Smart Cities & Research

World Standards Day

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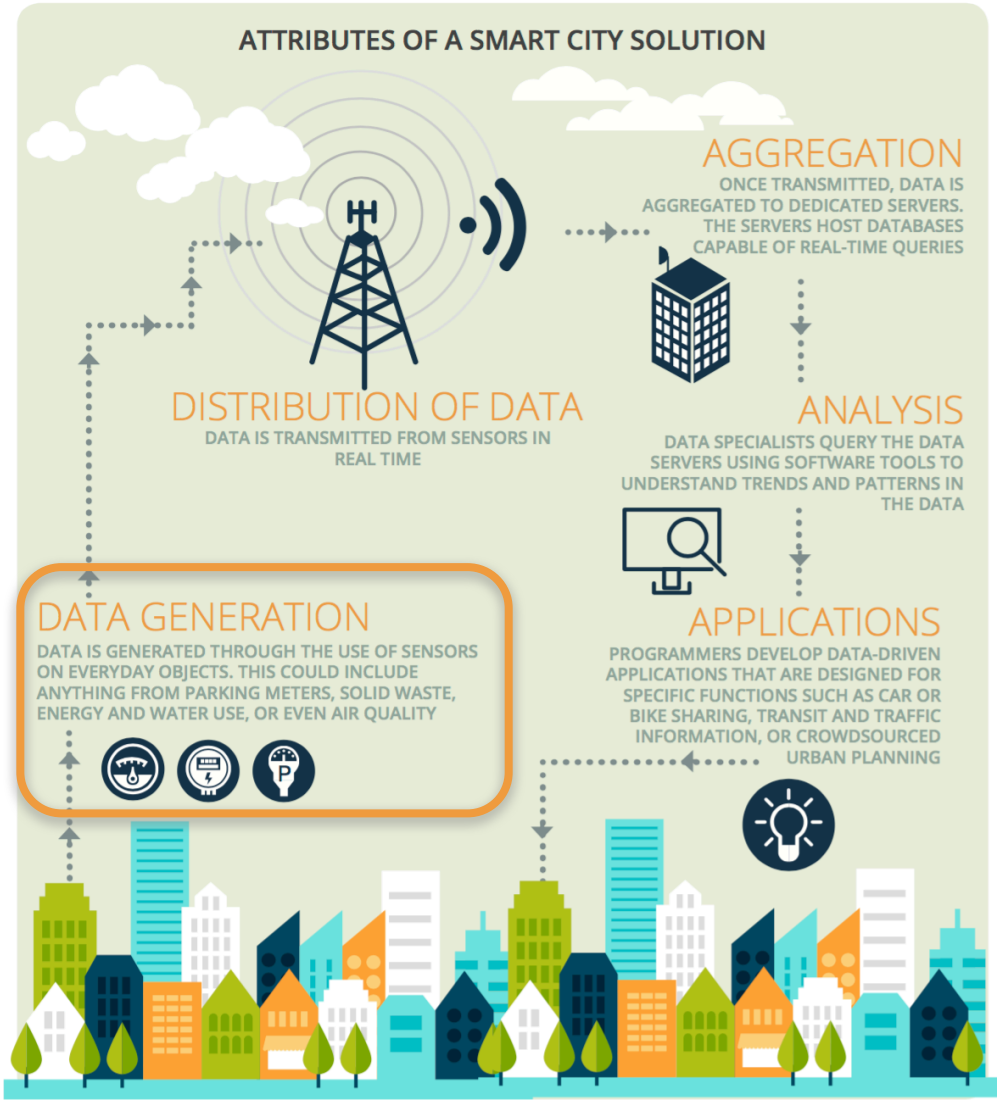
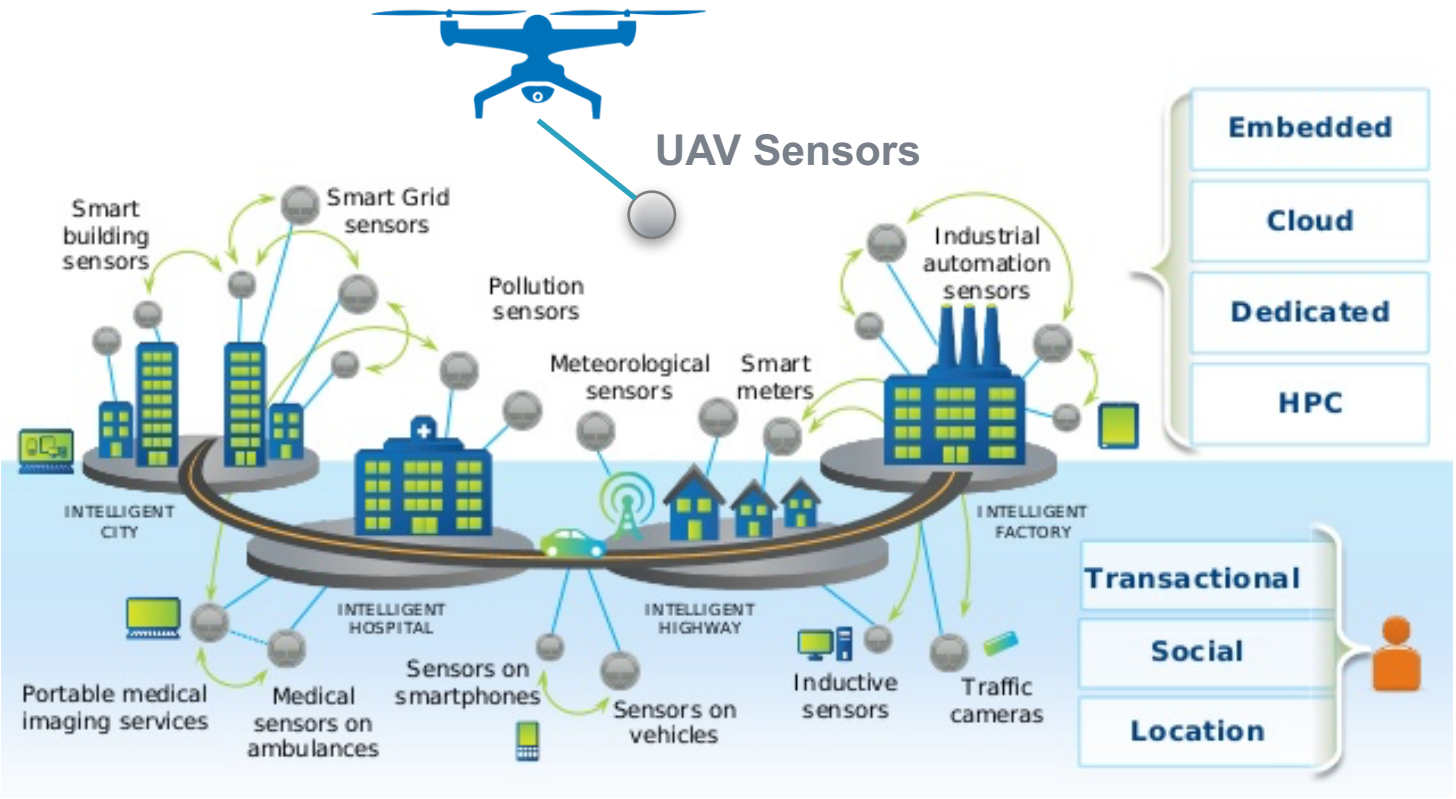
Smart City – What?



Source: “Getting Smart About Smart Cities”, USDN Resource Gide

Smart City Sensors



Source: Intel

What is a UAV?

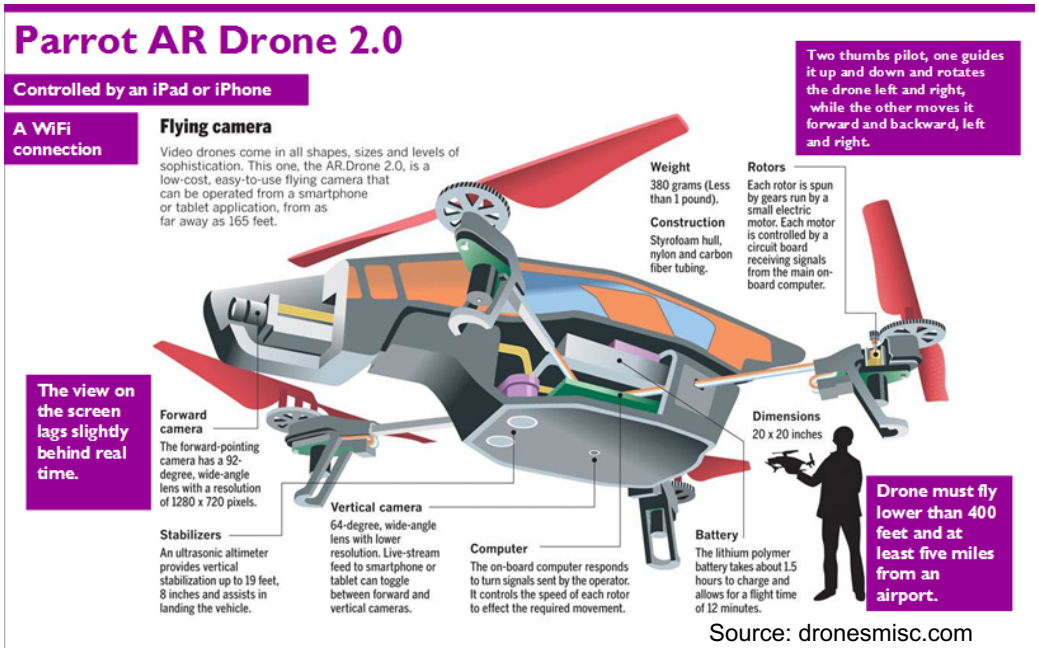
- **Unmanned Aerial Vehicle**
  - Also referred to as drone or unmanned aircraft system (UAS)
  - Aircraft with no pilot on board
- **Control**
  - Remotely by an operator
  - Autonomous
- **Different types of UAVs**
  - Fixed-wing UAV
  - Rotary wing UAV

ERMP Warrior

Source: Purdue University

UAV as IoT device

- **Well-known commercial UAV example**

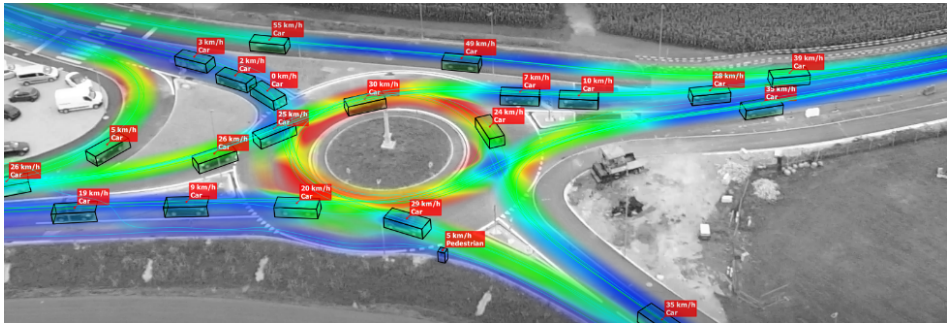


Source: dronesmisc.com

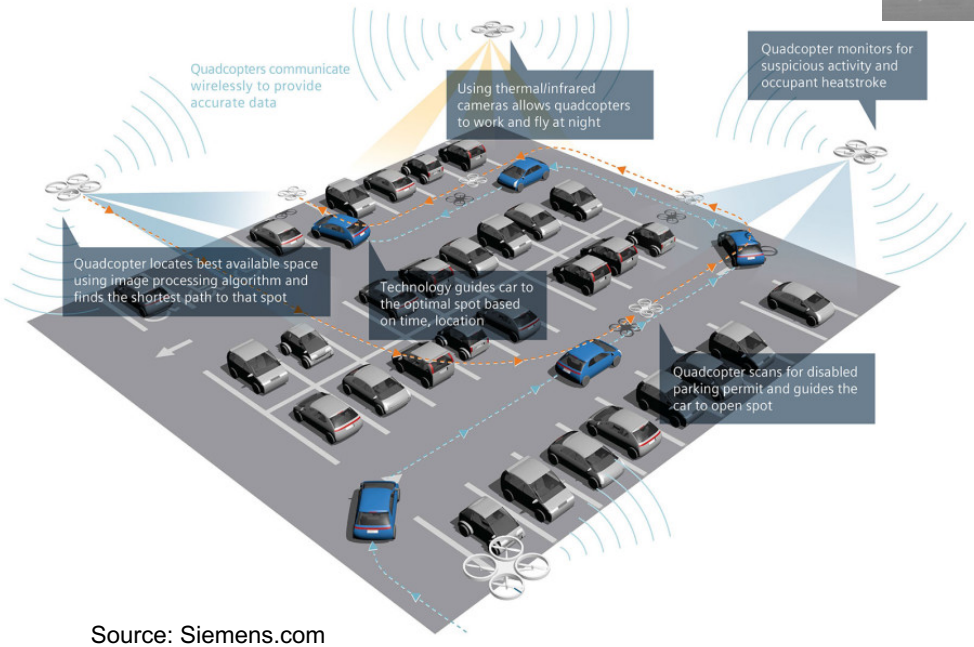
- **UAVs are:**
  - Connected
  - Mobile
  - Controllable
  - Flexible

UAVs for Smart Cities (1)

- **Traffic and crowd management**
  - Vehicular traffic monitoring
  - Crowd monitoring
  - Smart parking



Source: Datafromsky



Source: Siemens.com

Source: Telegraph.co.uk

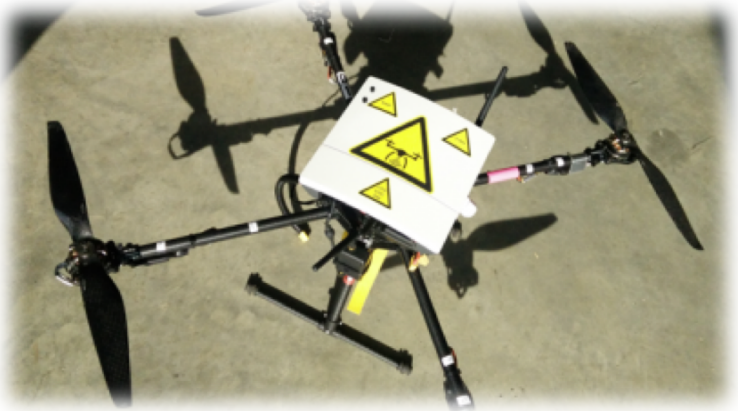
UAVs for Smart Cities (2)

- **Natural disaster control and monitoring**
  - Disaster zones analysis
  - Act as 3G/4G towers when Internet has become unavailable
- **Infrastructure inspection**
  - Ecological footprint monitoring
  - Monitoring of buildings/tunnels/bridges, etc.

Source: Cyberhawk.com

UAVs for Smart Cities (3)

- **Environment monitoring**
  - Air quality monitoring (CO2, NOx, radiation levels, etc.)
  - Harmful substances monitoring next to oil/gas facilities



Source: aretasaerial.com

UAVs for Smart Cities (4)

- **Search and Rescue**
  - Avalanche survivors search
  - Defibrilator

Source: dronehebdo.com

Source: sustainableurbandelta.com

- **Delivery**
  - Amazon Prime Air

Source: Amazon.com

Current Challenges

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- **Business challenges**
  - Ethics and Privacy
  - Cost
  - Licensing, legislations and normalisation
- **Technical challenges**
  - Increase flight time
  - Decrease weather conditions sensitivity
  - Development of fail-safe systems
  - Development of sense and avoid mechanisms

[1] Farhan Mohammed, Ahmed Idries, Nader Mohamed, Jameela Al-Jaroodi and Imad Jawhar, UAVs for Smart Cities: Opportunities and Challenges, 2014 International Conference on Unmanned Aircraft Systems (ICUAS) May 27-30, 2014. Orlando, FL, USA

UAVs Standards

- **ISO/ TC 20/ SC 16 – Unmanned aircraft system**
  - Created June 2015
  - WG1: General requirements for UAS for civil and commercial applications
  - WG2: Product manufacturing and maintenance
  - WG3: Operations and procedures
  - 15 participating countries and 4 observers (incl. Luxembourg)
  - 4 standards under development

- **ISO/IEC JTC1/ SC 17 - Cards and personal identification**
  - Drone Identify Module and Drone License (ISO/IEC AWI 22460)

UAVs Standards

- **Committee F38 on Unmanned Aircraft Systems**
  - Scope: development of standards and guidance materials for unmanned aircraft systems
  - 14 standards
- **IEEE DWG - Drones Working Group (10/2015)**
  - P2025.1 Standard for Consumer Drones: Taxonomy and Definitions
  - P2025.2 Standard for Consumer Drones: Privacy and Security

UAVs for Smart Cities - Summary

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- Huge potential of UAVs in smart cities
- BUT
- Requires standards and regulations to permit to develop this market

Current Research

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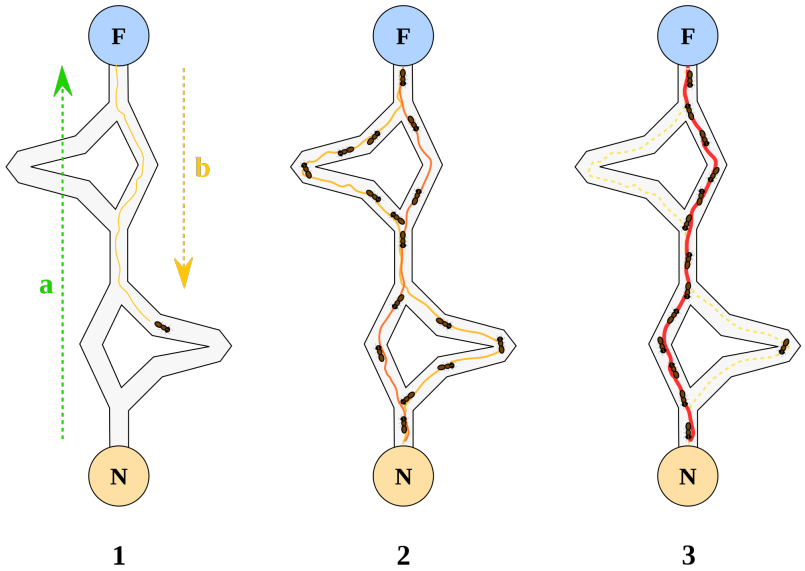
- **Autonomous UAVs swarms**
  - Embedding wireless communication interface
  - Form Flying Ad Hoc Networks (FANETs)
- **Research challenges**
  - New mobility mobility models for autonomous UAV swarms

Nature Inspired Techniques

Ant Colony Optimization (ACO)

- **Able to find shortest route from nest to source**
- **Stigmergy: ants are unsophisticated, but collectively they can perform complex tasks**
  - They communicate using pheromones



UAV Swarm Mobility Models

Theoretical and realistic simulations

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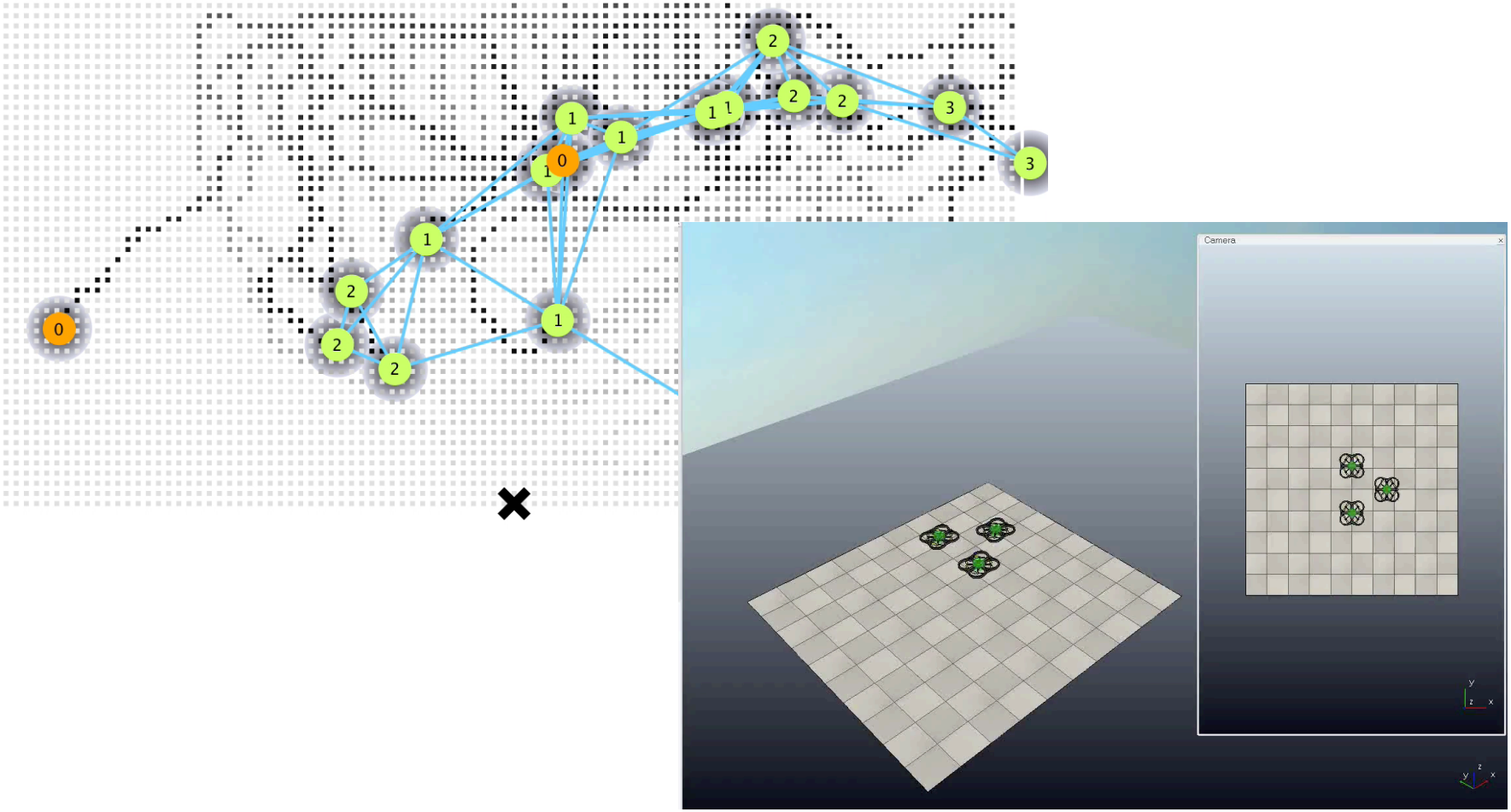
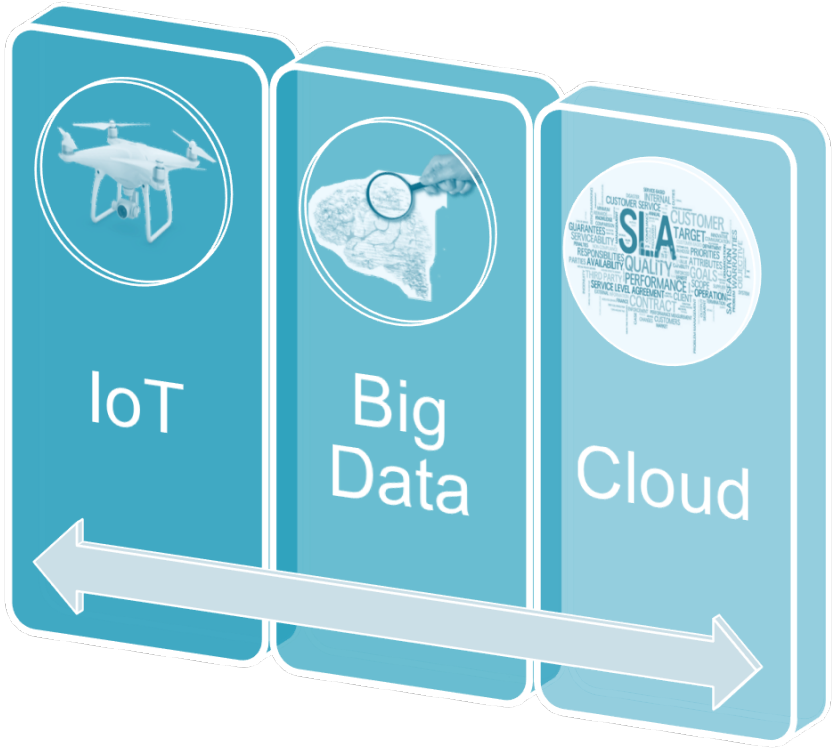


ILNAS-UL/SnT Research Programme



Digital Trust

Thank you for your attention

Questions?

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