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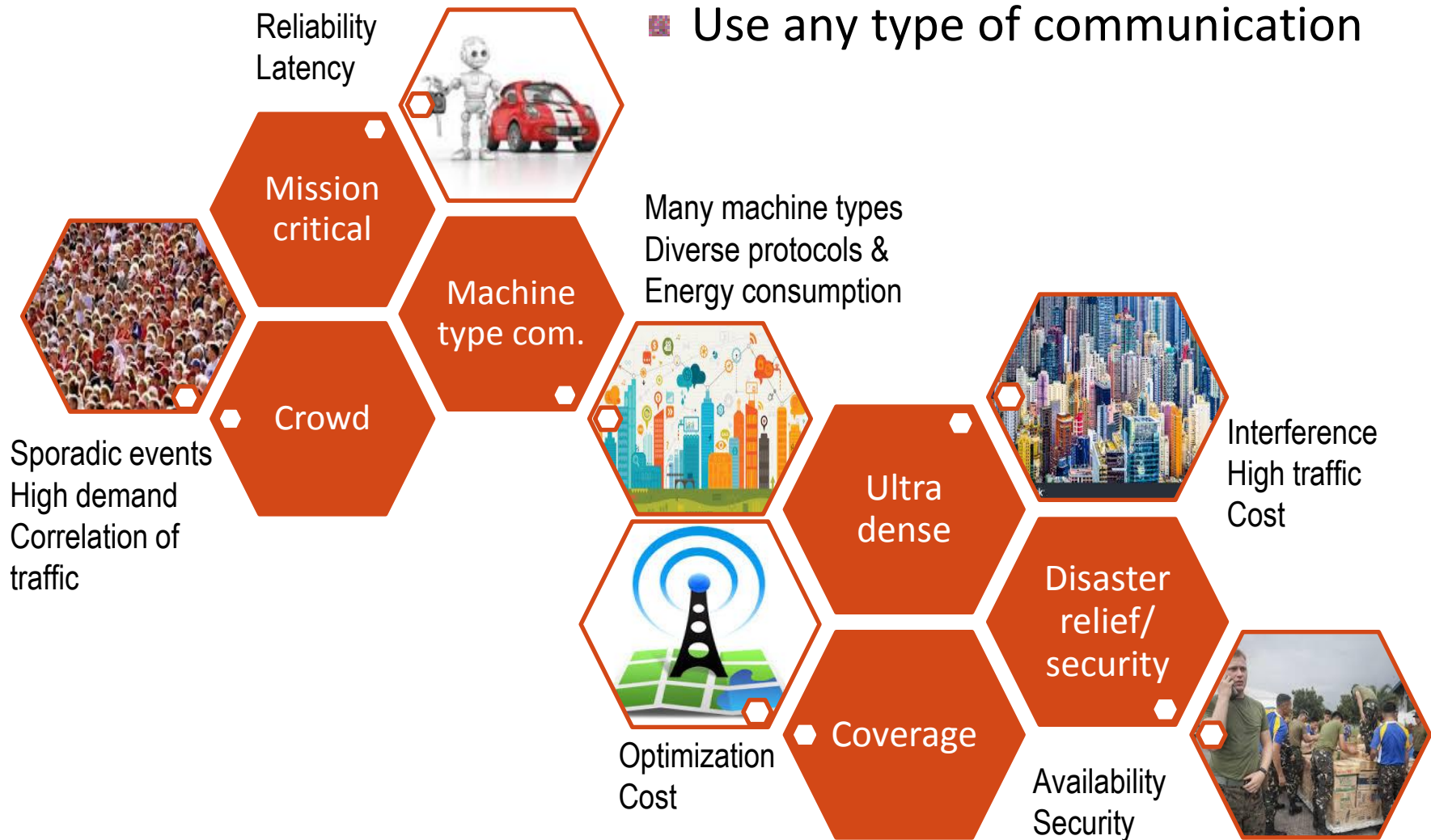
SDN/NFV and V2X Applications

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Software Centric & Autonomic Networking

5G challenging scenarios

Reliability
Latency

■ Use any type of communication

Mission critical

Many machine types
Diverse protocols &
Energy consumption

Machine type com.

Crowd

Sporadic events
High demand
Correlation of
traffic

Ultra dense

Interference
High traffic
Cost

Coverage

Disaster relief/ security

Optimization
Cost

Availability
Security

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5G networks and SDN/NFV …..

→ …..should support the connection, communication, collaboration/interaction with …..

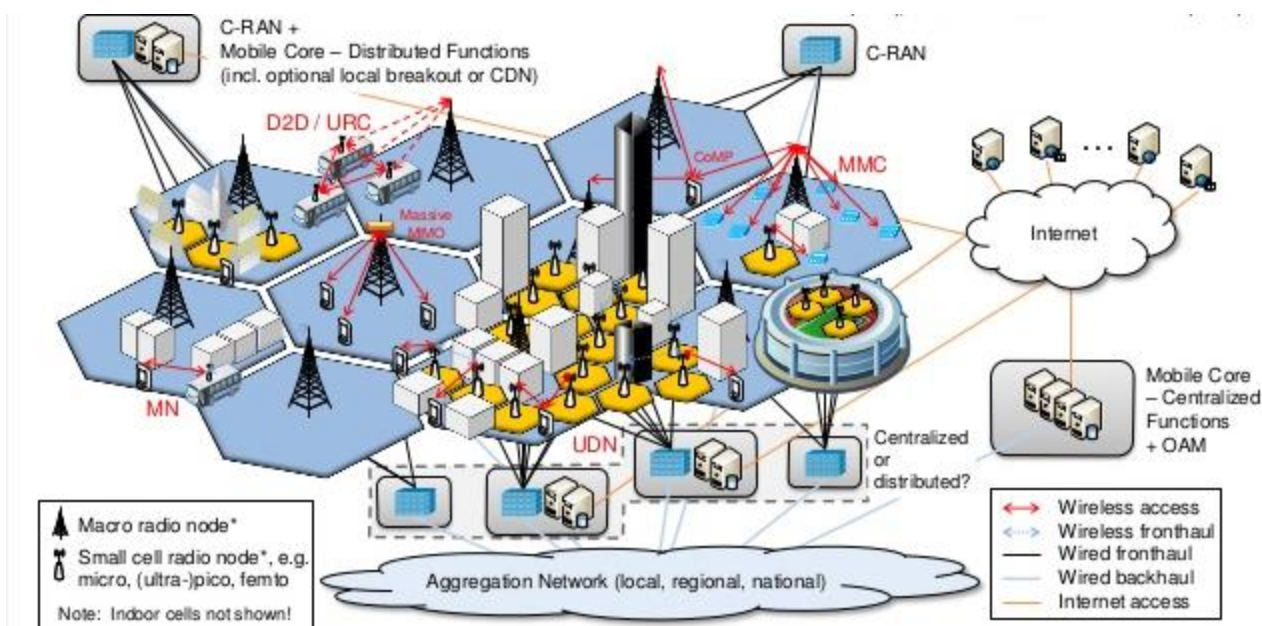

people   places   things
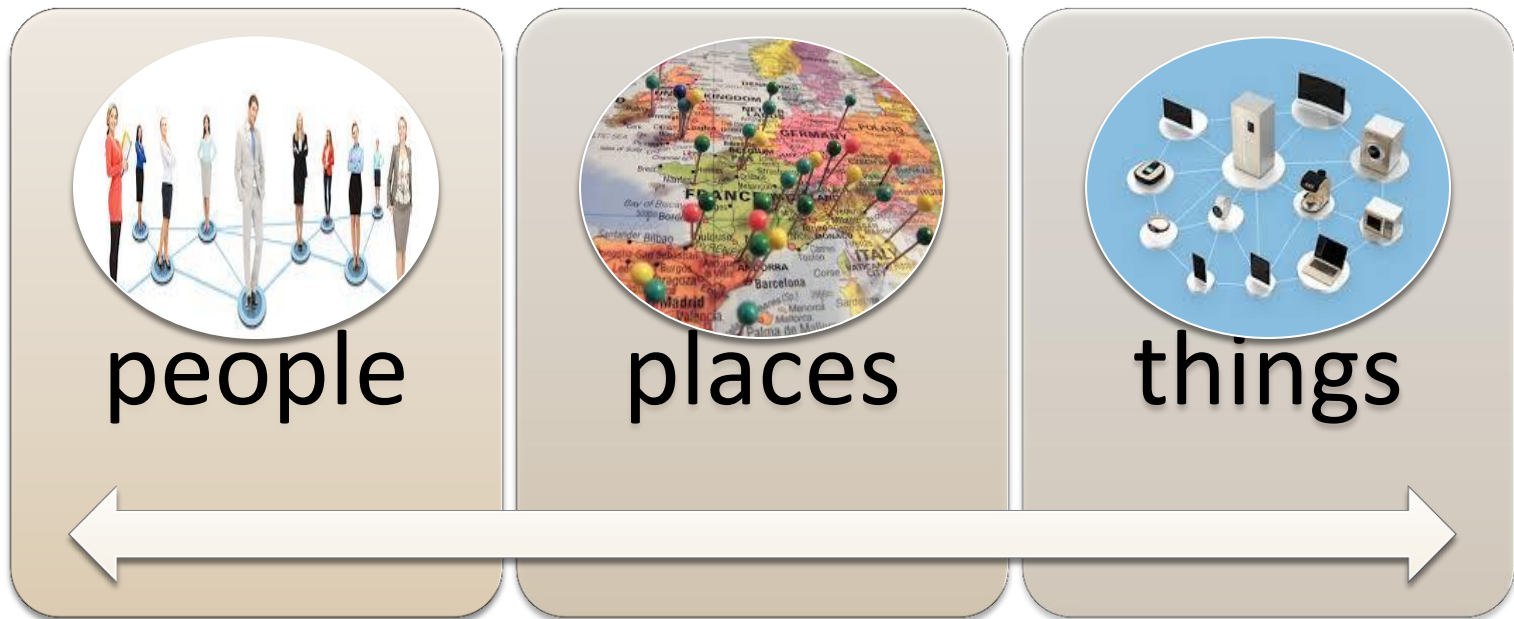
SDN and NFV

- **Create and manage Virtual (Private) Networks with SDN**
  - Scale the BUSINESS
- **Create and manage Virtual Network Functions with NFV**
  - Scale the NETWORK
- **CAPEX - Infrastructure optimization through:**
  - Multi tenancy, Virtualization
  - Resource Pooling
- **Optimized support of low latency applications, like V2X**

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Infocom World 2016 _ Athens, Greece, Nov.02, 2016
SESAME-based Special Session

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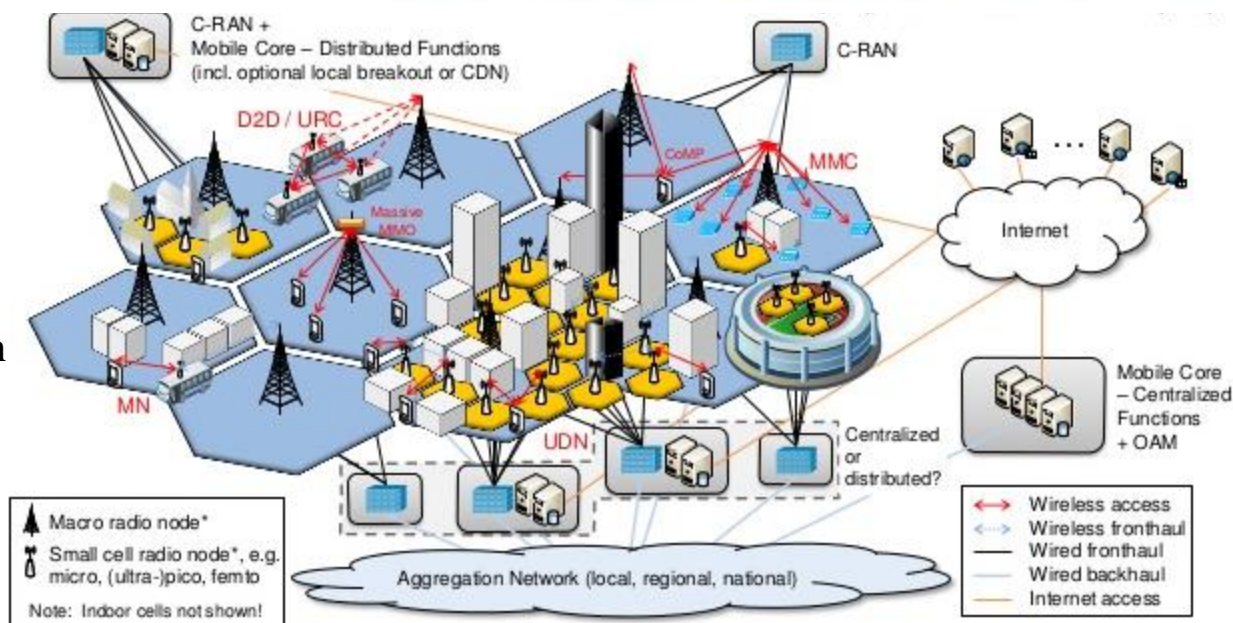Software Centric & Autonomic Networking

The current status

- Various Networks and devices interconnected through vertically designed protocols and platforms – siloed
- Will Network Softwarization be a solution?

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The new WAVE

COMaaS, RAaaS

NaaS, RANaaS

D2DaaS

Virtualized 5G & wireless Networks

Network virtualization

Service provisioning

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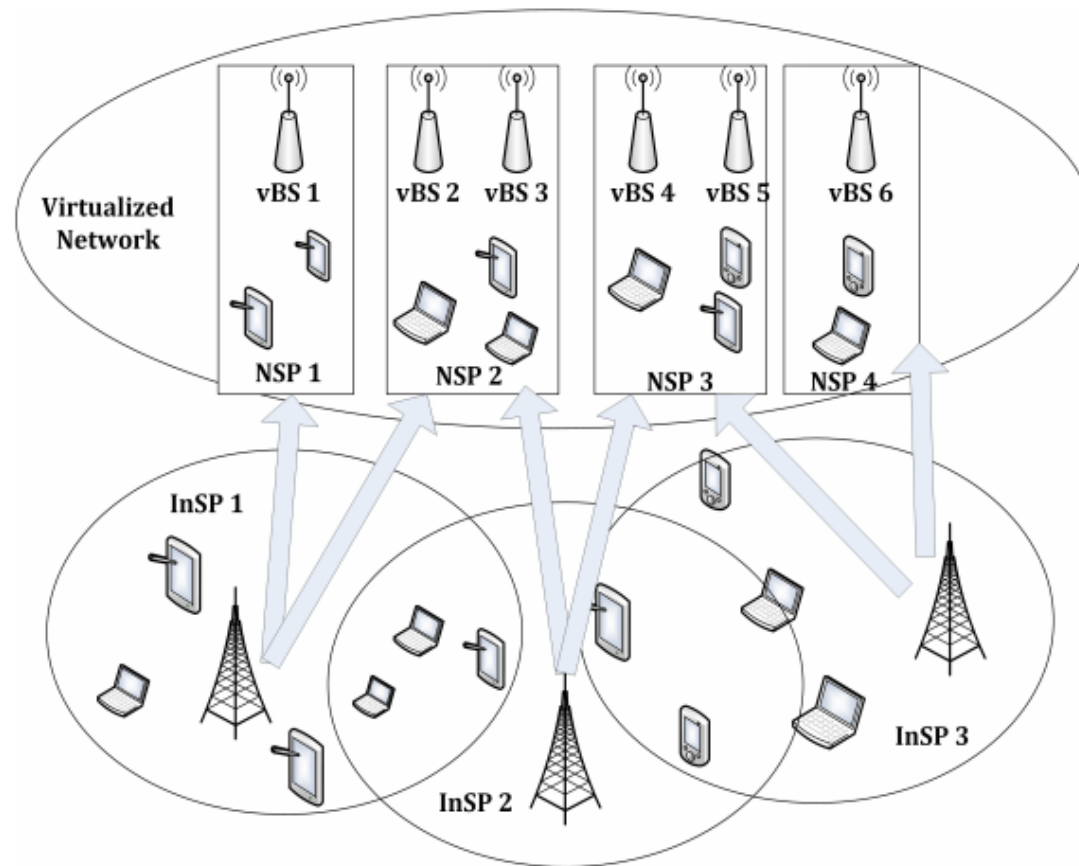*SESAME-based Special Session*

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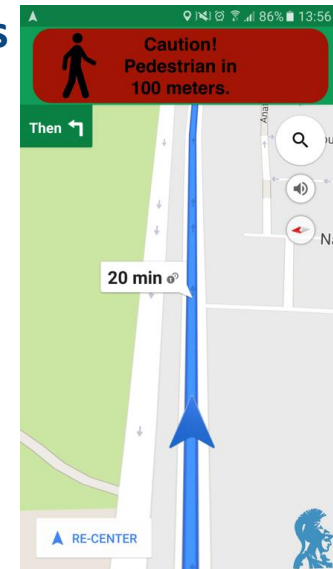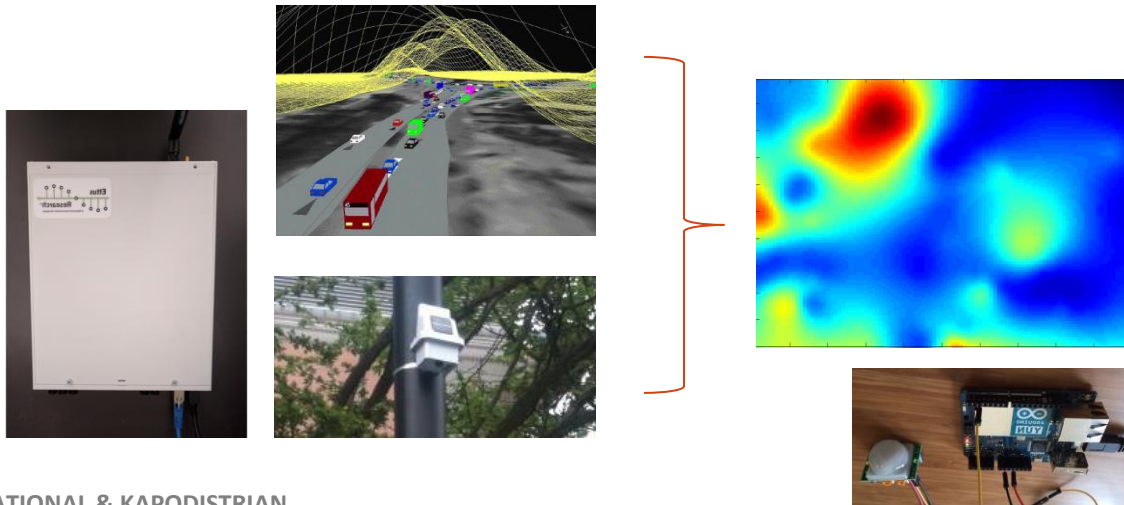# Example wireless network virtualization

- (Wireless/5G)Network resources can be offered as services to network providers

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SDN/NFV enabled V2X applications

- **Virtual wireless/radio access network resources**

- **Virtual Sensors**

- **SDN enabled M2M - enabling direct sensor and vehicle device communication**

- **Practical implementation:**

  - ❖ **pedestrian warning system and application**

  - ❖ **Road safety warning systems and applications (e.g., car crush, road works)**

  - ❖ **V2I, V2V interaction for extended road and traffic status awareness**

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Holistic control and user plane framework

- Low latency SDN/NFV enabled V2I communication
- Separate common control plane for cross-air access and sensor interfaces
- Holistic control of user plane functions
- Flow classification and rule based low latency service support
- Direct flow delivery at the edge between devices, eliminating the delays for the information exchange at the application layer for IoT

SDN controlled wireless integration service - Overview of the prototype system

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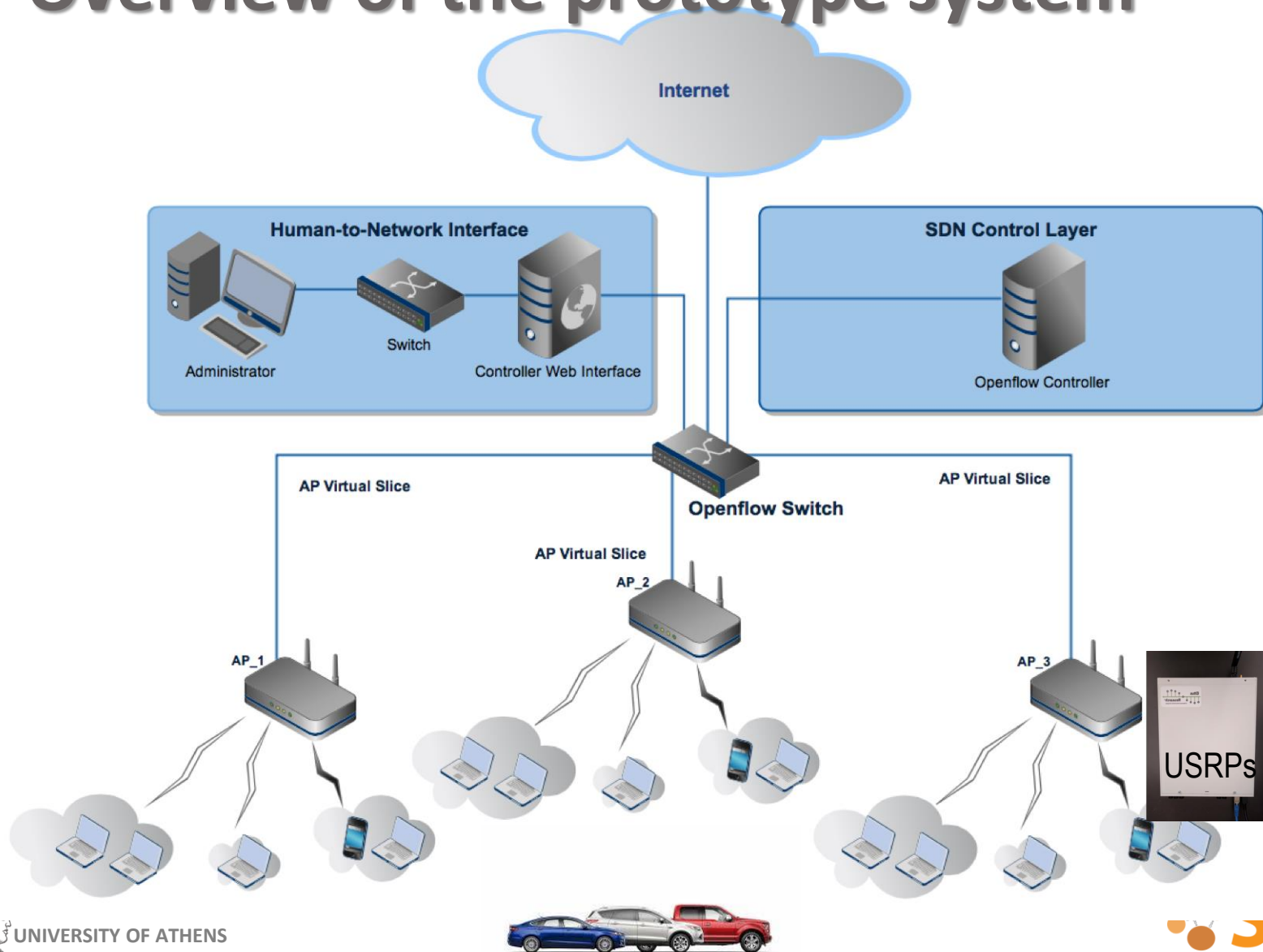
Technologies / Frameworks

❑ 5G-EMPOWER

❑ Wireless FlowVisor

❑ OpenVirtex

❑ ONIX and NOX

❑ OpenRoads

❑ AetherFlow

❑ ODIN

SDN/Radio Access Virtualization – interesting results

- Smart device Cooperation – e.g., **Road safety applications**, **Pedestrian warning system**.
  - ❖ The capability for heterogeneous device to device (D2D) interaction provides the opportunity for device cooperation in critical information transmission/reception.
  - ❖ Initial results show sensor2Antenna2Vehicle interaction ranging from 5ms to 25ms
- Context aware mobility - Elimination of cell boundaries
  - ❖ Network virtualization will eliminate the service boundaries posed by today's cellular physical network architecture – the UE will be dynamically (re-)associated to cells enabling a device aware approach supporting low latency flow requirements
- Cognitive Access Point Optimization
  - ❖ The access point controller will accommodate knowledge associated with the critical flows that have to be facilitated and directly propagated between devices

Conclusions

- 5G networks will drive their full potential through the accommodation of SDN and NFV solutions
- The new wave of communication potentials will incorporate the concept of "everything as a service".
- Promising results for SDN/NFV in 5G already in V2X communications for increased User Experience

For more results and info: scan.di.uoa.gr

Questions – contact details

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