

# PiCasso: Information-Centric Edge Computing Platform for Community Mesh Networks

---

**Adisorn Lertsinsrubtavee**

University of Cambridge

IRTF GAIA Meeting, IETF 101, London

22 March 2018

Environment: Data centers

Technology: Heavy weight VMs

Hardware: Hi-end server grade machines



Facility: Reliable electricity supply, Hi-speed LANs, Stable network connectivity

# EDGE COMPUTING VS COMMUNITY NETWORKS

## Service Providers



## Data center

Internet

Constrained Backhaul

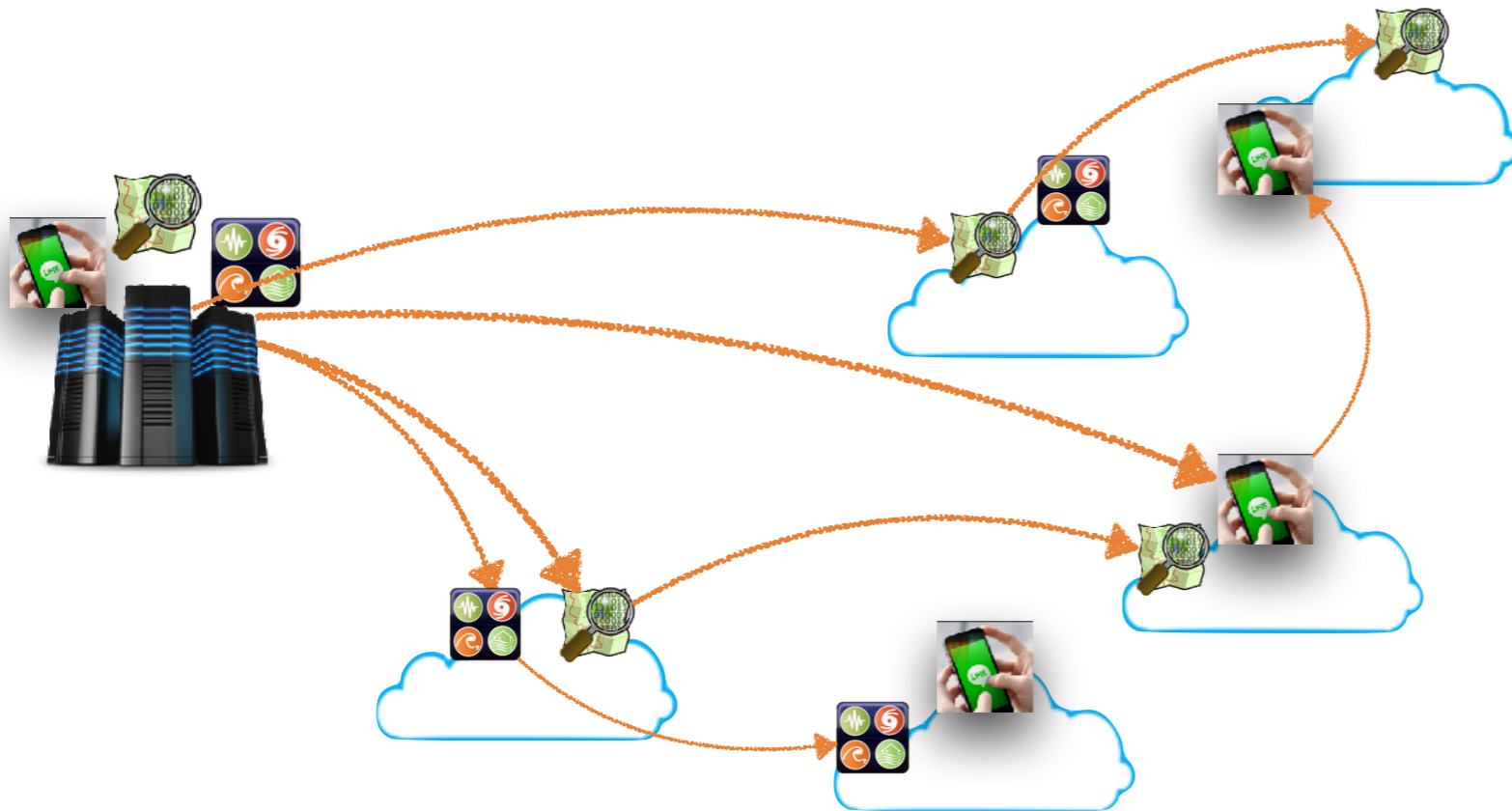
Gateway



- Low speed bandwidth
- Intermittent link
- Poor Quality of Service
- High latency
- Service unreachable

## Community Network

# DISTRIBUTE SERVICE TO THE EDGE



## Running Service at the edge

- Easy hosting and migration of local services could be highly beneficial in community networks.

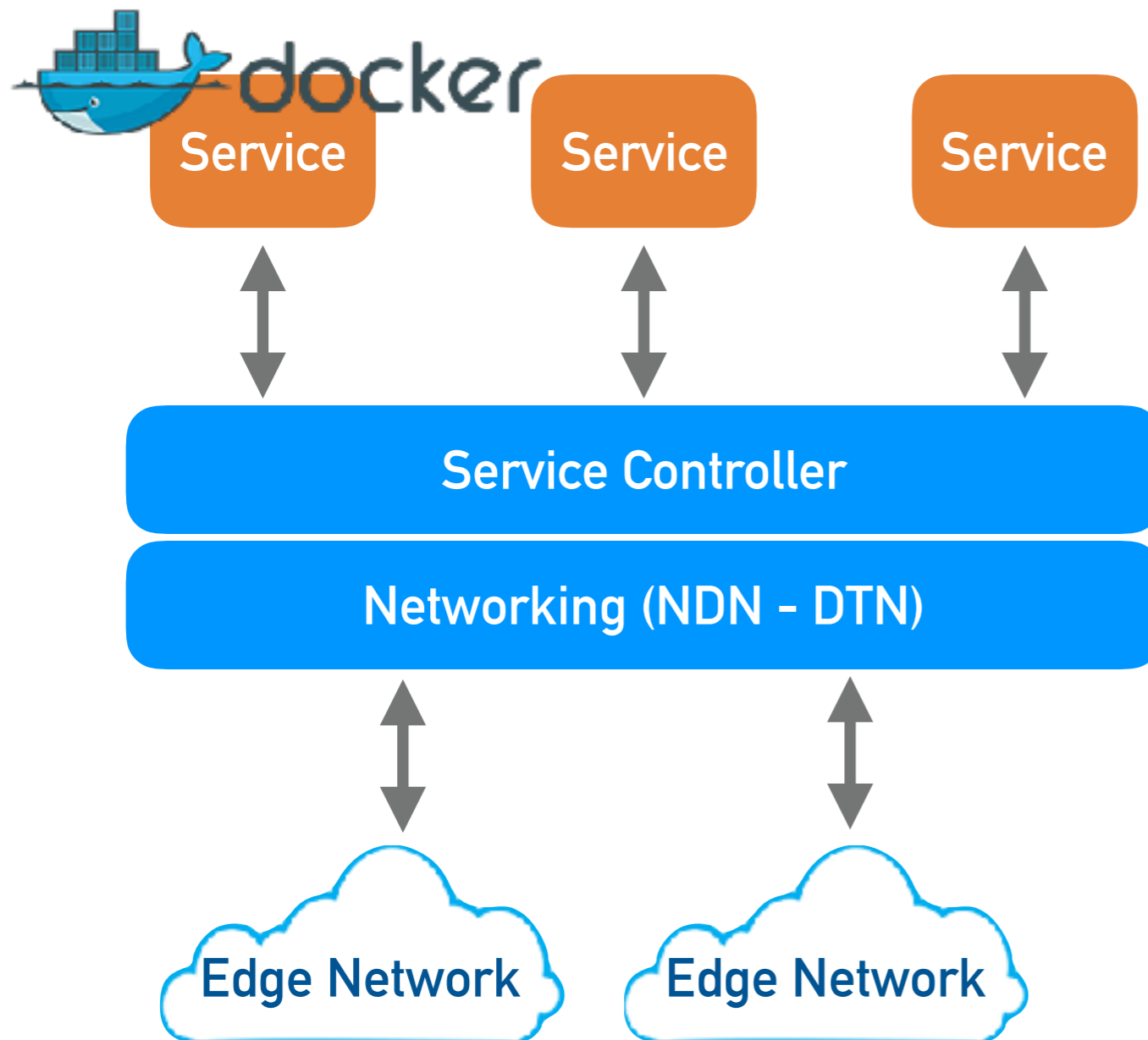
## Lightweight Virtualisation technology

- Allow very small (e.g., 2MB) virtual machine services to be migrated across a network with very little cost.

## Overcome the intermittent connectivity

- Rather than hosting services in fixed predetermined locations, service can be retrieved from anywhere

# PICASSO: SYSTEM OVERVIEW



## Automatic Decision Making

- Service Deployment
- Where to and When to place service ?
  - QoS, SLA
  - Network condition
  - Hardware resources

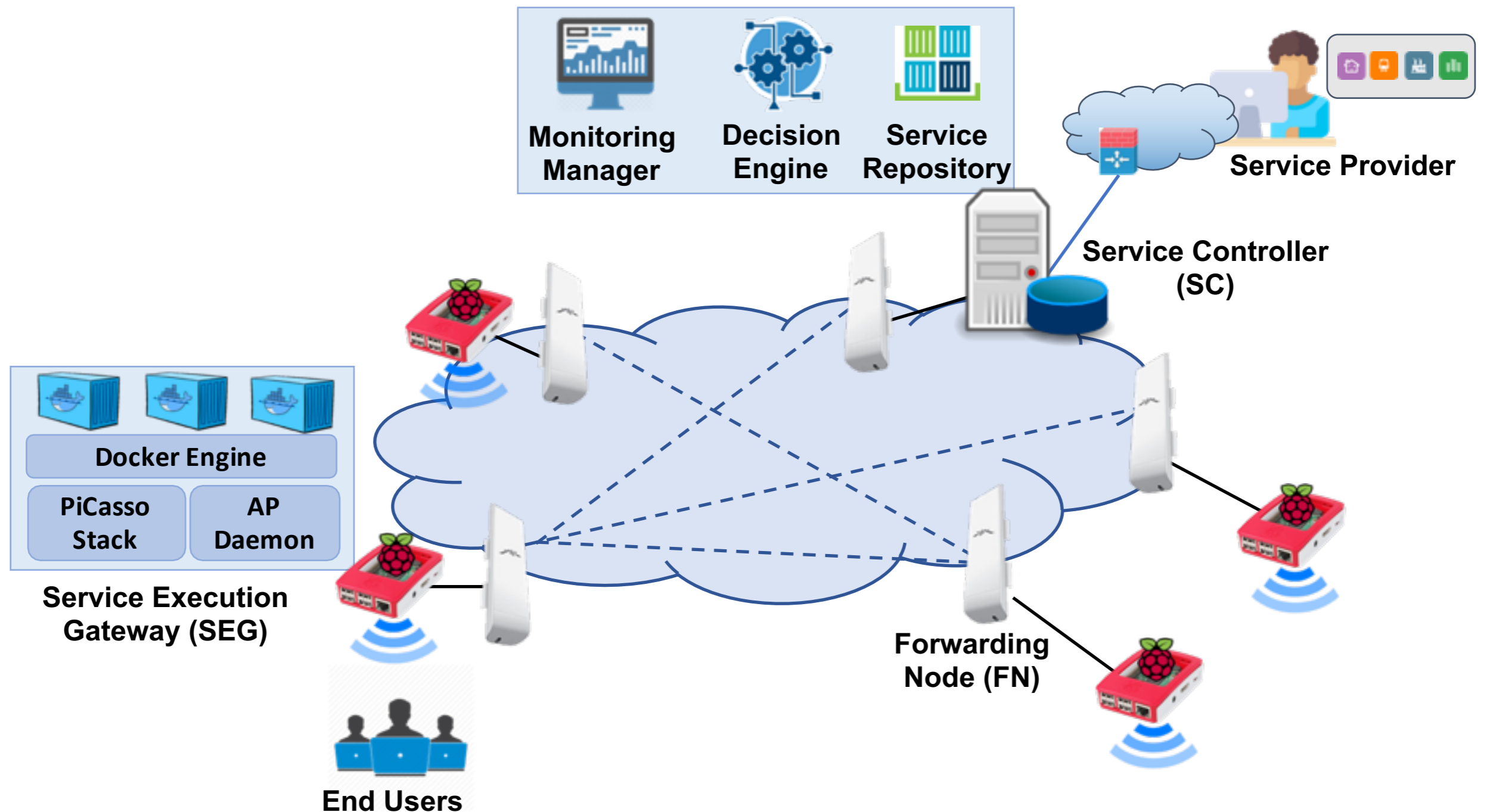
## Monitoring System

- Node usage (CPU, Memory)
- Network condition

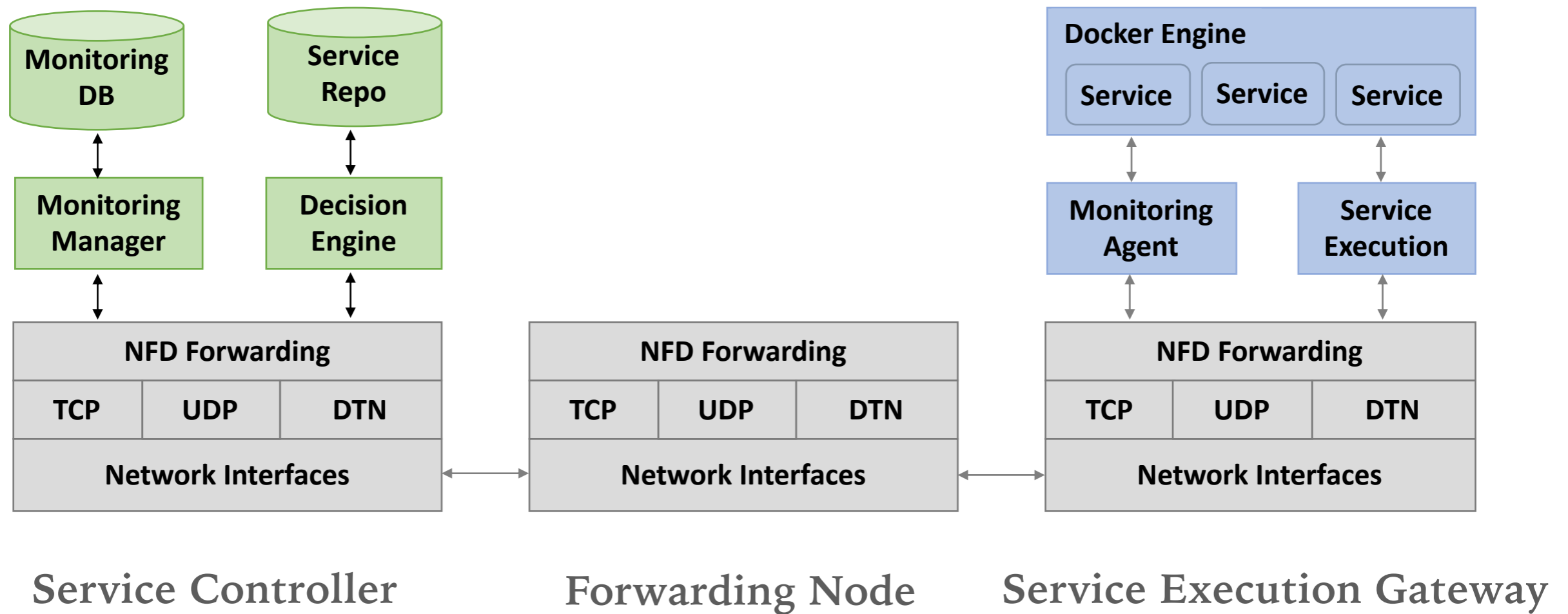
## Smart Forwarding

- Named Data Networking (NDN)
- Delay Tolerant Networking (DTN)
  - Name based routing
  - Dynamic in-network caching
  - Store-and-Forward fashion

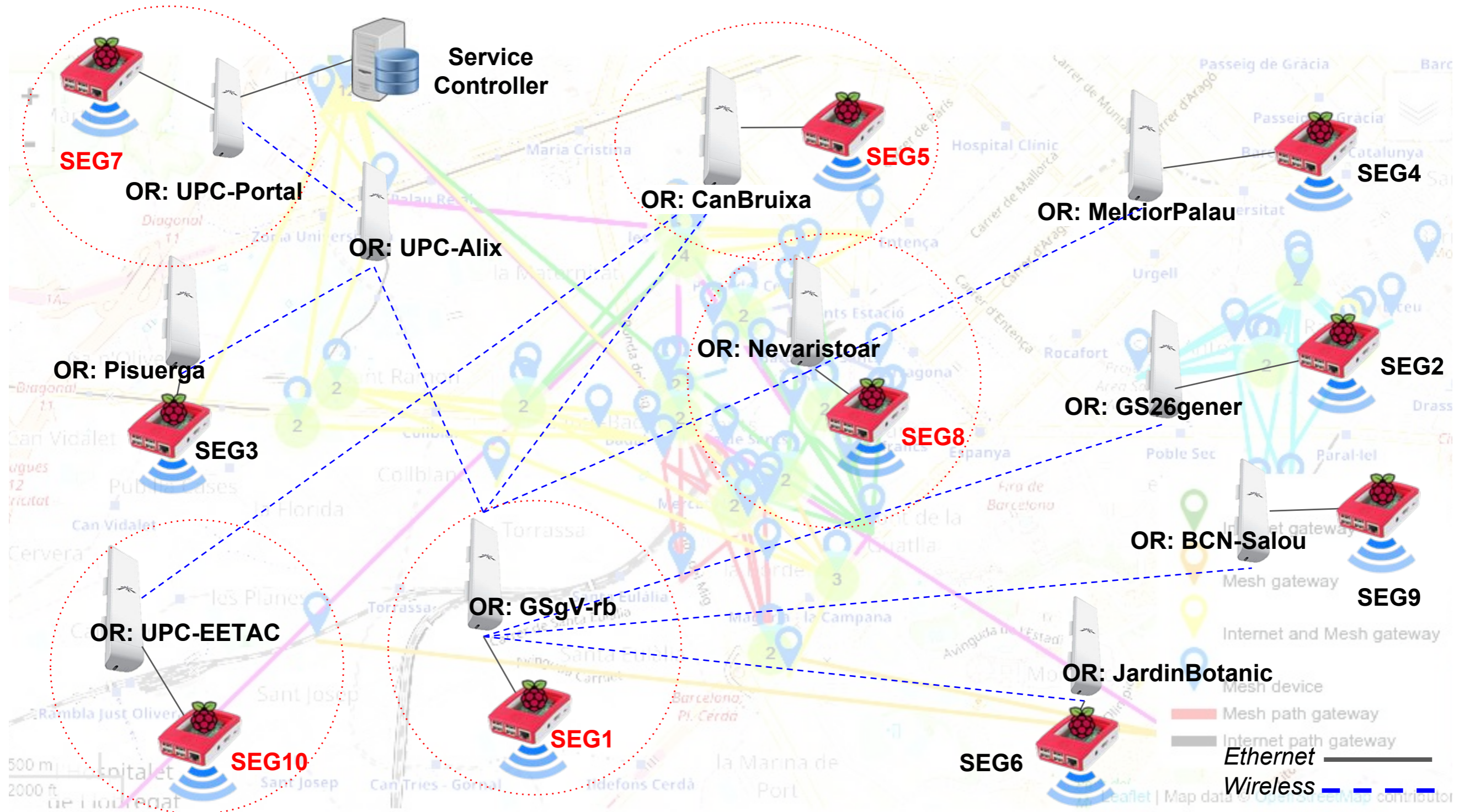
# PICASSO: ARCHITECTURE



# PICASSO: MODULES



# PICASSO DEPLOYMENT IN GUIFI.NET

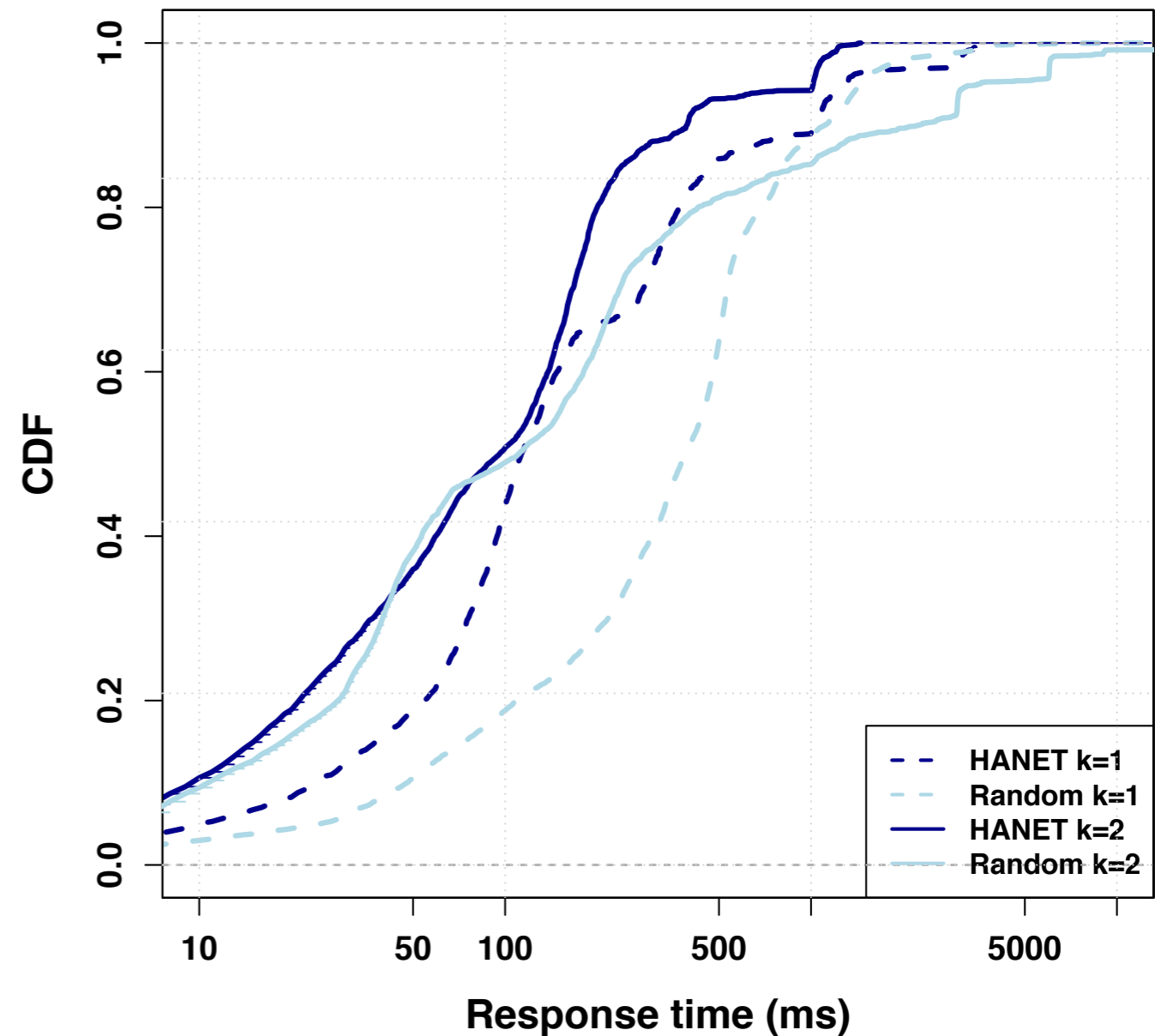




# HANET SERVICE DEPLOYMENT HEURISTIC

## Select replica to host the service

- **Service:** webserver (300 bytes payload)
- **Factor:**  $k=1$ ,  $k=2$
- **Tools:** Apachebench (generate concurrent HTTP requests)
- **Metrics:** HTTP Response time
- **Comparison:** Random strategy



- HANET selects better node to host the service (enough CPU, better bw)

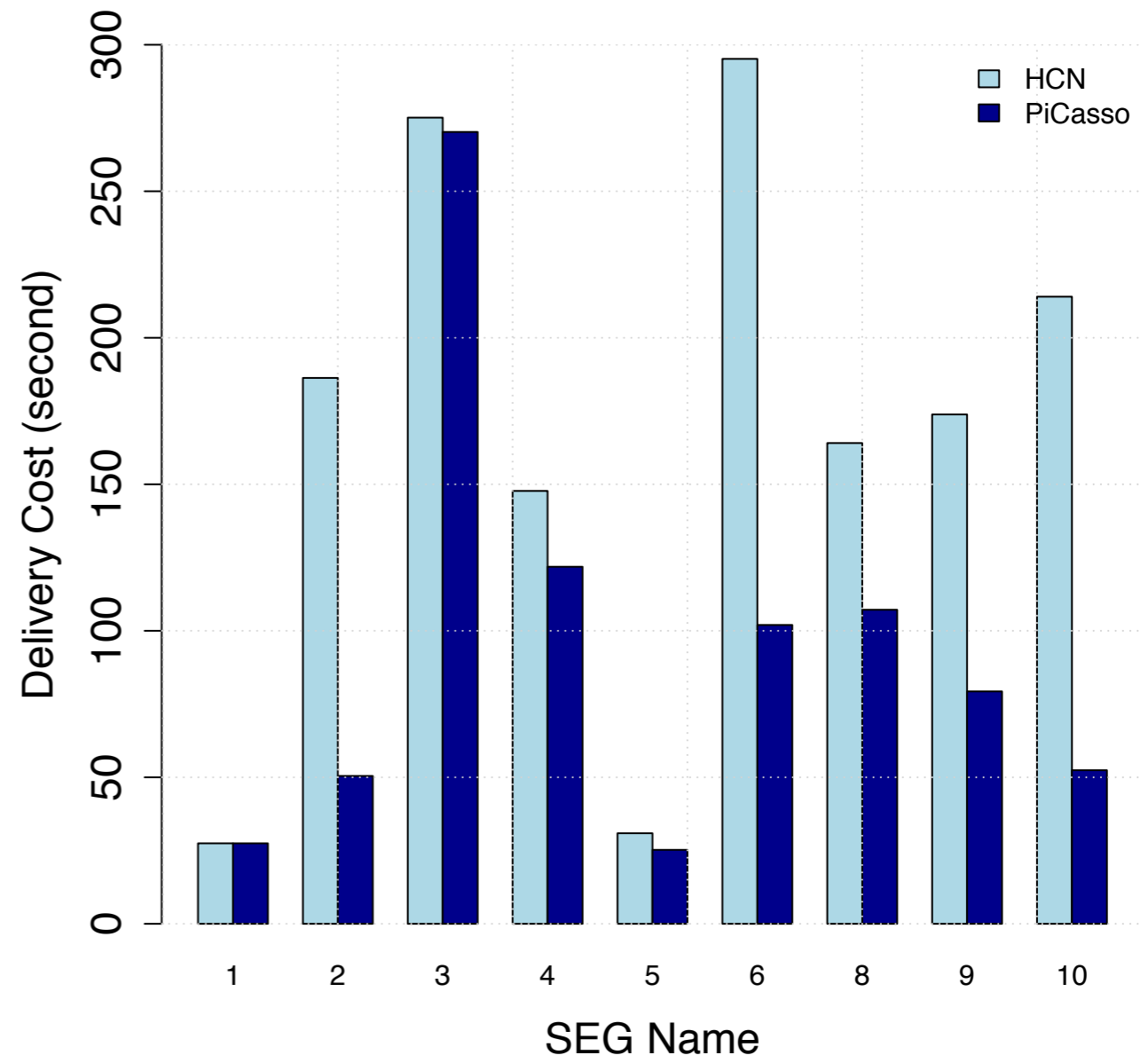
- **HANET**  $k=2$ , **90%** of requests achieve response time less than 500 ms

# SERVICE DELIVERY COST IN GUIFI.NET

## Delivery Service image from Service Repo to all SEGs

- **Service:** debian image (145 MB)
- **Metrics:** Delivery Cost
- **Comparison:** HCN (IP unicast)

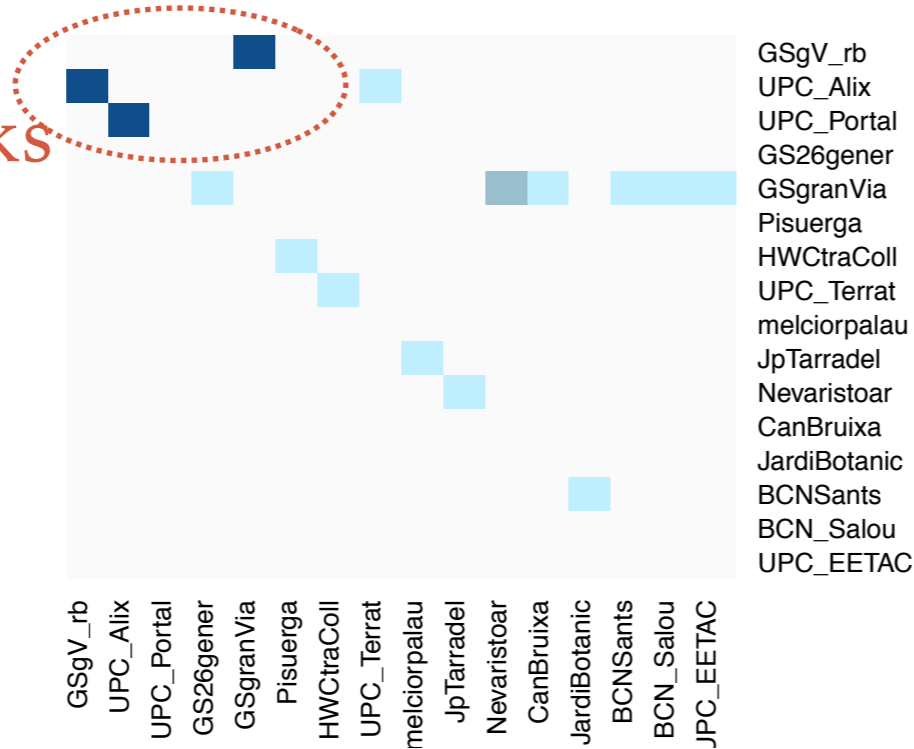
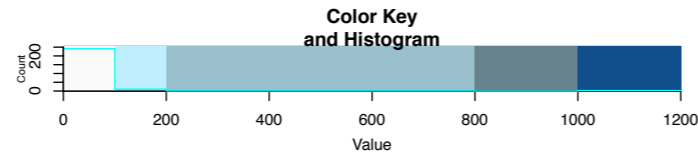
- PiCasso node automatically retrieves the data chunks from the nearest cache
- HCN: Every request is forwarded to Service Repo



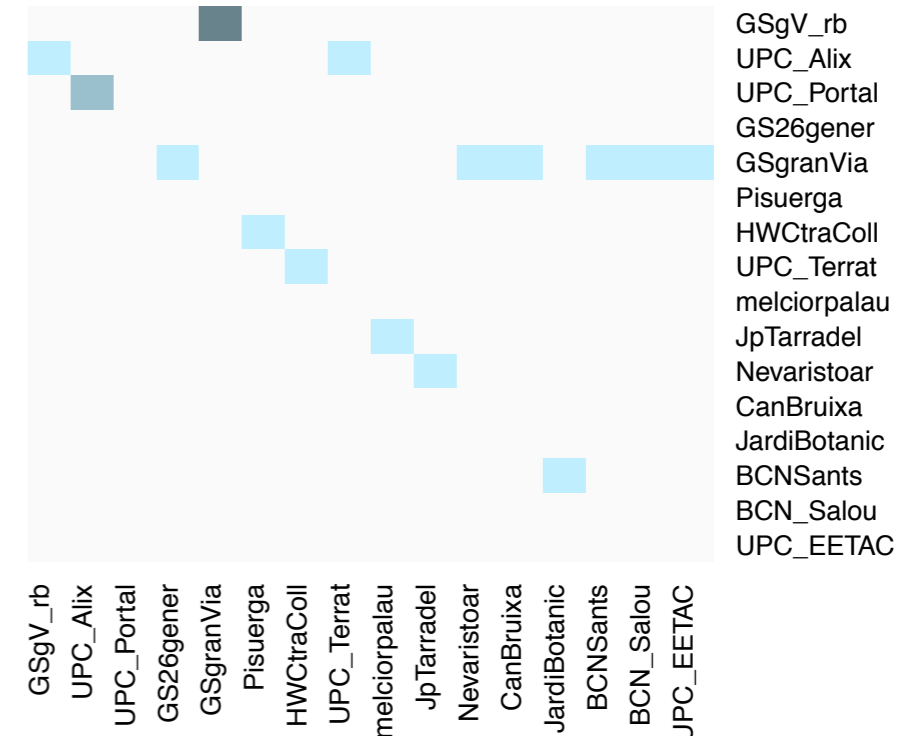
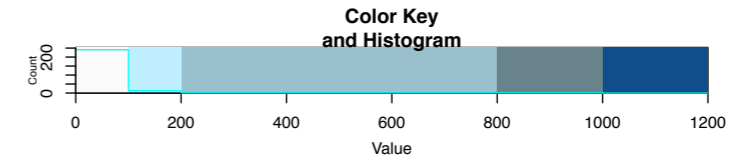
- **Average Delivery cost:** PiCasso (70s) HCN (155s)
- **54% improvement**

# TRAFFIC CONSUMPTION OF SERVICE DELIVERY

Heavy traffic consumption links

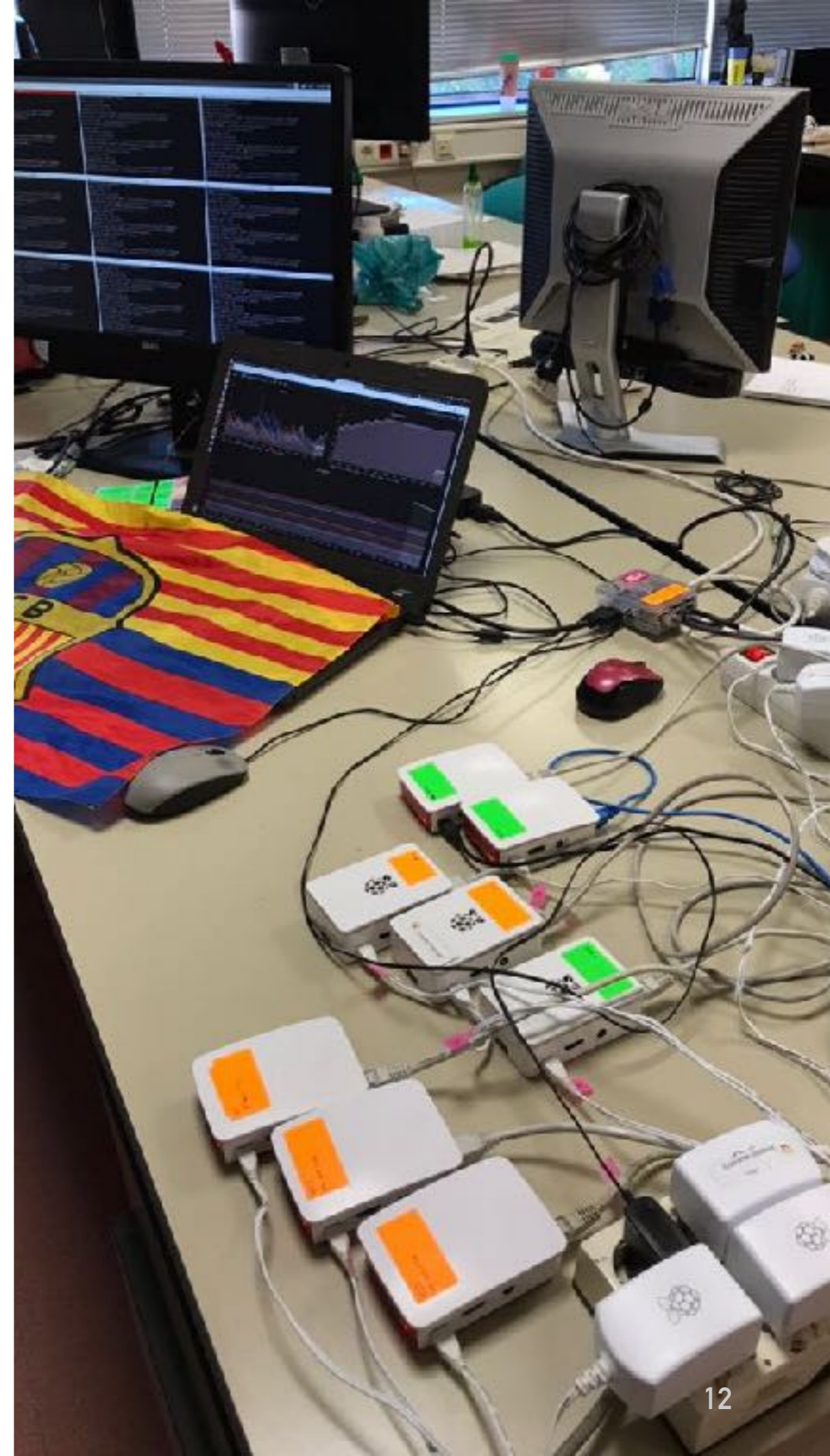


HCN



PiCasso

➤ PiCasso consumes less traffic consumption up to **43.24%**



**guifi·net**

# THANK YOU Q&A

[adisorn.lertsinsrubtavee@cl.cam.ac.uk](mailto:adisorn.lertsinsrubtavee@cl.cam.ac.uk)  
<https://github.com/AdL1398/PiCasso>



Planning to come to



103 in Bangkok?

wait **there's** **MORE.**



Association for  
Computing Machinery



# AINTEC 2018

## ASIAN INTERNET ENGINEERING CONFERENCE



**November 12-14, 2018**

**Bangkok, Thailand**

**<https://interlab.ait.ac.th/aintec2018/>**



Image by Warawut Srisopark - Own work, CC BY-SA 3.0/  
70% Opacity

