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# Hierarchical Orchestration of End-to-End Networks

**CONNECT | Trinity College Dublin**

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WInnComm Europe

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**ORCHESTRATION AND RECONFIGURATION CONTROL ARCHITECTURE**

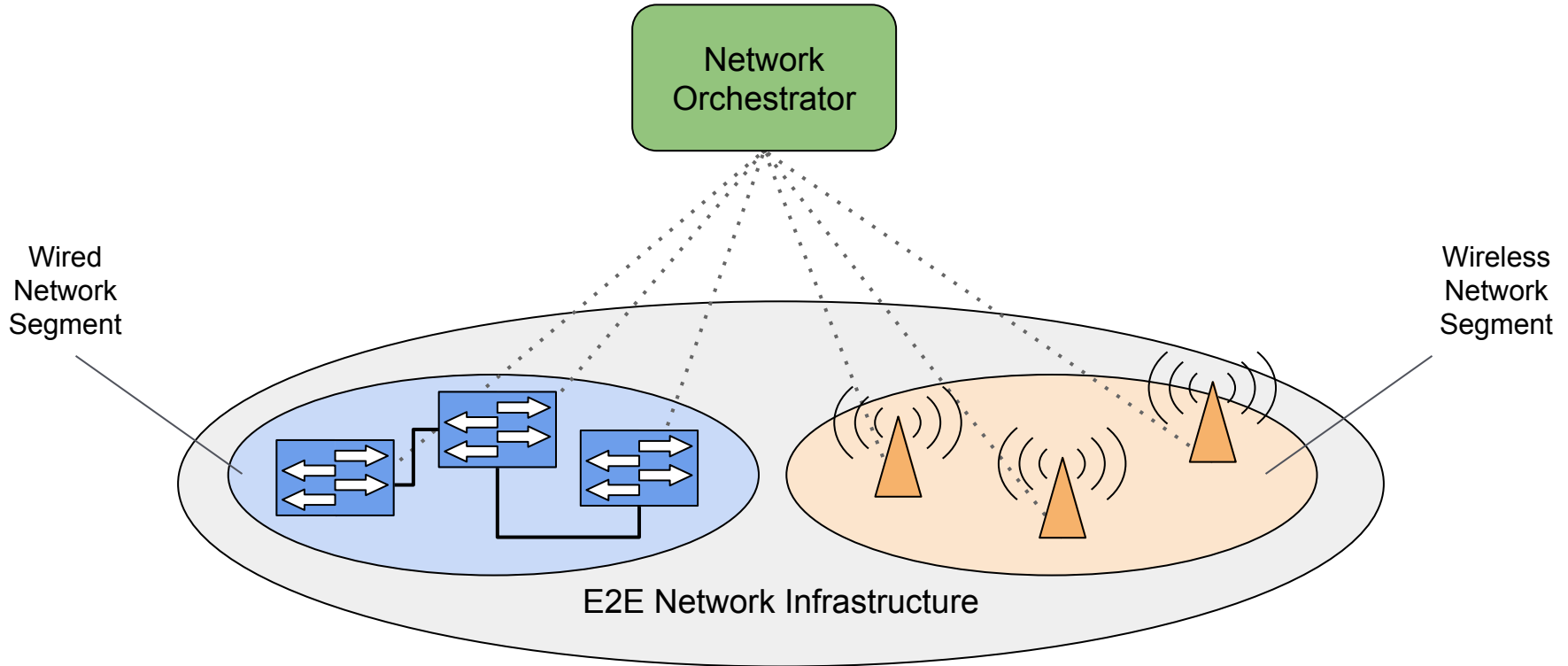
# Outline

1. Problem Definition
2. RAN as a Service Challenges
3. Experimental Results
4. Conclusions

# 1

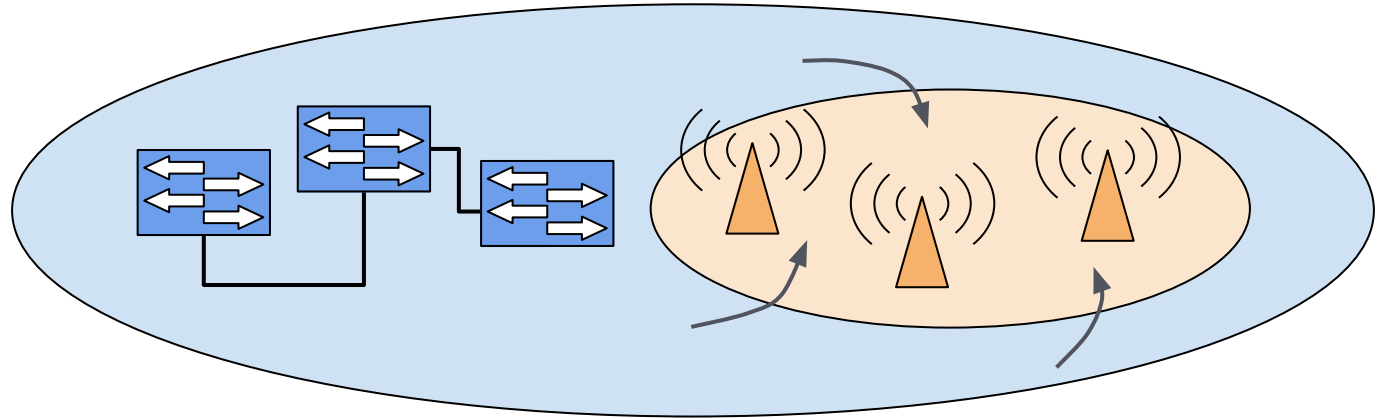
## Problem Definition

# End-to-End Network Orchestration



# Current Approaches

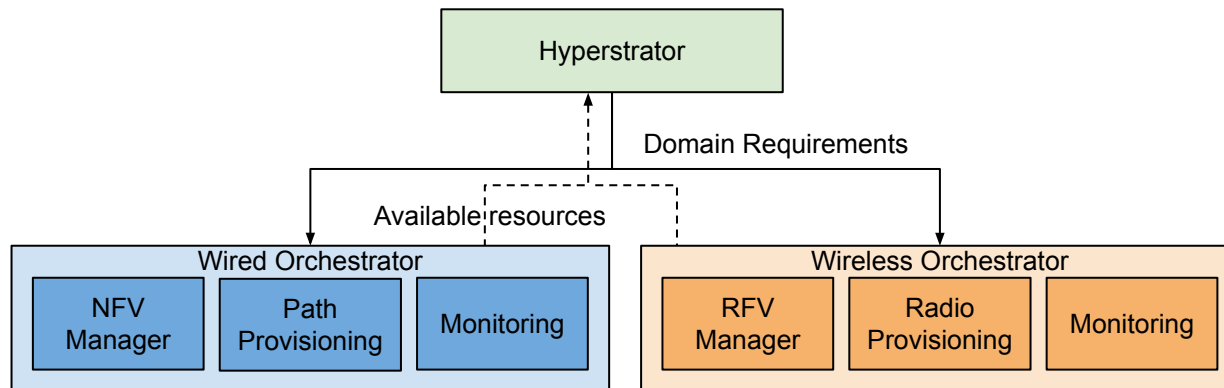
- OpenStack
- OSM
- OPNFV
- M-CORD



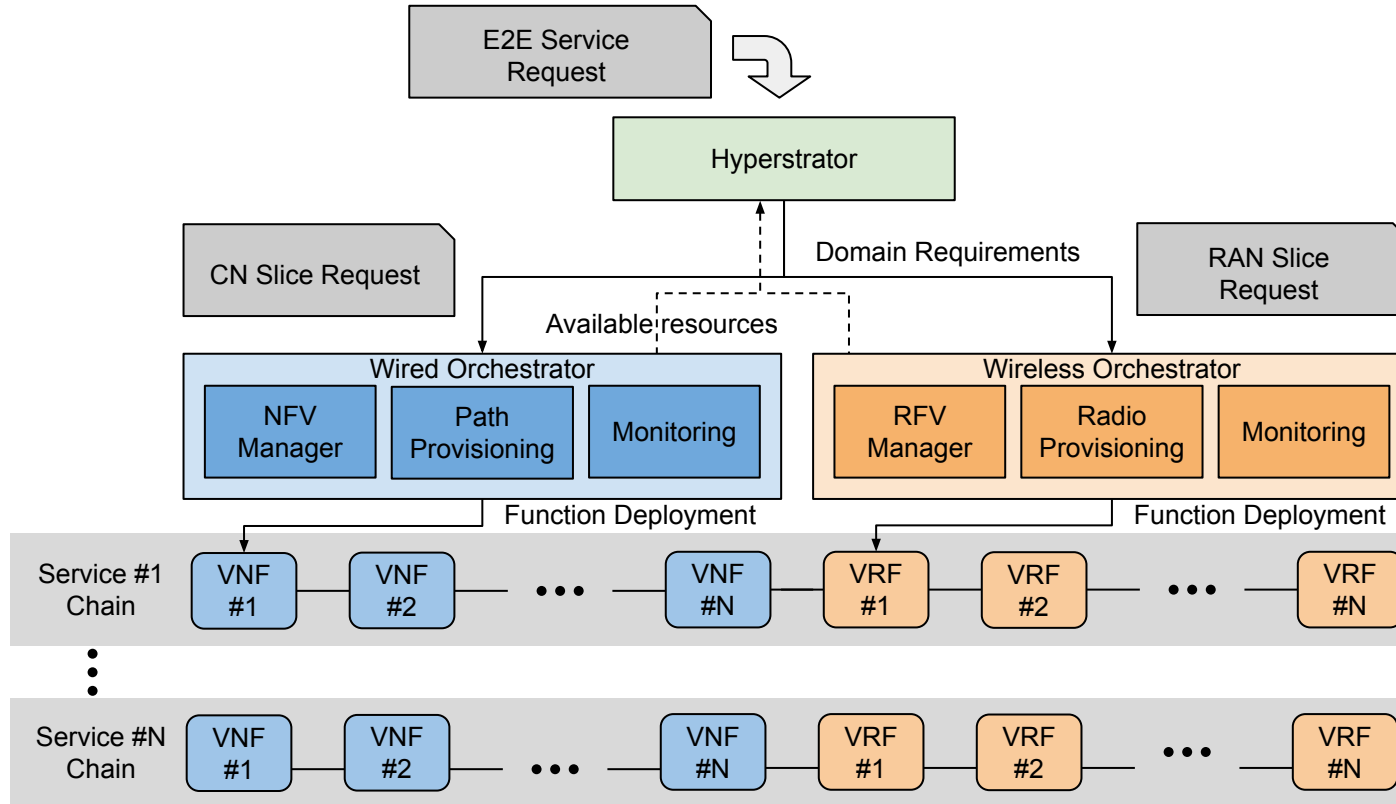
# Problems

- Centralised **one-size-fits-all** management
- **Oversimplification** of the wireless network management
- Do not support or consider **RAN/radio slicing**
- Operating in different **timescales**
- Need for cohesive **resource allocation** across RAN and CN

# Hierarchical Orchestration Scheme

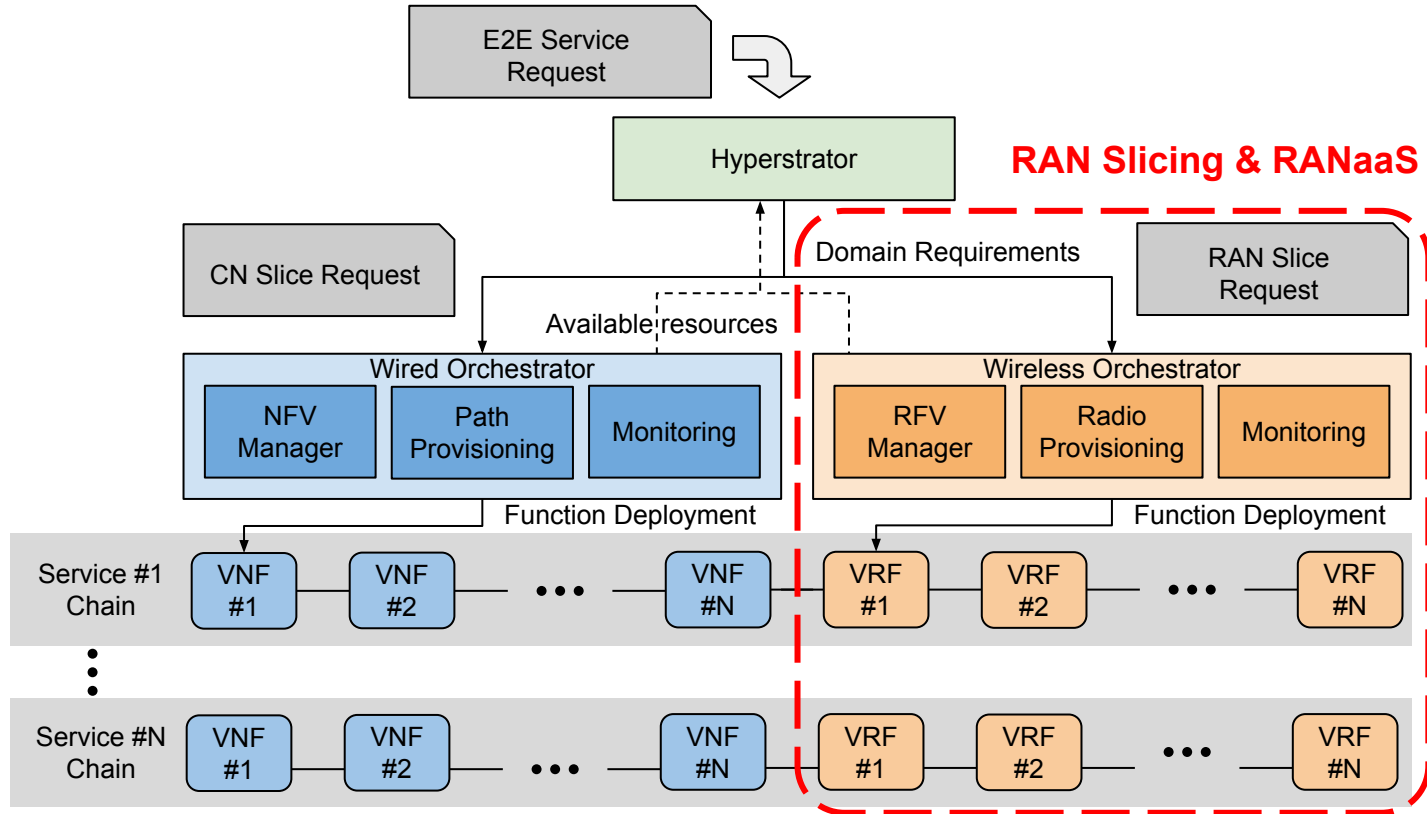


# Hierarchical Orchestration Scheme





# Hierarchical Orchestration Scheme



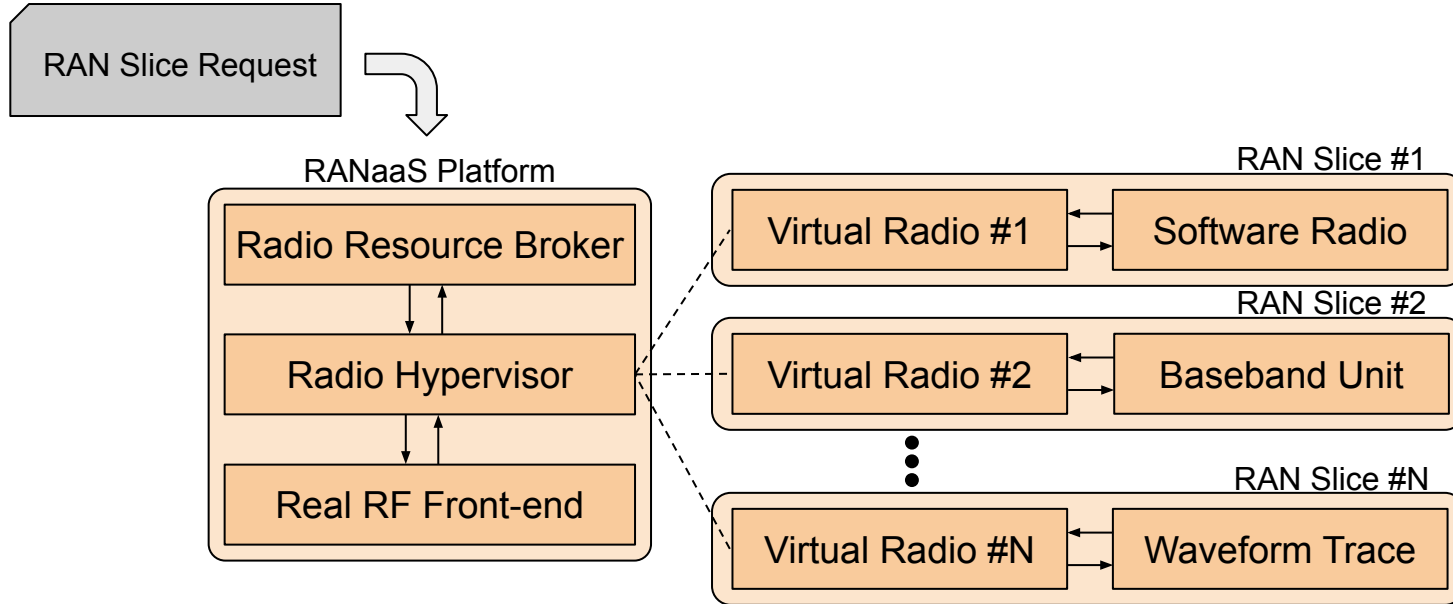
# Our Contribution

- Creation of RAN slices **as a service**
- Supporting RAN slices with **different technologies**
- RAN Slices isolated in **spectrum** and **performance**
- Integration with **higher-layers** of the stack

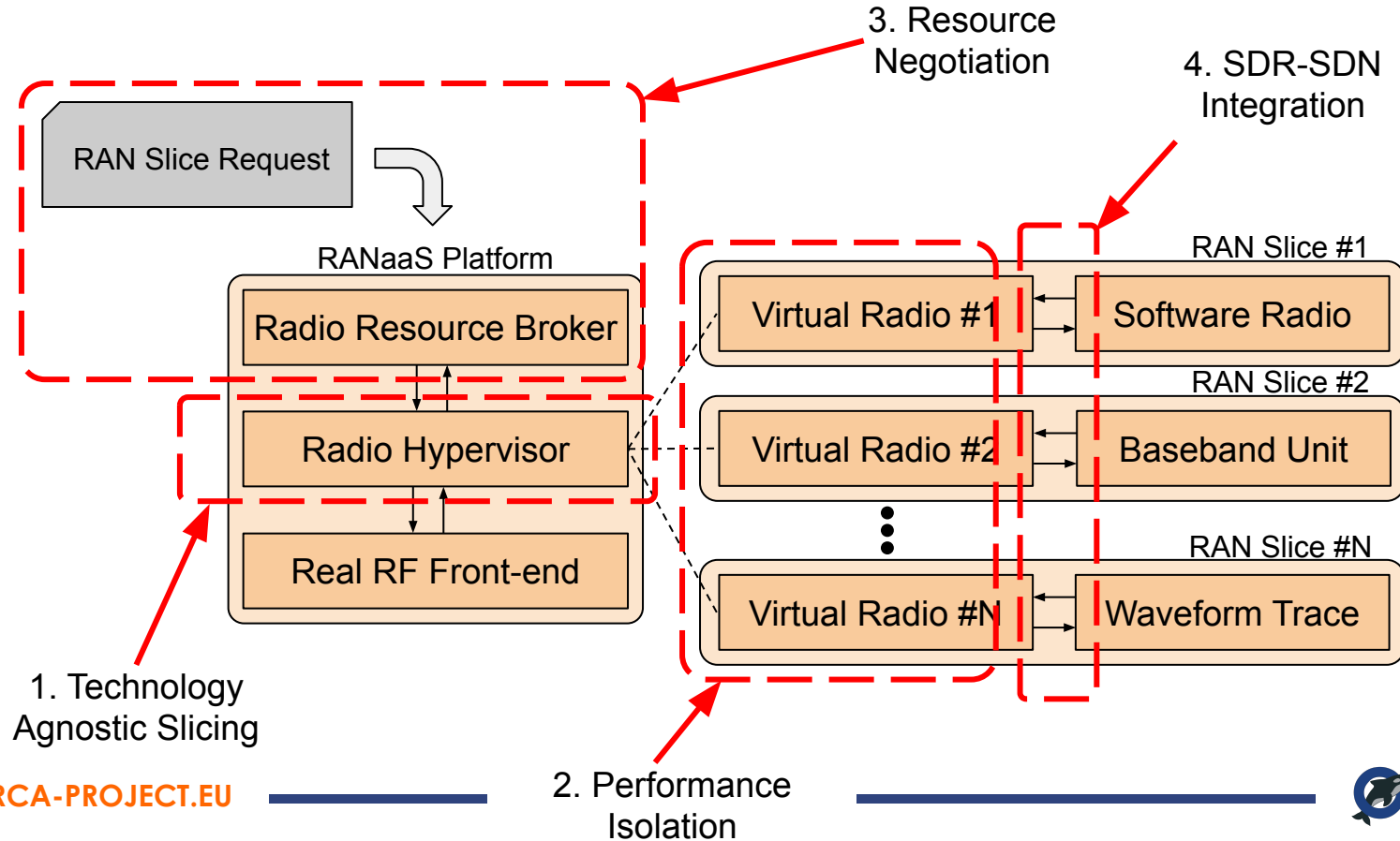
# 2

## RAN as a Service Challenges

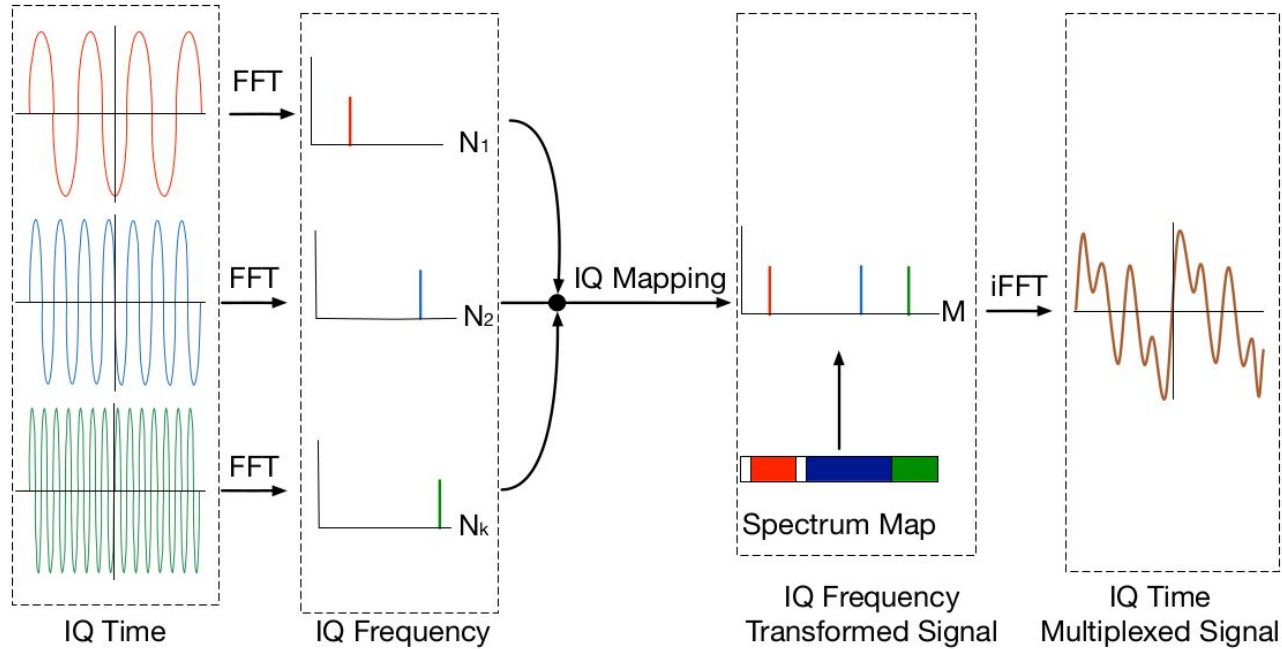
# RAN Slicing



# RAN Slicing Challenges

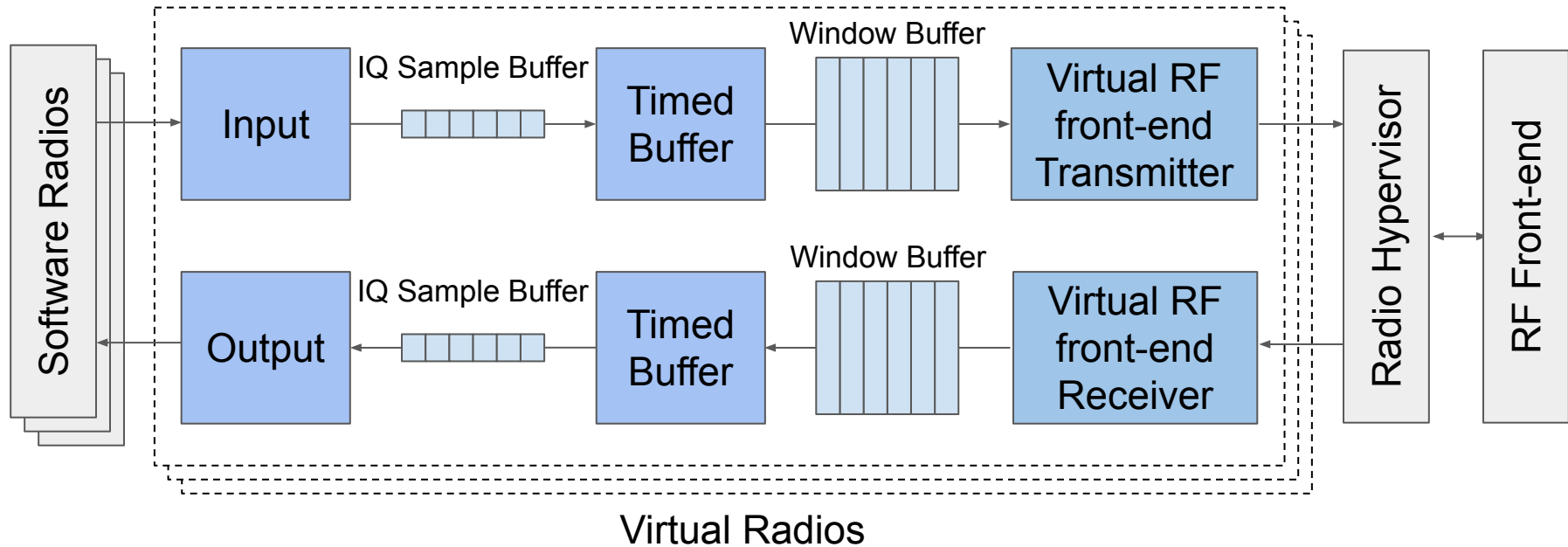


# 1. Technology Agnostic Radio Slicing



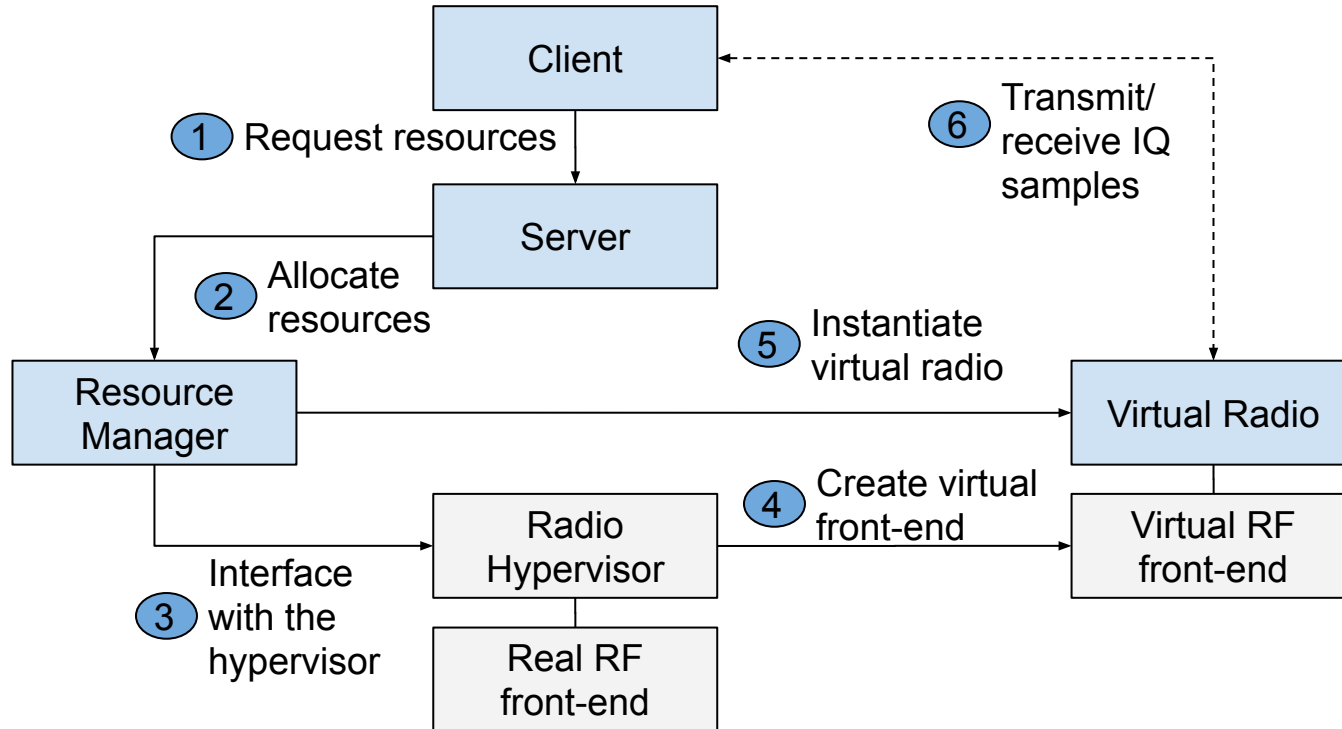
- FFT-Based Technology Agnostic Radio Hypervisor

## 2. Radio Performance Isolation



- Computational Isolation and Multiplexing Padding

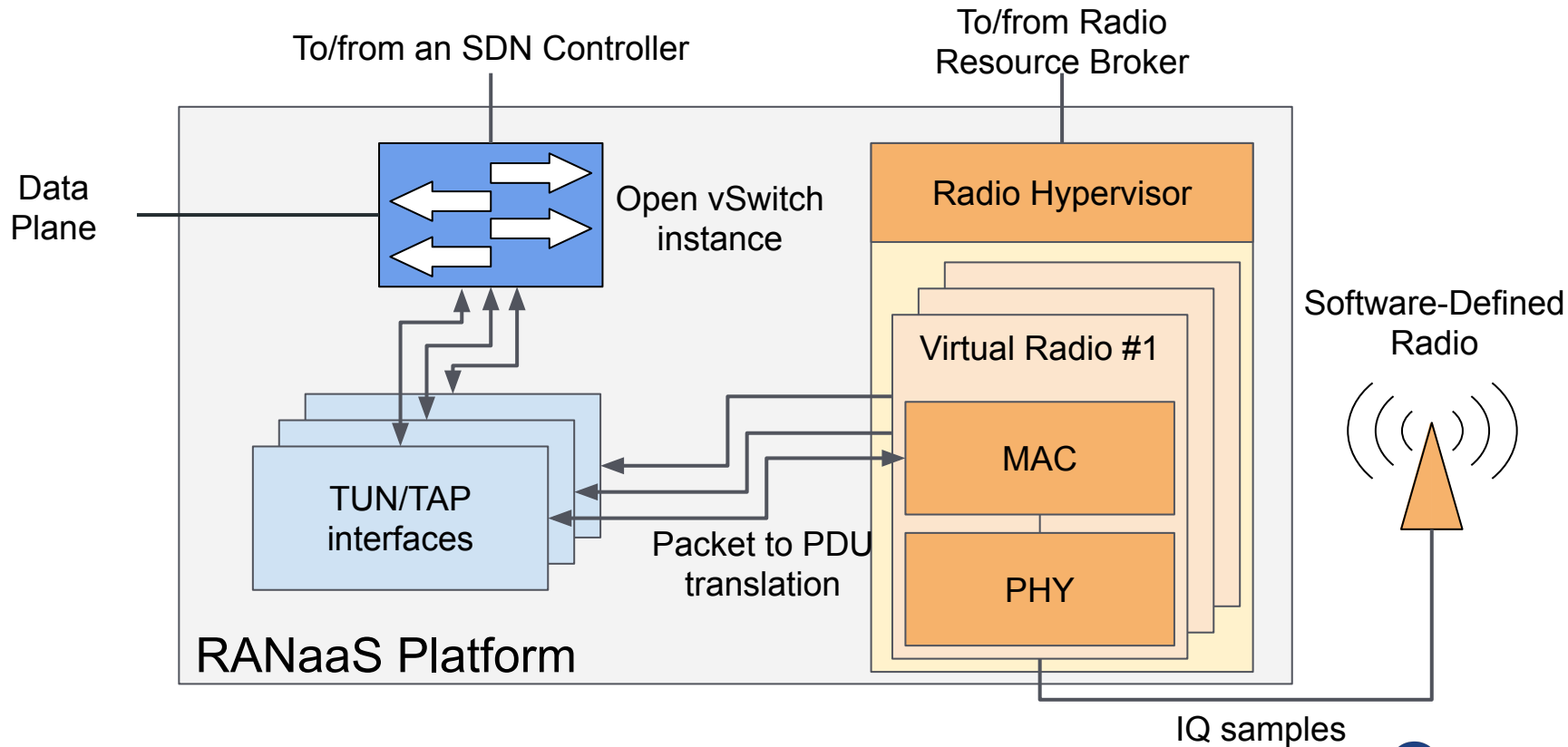
# 3. Radio Resource Negotiation



- ZMQ-based Messaging Radio Resource Broker



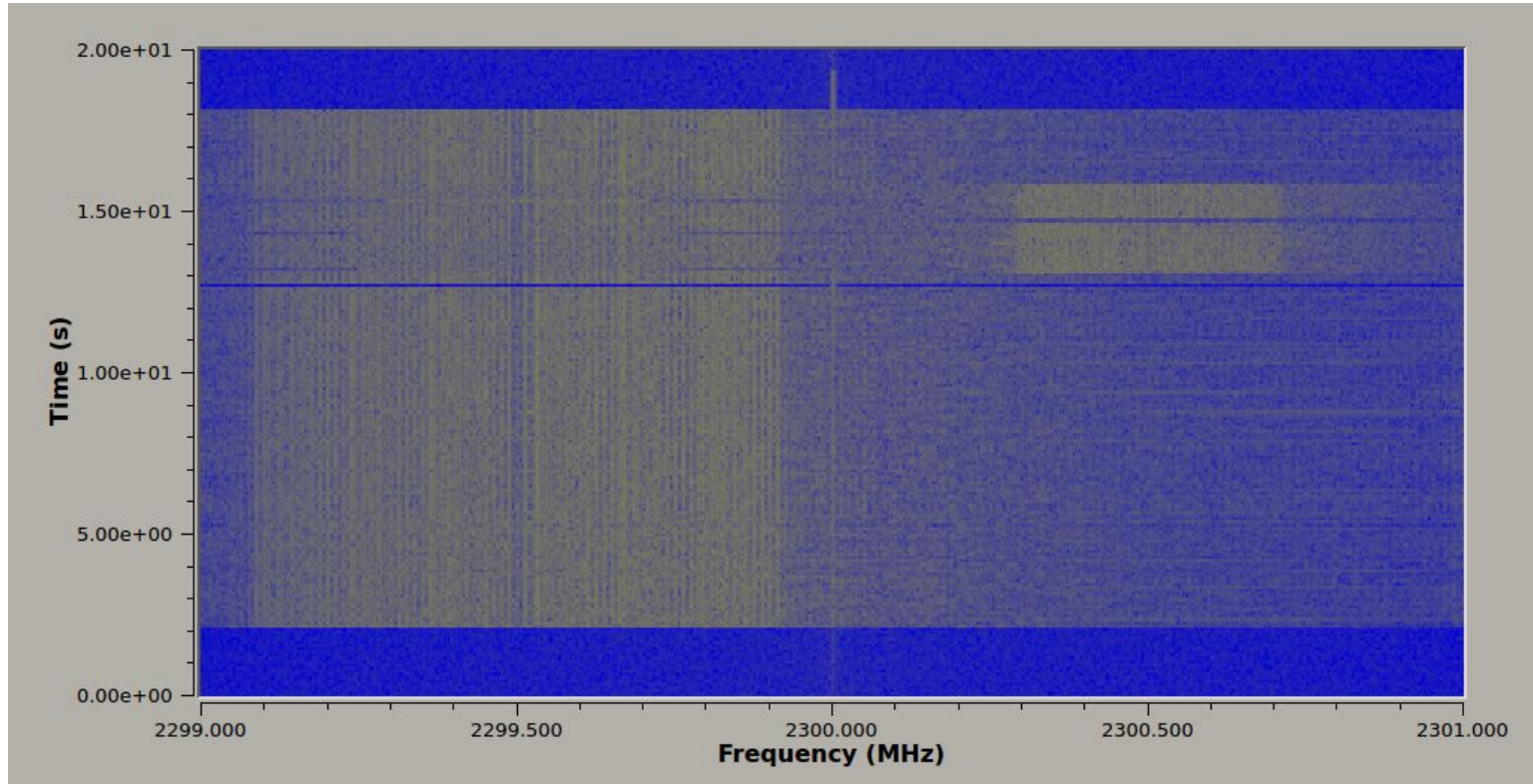
# 4. SDR-SDN Integration



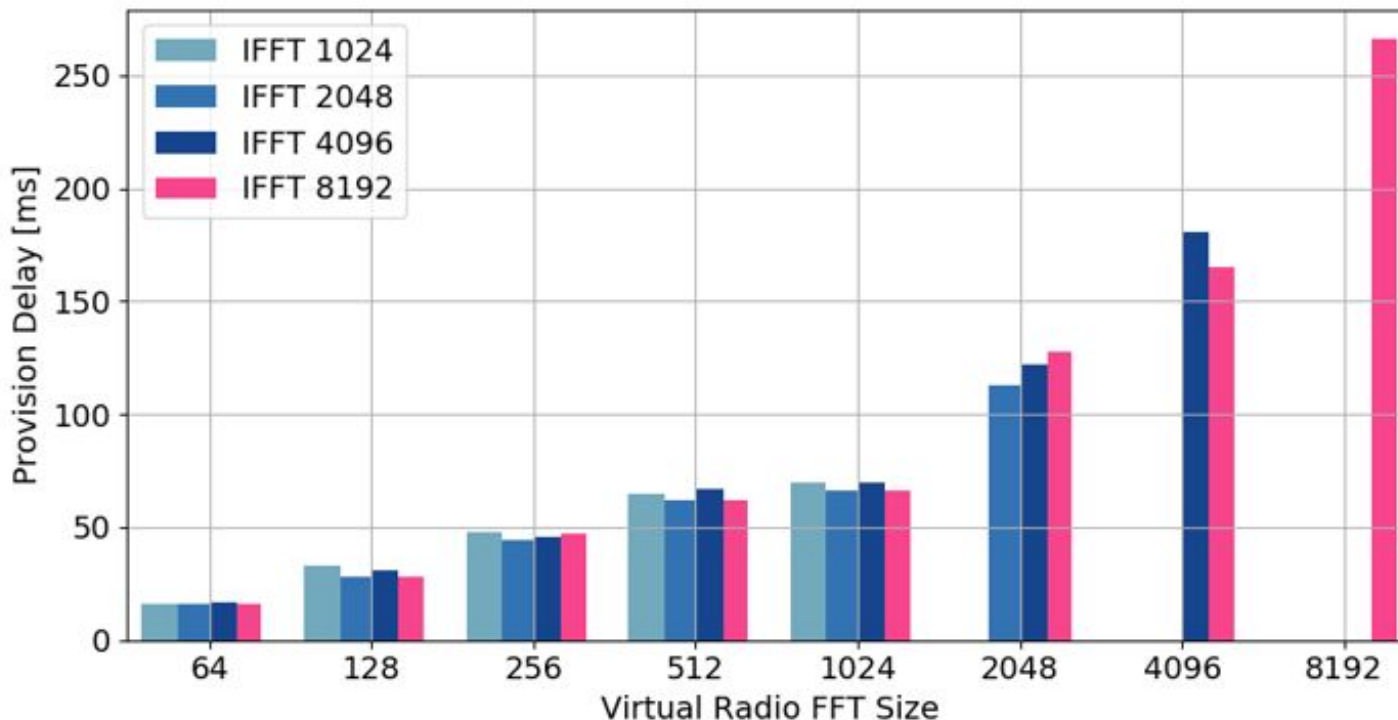
# 3

## Experimental Results

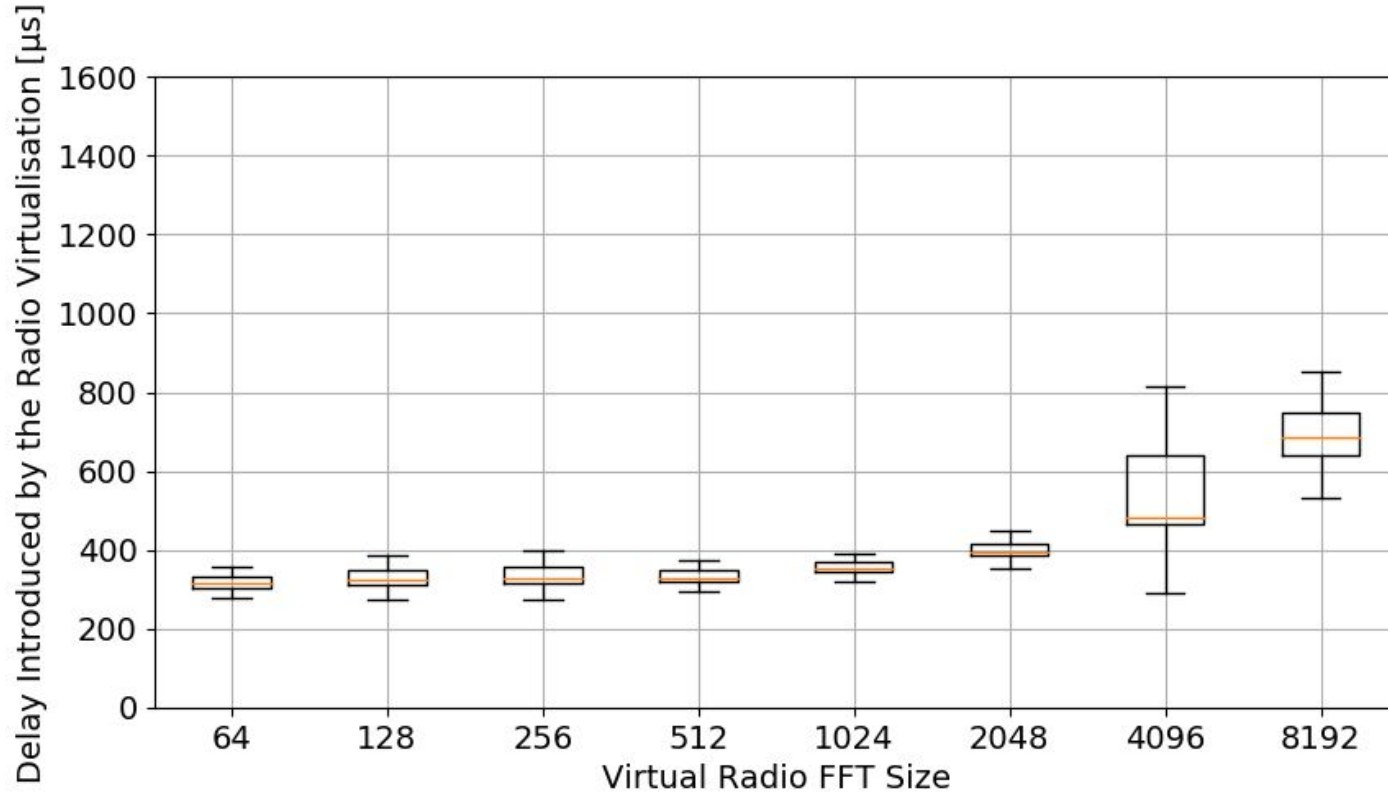
# RAN Slicing - Spectrum



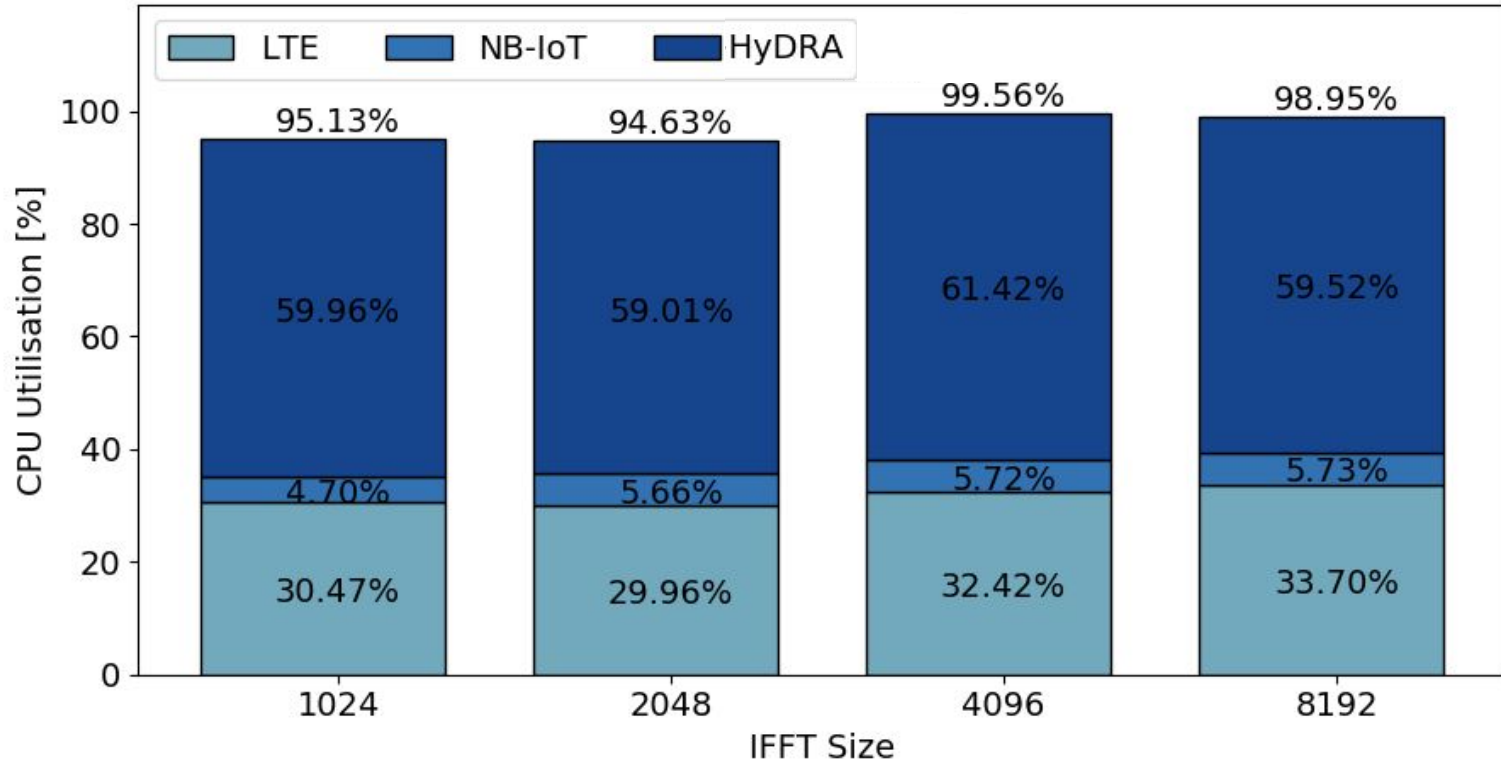
# RAN Slicing - Provisioning Delay



# RAN Slicing - Service Delay



# RAN Slicing - Computational Complexity



# 4

## Conclusions

# Conclusions

Contributions:

- **Technology agnostic** RAN slicing platform
- **Dynamic** deployment of virtual radios in **real time**
- Isolated virtual radios in **spectrum** and **performance**
- Initial **SDR-SDN** integration

Next Steps:

- Optimal virtual radio **resource allocation**
- **Dynamic reconfiguration** of the radio stack



# THANK YOU FOR YOUR ATTENTION

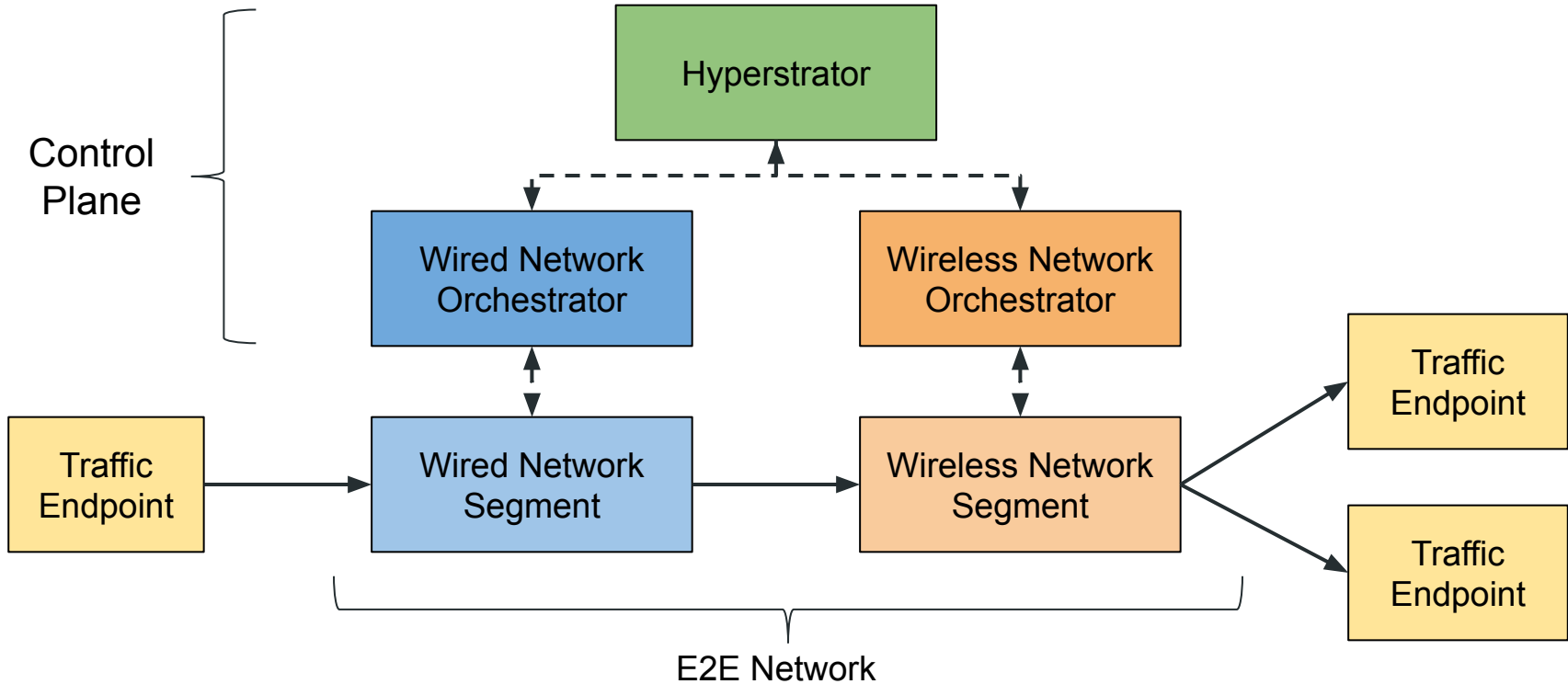
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# End-to-End Prototype Concept



# Current Set-Up

