A Holistic Approach to Future Networks Research

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Smart Internet Lab@Bristol: Who are we?

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Founded by three research groups

- Communication Systems & Networks,
- High Performance Networks,
- Photonics & Quantum (Optical Comms)

Combined expertise across optical, wireless, IoT and cloud technologies

Research across:

- Enabling technologies, Systems and Networks, Services and Applications

Holistic approach to end-to-end network design and optimisation

Extensive expertise on hardware, software and co-design

Real world deployments and large-scale experimentation

Current research portfolio: 22 projects (EPSRC, Research England, DCMS, EU, Industry

End-to-End Network Research @ Smart Internet Lab

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#1–Multi-access Convergence (Radio + Fibre) & Mobile Edge Computing

Integration of MEC and network edge (programmable hardware)

AI and processing at the edge: Infer User preferences for network service requests

#2 Wireless, Fibre & Satellite Backhaul

High performance, elastic high bandwidth backhaul

#3 – Network Slicing & Service Orchestration

Dynamic network slices, multitenancy, protection and prioritisation of services

End-to-end intelligent service orchestration-multi-technology & multidomain

#4 – User Experience

Use cases relevant to the industry and public

Co-creation: Users Involved in the innovation Cycle

Test Networks @ Smart Internet Lab

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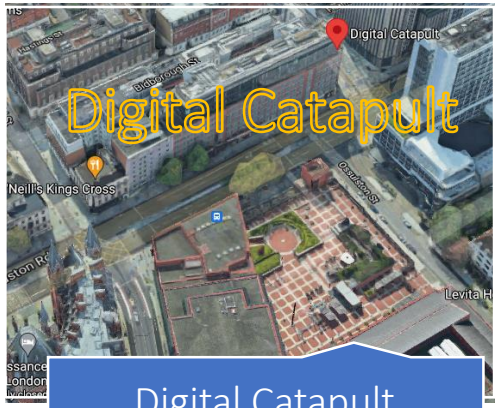
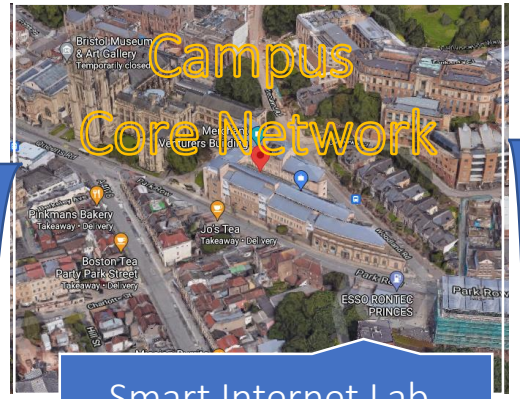


Digital Catapult (London)



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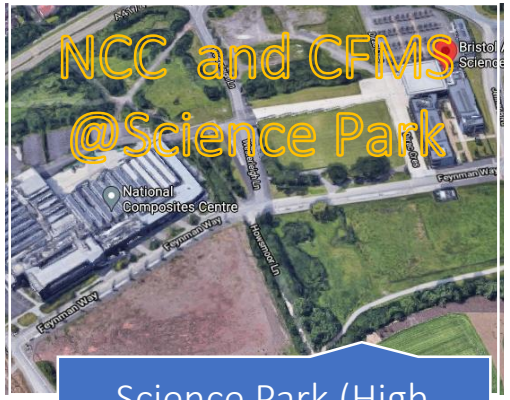
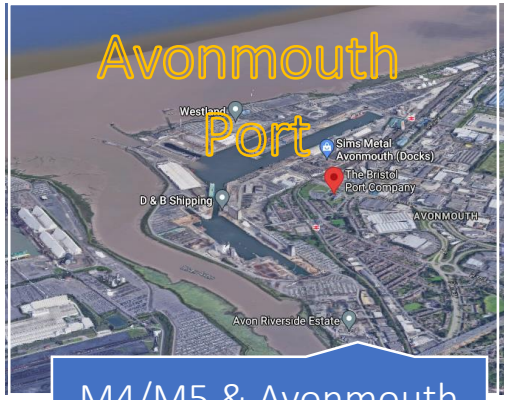
5G Exchange
Slough Virtus Data Centre

Private Leased Line



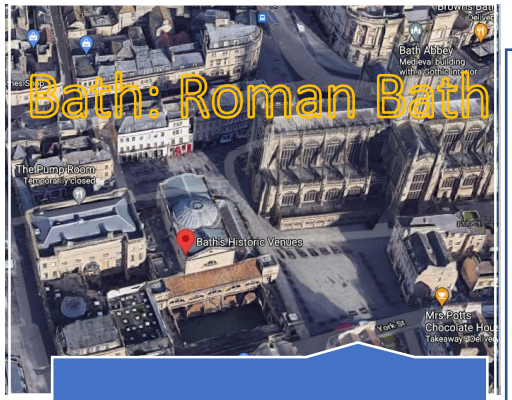
Science Park (High Value Manufacturing)



M4/M5 & Avonmouth (Highways and Ports)

KCL (London)

Harbourside (Centre), Bristol



Cathedral square, Bath

- Smart City
- Freeport Zones
- Transport
- Logistics
- Manufacturing
- Security
- Assisted Living
- Robotics
- Smart tourism
- Digital Media
- Music & Sports
- Public safety
- Connected Homes

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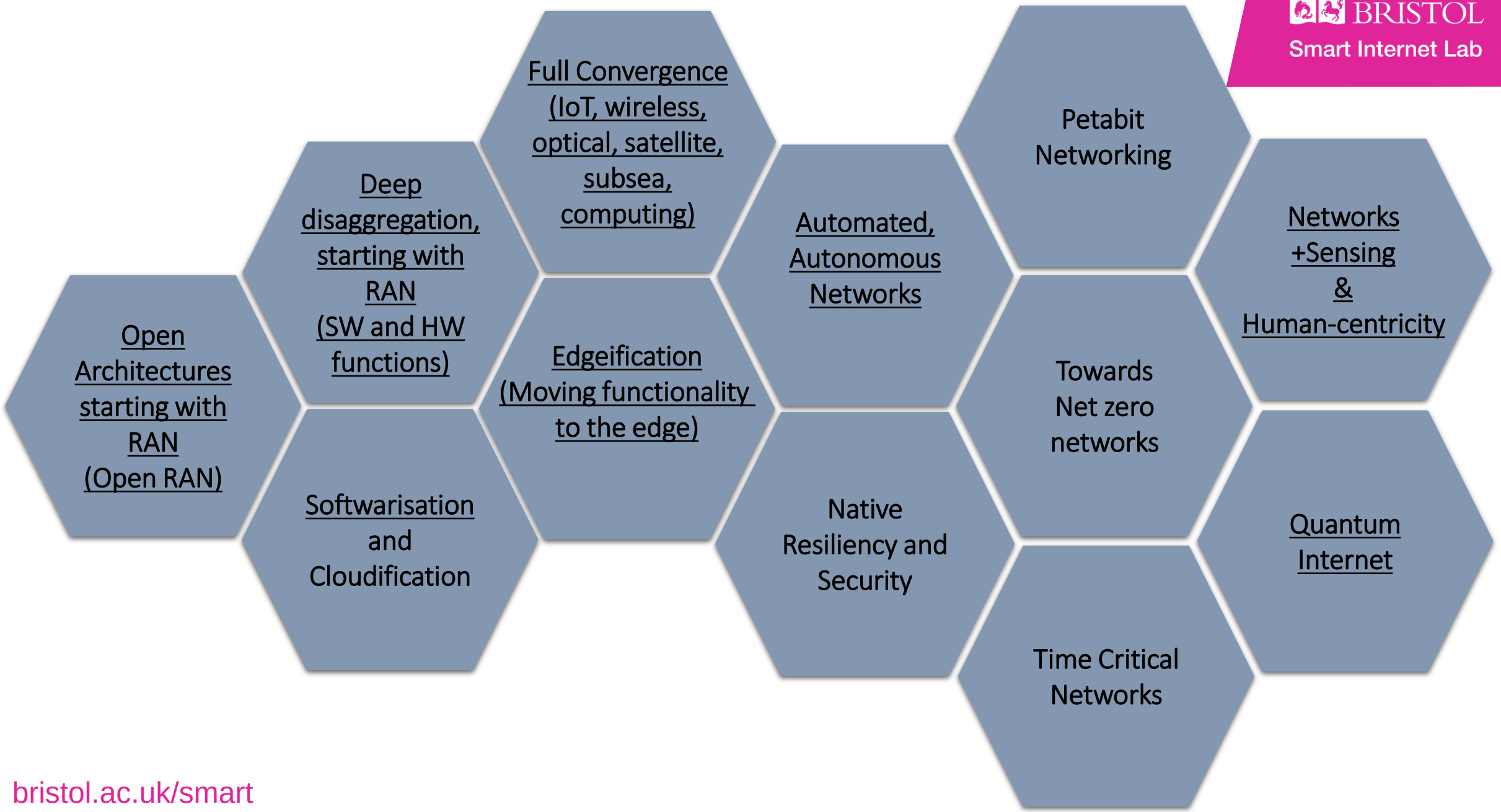
Key Research Focus on Future Networks and 6G

Future Networks Trends



From Automated to Autonomous Networks

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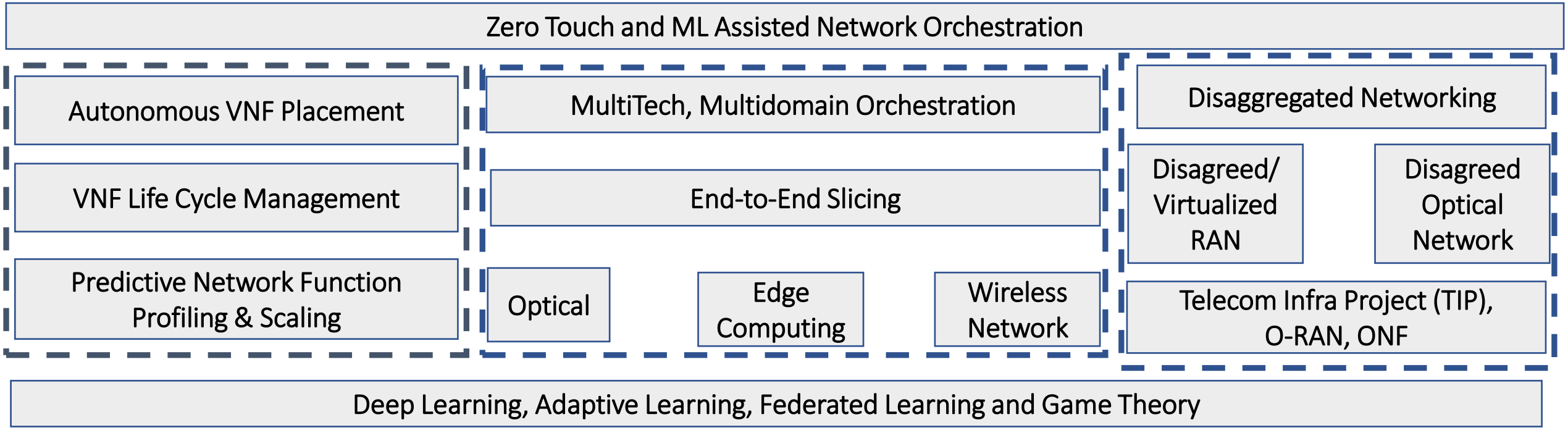
Self-Composable and Self-Driving Networks



Disaggregated RAN : Evolution Towards Open RAN

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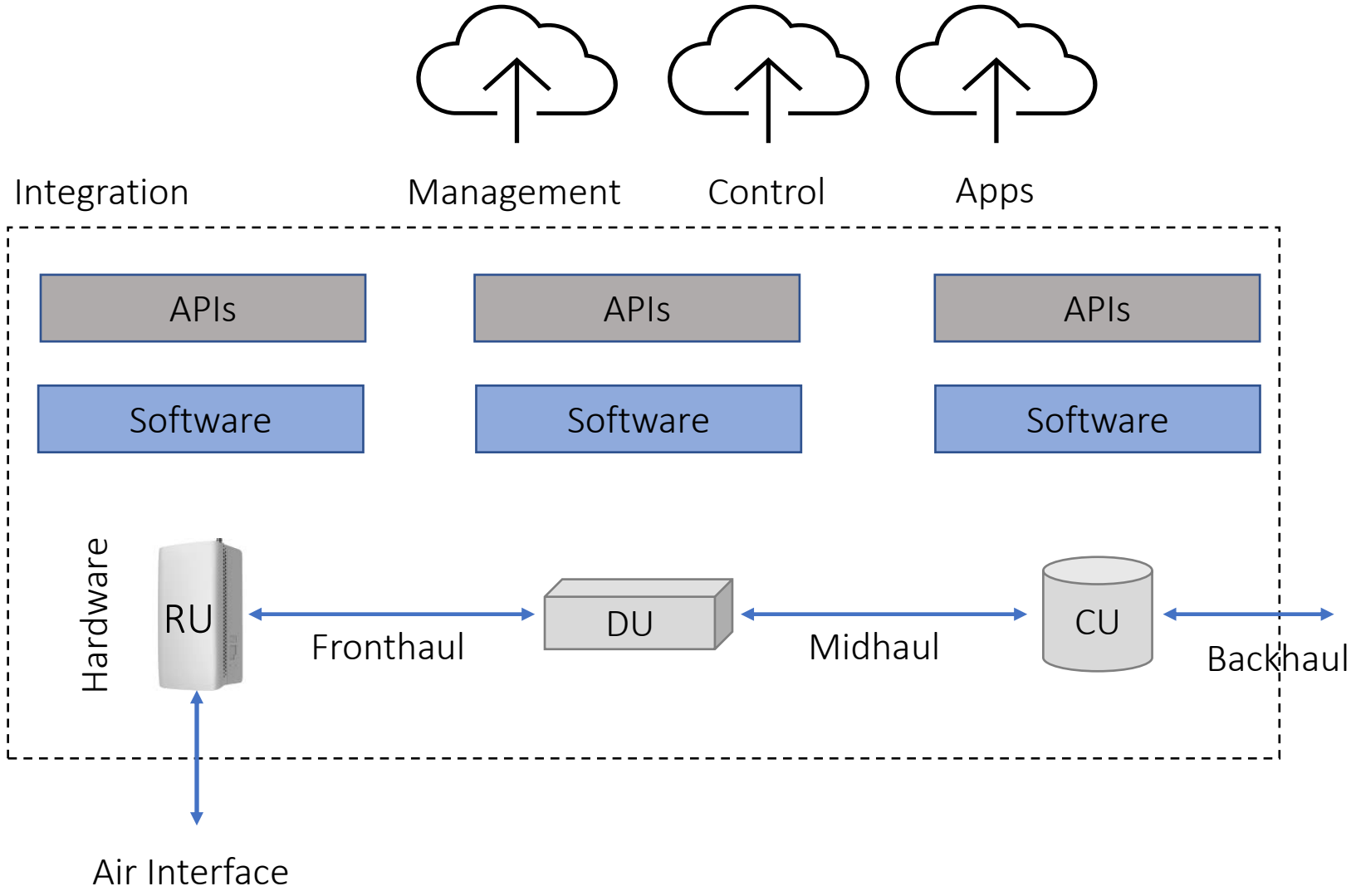
Why?

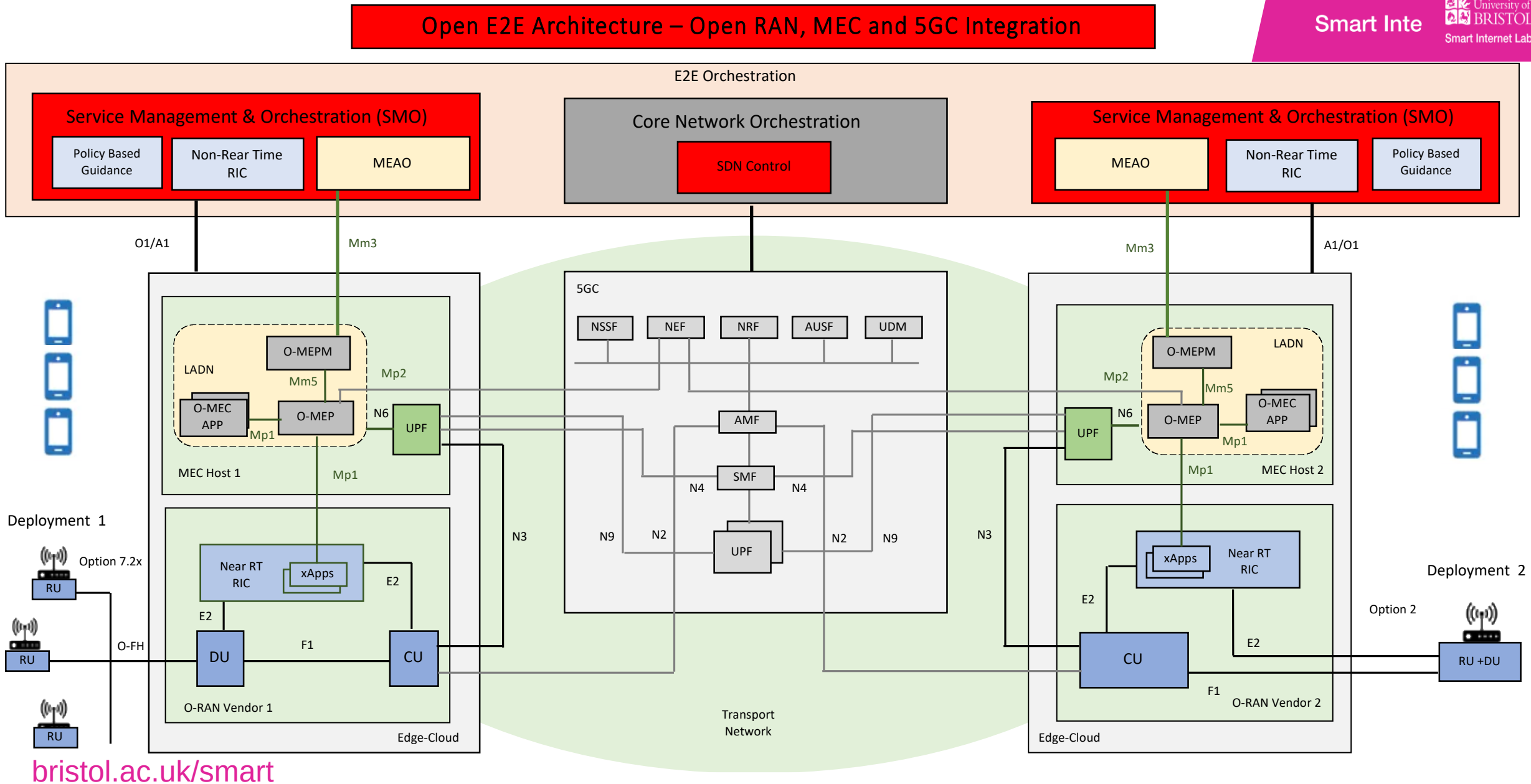
- Accelerate multi-vendor interoperable solutions in the RAN domain
- Enabling supply chain diversity

Our Research

- Innovation via Adoption of New Technologies (AI/ML)
- RAN programmability through RIC leading to new optimisation solutions
- Opportunity to integrate fibre access with fronthaul/midhaul
- Integration: RAN integration with MEC and 5G Core and their overlapping orchestration platforms
- End-to-End Performance related to multi-vendor solution



Evolution Towards Open Networking



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Edgification: Enhanced Network Edge Functionality

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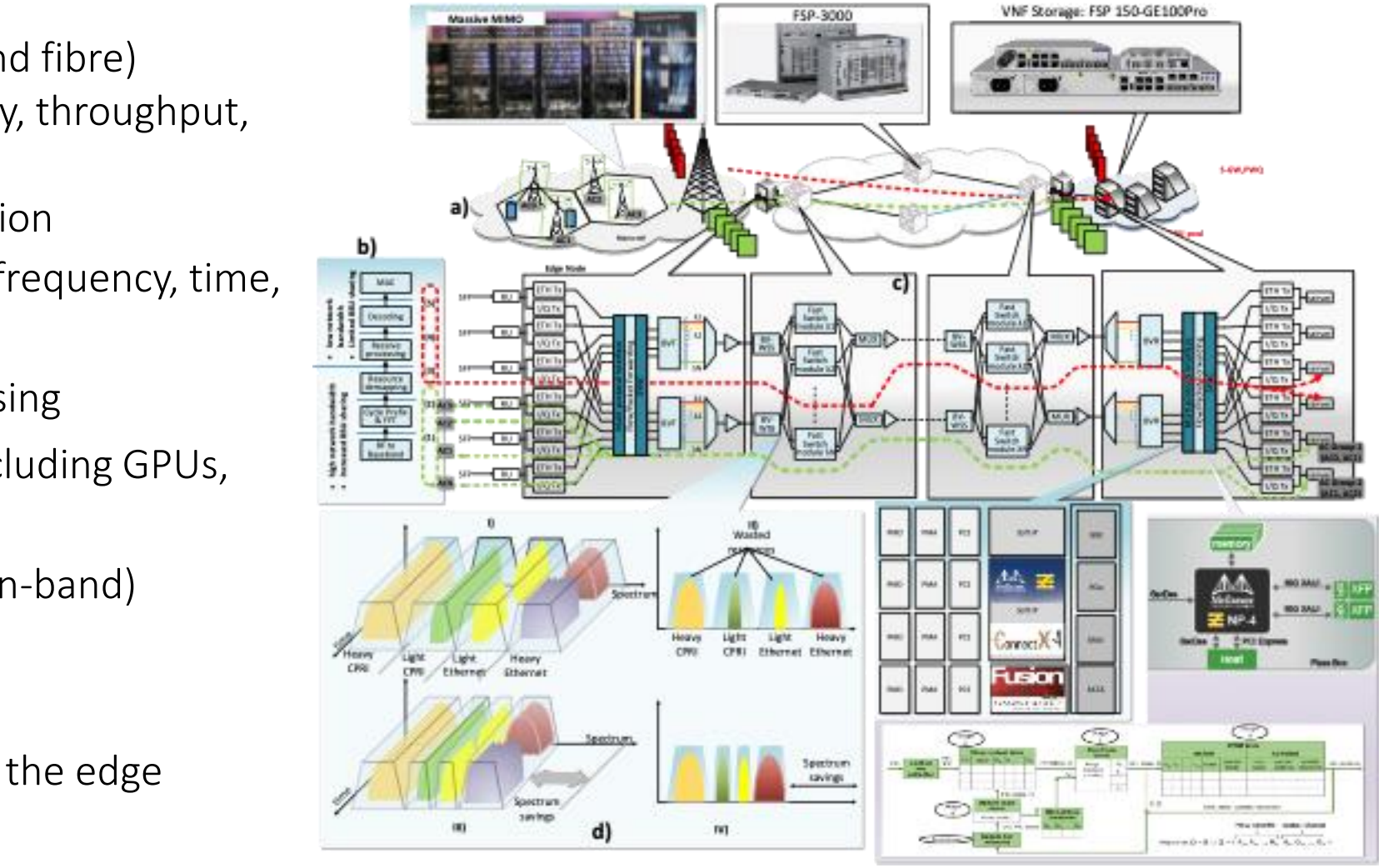
- Multi-Access (wireless, VLC and fibre)
- Manage KPI trade-offs (latency, throughput, location accuracy, …)
- Traffic management/aggregation
- Elastic bandwidth allocation (frequency, time, space)
- Programmable packet processing
- Acceleration technologies, including GPUs, Smart NICs, FPGAs and etc.
- Synchronization capabilities (in-band)
- Support for HW accelerated encryption/decryption
- Execution of AI/ML models at the edge



Edgification: Mobile Edge Computing

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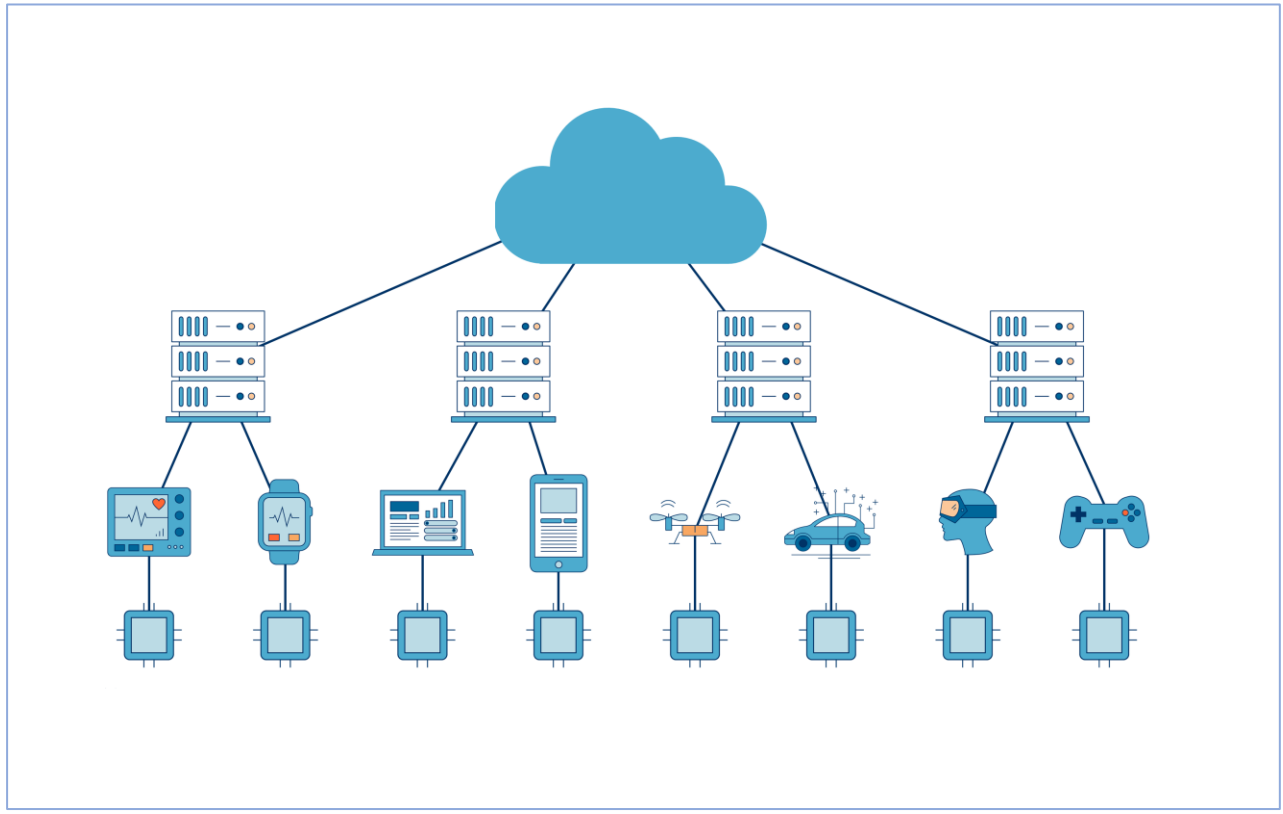
Research Focus:

- 5G + Edge Computing + AI:
  - Enabling intelligence in vertical sectors
  - Support for privacy-sensitive data processing
- MEC + Open RAN:
  - Share and control easier/better/interoperable MEC resources accessible via multiple distributed units
- Service handover delay in high mobility scenarios
- Security: MEC nodes more susceptible to attacks



Demands for IoT Driving the Evolution from 5G to 6G

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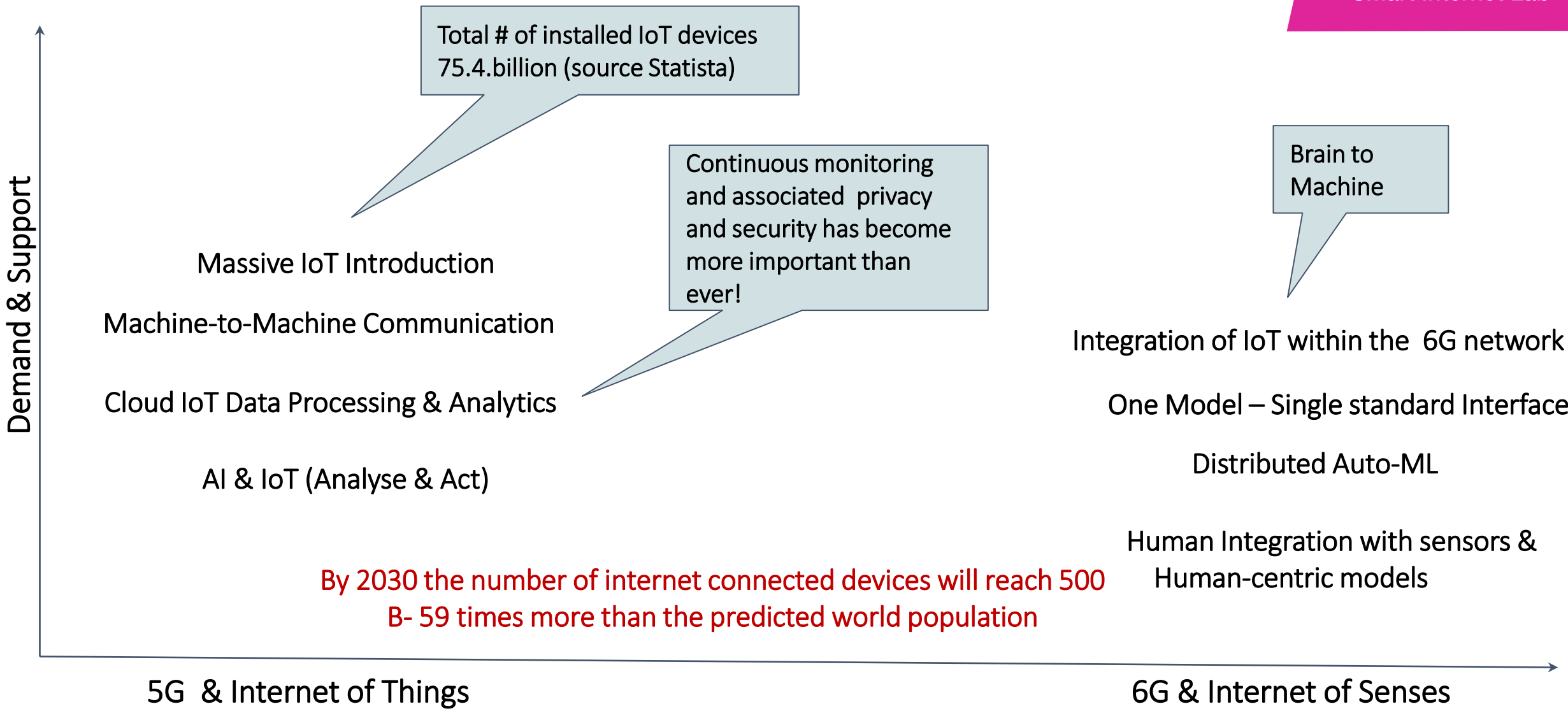

The Case for Human-Centric Networks

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- Today's mobile networks device-centric: users take part in the interaction only through their personal devices
- If devices are the main users of the network, what will be the role of humans in the service delivery chain?
- Collective Intelligence= Human + Machines + infrastructure
- Sociotechnical principles and social practices as the foundation for the design of future networks (responsible innovation, sustainability, inclusion, privacy, trust…)
- Co-creation of future connectivity and services with the end users

Reality Emulator: An Evolved Digital Twin for 6G Research

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Applications, Solutions, Functions, Policies, Regulation

Iterative

Physical Testbeds

Real Data

Virtual Production:

Data Analysis/Scaling
AI/ML, training
Software-Hardware
Security
Protocol Design
6G Emulation
Scenarios' creation

Digital Twin Creation

Digital Model

Services

Immersive Experiences (Users)

Laboratories
IoT Platforms
Fibre and 5G Radio assets
SA packet cores
Open Networking and 6G hosting

Iterative

HPC, Cloud
Data Platforms
Programmable Hardware
Optical Interconnect/Switching
Hosting Research Hardware: New Fibre, Neuromorphic, Quantum…

Continuous evolution and optimization (pre-trained ML models)

Multi-user
Multi-purpose
Interactive
Multisensory

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Smart Internet Lab: A Holist Approach to Networks Research

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Design of future network and service architectures at scale

Co-creation with the end users: experience driven innovation

Address Security, privacy, Net Zero carbon emission for Telecoms- Responsible Innovation

Addressing societal challenges

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Thank you

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