Open testbed research infrastructure with Open Ireland and COSMOS

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Open Ireland: Ireland’s Open Networking Testbed

Based in Trinity College campus

www.openireland.eu

Optical transmission, analog RoF, mmWave-THz

Reconfigurable and **Lego-like** topology reconfiguration with following blocks:
- 1,700km fibre, **SDN ROADMs**, **amplifiers and coherent Tx** (Cassini), virtual PON, OSA, etc.
- **5G O-RAN** (outdoor and indoor); **OpenSource 5G** (OAI and SRS)
- **Edge cloud**, L2 switching, P4 programmability
ComReg 100MHz spectrum license

### Existing 3.6 GHz for 5G

- **Region:**
  - Borders Midlands & West
  - South West
  - East
  - South East
  - Dublin City and Suburbs
  - Cork City and Suburbs
  - Galway City and Suburbs
  - Limerick City and Suburbs
  - Waterford City and Suburbs

- **Frequency Range (MHz):**
  - 3410 - 3435
  - 3475 - 3580
  - 3580 - 3615
  - 3615 - 3700
  - 3700 - 3800

### Upper 4 GHz band for 5G

- **Frequency Range (MHz):**
  - 3850 - 3950

#### Key Points:

- **5G spectrum enables experimentation with commercial devices (smartphones and future AR, smart cities, etc)**
- **Use AI to solve complex network interference optimization problems based on real data**
- **Put together interesting 5G demos, such as smart intersection...**

**Upper N77 band: 3.8 – 4.2 GHZ**
Worldwide reach... and further plans

https://wiki.cosmos-lab.org/wiki

Foundation testbed in CONNECT2
Starting point for further exploration:

⇒ **mmWave and THz experimentation**

⇒ **Connected City Infrastructure**

⇒ **Quantum Internet**
Sample use case: Building a QoT estimation algorithm

Control plane algorithm development and test based on simulation:
- Online learning through agent that loads the optical spectrum with optical channel and measures OSRN variation
- Through multiple iterations the agent improves strategy for channel selection

Work carried out with Politecnico di Milano optical group

How many channels are allocated without disruptions?

Use of simulated data plane

<table>
<thead>
<tr>
<th>ONIS OPERATION TIMINGS</th>
<th>OSA-based OSNR computation</th>
<th>ROADM-based OSNR computation</th>
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</thead>
<tbody>
<tr>
<td>Algorithm initialization</td>
<td>3.15 s</td>
<td></td>
</tr>
<tr>
<td>Single channel opening + OSNR + reward</td>
<td>1.31 s</td>
<td></td>
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<tr>
<td>Episode (full spectrum filled)</td>
<td>2400 s (40 mins)</td>
<td>182.2 s (3 mins)</td>
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<tr>
<td>OSNR computation</td>
<td>25.84 s</td>
<td>1.18 s</td>
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As the capacity requirement changes, the SDN controller reduces the bandwidth required (i.e., to save on bandwidth resources).
Experiments can be built through python APIs and/or GUI

Access individual elements (including lab equipment, i.e., spectrum analyzer)