

Overview of the trend on remote testing, issues and challenges of standalone testbeds

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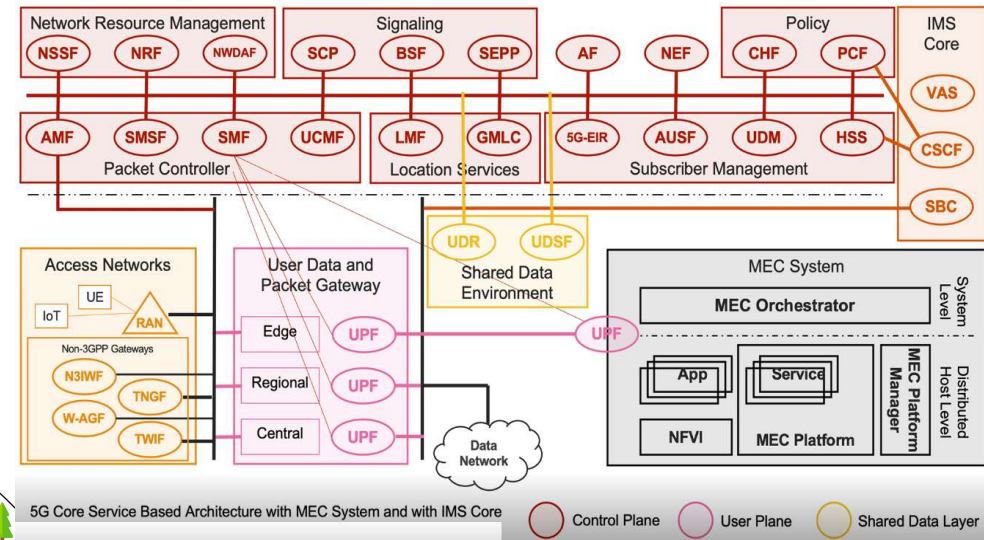
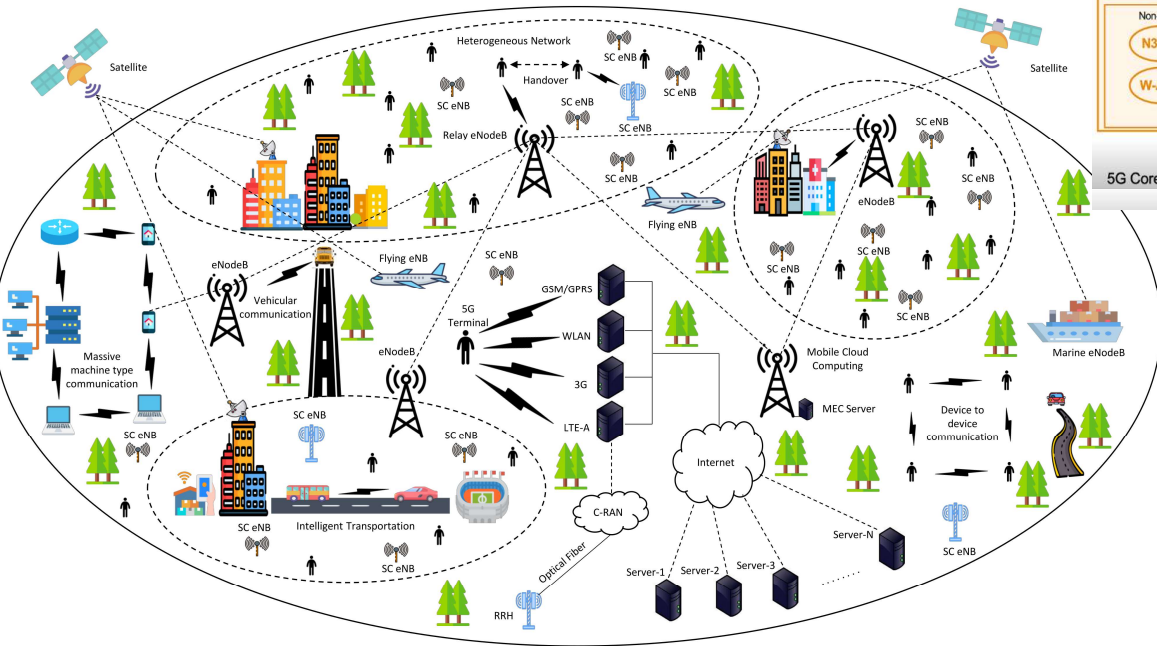
Outline

- **Ecosystem Developments in B5G**
- **Remote Testing Trend Evolution (with SA Testbeds)**
- **Trend Examples of Flagship Testbeds**
- **Challenges and Opportunities**
- **Outlook**



Ecosystem Developments in B5G

Open, inclusive, software based, duo-pole center of gravity, digitalization-driven capabilities, data driven



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Remote Testing Trend Evolution (with SA Testbeds)

- **Ecosystems are becoming more open → transition from CSP-centric ecosystem to multi-vendor multi-CSP, and SME/ISV friendly mode**
- **Ecosystems are becoming inclusive with their space open to new disruptive and smaller players such as ISVs, AISVs, and SMEs in general**
- **Best in class assets as software/algorithms/turnkey and managed services are then becoming part of the ecosystem**
- **Democratizing the value chain is taking place at steady pace, with examples such as: democratizing the RAN part of the value chain via OpenRAN, Cloud RAN, vRAN**
- **IT capabilities of stakeholders via Digital Transformation (&Industry 4.0/5.0) are enabling them to index, expose, discover and use assets among themselves via Network, Testbeds, Service, and Software Federation**



Large Industrial Testbeds Trend Leaders and Examples (1): Fraunhofer



- 5GACIA – Deterministic 5G URLLC for Industrial Automation Testbed
- Fraunhofer FOKUS and IPK build up an “Open 5G Campus Network for the Software-defined Factory” in Berlin, Germany. It integrates distributed 5G standalone network components from different manufacturers.
- Purpose is to validate deterministic 5G URLLC in an Automated Guided Vehicle and other use cases on own premises.
- Open 5G Campus Networks provide the required flexibility and innovation needed for the automation industry. The 5G Campus Network for the Software-defined Factory is a new environment to assess the 5G ecosystem evolution



Large Industrial Testbeds Trend Leaders & Examples (2): X-Air UK

- Dense Air upgraded the 5G testbed developed as part of the AutoAir project in the UK to add more flexible OpenRAN, vRAN, CloudRAN technologies.
- The network at Millbrook, Bedfordshire, is among the largest standalone 5G neutral host networks in Europe. Connected and Autonomous Vehicle (CAV) developers will have access to the latest technology, including low latency connectivity, network slicing and the opportunity to test vehicles in more advanced networks which are available in key export markets.
- The AutoAir network is being migrated to commercial grade OpenRAN, disaggregated RAN and cloud native 5GC based 3GPP 5G SA technologies, making extensive use of Airspan Networks' products. This deployment supports the UK Government's supply chain diversity initiative. It aligns with emerging OpenRAN standards.



Sample Use Cases/Applications in Remote Testing with Federation

- Innovation in Mobile Testing
- Continuous Accessibility Test Automation
- Unified Test Management Platforms
- DataOps for Testers
- Synthetic Data (AI-driven synthetic data)
- AI Automation in production and API Simulation
- Self-Service Cloud Development Environments
- Platform Engineering
- AI Assistance in Automation Testing



- Numerous/Endless Use Cases with NSA&SA 5G
- New Technology-Driven Value-Added Services
- Key Challenge: Commercial Viability

- Range of UC covers many verticals
- Single Digit Percentage of Use Cases is Commercializable
- Monetization of UC(Challenge)→ Viable Business Cases

UC: Campus Network
BC: Giga-Factory



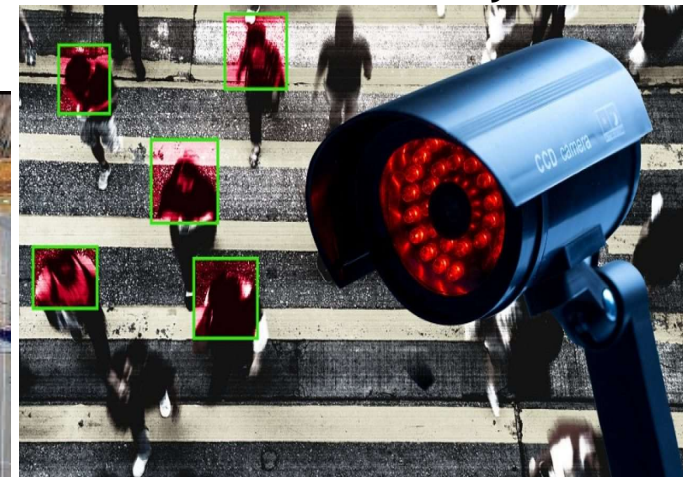
UC: Race Track w. Multimedia Communications

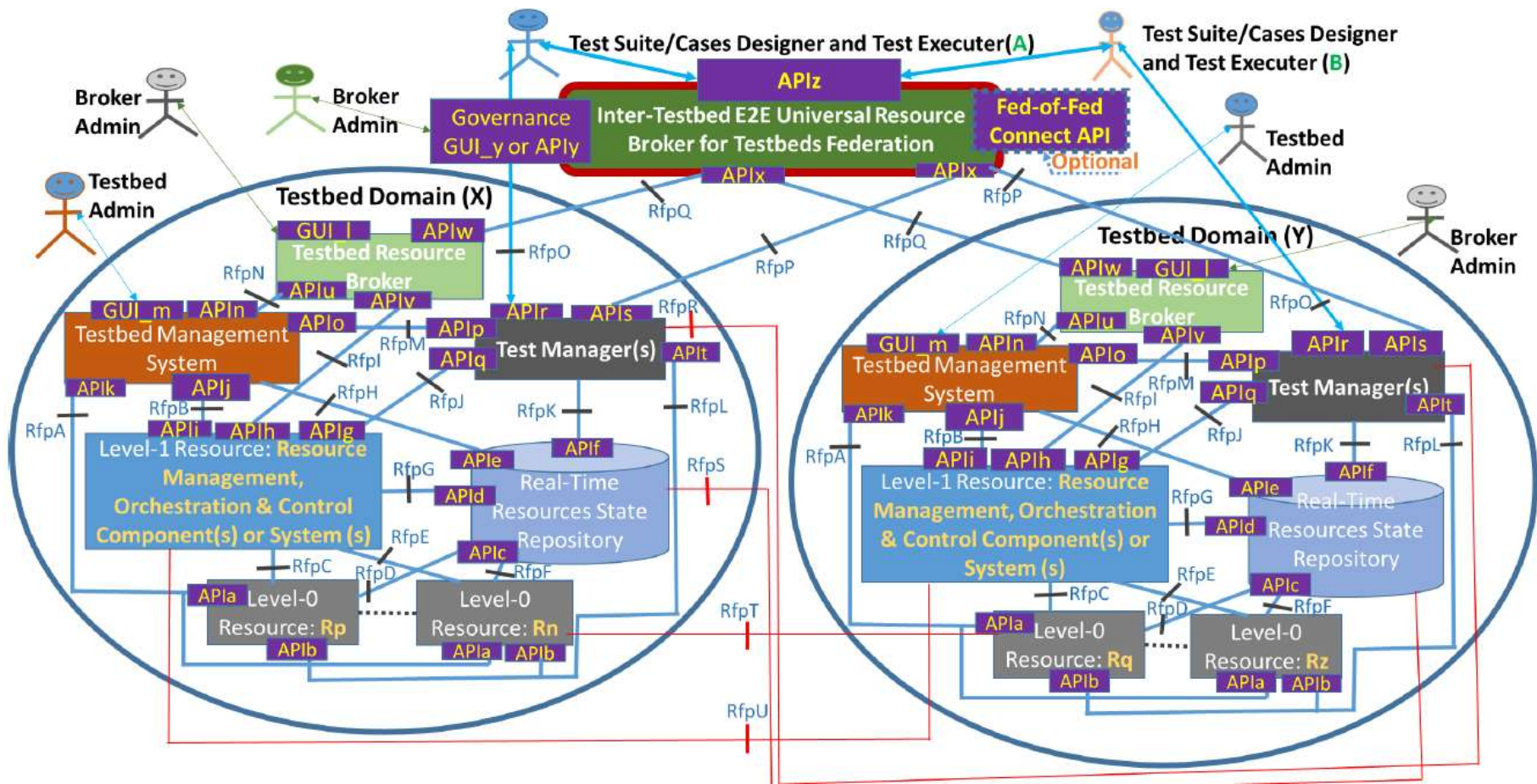
BC: Autonomous Driving



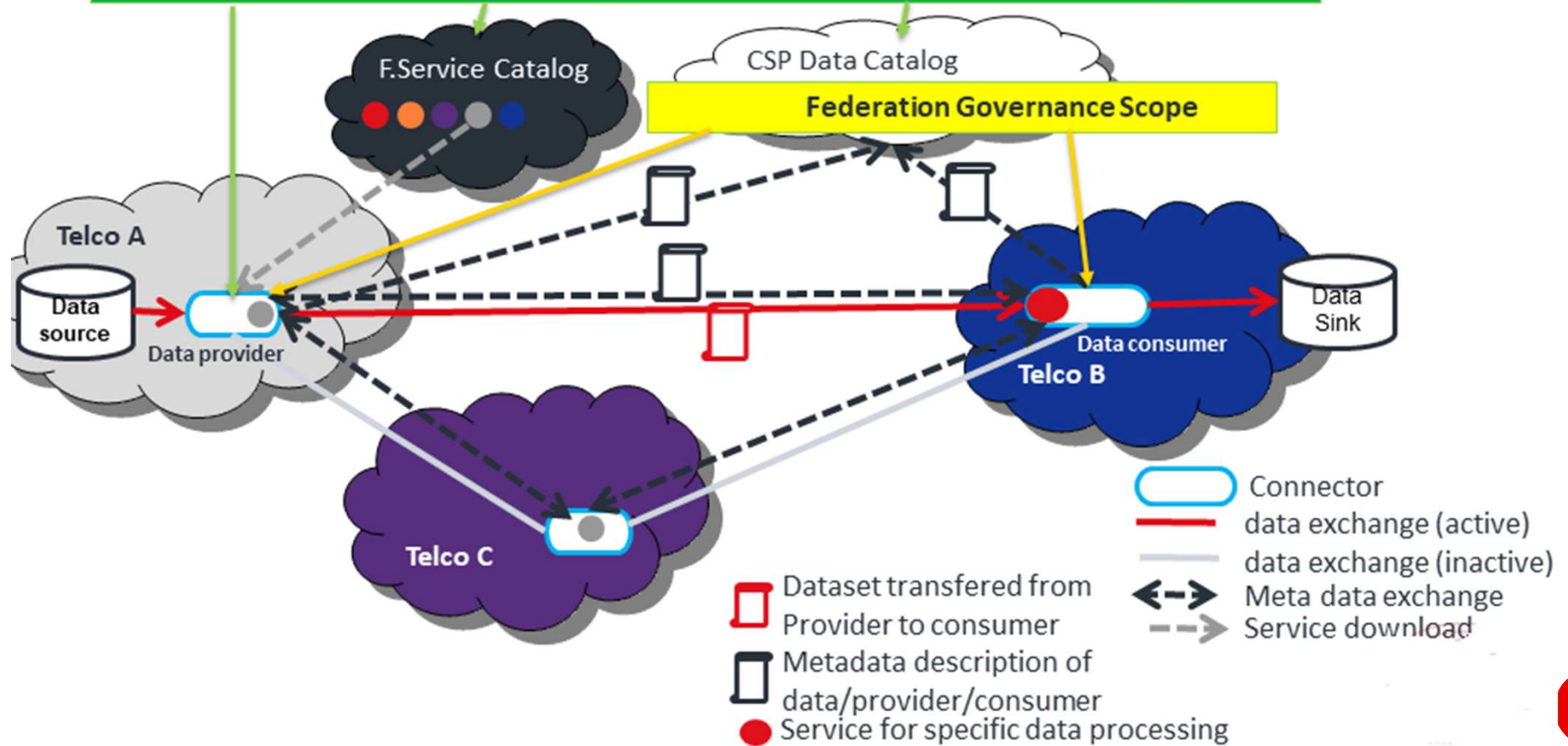
UC: Face Recog., Surveillance

BC: Public Safety





Federated CSP Ecosystem Governance (Data&Information)



Outlook

- **5G Core is a major catalyst for ecosystem evolution and development**
- **Ecosystems in B5G are becoming more open and inclusive to new players**
- **The value chain in all parts is becoming more and more democratized**
- **Testbeds and testbed providers are gaining important ground for integrating with other players**
- **Federation at all levels (Network, Service, Software, Application, Asset) remains a key mechanism for extending the reach of capabilities and enables testing and operations to be conducted in a collaborative manner.**

