

# Testbeds Catalogue

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Title	Location	Owner Organization	Short Description	Website
<a href="#">5G Playground</a>	Germany, Berlin	Fraunhofer FOKUS	5G playground encompasses a comprehensive, highly customizable and re-configurable network environment, based on commercially available components and the Fraunhofer own toolkits	<a href="#">5GPlayground.org</a>
<a href="#">Imaginlab</a>			It is an open platform thought for interoperability tests in fixed and mobile networks	N/A
<a href="#">Com4innov</a>			It is a consortium providing the framework for testing solutions and services on next generation networks and technologies, including M2M applications	<a href="http://www.com4innov.com">http://www.com4innov.com</a>
<a href="#">5G haus</a>	Germany	Deutsche Telekom	DT has set-up a European wide program for the coordination, planning, and carrying out of 5G related experiments, tests, and field trials.	<a href="https://www.telekom.com/5ghaus">https://www.telekom.com/5ghaus</a>
<a href="#">5G Center for Innovative Networks</a>	Turkey	NETAS	5GNET based in Istanbul focuses on wireless access technologies and performs combined functionalities with a wide function equipped laboratory and venture capital.	N/A
<a href="#">5G-EmPOWER testbed</a>	Italy	Create-Net	5G-EmPOWER developed by Create-Net is a unique and open toolkit for SDN/NFV research and experimentation over wireless and mobile networks.	<a href="https://github.com/5g-empower/5g-empower.github.io/wiki/Overview">https://github.com/5g-empower/5g-empower.github.io/wiki/Overview</a>
<a href="#">Network Implementation Testbed using Open Source platforms - NITOS</a>	Greece	University of Thessaly	It is a remotely accessible and configurable testbed established through the EU Future Internet Research and Experimentation (FIRE) initiative. The testbed is equipped with cutting edge fully programmable networking equipment (LTE-A, LTE, WiMAX, WiFi, ZigBee, Software Defined Radio equipment, hardware OpenFlow switches, Cloud Computing infrastructure).	<a href="http://nitlab.inf.uth.gr/NITLab/index.php/nitos.html">http://nitlab.inf.uth.gr/NITLab/index.php/nitos.html</a>
<a href="#">iMinds</a>	Belgium	University of Ghent	iLab.t technical testing offers access to the hardware, measurement equipment, user-friendly software tools and professional technical expertise needed to efficiently prototype, develop, and test innovative ICT innovations.	<a href="http://ilabt.iminds.be/homelab">http://ilabt.iminds.be/homelab</a>
<a href="#">EHU-OEF</a>	Spain	University of the Basque Country	The OpenFlow Enabled Facility is one of the oldest OpenFlow based facilities that is currently being used both on production and for research activities.	<a href="http://i2t.ehu.es/resources/ehu-oef">http://i2t.ehu.es/resources/ehu-oef</a>
<a href="#">5G Wireless Innovation Center, Argela</a>	Turkey	Istanbul	5GWiN based in Istanbul and Silicon Valley focuses on software defined future radio access technologies. Current projects listed as ULAK to develop 4G base station, short and long range Small Cell, programmable C-RAN.	<a href="http://www.tinvestorrelations.com/turk-telekom-group/group-companies/argela.aspx">http://www.tinvestorrelations.com/turk-telekom-group/group-companies/argela.aspx</a>
<a href="#">OneLab</a>	France	UPMC	The OneLab facility provides single entry point for federated infrastructures, a common API and a Portal to browse and reserve resources of different technologies, from Wireless or IoT based to Cloud based like OpenStack or distributed at a global scale on Internet.	<a href="https://www.onelab.eu">https://www.onelab.eu</a>

KU Leuven Networked Systems	Belgium	KU Leuven	The test facility consists of 45 FPGA-enabled software radios (90 antennas) that can be configured in various ways to explore the benefits of many networking architectures relevant to 5G and beyond.	<a href="https://www.esat.kuleuven.be/telemic/research/NetworkedSystems">https://www.esat.kuleuven.be/telemic/research/NetworkedSystems</a>
SICS ICE	Sweden	SICS North	It is a full scale datacenter testlab planned to be built in 2 phases at Luleå University of Technology, Sweden, campus. First phase is operational. Consists of compute pods with 200 servers, 3600 cores, 4 TB RAM, up to 7 petabytes hard disk.	<a href="https://www.sics.se/media/news/sics-ice-data-center-in-lulea">https://www.sics.se/media/news/sics-ice-data-center-in-lulea</a>
OpenSAND	France	CNES	It is an user-friendly and efficient tool to emulate satellite communication systems, mainly DVBS2/RCS2.	<a href="http://opensand.org">http://opensand.org</a>
i2CAT's OpenFlow-enabled islands	Spain	i2CAT	The I2CAT Island's main objective, as part of the OFELIA facility, was to address the need to test and evaluate innovative solutions and ideas in real network environments, in addition to simulations or laboratory setups.	<a href="http://www.fed4fire.eu/i2cat-ofelia">http://www.fed4fire.eu/i2cat-ofelia</a>
WST - Wireless Actuator and Sensor Network Testbed	Italy	Univ. of Parma	The main objective of the WASN Lab Testbed is to create an innovative Internet of Things experimental environment.	N/A
Future Networks Innovation Lab	Italy	Italtel	The facility is aimed to the application of the NFV and SDN concepts for improving multimedia real time communications and M2M/IoT services.	N/A
5GIC campus testbed	UK	Univ. of Surrey	The main objective of the 5GIC testbed is to facilitate experimentation of algorithms, techniques and novel concepts for the future 5G wireless system; the test facility will allow testing of all aspects of a future system in a real-life network deployment.	<a href="http://www.surrey.ac.uk/5gic">http://www.surrey.ac.uk/5gic</a>
VirNet@Unibo - Cloud Virtual Networking and SDN Experimental Facility	Italy	University of Bologna	The primary goal of VirNet@Unibo is to provide a platform to test and analyse architectures to provide networking services in a virtual environment in the cloud.	N/A
Computer and Communication Systems laboratory	Greek islands	CCSL	CCSL has installed a Remote EMF Monitoring System (REMS) in the majority of Greek islands in order to monitor the level of electromagnetic radiation as well as the occupancy of licensed and unlicensed wireless spectrum bands.	<a href="http://samosweb.aegean.gr/ccsl">http://samosweb.aegean.gr/ccsl</a>
UoP's Association to Experimental Facilities	Greece	Univ. of Peloponnese	The objective of the facility is to integrate and experimentally validate novel as well as legacy access network solutions with respect to their ability to support heterogeneous LAN/last-mile systems in the access.	N/A
CARMEN - A Cognition Network Testbed	Italy	Univ. of Padova	CARMEN is to build a flexible testbed that makes it possible to observe and act upon both in-stack and out-stack parameters, i.e., both on the communication protocols and the device sensorial peripherals.	N/A
Experimental Facilities for Optical Wireless Trials towards 5G	Germany, Czech Republic, Italy, UK	Fraunhofer HHI, Czech Technical University, Scuola Superiore Sant'Anna, Univ. of Edinborough	It is proposed to use optical wireless to accelerate implementation, test and validation in particular of advanced 5G interference management techniques.	N/A
DIWINE-Dense Cooperative Wireless Cloud Networks	UK	Univ. of York	This testbed is currently under development within the DIWINE project funded by the EU FP7 framework, with some interim implementation showing proof-of-concept already available.	N/A
VISTA-Virtual Road Simulation and Test Facility	Germany	Technical Univ. Ilmenau	The objectives of VISTA are the characterization and test of automotive communication systems and antennas with a special focus on Over the Air and MIMO measurement techniques.	N/A

AMAZING-Advanced Mobile Wireless Network playground	Portugal	Univ. of Aveiro	Free access wireless testbed composed by 24 fixed nodes located at the rooftop of Instituto de Telecomunicações – Aveiro, complemented with 50 additional mobile devices which can roam freely.	<a href="http://amazon.g.atnouv.av.it.pt">http://amazon.g.atnouv.av.it.pt</a>
CTTC 5G end-to-end experimental platform	Spain	CTTC	The existing experimental facilities cover complementary technologies from terminals, sensors and machines to radio access networks, aggregation/core networks, and cloud/fog computing.	N/A
5G Experimental Facilities	UK	University of Bristol	The facility aims to create a unique, fully flexible, programmable and open experimental platform for all networks and IT technologies.	N/A
Wireless Networking Laboratory	Finland	University of Oulu	The WNL is intended to become an important infrastructure for enabling real-life testing of the existing and perspective radio and optical wireless communication technologies for 5G (WMAN, WLAN, WPAN/WBAN, VLC), their interoperability and ways of integration, and experimental characterization of the physical communication channels.	<a href="http://www.cwc.oulu.fi/wnl">http://www.cwc.oulu.fi/wnl</a>
PerformNetworks	Spain	University of Málaga	PerformNetworks (formerly PerformLTE) is a testbed integrated in the Future Internet Research and Experimentation (FIRE) EU initiative, designed to offer a realistic environment to allow controlled and automatic experimentation in LTE, LTE-A and beyond networks.	N/A
P2E-Patras Platforms for Experimentation	Greece	University of Patras	P2E since its first operation have been transformed to a remote experimentation facility. The latest years P2E follows ITU-T Y.30012 recommendations on Future networks, objectives and design goals.	<a href="http://nam.ece.upatras.gr/ppe/?q=node/1">http://nam.ece.upatras.gr/ppe/?q=node/1</a>
5TONIC-5G Telefonica Open Innovation Center	Spain	IMDEA	The test-bed is designed for partner companies to evaluate the feasibility and costs of a given technology, via a realistic evaluation of technology choices.	<a href="https://www.5tonic.org/">https://www.5tonic.org/</a>
AINE-Advanced IP Network Emulator	Spain	INDRA Sistemas	AINE is a real time emulation software running as a user process on a Linux based platform, used for performance characterization of communication networks, particularly satellite communication systems, providing IP over Ethernet interfaces to test real applications on the modelled packet networks.	N/A
FORTE-Facility for Over-the-air Research and Testing	Germany	Technical University Ilmenau	SatCom: Main objective for SatCom on the move system tests is the overall system performance under realistic but repeatable conditions. OTAinVEE: The objective of the facility is to allow full validation and characterization of complex wireless communication systems under reproducible conditions in a virtual electromagnetic environment using wave field synthesis.	<a href="http://www.iis.fraunhofer.de/en/profil/standorte/forte.html">http://www.iis.fraunhofer.de/en/profil/standorte/forte.html</a>
Over-the-Air Testbed in the city of Erlangen	Germany	Erlangen	The objective of the facility is to allow field testing, characterization and validation of waveforms and software applications of 4G systems and beyond.	N/A
Real-Time Emulation, Characterization, and Validation of Millimeter-Wave Front-/Backhauling Links	Germany	Fraunhofer IIS labs	The objective of the facility is to allow full system validation of wireless high-rate links. It comprises equipment for high-rate signal generation, validation and characterization of millimeter-wave transmission, as well as data-analysis and validation.	N/A
JOLNet-a geographical SDN network test-bed	Italy	Telecom Italia	The JOLNet network test-bed is aimed to deploy an SDN geographical overlay network facility, in order to extensively and concretely assess the SDN and virtualization technologies and its operational impact.	<a href="https://www.softfire.eu/jolnet/">https://www.softfire.eu/jolnet/</a>
Fit/CortexLab	France	INRIA Socrate Team	CortexLab counts with more than 80 nodes in two main types, namely Wireless Sensor Networks (WSN) and Software Defined Radio (SDR). The test-bed can be used remotely to run radio experiments in state-of-the-art future communications techniques, such as the ones considered for the 5th generation of cellular systems.	<a href="http://www.cortexlab.fr/">http://www.cortexlab.fr/</a>
Communications	Spain	Universidad Carlos III de Madrid	Research Laboratory The Communications Research Laboratory has the goal of developing, analysing and prototyping wireless communications systems with applications to mobile communications, space and security.	N/A

OVNET	Spain	CBA UPC BarcelonaTECH	Experimental Overlay Network The OVNET is a joint effort among academics, research laboratories, major companies (e.g., Microsoft, Facebook, and Verisign) and operators (e.g., Level3) to provide a worldwide experimental facility. The experimental network has around 200 nodes in 27 countries and has its own IP address space (one /16 IPv4 and one /32 IPv6 prefix).	N/A
Comnets	Germany	TUHH	The wireless sensor network testbed at Hamburg University of Technology Institute of Communication Networks (ComNets) aims at performance evaluation for safety critical communication.	<a href="https://www.tuhh.de/et6/homepage.html">https://www.tuhh.de/et6/homepage.html</a>
PhotonLab	Italy	ISMB	It is a joint initiative by Istituto Superiore Mario Boella and Politecnico di Torino (Italy); it is a large experimental facility focused on the study of the physical layer of optical communications networks.	<a href="http://www.ismb.it">http://www.ismb.it</a>
Antelia	Spain	University of Vigo	Antelia is the antenna test laboratory of the University of Vigo that is under the supervision and operation of the Radio Systems research group. The facilities available at Antelia include an anechoic chamber where a spherical far field measurement system is implemented.	N/A
mHOP	Spain	Universidad Miguel Hernandez de Elche	mHOP is a real-time experimental platform for the study of the connectivity and end-to-end performance of device-centric wireless networks, in particular Multi-hop Cellular Networks (MCN) using mobile relays and Device-to-Device (D2D) communications; D2D communications are based on the 802.11 standard.	N/A
Flexible testbed for 5G millimeter wave communications	Norway	SINTEF-ICT-CS	The purpose of the testbed is to test and demonstrate MIMO techniques and PHY and MAC communication protocols for 5G systems at millimetre wave frequencies. It is based on flexible SoC platforms from Xilinx and 60 GHz transceivers from Hittite.	N/A
5G Lab Germany	Germany	TU Dresden	It is an interdisciplinary team with more than 500 researchers and aims to deliver key technologies for enabling 5G. The 5G Holistic Testbed consists of several connected test-beds which enable holistic research approaches for areas from silicon, wireless, networks, edge clouds and applications.	<a href="http://5glab.de">http://5glab.de</a>
IMB5	Germany	Nokia Networks	Integration of Broadcast and Mobile Broadband in LTE/5G – Two test beds located in Munich and Erlangen, Germany for the purpose of testing the capabilities and limitations of current LTE eMBMS for nationwide broadcast infrastructure.	N/A
Netleap	Finland	Nokia Networks, Aalto University	This network is fully functional real life Cloud based LTE evolution network with both outdoor and indoor coverage in Finland. It supports both research and innovation projects.	N/A
FUHF	Finland	Turku University of Applied Sciences, VTT, Nokia Networks	The objectives of the FUHF project, are to research the changing media environment, long-term media consumption formats, and especially evaluate and strategize around their impact on business models for different actors, that is, mobile operators, broadcasters, mobile network manufacturers, and broadcast network providers/operators.	<a href="http://fuhf.turkuamk.fi">http://fuhf.turkuamk.fi</a>
TAKE-5	Finland	Aalto, VTT, Nokia Networks	TAKE-5 creates of a multidisciplinary and open research platform for investigation and experimental evaluation of innovative ideas in networking and services for 5G.	<a href="http://5gtnf.fi/projects/take-5">http://5gtnf.fi/projects/take-5</a>
CORE++	Finland	VTT, Nokia Networks, Centria University of Applied Sciences	CORE++ trial environment provides a unique environment for spectrum sharing trials with live LTE networks on several frequency bands (licensed, unlicensed and shared bands).	<a href="http://5gtnf.fi/projects/core/">http://5gtnf.fi/projects/core/</a>
5GTN	Finland	VTT Technical Research Centre of Finland Ltd, University of Oulu, Nokia Networks	It is a research project, building a 5G test network at Oulu, Finland. In the test network, critical new technologies can be developed and it will allow testing of the performance of the novel technologies in a realistic environment.	<a href="http://5gtn.fi">http://5gtn.fi</a>

<a href="#">5GTNF</a>	Finland	5G Test Network	It coordinates and combines the research and technology development activities from the 5G infrastructures built under Tekes' 5th Gear programme.	<a href="http://5gtnf.fi">http://5gtnf.fi</a>
<a href="#">EuWIn@CTTC</a>	Spain	CTTC	The laboratory is part of EuWIn, and it explores key future challenges faced by radio interfaces in wireless systems with particular emphasis on energy efficiency, spectral efficiency and the interplay with positioning capabilities.	<a href="http://www.euwin.org/index.php/organization/sites/euwin-cttc">http://www.euwin.org/index.php/organization/sites/euwin-cttc</a>
<a href="#">RadioNetworks</a>	Italy	University of Bologna	This laboratory is part of EuWIn, and is partly developed in collaboration with Telecom Italia Labs; it provides facilities for testing network architectures, protocol stack and air interfaces for the Internet of Things.	N/A
<a href="#">Openair5GLAB</a>	France	EURECOM	This laboratory is part of EuWIn and it provides truly open-source solutions for prototyping 5th Generation Mobile Networks and devices.	<a href="http://openairinterface.eurecom.fr/openair5g-lab">http://openairinterface.eurecom.fr/openair5g-lab</a>
<a href="#">EuWIn</a>	Italy, Spain and France	University of Bologna/CNIT, Italy. EURECOM, France. CTTC, Spain.	European Laboratory of Wireless Communications for the Future Internet is joint and distributed laboratory that has been created in the framework of the Network of Excellence Newcom# and will be maintained after its end through the participation to subsequent networking projects (COST Action IRACON)	<a href="http://www.euwin.org">http://www.euwin.org</a>