

IRIS & OpenIreland Testbed

Diarmuid Collins

CONNECT Centre, Trinity College Dublin

IoT Week, 23rd of June 2022

HOST INSTITUTION



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

PARTNER INSTITUTIONS





Academic partners



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin



MTU
Ollscoil Teicneolaíochta na Mumhan
Munster Technological University



Maynooth
University
National University
of Ireland Maynooth



Tyndall
National Institute
Institiúid Náisiúnta



UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh



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TU
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Teicneolaíochta
an Oirthuaisirt
South East
Technological
University

01

Fed4FIRE+ IRIS testbed Overview



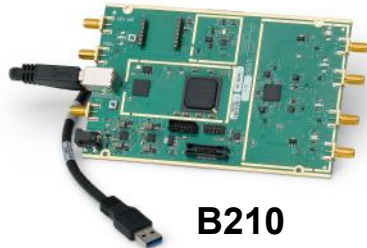
Iris testbed USRP and UE Equipment



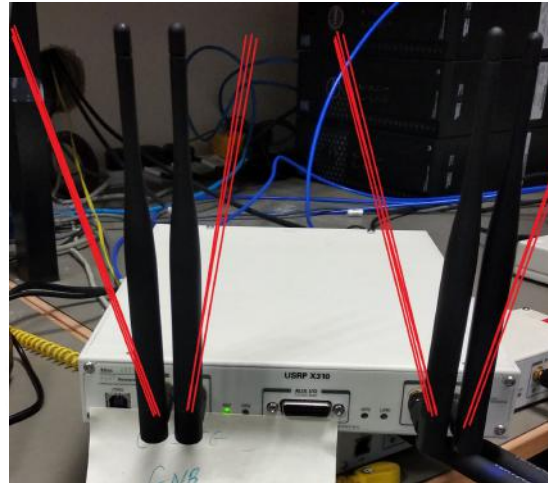
X310



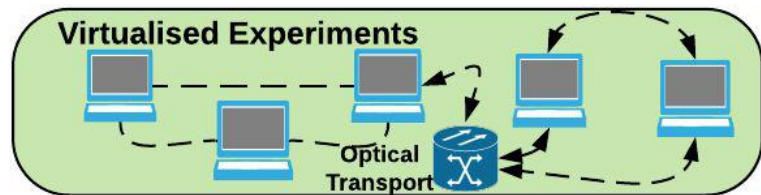
N210



B210



Iris Testbed Architecture (Evolving)



Management and Orchestration Layer

FED4FIRE
FEDERATION FOR FIRE PLUS
O2CMF Framework

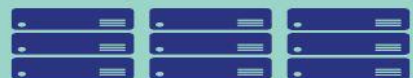


Open Source
MANO

Virtualisation Layer



Functional Elements



Ubuntu





Two Sets of Testbed Challenges

Political Challenges including funds to:

- Pay testbed support personnel
- Purchase new Equipment
- Upgrade and replace USRPs, Servers, switches
- Evolution in the cloud, SDR frameworks, etc.

Experimental Challenges:

- Automation
- Experiment Reproducibility - How?
- Data - What repository?
- Testbed Evolution

Opportunities



COLLABORATION



02

OpenIreland Testbed

NI



Open Ireland: Ireland's Open Networking Testbed

- Testbed for research on end-to-end: wireless-optical-cloud based on **open interfaces** and **open source**
 - **Investigate** end-to-end operation of OpenRAN, Cloud Central Office and Disaggregated optical systems.
- Investigate intelligent control plane, technology and protocols and to enable **100X** scalability:
 - Capacity, Latency, Availability, Energy, Automation...

Network Orchestration

AI-driven automation ✓	Customisation ✓
Wireless/optical/cloud Convergence ✓	Open source/interface ✓

Infrastructure sharing

Many Services ✓
Many operators ✓
Smart contracts ✓

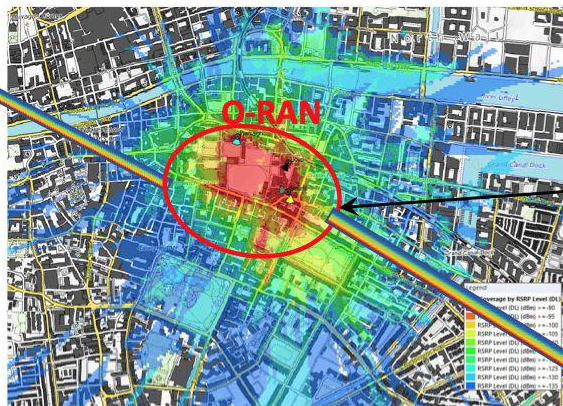
New Technology

OpenRAN and radio frequency ✓
Disaggregated Optical networking, transmission and switching ✓
Edge cloud ✓

In support for new services

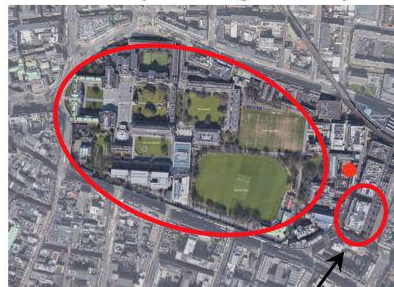
Extended Reality ✓	Connected vehicles ✓
Cloud Robotics ✓	eHealth ✓

Open Ireland: Ireland's Open Networking Testbed



www.openireland.eu

Based in Trinity College campus



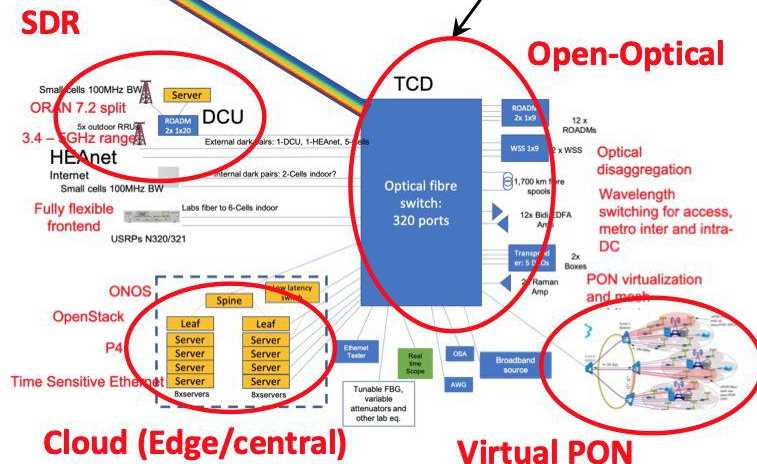
CONNECT research centre building

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

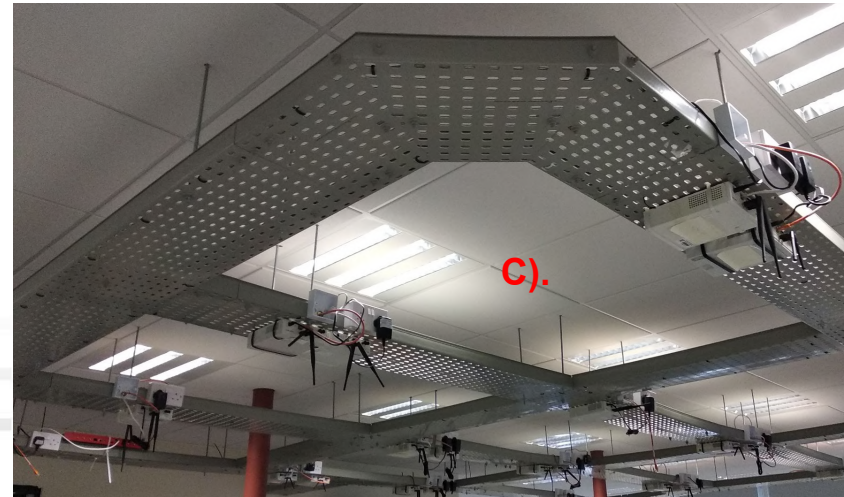
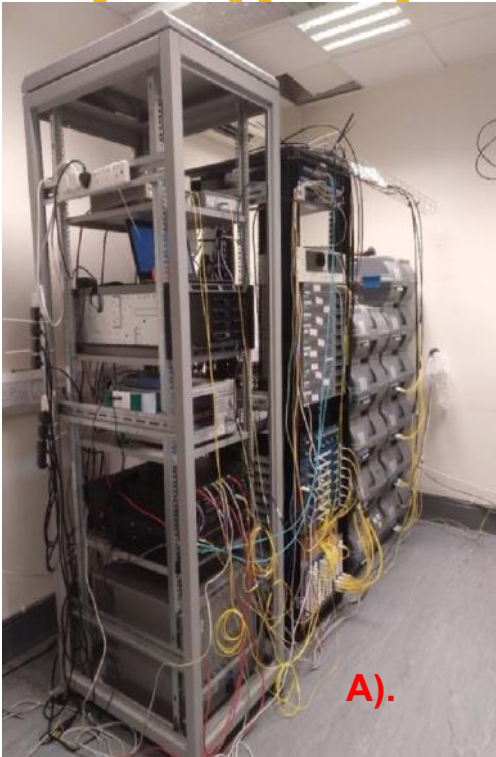
- 1,700km fibre, **SDN ROADMs**, **amplifiers and coherent Tx** (Cassini), virtual PON, OSA, etc.
- **5G O-RAN** (outdoor and indoor); **OpenSource 5G** (OAI and SRS)
- **Edge cloud**, L2 switching, P4 programmability

Run an experiment:

- Use optical fibre switch to put together a suitable physical topology of such blocks
- Load your image into servers for data plane (5G-SDR, Virtual PON, etc..)
- Load your SDN control plane and run experiment (execute commands, read network parameters, train ML algorithm, etc.)



OpenIreland Optical, Wireless and Cloud

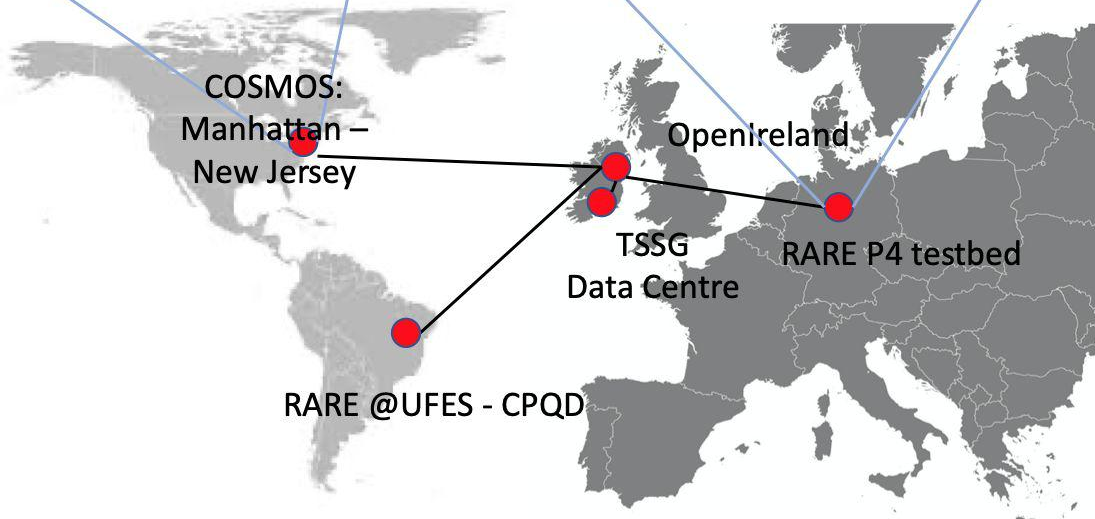
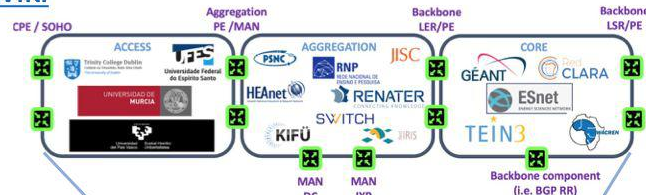
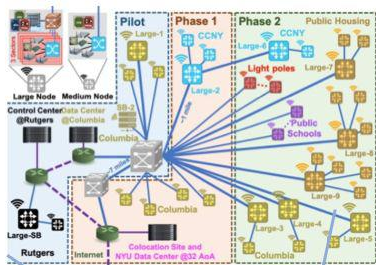


D).



Worldwide reach... and further plans

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

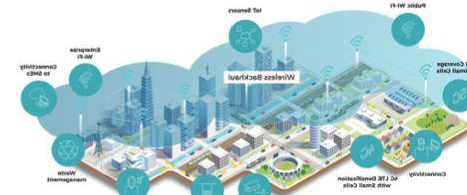


Foundation testbed in CONNECT2
Starting point for further exploration:

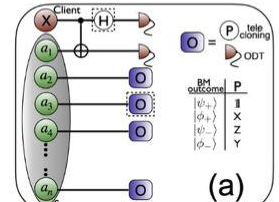
⇒ **mmWave and THz experimentation**



⇒ **Connected City Infrastructure**

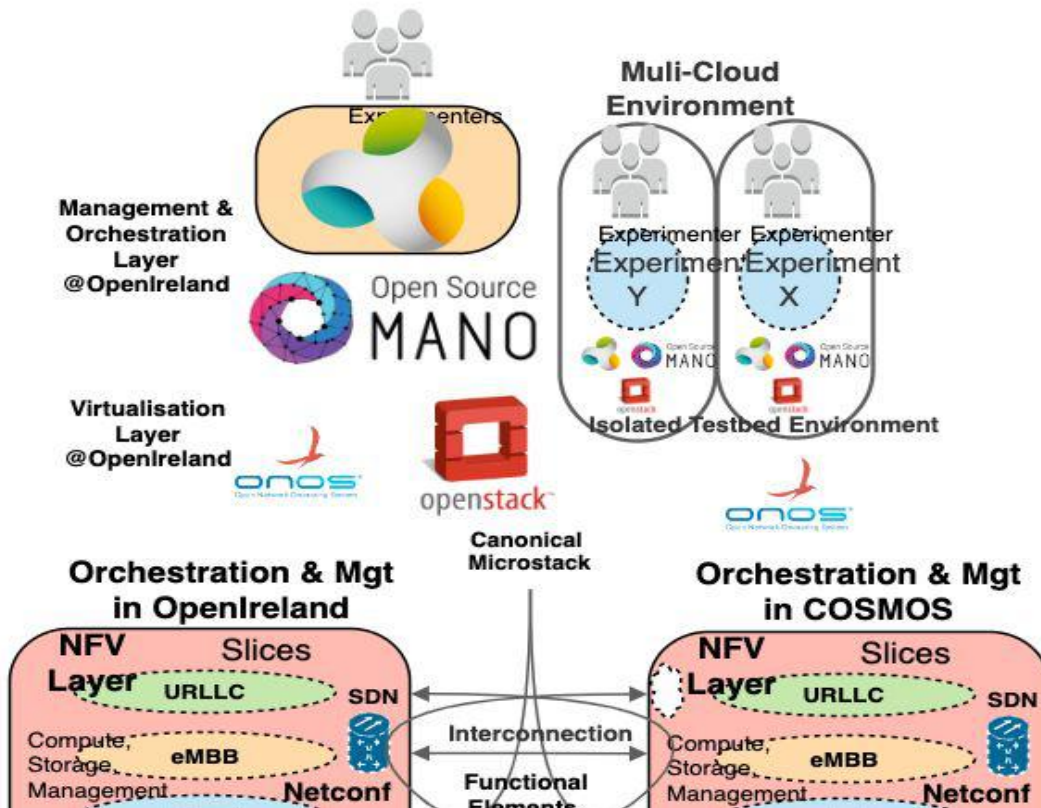
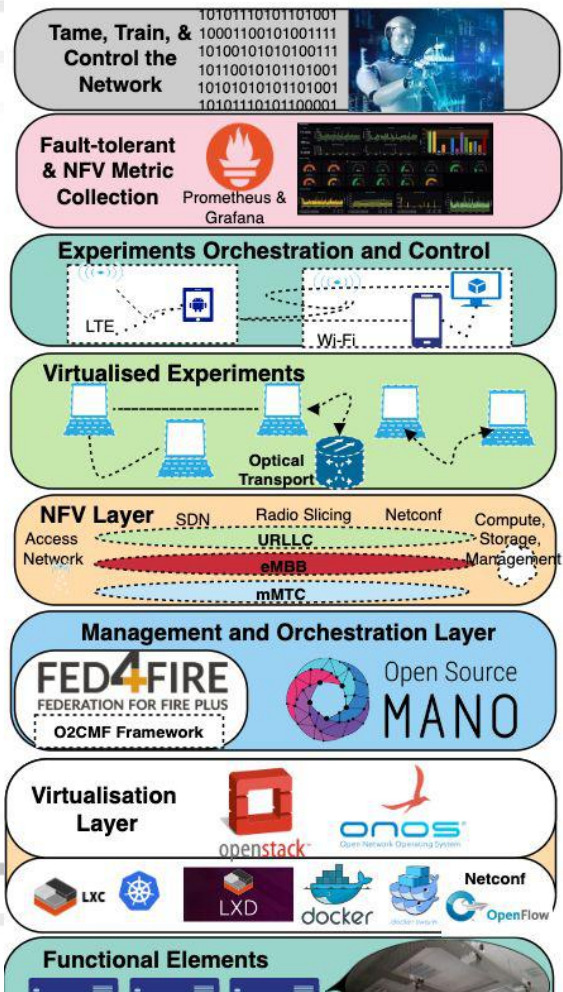


⇒ **Quantum Internet**





OpenIreland Cloud Architecture



Data Capture – Physical Performance of the network



SNMP data
powerUsageInstantaneousHeadroom:
1.3.6.1.4.1.674.10892.1.600.60.1.20
Defines the system instantaneous headroom
(in Watts). This is the theoretical maximum power drawn by the power supply minus instantaneous power draw. This value increases if the instantaneous power decreases, it takes low values if the the energy consumption is high

-----Signal-----				-----DL-----							-----UL-----		
rat	pci	rsrp	pl	cfo	mcs	snr	iter	brate	bler	ta_us	mcs	buff	
lte	1	-11	11	-1.4u	0	142	0.0	0.0	0%	0.0	0	0.0	
nr	500	1	0	23u	27	70	1.0	8.5M	0%	0.0	28	36k	
lte	1	-11	11	-1.4u	0	142	0.0	0.0	0%	0.0	0	0.0	
nr	500	1	0	23u	27	70	1.0	9.2M	0%	0.0	28	24k	
lte	1	-11	11	-1.4u	0	142	0.0	0.0	0%	0.0	0	0.0	
nr	500	2	0	23u	27	69	1.0	4.6M	0%	0.0	28	19k	

powerUsagePeakWatts: 1.3.6.1.4.1.674.10892.1.600.60.1.9 Defines the peak wattage reading (in Watts) for this entity since the date and time specified by the powerUsagePeakWattsStartDateName attribute.

ComReg 100MHz spectrum license

Existing 3.6 GHz for 5G

Upper 4 GHz band for 5G

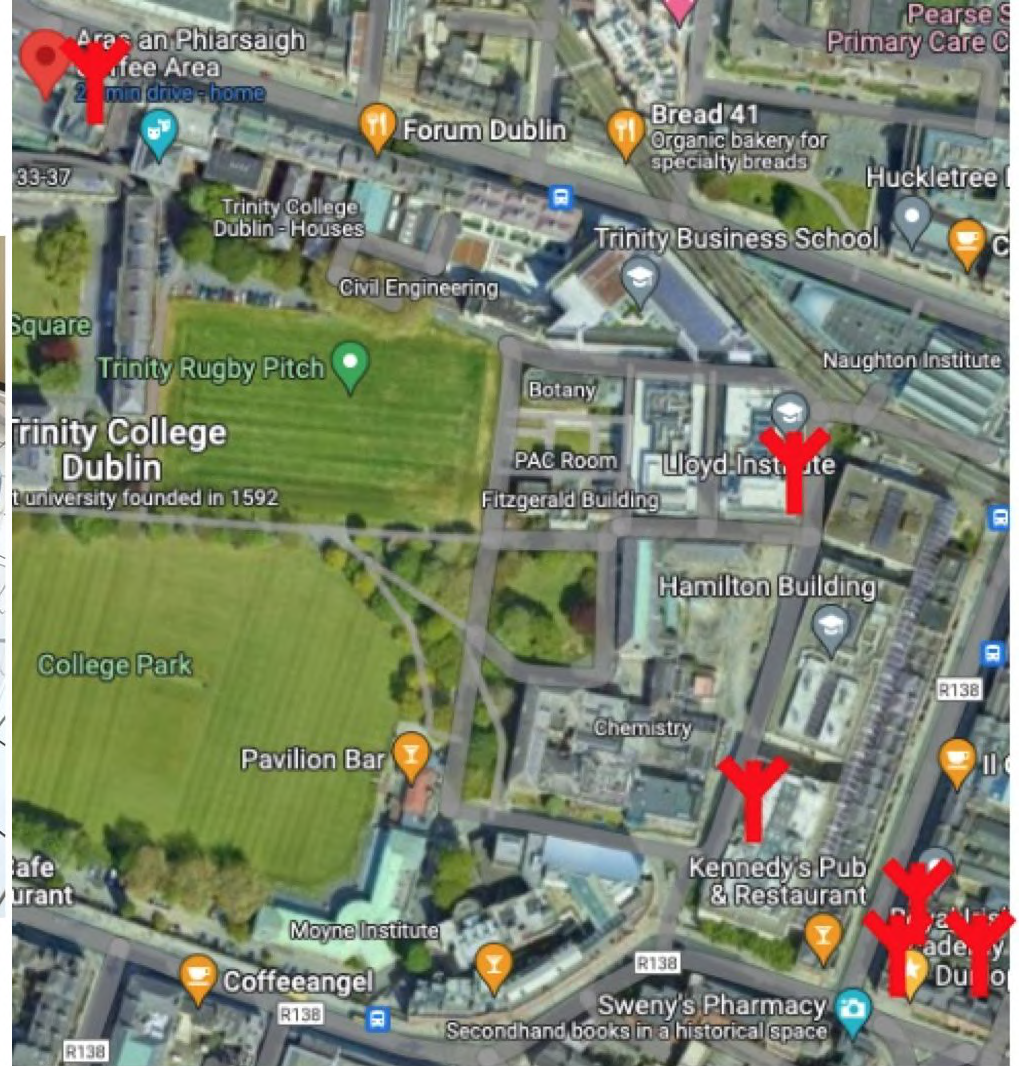
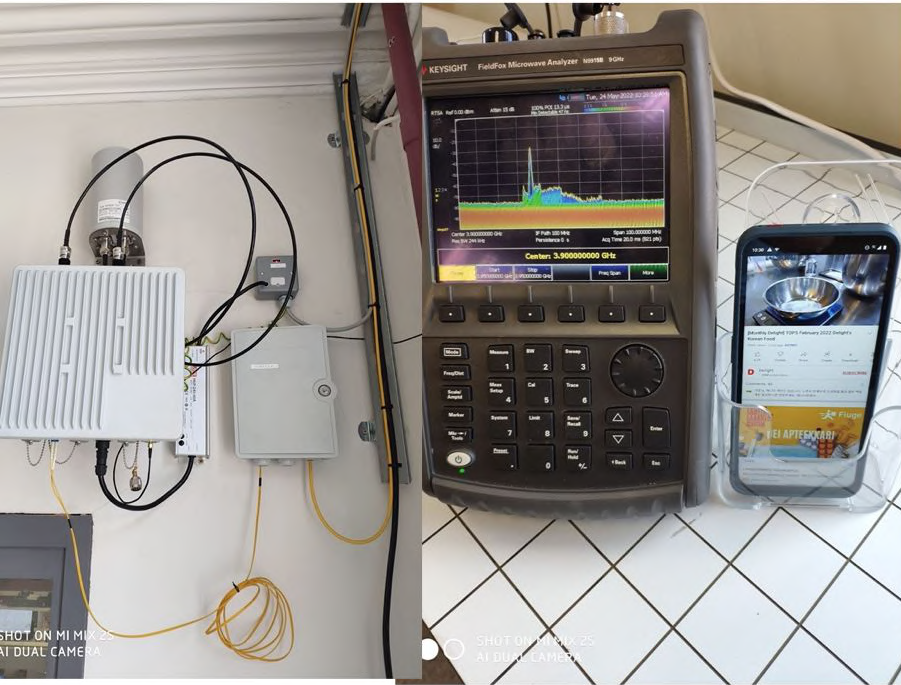
Region	A-Lot		3560 - 3620				B-Lots			
Borders Midlands & West	Guard Band	Airspar	State Services	Imagine		Meteor	Three	CONNECT		
South West										
East										
South East										
Dublin City and Suburbs										
Cork City and Suburbs										
Galway City and Suburbs										
Limerick City and Suburbs										
Waterford City and Suburbs										
Frequency Range (MHz)	3410 - 3435	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

OpenIreland 5G



Pervasive Nation LoRaWAN IoT

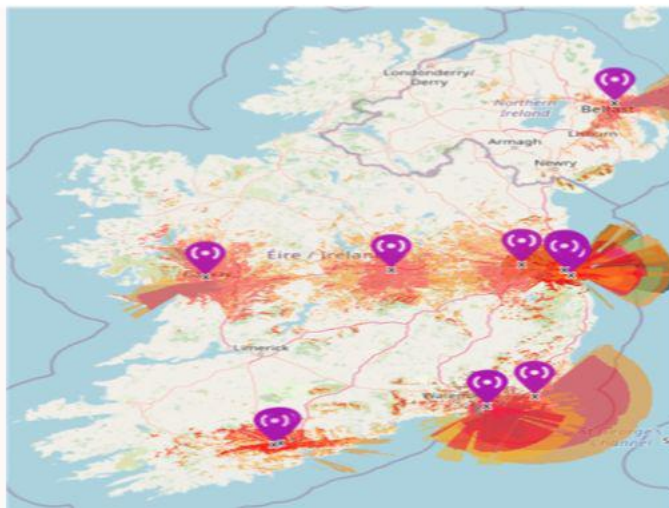
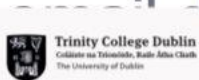
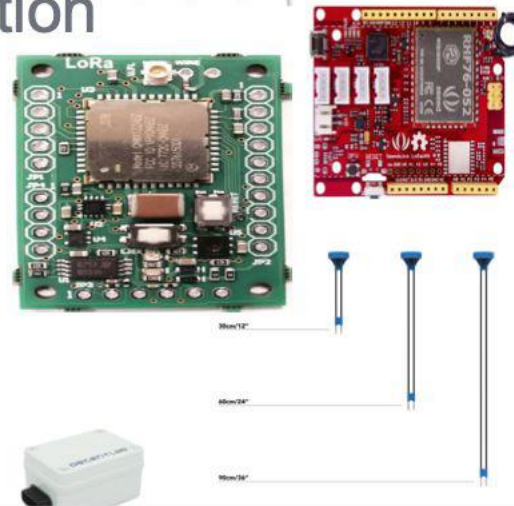


Enable LoRaWAN IoT research and experimentation

Help Train (technical experimenters/students)

Help non-technical users – i.e., natural scientists

Various Tutorials and how to access and use the testbed are available on iristestbed.eu website or

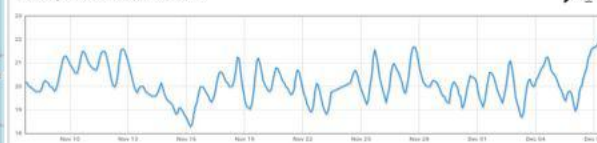


Soil

Data Table - SmartBog_STM_570

Timestamp	BatteryVoltage	DielectricPermittivity	SoilTemperature	VolumetricWaterContent
2020-12-07 17:00:00	2.968	1.22	21.5	-0.01818681185359993
2020-12-07 15:00:00	2.968	1.22	21.733333333333334	-0.01818681185359993
2020-12-07 13:00:00	2.968	1.22	22	-0.01818681185359993
2020-12-07 11:00:00	2.968	1.22	22.266666666666666	-0.01818681185359993
2020-12-07 09:00:00	2.9676666666666667	1.22	22.083333333333332	-0.01818681185359993
2020-12-07 07:00:00	2.966	1.22	21.9	-0.01818681185359993

Soil Temperature - SMARTBOG_STM_570



03

Being Part of a Federation of Testbeds



Benefits

- Resources - Aggregate Manager and JFed Frameworks
- Experimentation across distributed infrastructure.
- Iris has been a foundation element to getting EU funding for TCD.
- Guidance and help in matters such as GDPR, Governance, etc.
- Fed4FIRE+ partners and experimenters are our community - IMEC, SRS, ALLBESMART, South East Technological University, etc
- Project involvement



Collaboration

- Some very successful collaborations with other research institutes and SMEs supported by IRIS
- Trained students, researchers, and SMEs across different testbeds with some continuing to work on the testbed today



Funding Opportunities

NGI

GET FUNDED

NGI INNOVATORS

NEWS & EVENTS

JOIN NGI

WHAT IS NGI

LIBRARY



Dublin City Council
Comhairle Cathrach Bhaile Átha Cliath

The SBIR has proven to be a very important initiative for the Dublin region and following the completion of the REP targets for Q4 2019 the SBIR continues to be developed and managed in the Dublin area.

The four Dublin Regional Challenges have commenced or are in the process of commencing the 2nd and final phase, that of developing a working prototype. The 1st phase of delivering a proof of concept having been delivered. COVID-19 has had an impact on phase two schedules, but all should be completed by Q3 of 2020. The live challenges which have commenced are as follows:

- Dun Laoghaire Rathdown (Internet of things).
- Smart Dublin (Last Mile Delivery).
- Smart Dublin (Smart Mobility).
- Dublin City Council (Gully monitoring).

At the Public Sector Innovation conference, notable achievements were highlighted such as the Gully monitoring Challenge **between Dublin City Council and two SMEs**: Danalto and Semicon. The Gullyspy product has been continuing to garner interest on an international level. The Dun Laoghaire-Rathdown County Council are responsible for running the Internet of things challenge. This has progressed over time to focus on an innovative product to remotely monitor cracks in buildings and civil infrastructure. Crack sensors will notify authorities as to any movement of a fissure and by so doing provide additional security while reducing time and costs spent on physical inspections.

FUND YOUR IDEA!

Don't miss the NGI Open Call.



GET FUNDED!

IT'S EASY!



NGI INNOVATORS

SMART GIRLS & GUYS



NGI COMMUNITY

JOIN US!



NGI VISION

THIS IS NGI

OUR FACILITIES

TESTBEDS

5G, Internet of Things,
Cloud Computing, Wired and
Wireless Computer Networking...

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All News

All Events

04

The Future....



Our testbed is growing and expanding

- Its our intention to join SlicesRI
- We are having discussions with other Irish testbeds about providing access
- Our goal is to provide a multi-cloud environment which can extend into other Testbeds domains supported by interconnection



Thank you

Contact: Diarmuid Collins

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Twitter: [@OpenIreland6G](https://twitter.com/OpenIreland6G)

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connectcentre.ie



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info@connectcentre.ie

TeamViewerEditConnectionExtrasWindowHelp

iristestbed-Precision-M4600

Menu

iristestbed@iristestbed-Precision-M4600: ~

My PDU - Outlet Details 6 — Mozilla Firefox

My PDU - Outlet Details 6 × +

https://172.16.7.222/#/outlets/1/6

Raritan
A brand of Legrand

My PDU

EN |

Dashboard

PDU

Inlet

Outlets

Outlet Groups

Peripherals

Feature Port

User Management

Device Settings

Maintenance

Model

Outlet 6

Details

Label	6
Outlet status	on
Receptacle type	IEC 60320 C13
Lines	L1-NEUTRAL
Inlet	Inlet I1

Sensors

Sensor	Value	State
RMS Current	0.185 A	normal
RMS Voltage	236 V	normal
Line Frequency	50.0 Hz	normal
Active Power	38 W	normal
Active Energy	106717 Wh	normal
Apparent Power	44 VA	normal

TeamViewer

Free license (non-commercial use only)

Session list

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(1 257 692 152)

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www.teamviewer.com