HELNET – Federated Greek Infrastructures for Future Internet Research

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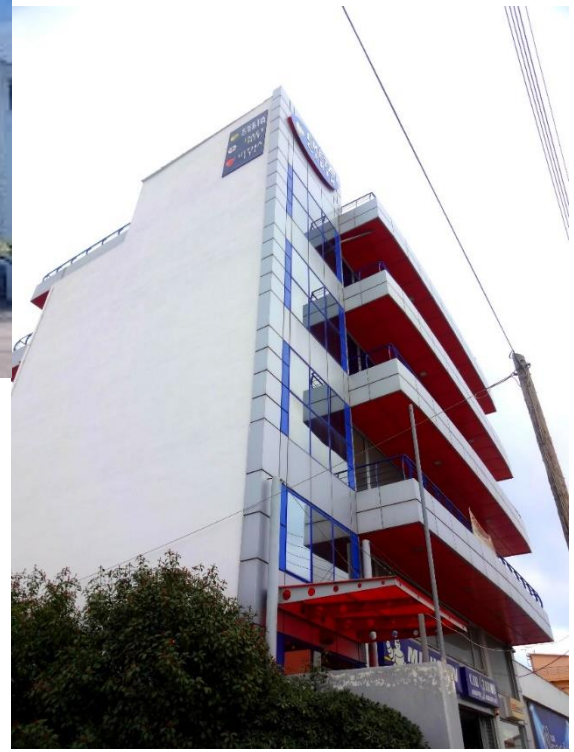
NETLAB
NETWORK IMPLEMENTATION TESTBED LABORATORY

NITOS

Network Implementation Testbed Laboratory (NITLab)

- ✓ Affiliated with UTH and CERTH
- ✓ 5 faculty members
- ✓ 25 researchers (research engineers, postdocs, PhD students, master students)
- ✓ Research activities in the field of wired and wireless networking, cloud, smart cities
- ✓ Strong participation in EU projects
- ✓ Website: nitlab.inf.uth.gr



HELNET Project

- ✓ Project Title: HELIX-National Digital Infrastructures for Research
- ✓ Subproject: HELNET - Πανελλήνια πειραματική υποδομή
- ✓ Involved partners

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UNIVERSITY OF PATRAS
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ

National Technical University of Athens

National and Kapodistrian UNIVERSITY OF ATHENS

Background and Concept

- ✓ Future Internet Research and Experimentation initiative in Europe:
  - ✓ Provide open and remotely accessible resources to experimenters
  - ✓ Single sing-in procedure for all the testbeds
  - ✓ Environment for experimentally-driven evaluation of new protocols and ideas
  - ✓ Repeatability of experiments, customizable environment

- ✓ Several EU funded projects towards this goal:
  - ✓ E.g. Fed4FIRE/Fed4FIRE+, OpenLab, FLEX, 5GinFIRE, etc.
  - ✓ Cooperation with other countries:
    - ✓ E.g. SmartFIRE (EU-Korea), FIBRE, FUTEBOL (EU-Brazil), ECIAO (EU-China)

The European Open Ecosystem for Future Internet Experimentation & Innovation

Background and Concept

- ✓ Target: Federation of Greek FIRE research infrastructure
- ✓ Wide offering of resources:
  - ✓ Wireless Networking
    - ✓ WiFi, 5G (5G-NR), 4G (LTE/LTE-A), WiMAX, ZigBee/LoRa, Software Defined Radios
  - ✓ Wired Networking
    - ✓ Software Defined Networking – OpenFlow
  - ✓ Cloud Computing
    - ✓ Virtualized resources for experimentation
- ✓ Four testbeds are participating:
  - ✓ NITOS – UTH – http://nitlab.inf.uth.gr
  - ✓ P2E – UoP - http://nam.ece.upatras.gr/ppe/
  - ✓ NETMODE – NTUA - http://www.netmode.ntua.gr/main/
  - ✓ SCAN – NKUA - http://scan.di.uoa.gr/

HELNET Objectives

- ✓ Extension of the testbeds with cutting-edge equipment to allow evaluation of emerging technologies
- ✓ Adoption of common experimentation control tools
  - ✓ milden the learning curve for experimenters using the HELNET infrastructure
  - ✓ enable repeatability and portability of experiments between testbeds
- ✓ Adoption of common measurement collection tools
- ✓ Strengthen the competitiveness of Greek Research Infrastructure, attract new experimenters from around the globe
- ✓ Promotion of experimentally driven research
- ✓ Exploitation of the infrastructure for educational purposes – hands on experience for University students

Research Infrastructure – HELNET Testbed Sites

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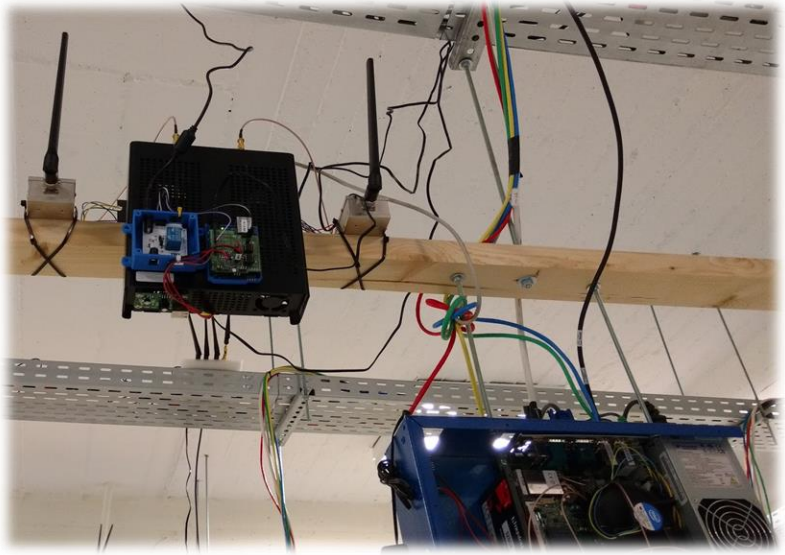
NITOS Wireless Testbed (1/3)

- ✓ NitLab developed and operates NITOS, a research experimental facility that supports the research activity of the lab in EU level
- ✓ NITOS stands for “Network Implementation Testbed using Open Source tools”
- ✓ NITOS supports multiple technologies like wireless (Wi-Fi, 5G, 4G, mmWave, SDR), wired networks, SDN/NFV, cloud, sensors.



NITOS Wireless Testbed (2/3)

- ✓ NITOS is the main testbed facility of multiple EU projects (currently in two 5GPPP - 5G-Xhaul, 5G-PICTURE).
- ✓ NITOS is constantly upgraded with state-of-the-art hardware and software.

NITOS Wireless Testbed (3/3)

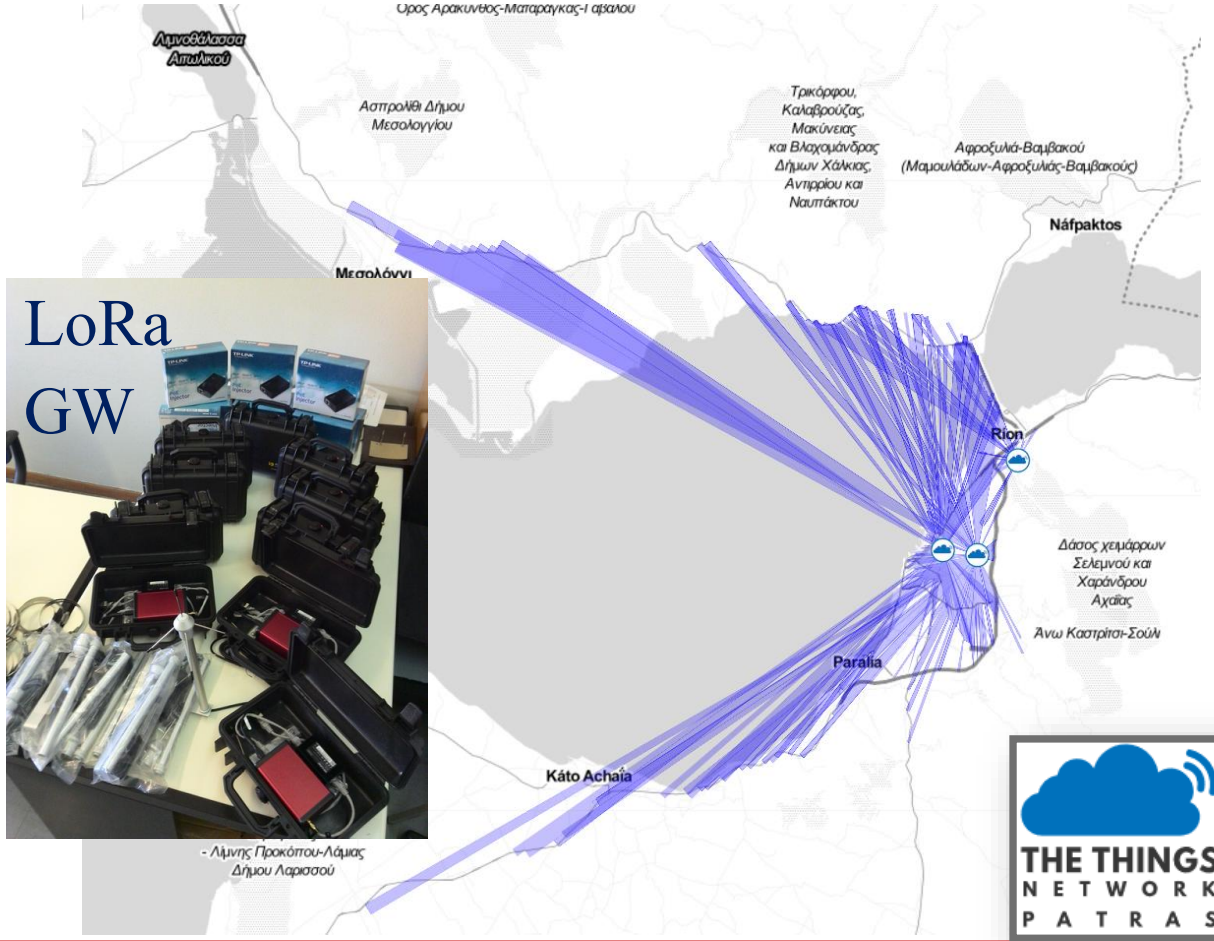
- ✓ Wide offering of resources for Wireless/Wired/IoT/Cloud experimentation
- ✓ Organized in three different setups, to cover different experimental settings
  - ✓ Indoor RF-isolated setup
  - ✓ Outdoor, prone to external uncontrolled interference
  - ✓ Office setup, with low external interference
- ✓ Over 100 physical machines as testbed nodes that can be reserved with the testbed's tools, offering different technologies (COTS LTE, Open Source LTE, WiFi, WiMAX, SDRs, mmWave Units, OpenFlow switches, ZigBee/LoRa/LoRaWAN sensors and cloud infrastructure)

Patras Cloud Platform

- ✓ Can host core network components, NFV and MEC deployments
- ✓ Total computing power of 212 CPUs, 768GB of RAM and 30TB storage
- ✓ Two servers with 4x10Gbe NICs DPDK enabled
- ✓ Cloudville Experimentation Platform
  - ✓ OpenStack as the cloud operating system
  - ✓ Open Source MANO FOUR for NFV/NSD deployment
  - ✓ Grafana for monitoring
  - ✓ ElasticSearch and Kibana for data collection and visualization

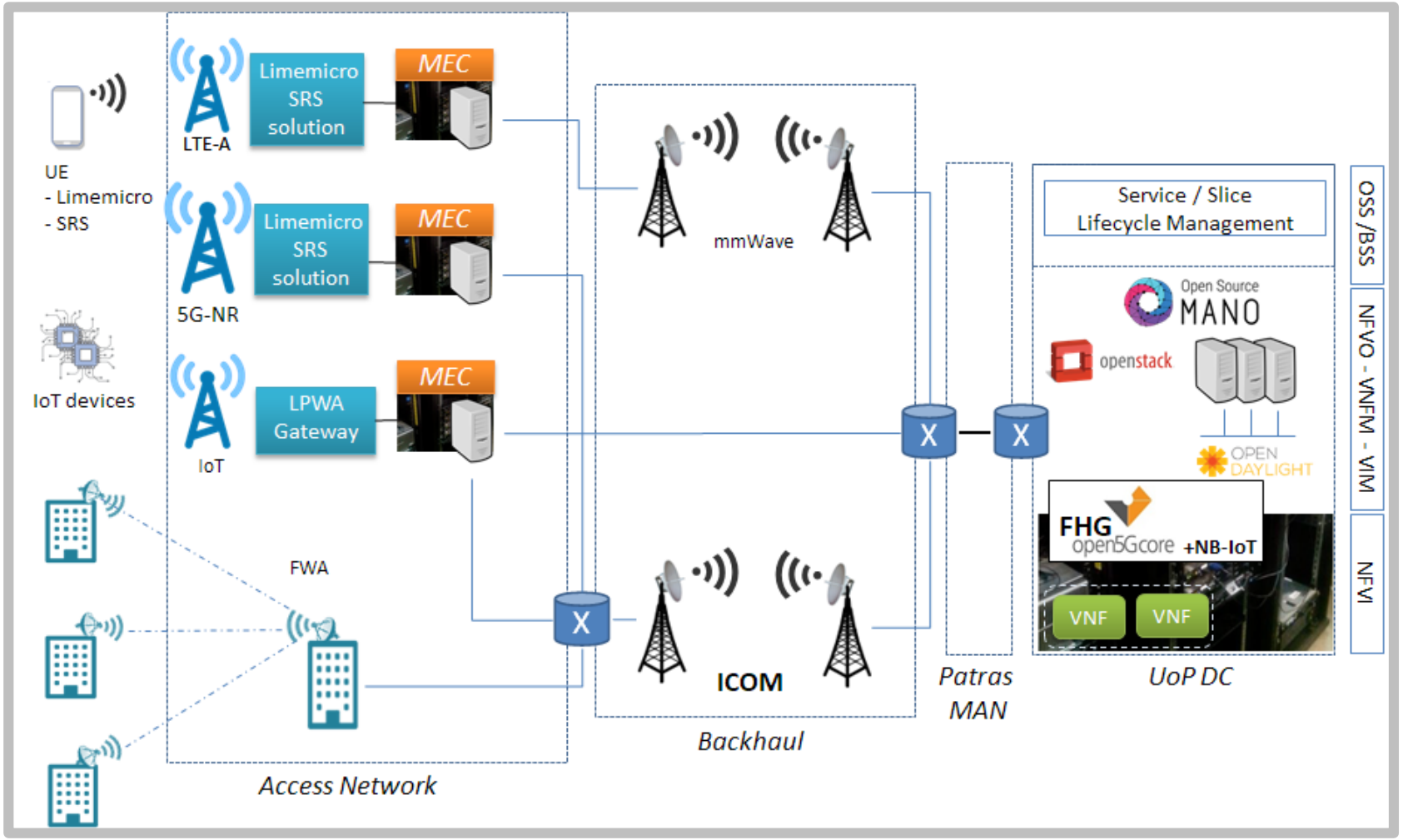
Patras TheThingsNetwork

- ✓ IoT Gateways → Core IoT Networks
- ✓ Open IoT deployment allows various city communities and organizations to start building their own solutions and share data and applications
- ✓ TheThingsNetwork is a public IoT network free to use
- ✓ Integrated with Sense.City
- ✓ Allow citizens/developers to experiment and exchange apps, devices and data



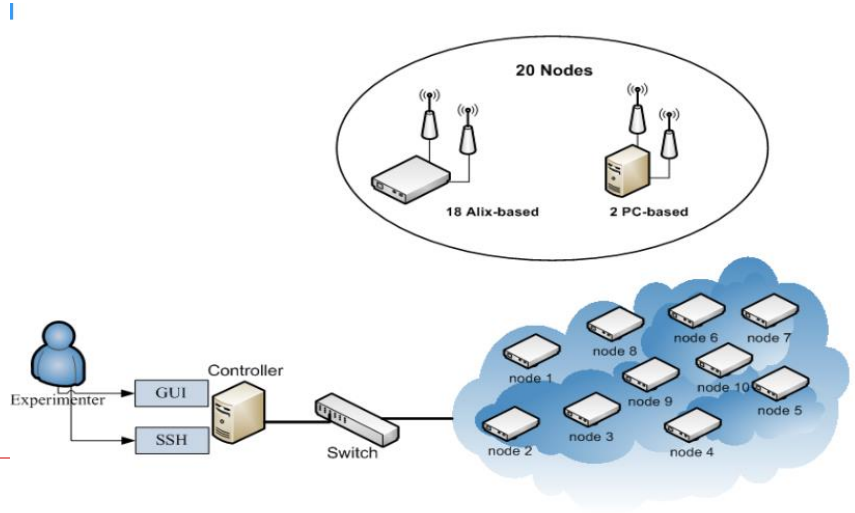
5G-VINNI Facility in Patras

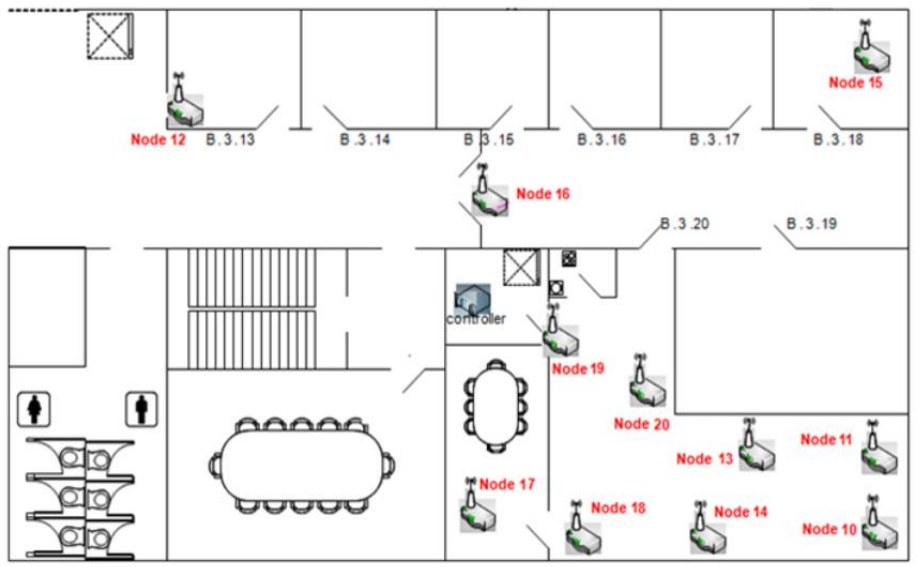
- ✓ Part of the 5G-VINNI project
- ✓ Facility for evaluating vertical services and applications for 5G Networks



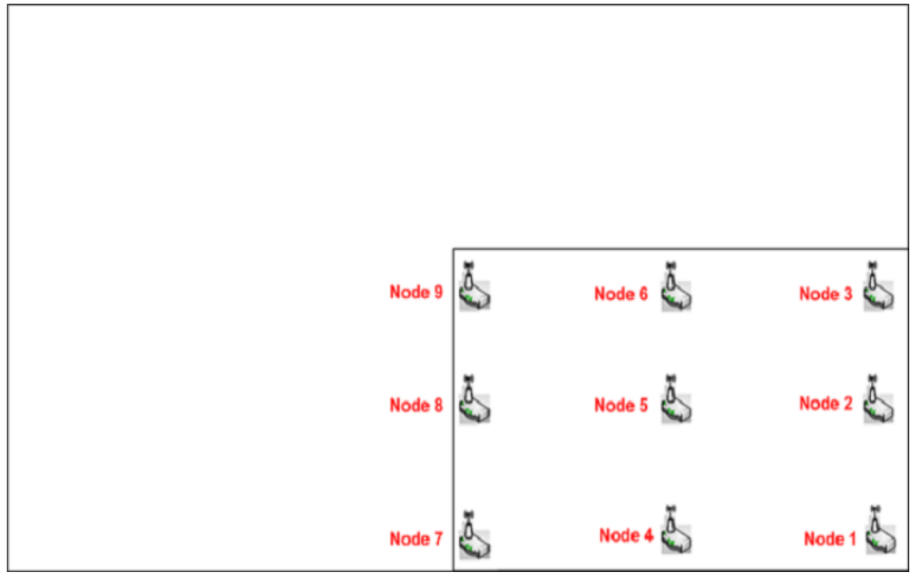
NTUA – NETMODE testbed

- ✓ Indoor & outdoor deployment
- ✓ Remotely accessible, offering WiFi and Ethernet resources for experimentation
- ✓ Future Extensions:
  - ✓ Mobile Edge Computing and IoT
  - ✓ Mobile Robots.
  - ✓ Environmental and motion sensors.





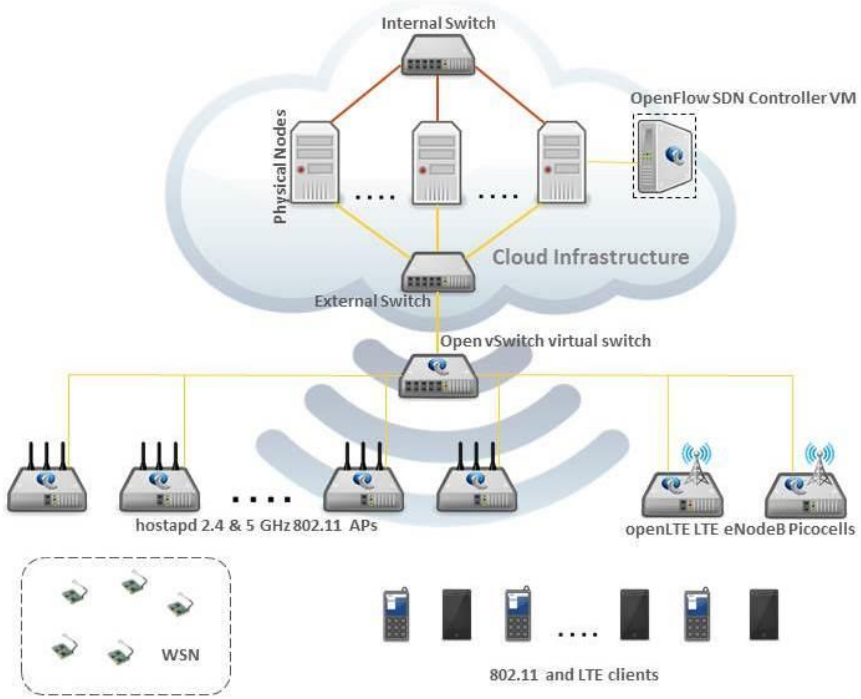
Wireless Testbed Topology (3rd floor - Indoor)



Wireless Testbed Topology (Roof - Outdoor)

NKUA - SCAN

- ✓ SCAN infrastructure consists of:
  - ✓ Virtual-server cloud infrastructure with capacity of more than 100 VMs
  - ✓ Smartphones and laptops used as 802.11 and LTE clients
  - ✓ A great number of wireless sensors (temperature, humidity, light, movement detection, …)
  - ✓ Programmable nodes and Desktop PCs with multiple Ethernet and wireless interfaces
  - ✓ Using OpenStack for the testbed management



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SCAN lab
Software Centric & Autonomic Networking

Heterogeneous Technologies, Different manner of managing them

IoT

- Massive clusters of IoT resources generating massively data
- Connected to the network with state-of-the-art technologies

Wireless

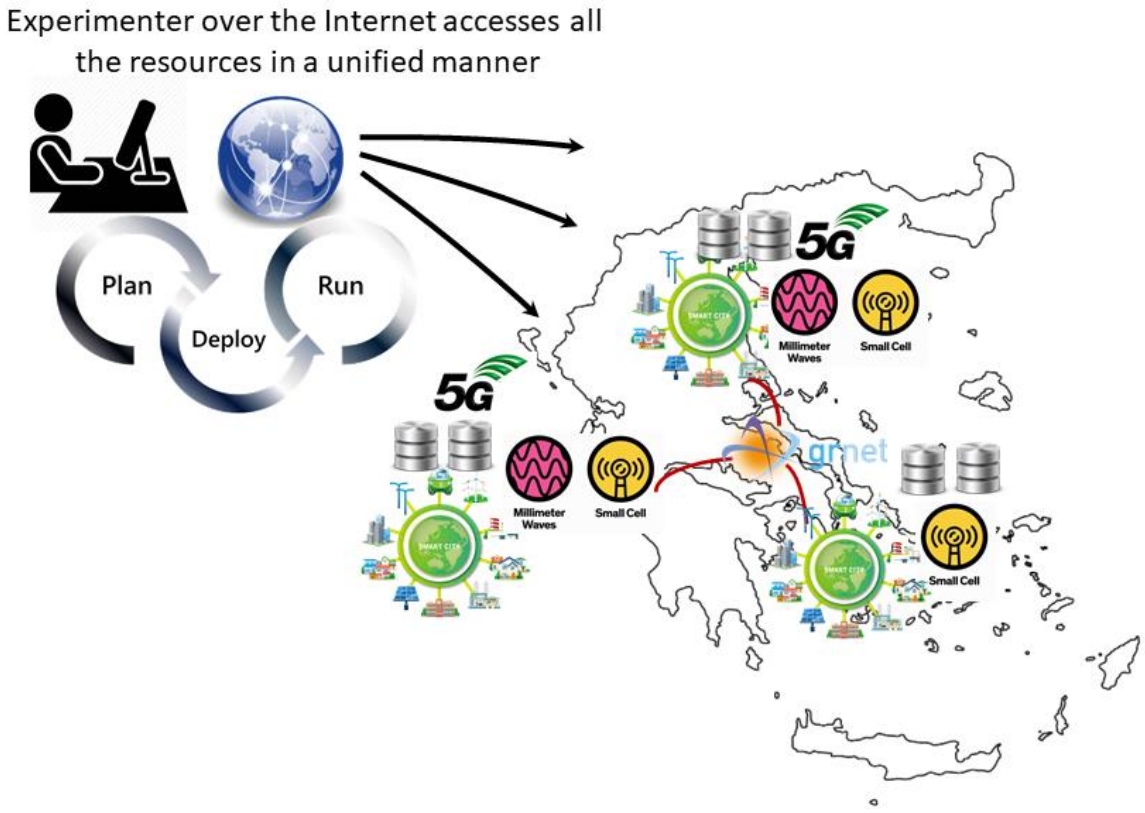
- 4G/5G/WiFi access, Indoor/Outdoor/RF-isolated setups
- Off-the-shelf and open source equipment fully programmable

Cloud

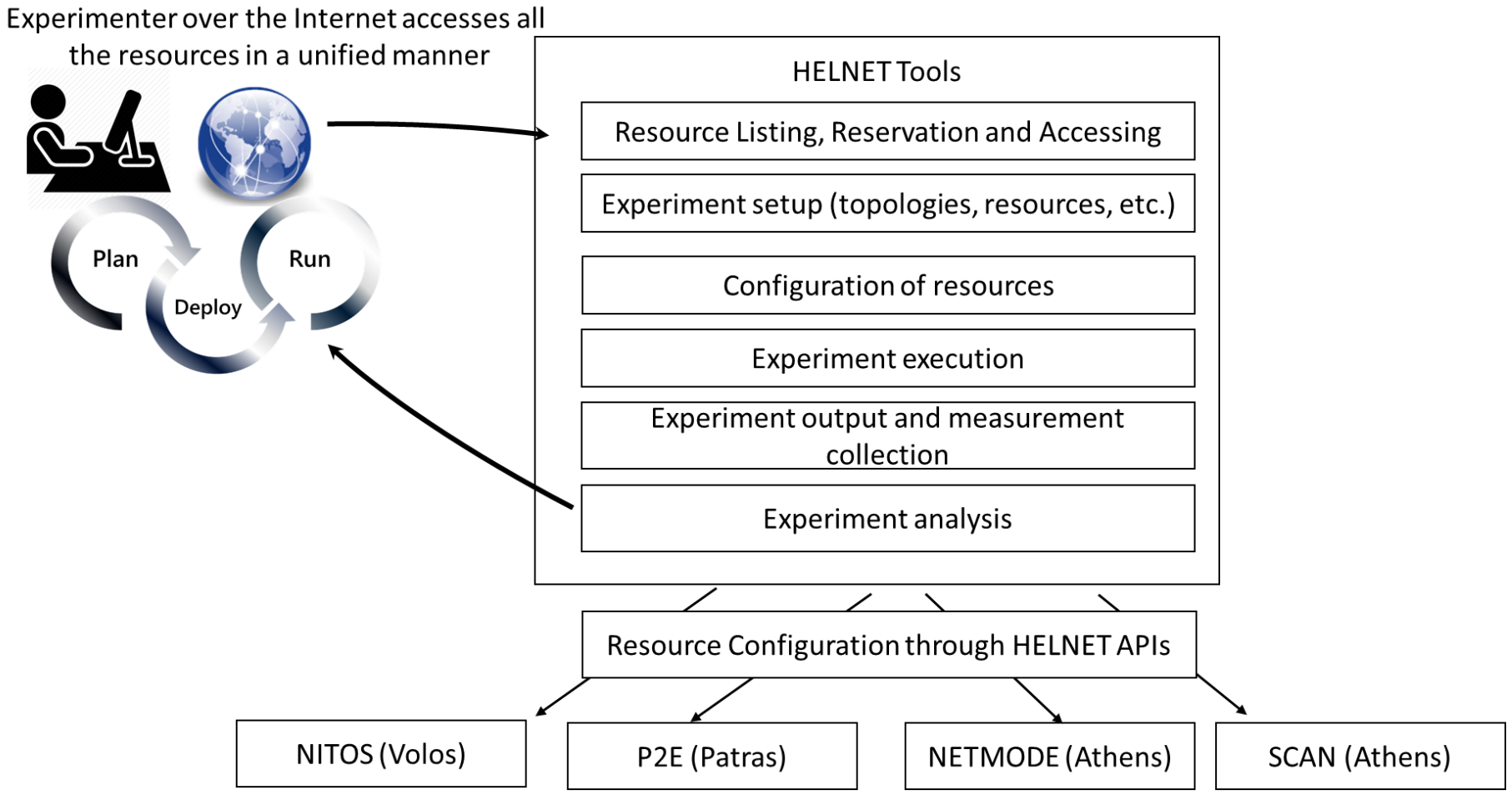
- Provide access to VM and Bare metal
- Open cloud testbeds

HELNET Federation Goals

- ✓ Make it easy for experimenters to use multiple testbeds
  - ✓ Single account
  - ✓ Single (or small number) of tools, choice of tools
- ✓ Multiple testbeds
  - ✓ To scale up
  - ✓ To use/combine special resources (e.g. 5G cellular & core network at another site)
  - ✓ Redundancy (e.g. testbed in maintenance)
  - ✓ To re-use experiments (class exercises, portability of experiments)
  - ✓ To compare environments (e.g. wireless)



Federation Process & Tools



Thank you for your attention!

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