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Open testbed research infrastructure with Open Ireland and COSMOS

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CONNECT research centres



**Trinity
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Ireland's European Structural and
Investment Funds Programmes
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Co-funded by the Irish Government
and the European Union



European Union
European Regional
Development Fund

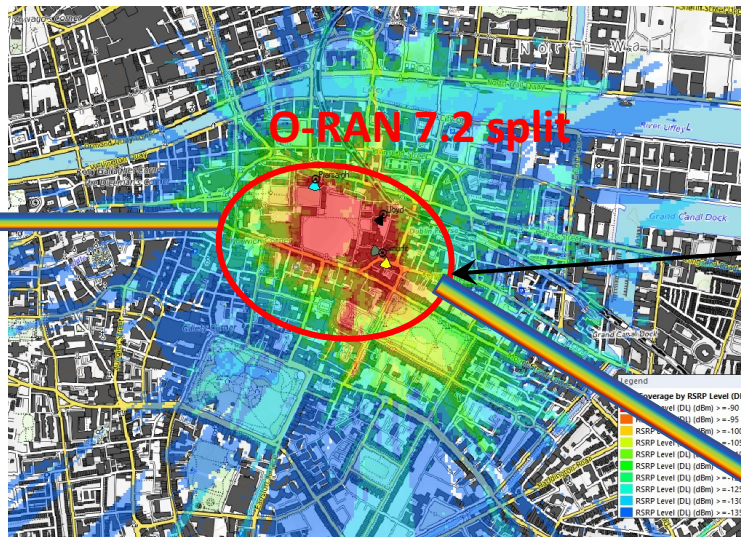


Open Ireland: Ireland's Open Networking Testbed

www.openireland.eu



Optical transmission, analog RoF,
mmWave-THz



Based in Trinity College campus

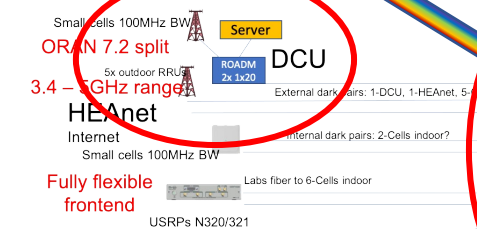


CONNECT research centre building

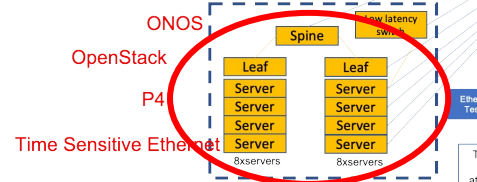
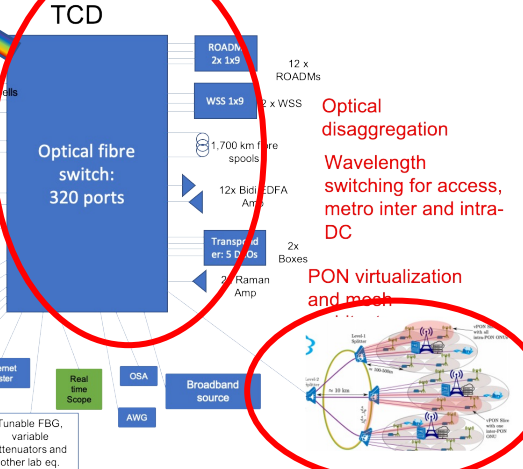
Reconfigurable and **Lego-like** topology reconfiguration with following blocks:

- 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

SDR



Open-Optical



Cloud (Edge/central)

Virtual PON

ComReg 100MHz spectrum license

Existing 3.6 GHz for 5G

Upper 4 GHz band for 5G

Region		A-Lot	3560 - 3620				B-Lots	
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	Guard Band	Airspan	State Services	Vodafone		Imagine	Meteor	Three
				Airspan				
Frequency Range (MHz)		3410 - 3435	3410 - 3475	3475 - 3580	3580 - 3615	3615 - 3700	3700 - 3800	3850 - 3950

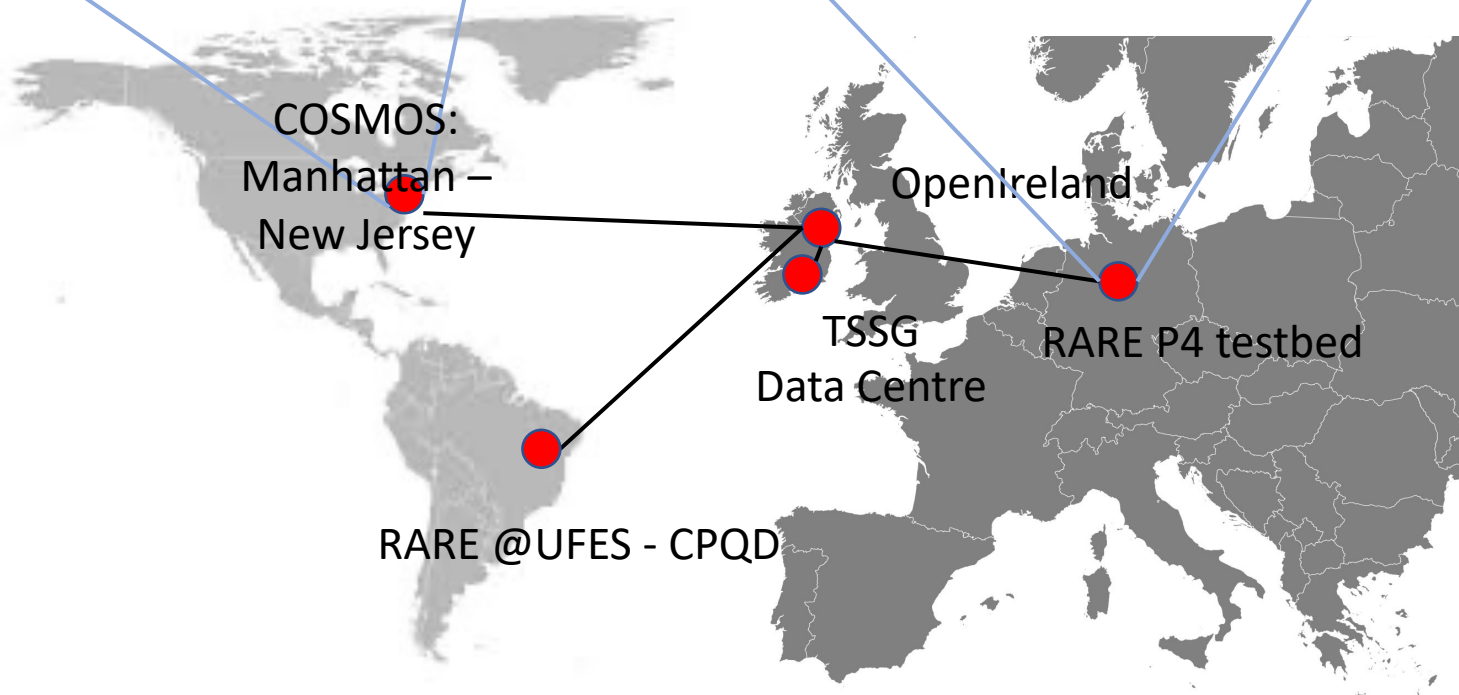
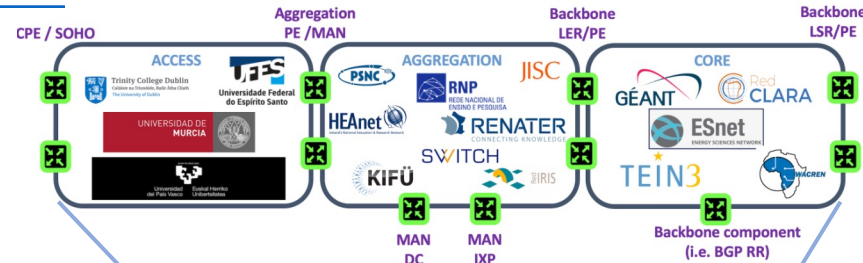
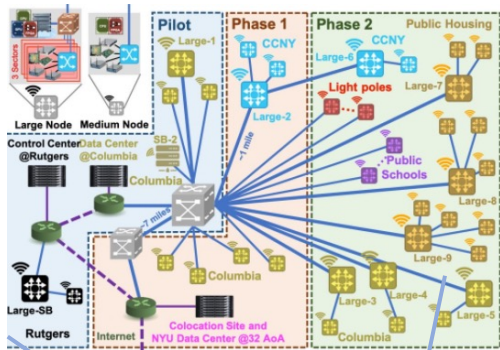
- 5G spectrum enables experimentation with commercial devices (smartphones and future AR, smart cities, etc)
- Use AI to solve complex network interference optimization problems based on real data
- Put together interesting 5G demos, such as smart intersection...



Upper N77 band: 3.8 – 4.2 GHz

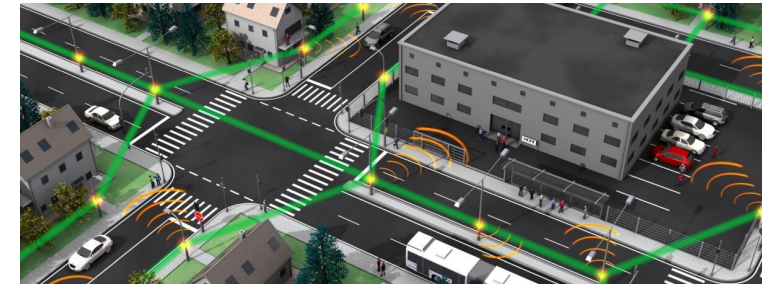
Worldwide reach... and further plans

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

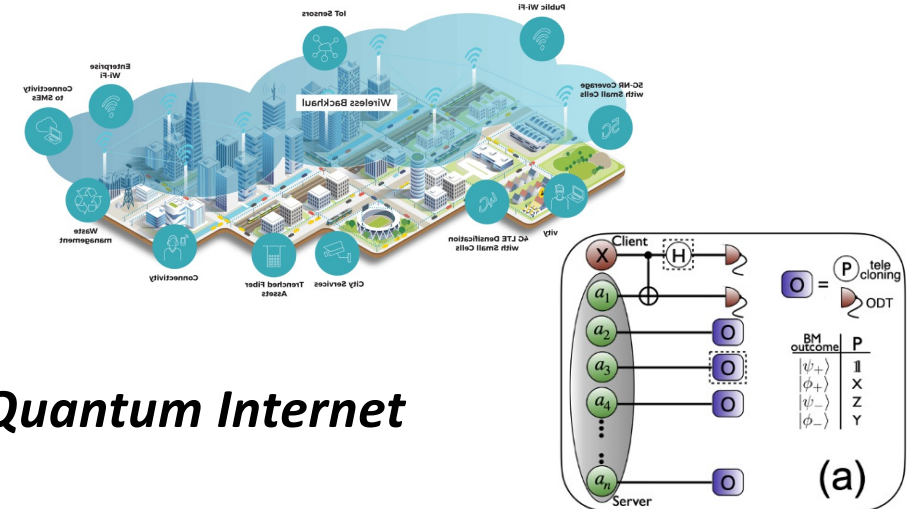


Foundation testbed in CONNECT2
Starting point for further exploration:

⇒ *mmWave and THz experimentation*



⇒ *Connected City Infrastructure*



⇒ *Quantum Internet*

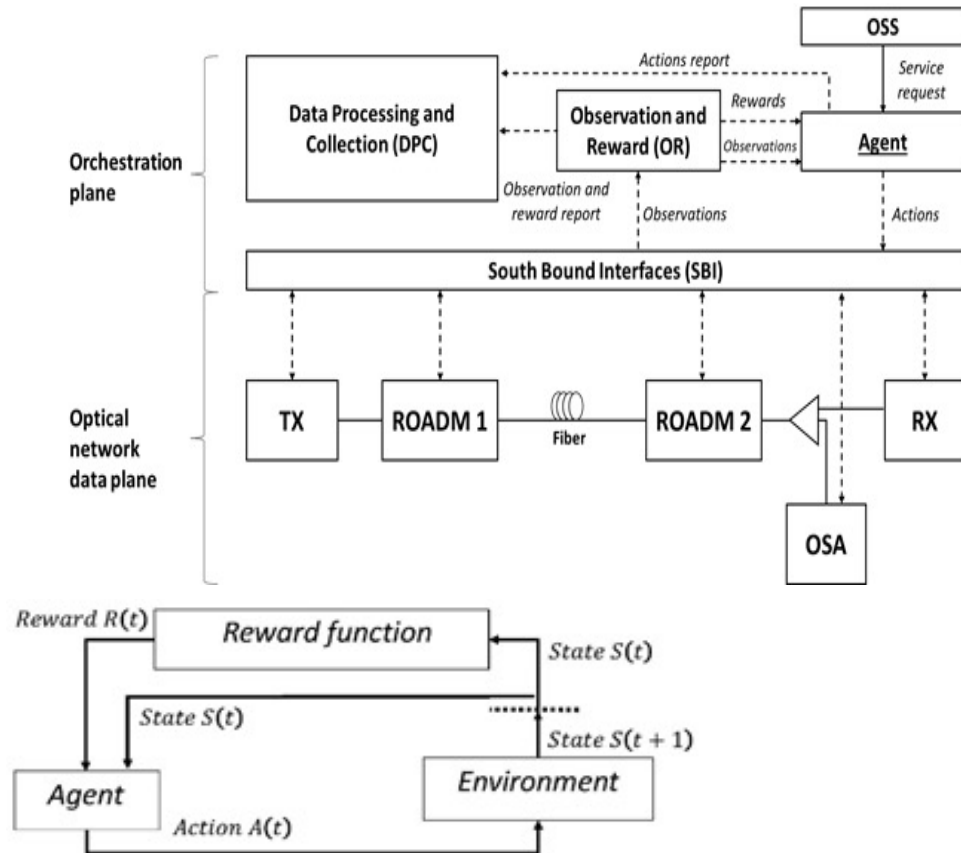
Sample use case: Building a QoT estimation algorithm



POLITECNICO
MILANO 1863

Control plane algorithm development and test based on simulation:

- Online learning through agent that loads the optical spectrum with optical channel and measures OSNR 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?

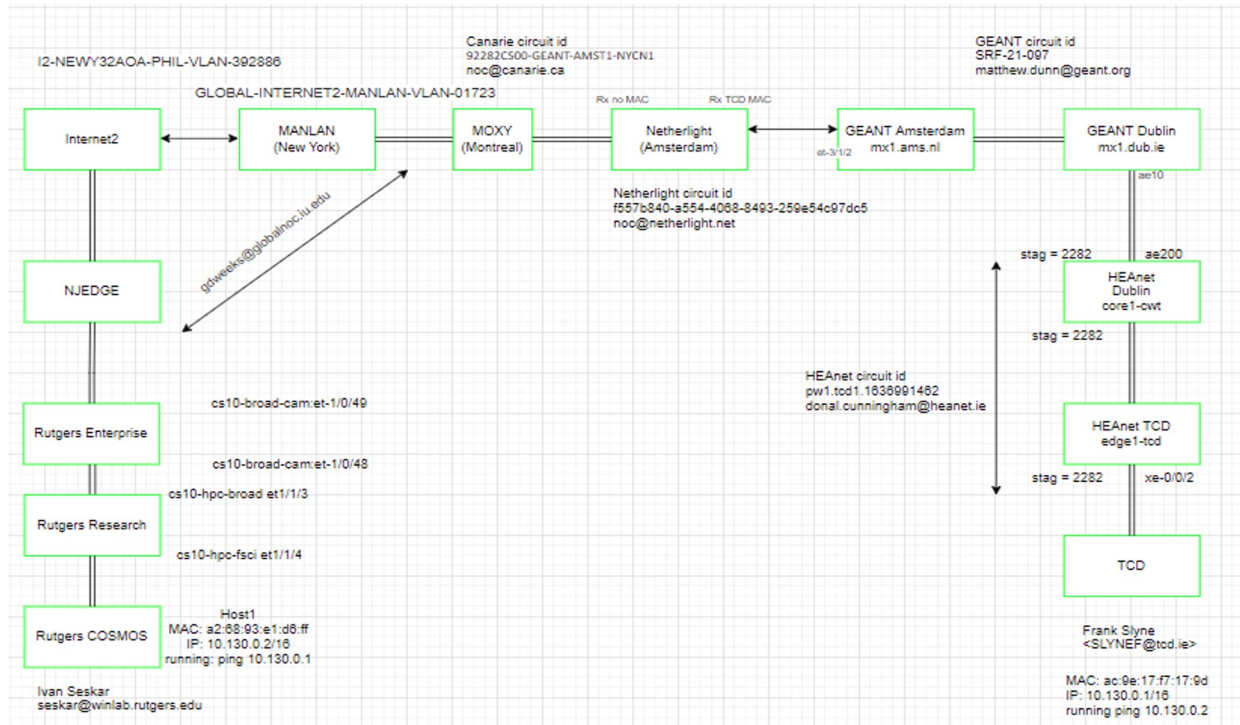
Use of simulated data plane

ONIS OPERATION TIMINGS		
	OSA-based OSNR computation	ROADM-based OSNR computation
Algorithm initialization	3.15 s	
Single channel opening + OSNR + reward step	1.31 s	
Episode (full spectrum filled)	2400 s (40 mins)	182.2 s (3 mins)
OSNR computation	25.84 s	1.18 s

OpenIreland - COSMOS Demo

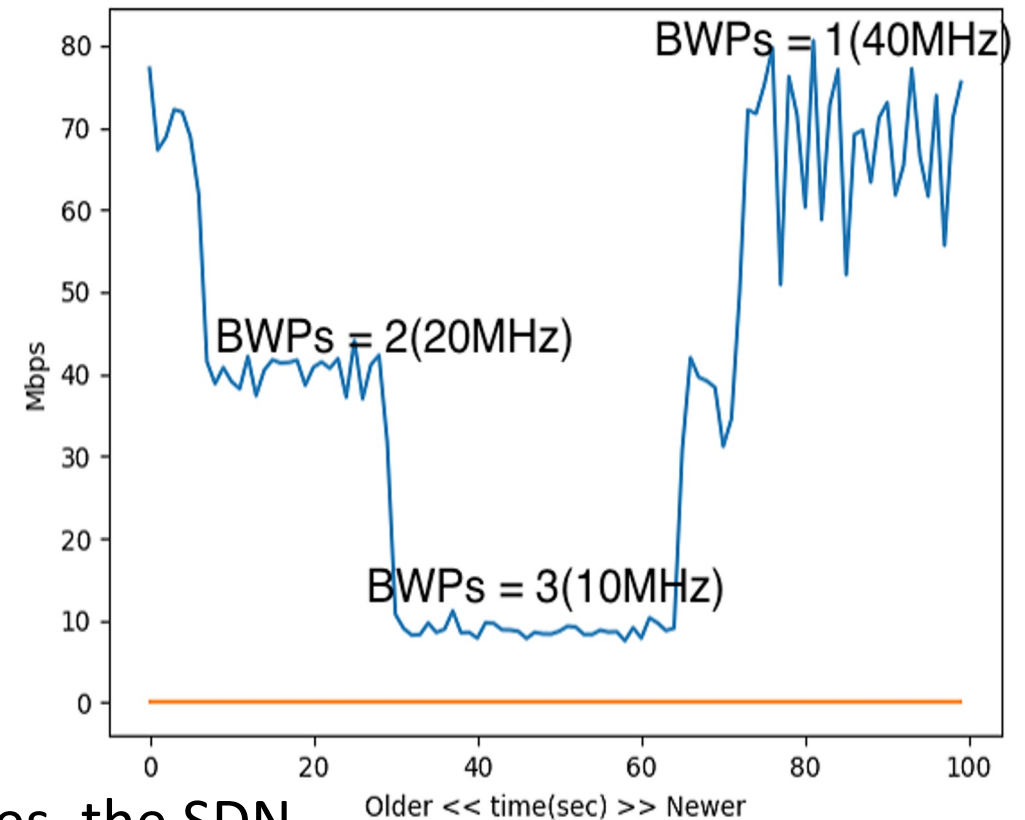
- Assume traffic variation from a user application (COSMOS), affects the bandwidth required in cells in Open Ireland.
- The use case is that of a service provider in COSMOS that wants to offer dedicated capacity towards users that are outside its area (Open Ireland).

Dedicated 10G link COSMOS-OpenIreland



Implemented on OAI 5G

Interface Tx/Rx traffic dde

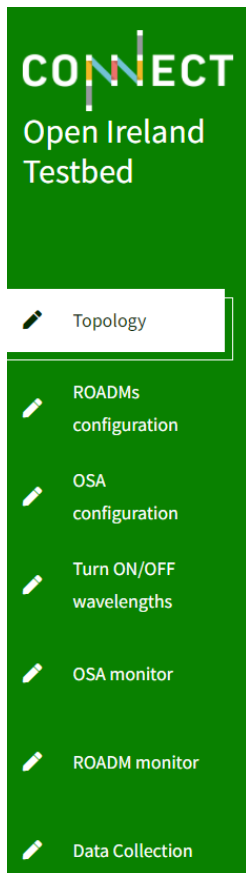


As the capacity requirement changes, the SDN controller reduces the bandwidth required (i.e., to save on bandwidth resources)

Running optical experiments

Experiments can be built through python APIs and/or GUI

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



Make topology

Connect Input and Output of the network elements.

-----OUTPUT-----

ROADM: Port:

ADVA equipment:

ILA:

Cassini laser:

Laser N7711A:

Attenuator:

Fiber:

Splitter:

-----INPUT-----

ROADM: Port:

ADVA equipment:

ILA:

Cassini laser:

Attenuator:

OSA:

Fiber:

Splitter:

-----ADD-----

Status of "Make topology"

Copy and paste here the line you want to remove:

Remove

Status:

