CONNECT
Centre for Future Networks

A World Leading SFI Research Centre

Science Foundation Ireland sfi For what's next

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

MTU
DCU
Maynooth University
DUBLIN
Tyndall
UCC
University College Dublin
An Coláiste Ollscoile, Baile Átha Cliath
UNIVERSITY OF LIMERICK
OLLSCOIL LUIMNIGH
SETU

Academic partners

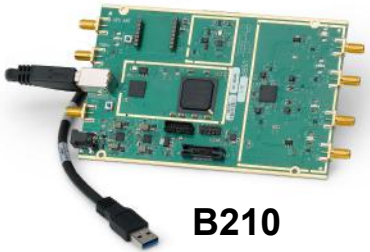
01

Fed4FIRE+ IRIS testbed Overview

Iris testbed USRP and UE Equipment

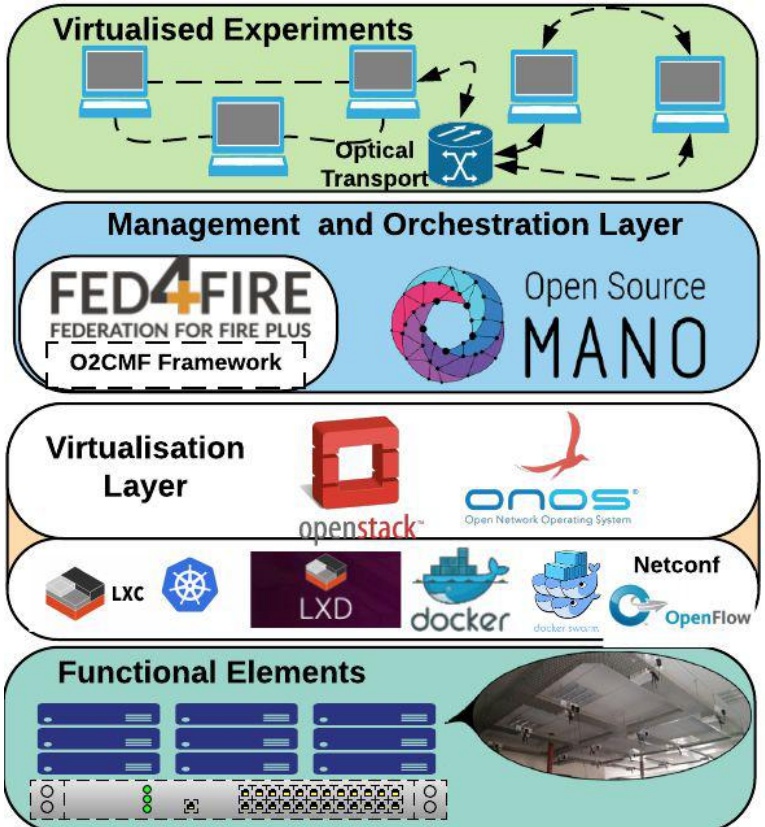
X310

N210



B210

Iris Testbed Architecture (Evolving)



openstack
CLOUD SOFTWARE

OPEN AIR INTERFACE

Ubuntu

NATIONAL INSTRUMENTS

SRSRAN

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

5G

OPEN AIR INTERFACE

Open Source MANO

openstack
CLOUD SOFTWARE

INNOVATE!

SRSRAN

COLLABORATION

02
OpenIreland Testbed

Open Ireland: Ireland's Open Networking Testbed

Trinity College Dublin
The University of Dublin

- 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 ✓

CONNECT Networks of the Future

Open Ireland: Ireland's Open Networking Testbed

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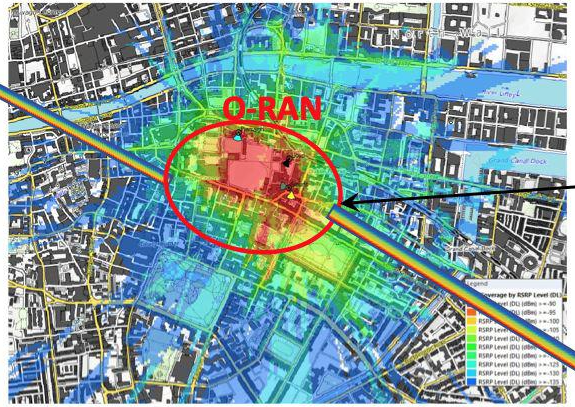
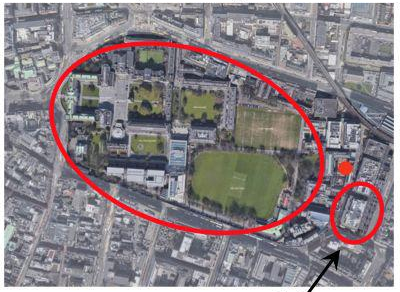
www.openireland.eu

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



Based in Trinity College campus

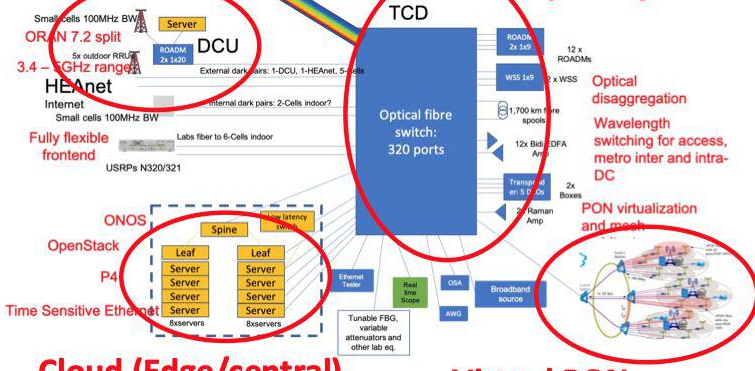


O-RAN

CONNECT research centre building

SDR

Open-Optical



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.)

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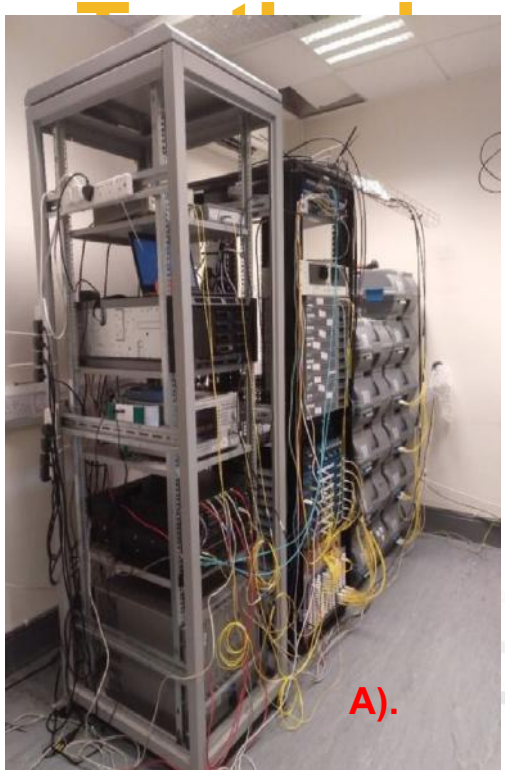
Networks of the Future

OpenIreland Optical, Wireless and Cloud



A).

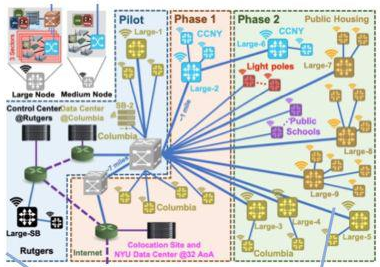
B).

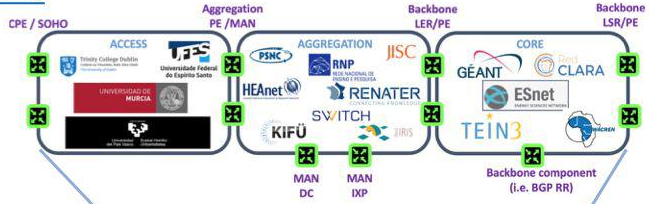
C).

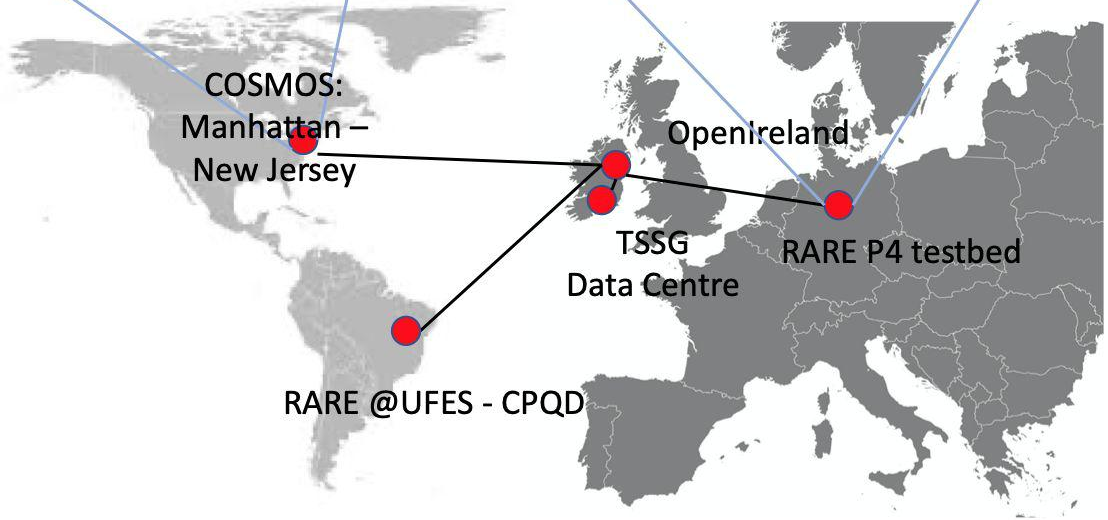
D).

Worldwide reach… and further plans

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



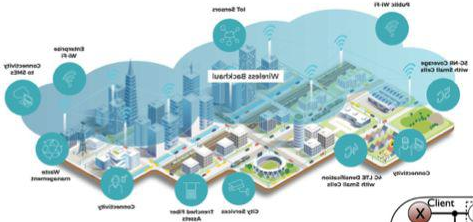




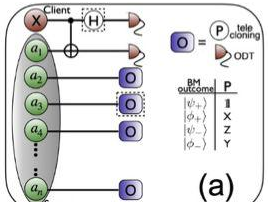
Foundation testbed in CONNECT2
Starting point for further exploration:

⇒ ***mmWave and THz experimentation***

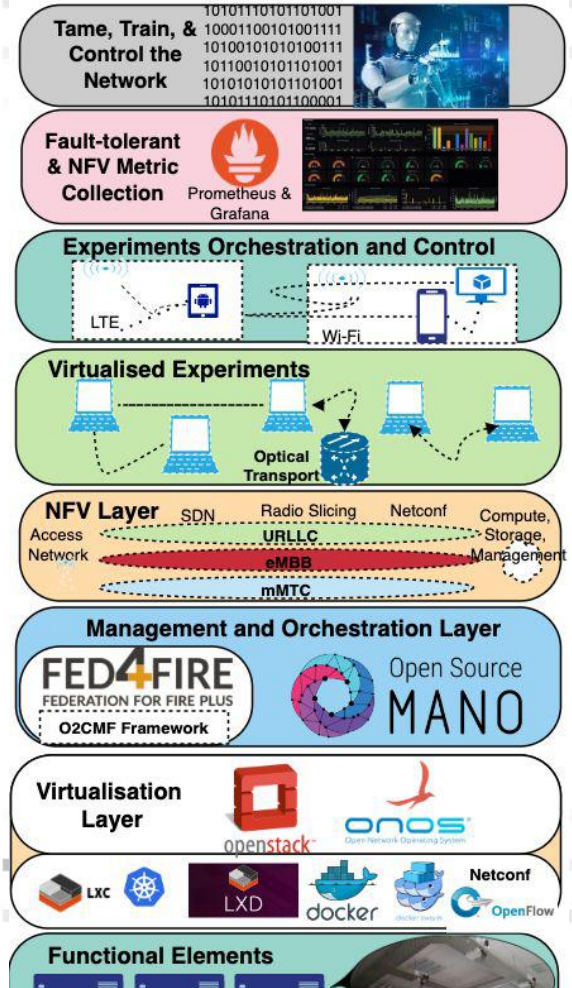
⇒ ***Connected City Infrastructure***

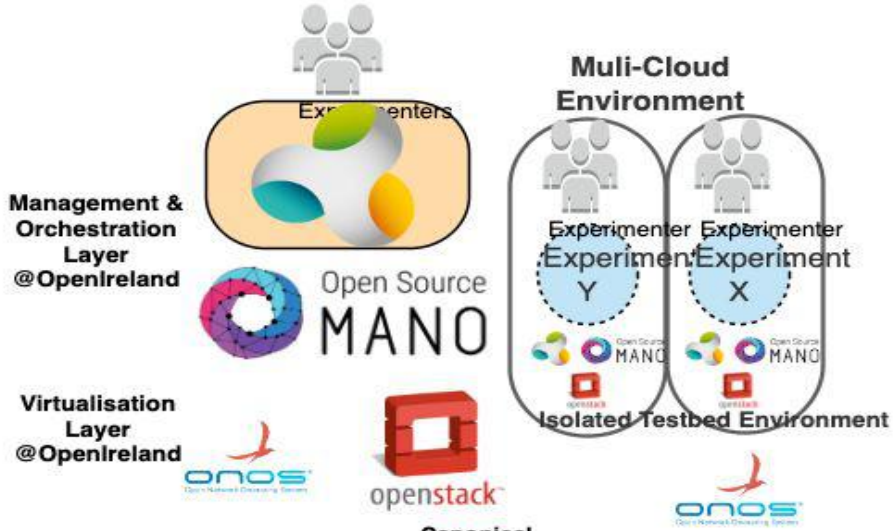


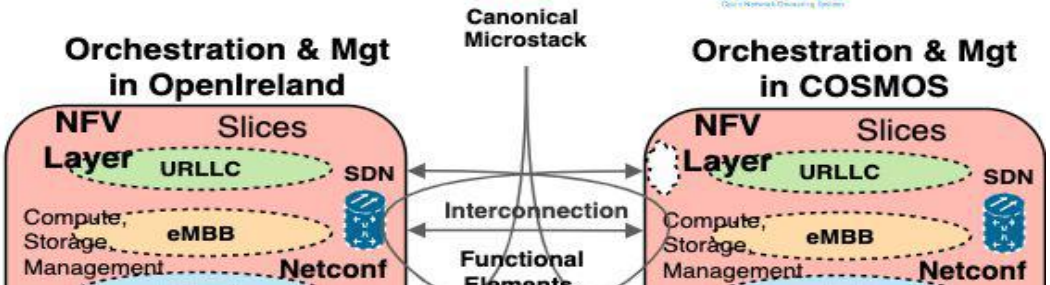
⇒ ***Quantum Internet***



OpenIreland Cloud Architecture







Data Capture – Physical Performance of the network

Signal					DL						UL		
rat	pci	rsrp	pl	cfo	mcs	snr	iter	brate	bler	ta_us	mcs	buff	brate	bler
lte	1	-11	11	-1.4u	0	142	0.0	0.0	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	8.3M	0%
lte	1	-11	11	-1.4u	0	142	0.0	0.0	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	8.1M	0%
lte	1	-11	11	-1.4u	0	142	0.0	0.0	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	4.2M	0%

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.

Tools: iPerf, ping, etc

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

ComReg 100MHz spectrum license

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The University of Dublin

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 Airspan	Meteor	Three	CONNECT
Frequency Range (MHz)		3410 - 3435	3410 - 3475	3475 - 3580	3580 - 3615	3615 - 3700	3700 - 3800	3850 - 3950

Upper N77 band: 3.8 – 4.2 GHZ

- 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…

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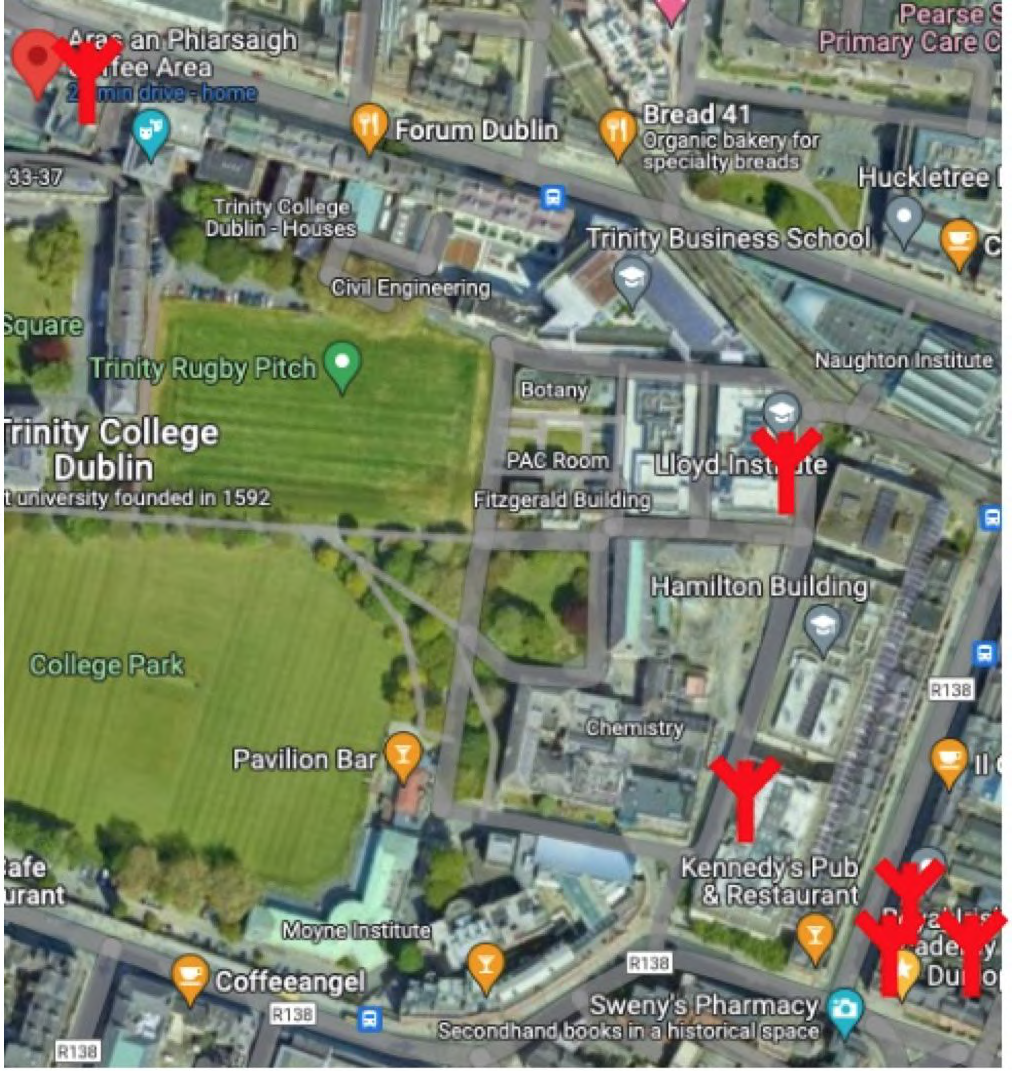
OpenIreland 5G



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

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CIT CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

DCU

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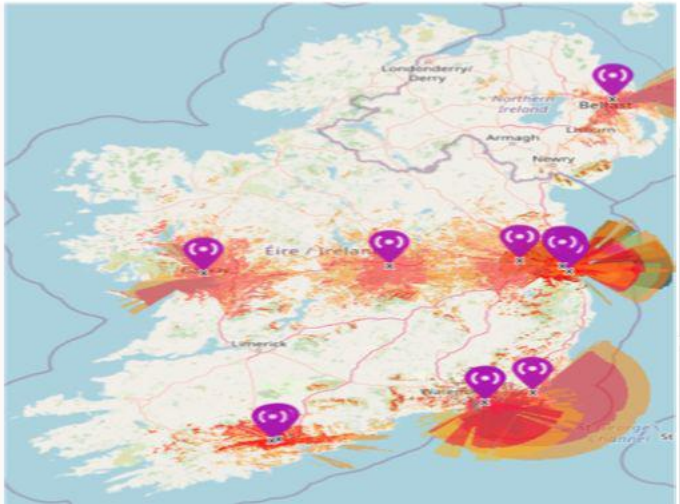
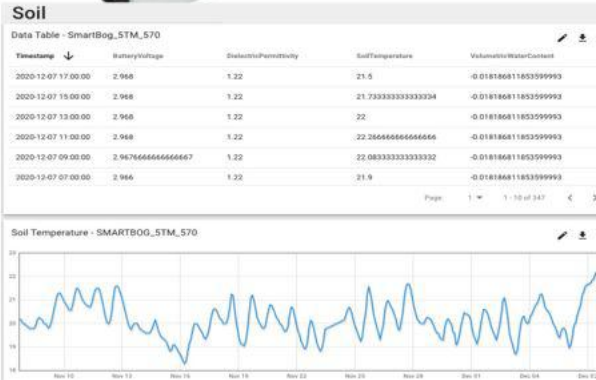
UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

UCD DUBLIN

Ulster University





03

Being Part of a Federation of Testbeds

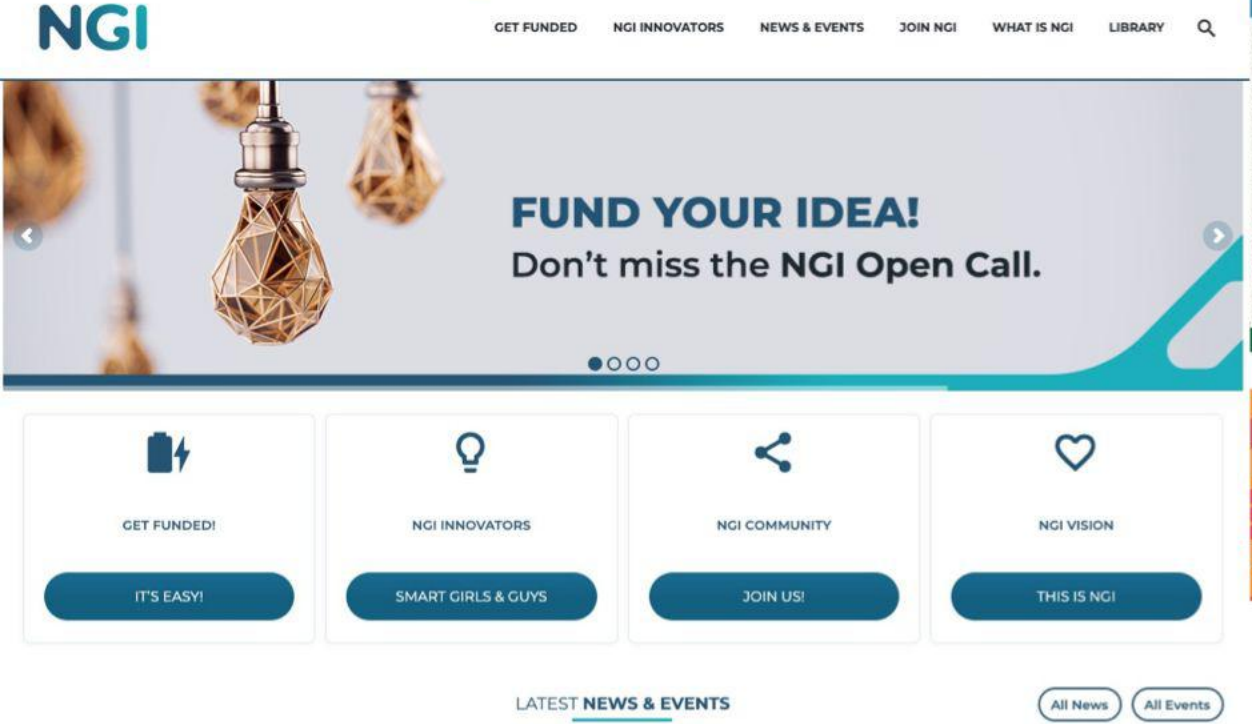
Benefits

- 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



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

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Thank you

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Twitter: @OpenIreland6G

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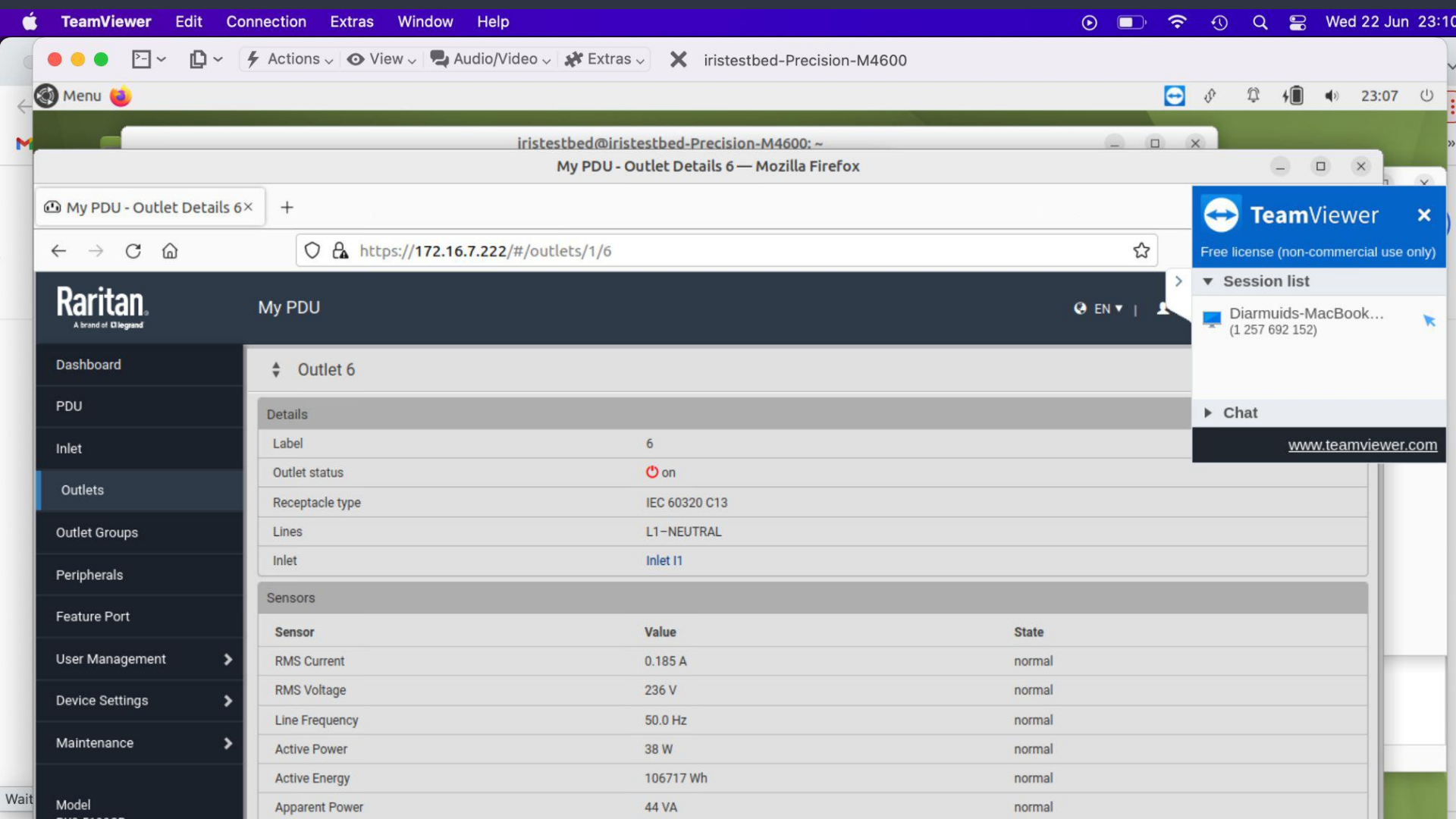
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Menu
23:07
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My PDU - Outlet Details 6 — Mozilla Firefox
My PDU - Outlet Details 6
https://172.16.7.222/#/outlets/1/6
TeamViewer
Free license (non-commercial use only)
Session list
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(1 257 692 152)
Chat
www.teamviewer.com
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
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Lines L1–NEUTRAL
Inlet Inlet I1
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RMS Voltage 236 V normal
Line Frequency 50.0 Hz normal
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