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Orchestration and Reconfiguration Control Architecture

D6.4: Second SDR experimentation toolset for testbeds

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Abstract	This deliverable provides an overview of toolset developed for the SDR experimentation in ORCA testbed in the 2nd year of ORCA. More information can be found on the ORCA portal webpage.
Keywords	SDR, Experimentation, Testbed

General control of SDR devices in testbeds:

General control here refers to functions such as activating experiments and power cycle SDR devices, although these functions has already been achieved in the 1st year of ORCA, it has to be extended for the newly deployed SDR hardware. For instance for the B200/B210 USRP deployment in w-iLab.t testbed, the device gets powered from USB bus, which prevents it from being remotely power controlled. A USB hub is then placed in between the USRP and host, with proper software driver deployed to remotely control the USB bus based USRP devices. Similar development has been done in other new devices in each individual ORCA testbed. For more details please refer to the ORCA portal https://www.orca-project.eu/testbeds/.

SDR specific configuration in testbeds:

For functionalities of the SDR devices, such as configuring the device to receive or transmit signals, users should use dedicated software and drivers.

In the w-iLab.t testbed from IMEC, and the ORBIT testbed from RUTGERS, Operating System (OS) images are configured with UHD[1] driver installed for USRP, and Xilinx Vivado tools[2] installed for ZYNQ SDR platform. Users have the privilege to create his own OS image with other desired tools, hence they are not limited to the pre-configured OS image. In this year a few new images are created in order to support RFNoC[3] framework, srsLTE[4]. In addition, software components offered in open call such as IQ switch and CONSENSE are validated in the testbed, and tutorials are written to introduce the usage.

In the OWL testbed from TUD, in order to improve the user experience, video tutorials are provided for users on a dedicated YouTube channel. The experimenters can follow the tutorial to setup an experiment and access into the resource nodes systematically. In addition, an OS image selection function is now also included in TUD testbed, which was not possible in the first year where only a fixed image is allowed. Considering the privacy and security, in this year TUD OWL testbed also uses virtual machines as virtual experiment servers and completed the Virtual Local Area Net (VLAN) management in the testbed, to separate the experiment behaviours of different F4F project groups.

In KUL, the in-band full duplex testbed is updated by the enhanced version of the cross-layer PHY-MAC architecture. In addition, the digital self-interference cancelation module is integrated to improve the performance of self-interference cancelation. The Massive MIMO testbed has joined the Fed4Fire compliance in this year of ORCA. External power amplifier was added to support outdoor

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[1] Universal Hardware Driver (UHD), https://files.ettus.com/manual/

[2] Xilinx Vivado, https://www.xilinx.com/products/design-tools/vivado.html

[3] RFNoC, https://www.ettus.com/sdr-software/detail/rf-network-on-chip

[4] srsLTE, https://www.xilinx.com/products/design-tools/vivado.html

experiment.

Massive MIMO testbed at KUL as different USRP subsystems, runs its own applications frameworks in LabVIEW Communication Design Suite 2.0. Those frameworks include one Base Station Host and multiple Mobile Station Host, to measure different key parameters indicators (KPI) for uplink and downlink.

At TCD, to provide continuous testbed upgrade, improvement, and stability for experimenters, the IRIS testbed has started moving towards the OpenStack cloud platform to manage all virtual machine images connected to N210s and X310 equipment. The virtual machines are preinstalled with the relevant UHD drivers. Depending on the needs of the experimenter, OS images for SDR, network control and management, and Evolved Packet Core (EPC), are available via jFed, including IRIS, GNU Radio, srsLTE, the WiSHFUL framework, Open Air Interface, and so forth. There are updates to support srsLTE EPC and eNB software. See [5] for the most up-to-date list of available equipment and resources. A full set of Iris tutorials are available at[6]. Users have the freedom to install drivers, tools, and libraries based on their experiment requirements. However, all experimenters must agree to testbed Terms and conditions before use[7].

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[5] Iris Testbed architecture, https://iris-testbed.connectcentre.ie
[6] Experiment Tutorial, https://iris-testbed.connectcentre.ie/experiment_tutorial/
[7] Iris testbed terms and conditions, https://iris-testbed.connectcentre.ie/terms-of-use/