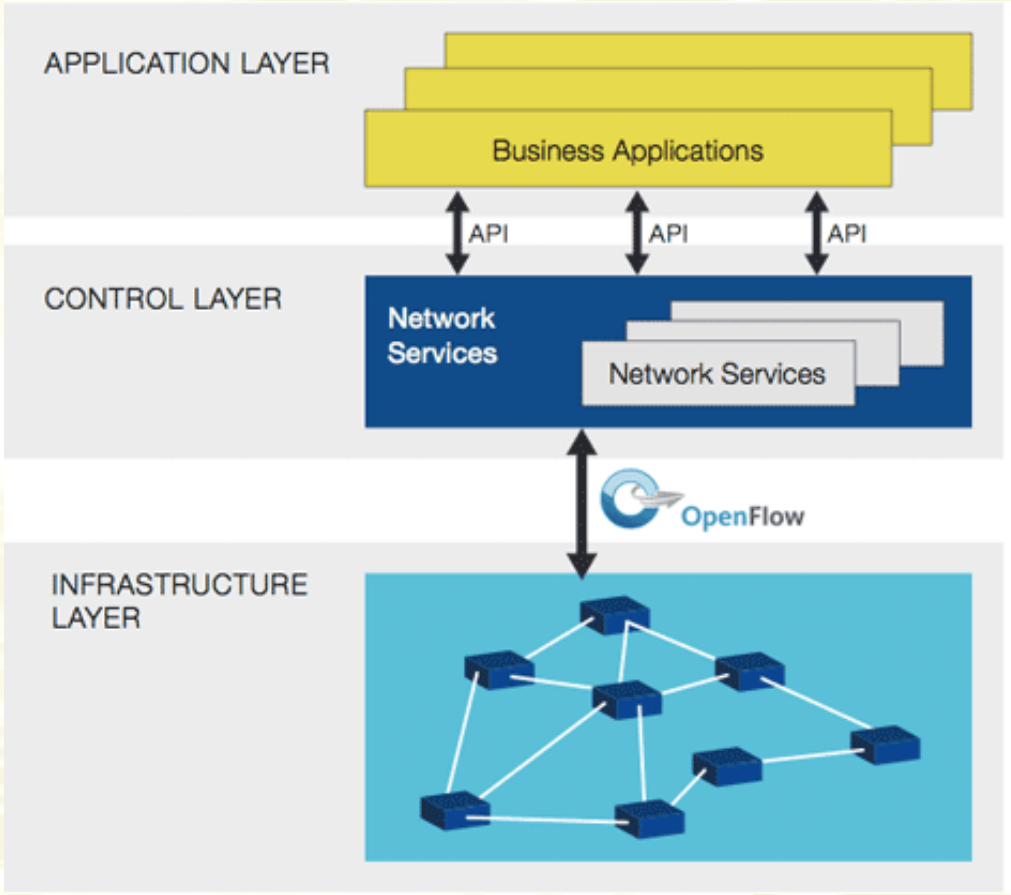
Floodlight RESTful interface

Carlo Vallati
Assistant Professor@ University of Pisa
c.vallati@iet.unipi.it

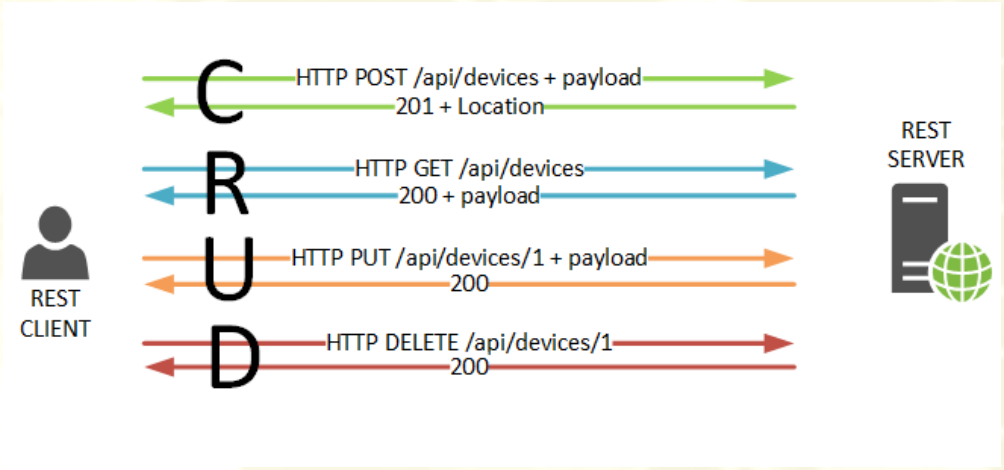
SDN Northbound interface

- 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

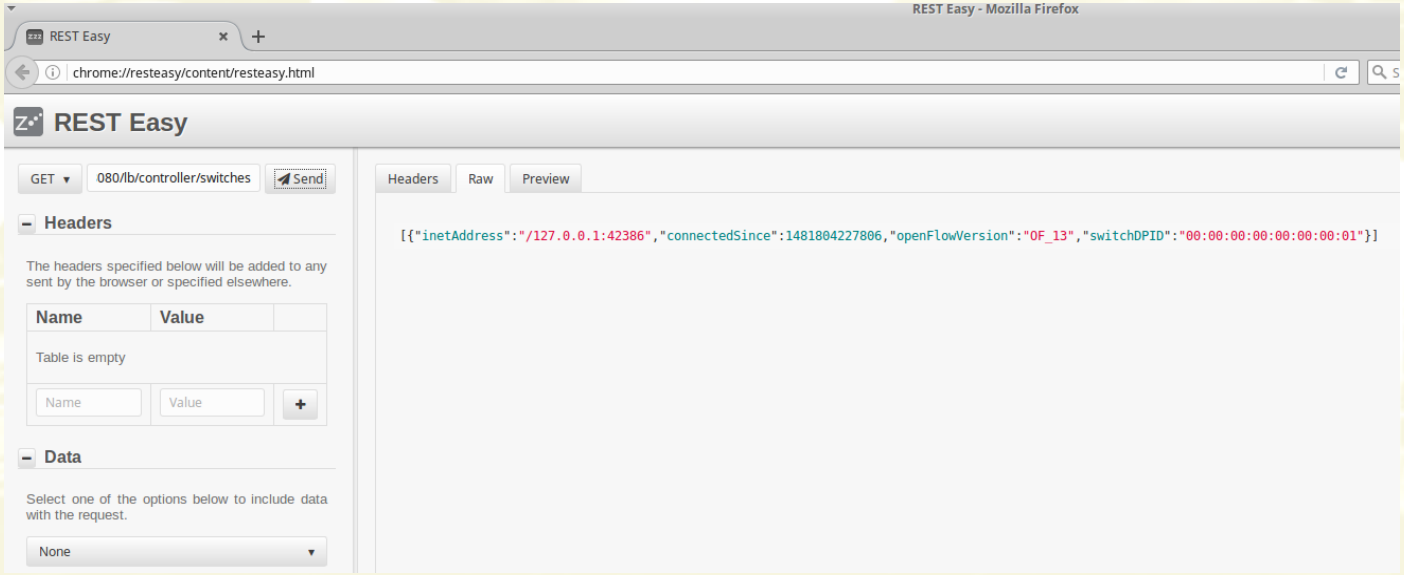
- Third step, add the REST interface at startup

```
@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” 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) {
     // 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");
  }
}
```

References

- *Floodlight REST tutorial:*
  https://floodlight.atlassian.net/wiki/display/floodlightcontroller/How+to+add+a+REST+API+to+a+Module