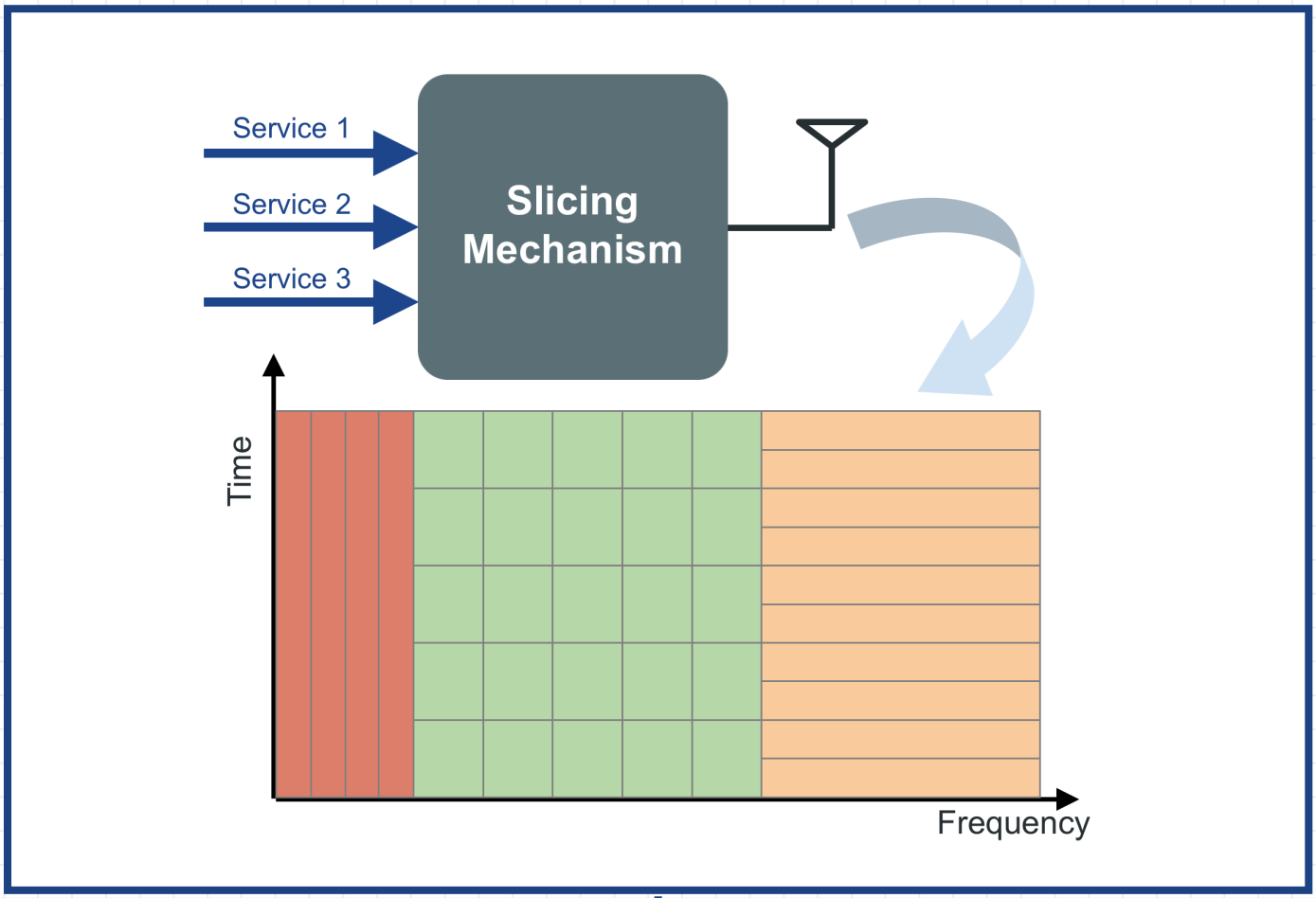
Orchestration and Reconfiguration Control Architecture

BASIC SDR CONTROL PLANE FUNCTIONALITY

Radio slicing: resource allocation and instantiation

Physical resource slicing



Platforms for physical radio resource slicing:

- Different services can operate simultaneously by being allocated to different virtual wireless network slices.
- Isolation of frequency slices is ensured by using FFT-based or filter bank-based slicing mechanisms.
- Isolation of spatial slices is ensured through adaptive antennas.

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CONTEXT

The concept of “physical resource slicing” in wireless communication isn’t entirely new. Radio access technologies generally operate at certain range of radio frequencies, which are referred to as channels. In cellular network, a base station has certain coverage in space. These are all existing approaches for physical resource allocation. Though conventional allocation of resources is based on individual radio access technology, and the performance of end-to-end communication is rarely considered. Secondly, the resource allocation in the context of SDR has a lot more flexibility than with commercial off-the-shell devices, in this offer we aim to give an overview of how physical resources such as frequency, time, and space can be sliced on SDR platforms within the ORCA project.

UNIQUE SELLING POINT

For frequency slicing, one option developed in ORCA is to apply a broadband radio frontend and perform frequency slicing in digital domain using configurable filter banks, in this way we achieve:

- the usage of multiple frequency slices at the same time, e.g., a technology across multiple channels.
- the usage of one piece of radio spectrum in multiple slices, e.g. RAN with different technologies using overlapping channel definitions in frequency domain.

Slicing in time can be achieved by a flexible PHY implementation with quick reconfiguration times or several integrated RATs in the FPGA of the SDR platform. Thus, several technologies can share the same frequency band. Spatial slicing can be explored via experimental datasets generated by the mmWave system. These are useful for offline evaluation and simulation of a system, where different services are supported in different spatial slices.

We offer these features including but not limited to the Xilinx Zynq ZC706 evaluation board with the Analog Device frontend FMCOMMS2 board, the following steps should be followed to get started:

- a quick scheme through the AD reference design is recommend through this link: https://wiki.analog.com/resources/fpga/docs/hdl
- multiple SDR platforms are available in w-ilab.t testbed, where the Zynq and AD FMCOMMS2 based SDR will also be deployed, http://doc.ilabt.iminds.be/ilabt-documentation/wilabfacility.html

In addition, a flexible waveform generation framework is presented in [1] and [2], whereas its implementation is covered by [3].

OPPORTUNITIES

- The frequency slicing in digital domain via filter banks allows flexible configuration of the slicing paradigm at design or even runtime.
- The time domain slicing can be achieved by configuring flexible PHY implementations in the FPGA of the SDR platform, allowing waveform to be configured at run time.
- Spatial slicing can be explored via experimental data created by the ORCA’s mmWave setup.

1 M. Simsek; D. Zhang; D. Öhmann; M. Matthé; G. Fettweis, "On the Flexibility and Autonomy of 5G Wireless Networks," in IEEE Access , vol.PP, no.99, pp.1-1

2 Ivan Gaspar, Luciano Mendes, Maximilian Matthé, Nicola Michailow, Dan Zhang, Antonio Albertiy, Gerhard Fettweis, “GFDM - A Framework for Virtual PHY Services in 5G Networks” in arXiv:1507.04608v1

3 M. Danneberg, N. Michailow, I. Gaspar, D. Zhang and G. Fettweis “Short Paper: Flexible GFDM implementation in FPGA with support to run-time reconfiguration” in Proceedings of the IEEE 82nd IEEE Vehicular Technology Conference (VTC Fall'15), Boston, USA, 6.9. - 9.9.2015