Εθνικό και Καποδιστριακό
Πανεπιστήμιο Αθηνών

National and Kapodistrian
University of Athens

Network Management in Mission Critical Cases – PPDR & Smart evacuation Guide

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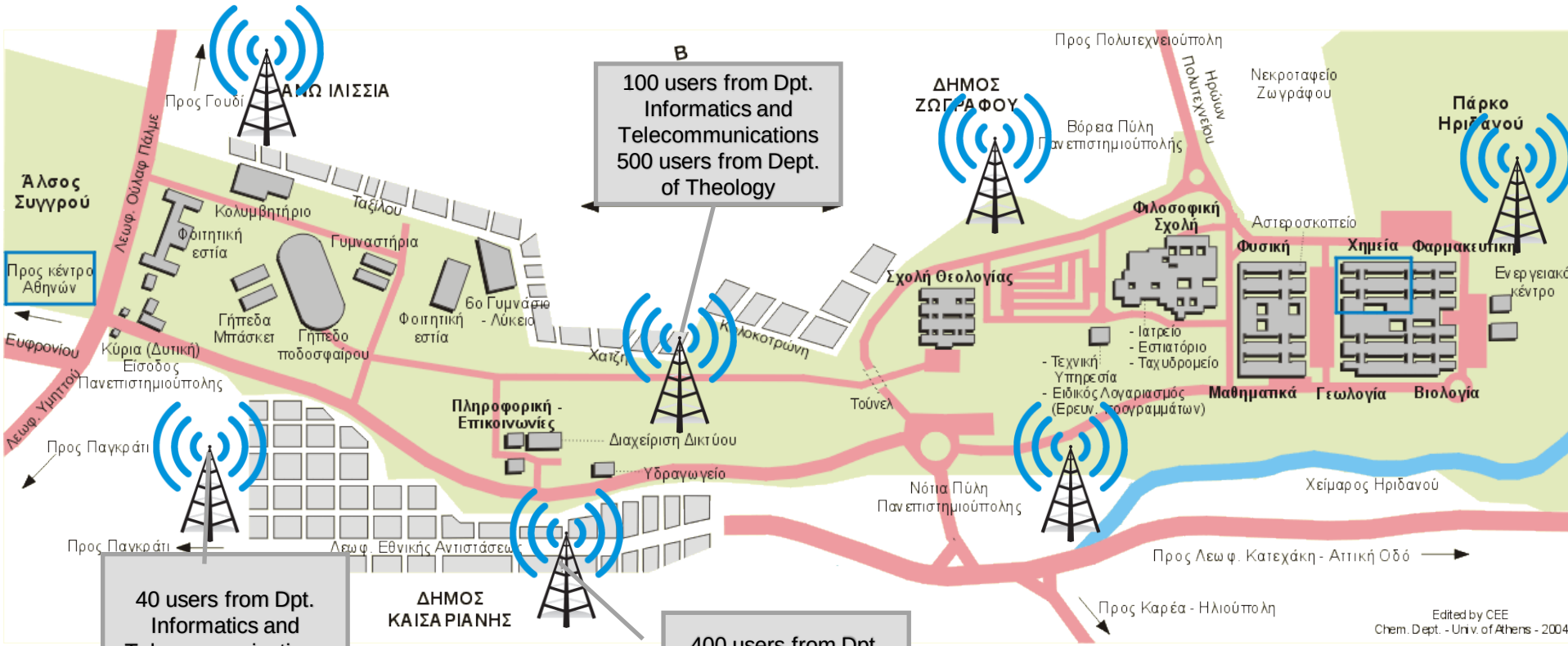
National Kapodistrian University of Athens

Outdoor 5G



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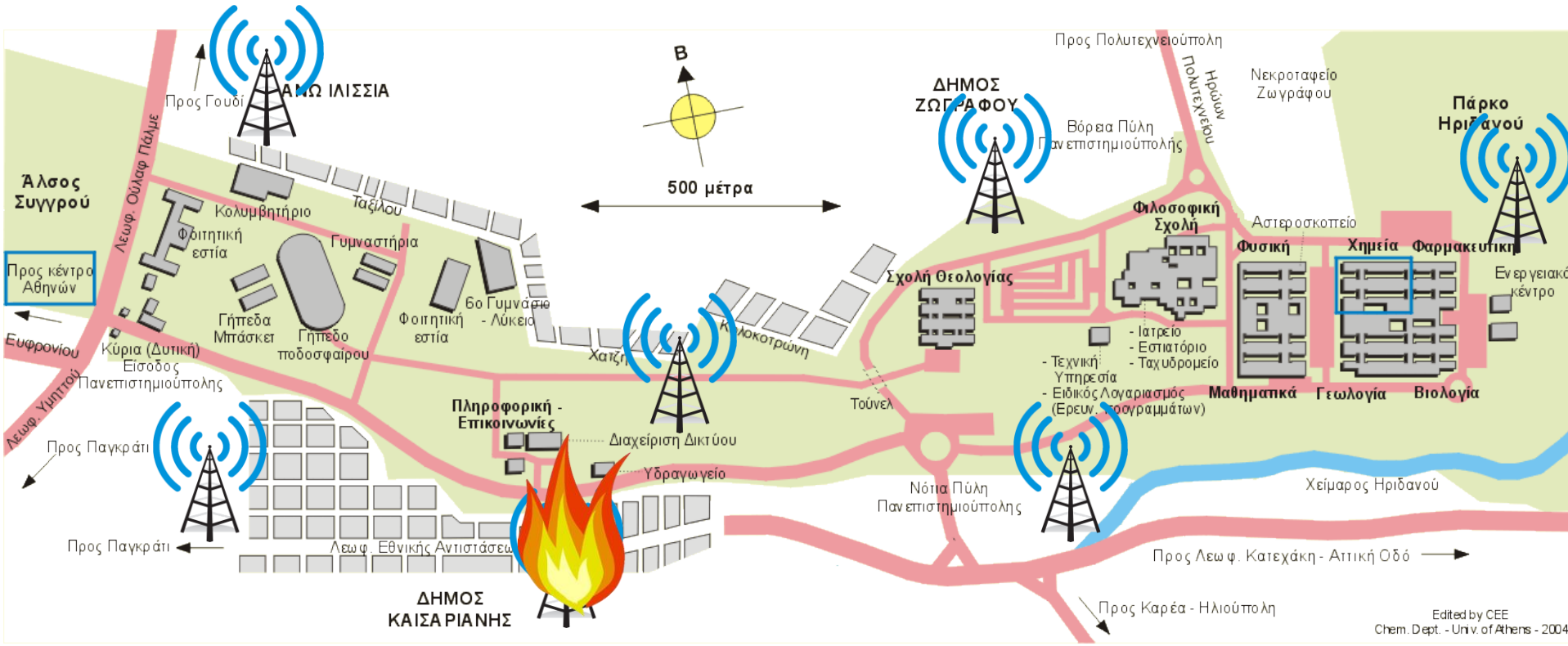
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Άλσος Συγγρού
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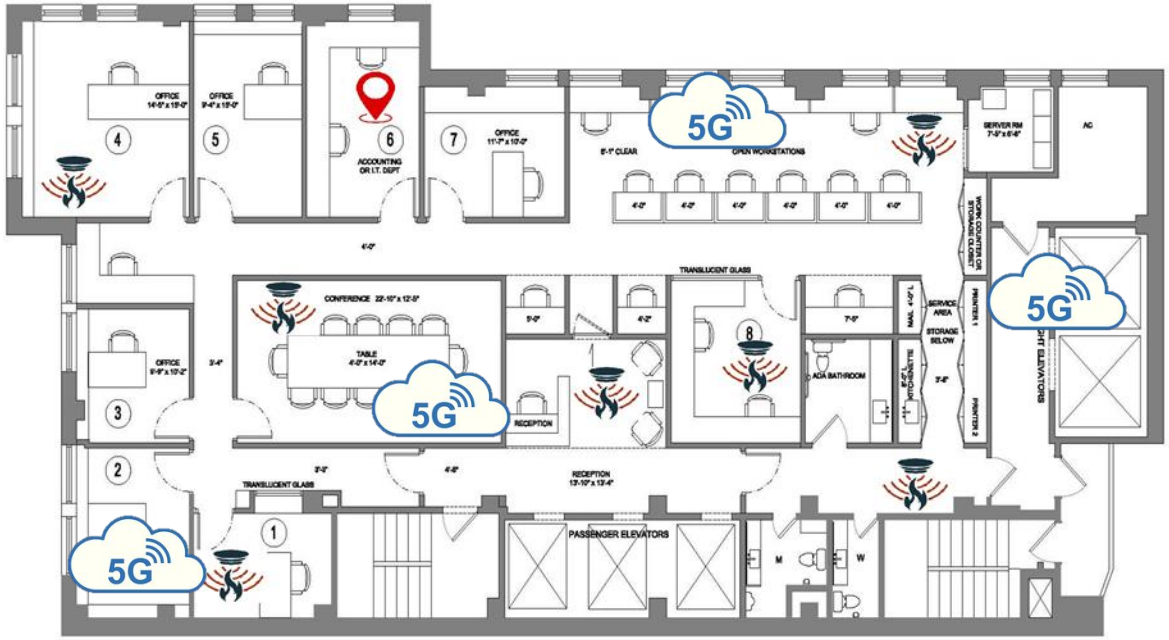
Indoor 5G



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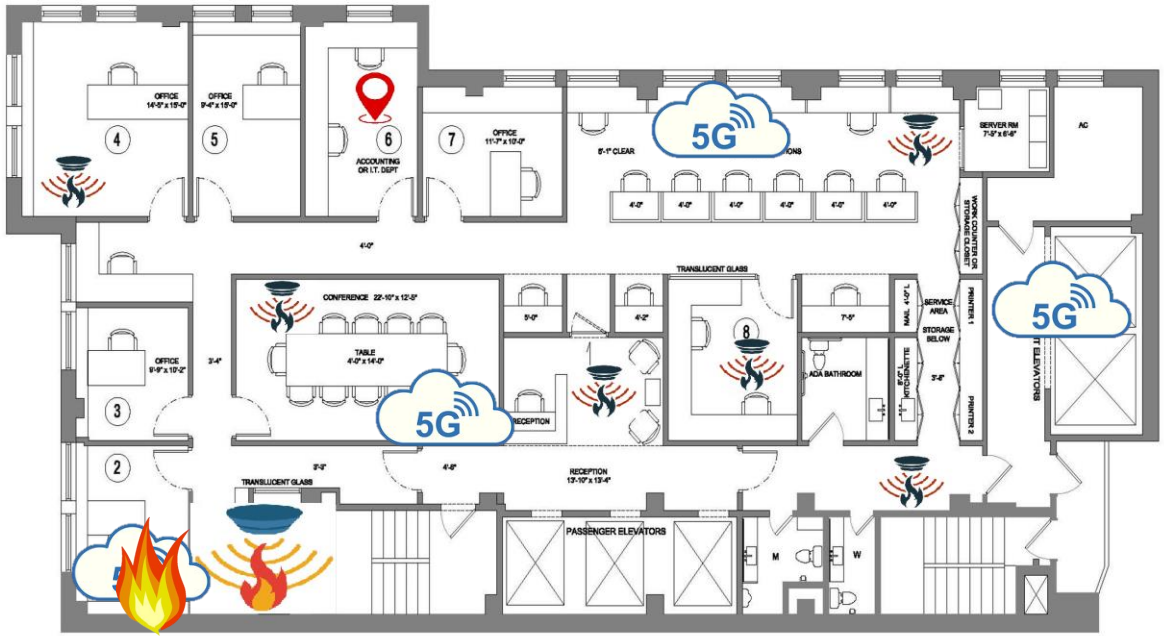
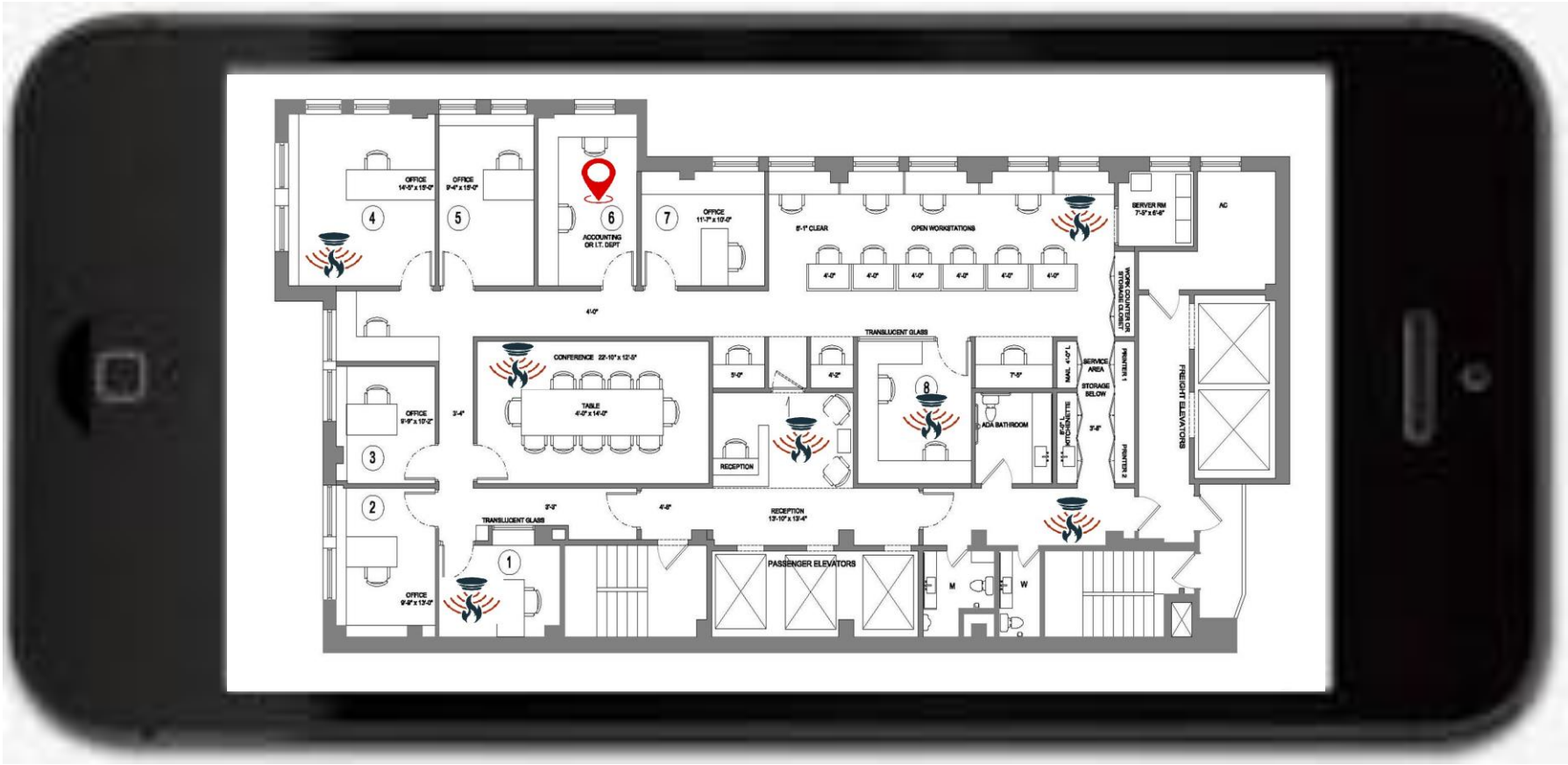
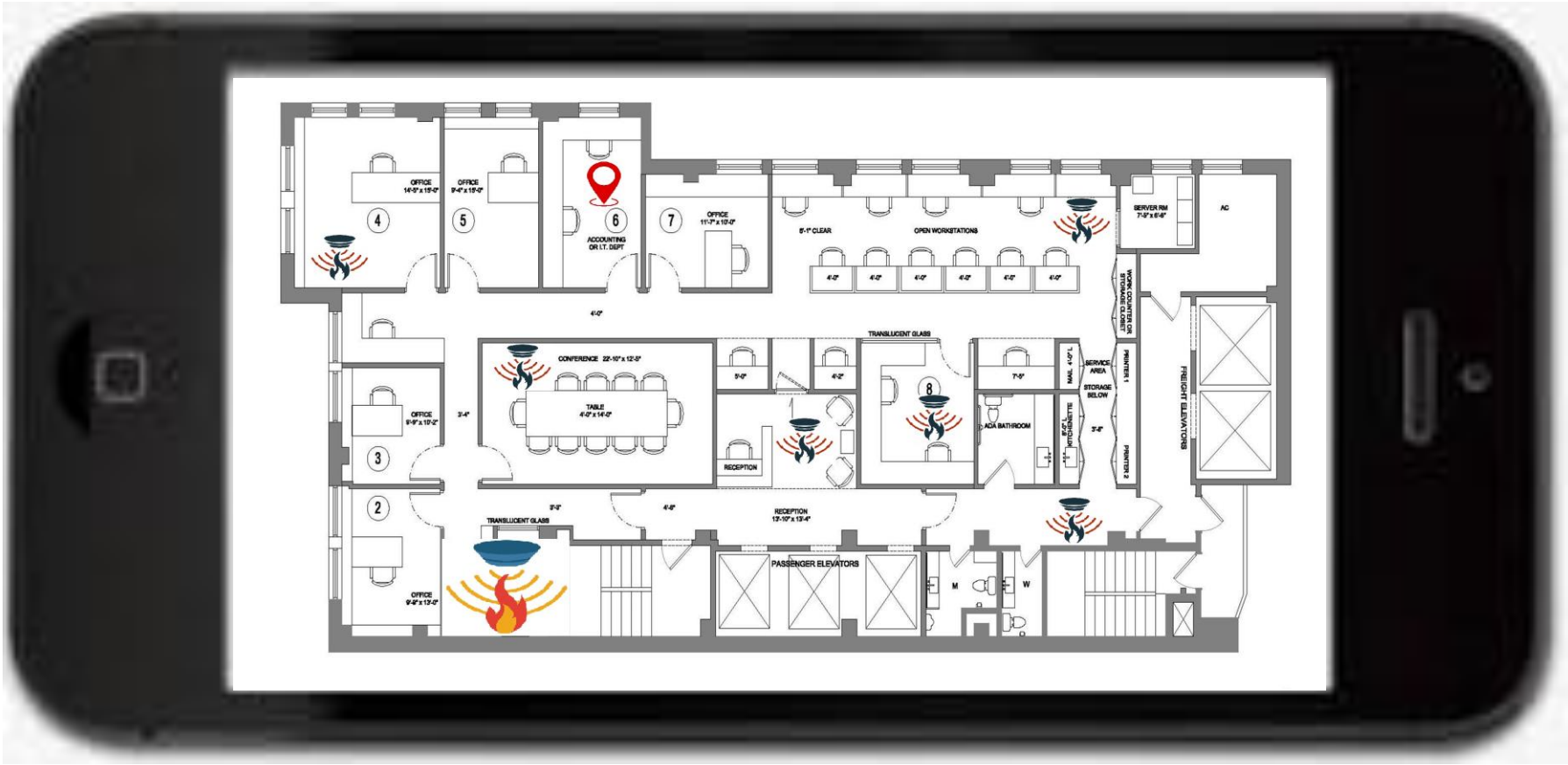
Indoor


5G
5G
5G
OFFICE
OFFICE
ACCOUNTING OR I.T. DEPT
OFFICE
SERVER RM
AC
CONFERENCE
TABLE
RECEPTION
TRANSLUCENT GLASS
ADA BATHROOM
SERVICE AREA
STORAGE BELOW
PRINTER 1
PRINTER 2
WORK COUNTER OR STORAGE CLOSET
RECEPTION
PASSENGER ELEVATORS
TRANSLUCENT GLASS
M
W

User Interface

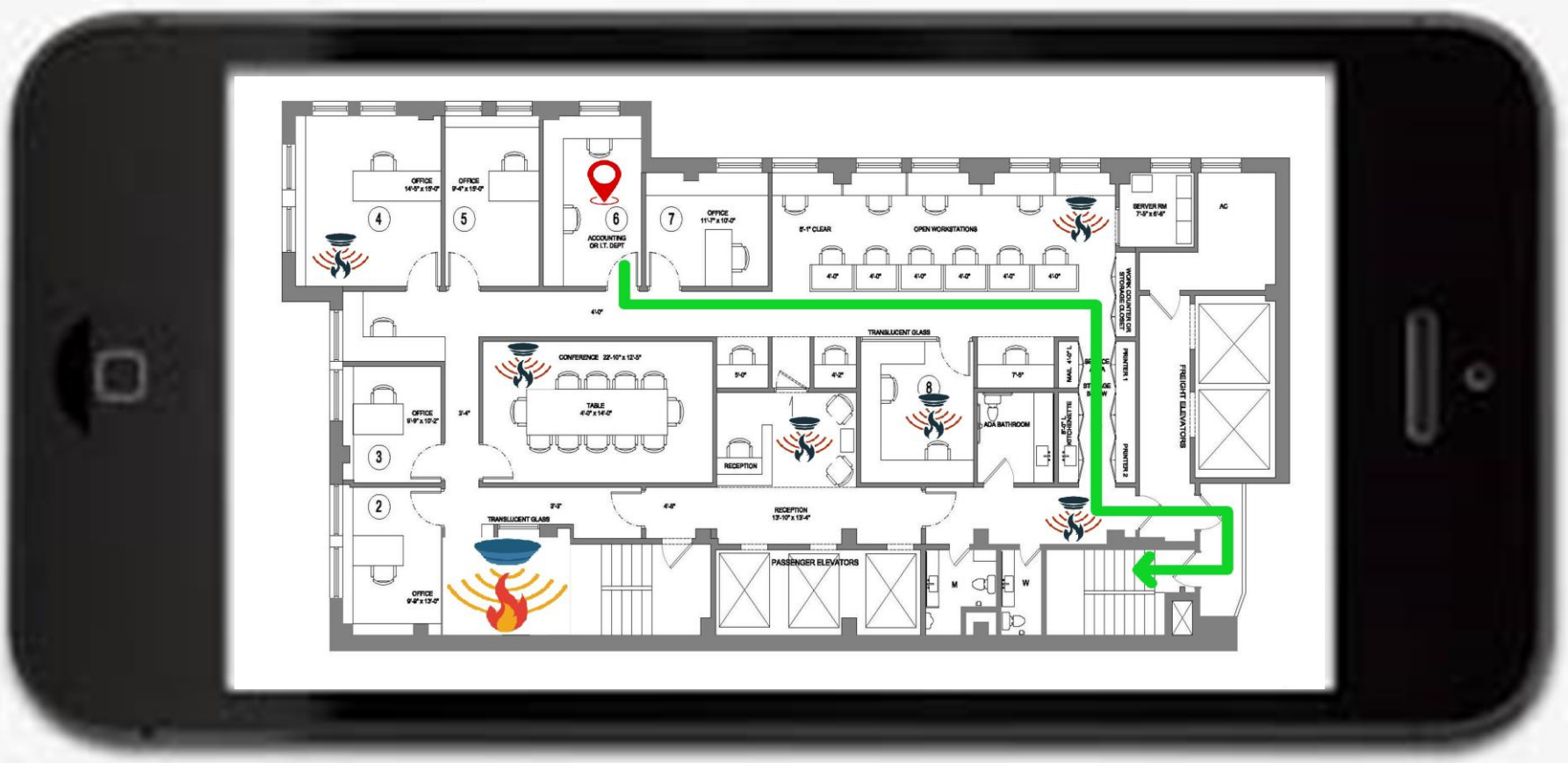


Identification of fire incident

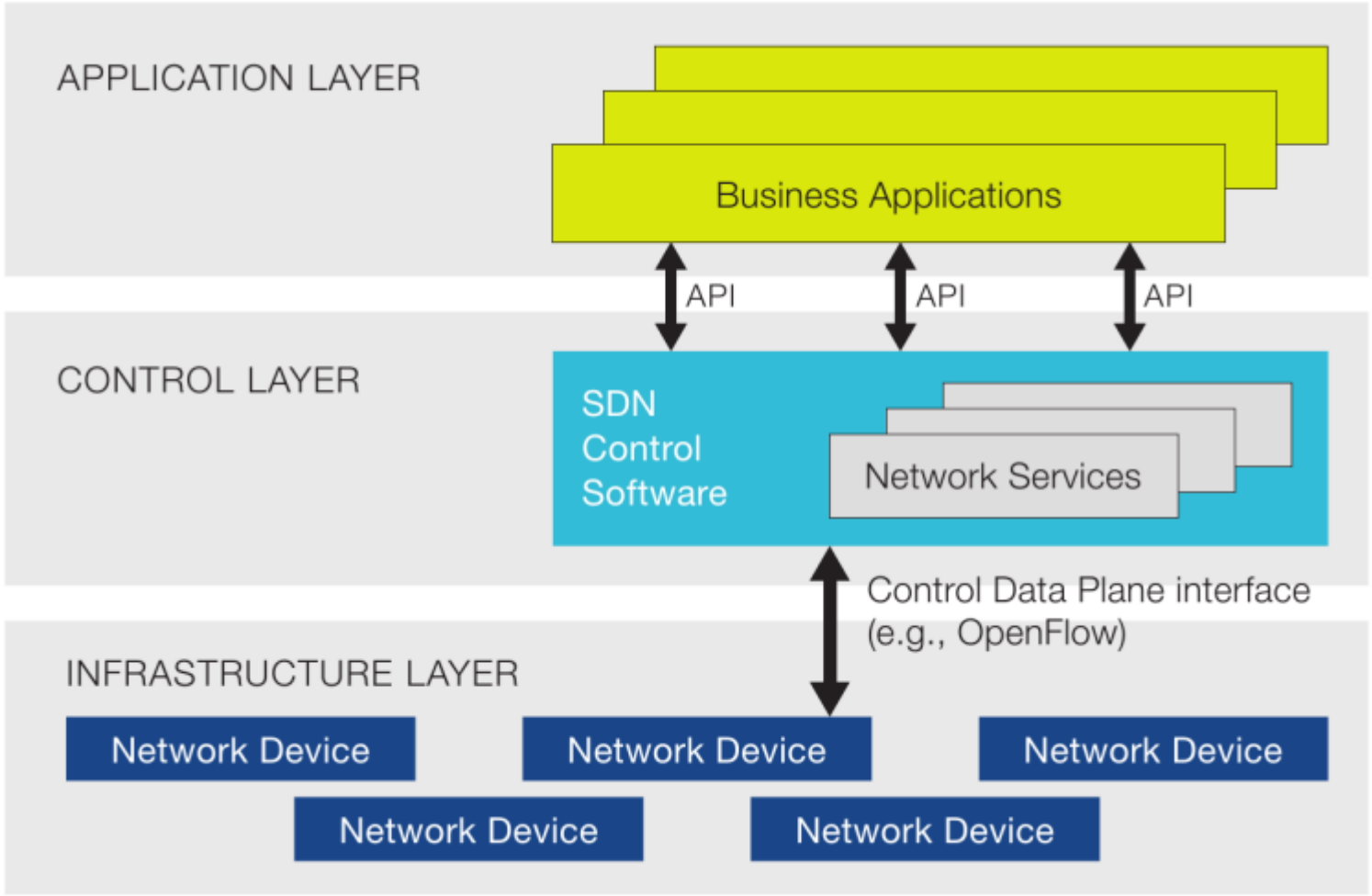


Audio and Visual Alarm

Escape route identification – smart navigation

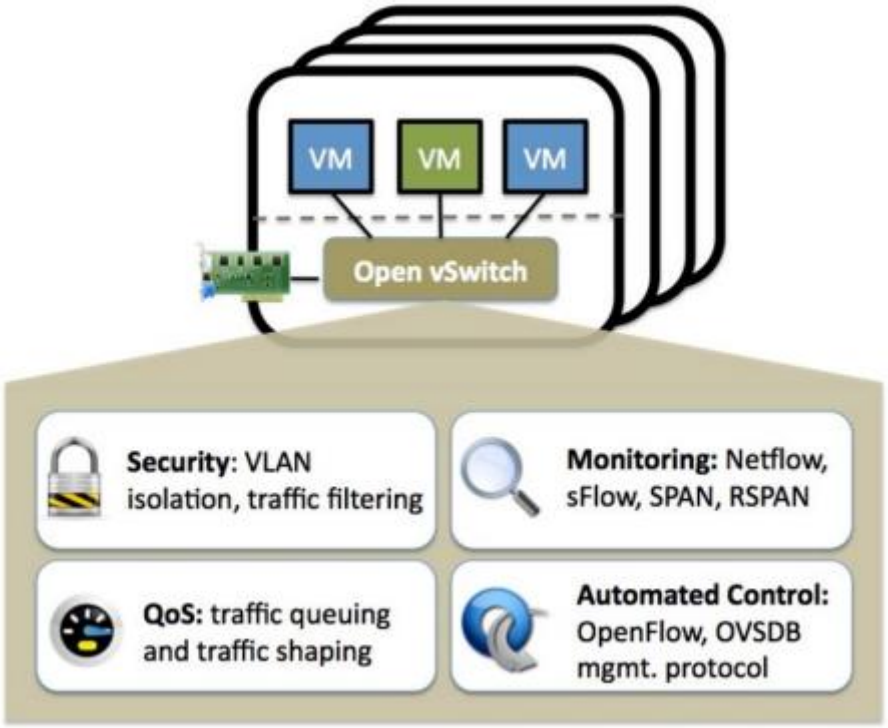


Some Background - SDN



Some Background - OVS

- Open vSwitch is a production quality, multilayer virtual switch licensed under the open source Apache2.0 license.
- Network automation through programmatic extensions



OVS – Basic commands

- ovs-vsctl : Used for configuring the ovs-vswitchd configuration database (known as ovs-db)
- ovs-ofctl : A command line tool for monitoring and administering OpenFlow switches
- ovs-dpctl : Used to administer Open vSwitch datapaths ovs−appctl : Used for querying and controlling Open vSwitch daemons
- ovs-ofctl dump-flows sw : List the flows assigned to the bridge
- ovs-ofctl show sw : connects to the switch and prints out port state and OF capabilities
- ovs-ofctl del-flows sw : Deletes all flows from the switch
- ovs-ofctl add-flow sw in_port=1,actions=output:2 : Adds a flow (rule) – port-based.
- ovs-ofctl mod-flows switch in_port=1,actions=drop : Modifies a flow entry

Mininet-WiFi

- A fork of Mininet
- Emulator for Software Defined Networking
- Simple to create topologies and run network scenarios
- https://mininet-wifi.github.io/
- Virtualized Access Points
- Emulates mobility & supports various mobility models
- Remote controllers are also supported

Mininet-WiFi – Installation

- Option 1 – VM install:
  - Download the Mininet-WiFi VM image
  - Download and install a virtualization system. We recommend VirtualBox (free, GPL) because it is free and works on OS X, Windows, and Linux (though it's slightly slower than VMware in our tests.) You can also use Qemu for any platform, VMware Workstation for Windows or Linux, VMware Fusion for Mac, or KVM (free, GPL) for Linux.
- Option 2 - Native Installation from Source (Debian):
  - git clone git://github.com/intrig-unicamp/mininet-wifi
  - cd mininet-wifi
  - sudo util/install.sh –Wlnfv

Everything regarding the installation process is available: https://mininet-wifi.github.io/get-started/

Mininet-WiFi - Basic Classes

- **addHost():** adds a host to a topology and returns the
- host name
- **addStation():** adds a station to a topology and returns the station name
- **addAccessPoint():** adds an access point to a topology and returns the access point name
- **addLink():** adds a bidirectional link to a topology

Mininet-WiFi – Usage (1)

https://mininet-wifi.github.io/usage/

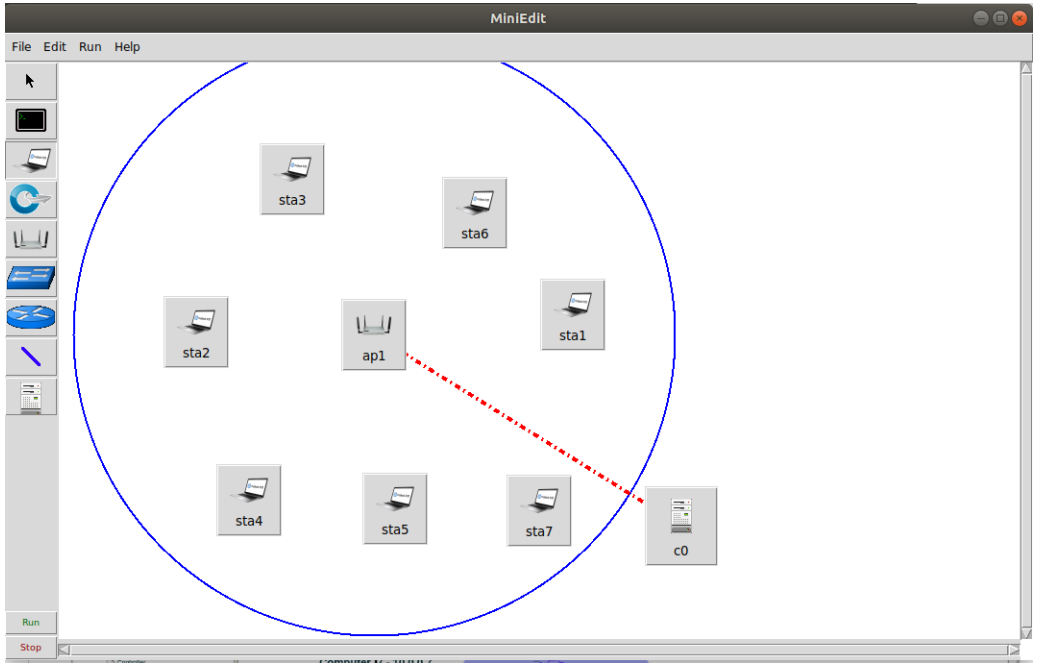
- Start a minimal topology and enter the CLI: sudo mn –wifi
- Display Mininet CLI commands: mininet-wifi> help
  - Display Nodes: mininet-wifi> nodes
  - Run a command on a station process: mininet-wifi> sta1 ifconfig –a
  - Run a command on a access point: mininet-wifi> ap1 ifconfig –a
  - Get information of the wireless network interfaces: py sta1.wintfs
  - Verify that you can ping from station1 to station2: mininet-wifi> sta1 ping -c1 sta2
    - Ping all network pairs (ex. sta1 – sta2, sta1-sta3, sta2 – sta3 etc.): mininet-wifi> pingall
  - Exit CLI: mininet> exit
  - **If Mininet crashes for some reason, clean it up: sudo mn –c**
  - You can create a wired link between station and access point with cls=TCLink, as shown below:
    - Import in your file: from mininet.link import TCLink
    - Use command in file: net.addLink(sta1, ap1, cls=TCLink)
  - To display an xterm for sta1 and sta2: xterm sta1 sta2
  - Start AP/Shutting AP down: mininet-wifi> py ap1.start_() / mininet-wifi> py ap1.stop_()
  - Start/ Stop Simulation: mininet-wifi> start / mininet-wifi> stop

Mininet-WiFi – Usage (2)

https://mininet-wifi.github.io/advanced/

https://mininet-wifi.github.io/commands/

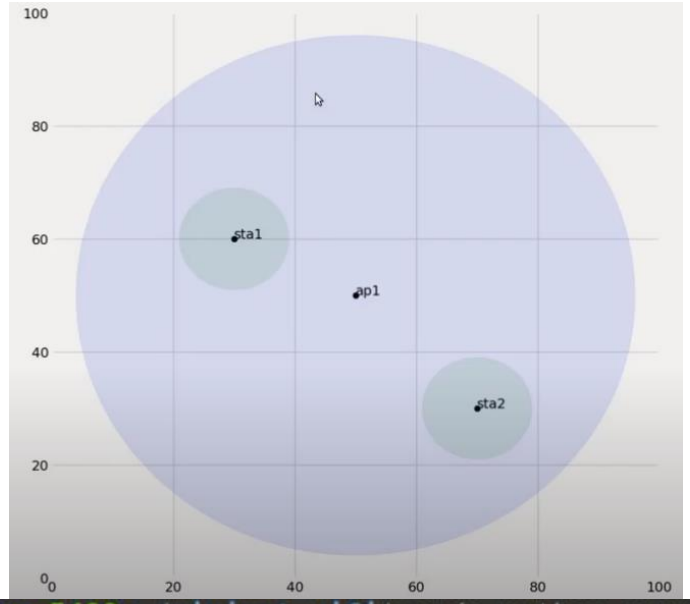
- You can use also the miniedit GUI: sudo python examples/miniedit.py
- https://www.youtube.com/watch?v=j4JS4xxCrCA&list=PLccoFREVAt_4nEtrkl59mjjf5ZzRX8DZA&index=17



Mininet-WiFi – Usage (3)

https://www.youtube.com/watch?v=k69t9Xkb0nU

- Setting and getting node attributes via socket

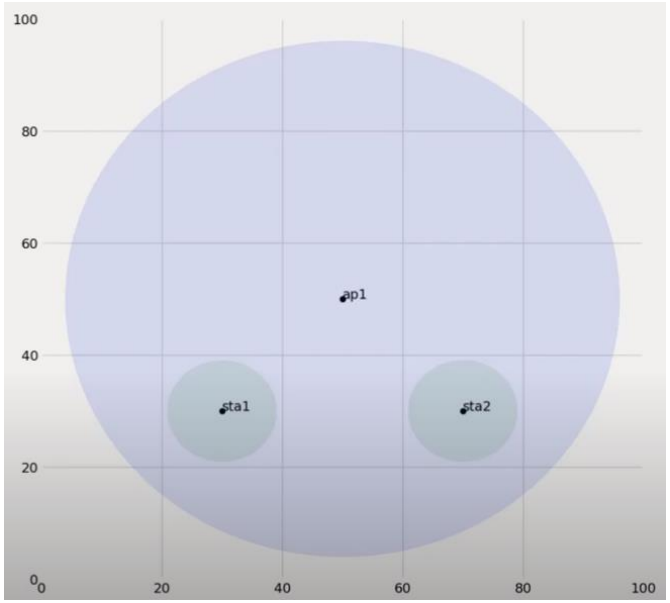



```
alpha@alpha-Inspiron-5480:~/mininet-wifi$ sudo python examples/socket_client.py
[sudo] password for alpha:
-> get.sta1.position
Received from server: [30.0, 60.0, 0.0]
-> get.sta1.rssi
Received from server: [-76.0]
-> get.sta1.range
Received from server: [9]
```

Mininet-WiFi – Usage (4)

https://www.youtube.com/watch?v=k69t9Xkb0nU

- Moving a station to a new location

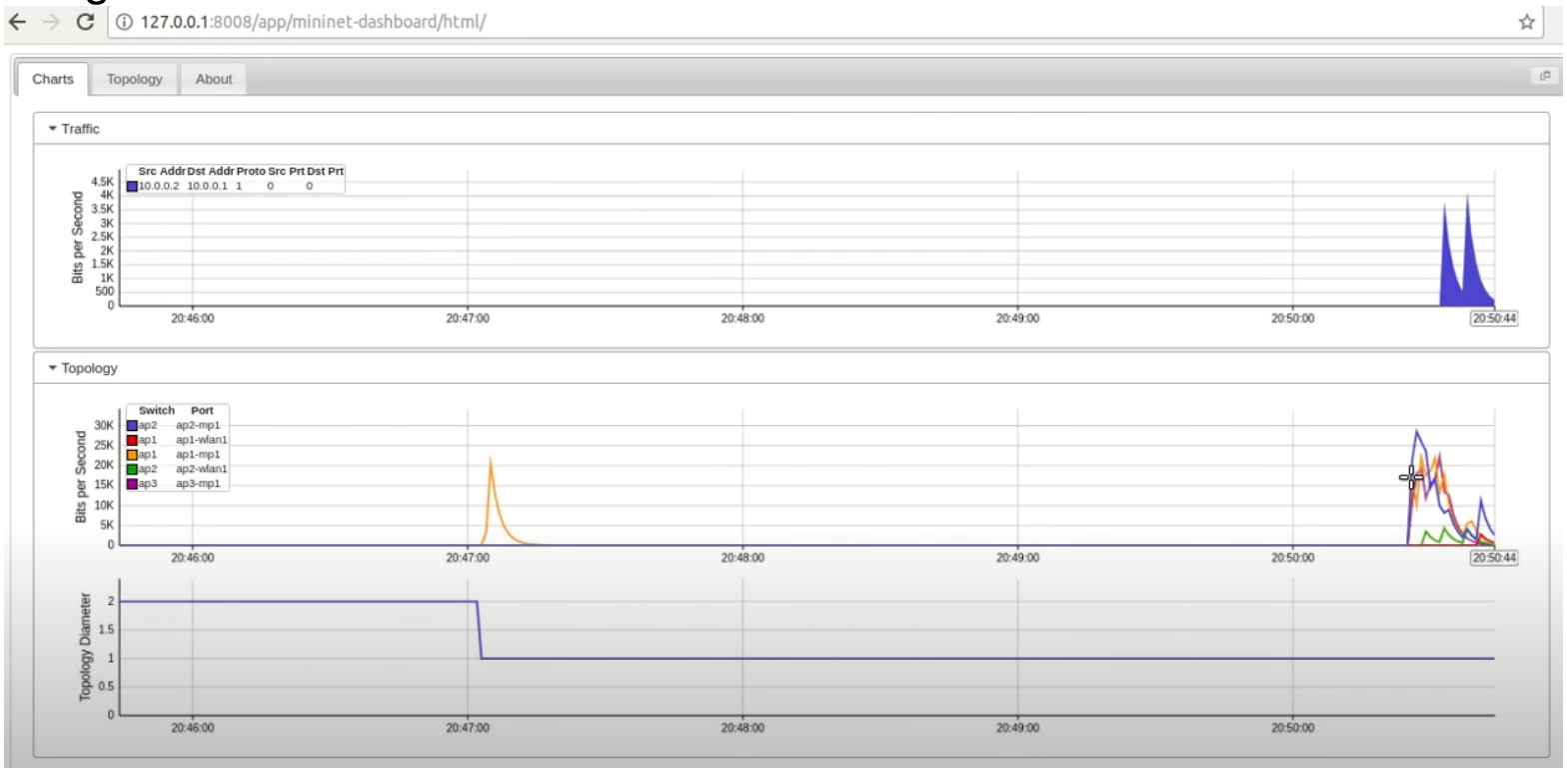



```
-> set.sta1.setPosition.30,30,0
Received from server: command accepted!
```

Mininet-WiFi – Usage (5)

https://www.youtube.com/watch?v=4ccua2b26k8&list=PLccoFREVAt_4nEtrkl59mjjf5ZzRX8DZA&index=18

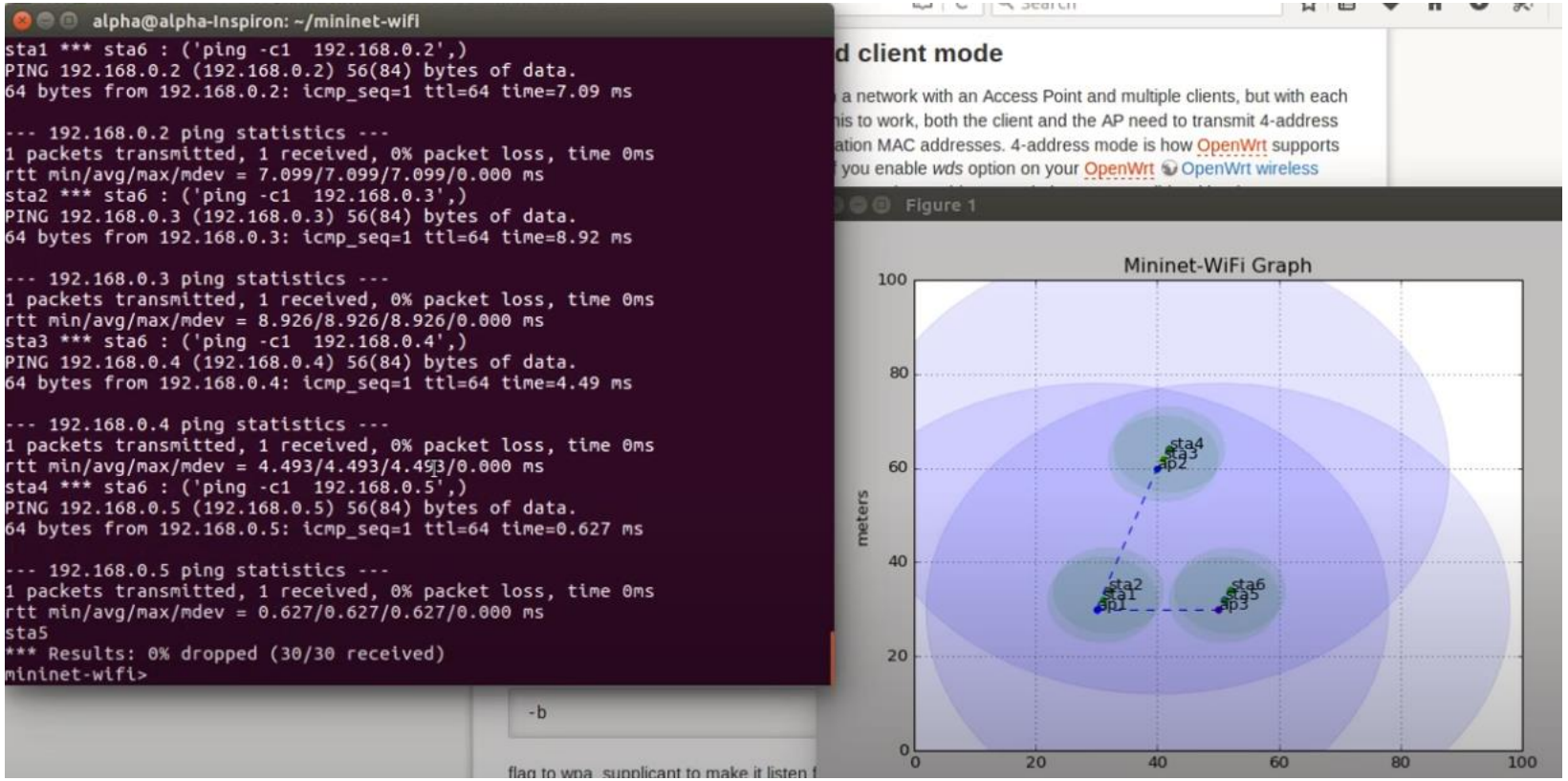
- Integration between Mininet-WiFi and sflow-rt



Mininet-WiFi – Usage (6)

https://www.youtube.com/watch?v=xWfWSqtYA8A&list=PLccoFREVAt_4nEtrkl59mjjf5ZzRX8DZA&index=22

- Mininet-WiFi: Using 4-address for AP and client mode



Mininet-WiFi – Usage (7)

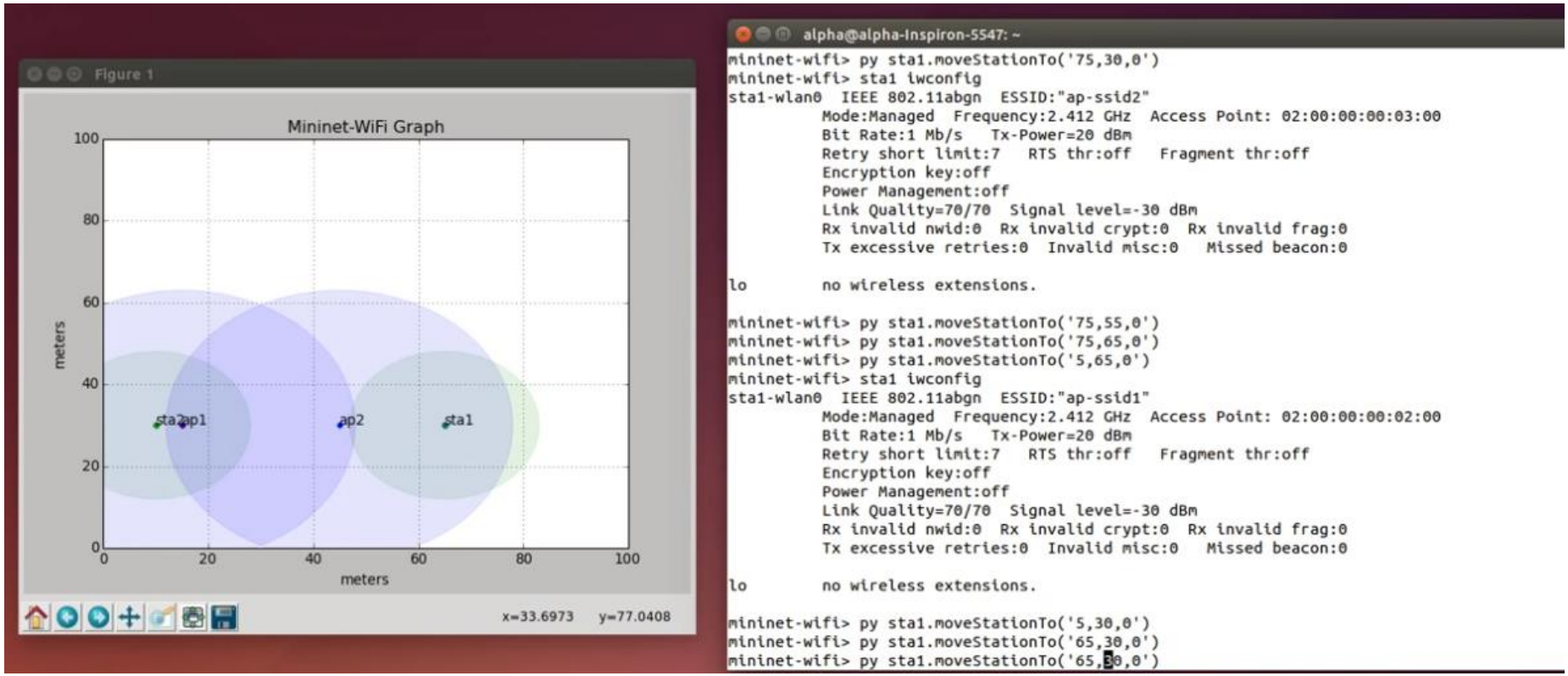
https://www.youtube.com/watch?v=lMkIV0YBTss&list=PLccoFREVAt_4nEtrkl59mjjf5ZzRX8DZA&index=34

- Mininet-WiFi: Building 3D graphic

Mininet-WiFi – Usage (8)

https://www.youtube.com/watch?v=-Q59NNNjt9I&list=PLccoFREVAt_4nEtrkl59mjjf5ZzRX8DZA&index=41

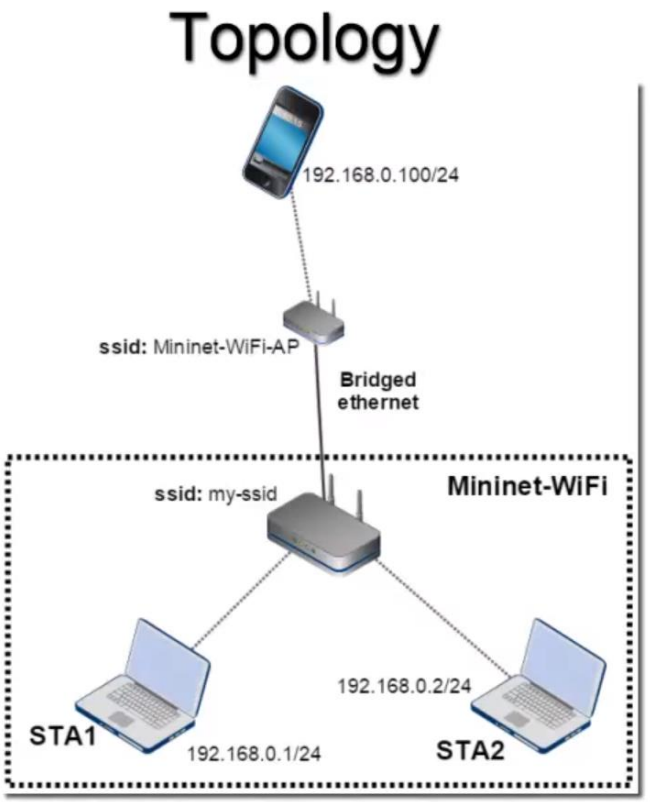
- Mininet-WiFi: Working at runtime



Mininet-WiFi – Usage (9)

https://www.youtube.com/watch?v=WH6bSOKC7Lk&list=PLccoFREVAt_4nEtrkl59mjjf5ZzRX8DZA&index=52

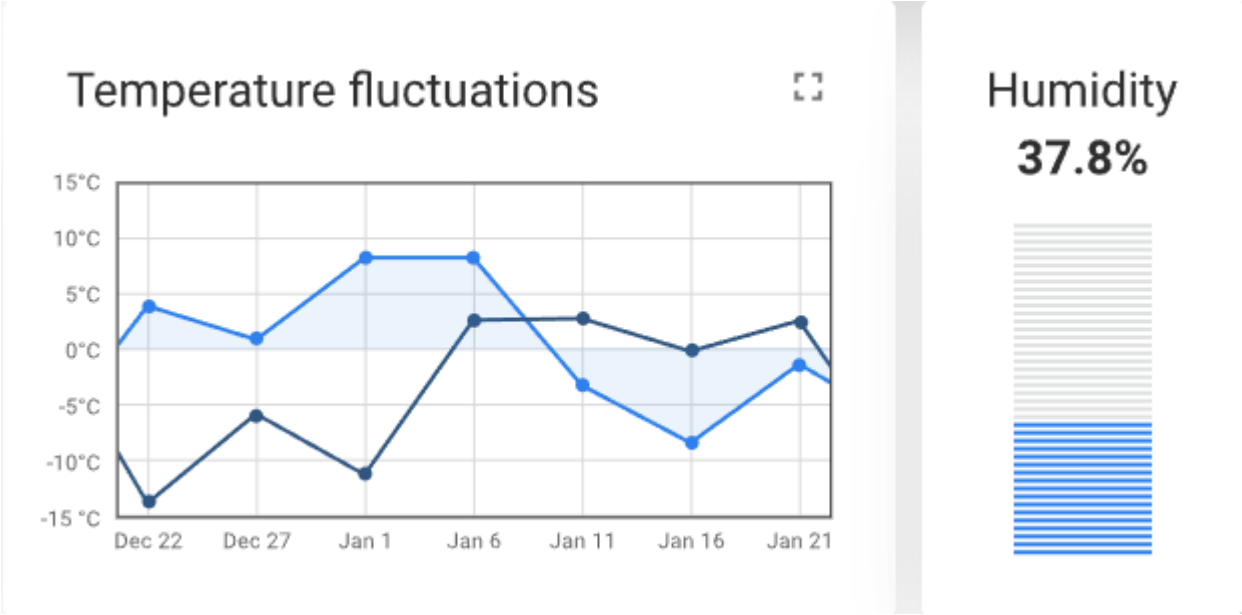
- Integration between Mininet-WiFi and Physical Wireless Interface
- Όπου το κινητό μπορεί να είναι ο server του Thingsboard με δικιά του IP και Port
- Και stations μπορούν να είναι οι clients που στέλνουν τα δεδομένα θερμοκρασίας στον server (άρα έχουν τον ρόλο των sensors)



Thingsboard

ThingsBoard CE - https://thingsboard.io/

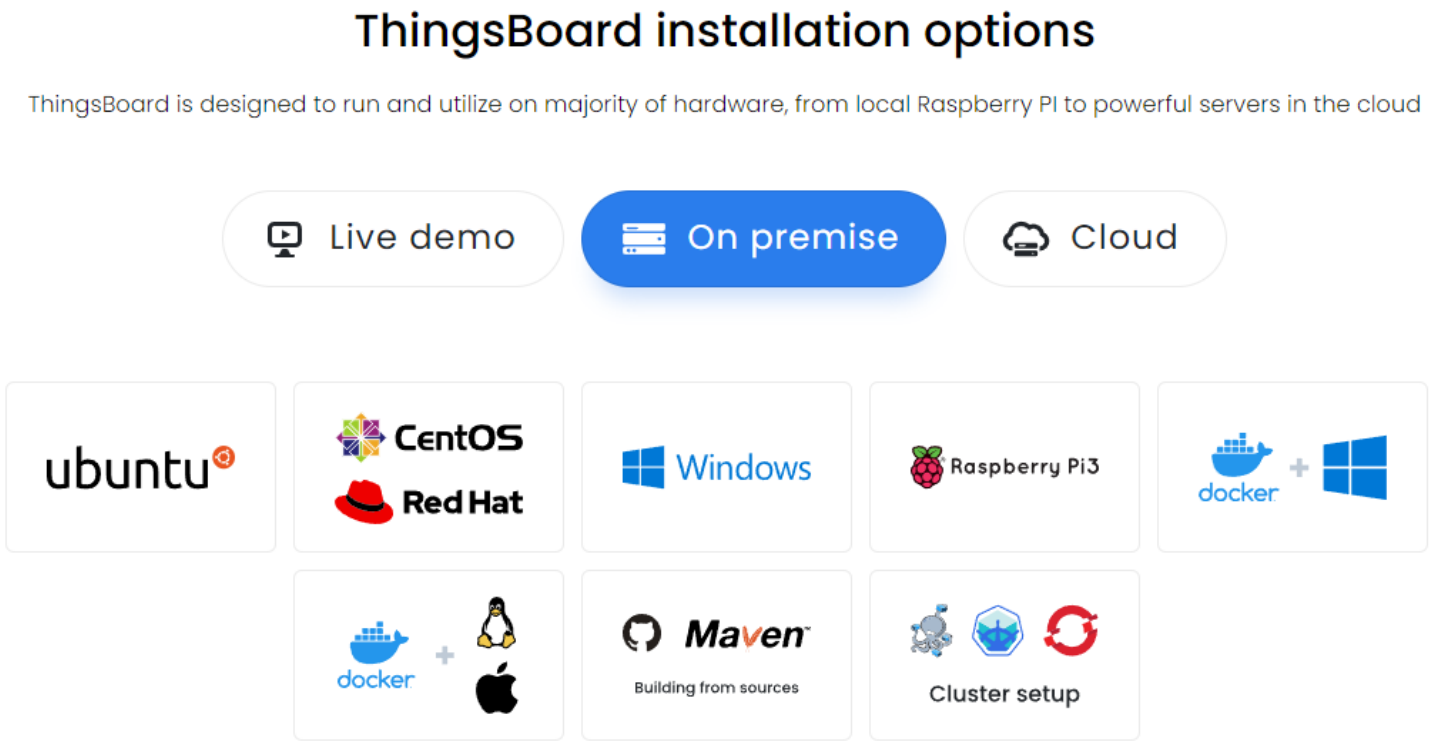
- Open-source IoT Platform
- Device management, data collection, processing and visualization for your IoT solution



Thingsboard – Installation (1)

https://thingsboard.io/docs/user-guide/install/installation-options/

- Μπορείτε να επιλέξετε όποιο θέλετε (προτίμηση στις επιλογές Ubuntu, Windows)

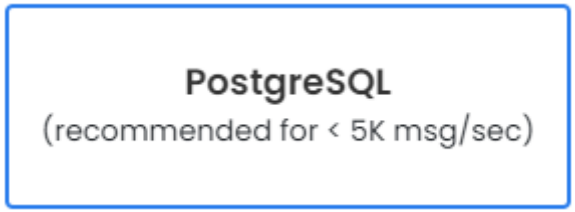


Thingsboard – Installation (2)

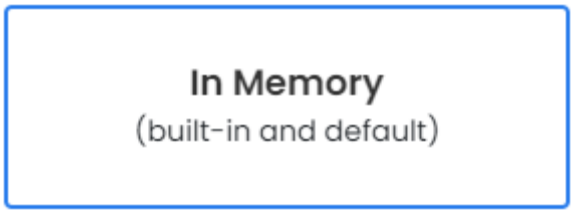
https://thingsboard.io/docs/user-guide/install/ubuntu/

https://thingsboard.io/docs/user-guide/install/windows/

- Ακολουθείτε τα βήματα του συνδέσμου και επιλέγετε για την βάση και queue service τα παρακάτω
- Για την βάση:



- Για το queue service:



- Μπορείτε να δοκιμάσετε και τις άλλες επιλογές αλλά οι recommended είναι οι πιο απλές

Thingsboard – Usage (1)

https://thingsboard.io/docs/user-guide/install/ubuntu/

https://thingsboard.io/docs/user-guide/install/windows/

- Getting started guides - These guides provide quick overview of main ThingsBoard features. Designed to be completed in 15-30 minutes.
- Connect your device - Learn how to connect devices based on your connectivity technology or solution.
- Data visualization - These guides contain instructions how to configure complex ThingsBoard dashboards.
- Data processing & actions - Learn how to use ThingsBoard Rule Engine.
- IoT Data analytics - Learn how to use rule engine to perform basic analytics tasks.
- Hardware samples - Learn how to connect various hardware platforms to ThingsBoard.
- Advanced features - Learn about advanced ThingsBoard features.

Thingsboard – Usage (2)

Hello world

Learn how to collect IoT device data using MQTT, HTTP or CoAP and visualize it on a simple dashboard. Provides variety of sample scripts that you can run on your PC or laptop to simulate the device.

End user IoT dashboards

Learn how to perform basic operations over Devices, Customers, and Dashboards.

Device data management

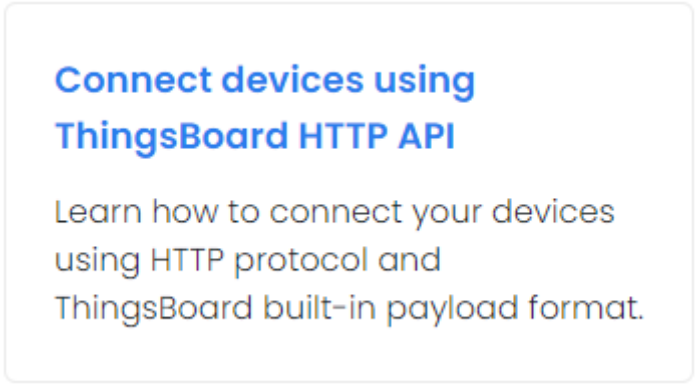
Learn how to perform basic operations over device attributes to implement practical device management use cases.

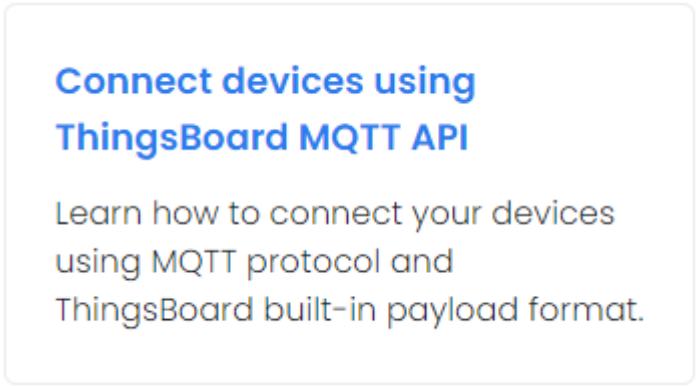
Getting started with Rule Engine

Learn about ThingsBoard rule engine and typical use cases you can implement. Review Hello World example and learn how-to enable filtering of incoming telemetry messages.

Thingsboard – Usage (3)

- Για να συνδέσετε συσκευή που να στέλνει δεδομένα στο server σας προτιμάμε το HTTP API
- Σε κανονικά σενάρια προτιμούμε το MQTT, επειδή προσφέρει πολλές δυνατότητες





Thingsboard – Usage (4)

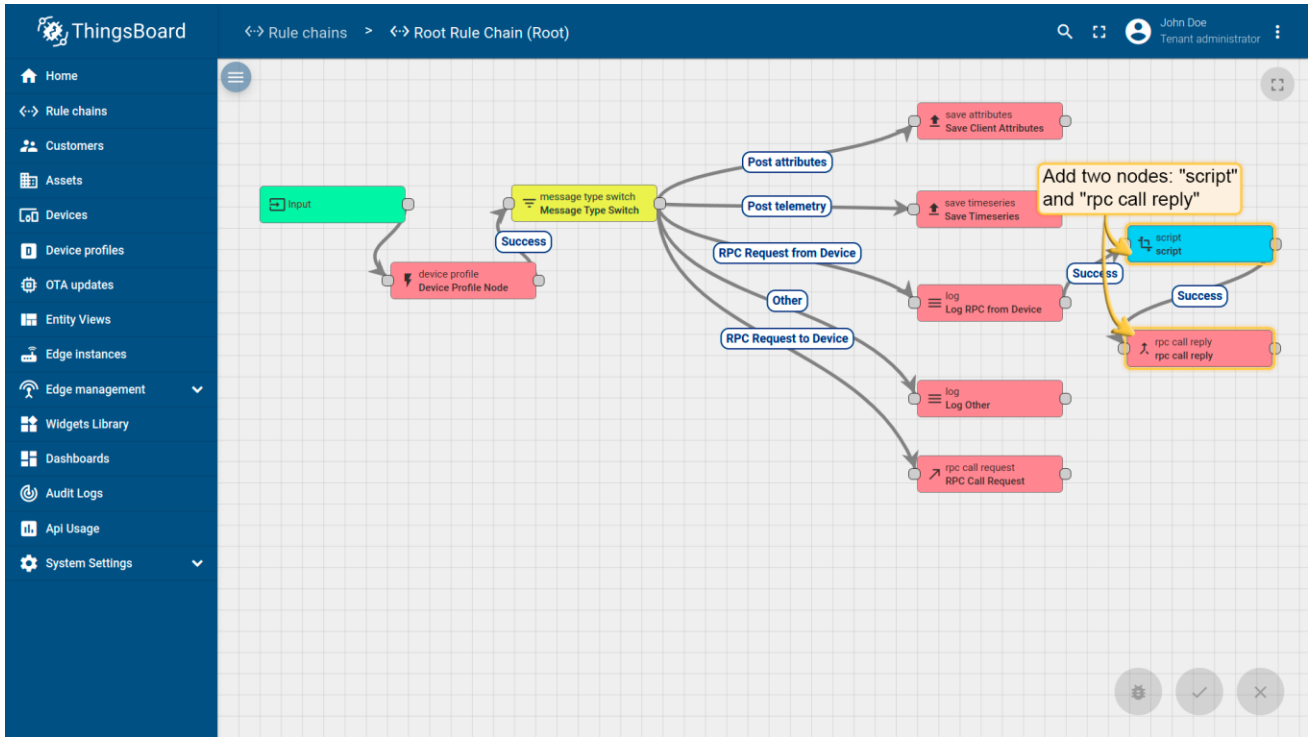
- Παράδειγμα χρήσης JSON και API
  - JSON →

```
{
 "stringKey":"value1",
 "booleanKey":true,
 "doubleKey":42.0,
 "longKey":73,
 "jsonKey": {
    "someNumber": 42,
    "someArray": [1,2,3],
    "someNestedObject": {"key": "value"}
 }
}
```

- API: http(s)://host:port/api/v1/$ACCESS_TOKEN/telemetry
- Παράδειγμα:
  - # Publish data as an object without timestamp (server-side timestamp will be used). Replace $THINGSBOARD_HOST_NAME and $ACCESS_TOKEN with corresponding values.
  - curl -v -X POST --data "{"temperature":42,"humidity":73}" http://$THINGSBOARD_HOST_NAME/api/v1/$ACCESS_TOKEN/telemetry --header "Content-Type:application/json"

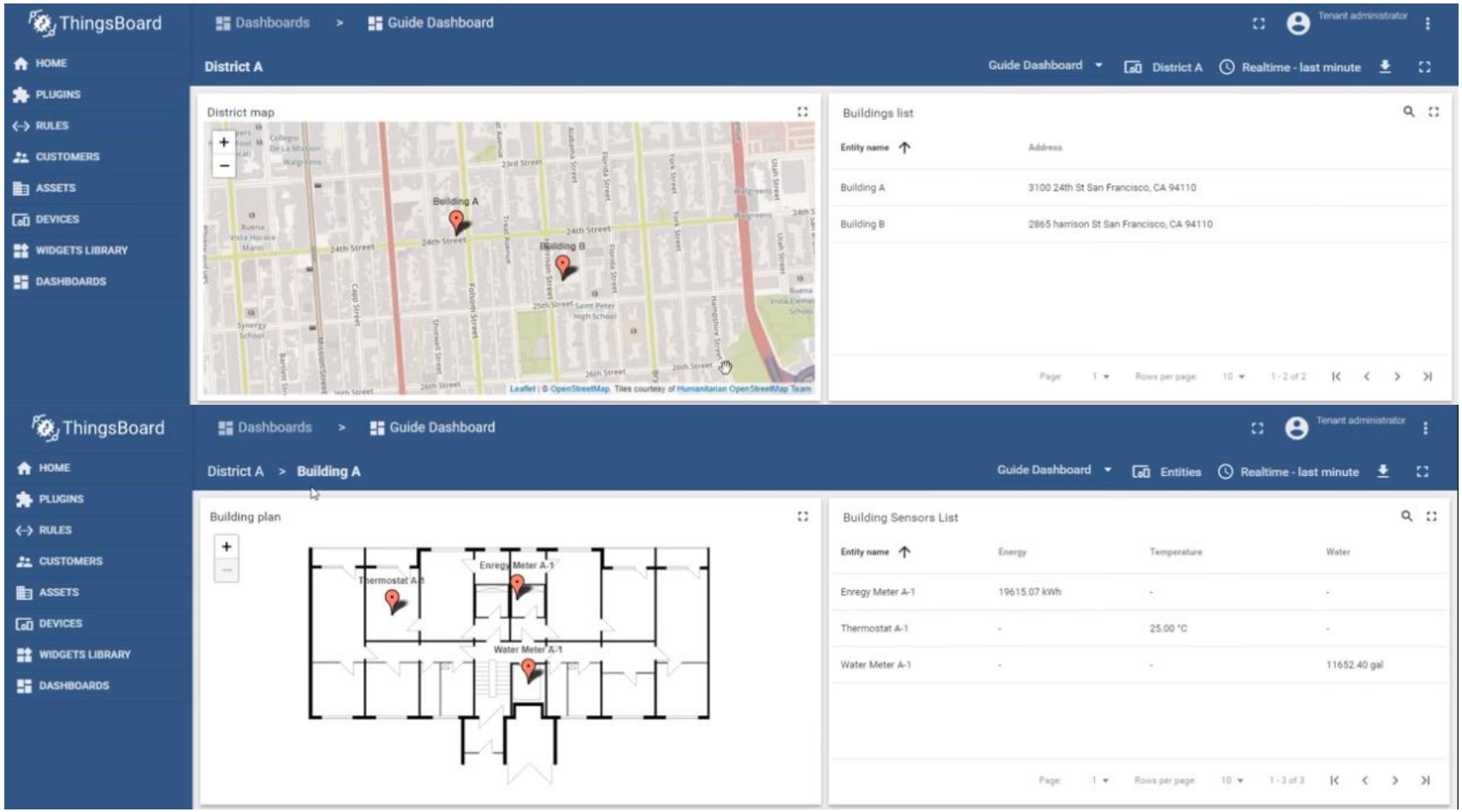
Thingsboard – Usage (4)

- Θα χρειαστεί να χρησιμοποιήσετε το GUI για την εφαρμογή κανόνων που να ανταποκρίνονται στα σενάρια
- Για παράδειγμα στους κανόνες



Thingsboard – Usage (5)

- Παραδείγματα Dashboard που θα χρειαστείτε



Thingsboard – Usage (5)

- Βοηθητικοί σύνδεσμοι για να μπορέσετε να φτιάξετε τα σενάρια
  - Widget configuration guide, Part 1: Basic Settings
  - Widget configuration guide, Part 2: Latest Values Map Widget
  - Widget configuration guide, Part 3: Time Series Map Widget
  - Getting started with ThingsBoard
- Παραδείγματα Widget που θα χρειαστείτε