

Floodlight RESTful interface

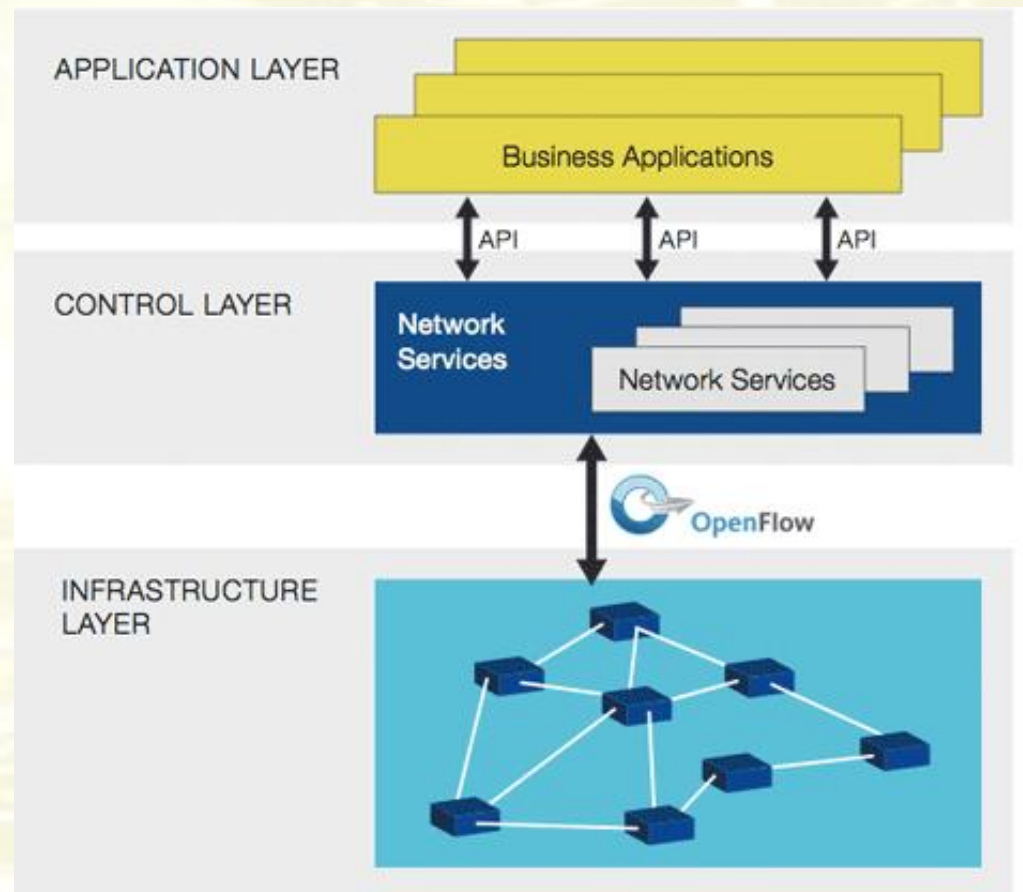
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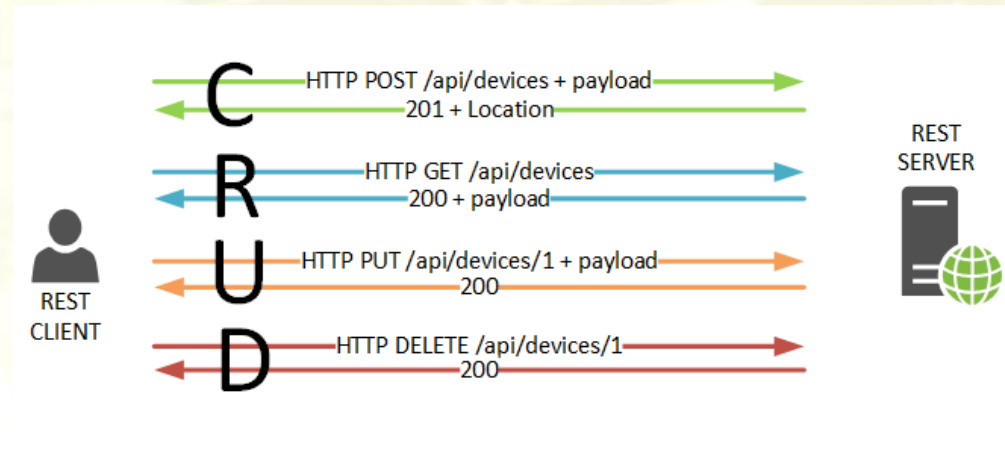
SDN Northbound interface

- Core advantage of Software Defined Networks over traditional deployments is their re-programmability
- Such changes are usually applied automatically by external applications and monitoring process to react to events (e.g. variations in the load)
- To this aim, a northbound interface is exposed by controllers



RESTful APIs

- Controller defines the APIs of the northbound interface using the RESTful paradigm
- Each controller exposes a set of resources that can be used by applications to retrieve network information or issue configuration changes or trigger operations



Resource	POST create	GET read	PUT update	DELETE delete
/dogs	create a new dog	list dogs	bulk update dogs	delete all dogs
/dogs/1234	error	show Bo	if exists update Bo if not error	delete Bo

Floodlight RESTful API – STEP 1

- Each Floodlight module can expose a RESTful interface for external applications. REST interface for the *loadbalancer*.
- First step, add the IRestApiService among the dependences and retrieve a reference to it

```
protected IRestApiService restApiService; // Reference to the Rest API service

...
@Override
public Collection<Class<? extends IFloodlightService>> getModuleDependencies() {
    Collection<Class<? extends IFloodlightService>> l = new ArrayList<Class<?
        extends IFloodlightService>>();

    ...
    // Add among the dependences the RestApi service
    l.add(IRestApiService.class);
    return l;
}

...
@Override
public void init(FloodlightModuleContext context) throws FloodlightModuleException {
    ...
    // Retrieve a pointer to the rest api service
    restApiService = context.getServiceImpl(IRestApiService.class);
}
```

Floodlight RESTful API – STEP 2

- Second step, create a class representing the RESTful interface

```
public class LoadBalancerWebRoutable implements RestletRoutable {
    /**
     * Create the Restlet router and bind to the proper resources.
     */
    @Override
    public Restlet getRestlet(Context context) {
        Router router = new Router(context);

        // Add some pre-defined REST resources available in the floodlight framework

        // This resource will show the some summary stats on the controller
        router.attach("/controller/summary/json", ControllerSummaryResource.class);

        // This resource will show the list of modules loaded in the controller
        router.attach("/module/loaded/json", LoadedModuleLoaderResource.class);

        // This resource will show the list of switches connected to the controller
        router.attach("/controller/switches/json", ControllerSwitchesResource.class);

        return router;
    }
    @Override
    public String basePath() {
        // The root path for the resources
        return "/lb";
    }
}
```


Floodlight RESTful API – STEP 3

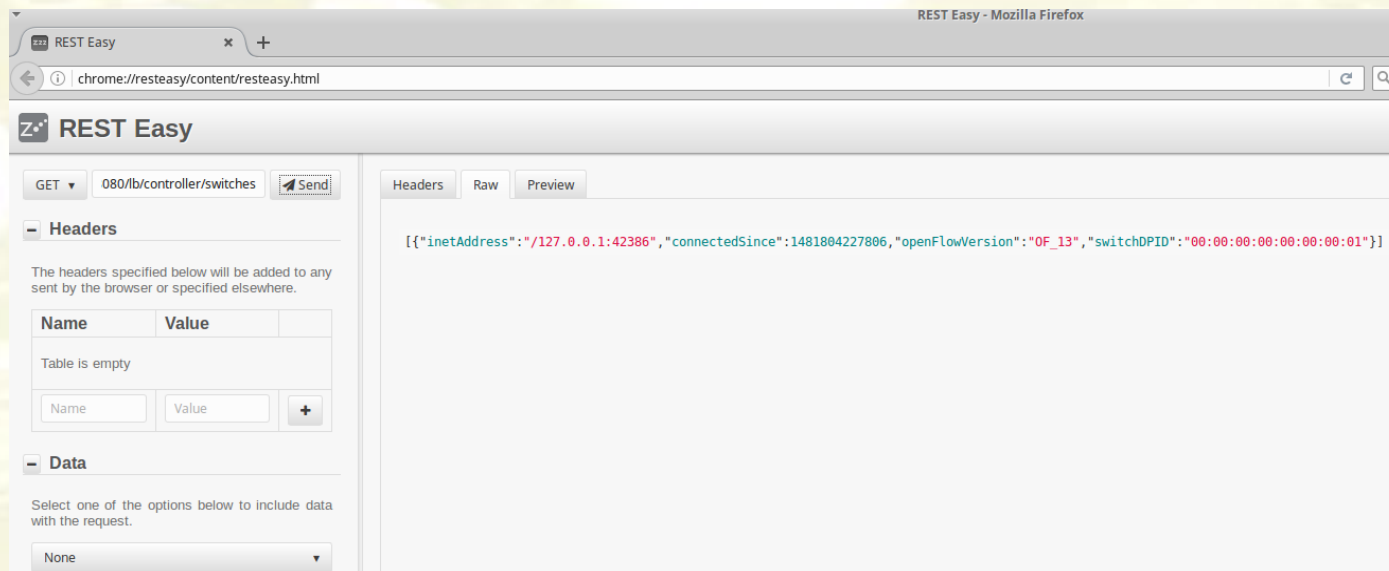
- Third step, add the REST interface at startup

```
@Override
public void startUp(FloodlightModuleContext context) throws FloodlightModuleException
{
    ...

    // Add as REST interface
    restApiService.addRestletRoutable(new LoadBalancerWebRoutable());
}
```

Floodlight RESTful API – TEST

- The module is now ready to expose some pre-defined floodlight resources, e.g. to show general statistics on the SDN network
- The REST interface can be tested through one of the REST add-ons for browsers, for example “REST Easy” or “RESTED” for Firefox
- The REST interface is exposed by floodlight on the port
- Test the resource <http://127.0.0.1:8080/lb/controller/switches/json> to get a list of the switches connected



Floodlight RESTful API – Custom res

- In order to add custom resources to your module additional class must be defined
- New resources can be defined only through external classes as this one for example that simply returns a custom JSON message:

```
/**
 * Test resource
 */

public class TestResource extends ServerResource {

    @Get("json")
    public Map<String, Object> Test() {

        Map<String, Object> info = new HashMap<String, Object>();

        info.put("name", "value");

        return info;

    }
}
```


Floodlight RESTful API – Custom res

- As external class, such custom resources can not access to internal module information, neither trigger internal operations
- In order to export functionalities and data to other classes the module must define and implement a public interface available to other module as follow:

```
// Service interface for the module  
// This interface will be use to interact with other modules  
// Export here all the methods of the class that are likely used by other modules  
  
public interface ILoadBalancerREST extends IFloodlightService {  
    // Method exposed by the module  
    // Method to retrieve the info on the real servers of the pool  
    public Map<String, Object> getServersInfo();  
    // Method to set the hardtimeout for load balancing  
    public void setHardTimeout(int newValue);  
}
```

Floodlight RESTful API – Custom res

- The module must include the interface through the following steps:
 1. Add the implementation of the interface:

```
public class LoadBalancerREST implements
    IOFMessageListener, IFloodlightModule, ILoadBalancerREST {
```

```
@Override
public Collection<Class<? extends IFloodlightService>> getModuleServices() {
    Collection<Class<? extends IFloodlightService>> l =
        new ArrayList<Class<? extends IFloodlightService>>();
    l.add(ILoadBalancerREST.class);
    return l;
}
@Override
public Map<Class<? extends IFloodlightService>, IFloodlightService> getServiceImpls()
{
    Map<Class<? extends IFloodlightService>, IFloodlightService> m =
        new HashMap<Class<? extends IFloodlightService>, IFloodlightService>();
    m.put(ILoadBalancerREST.class, this);
    return m;
}
```

Floodlight RESTful API – Custom res

- The module must implement the methods of the interface:

```
@Override
public Map<String, Object> getServersInfo(){
    Map<String, Object> info = new HashMap<String, Object>();
    for( int i = 0; i < SERVERS_MAC.length; i++){
        info.put( SERVERS_IP[i] , SERVERS_MAC[i]);
    }
    return info;
}

@Override
public void setHardTimeout(int newValue){
    HARD_TIMEOUT = (short) newValue;
    System.out.println("Timeout value changed to " + newValue + "\n");
}
```

Floodlight RESTful API – Custom res

- For each REST resource its implementation can invoke the methods of the public interface, e.g. a resource to retrieve the list of the servers in the pool

```
// Implementation of a resource to retrieve the list of the servers in the pool
public class GetServerInfo extends ServerResource {
    @Get("json")
    public Map<String, Object> Test() {
        ILoadBalancerREST lb =
            (ILoadBalancerREST)getContext().getAttributes()
                .get(ILoadBalancerREST.class.getCanonicalName());
        return lb.getServersInfo();
    }
}
```

Floodlight RESTful API – Custom res

- Resource to set the value for load balancing

```
public class ChangePeriod extends ServerResource {
    @Post
    public String store(String fmJson) {

        // Check if the payload is provided
        if(fmJson == null){
            return new String("No attributes");
        }

        // Parse the JSON input
        ObjectMapper mapper = new ObjectMapper();
        try {
            JsonNode root = mapper.readTree(fmJson);
            // Get the field hardtimeout
            int newValue = Integer.parseInt(root.get("hardtimeout").asText());
            ILoadBalancerREST lb = (ILoadBalancerREST)
                getContext().getAttributes()
                    .get(ILoadBalancerREST.class.getCanonicalName());
            lb.setHardTimeout(newValue);
        } catch (IOException e) {
            e.printStackTrace();
        }
        return new String("OK");
    }
}
```



Floodlight RESTful API – TEST

- Test the resource <http://127.0.0.1:8080/lb/timeout/json>
- The argument must be specified in JSON format in the POST payload as follow:

REST Easy

POST ▼

<http://127.0.0.1:8080/lb/timeout/json>

Send

+ Headers

- Data

Select one of the options below to include data with the request.

Custom ▼

Enter the data and its corresponding MIME type below.

application/json

```
{"hardtimeout": "30"}
```

+ Authentication

Headers Raw Preview

200 OK

Name	Value
Content-Length	2
Content-Type	application/json; charset=UTF-8
Date	Sat, 17 Dec 2016 11:36:03 GMT
Accept-Ranges	bytes
Server	Restlet-Framework/2.3.1
Vary	Accept-Charset, Accept-Encoding, Ac
Access-Control-Expose-Headers	Authorization, Link
Access-Control-Allow-Credentials	true
Access-Control-Allow-Methods	GET,POST,PUT,DELETE
Access-Control-Allow-Origin	*
Access-Control-Allow-Headers	*
Connection	keep-alive

References

- *Floodlight REST tutorial:*
<https://floodlight.atlassian.net/wiki/display/floodlightcontroller/How+to+add+a+REST+API+to+a+Module>
- RESTED Firefox extension:
<https://addons.mozilla.org/it/firefox/addon/rested/>