ORCA-PROJECT.EU

ORCHESTRATION AND RECONFIGURATION CONTROL ARCHITECTURE ORCA

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imec

CROWNCOM 2017

Lisbon, 21 September 2017

ORCA at a glance

ORCA - Orchestration and **R**econfiguration **C**ontrol **A**rchitecture

- **Call**: H2020-ICT-2016-1
- **Topic**: ICT-13-2016

  (Future Internet Experimentation - Building a European experimental Infrastructure)
- **Type of Action**: RIA
- **Budget:** 4.996.475 €

  (of which 1.790.000 € for Open Calls)
- **Duration:** January 2017 – December 2019

Partners

imec

Trinity College Dublin
The University of Dublin

KU LEUVEN

TECHNISCHE UNIVERSITÄT DRESDEN

RUTGERS
WINLAB | Wireless Information Network Laboratory

NATIONAL INSTRUMENTS

MARTEL innovate

Motivation for ORCA project

Different applications and services often have to **share the same wireless technologies and/or spectral bands**, making it very challenging to meet the diverging QoS requirements simultaneously

Driving showcase
Factory-of-the-future

Driving showcase: factory-of-the-future

Traffic class	Requirements
TC1: time-critical sensor/ actuator control loop	bidire… order kbps), stringent timing requirements (below 1 ms cycle time, **order 100 us response time**, below 1 us jitter), **ultra-high reliability** (99.9999999 %), inc…
TC2: time-critical vision-controlled processes	b… mmunication **ultra-high data rate** (up to 10 Gbps), **low latency** (below 0.5 ms), high re… 10-100 m).
TC3: low-latency continuous med… throughput	…nt-to-m… data rate (order 10-100 kbps), **low** …bility … VERAGE
TC4: correlated … capturing	…, **ultra-** …
TC5: non time-c… factory commun…	…(limited …age
TC6: bursty traffic	non… d), **large data volumes** (1 MB -100 GB).

ULTRA-LOW RESPONSE TIME (< 100 µs)

ULTRA-HIGH RELIABILITY (> 99.9999999 %)

LOW-LATENCY (< 0.5 ms)

ULTRA-HIGH DATA RATE (up to 10 Gbps)

LOW JITTER (< 10 ms)

LARGE DATA VOLUMES (1 MB - 100 GB)

CAN THIS BE ACHIEVED

- **WITH A SINGLE WIRELESS TECHNOLOGY?**
- **SHARING THE SAME SPECTRAL BANDS?**

HOW DO WE CONTROL?

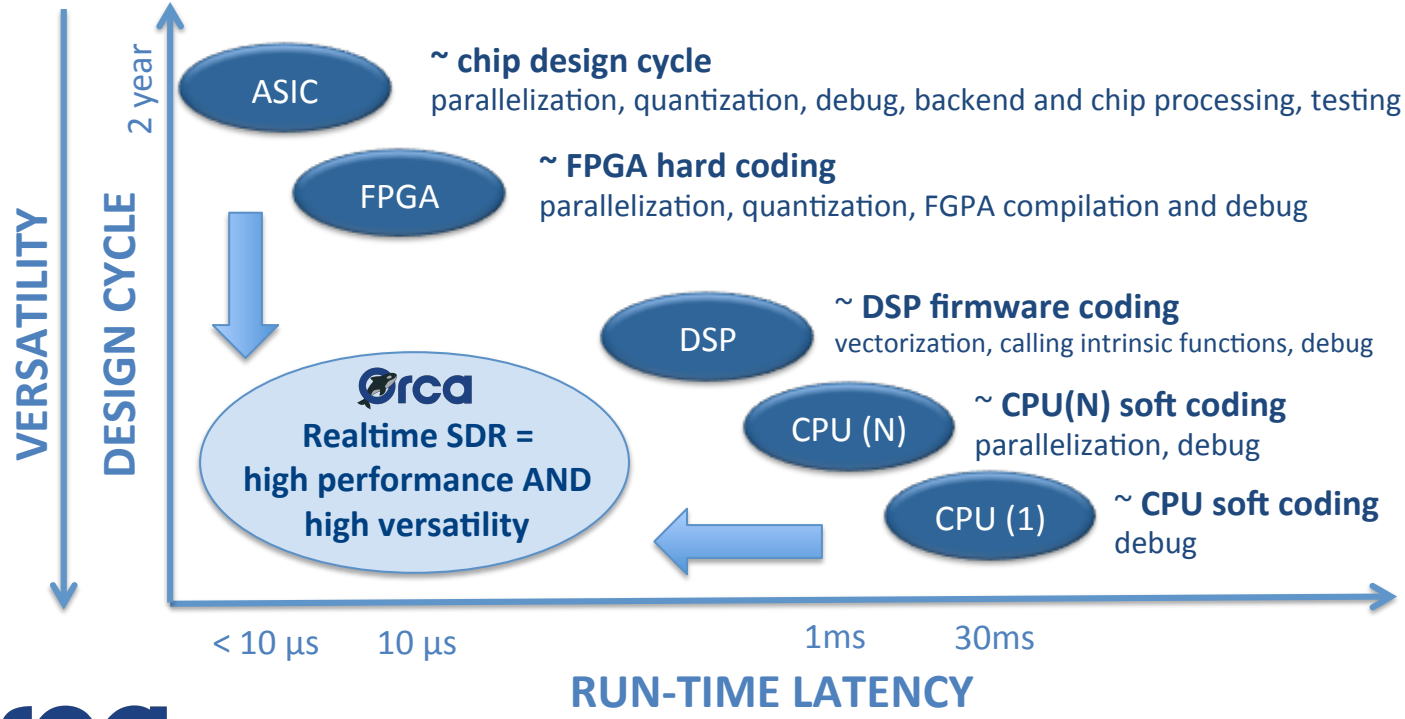
Motivation for ORCA project

Interesting evolutions are happening at different levels

- At the **NETWORK LEVEL**: Software-Defined Networking (**SDN**)
  - decoupling the network control and data plane forwarding functions
  - enabling network virtualization/slicing
  - mainly involving higher layers of the protocol stack (layer 4-7)
- At the **RADIO LEVEL**: Software-Defined Radio (**SDR**)
  - trade-off between
    - design cycle speed
    - versatility [= reconfigurability + reprogrammability]
    - Performance (runtime latency, efficiency)
- At the **SPECTRUM LEVEL**:
  - Dynamic Spectrum Sharing (**DSS**): using unused spectrum in underutilized bands
  - use more and higher frequency bands: towards **mmWave** wireless technologies

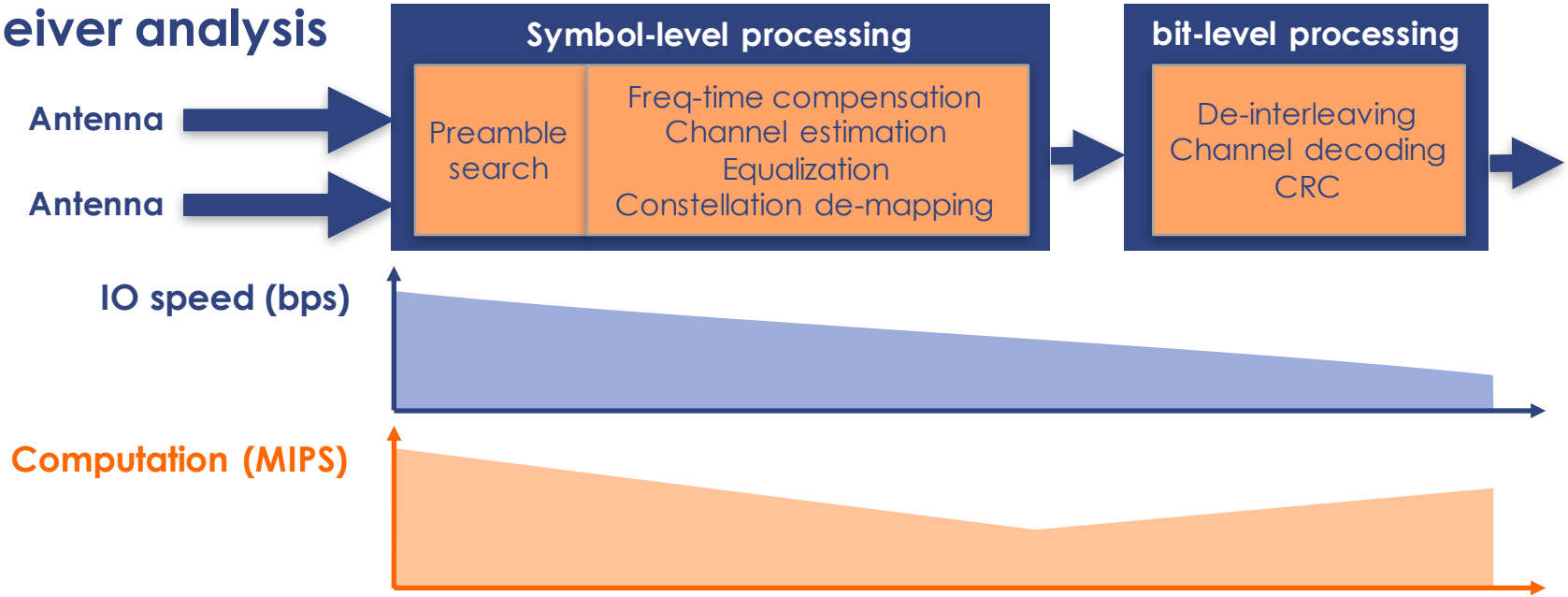
ORCA objective: real-time SDR

Real-time SDR: closing the gap between **high versatility** and **low latency**



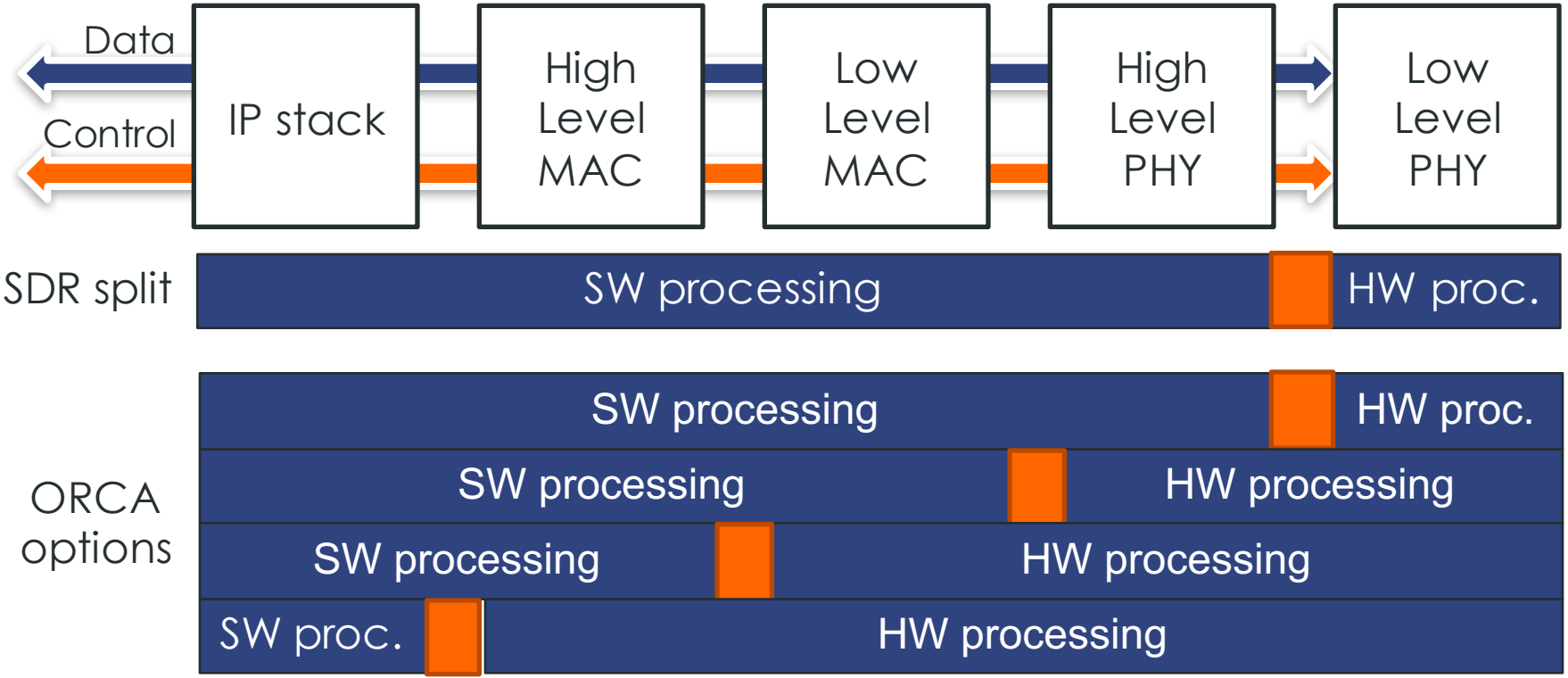
SW (versatility) / HW (performance) dilemma

Receiver analysis



SW approach: ➜ NOT REAL-TIME ➜ NEED FOR HW ACCELERATION

ORCA: towards more real-time implementation



Motivation for ORCA project

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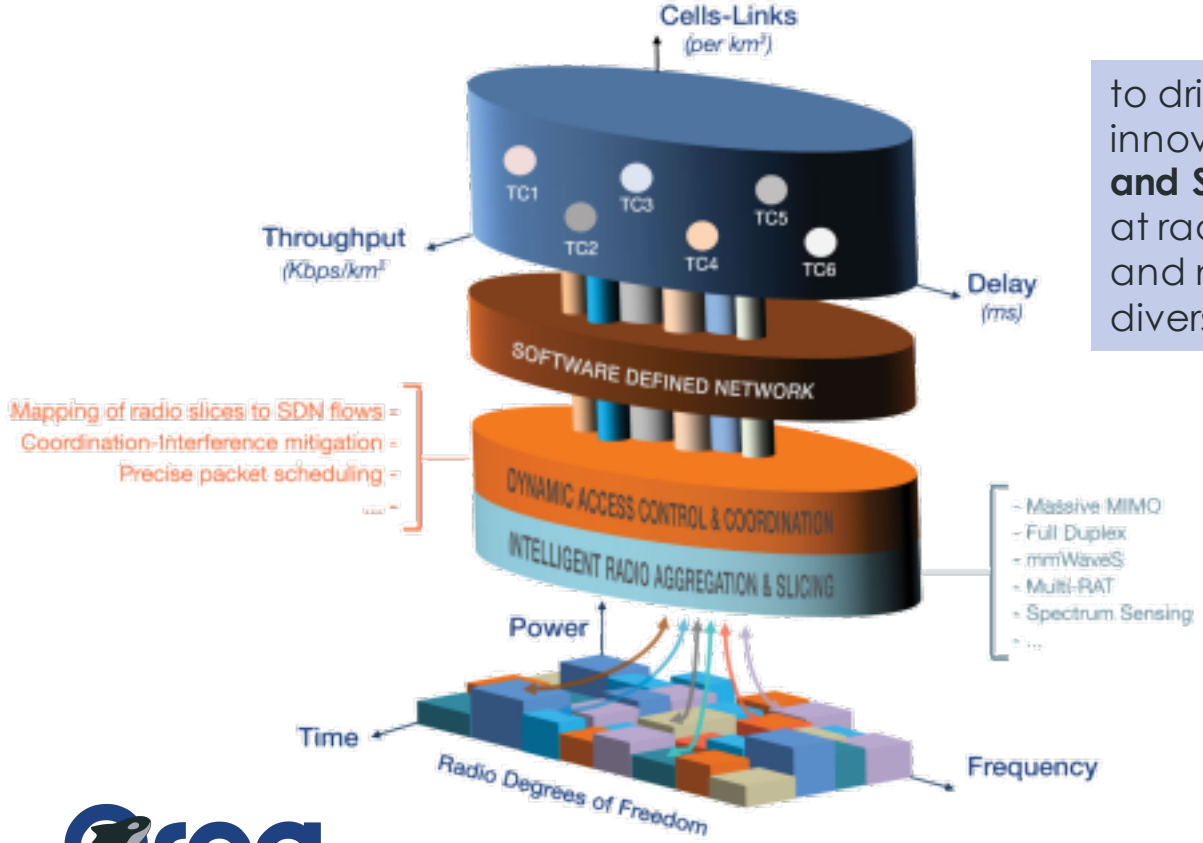
ORCA objective: bridging SDR and SDN

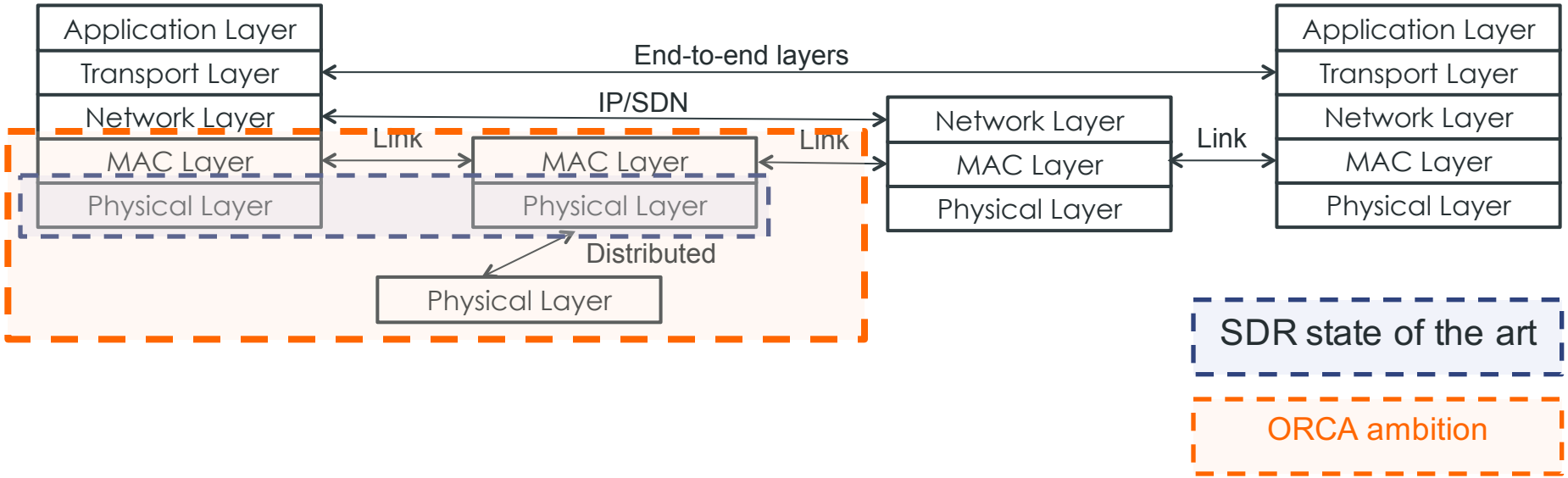


to drive end-to-end wireless network innovation by **bridging real-time SDR and SDN** exploiting maximum flexibility at radio level, medium access level and network level, to meet very diverse application requirements

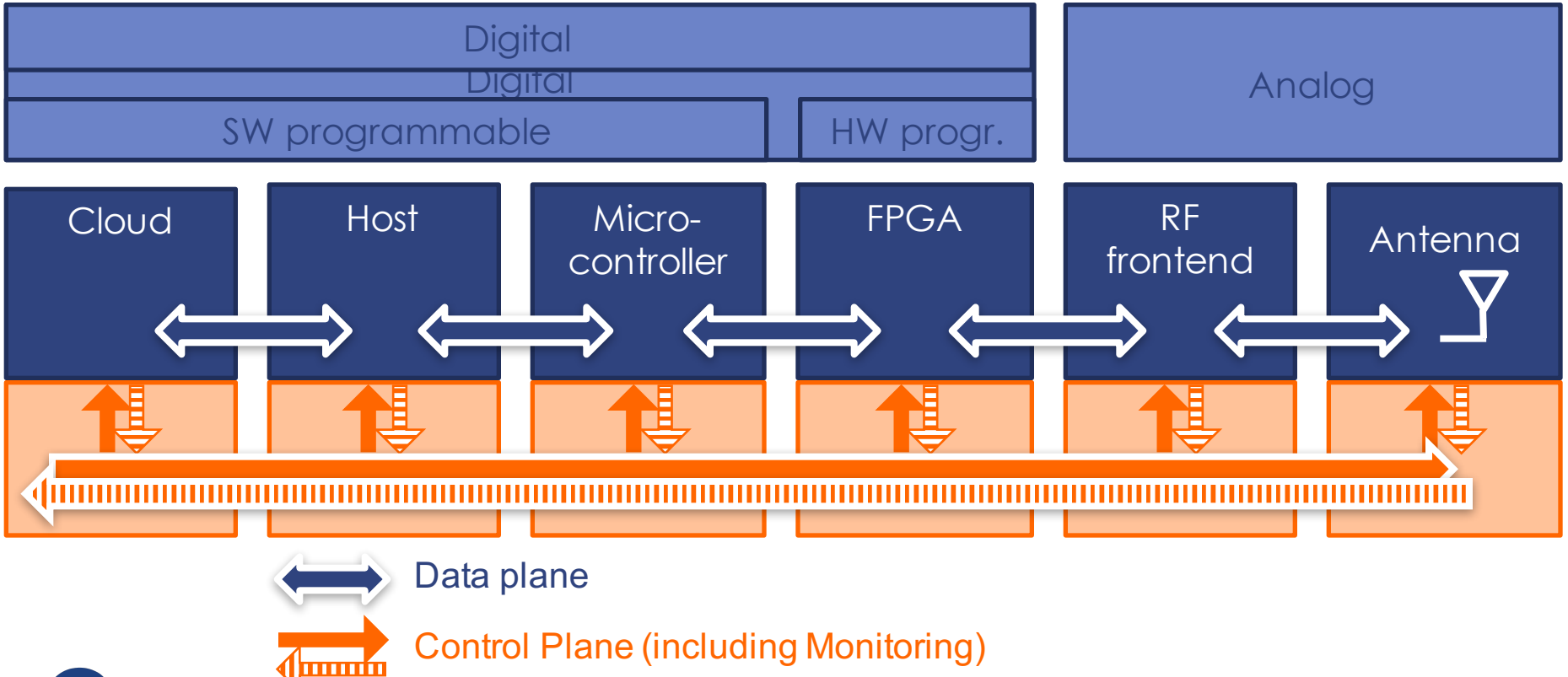
Mapping of radio resource slices to SDN flows

ORCA ambition: end-to-end networking

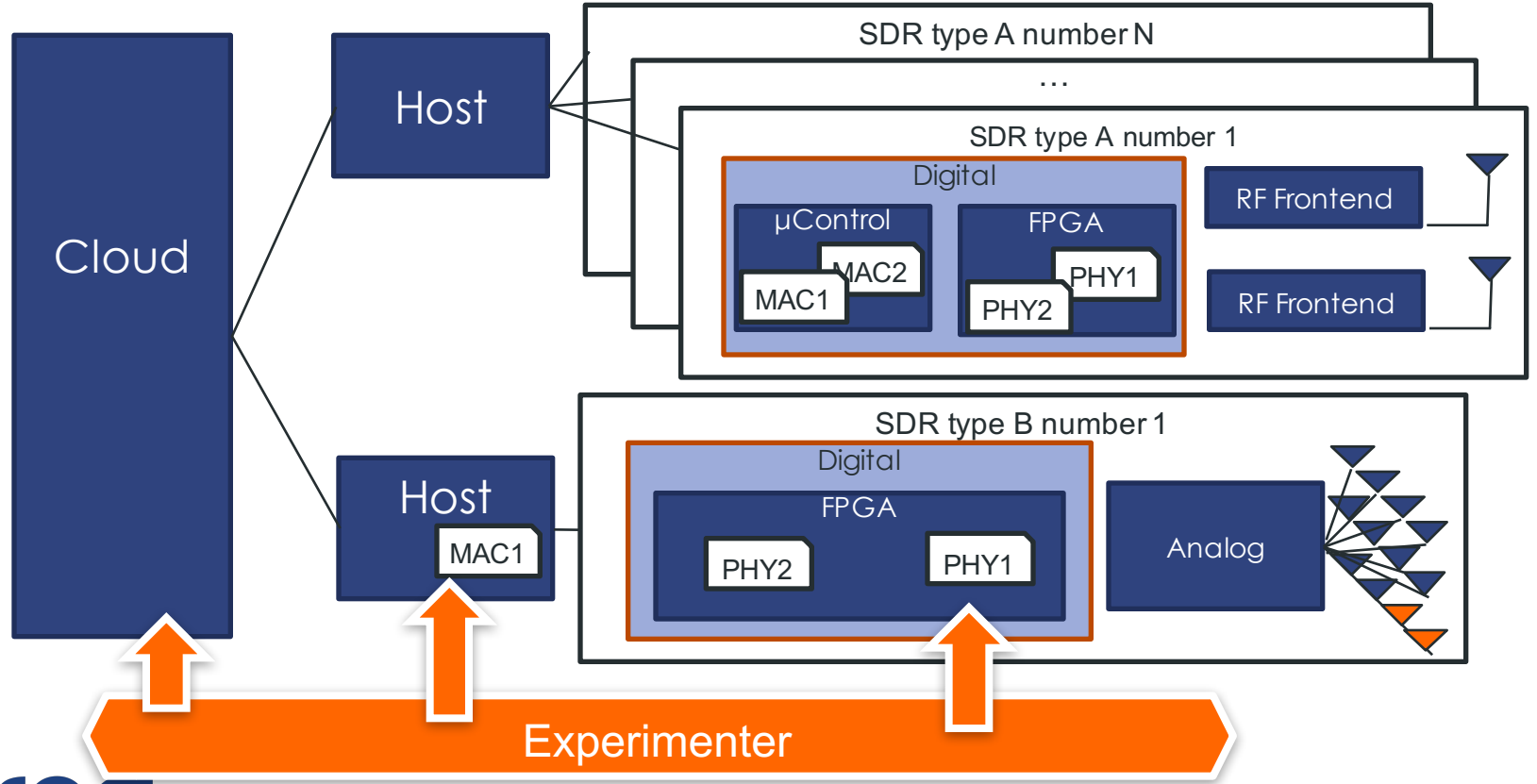
Enabling end-to-end networking requires the implementation of PHY and MAC functionality on SDR.



ORCA SDR architecture: controllable from the cloud



ORCA architecture: multiple networked SDR

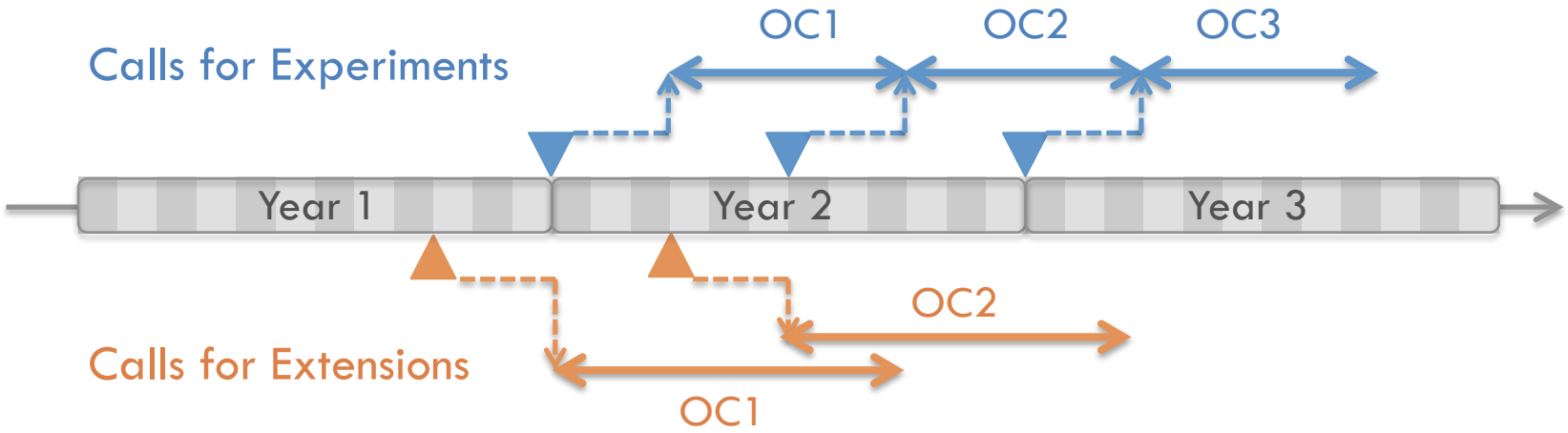


ORCA facility: advanced SDR capabilities

- real-time low latency and high throughput operation
- end-to-end wireless experimentation
- flexible design of of PHY, MAC and higher networking layers
- control plane: runtime orchestration and parametric (re)configuration
- management plane: live HW and SW reprogramming
- **offered in various Fed4FIRE compliant testbeds**

E2E + HW performance + SW control

ORCA Open Calls



TODAY: launch of Open Call 1 for Extensions

https://www.orca-project.eu/open-calls/1st-orca-open-call-extension/

ORCA Open Cal 1 for Extensions

Project full name	ORCA - Orchestration and Reconfiguration Control Architecture
Project grant agreement No.	732174
Call identifier	ORCA-OC1-EXT
Call title	First ORCA Open Call for Extension
Submission deadline	Wednesday the 15th November 2017, at 17:00 Brussels local time
Feasibility check deadline	Wednesday the 8th November 2017, at 17:00 Brussels local time

Category / identifier	Call budget	Max. budget per Extension	Guaranteed support
ORCA-OC1-EXT	€ 300 000	€ 80 000	€ 18 000
Total expected number of Extensions to be funded			4

ORCA Open Cal 1 for Extensions

Call topics

EXT1	End-to-end slicing support for SDR and SDN
EXT2	LBT functionality on FPGA as an IP core
EXT3	RAT interworking on NS-3 based SDR Prototyping Platform
EXT4	Digital self-interference cancellation for In-Band Full Duplex

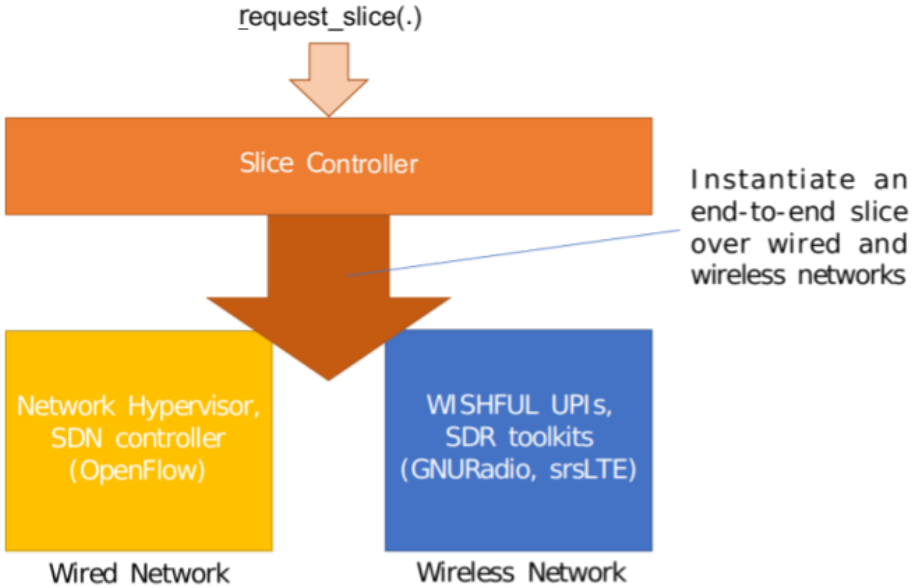
Selection process

- Only proposals with all scores above threshold are eligible for funding
- Select best proposal per topic

ORCA Open Cal 1 for Extensions

Call topics

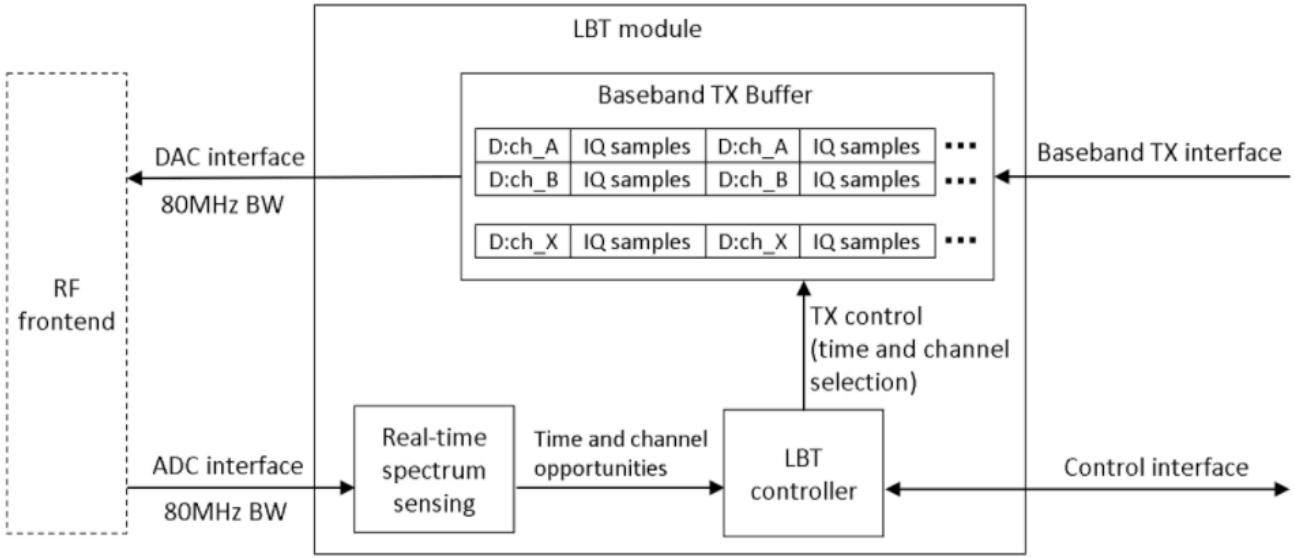
EXT1 - End-to-end slicing support for SDR and SDN



ORCA Open Cal 1 for Extensions

Call topics

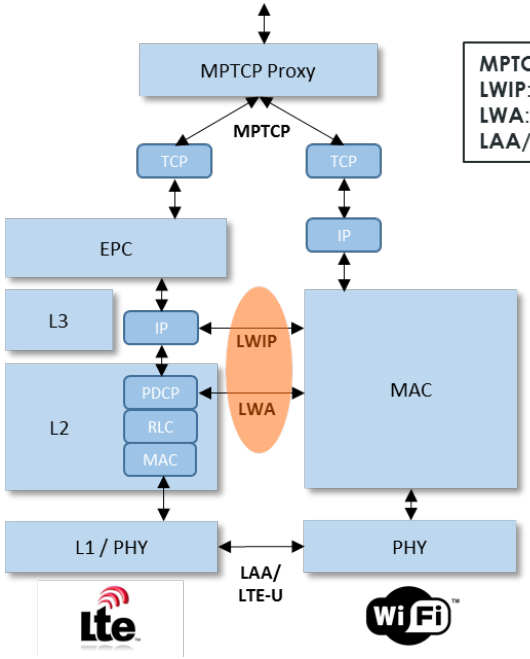
EXT2 - LBT functionality on FPGA as an IP core



ORCA Open Cal 1 for Extensions

Call topics

EXT3 - RAT interworking on NS-3 based SDR Prototyping Platform

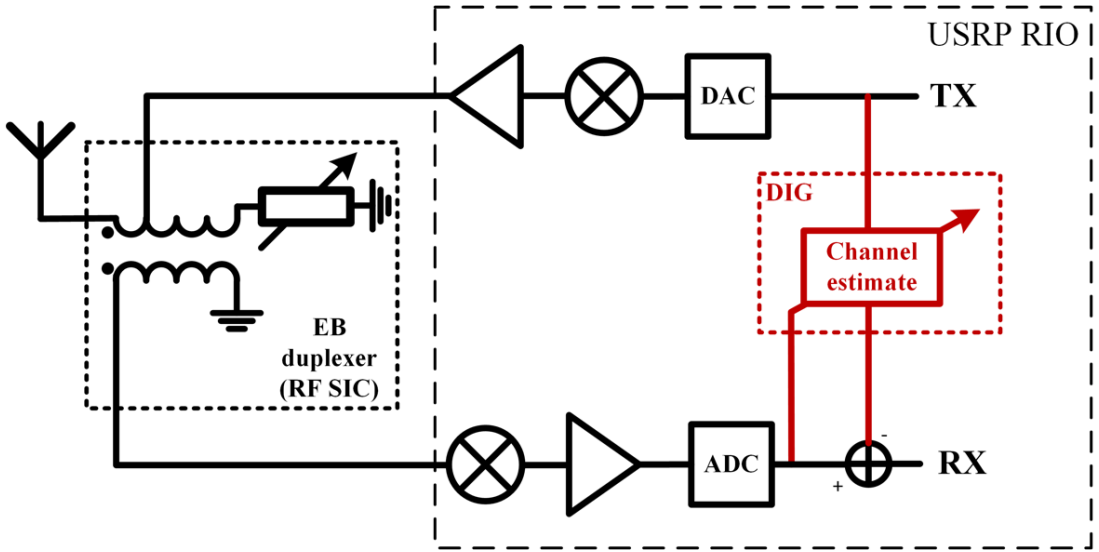


MPTCP: Multi-path TCP
LWIP: LTE/WLAN Radio Level Integration
LWA: LTE-WLAN Radio Aggregation
LAA/LTE-U: LTE-License Assisted Access / LTE-Unlicensed

ORCA Open Cal 1 for Extensions

Call topics

EXT4 - Digital self-interference cancellation for In-Band Full Duplex



ORCA Open Cal 1 for Extensions

Evaluation criteria

Criterion	Short description	Weight	Maximum score
1	Clarity and methodology	1	5
2	Feasibility	1	5
3	Qualifications of the proposer	1	5
5	Value for money	1	5
7	Degree of functional innovation	2	10
8	Degree of platform independence	2	10
9	Scientific/industrial impact	2	10
10	Demonstration potential	1	5
11	Potential for feedback	1	5
	Maximum total score		**60**

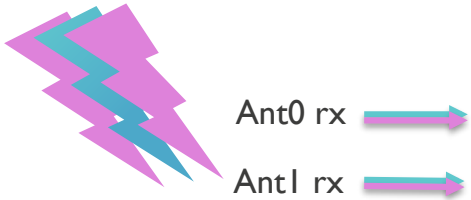
DEMO: Multiple virtual radios on a single chip

Wi-Fi and Sensor traffic

Download **BLE scanner** from App store or Google play…

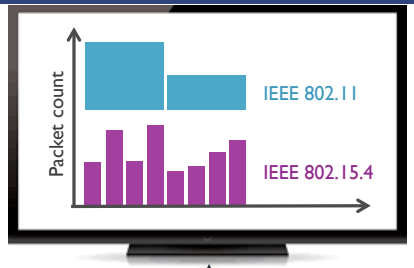
BLE

… and see preamble counting on your own device!



Host

- Cha[illegible]l status display
- [illegible]mple generation
- [illegible]ion for BLE



TCP

- [illegible]ct 2 Wi-Fi + 8 sensor channels simultaneously
- [illegible]eamble counting
- [illegible]recise packet timing information (< 1 µs)


Q&
A