

RESTful API Binary Provisioning Agent (BPA)

This is a Golang application providing a RESTful API to interact with and upload image objects.

The API application source files are in the `icn/cmd/bpa-restapi-agent` directory.

While the database back-end is extensible, this initial release requires `mongodb`.

- 1 [Motivation](#)
- 2 [Requirements](#)
- 3 [Design](#)
 - 3.1 [Implementation](#)
 - 3.2 [Proposed Usage](#)
- 4 [How To Use The BPA RESTful API Service](#)
- 5 [RESTful API usage examples](#)
 - 5.1 [Sample POST request format](#)
 - 5.2 [Create image - POST](#)
 - 5.2.1 [Request](#)
 - 5.2.2 [Response](#)
 - 5.3 [List image - GET](#)
 - 5.3.1 [Request](#)
 - 5.3.2 [Response](#)
 - 5.4 [Upload container image - PATCH](#)
 - 5.4.1 [Request](#)
 - 5.4.2 [Response](#)
 - 5.5 [Check uploaded image - GET](#)
 - 5.5.1 [Request](#)
 - 5.5.2 [Response](#)
 - 5.6 [Resumable upload - PATCH](#)
 - 5.6.1 [Request](#)
 - 5.7 [Check upload - GET](#)
 - 5.7.1 [Request](#)
 - 5.7.2 [Response](#)
 - 5.7.3 [Request](#)
 - 5.7.4 [Response](#)
 - 5.8 [Update image description - PUT](#)
 - 5.8.1 [Request](#)
 - 5.8.2 [Response](#)
 - 5.9 [Delete an image - DELETE](#)
 - 5.9.1 [Request](#)
- 6 [How To Write ICN Unit Tests in Go using Testify](#)

Motivation

The ICN RESTful API intends to provide access to resources inside the system using a uniform interface through the provision of one logical URI. As a constraint, "Servers and clients may also be replaced and developed independently, as long as the interface between them is not altered."

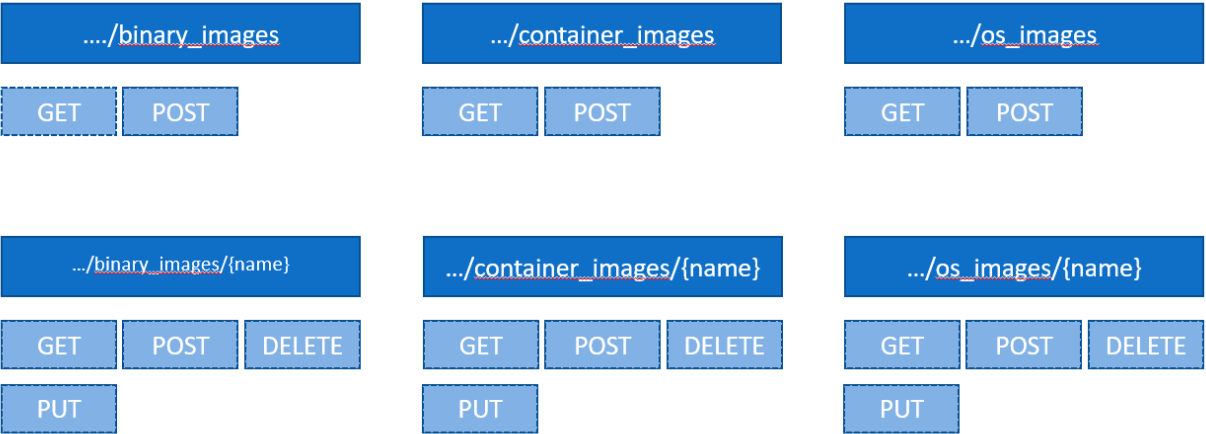
Requirements

This RESTful API service will expose the following resources to a user:

1. Binary Images
2. Container Images
3. OS Images

Design

- Use nouns to describe resources
- In the top URL, identify version, bare-metal cluster name, and resource
- GET - This will be used to list image resources
- POST - This will be used to create image resources
- PUT - This will be used to upload image resources
- DELETE - This will be used to delete image resources



Implementation

Sample **GET** Implementation:

Integrated Cloud Native RESTful API 1.0.0

Addresses deployment of workloads in the edge

Schemes

HTTP



Deployment of Images



GET

/v1/baremetalcluster/{clustername}/images/ List all Images.

Endpoint to list all Images.

Parameters

Try it out

Name

Description

clustername * required

Name of the cluster used to query

string

(path)

clustername - Name of the cluster used to query

Responses

Response content type

application/json



Code**Description**

200

successful operation

Example Value | [Model](#)

```
{
  "ID": "string",
  "image_id": "string",
  "repo": "string",
  "tag": "string",
  "description": "string"
}
```

default

generic error response

Example Value | [Model](#)

```
{
  "code": 0,
  "message": "string"
}
```

GET**/v1/baremetalcluster/{clustername}/images/{name}** Get details of an image.

Endpoint to get details of ICN available images.

Parameters**Try it out****Name****Description****clustername** * required

Name of the cluster used to query

string

clustername - Name of the cluster used to query

*(path)***name** * required

Name used to query

string

name - Name used to query

*(path)***Responses**

Response content type

application/json

**Code****Description**

200

successful operation

Example Value | Model

```
{
  "ID": "string",
  "image_id": "string",
  "repo": "string",
  "tag": "string",
  "description": "string"
}
```

default

generic error response

Example Value | Model

```
{
  "code": 0,
  "message": "string"
}
```

The sample API

Proposed Usage

Proposed sample command to GET all binary images

```
# Get all binary images
curl -i http://localhost:9015/v1/baremetalcluster/{clustername}/binary_images/

# Get one binary image
curl -i http://localhost:9015/v1/baremetalcluster/{clustername}/binary_images/{name}
```

Proposed sample command to GET all container images

```
# Get all container images
curl -i http://localhost:9015/v1/baremetalcluster/{clustername}/container_images/

# Get one container image
curl -i http://localhost:9015/v1/baremetalcluster/{clustername}/container_images/{name}
```

Proposed sample command to GET all OS images

```
# Get all container images
curl -i http://localhost:9015/v1/baremetalcluster/{clustername}/os_images/

# Get one container image
curl -i http://localhost:9015/v1/baremetalcluster/{clustername}/os_images/{name}
```

How To Use The BPA RESTful API Service

Install and start mongodb. For instructions: <https://docs.mongodb.com/manual/installation/>

```
git clone "https://gerrit.akraino.org/r/icn"
cd icn/cmd/bpa-restapi-agent
```

Run the application
`go run main.go`

Sample output without a config file:

```
2019/08/22 14:08:41 Error loading config file. Using defaults
2019/08/22 14:08:41 Starting Integrated Cloud Native API
```

Cloud Storage with MinIO

Start MinIO server daemon with docker command before run REST API agent, default settings in config/config.go.

```
AccessKeyID: ICN-ACCESSKEYID
SecretAccessKey: ICN-SECRETACCESSKEY
MinIO Port: 9000
```

...

```
$ docker run -p 9000:9000 --name minio1 \
-v /mnt/data:/data \
-v /mnt/config:/root/.minio \
minio/minio server /data
...
```

MinIO Client will automatic initialize in main.go, and create 3 buckets: binary, container, operatingsystem.
The Upload image will "PUT" to corresponding buckets by HTTP PATCH request url.
You can also check by open browser: <http://127.0.0.1:9000/>

RESTful API usage examples

Sample POST request format

```
curl -i -F "metadata=<jsonfile;type=application/json" -F file=@/home/<username>/<dir>/jsonfile -X POST http://NODE_IP:9015/baremetalcluster/{owner}/{clustername}/<image_type>
```

#image type can be binary_image, container_image, or os_image

Example requests and responses:

Create image - POST

#Using a json file called sample.json
#image_length in sample.json can be determined with the command
ls -al <image_file>

Request

```
curl -i -F "metadata=<sample.json,type=application/json" -F file=@/home/enyi/workspace/icn/cmd/bpa-restapi-agent/sample.json -X POST http://localhost:9015/v1/baremetalcluster/alpha/beta/container_images
```

Response

HTTP/1.1 100 Continue

HTTP/1.1 201 Created
Content-Type: application/json
Date: Thu, 22 Aug 2019 22:56:16 GMT
Content-Length: 239

```
{"owner":"alpha","cluster_name":"beta","type":"container","image_name":"asdf246","image_offset":0,"image_length":29718177,"upload_complete":false,"description":{"image_records":[{"image_record_name":"iuysdi1234","repo":"icn","tag":"1"}]}}
```

#this creates a database entry for the image, and an empty file in the file system

List image - GET

```
curl -i -X GET http://localhost:9015/v1/baremetalcluster/{owner}/{clustername}/{image_type}/{imgname}
```

example:
#continuing with our container image from above

Request

```
curl -i -X GET http://localhost:9015/v1/baremetalcluster/alpha/beta/container_images/asdf246
```

Response

HTTP/1.1 200 OK
Content-Type: application/json
Date: Thu, 22 Aug 2019 22:57:10 GMT
Content-Length: 239

```
{"owner":"alpha","cluster_name":"beta","type":"container","image_name":"asdf246","image_offset":0,"image_length":29718177,"upload_complete":false,"description":{"image_records":[{"image_record_name":"iuysdi1234","repo":"icn","tag":"1"}]}}
```

Upload container image - PATCH

Request

```
curl --request PATCH --data-binary "@/home/enyi/workspace/icn/cmd/bpa-restapi-agent/sample_image" http://localhost:9015/v1/baremetalcluster/alpha/beta/container_images/asdf246 --header "Upload-Offset: 0" --header "Expect:" -i
```

Response

HTTP/1.1 204 No Content
Upload-Offset: 29718177
Date: Thu, 22 Aug 2019 23:19:44 GMT

Check uploaded image - GET

Request

```
curl -i -X GET http://localhost:9015/v1/baremetalcluster/alpha/beta/container_images/asdf246
```

Response

HTTP/1.1 200 OK
Content-Type: application/json
Date: Fri, 23 Aug 2019 17:12:07 GMT
Content-Length: 245

```
{"owner":"alpha","cluster_name":"beta","type":"container","image_name":"asdf246","image_offset":29718177,"image_length":29718177,"upload_complete":true,"description":{"image_records":[{"image_record_name":"iuydsdi1234","repo":"icn","tag":"1"}]}}
```

#after the upload, the image_offset is now the same as image_length and upload_complete changed to true
#if upload was incomplete

Resumable upload -PATCH

#this is the current resumable upload mechanism

Request

```
curl --request PATCH --data-binary "@/home/enyi/workspace/icn/cmd/bpa-restapi-agent/sample_image" http://localhost:9015/v1/baremetalcluster/alpha/beta/container_images/asdf246 --header "Upload-Offset: 0" --header "Expect:" -i --limit-rate 200K
```

#the above request limits transfer for testing purposes
#ctl c' out after a few seconds, to stop file transfer
#check image_offset with a GET

Check upload - GET

Request

```
curl -i -X GET http://localhost:9015/v1/baremetalcluster/alpha/beta/container_images/asdf246
```

Response

HTTP/1.1 200 OK
Content-Type: application/json
Date: Sat, 24 Aug 2019 00:30:00 GMT
Content-Length: 245

```
{"owner":"alpha","cluster_name":"beta","type":"container","image_name":"asdf246","image_offset":4079616,"image_length":29718177,"upload_complete":false,"description":{"image_records":[{"image_record_name":"iuydsdi1234","repo":"icn","tag":"2"}]}}
```

#from our response you can see that image_offset is still less than image_length and #upload_complete is still false
#next we use the dd command (no limiting this time)

Request

```
dd if=/home/enyi/workspace/icn/cmd/bpa-restapi-agent/sample_image skip=4079616 bs=1 | curl --request PATCH --data-binary @- http://localhost:9015/v1/baremetalcluster/alpha/beta/container_images/asdf246 --header "Upload-Offset: 4079616" --header "Expect:" -i
```

#the request skips already uploaded 4079616 bytes of data

Response

25638561+0 records in
25638561+0 records out
25638561 bytes (26 MB, 24 MiB) copied, 207.954 s, 123 kB/s
HTTP/1.1 204 No Content
Upload-Offset: 29718177
Date: Sat, 24 Aug 2019 00:43:18 GMT

Update image description - PUT

let's change the tag in description from 1 to latest
once the change is made in sample.json (or your json file)

Request

```
curl -i -F "metadata=<sample.json;type=application/json" -F file=@/home/enyi/workspace/icn/cmd/bpa-restapi-agent/sample.json -X PUT http://localhost:9015/v1/baremetalcluster/alpha/beta/container_images/asdf246
```

Response

HTTP/1.1 100 Continue

HTTP/1.1 201 Created
Content-Type: application/json
Date: Fri, 23 Aug 2019 17:21:01 GMT
Content-Length: 239

```
{"owner":"alpha","cluster_name":"beta","type":"container","image_name":"asdf246","image_offset":0,"image_length":29718177,"upload_complete":false,"description":{"image_records":[{"image_record_name":"iuysdi1234","repo":"icn","tag":"2"}]}}
```

Delete an image - DELETE

Request

`curl -i -X DELETE http://localhost:9015/v1/baremetalcluster/alpha/beta/container_images/asdf246`

How To Write ICN Unit Tests in Go using Testify

Go version used is go1.12.9

To install Go, follow the instructions on the official site, (<https://golang.org/doc/install>).

Testify documentation can be found on Github, <https://github.com/stretchr/testify>

The first question is, "what to test?" In this case, I'll test a method called `GetDirPath` in the file `image.go`.

`GetDirPath` uses the Go core packages `user` and `path` to return a file path, and a directory path.

```
package app

import (
    "os/user"
    "path"

    pkgerrors "github.com/pkg/errors"
)

func (v *ImageClient) GetDirPath(imageName string) (string, string, error) {
    u, err := user.Current()
    if err != nil {
        return "", "", pkgerrors.Wrap(err, "Current user")
    }
    home := u.HomeDir
    dirPath := path.Join(home, "images", v.storeName)
    filePath := path.Join(dirPath, imageName)

    return filePath, dirPath, err
}
```

Here is the `ImageClient` type that the method `GetDirPath` is defined on:

```
type ImageClient struct {
    storeName string
    tagMeta   string
}
```

To test Go packages, Go has a core package called `testing` which is used with the command `go test`. I'll create the test file `image_test.go` in the same package as my `image.go` file. A test for the `GetDirPath` could look like this:

```
import (
    "testing"
)

func TestGetDirPath(t *testing.T) {

    imageClient := &ImageClient{"test_image", "test_meta"}
    actual, dir, err := imageClient.GetDirPath("test")
    var expected = "/home/enyi/images/test_image/test"
    if actual != expected {
        t.Errorf("Path was incorrect, got: %s, want %s.", actual, expected)
    }
}
```

The TestGetDirPath (test functions begin with 'Test') function uses the testing package to print a message before failing. You can explore the testing package here <https://golang.org/pkg/testing/>.

Change into your package directory and run:

```
go test
```

It should pass.

Next, we'll mock out the user package with Testify and rewrite our test.

If you're using go modules for dependency management, you don't have to install Testify. Otherwise, run:

```
go get https://github.com/stretchr/testify
```

To mock a third party application we use an interface. This allows us to create a method, GetUser, that uses the package that we'd like to mock.

So, ultimately, we'll have two definitions of our interface: actual definition and mock definition.

The interface:

```
// Interface for imported packages
type ImportsService interface {
    GetCurrentUser() (*user.User, error)
}
```

Let's make ImageClient use ImportsService to get user. So, ImageClient implements and uses ImportsService.

```
type ImageClient struct {
    user ImportsService
    storeName string
    tagMeta string
}
```

Let's rewrite GetDirPath to use GetCurrentUser.

```
func (v *ImageClient) GetDirPath(imageName string) (string, string, error) {
    u, err := v.GetCurrentUser()
    home := u.HomeDir
    dirPath := path.Join(home, "images", v.storeName)
    filePath := path.Join(dirPath, imageName)

    return filePath, dirPath, err
}
```

Let's define GetCurrentUser on ImageClient.

```
// define GetCurrentUser
func (v *ImageClient) GetCurrentUser() (*user.User, error) {
    u, err := user.Current()
    if err != nil {
        return nil, pkgerrors.Wrap(err, "Current user")
    }

    return u, nil
}
```

To test GetDirPath using testify mock, let's re-write image_test.go

```
package app

import (
    "fmt"
    "os/user"
    "testing"

    "github.com/stretchr/testify/mock"
)

type mockImports struct {
    mock.Mock
}

func (m *mockImports) GetCurrentUser() (*user.User, error) {
    fmt.Println("Mocked Get User")
    args := m.Called()

    return args.Get(0).(*user.User), args.Error(1)
}

func TestService(t *testing.T) {
    fakeUser := user.User{}

    myImports := new(mockImports)

    myImports.On("GetCurrentUser").Return(&fakeUser, nil)

    imageClient := ImageClient{myImports, "test_image", "test_meta"}
    _, dir, err := imageClient.GetDirPath("test")
    if err != nil {
        t.Errorf("Path was incorrect, got: %q, want: %q.", dir, "some_path")
    }
}
```

With GetCurrentUser defined on mockImports, inside my TestService, I choose the mockImports object for testing:

```
imageClient := ImageClient{myImports, "test_image", "test_meta"}
```

Run:

go test -v

References:

1. <https://restfulapi.net/rest-architectural-constraints/>