NUBOMEDIA: The First Open Source WebRTC PaaS

ACM Multimedia 2017 – Open Source Competition
25th October 2017 (Mountain View, CA, USA)

Boni García
Universidad Rey Juan Carlos (Spain)
boni.garcia@urjc.es

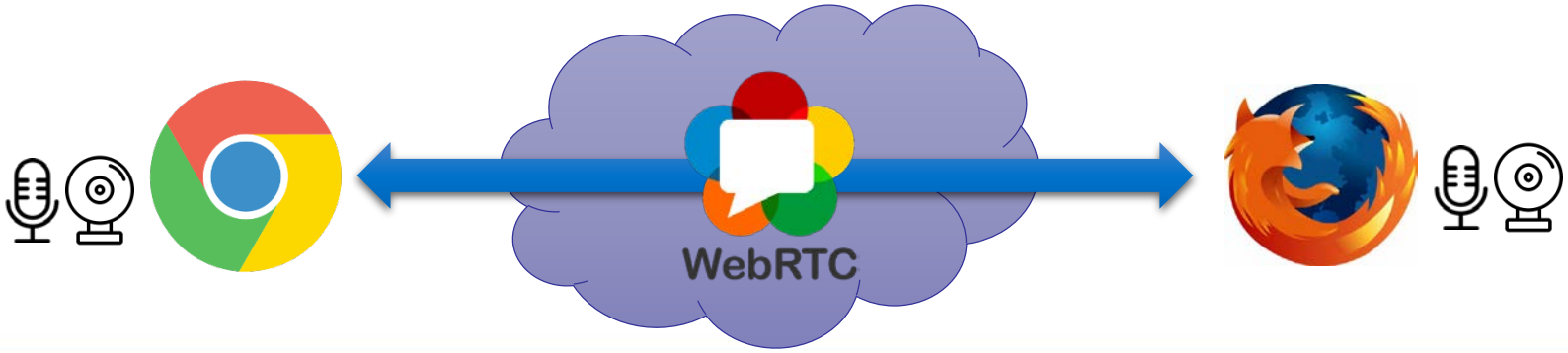
Table of contents

Table of contents

1. Introduction

Context

- **WebRTC** is the umbrella term for a number of technologies aimed to bring high-quality *Real Time Communications* to the Web
  - W3C (JavaScript APIs): *getUserMedia*, *PeerConnection*, *DataChannels*
  - IETF (protocol stack): ICE, SDP, TURN, STUN, …



1. Introduction

Problem at hand

- Multimedia applications and services are becoming the main force of the Internet
  - For example WebRTC, but also Video Content Analysis (VCA) or Augmented Reality (AR)
- Deploying these types of technologies in common clouds infrastructures is complex and cannot be achieved easily

1. Introduction

Our proposal: NUBOMEDIA

- NUBOMEDIA is an open source **PaaS** (Platform as a Service)
- NUBOMEDIA exposes to developers the ability of **deploying and leveraging** applications with media capabilities:
  - WebRTC, media recording, group communications, VCA, AR, etc.

1. Introduction

Our proposal: NUBOMEDIA

- NUBOMEDIA has been conceived for simplifying the way developers use to deal with multimedia applications
  - From the developer's perspective, NUBOMEDIA capabilities are accessed through a set of **APIs and SDKs**
  - NUBOMEDIA applications can be deployed using the NUBOMEDIA **PaaS Manager**

1. Introduction

References

- Home page

  http://www.nubomedia.eu/

- Developers guide

  http://nubomedia.readthedocs.io/

- GitHub organization

  https://github.com/nubomedia/

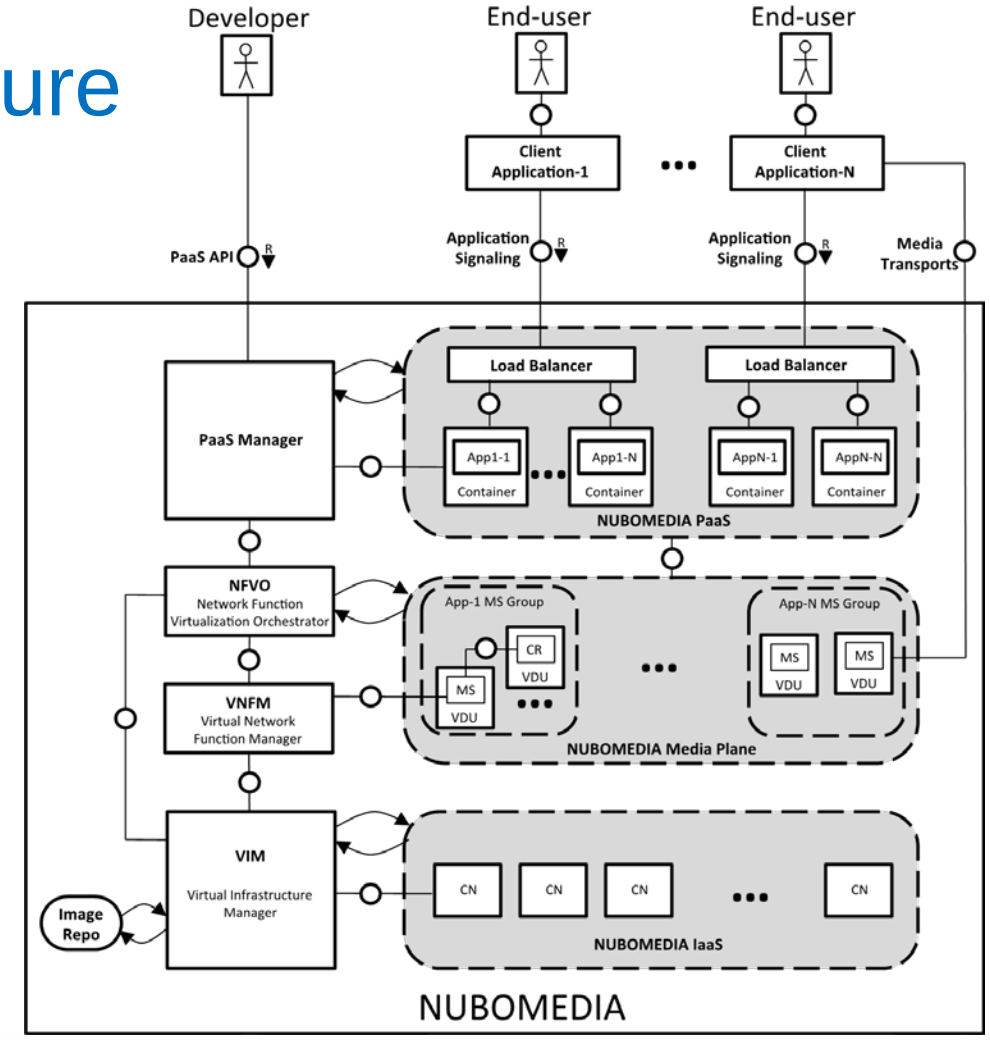
- Support for developers

  https://groups.google.com/forum/#!forum/nubomedia-dev

Table of contents

2. NUBOMEDIA overview

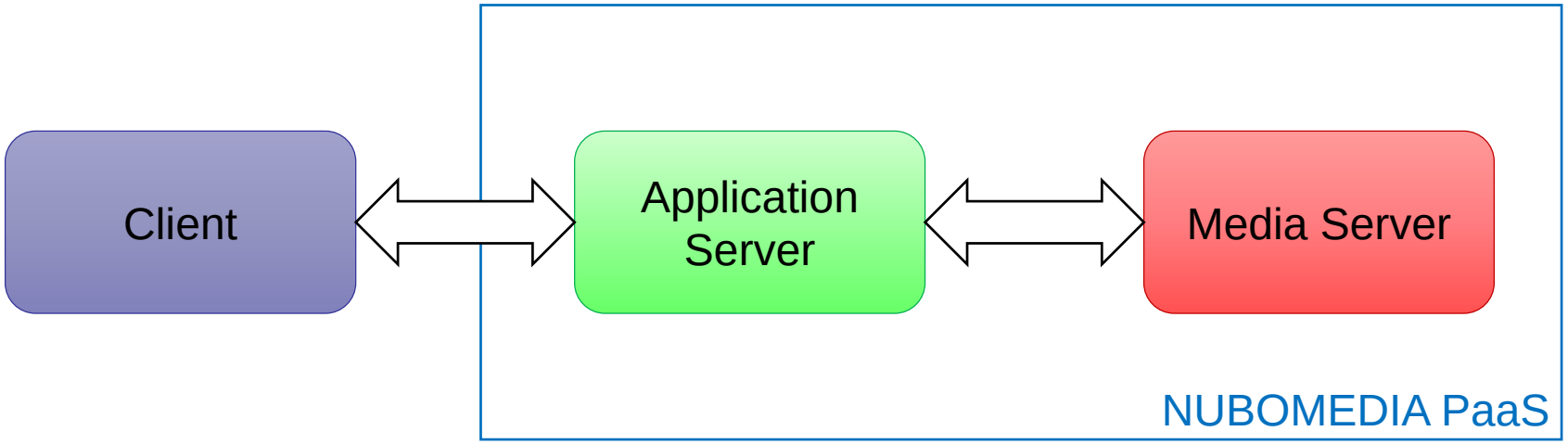
Architecture



2. NUBOMEDIA overview

Architecture

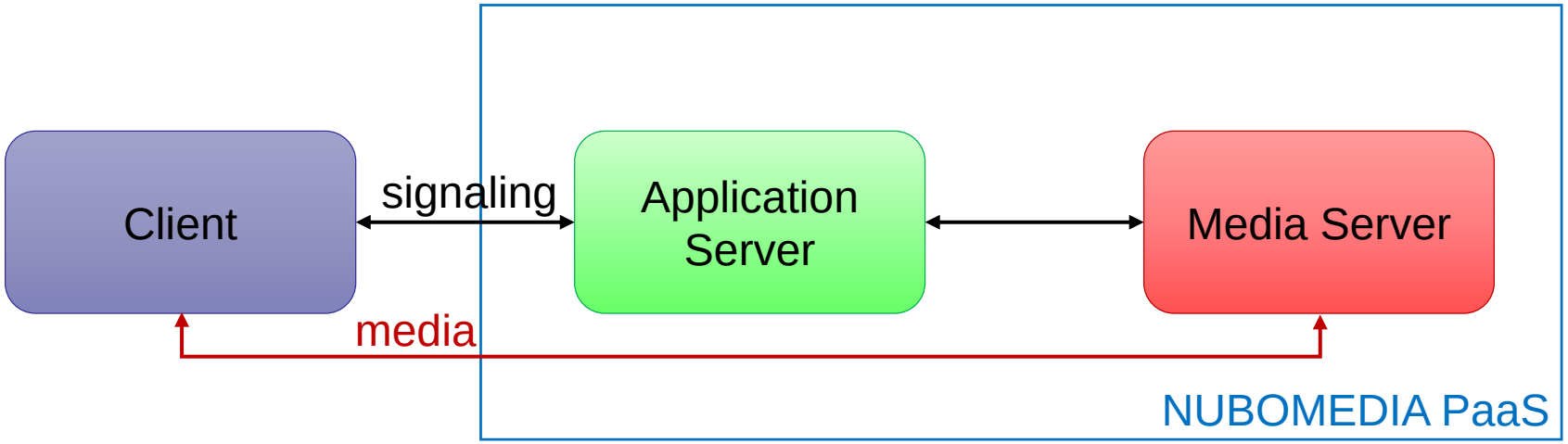
- A NUBOMEDIA application follows a three-tier model (inspired in the Web)



2. NUBOMEDIA overview

Architecture

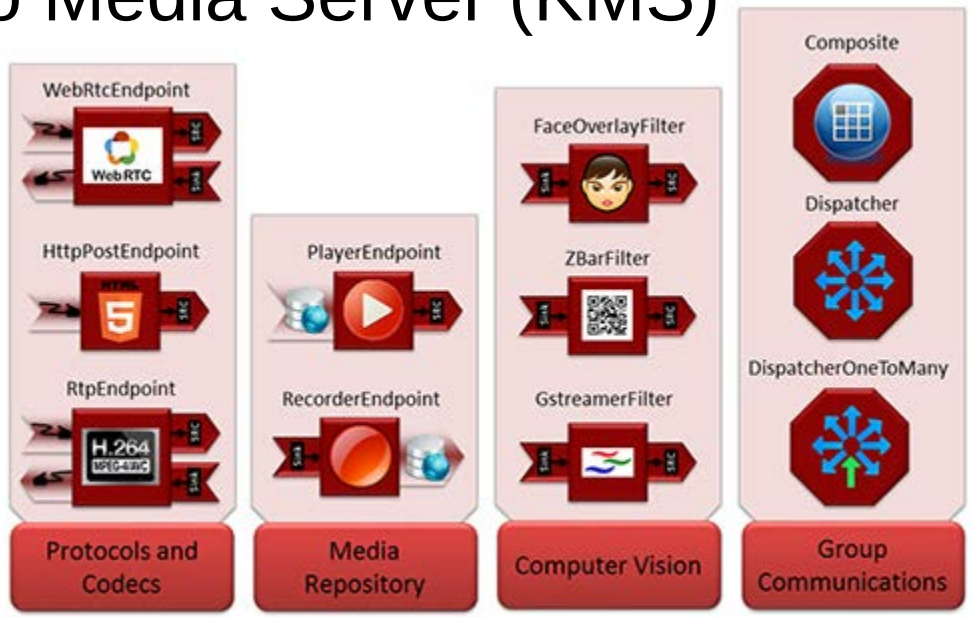
- Like every application with media capabilities, it is important to distinguish between the **media** and **signaling** plane



2. NUBOMEDIA overview

Media API

- NUBOMEDIA Media API allows to Java developers consume the media services provided by Kurento Media Server (KMS)
- Concepts:
  - Media Element
  - Media Pipeline



2. NUBOMEDIA overview

Media API

- KMS instances are provided elastically by NUBOMEDIA
  - The number of available KMS instances depends on the PaaS Manager configuration
- Each KMS has a total amount of available points to create Media Pipelines and Media Elements
  - The total points depends on the number of VCPUs of the KMS
  - The type of the instance can be selected on the PaaS Manager configuration

Instance type	# VCPUs	KMS points
Medium	2	200
Large	4	400

2. NUBOMEDIA overview

Media API

- Each KMS is controlled by an instance of `KurentoClient`

```
<dependency>
    <groupId>org.kurento</groupId>
    <artifactId>kurento-client</artifactId>
</dependency>

<dependency>
    <groupId>de.fhg.fokus.nubomedia</groupId>
    <artifactId>nubomedia-media-client</artifactId>
</dependency>
```

Dependencies (Maven)

- With each media session an instance of `KurentoClient` should be created

```
KurentoClient kurentoClient = KurentoClient.create();
```

- The number of available points per KMS decreases with each Media Element creation (scaling in/out)

2. NUBOMEDIA overview

Media API

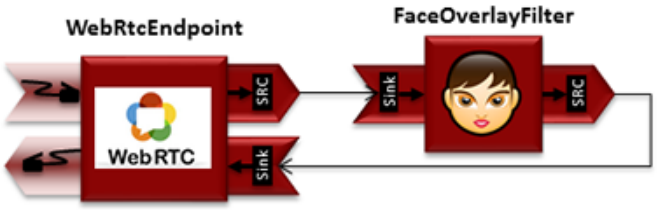
- Example: nubomedia-magic-mirror

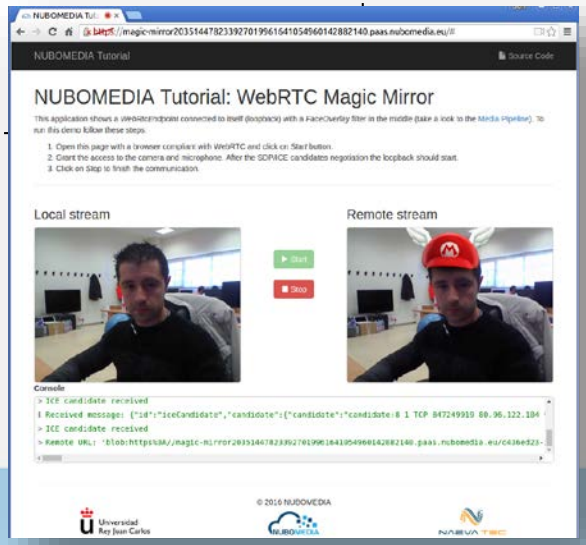
```
 // One KurentoClient instance per session
KurentoClient kurentoClient = KurentoClient.create();

// Media logic (pipeline and media elements connectivity)
MediaPipeline mediaPipeline = kurentoClient.createMediaPipeline();

WebRtcEndpoint webRtcEndpoint = new WebRtcEndpoint.Builder(mediaPipeline).build();
FaceOverlayFilter faceOverlayFilter = new FaceOverlayFilter.Builder(mediaPipeline).build();
faceOverlayFilter.setOverlayedImage("http://files.kurento.org/img/mario-wings.png", -0.35F,
        -1.2F, 1.6F, 1.6F);

webRtcEndpoint.connect(faceOverlayFilter);
faceOverlayFilter.connect(webRtcEndpoint);
```





2. NUBOMEDIA overview

Room API

- The Room API is a high-level communications library that provides capabilities for managing multi-conference WebRTC sessions. It has the following components:
  - Room Server: a container-based implementation of the server, uses JSON-RPC over WebSockets for communications with the clients
  - Room JavaScript Client: module implementing a Room client for Web applications
  - Room Client: a client library for Java web applications or Android clients

2. NUBOMEDIA overview

Room API

- Example: nubomedia-room-tutorial

Server-side: `KurentoClient` management

```
<dependency>
   <groupId>org.kurento</groupId>
   <artifactId>kurento-room-server</artifactId>
</dependency>
<dependency>
   <groupId>org.kurento</groupId>
   <artifactId>kurento-room-client-js</artifactId>
</dependency>
```

Dependencies (Maven)

```
public class SingleKmsManager extends KmsManager {

  @Override
  public KurentoClient getKurentoClient(KurentoClientSessionInfo sessionInfo) throws RoomException {
    return KurentoClient.create();
  }

  @Override
  public boolean destroyWhenUnused() {
    return true;
  }

}
```

2. NUBOMEDIA overview

Room API

- Example: nubomedia-room-tutorial

Client-side room management

```
var kurento = KurentoRoom(wsUri, function (error, kurento) {
   if (error) return console.log(error);

   room = kurento.Room({
      room: $scope.roomName,
      user: $scope.userName,
      updateSpeakerInterval: $scope.updateSpeakerInterval,
      thresholdSpeaker: $scope.thresholdSpeaker
    });

   var localStream = kurento.Stream(room, {audio: true,  video: true, data: true});

   localStream.addEventListener("access-accepted", function () {
      room.addEventListener("room-connected", function (roomEvent) {
      var streams = roomEvent.streams;
      localStream.publish();
      ServiceRoom.setLocalStream(localStream.getWebRtcPeer());
      for (var i = 0; i < streams.length; i++) {
         ServiceParticipant.addParticipant(streams[i]);
      }
    });

    // ...
});
```

2. NUBOMEDIA overview

Room API

- Example: nubomedia-room-tutorial

2. NUBOMEDIA overview

PaaS Manager

- NUBOMEDIA PaaS manager which controls the way in which the NUBOMEDIA applications are built and deployed
- Internally, the NUBOMEDIA PaaS uses **Docker containers** to deploy applications
- We need to include a **Dockerfile** in GitHub repository to be deployed on NUBOMEDIA

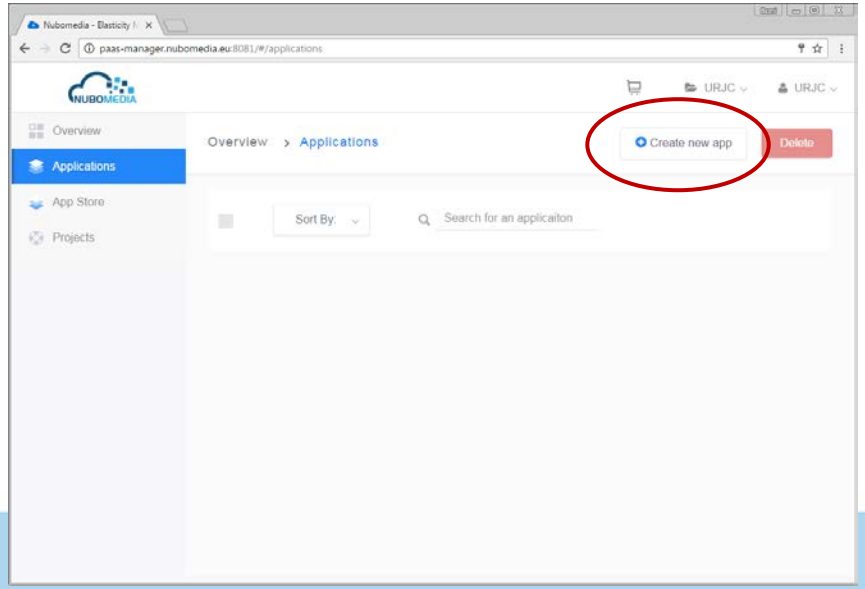
```
FROM nubomedia/apps-baseimage:src
MAINTAINER Nubomedia
ADD . /home/nubomedia
ENTRYPOINT cd /home/nubomedia && mvn spring-boot:run
```

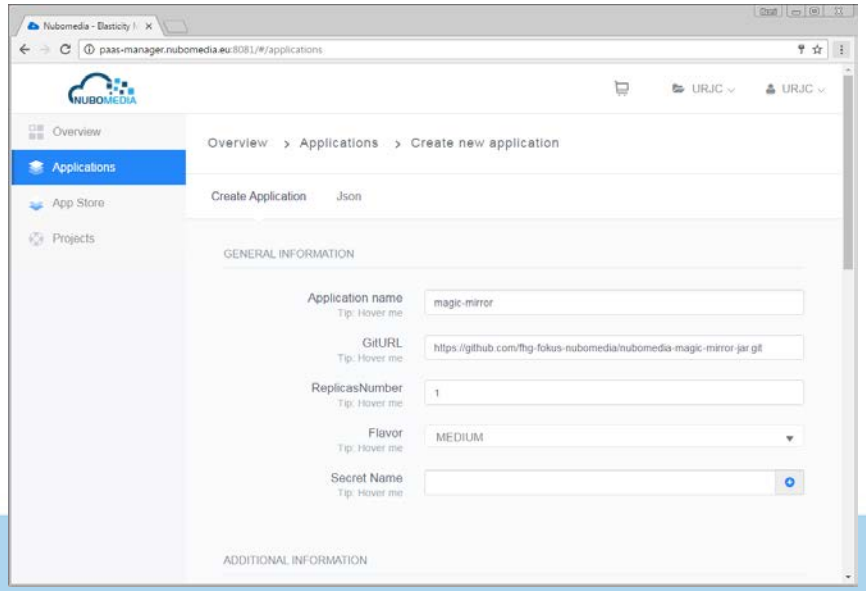
https://docs.docker.com/engine/reference/builder/

2. NUBOMEDIA overview

PaaS Manager

- The capabilities provided by the Paas Manager can be used by developers using the **PaaS GUI**
- NUBOMEDIA apps are deployed using GitHub repositories and a set of configuration parameters





2. NUBOMEDIA overview

PaaS Manager

- Most important configuration values:

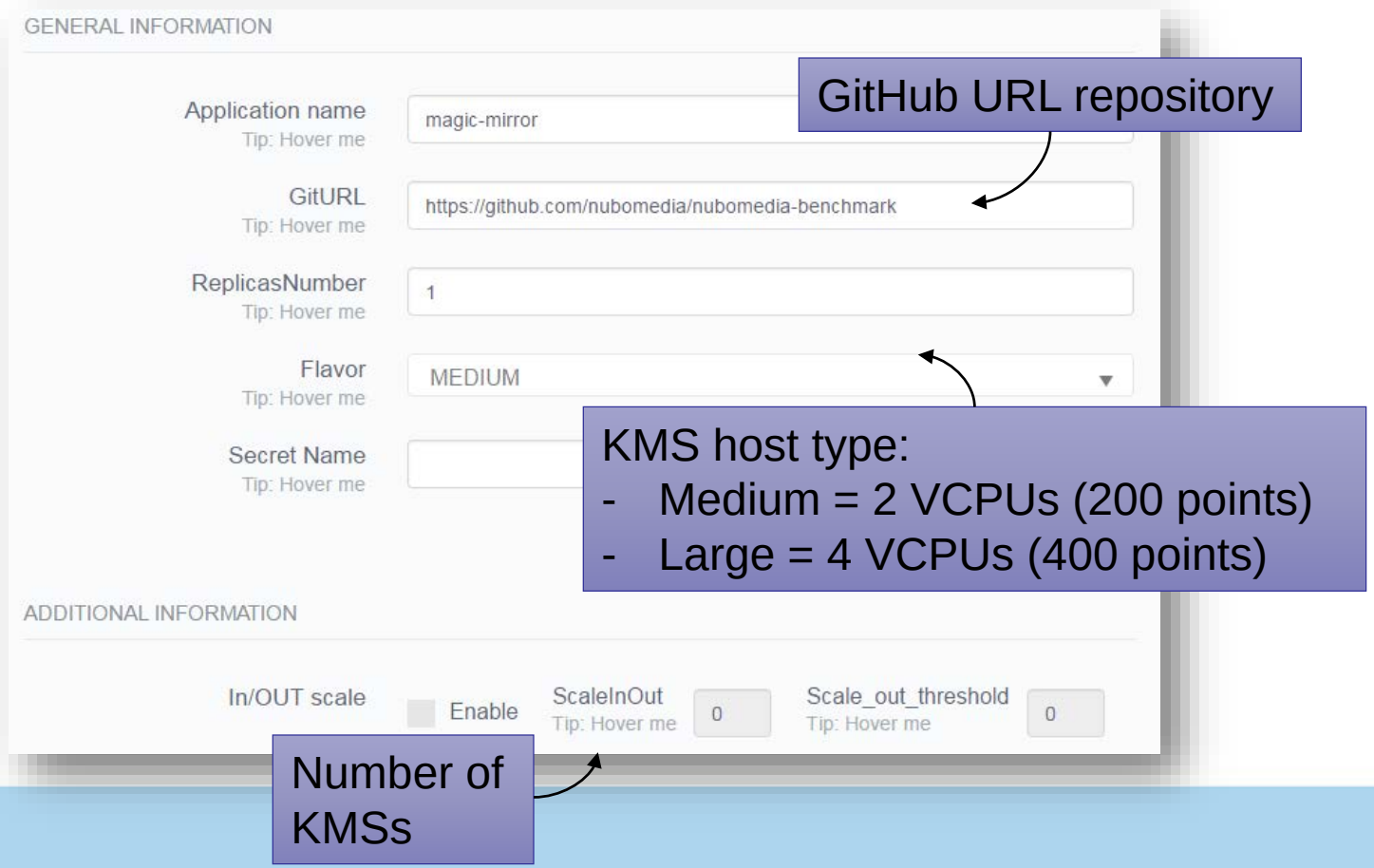


Table of contents

Table of contents

4. Conclusions

- NUBOMEDIA is a PaaS platform enabling the convergence of WebRTC and advanced media processing
- It can be used by developers for saving tons of effort when creating applications with advance media capabilities
- Possible improvement: scheduling and placement algorithms for sessions based on policies beyond the points mechanisms

Thank you!
QA

Boni García
Universidad Rey Juan Carlos (Spain)
boni.garcia@urjc.es