

Virtualisation of Wireless Networks

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Vision

Wireless networks of the future will be characterised by **heterogeneity**

- of spectrum usage regimes
 - of ownership models
 - of radio access technologies
- where resources are **shared and orchestrated** to create **bespoke, virtual networks** designed for specific **services**



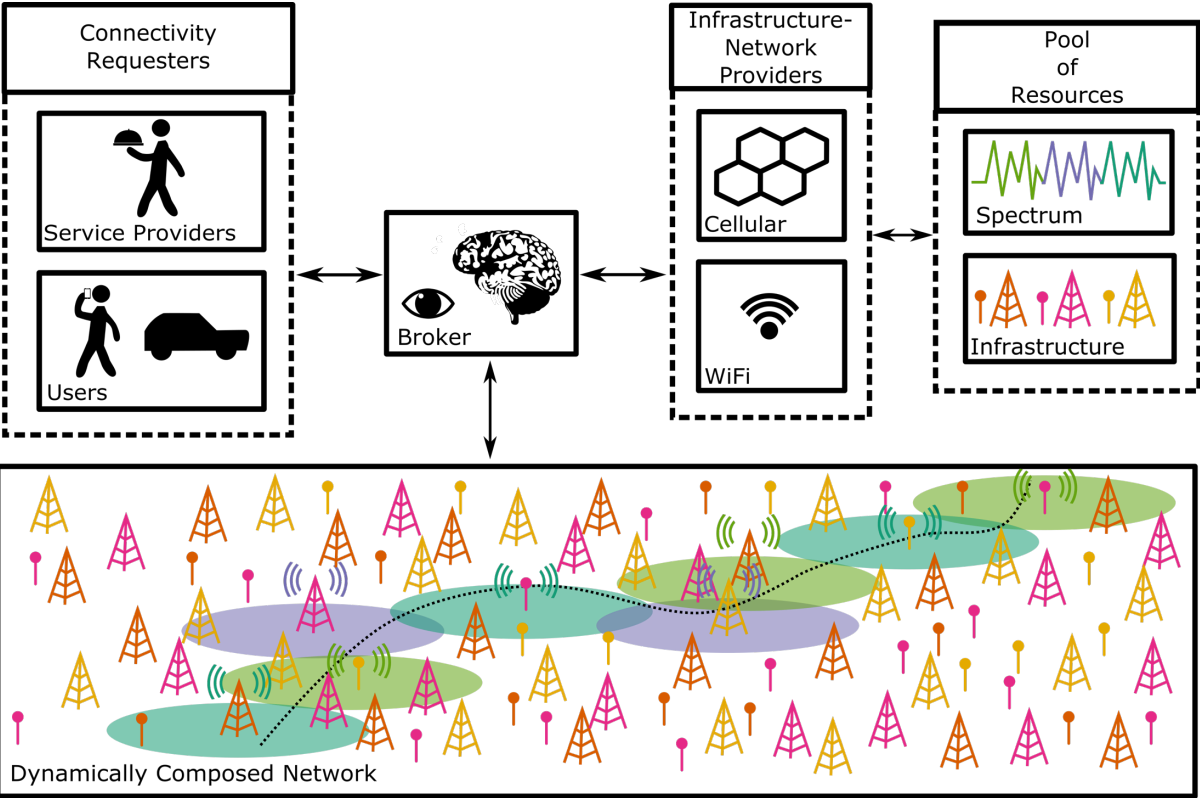
Inter-operator RAN and spectrum sharing is a key step towards that future

- cost efficiencies, tempered by
- competitive advantage considerations
- regulatory constraints

Virtualisation = the illusion of exclusive access to physical resources that are, in fact, shared

A virtual wireless access network feels to the user like a traditional network operated by a single entity but is in fact orchestrated out of a diverse pool of resources with different ownership models

A set of physical resources can host several virtual networks



New questions...

1. How to select physical resources to meet the needs of a virtual operator?
2. How to dynamically manage these virtual networks?
3. How to ensure security, and privacy?
4. What economic and public policy models will support this new model?

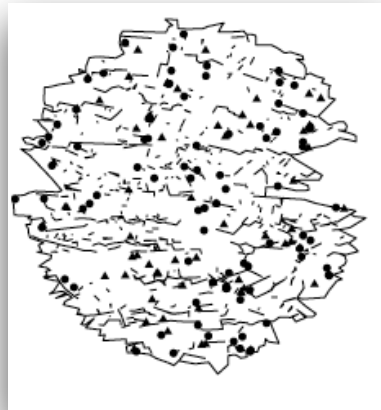
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Approaches

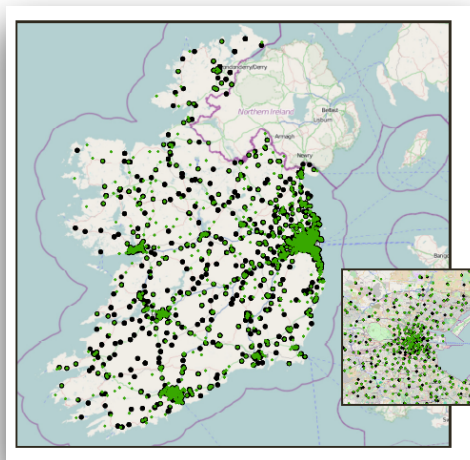
optimization

$$\begin{aligned} & \min \sum_{l \in \mathcal{L}} \varphi(l, m^*), & (12) \\ \text{subject to:} & & \\ & \sum_{l \in \mathcal{L}, m \in \mathcal{M}} \sigma_j(l, m, q, \text{GBR}) p(l, q) \geq & \\ & \sum_{m \in \mathcal{M}} \max \left(d(m, q, \text{GBR}) - \sum_{l \in \mathcal{L}} \sigma_p(l, m, q, \text{GBR}), 0 \right), \forall q \in \mathcal{Q}, & (13) \\ & \sum_{q \in \mathcal{Q}, m \in \mathcal{M}} \sigma_j(l, m, q, \text{GBR}) \leq \varphi(l, m^*) r(l), \forall l \in \mathcal{L}, & (14) \\ & \varphi(l, m^*) \in \{0, 1\}, \forall l \in \mathcal{L}, & (15) \\ & \sigma_j(l, m, q, \text{GBR}) \in \mathbb{Z}_+, \forall l \in \mathcal{L}, m \in \mathcal{M}. & (16) \end{aligned}$$

stochastic
geometry



game theory



real data

Reconfigurable Radio Testbed



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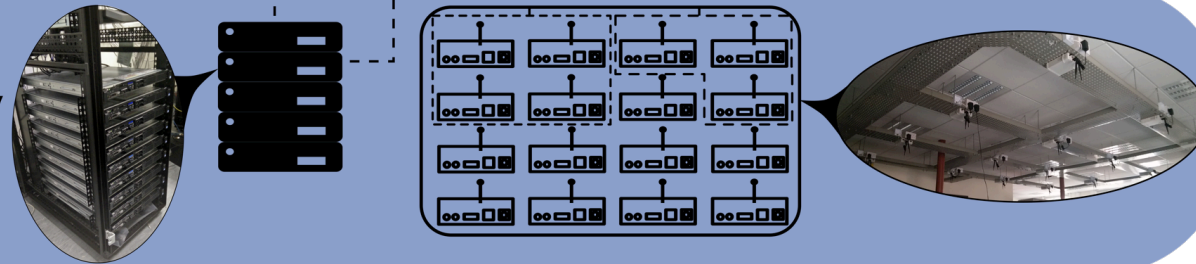
Experiments



Virtual Testbeds



Functionality Elements



FUTEBOL

Federated Union of Telecommunications Research Facilities for an EU-Brasil Open Laboratory



- the composition of federated research infrastructure suited for integrated optical/wireless experimentation
- the development of a converged control framework to support experimentation on the federated research infrastructure
- the convergence of resource management, slicing, virtualisation techniques across optical and wireless domains

