# Upgrade of the CERN RADE Framework Architecture
## Using RabbitMQ and MQTT

M. K. Miskowiec, O. O. Andreassen, F. Marazita
CERN, Geneva, Switzerland

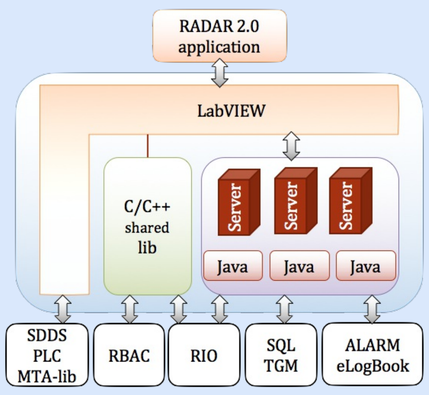
ICALEPCS2017
Barcelona · Spain, October 8-13 · Palau de Congressos de Catalunya

ABSTRACT

AMQP (Advanced Message Queuing Protocol) was originally developed for the finance community as an open way to communicate the vastly increasing over-the-counter trace, risk and clearing market data, without the need for a proprietary protocol and expensive license. In this paper, we explore the possibility to use AMQP with MQTT (Message Queue Telemetry Transport) extensions in a cross platform, cross language environment, where the communication bus becomes an extendible framework in which simple/thin software clients can leverage the many expert libraries at CERN.

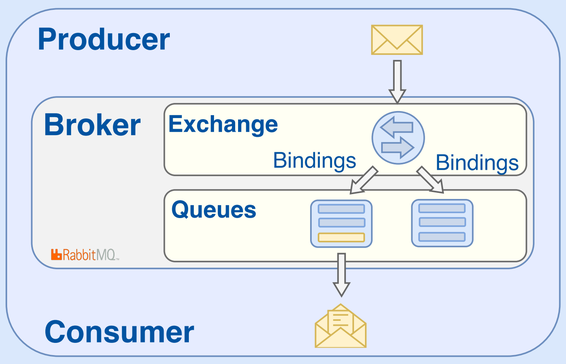
## BACKGROUND

### The RADE Framework




- Interface LabVIEW based equipment and software with CERN technical infrastructure
- Distributed architecture with several application servers hosting analysis libraries and dedicated communication

### RabbitMQ




- Open source, lightweight message broker
- Supports various communication channels
- Data shared using protocols like AMQP, MQTT
- Benefits: load balancing, job distribution, cross-communication, cross-platform

### AMQP and MQTT Protocols

AMQP Advanced Message Queuing Protocol

- Openly published wire specification for asynchronous messaging
- Standard protocol for message-oriented middleware

MQTT.ORG

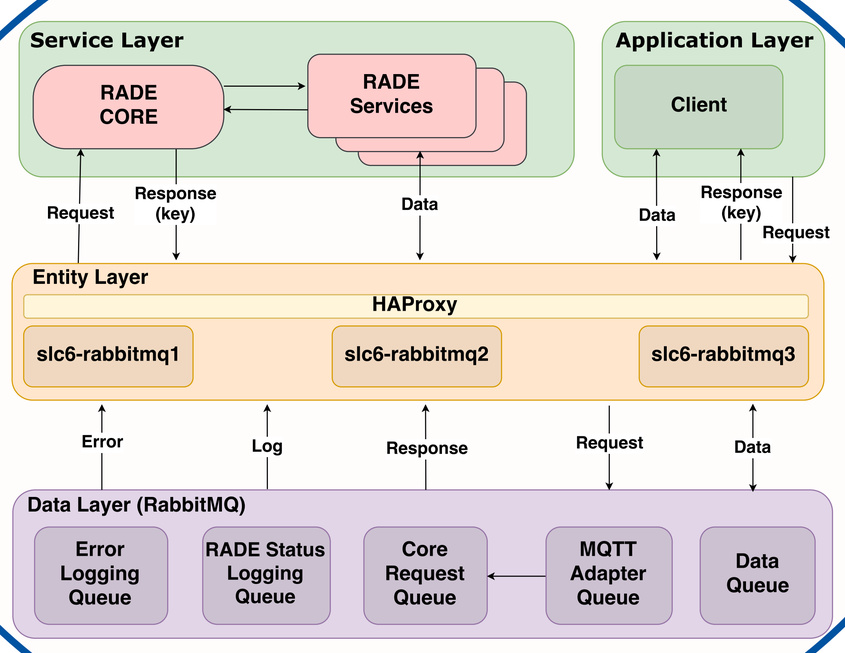
- Machine-to-machine connectivity protocol
- Lightweight messaging transport
- Used in industry for endpoint communication

## SOFTWARE ARCHITECTURE

### Service Layer
The RADE CORE Service is a generic Java based virtual class that extends all the communication layers needed to connect to the CERN technical infrastructure.

### Data Layer
The data layer contains five main queues:

- Error queue
- RADE Server status log queue
- Core request queue
- MQTT adapter queue
- Data queue




### Application Layer
Clients from the application layer communicate with the RADE CORE service via the entity layer.

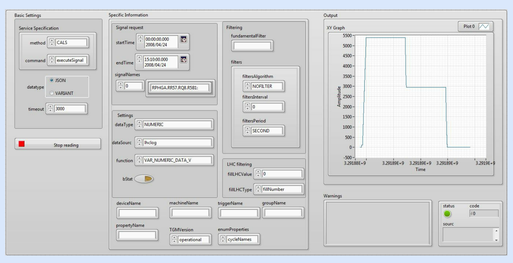
### Entity Layer
The entity layer proxies' data to a free broker using a designated routing key.

### The new system architecture:

- The service layer
- The application layer
- The entity layer
- The data layer

## WORKFLOW

### LabVIEW Client



In the test system, all LabVIEW clients are connected and send their request to dedicated broker using the MQTT protocol.

MQTT

### RabbitMQ Broker

Through the Broker the request is sent to an appropriate service executed depending on the request message payload.

AMQP

### RADE Java Services

The requested information is sent back to the broker using AMQP protocol, and then relayed to the requesting client.

## CONCLUSION

- Improved scalability, redundancy, performance and development flexibility for our applications.
- Lightweight, open source protocols provide cross platform and cross language communication.
- Cluster based backend such as RabbitMQ gives us a safer and more robust architecture.
- Moving forward towards more standardized and efficient applications with smaller footprints.