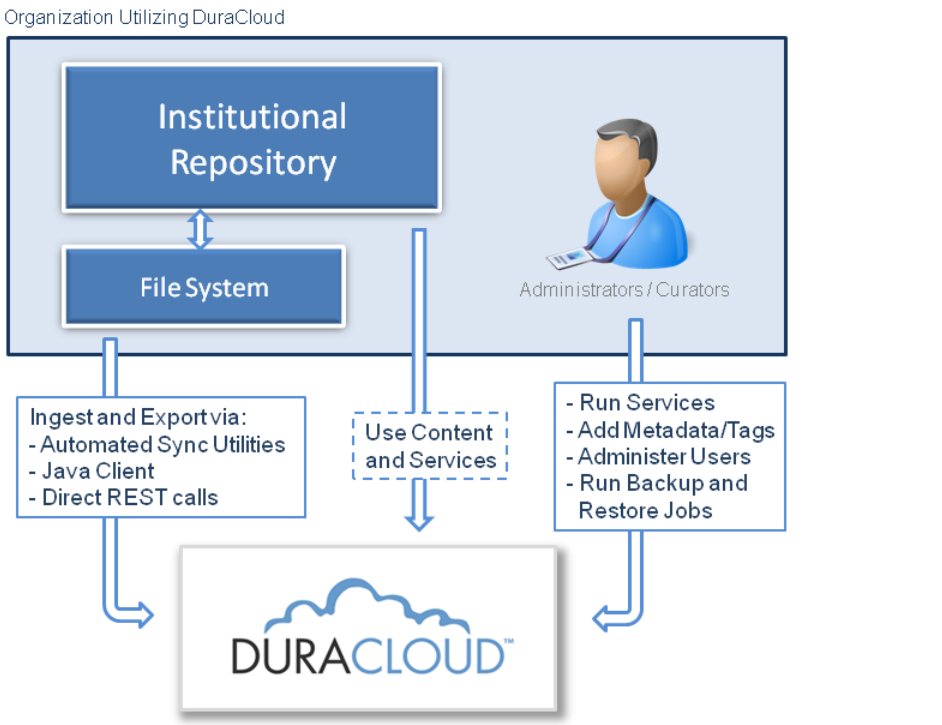
        - https://[your-institution].duracloud.org/duradmin
        - https://[your-institution].duracloud.org/durastore
2. If you are not part of the DuraCloud pilot program, you will can either
    a. Wait until DuraCloud is made publicly available, which is planned for early 2011
    b. Download a copy of the source code and deploy your own DuraCloud instance

Support

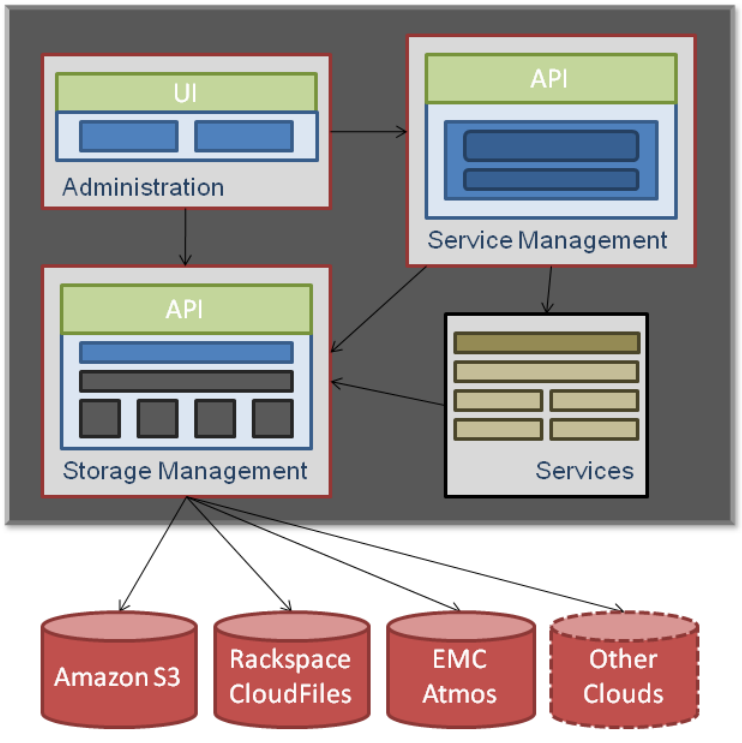
- Bugs and feature requests
    - Please head over to our JIRA issue tracker and let us know about issues that you encounter.
- Discussion
    - Head over to the DuraCloud forum to discuss DuraCloud ideas and technology

DuraCloud Architecture

DuraCloud In Context

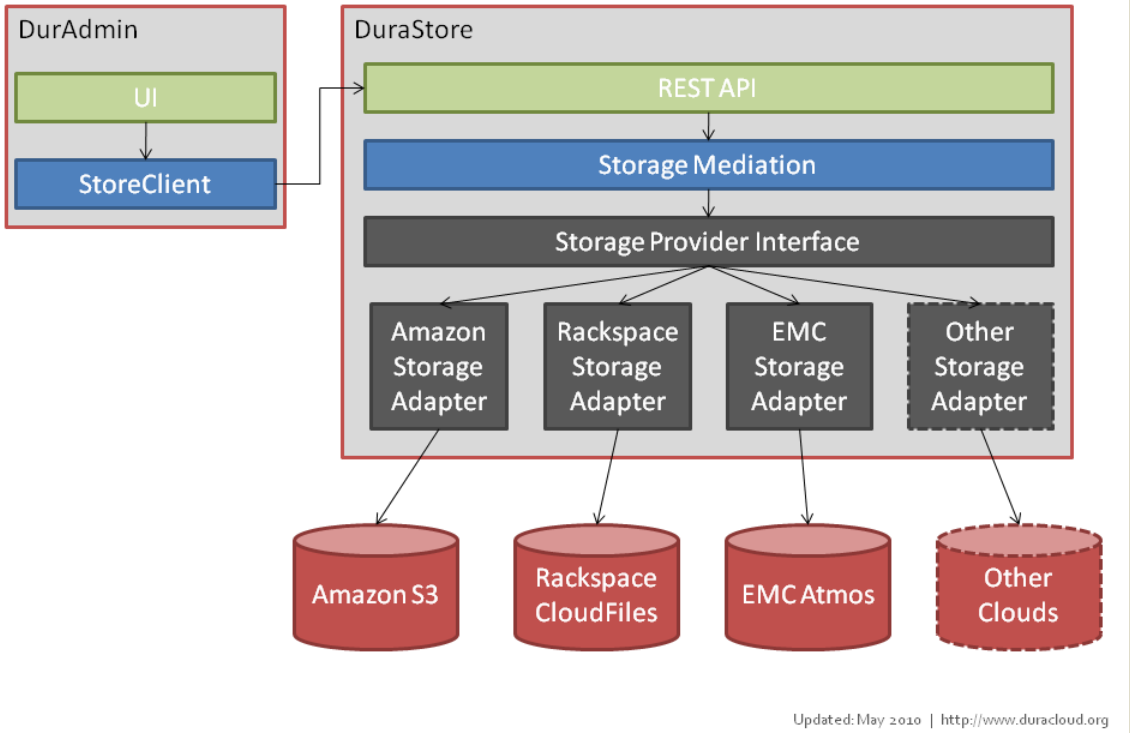


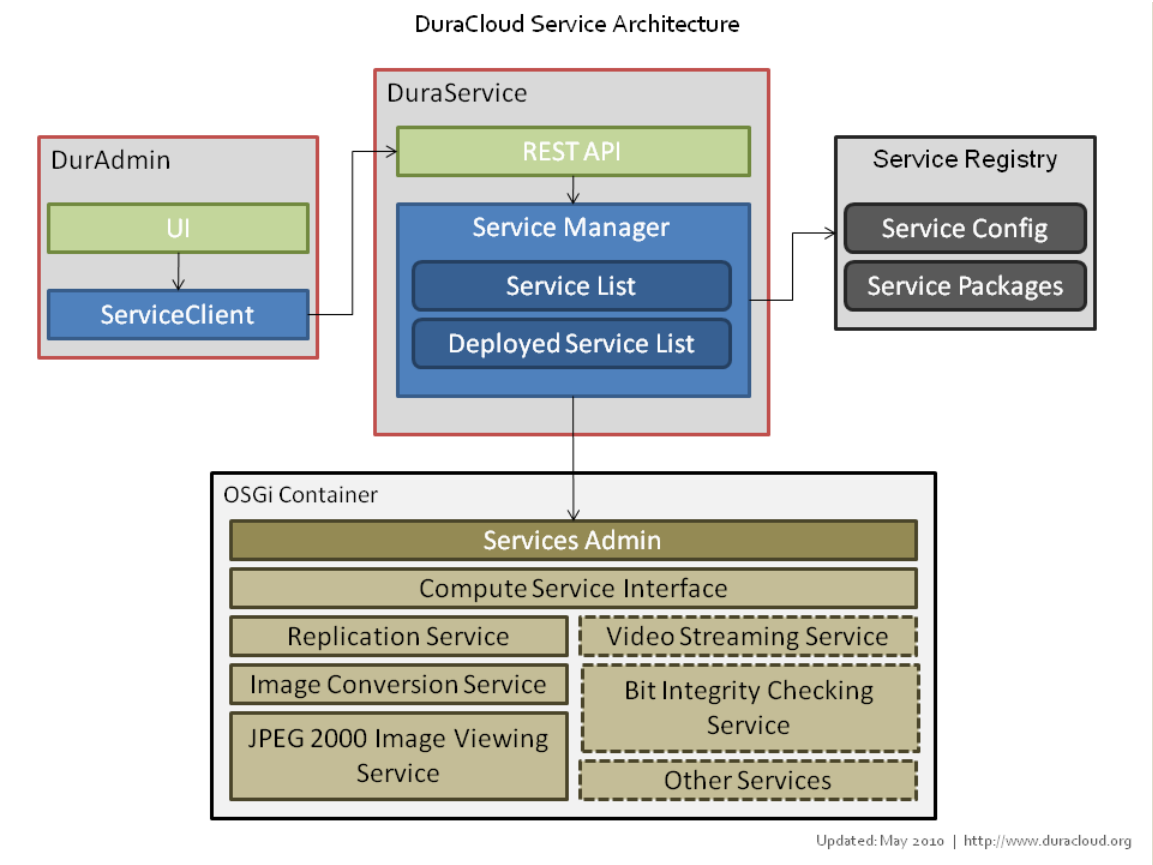
DuraCloud High Level Interaction



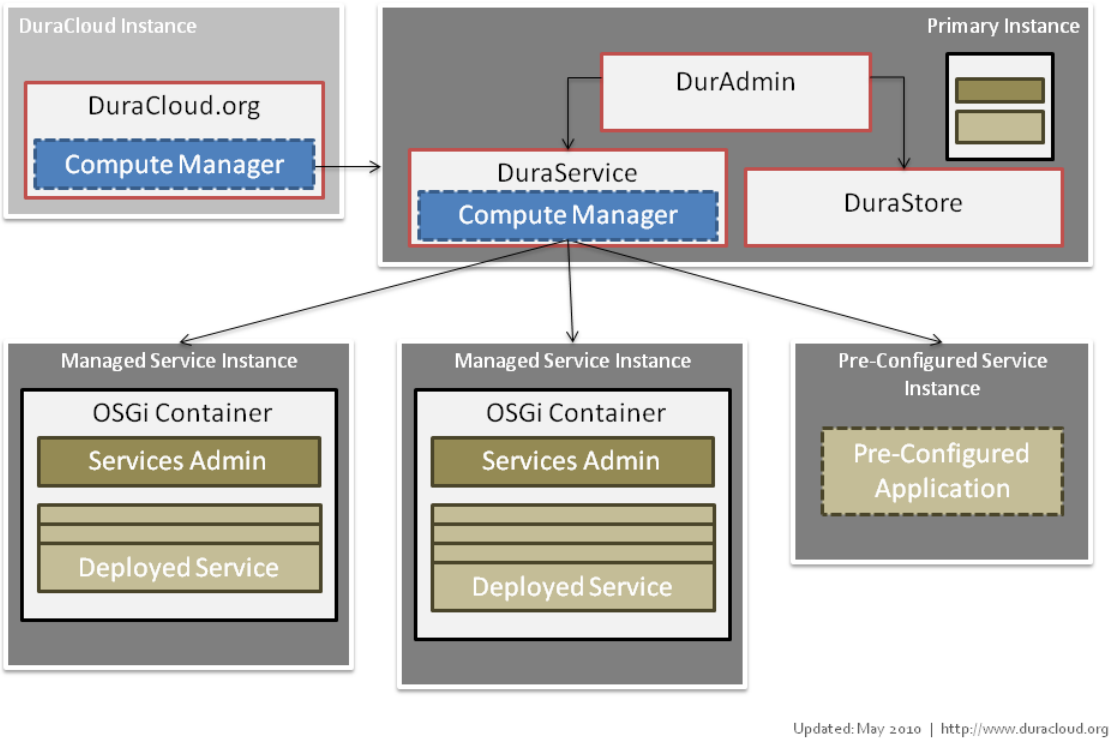
Updated: May 2010 | http://www.duracloud.org

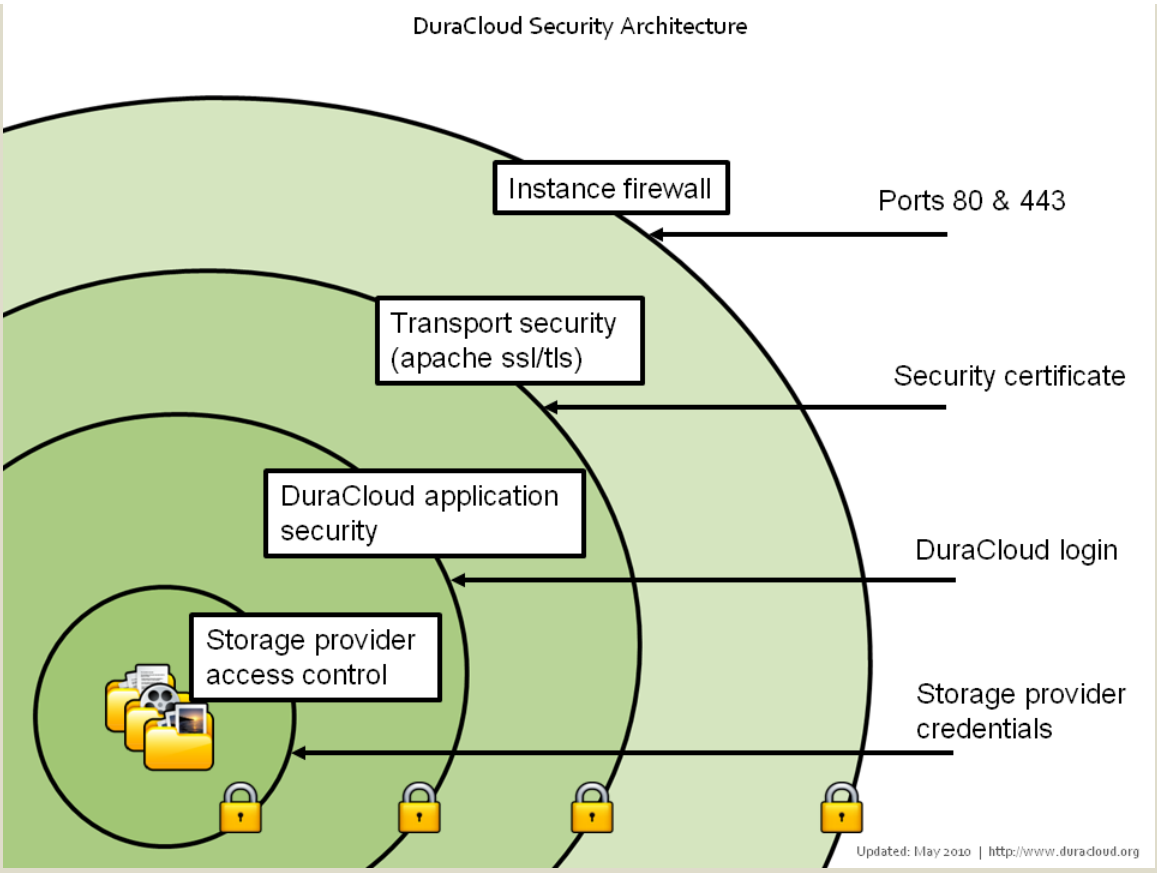
DuraCloud Storage Architecture




DuraCloud Service Architecture
DuraService
REST API
Service Manager
Service List
Deployed Service List
DurAdmin
UI
ServiceClient
Service Registry
Service Config
Service Packages
OSGi Container
Services Admin
Compute Service Interface
Replication Service
Video Streaming Service
Image Conversion Service
Bit Integrity Checking Service
JPEG 2000 Image Viewing Service
Other Services
Updated: May 2010 | http://www.duracloud.org

DuraCloud Server Architecture (Planned)




DuraCloud Security Architecture
Instance firewall
Ports 80 & 443
Transport security (apache ssl/tls)
Security certificate
DuraCloud application security
DuraCloud login
Storage provider access control
Storage provider credentials
Updated: May 2010 | http://www.duracloud.org

DuraCloud Chunker Tool

Introduction

The Chunker Tool is a utility which was created in order to provide a simple way to copy files from a local file system to DuraCloud in a "one-off" manner. Actually, although the common case is to use this tool to copy one or more files to DuraCloud, it may also be run to copy files to another location on the local file system.

Operational notes

- If you want to jump directly into using the tool, download it from the link below and run the following command

  ```
  java -jar chunk-{version}-driver.jar
  ```

  The resulting usage statement (detailed below) should be enough to help you get started.

- The Chunker Tool allows you to copy multiple local files and directories into a single space within DuraCloud. The names of the objects which are added to DuraCloud will contain all of the directory elements in the path starting from the first element below the base directory down to the individual file names.

Using the Chunker Tool

- To run the Chunker Tool, open a terminal or command prompt and navigate to the directory where the Chunker Tool is located and run the above command.
- The following options are available when running the Chunker Tool

Short Option	Long Option	Arguments	Description
-a	--add	<f t s>	add content from directory:<f> to space or directory:<t> of maximum chunk size:<s>, where the chunk size must have a unit suffix of K,M, or G — If the -c option is provided, the destination space <t> will be interpreted as the name of a space in the DuraCloud account found at the host:port provided in the -c option, otherwise the destination space will be interpreted as a directory on the local file system.
-c	--cloud-store	<host:port>	use cloud store found at <host>:<port> as content destination
-d	--dir-filter	<l>	limit processed directories to those listed in file-list:<l> — If the -d option is not used, all directories under the base source directory provided in the -a option will be included. The file specified by this option is expected to contain a list of directory names each on there own line. The list is converted to an OrFileFilter from Apache Commons IO
-f	--file-filter	<l>	limit processed files to those listed in file-list:<l> – The file specified by this option is expected to contain a list of file names each on there own line. The list is converted to an OrFileFilter from Apache Commons IO
-g	--generate	<outFile numBytes>	generate test data to <outFile> of <size> bytes — This option does not copy any files, it only generates test data files of the size specified in the give argument.
-i	--ignore-large-files	no args	if this option is set, files over the chunk size specified in the 'add' option will be ignored.
-p	--password	<password>	password of duracloud instance
-u	--username	<username>	username of duracloud instance

-x	--exclude-chunk-md5s	no args	if this option is set, chunk MD5s will NOT be preserved in the manifest — It is expected that this option is rarely used, but in certain situations where the MD5s of the segments of a file that needed to be chunked because the parent file was larger than the limit set in the -a option, not generating these MD5s improves performance.

DuraCloud REST API

DuraCloud REST API methods:

- DuraStore
  - Initialize Stores
  - Initialize Security Users
  - Get Stores
  - Get Spaces
  - Get Space
  - Get Space Metadata
  - Create Space
  - Set Space Metadata
  - Delete Space
  - Get Content
  - Get Content Metadata
  - Store Content
  - Set Content Metadata
  - Delete Content
  - Get Tasks
  - Perform Task
    - Tasks
- DuraService
  - Initialize Services
  - Initialize Security Users
  - Get Services
  - Get Service
  - Get Deployed Service
  - Get Deployed Service Properties
  - Deploy Service
  - Update Service Configuration
  - UnDeploy Service
- DurAdmin
  - Initialize Application
  - Initialize Security Users

As of release 0.3, each of the methods below has specific security requirements. See DuraCloud Security for more information

DuraStore

Purpose: DuraStore is the application through which DuraCloud manages storage. The DuraStore REST API provides access to storage by mediating the underlying storage provider APIs to allow access to multiple cloud storage options through a single API.

Store REST Methods
Initialize Stores

- Purpose: Allows the initialization of storage provider accounts
- Request: POST http://host:port/durastore/stores
- Request Body: XML similar to:

```
<storageProviderAccounts>
  <storageAcct ownerId='0' isPrimary='true'>
    <id>1</id>
    <storageProviderType>AMAZON_S3</storageProviderType>
    <storageProviderCredential>
      <username>username</username>
      <password>password</password>
    </storageProviderCredential>
  </storageAcct>
</storageProviderAccounts>
```

- Response Code: 200 (on success)
- Response Body: "Initialization Successful" (on success)

Initialize Security Users

- Purpose: Allows the initialization of authorized users
- Request: POST http://host:port/durastore/security
- Request Body: XML similar to:

```
<?xml version="1.0" encoding="UTF-8"?>
<dur:security-users schemaVersion="0.2" xmlns:dur="duracloud.org">
  <security-user>
    <username>username-0</username>
    <password>password-0</password>
    <enabled>true</enabled>
    <accountNonExpired>true</accountNonExpired>
    <credentialsNonExpired>true</credentialsNonExpired>
    <accountNonLocked>true</accountNonLocked>
    <grantedAuthorities>ROLE_USER</grantedAuthorities>
  </security-user>
  <security-user>
    <username>username-1</username>
    <password>password-1</password>
    <enabled>false</enabled>
    <accountNonExpired>false</accountNonExpired>
    <credentialsNonExpired>false</credentialsNonExpired>
    <accountNonLocked>false</accountNonLocked>
    <grantedAuthorities>ROLE_USER ROLE_ADMIN</grantedAuthorities>
  </security-user>
</dur:security-users>
```

- Response Code: 200 (on success)
- Response Body: "Initialization Successful" (on success)

Get Stores

- Purpose: Provides a listing of available storage providers accounts (without credentials)
- Request: GET http://host:port/durastore/stores
- Parameters: None
- Response Code: 200 (on success)
- Response Body: XML similar to:

```
<storageProviderAccounts>
  <storageAcct isPrimary='true'>
    <id>1</id>
    <storageProviderType>AMAZON_S3</storageProviderType>
  </storageAcct>
  <storageAcct isPrimary="false">
    <id>2</id>
    <storageProviderType>RACKSPACE</storageProviderType>
  </storageAcct>
</storageProviderAccounts>
```

Space REST Methods

Get Spaces

- Purpose: Provides a listing of all of the spaces that a customer has created
- Request: GET http://host:port/durastore/spaces ? (storeID)
- Response Code: 200 (on success)
- Response Body: XML similar to:

```
<spaces>
  <space id="space1" />
  <space id="space2" />
</spaces>
```

Get Space

- Purpose: Provides a listing of the contents of a space along with space metadata
- Request: GET http://host:port/durastore/spaceID ? (storeID) (prefix) (maxResults) (marker)
  - storeID (optional) - ID of the content storage provider to query (default is primary store)
  - prefix (optional) - Only retrieve content ids with this prefix (default is all content ids)
  - maxResults (optional) - The maximum number of content IDs to return in the list (default is 1000)
  - marker (optional) - The content ID marking the last item in the previous set (default is the first set of ids)
- Response Code: 200 (on success)
- Response Body: XML similar to:

```
<space id="space1">
  <item>Image 1</item>
  <item>Image 2</item>
</space>
```

- Response Headers: All available space metadata, example:

```
  x-dura-meta-space-count=65
  x-dura-meta-space-access=OPEN
  x-dura-meta-space-created=Mon, 01 Jan 2000 08:00:00 EST
  x-dura-meta-custom-metadata=Custom Metadata Value
```

Get Space Metadata

- Purpose: Provides all space metadata
- Request: HEAD http://host:port/durastore/spaceID ? (storeID)
- Response Code: 200 (on success)
- Response Headers: Same as for Get space (above)

Create Space

- Purpose: Creates a new space
- Request: PUT http://host:port/durastore/spaceID ? (storeID)
- Request Headers: Metadata about the space, example:

```
x-dura-meta-space-access=OPEN
x-dura-meta-custom-metadata=Custom Metadata Value
```

- Response Code: 201 (on success)
- Response Headers: Location of the new space (i.e. the URL used to create the space), example:

```
Location=http://myhost:8080/durastore/space1
```

Set Space Metadata

- Purpose: Updates the metadata associated with a space
- Request: POST http://host:port/durastore/spaceID ? (storeID)
- Request Headers: Same as Create space (above)
- Response Code: 200 (on success)
- Response Body: "Space $spaceID updated successfully" (on success)

Delete Space

- Purpose: Deletes a space
- Request: DELETE http://host:port/durastore/spaceID ? (storeID)
- Response Code: 200 (on success)
- Response Body: "Space $spaceID deleted successfully" (on success)

Content REST Methods

Get Content

- Purpose: Retrieves a piece of content along with its metadata
- Request: GET http://host:port/durastore/spaceID/contentID ? (storeID) (attachment)
    - if attachment param value is true, a Content-Disposition header is included with the response
- Response Code: 200 (on success)
- Response Body: The content stream
- Response Headers: All available content metadata, example:

```
Content-Type=text/plain
Content-Length=5732
Content-MD5=345670923478509747383920 2
ETag=345670923478509747383920 2
x-dura-meta-content-name=Testing Content
x-dura-meta-content-owner=JSmith
```

Get Content Metadata

- Purpose: Retrieves the metadata of a piece of content without the content itself
- Request: HEAD http://host:port/durastore/spaceID/contentID ? (storeID)
- Response Code: 200 (on success)
- Response Headers: Same as Get content (above)

Store Content

- Purpose: Adds a piece of content to the store
- Request: PUT http://host:port/durastore/spaceID/contentID ? (storeID)
- Request Body: Content to be added
- Request Headers: Metadata about the content, example:

```
Content-Type=text/plain
Content-MD5=4cd56e137a93a1accb43c5d32f4afffb
x-dura-meta-content-name=Testing Content
x-dura-meta-content-owner=JSmith
```

    - Note that when the optional Content-MD5 header is included, the final checksum of the stored file is compared against the MD5 value included in the header to ensure that the file was stored correctly. If the header is not included, an MD5 checksum is computed as the file is transferred to storage, and that value is used in the final comparison.
- Response Code: 201 (on success)
- Response Headers: Location of the new content (i.e. the URL used to create the content), example:

```
Location=http://myhost:8080/durastore/space1/content1
```

Set Content Metadata

- Purpose: Updates the metadata associated with a piece of content
- Request: POST http://host:port/durastore/spaceID/contentID ? (storeID)
- Request Headers: Same as Store content (above)
- Response Code: 200 (on success)
- Response Body: "Content $contentID updated successfully"

Delete Content

- Purpose: Removes a piece of content from the store
- Request: DELETE http://host:port/durastore/spaceID/contentID ? (storeID)
- Response Code: 200 (on success)
- Response Body: "Content $contentID deleted successfully"

Task REST Methods

Tasks are used to perform storage provider actions which cannot be performed in a generic manner across multiple providers.

Get Tasks

- Purpose: Provides a listing of all of the supported tasks for a given provider. Note that if no storeID parameter is included, the task listing is provided for the primary storage provider.
- Request: GET http://host:port/durastore/task ? (storeID)
- Response Code: 200 (on success)
- Response Body: XML similar to:

```
<list>
  <string>task1</string>
  <string>task2</string>
</list>
```

Perform Task

- Purpose: Performs a particular task. Note that most tasks can be performed by only one storage provider type.
- Request: POST http://host:port/durastore/task/taskName ? (storeID)
- Request Body: Parameters for task. Each task will expect parameters in a specific format, see task listing for more details.
- Response Code: 200 (on success)
- Response Body: Response value for task, format varies by task.

Tasks

taskName	Storage Provider	Name	Description	Request Body	Response Body
enable-streaming	Amazon S3	Enable Streaming task	Enables RTMP streaming for all files within a DuraCloud space through the use of Amazon's Cloudfront streaming capability. This task may take up to 15 minutes to complete.	Name of the space for which streaming is to be enabled	Text indicating the results of the task, including the streaming host
disable-streaming	Amazon S3	Disable Streaming task	Disables streaming by removing the ability for Cloudfront to access files within a space. This does not remove the streaming distribution, only disables its use, so enabling streaming on the same space again can be performed much more quickly. Some content in the space may continue to be available for streaming up to 24 hours after streaming has been disabled.	Name of the space for which streaming is to be disabled	Text indicating the results of the task
delete-streaming	Amazon S3	Delete Streaming task	Removes a streaming distribution created by the enable-streaming task. This task should be performed after performing the disable-streaming task. This task may take up to 15 minutes to complete, after which no content in the space will be available for streaming.	Name of the space for which streaming is to be deleted	Text indicating the results of the task
noop	Amazon S3	Test task	Provides a simple way to test the calling of tasks	Body content is ignored	Text indicating successful task completion

DuraService

Purpose: DuraService is the application through which DuraCloud manages services. The DuraService REST API provides the means by which services available in the DuraCloud service repository are deployed, configured, and undeployed.

Service REST Methods

Initialize Services

- Purpose: Initializes the DuraService application
- Request: POST http://host:port/duraservice/services
- Request Body: XML similar to:

```
<servicesConfig>
  <primaryServiceInstance>
     <host>[PRIMARY-SERVICE-INSTANCE-HOST]</host>
     <servicesAdminPort>[PRIMARY-SERVICES-ADMIN-PORT]</servicesAdminPort>
     <servicesAdminContext>[PRIMARY-SERVICES-ADMIN-CONTEXT]</servicesAdminContext>
  </primaryServiceInstance>
  <userStorage>
    <host>[USER-STORAGE-HOST-NAME]</host>
    <port>[USER-STORAGE-PORT]</port>
    <context>[USER-STORAGE-CONTEXT]</context>
    <msgBrokerUrl>[USER-STORAGE-MSG-BROKER-URL]</msgBrokerUrl>
  </userStorage>
  <serviceStorage>
    <host>[SERVICES-STORAGE-HOST-NAME]</host>
    <port>[SERVICES-STORAGE-PORT]</port>
    <context>[SERVICES-STORAGE-CONTEXT]</context>
    <spaceId>[SERVICES-STORAGE-SPACE-ID]</spaceId>
  </serviceStorage>
  <serviceCompute>
    <type>AMAZON_EC2</type>
    <imageId>[MACHINE-IMAGE-ID]</imageId>
    <computeProviderCredential>
      <username>[USERNAME]</username>
      <password>[PASSWORD]</password>
    </computeProviderCredential>
  </serviceCompute>
</servicesConfig>
```

- Response Code: 200 (on success)
- Response Body: "Initialization Successful" (on success)

Initialize Security Users

- Purpose: Allows the initialization of authorized users
- Request: POST http://host:port/duraservice/security
- Request Body: XML similar to:

```
<?xml version="1.0" encoding="UTF-8"?>
<dur:security-users schemaVersion="0.2" xmlns:dur="duracloud.org">
  <security-user>
    <username>username-0</username>
    <password>password-0</password>
    <enabled>true</enabled>
    <accountNonExpired>true</accountNonExpired>
    <credentialsNonExpired>true</credentialsNonExpired>
    <accountNonLocked>true</accountNonLocked>
    <grantedAuthorities>ROLE_USER</grantedAuthorities>
  </security-user>
  <security-user>
    <username>username-1</username>
    <password>password-1</password>
    <enabled>false</enabled>
    <accountNonExpired>false</accountNonExpired>
    <credentialsNonExpired>false</credentialsNonExpired>
    <accountNonLocked>false</accountNonLocked>
    <grantedAuthorities>ROLE_USER ROLE_ADMIN</grantedAuthorities>
  </security-user>
</dur:security-users>
```

- Response Code: 200 (on success)
- Response Body: "Initialization Successful" (on success)

Get Services

- Purpose: Retrieves a listing of services, along with their configuration options
- Request: GET http://host:port/duraservice/services ? (show)
    - Parameter options for show (optional)
        1. available (default) - Includes only services which have not been deployed but are available for deployment
        2. deployed - Includes only services which have been deployed and started
- Response Code: 200 (on success)
- Response Body: XML list of services (see service config xsd)

Get Service

- Purpose: Retrieves information about a particular service including description, configuration options, and all deployments
- Request: GET http://host:port/duraservice/serviceID
- Response Code: 200 (on success)
- Response Body: XML service (see service config xsd)

Get Deployed Service

- Purpose: Retrieves information about a deployed service including description, configuration options, and a single deployment indicating the configuration options in use
- Request: GET http://host:port/duraservice/serviceID/deploymentID
- Response Code: 200 (on success)
- Response Body: XML service (see service config xsd)

Get Deployed Service Properties

- Purpose: Retrieves the runtime properties of a deployed service
- Request: GET http://host:port/duraservice/serviceID/deploymentID/properties
- Response Code: 200 (on success)
- Response Body: XML service (simple xml Map serialization)

Deploy Service

- Purpose: Deploys and starts an available service
- Request: PUT http://host:port/duraservice/serviceID ? (serviceHost)
    - Parameter value for serviceHost (optional) should indicate the services host on which the service should be deployed. Default is the primary customer host.
- Request Body: XML user configuration indicating the config selections for the service (see user config portion of service config xsd)
- Response Code: 201 (on success)
- Response Header: Location header indicates the URL at which information about the deployed service can be retrieved (the URL for a get deployed service call) which includes the deploymentID

Update Service Configuration

- Purpose: Updates the configuration of a deployed service
- Request: POST http://host:port/duraservice/serviceID/deploymentID
- Request Body: Updated XML user configuration indicating the config selections for the service (see user config portion of service config xsd)
- Response Code: 200 (on success)

UnDeploy Service

- Purpose: Stops and Undeploys a deployed service
- Request: DELETE http://host:port/duraservice/serviceID/deploymentID
- Response Code: 200 (on success)

DurAdmin

Purpose: DurAdmin is the user-facing application through which DuraCloud exposes DuraStore and DuraService functionality. The DurAdmin REST API provides the means by which DurAdmin is initialized.

Service REST Methods

Initialize Application

- Purpose: Allows the initialization of duradmin
- Request: POST http://host:port/duradmin/init
- Request Body: XML similar to:

```
<duradminConfig>
  <durastoreHost>[host]</durastoreHost>
  <durastorePort>8080</durastorePort>
  <durastoreContext>durastore</durastoreContext>
  <duraserviceHost>[host]</duraserviceHost>
  <duraservicePort>8080</duraservicePort>
  <duraserviceContext>duraservice</duraserviceContext>
</duradminConfig>
```

- Response Code: 200 (on success)
- Response Body: "Initialization Successful" (on success)

Initialize Security Users

- Purpose: Allows the initialization of authorized users
- Request: POST http://host:port/duradmin/security
- Request Body: XML similar to:

```
<?xml version="1.0" encoding="UTF-8"?>
<dur:security-users schemaVersion="0.2" xmlns:dur="duracloud.org">
  <security-user>
    <username>username-0</username>
    <password>password-0</password>
    <enabled>true</enabled>
    <accountNonExpired>true</accountNonExpired>
    <credentialsNonExpired>true</credentialsNonExpired>
    <accountNonLocked>true</accountNonLocked>
    <grantedAuthorities>ROLE_USER</grantedAuthorities>
  </security-user>
  <security-user>
    <username>username-1</username>
    <password>password-1</password>
    <enabled>false</enabled>
    <accountNonExpired>false</accountNonExpired>
    <credentialsNonExpired>false</credentialsNonExpired>
    <accountNonLocked>false</accountNonLocked>
    <grantedAuthorities>ROLE_USER ROLE_ADMIN</grantedAuthorities>
  </security-user>
</dur:security-users>
```

- Response Code: 200 (on success)
- Response Body: "Initialization Successful" (on success)

DuraCloud Security

Overview

The security approach is divided into two distinct spheres of responsibility

1. Channel security (encryption)
2. Application security (AuthN / AuthZ)

The configuration of any given user compute instance will consist of an Apache HttpServer layered on top of Tomcat.

1. Apache HttpServer
    - All requests will come through Apache on port 443 (https) of the instance
    - The requests will internally be unencrypted, where encryption exists, and redirected to tomcat as open text
2. Tomcat
    - A defined set of resource endpoints will require AuthN and AuthZ
    - Spring-security is being leveraged to wire AuthN and AuthZ across relevant resources

Channel Security Implementation

1. Apache HttpServer is configured to require all requests to the three DuraCloud web applications (/duradmin, /durastore, and /duraservice) go over https.
2. Below are the https enforcement rules configured in Apache

```
###
# ensure 'duradmin' uses https
###

RewriteCond %{REQUEST_URI} /duradmin
RewriteCond %{SERVER_PORT} !^443$
RewriteRule ^(.*)$ https://%{SERVER_NAME}$1 [R=301,L]

###
# require https for 'durastore' & 'duraservice' for external requests
###

RewriteCond %{REQUEST_URI} ^(/durastore|/duraservice)
RewriteCond %{SERVER_PORT} !^443$
RewriteCond %{SERVER_NAME} !^localhost$
RewriteCond %{SERVER_NAME} !^127.0.0.1$
RewriteCond %{REMOTE_HOST} !^127.0.0.1$
RewriteCond ${local-ip-map:%{REMOTE_HOST}} !^localhost$
RewriteRule ^(.*)$ https://%{SERVER_NAME}$1 [R=301,L]
```

Security Certificates

1. When accessing /duradmin for the first time, the user will need to accept the self-signed DuraCloud security certificate.
2. When accessing DuraCloud via client-side java applications, such as the synctool, it is necessary to have the security cert available in your local truststore.
    a. Get the cert
        - Run the following application (binary | source)

```
java -jar install-cert.jar <host>
```

        - Note: where 'host' is something like 'nypl.duracloud.org'
        - Enter '1' to save the cert locally as '*jssecacerts*'
    b. Add cert to truststore
        - Depending on your local system, one (or both) of the below should allow the application to use the downloaded cert
            - Option A: Specify the cert location as a jvm variable

```
java -Djavax.net.ssl.trustStore=<location to jssecacerts> <your-application>
```

            - Option B: Add the cert (*jssecacerts*) to the truststore

```
cp jssecacerts <JAVA_HOME>/jre/lib/security
```

Application Security Implementation

The basic AuthN flow is as follows

1. User requests secured resource
2. If credentials not in request
    - response 401
3. Spring AuthenticationProvider performs AuthN
    a. AuthProvider asks UserDetailsService for GrantedAuthorities for given Principal
    b. notes
        i. DuraCloud provides custom UserDetailsService implementation to return UserDetails of requesting Principal
        ii. AbstractSecurityInterceptor permanently caches user AuthN decisions by default
4. Authentication object and "configuration attributes" are passed to AccessDecisionManager for AuthZ

Security Servlet Filters

DuraCloud leverages Spring's mechanism for wiring AuthN/Z into an application across servlet url patterns.
The following access rules are placed across the durastore and duraservice REST-APIs:

Store REST Methods

Action	Role
Initialize Stores	ROLE_ROOT
Initialize Security Users	ROLE_ROOT
Get Stores	ROLE_USER
Get Spaces	ROLE_ANONYMOUS if space 'open', else ROLE_USER
Get Space	ROLE_ANONYMOUS if space 'open', else ROLE_USER
Get Space Metadata	ROLE_ANONYMOUS if space 'open', else ROLE_USER
Create Space	ROLE_USER
Set Space Metadata	ROLE_USER
Delete Space	ROLE_USER
Get Content	ROLE_ANONYMOUS if space 'open', else ROLE_USER
Get Content Metadata	ROLE_ANONYMOUS if space 'open', else ROLE_USER
Store Content	ROLE_USER
Set Content Metadata	ROLE_USER
Delete Content	ROLE_USER

Service REST Methods

Action	Role
Initialize Services	ROLE_ROOT
Initialize Security Users	ROLE_ROOT
Get Services	ROLE_USER
Get Service	ROLE_USER
Get Deployed Service	ROLE_USER
Get Deployed Service Properties	ROLE_USER
Deploy Service	ROLE_USER
Update Service Configuration	ROLE_USER
UnDeploy Service	ROLE_USER

Administrative UI REST Methods	
Action	**Role**
Initialize DurAdmin Application	ROLE_ROOT
Initialize Security Users	ROLE_ROOT

Roles

The fixed set of users/roles listed below are provided in DuraCloud. Each role in the list below represents a super set of the privileges of those above it.

1. ROLE_ANONYMOUS
    - no username/password
2. ROLE_USER
    - user created by DuraCloud-account admin
3. ROLE_ADMIN
    - owner of DuraCloud-account
4. ROLE_SYSTEM
    - internal user for delegation requests
5. ROLE_ROOT
    - DuraSpace personnel

User Management

1. In order for the administrator of a DuraCloud account to manage new users, an initial user with ROLE_ADMIN privileges is provided at start-up:
    - username: admin
    - password: changeme

Note: *Ultimately, the management of users will take place through the DuraCloud.org website (where users initially create accounts).*
User management is exposed in Duradmin in the upper-righthand corner of the console, but the usernames/passwords edited here are not persisted.
This means that when the application is migrated to the next release, those details will need to be re-entered/re-created.

DuraCloud Sync Tool

Introduction

The Sync Tool is a utility which was created in order to provide a simple way to move files from a local file system to DuraCloud and subsequently keep the files in DuraCloud synchronized with those on the local system.

Download

Download the sync tool here.

How the Sync Tool Works

- When you run the Sync Tool for the first time, you must include DuraCloud connection information (host, port, username, password) as well as the space where you would like all of your files stored. You must also provide a list of directories which will be synced to DuraCloud and a directory for the Sync Tool to use for its own backups.
- When the Sync Tool starts up, it will look through all of the files in each of the local sync directories and add them to its internal queue for processing. Each of those files will then be written to your DuraCloud space. As this initial write is happening a listener is set up to watch for any file changes within each of the sync directories. As a change occurs (a file is added, updated, or deleted), that change is added to the queue, and the appropriate action is taken to make the DuraCloud space consistent with the local file (i.e. the file is either written to the space or deleted from the space.)
- You can stop the Sync Tool at any time by typing 'x' or 'exit' on the command line where it is running. It will stop all listeners, complete any file transfers that are in progress, and close down.
- When you restart the Sync Tool, if you point it at the same backup directory, it will pick up where it left off. While the Sync Tool is running, it is constantly writing backups of its internal queue, so it first reads the most current backup and begins processing the files there. It then scans the sync directories to see if there are any files which have been added or updated since the last backup, and it also pulls a list of files from the DuraCloud space and scans that list to see if any local files have been deleted. Any changes detected are added to the internal queue, and the Sync Tool continues to run as usual.

Operational notes

- Security
  - Version 0.3+ of DuraCloud includes a requirement that all data must be transported over SSL. In order to connect to your DuraCloud instance, the Sync Tool needs to have access to the DuraCloud SSL certificate. See the page on DuraCloud Security for more information about including the DuraCloud certificate in your local truststore.
  - If you add the DuraCloud certificate to a truststore which is not picked up by your Java installation, you may need to specify its location on the command line. To do this, add the parameter

    ```
    -Djavax.net.ssl.trustStore=<path-to-truststore>
    ```

    prior to the -jar parameter when starting the Sync Tool. You will, of course, have to replace <path-to-truststore> with the path to the truststore in which the DuraCloud certificate is stored.

    - An error similar to this:

      ```
      Caused by: javax.net.ssl.SSLHandshakeException:
      sun.security.validator.ValidatorException:
      PKIX path building failed:
      sun.security.provider.certpath.SunCertPathBuilderException:
      unable to find valid certification path to requested target
      ```

      when attempting to run the Sync Tool indicates that the you'll need to include the explicit path to your truststore.
- Restarting
  - You can perform a restart of the Sync Tool by using the -c command line option to point to the Sync Tool configuration file, which is written into the backup directory (named synctool.config)
  - If you would like the Sync Tool to perform a clean start rather than a restart (i.e. you would like it to compare all files in the sync directories to DuraCloud) you will need to either point it to a new backup directory, or clear out the existing backup location.
  - The Sync Tool will perform a clean start (not a restart) if the list of sync directories is not the same as the previous run. This is to ensure that all files in all sync directories are processed properly.
- Collisions
  - The Sync Tool allows you to sync multiple local directories into a single space within DuraCloud. Because of this, there is the possibility of file naming collisions, where two local files resolve to the same DuraCloud ID. If this happens, one file will be overwritten by the other. There are a few ways to ensure that this does not occur:
    - Ensure that the top level files and directories within the set of sync directories do not have overlapping names.
    - Sync only a single directory to a space. You can run multiple copies of the Sync Tool, each over a single local directory, syncing to its own DuraCloud space.
- Backup Directory - these files and directories can be found in the backup directory (specified using the -b command line parameter)
  - Config Files
    - When the Sync Tool starts up, it writes the list of parameters and values provided by the user on startup to a file called synctool.config in the backup directory. This file can be used to restart the Sync Tool, using the -c parameter to point to the file's location. You can also restart the Sync Tool by indicating the same set of options as used originally. The -c parameter is for convenience only and is not required in any circumstance. Note that this file is overwritten each time the Sync Tool is run with a different set of parameters, so you may choose to copy the file elsewhere (or give it a new name) if you would like to keep a copy of a particular configuration set.
    - You may also see a file named synctool.config.bak in the backup directory which is used to compare against the current config in order to determine if a restart is possible. In order for a restart to occur the list of sync directories (-d parameter) must be the same as the previous execution of the tool, and there must be at least one changed list backup (see below.)
  - Changed List Directory
    - While the Sync Tool is running it is constantly updating the list of files which have been changed (when starting the first time, this includes all files in the directories that need to be synced). In order to allow the Sync Tool to restart after it has been stopped, this list of files is continually backed up into the *changedList* directory. There is no reason to edit these files, but you may choose to delete the *changedList* directory along with the config files mentioned above to ensure that the Sync Tool does not attempt to perform a restart.
  - Logs Directory
    - Information about what the Sync Tool is doing while it is running can be found in the sync-tool.log file. It is a good idea to monitor this file for errors and warnings as this information is not printed to the console.
    - The duracloud.log file is useful for application debugging when the information in the sync-tool.log file is insufficient to understand a problem.

Prerequisites

- You must have Java version 6 or above installed on your local system. If Java is not installed, you will need to download and install it. To determine if the correct version of Java is installed, open a terminal or command prompt and enter

  ```
  java -version
  ```

The version displayed should be 1.6.0 or above. If running this command generates an error, Java is likely not installed.

- You must have downloaded the Sync Tool. It is available as a link near the top of this page.

Starting the Sync Tool

- To run the Sync Tool, open a terminal or command prompt and navigate to the directory where the Sync Tool is located
- To display the help for the Sync Tool, run

```
java -jar synctool-0.4.0-driver.jar
```

- When running the Sync Tool for the first time, you will need to use these options:

Short Option	Long Option	Argument Expected	Required	Description	Default Value (if optional)
-h	--host	Yes	Yes	The host address of the DuraCloud DuraStore application	
-p	--port	Yes	No	The port of the DuraCloud DuraStore application	443
-s	--space	Yes	Yes	The ID of the DuraCloud space where content will be stored	
-u	--username	Yes	Yes	The username necessary to perform writes to DuraStore	
-w	--password	Yes	Yes	The password necessary to perform writes to DuraStore	
-d	--sync-dirs	Yes	Yes	A list of the directory paths to monitor and sync with DuraCloud. If multiple directories are included in this list, they should be separated by a space.	
-b	--backup-dir	Yes	Yes	The state of the sync tool is persisted to this directory	
-f	--poll-frequency	Yes	No	The time (in ms) to wait between each poll of the sync-dirs	10000 (10 seconds)
-t	--threads	Yes	No	The number of threads in the pool used to manage file transfers	3
-m	--max-file-size	Yes	No	The maximum size of a stored file in GB (value must be between 1 and 5), larger files will be split into pieces	1
-x	--sync-deletes	No	No	Indicates that deletes performed on files within the sync directories should also be performed on those files in DuraCloud; if this option is not included all deletes are ignored	Not set

- When the Sync Tool runs, it creates a backup of your configuration in the backup directory that you specify. When running the tool again, you can make use of this file to keep from having to re-enter all of the options specified on the initial run. In this case you need only a single option:

Short Option	Long Option	Argument Expected	Required	Description
-c	--config-file	Yes	Yes	Read configuration from this file (a file containing the most recently used configuration can be found in the backup-dir, named synctool.config)

- An example for running the Sync Tool

```
java -jar synctool-0.4.0-driver.jar -b C:\tools\synctool\backup -d C:\files\important -f 2000 -h
test.duracloud.org -s important-dir-backup -t 5 -u myname -w mypassword
```

Runtime commands

- While the Sync Tool is running, these commands are available. Just type them on the command line where the tool is running.

Short Command	Long Command	Description
x	exit	Tells the Sync Tool to end its activity and close

c	config	Prints the configuration of the Sync Tool (the same information is printed at startup)
s	status	Prints the current status of the Sync Tool
l <Level>	N/A	Changes the log level to <Level> (may be any of DEBUG, INFO, WARN, ERROR)
h	help	Prints the runtime command help

Logging Configuration

Introduction

The logging framework used in the DuraCloud application is SLF4J with the LogBack implementation statically bound at runtime.
See the LogBack website for a detailed description of the configuration options.

The application also contains bridges for both Log4J and Commons-Logging which translates any underlying, dependency libraries which are configured to write to these frameworks into the SLF4J API. The effect is that all logging is channeled through the SLF4J configuration.

General Usage

- By default, if no configuration file is found by LogBack, the logging level is set to "DEBUG" and the appender is set to "STDOUT"
- When starting any DuraCloud application, a LogBack configuration file may be specified by using the following system variable

```
java -Dlogback.configurationFile={path-to-logging-configuration-file} -jar any-application
```

- Additionally, LogBack will use the file named "logback.xml" found at the top of the classpath for configuration
- An example logback.xml file

```
1<?xml version="1.0" encoding="UTF-8"?>
2
3<configuration >
4  <!--<configuration debug="true" scan="true">-->
5  <jmxConfigurator/>
6  <property name="LOG_FILENAME" value="/home/duraspace/logs/duracloud-osgi.log" />
7
8  <appender name="DURACLOUD" class="ch.qos.logback.core.rolling.RollingFileAppender">
9    <File>${LOG_FILENAME}</File>
10    <encoder>
11      <pattern>%-14p %d{yyyy/MM/dd HH:mm:ss} [%t] (%F:%L\\) [%M(\\)] - %m%n</pattern>
12    </encoder>
13    <rollingPolicy class="ch.qos.logback.core.rolling.FixedWindowRollingPolicy">
14      <maxIndex>5</maxIndex>
15      <FileNamePattern>${LOG_FILENAME}.%i</FileNamePattern>
16    </rollingPolicy>
17    <triggeringPolicy class="ch.qos.logback.core.rolling.SizeBasedTriggeringPolicy">
18      <MaxFileSize>20MB</MaxFileSize>
19    </triggeringPolicy>
20  </appender>
21  <appender name="STDOUT" class="ch.qos.logback.core.ConsoleAppender">
22    <encoder>
23      <pattern>%-14p %d{yyyy/MM/dd HH:mm:ss} [%t] (%F:%L\\) [%M(\\)] - %m%n</pattern>
24    </encoder>
25  </appender>
26  <logger name="org.duracloud" level="DEBUG" additivity="false">
27    <appender-ref ref="DURACLOUD"/>
28  </logger>
29   <root level="WARN">
30    <appender-ref ref="STDOUT"/>
31  </root>
32</configuration>
```

- Notes on the above logback.xml file
  - on line 4, the attribute "debug" applies to displaying configuration information when LogBack starts up if set to "true"
  - on line 4, the attribute "scan" configures LogBack to re-read the given logback.xml every 60 seconds (by default) for updates

- on line 26, the attribute "additivity" configures the given logger to inherit the configuration of the parent logger, in this case, the root logger
- on line 26, if the "additivity" attribute were set to "true", all "DURACLOUD" log output would also log to "STDOUT"

Software

Building DuraCloud Software from Source

Introduction

DuraCloud application software is composed of many parts. A breakdown of the primary pieces is as follows:

- DuraStore - this web application provides the access to and management of storage resources, which includes handling the storage portion of the DuraCloud REST API
- StorageProviders - this set is made up of the StorageProvider interfaces and the implementations which connect to distinct cloud stores (currently Amazon S3, Rackspace CloudFiles, and EMC Atmos)
- DuraService - this web application handles the deployment and management of services within DuraCloud, which includes handling the services portion of the DuraCloud REST API
- Services - the set of all deployable services, as well as the support projects that allow the DuraCloud services infrastructure to function
- ComputeProviders - this set is made up of the ComputeProvider interfaces and the implementation which connect to distinct cloud compute services (currently Amazon EC2, using the typica library)
- Security - handles security for the DuraCloud applications
- Common - a set of projects which provide utilities for other portions of the codebase to reuse

The DuraCloud software, by its very nature, is designed to be integrated with underlying cloud storage and compute providers.
As may be expected, these integrations are exercised through many "integration tests". In order for DuraCloud to connect to these underlying providers, appropriate credentials must first be established and available to the build framework.
However, in order to get up and running quickly with the software, the baseline can be initially built with just its unit tests.
Once the developer has independently acquired credentials for one or more of the supported underlying storage providers (below) builds may then be run with integration tests.

- Amazon S3
- Rackspace CloudFiles
- EMC Atmos

This guide lays out the three tiers of building/testing the baseline:

1. build with unit tests
2. build with storage and services integration tests
3. build with OSGi services container integration tests

Although this document is written from a Linux environment perspective, analogous builds/installations have been tested in Windows (but may have limitations, as noted below). Any comments or feedback are welcomed.

Prerequisites

Software that must be installed on your system prior to building/using DuraCloud

1. Maven 2.2.1 or above
2. Tomcat 6.x or above

3. Java 6 (note: the djatoka service has compatibility issues with open-jdk)
4. Subversion

Building DuraCloud

Build with unit tests

1. Check out latest stable release from Subversion repository

```
svn co https://svn.duraspace.org/duracloud/tags/duracloud-0.4.1
```

2. Set environment variables

```
export JAVA_OPTS="-XX:MaxPermSize=256m"
```

3. Configure Tomcat
   a. Add to $CATALINA_HOME/conf/tomcat-users.xml

```
<tomcat-users>
  <role rolename="manager"/>
  <role rolename="admin"/>
  <user username="any-username" password="any-password" roles="admin,manager"/>
</tomcat-users>
```

4. Start tomcat

```
$CATALINA_HOME/bin/startup.sh
```

5. Configure Maven2
   a. Add tomcat user to $M2_HOME/conf/settings.xml

```
</servers>
  <server>
    <id>tomcat-server</id>
    <username>any-username</username>
    <password>any-password</password>
  </server>
</servers>
```

6. Build with only unit tests
   a. From top of source tree

```
mvn clean install -PskipIntTests
```

   Note: Each of the maven2 project modules are configured to halt the build if there is a test failure. The only exception to this is the *integration-test* module which is configured to run through all of its tests regardless of failures. So the above build command can optionally exclude the '-PskipIntTests' flag if desired.

Building in Windows: Currently the service projects which deploy as WAR files (beginning with WebAppUtilService) do not pass unit tests on a Windows environment due to limitations regarding the deployment of Tomcat instances. You may choose to either perform a build skipping tests "mvn clean install -DskipTests" or to allow the tests to run but not stop the build "mvn clean install -Dmaven.test.failure.ignore=true"

Build with integration tests

This step assumes the successful completion of the previous build instructions.
As mentioned above, the integration tests require credentials in order to connect to the underlying storage providers. The tests themselves are

configured to acquire these credentials from a locally created, encrypted database.

1. Create unit-test-db
    - From inside the //unit-test-db module, run:

```
mvn assembly:assembly
java -jar target/unit-test-db-[version]-db-util.jar
```

2. Running the above db util jar will provide a commandline interface for adding credentials
3. Add credentials for s3, emc, rackspace, root-user
    a. Set the root-user to username: 'root', password: 'rpw' to just use the application default.
    b. See *root user* discussion below for ways of changing the default.
4. Add the connection details for the unit-test-db to $M2_HOME/conf/settings.xml

```
<profile>
  <id>always</id>
  <properties>
    <duracloud.home>location-where-application-has-write-access</duracloud.home>

<unit.database.home.default>location-where-unit-test-db-was-created</unit.database.home.default>
    <unit.database.password.default>unit-test-db-boot-password</unit.database.password.default>
  </properties>
</profile>

<activeProfiles>
  <activeProfile>always</activeProfile>
</activeProfiles>
```

    - where duracloud.home is the directory under which the logs and osgi-container will be placed
    - where unit.database.home.default is the location of the unit-test-database created above
    - where unit.database.password.default is the boot password used during creation of the unit-test-database above
5. The integration tests also expect a registry (read: 'space') of services to be available within the primary storage provider of service storage host
    a. The naming of the space follows the convention "duracloud-<version>-service-repo"
    b. The services to be loaded into the registry can be found in the //services/packages directory
    c. See discussion below about application configuration, including the service storage host
6. Build with unit and integration tests
    a. From top of source tree

```
mvn clean install
```

7. As mentioned before, if there are any failures in the //integration-test module, the build will still complete, but the failures will be listed

Build with OSGi services container integration tests

This step assumes the successful completion of the previous build instructions

1. Start OSGi service container

```
cd //services/servicesadmin
mvn clean -f pom-run.xml pax:provision
cd runner
chmod +x run.sh
export BUNDLE_HOME=$DURACLOUD_HOME/osgi-container
./run.sh
```

    a. Where $DURACLOUD_HOME is a directory where the application has write access (can be same as <duracloud.home> set in Maven settings.xml above)
    b. The run.sh script will start an OSGi container and commandline interface to it
    c. The container starts with required bundles including the 'services-admin' installed
    d. See discussion below on OSGi container for more details
2. Once the 'services-admin' is running, tests that deploy services into the OSGi environment may be run
3. From inside the //integration-test module

```
mvn install -PrunServicesAdminTests
```

Optional items

Code coverage

1. If you plan on using Clover, the following element needs to be added to your maven 'settings.xml'

```
<profiles>
  <profile>
    <id>profile-clover</id>
    <activation>
      <property>
        <name>profile</name>
        <value>clover</value>
      </property>
    </activation>
    <properties>
      <cloverLicense>[specify-location-of-clover.license]</cloverLicense>
    </properties>
  </profile>
</profiles>
```

2. To run clover

```
mvn clover2:instrument clover2:aggregate clover2:clover -Pprofile-clover
```

3. A report will be generated in the following directory:
   //target/site/clover/

Logging

1. DuraCloud uses the SLF4j logging framework backed by the LogBack implementation
2. By adding either a logback.xml or logback-test.xml file on the classpath, logging configuration can be customized

DuraCloud internal tools

ServicesAdmin CLI

1. This tool provides a commandline interface for interacting with the 'services-admin' installed in a running OSGi container (see notes above for starting the container)
2. To build and run the CLI, from within the //servicesadminclient module

```
mvn assembly:assembly
java -cp target/servicesadminclient-<version>-cli.jar
```

Application initialization utility

1. This utility takes a config file (example at //app-config/src/main/resources/init.props) and initializes an instance of duracloud
2. Until the applications durastore and duraservice are initialized, they are non-functional
3. To build and run the app-config utility, from within the //app-config module

```
mvn assembly:assembly
java -jar target/app-config-1.0.0-driver.jar
```

StoreClient package

1. To create a distributable zip of the storeclient and its dependencies, from within //storeclient run

```
mvn install -Ppackage-client
```

2. The zip will be found at /storeclient/target/store-client.zip

Misc configuration/discussion

Services on Windows

The following services do not function in a Windows deployment environment

- WebAppUtilService
- HelloWebappWrapper
- J2KService
- ImageMagickService

If you would like to run the ImageConversionService, you must install ImageMagick and have its /bin directory in your PATH, which is essentially what the ImageMagickService does in a linux environment.

root user

application config

OSGi container

Release 0.4

Description

Release 0.4.1 (June 30, 2010)

- This build release is the first publicly available
- It primarily provides clean-up of projects and tests

Release 0.4 (June 21, 2010)

The primary features added in release 0.4 of DuraCloud are:

- Media Streaming Service
  - Provides a way to enable streaming for video and audio files as well as providing an example media player.
- Logging moved to SLF4J over Logback
  - Provides greater consistency in log output and greater flexibility in log configuration

For more details about specific changes in release 0.4, see the JIRA issue tracker.

Release Artifacts

1. Store Client - Includes storeclient.jar and all dependent jars as well as Javadocs
2. Sync Tool - Used to synchronize local content up to DuraCloud
3. Services
   a. Release 0.4.0 service registry
   b. Release 0.4.1 service registry

Services

Under development

1. Fixity Service
2. Metadata Export Service

Fixity Service

Design In-Progress
Comments/Suggestions welcome.
23-july-2010

Overview

The Fixity Service is intended to provide a simple and easy to use way of assuring that the content stored in your DuraCloud account has maintained bit integrity. The basic idea is that a DuraCloud account administrator provides a listing of expected content IDs and their associated MD5s. This listing is then used by the service as a basis for comparison against MD5s found in DuraCloud.

There is a trade-off between cost (both in time and money) and assurance in the trustworthiness of the MD5 provided by DuraCloud. The service is designed to offer three options to address this balance, see "Levels of trust" below. The fastest and cheapest option is to use the MD5 stored in the metadata of the content item. The underlying storage providers assert that this value which is created on ingest is also checked when the content item is read, and retrieves a mirrored copy of the content if there is a mismatch. As a note, when content is pushed into DuraCloud via the DuraStore REST-API an MD5 can be provided by the user to be automatically checked with the one generated by the underlying storage provider, and if no MD5 is provided the DuraCloud application calculates it for this comparison. If the administrator does not trust the assertion of the underlying storage provider, the Fixity Service also provides the option of reading the content and recalculating the MD5. Finally, if the administrator does not trust this recalculation, then the Fixity Service also provides the option of passing in a "salt" character string which will be appended to the content during the recalculation of the MD5.

The input listing is expected to be found as a user-specified content item within DuraCloud, and the resultant output file will be stored to a user-specified location within DuraCloud. The formats of the input and output files are the same, so a previous run's output may be used as a subsequent run's input.

see July 2010 NDIIPP presentation

Requirements

1. Service will match provided content item MD5s against MD5s of content items stored in DuraCloud
2. Service will retrieve input contentId and MD5 listing spaceId/contentId
3. Service will provide result output as a new stored content
4. Service will run in one of the three functional modes corresponding to the "Levels of trust" below
5. Service will run on a compute instance local to the input storeId - *future*

Design

Levels of trust

Provides the choice of balance amongst cost, time, and assurance

1. Trust in underlying storage providers
2. Trust in DuraCloud and opensource software
3. Trust in requester of service

Functionality spec

1. Service inputs
    a. comma-delimited file with listing of spaceId, contentId and expected MD5
        - each content item separated by newline character
        - first line in file will be ignored
    b. storeId of underlying storage provider (optional)
    c. options
2. Service options
    a. trust level (stored value, recalculate, salt)
    b. salt
    c. fail-fast boolean
    d. complete space(s) boolean
        - indicates if the input listing should be checked against the complete set of items in the space(s)
    e. space where input listing content is stored
    f. contentId of input listing file
    g. space where results file should be written
    h. contentId of results file
3. Service outputs
    a. comma-delimited string with listing of spaceIds, contentIds, expected MD5s, found MD5s, status state
    b. service status state
4. Service exceptions
    a. Checked

        - Contains the following enum
            i. missing MD5 (expected or found)
            ii. MD5 mis-match
            iii. unequal content listings
    b. Runtime
        i. internal error
        ii. salt option set but salt not provided
        iii. service level not supported
        iv. input content item not exists
        v. output result content item already exists

Operational modes

In order to address both scenarios of allowing the user to have certainty that MD5s are being generated/checked when requested and allowing the user to trust the service and have it execute with a single command, the following modes are available.

1. Two-step interaction
    a. User invokes service with a listing of contentIds (and other options) to check
    b. Fixity Service generates a listing of contentId/MD5 pairs based on the input options
    c. User invokes service with a listing of expected contentId/MD5 pairs to be compared to the generated listing
    d. Service generates result report
2. Single-step interaction
    a. User invokes service with a listing of contentId/**MD5 pairs** (and other options) to check
    b. Fixity Service generates a listing of contentId/MD5 pairs based on the input options **and performs comparison with input, expected MD5s**
    c. Service generates result report

Metadata Export Service

Design In-Progress
Comments/Suggestions welcome.
14-july-2010

Requirements

1. Service will create a listing of contentIds and associated MD5

Design

Functionality spec

1. Service inputs
    a. spaceId of contents for which associated metadata will be exported
    b. metadata field(s)
        i. MD5
        ii. TBD...
    c. spaceId where export file will be stored
    d. contentId of export file
2. Service outputs
    a. comma-delimited content item stored as input:spaceId/input:contentId
        - see output file description below
3. Service exceptions
    a. source space not found
    b. output space not found
    c. output content item already exists

Output File Description

1. The exported file will be comma-delimited
2. The first line of the file will contain a header for each column
3. If a metadata element is not found for any content item, the corresponding column will contain a message string

```
Space ID,Content ID,MD5
space0,path/contentA,15970caabc295dd928c0d3db20c72642
space0,path/contentB,MD5-not-found
space0,path/contentC,488e0b0466ee9c441fd20ff51a152a6c
```