5G OPEN BROADCAST EDGE CACHE APPLIANCE

ORS TECH TALK

THE TECH TALK WILL START AT 10 A.M. CEST

JOHANN MIKA - 27.4.2021

Agenda

- Introduction
- OBECA Overview
- Six Steps How To Start
- Outlook and Q&A

INTRODUCTION

AUSTRIAN BROADCASTING SERVICES

5G BROADCAST TRIAL VIENNA

MOTIVATION FOR OBECA

About Austrian Broadcasting Services (ORS)

Subsidiary of the Public Broadcaster in Austria (ORF)

Terrestrial

- 9 High-Power-High-Tower
- 420 transmitter sites
- 30 years experience
- UKW, DAB+, DVB-T2
- 5G Broadcast

Satellite

- Europe-wide program distribution
- 5 satellite uplinks in Vienna
- Two reserve uplinks in Graz
- Variable downlink Capacities

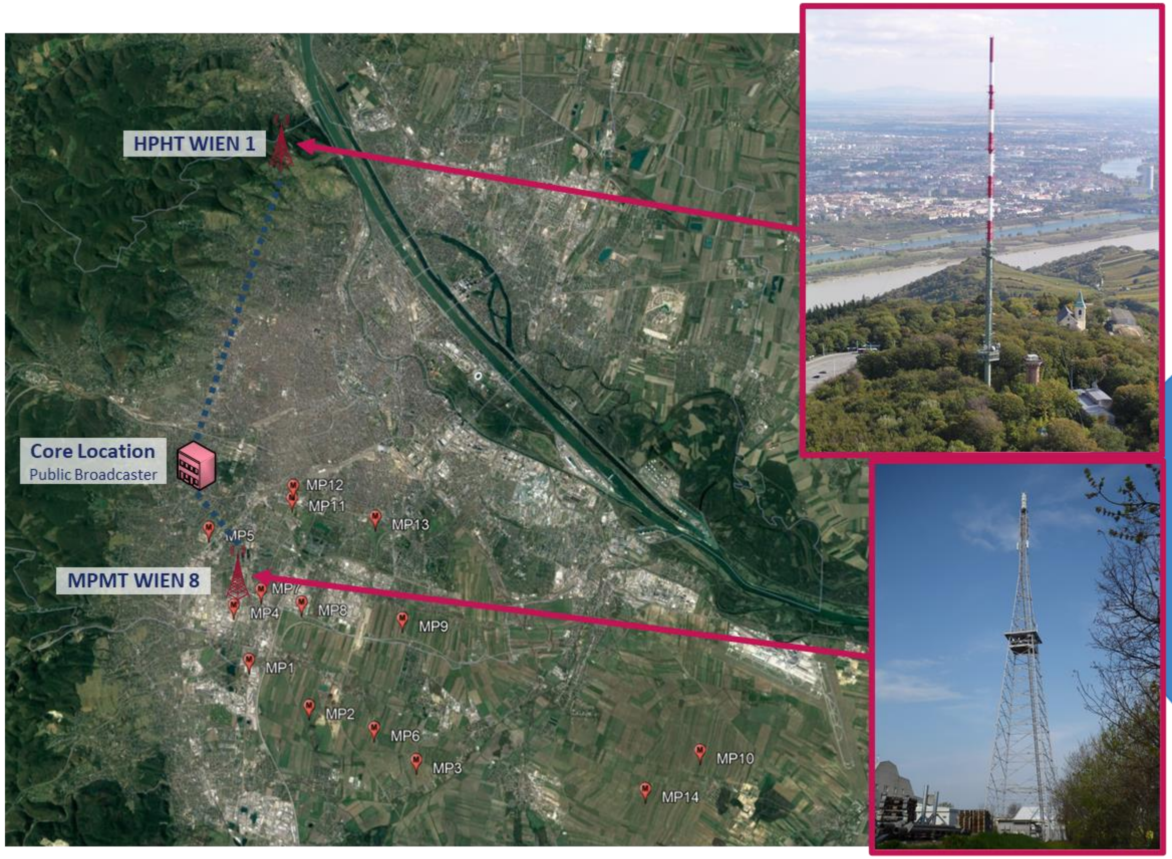
Content via IP

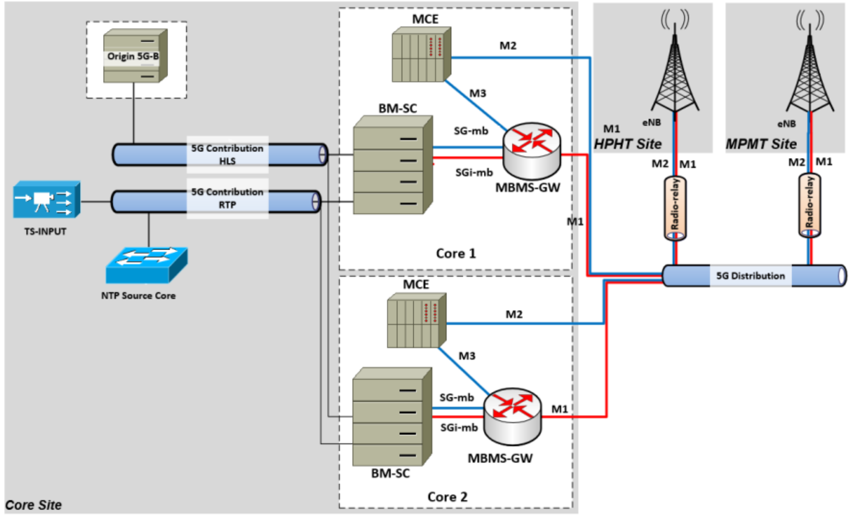
- Live Streaming & Video-on-Demand
- Restart / Catch-Up-TV
- UHD (4K, HDR)
- HbbTV
- Content Delivery Network

5G BC Trial

Q4/2019 – Q2/2021 (expansion planned until 2023)

- **Subject:** “Compare DVB-T2 – 5G BC”
- **Focus:** Increase internal know-how, maturity assessment
- **Transmitting Infrastructure:**
  - FeMBMS (3GPP Rel.14)
  - LTE-based 5G Terrestrial Broadcast (3GPP Rel.16) (a.k.a 5G BC SDO / 100% Downlink)
  - HPHT, MPMT (667 MHz, max. bandwidth 8-10 MHz)
  - Broadcast Cores of 2 different vendors
- **Payload**: Multiple MCHs with RTP and HLS content





Funded by the Austrian Media Regulatory Authority RTR

5G BC Trial

Q4/2019 – Q2/2021 (expansion planned until 2023)

- **Reception side: Measurements and Application Tests**
  - TU Wien: Link Level Simulations
  - Stationary and mobile measurements

Laptop with Middleware

Application Tests:
TU Braunschweig Receiver

Laptop with Enkom Software

Measurement System:
R&S TSMW

3h Battery Pack

?

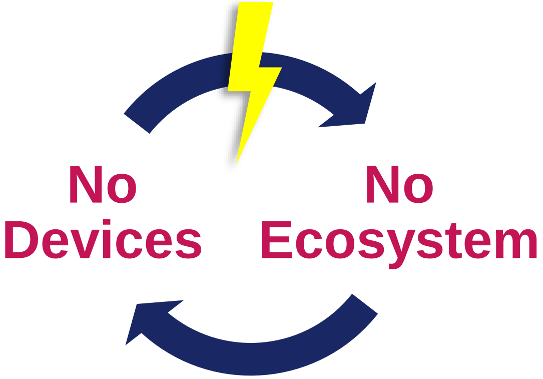
Funded by the Austrian Media Regulatory Authority RTR

„The Chicken or the Egg“- dilemma within 5G Broadcast

5G Broadcast is a smart technology for hybrid distribution scenarios, but…

„Devices will not be available if no ecosystem appears“

“No ecosystem without devices“



„Lot of specs exist“

„Product maturity will not improve“

„Lower layers are well studied; applications and business models are missing“

„Existing receivers not open for use-cases, enhancements and developments“

Requirements to use 5G BC

High-level application-centric perspective

- **Agile approach**

  → Dynamic channel provisioning and flexible use of capacity

- **Combine** the best of 2 worlds

  → IP/OTT distribution and terrestrial distribution – 1 system for all

- **Decouple** layers (to be future proof)

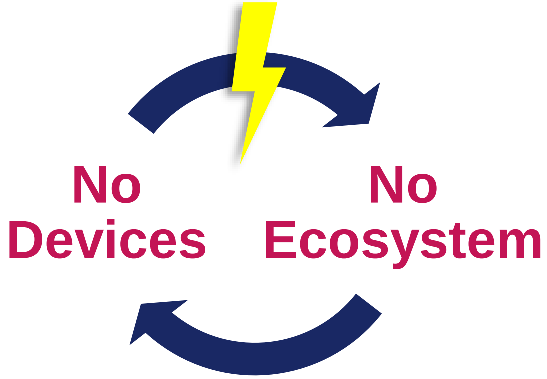
  → Lower layers (5G BC – (IP) network) are independent from upper content/application layers (media with encryption (DRM), compression (H.26x, VP9), format (HLS, DASH)…

„The Chicken or the Egg“- dilemma within 5G Broadcast

5G Broadcast is a smart technology for hybrid distribution scenarios, but…

„Devices will not be available if no ecosystem appears“

“No ecosystem without devices“



„Lot of specs exist“

„Product maturity will not improve“

„Lower layers are well studied; applications and business models are missing“

„Existing receivers not open for use-cases, enhancements and developments“

→ A platform for RECEPTION and APPLICATION DEVELOPMENT is needed

Platform principles

- Support the **Ecosystem**
- **Application** Centric
- **Affordable** and Easy-to-Use for Developers (Sample Files)
- **Open-source** and Modular Design
- **Real-World** implementations and **Use-Cases**
- **Community-driven** approach

→ **In mid-2020, ORS decided to actively promote the 5G Broadcast ecosystem through the development of a platform**

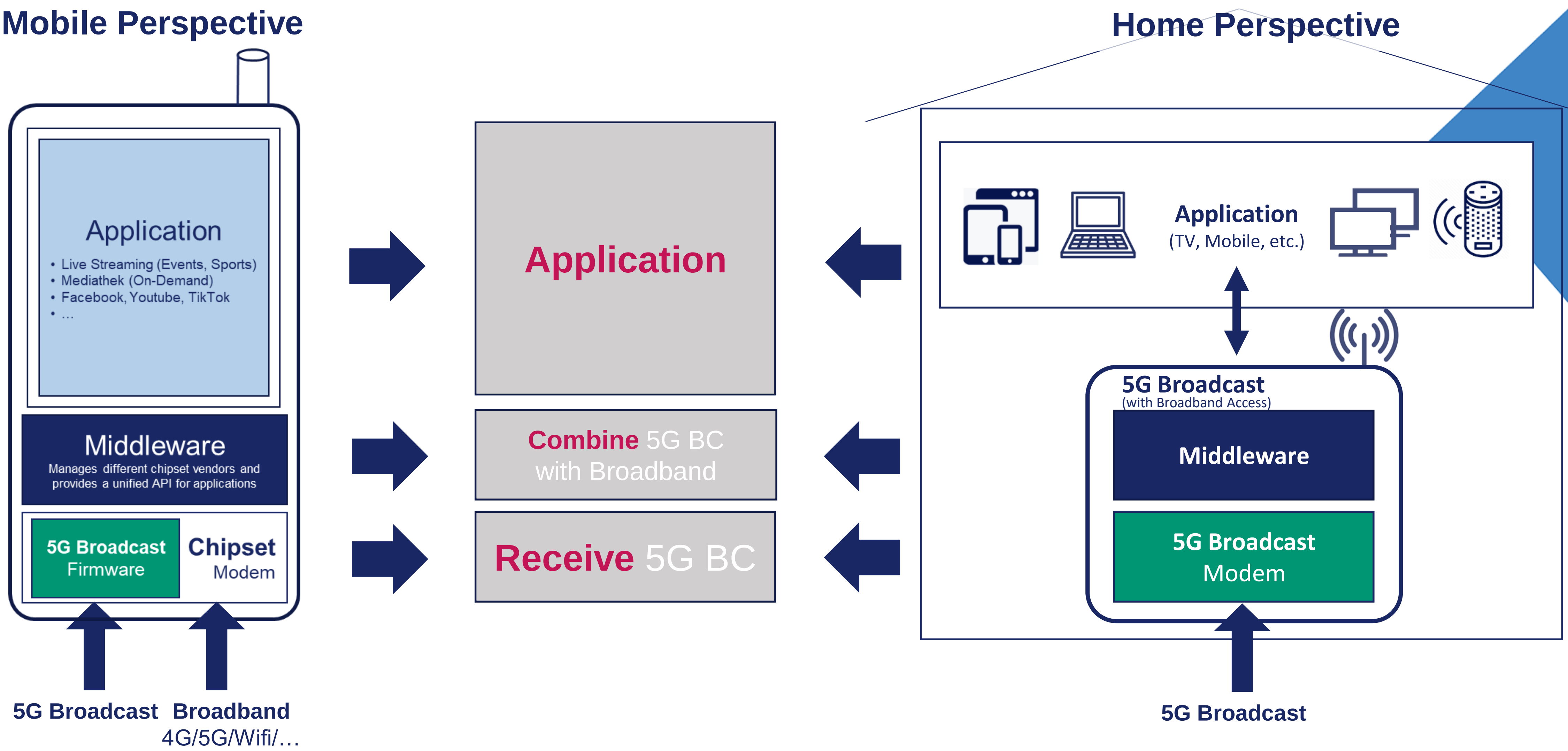
OBECA

OPEN BROADCAST EDGE CACHE APPLIANCE

HIGH LEVEL VIEW

Modular approach

Future Scenarios



Mobile Perspective

Application

- Live Streaming (Events, Sports)
- Mediathek (On-Demand)
- Facebook, Youtube, TikTok
- …

Middleware

Manages different chipset vendors and provides a unified API for applications

5G Broadcast Firmware

Chipset Modem

5G Broadcast

Broadband 4G/5G/Wifi/…

Application

Combine 5G BC with Broadband

Receive 5G BC

Home Perspective

Application (TV, Mobile, etc.)

5G Broadcast (with Broadband Access)

Middleware

5G Broadcast Modem

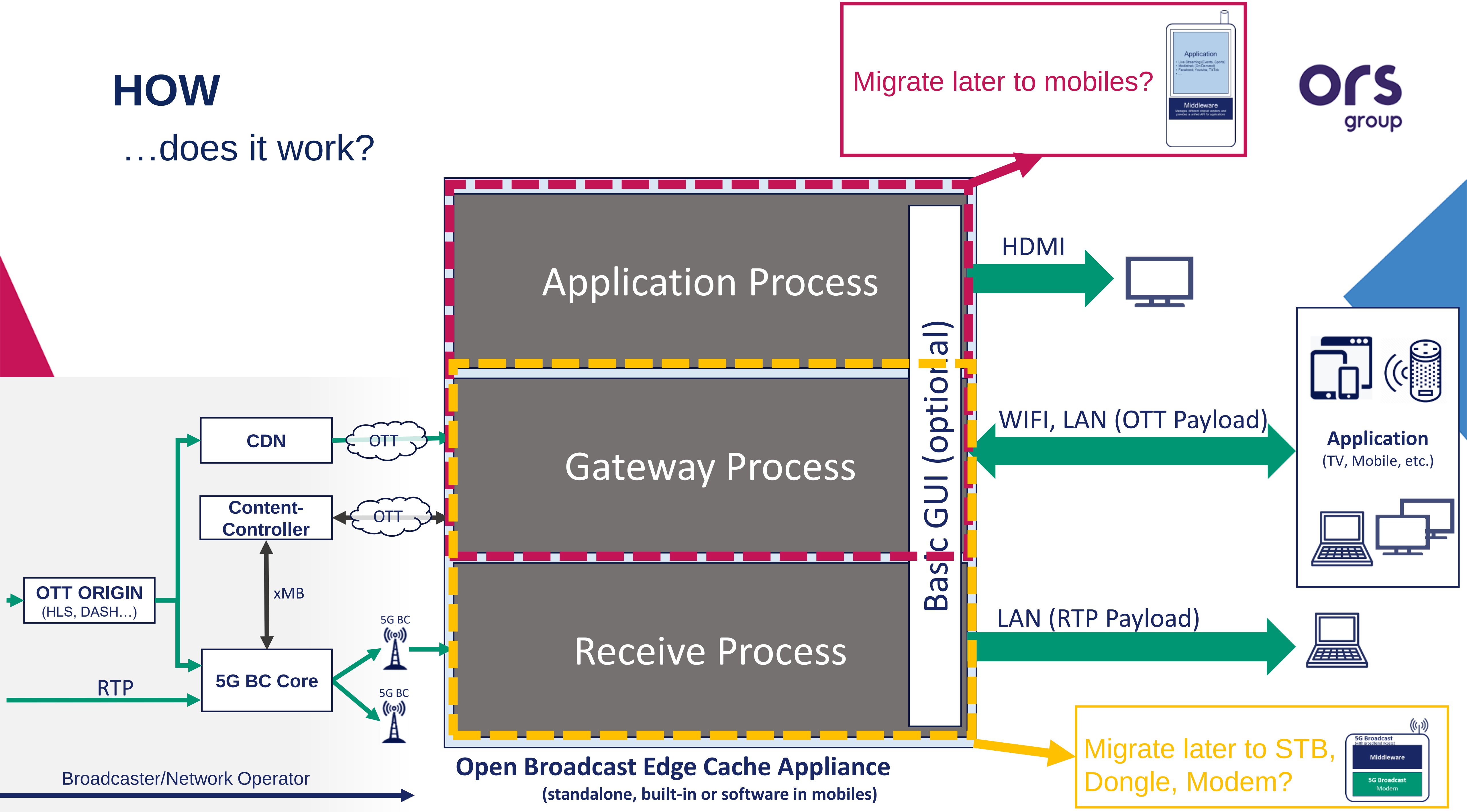
5G Broadcast

OBECA

- **O**pen **B**roadcast **E**dge **C**ache **A**ppliance (OBECA) is a software-platform to
  - **receive 5G broadcast** (5G BC) in dedicated mode **using SDRs**
    - i.e., using 100 % downlink capacity (EnTV/FeMBMS in 3GPP Rel.14/LTE-based 5G Terrestrial Broadcast in 3GPP Rel.16)
  - **combine** 5G BC **with** common (5G) (mobile) **broadband**, process and cache it for applications
  - **develop interactive applications** and PoCs' for hybrid distribution **for broadcasters**
- **Open-Source** software (AGPL) – based on srsLTE library
- Focus on **applications and demos** for 5G BC/BB ecosystem

HOW

…does it work?



Migrate later to mobiles?

Application

- Live Streaming (Events, Sports)
- Mediathek (On-Demand)
- Facebook, Youtube, TikTok
- …

Middleware

Manages different chipset vendors and provides a unified API for applications

Application Process

Gateway Process

Receive Process

Basic GUI (optional)

HDMI

WIFI, LAN (OTT Payload)

LAN (RTP Payload)

Application
(TV, Mobile, etc.)

CDN

OTT

Content-Controller

OTT

xMB

OTT ORIGIN
(HLS, DASH…)

5G BC

5G BC

5G BC Core

RTP

Broadcaster/Network Operator

Open Broadcast Edge Cache Appliance
(standalone, built-in or software in mobiles)

Migrate later to STB, Dongle, Modem?

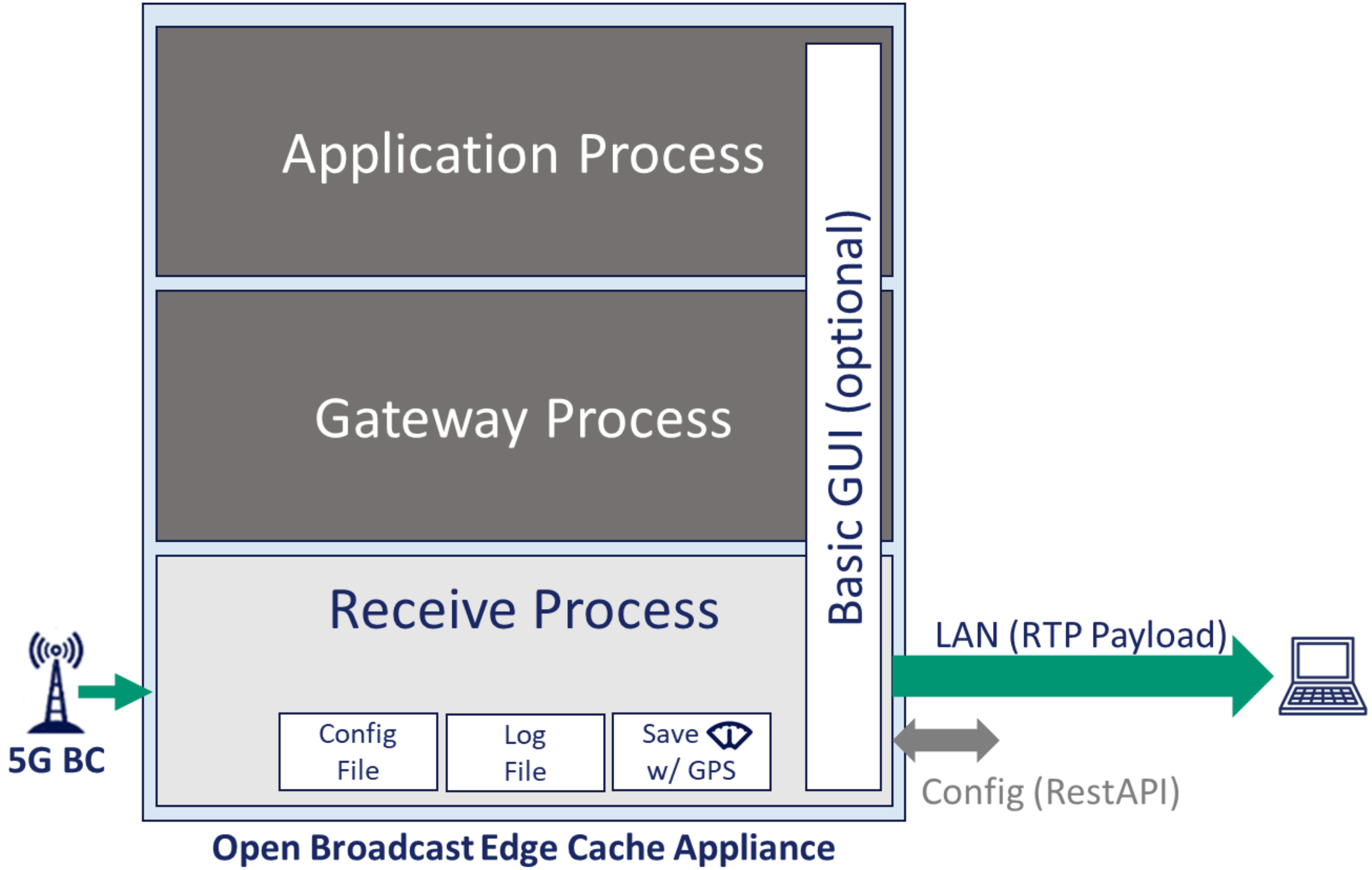
5G Broadcast
(with Broadband Access)

Middleware

5G Broadcast
Modem

Receive Process

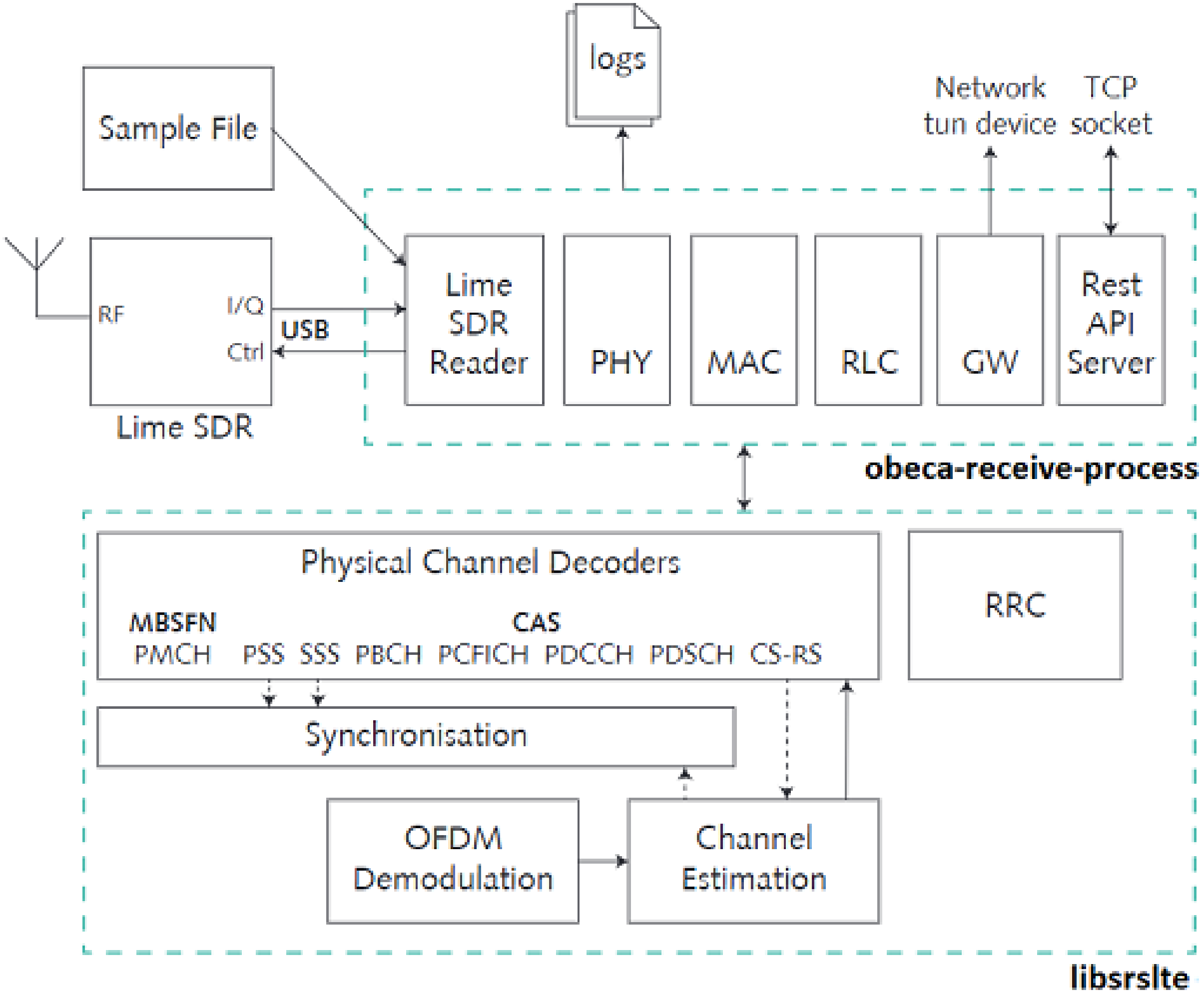
„convert 5G BC to IP“



Receive Process

How it works

- **Reception** of I/Q data from the Lime SDR Mini, for test purposes the real data can be replaced with data from a previously recorded sample file
- **PHY**: synchronization, OFDM demodulation, channel estimation, decoding of the physical control and user data channels
- **MAC**: evaluation of DCI , CFI, SIB and MIB. Decoding of MCCH and MTCH
- **RLC / GW**: Receipt of MTCH data, output on tun network interface
- **Rest API Server**: provides an HTTP server for the RESTful API
- Read out settings from the **configuration file**
- **Logging** of status messages via syslog



Receive Process

„convert 5G BC to IP“

obeca-receive-process v1.0

- **Input**: I/Q Data via SDR
- **Output**: IP packets on tun-interface
- **Payload**: RTP (native), HLS (3rd party)
- **Channel Bandwidths**: 3, 5, 6, 7, 8, 10 MHz
- **Modulation Coding Scheme:** 0-26

  (QPSK-64QAM, 3GPP TS 36.213 V16.4.0 Table 7.1.7.1.-1)
- **Sub Carrier Spacing**: 1.25 kHz, 2.5 kHz, 7.5 kHz
- **Cyclic Prefix**: 33.3 us, 200 us
- **Multiple MCHs, MTCHs**
- **Play/Record Sample Files** (raw data)
- **Recording** of signal parameters (CINR, BER, BLER)
- **Target**: ETSI TS 103.720

obeca-receive-process v1.1 (end of April)

+ SDR support: SoapySDR (more SDR devices)

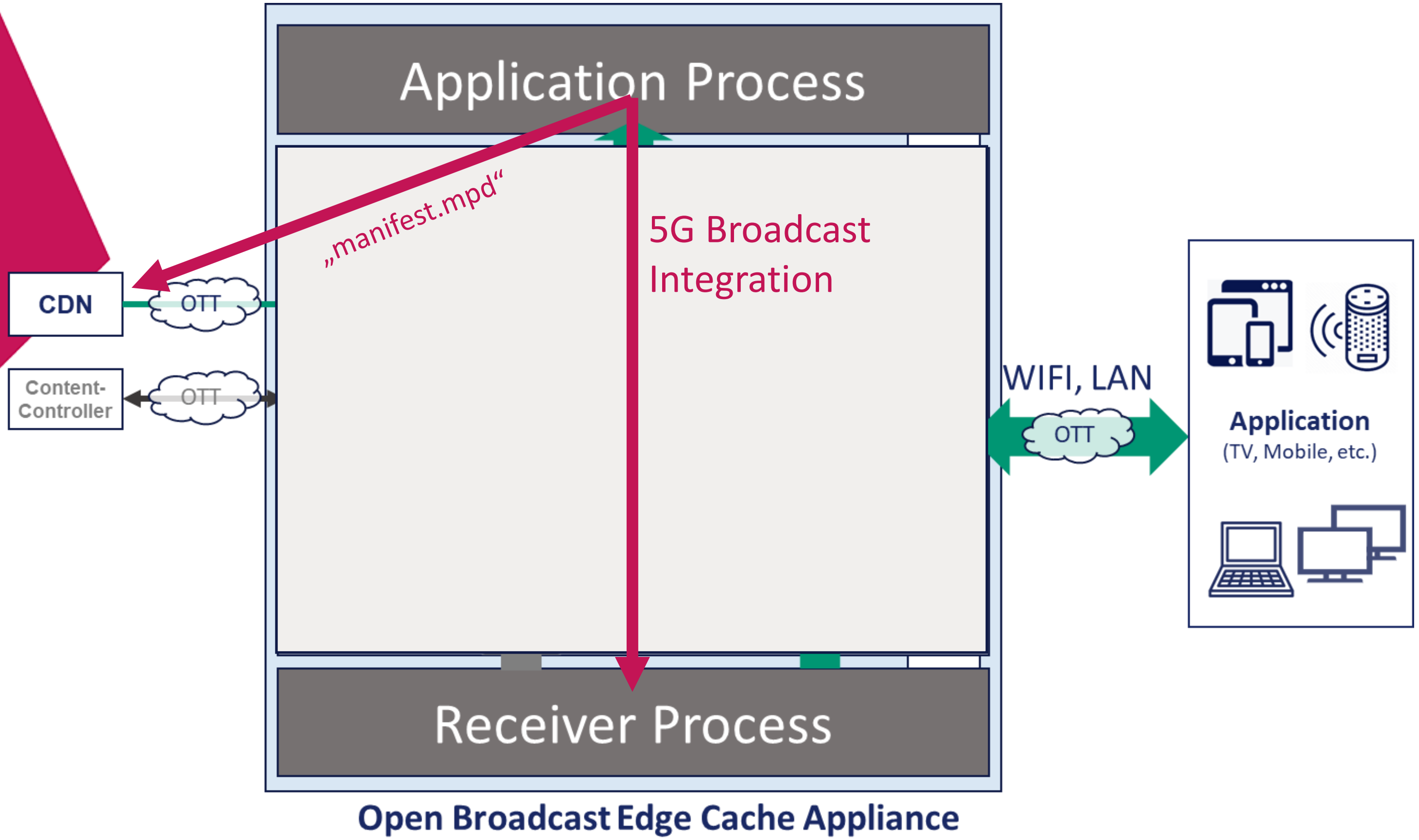
+ SDR support: Dektec DTA-2131

Backlog

- DVB-I, MBMS-API, ROUTE
- SCS 0.37 kHz and 15 kHz
- Cell search and selection
- Common Interface between modem/chipset and gateway (hardware/API perspective)?

Gateway Process

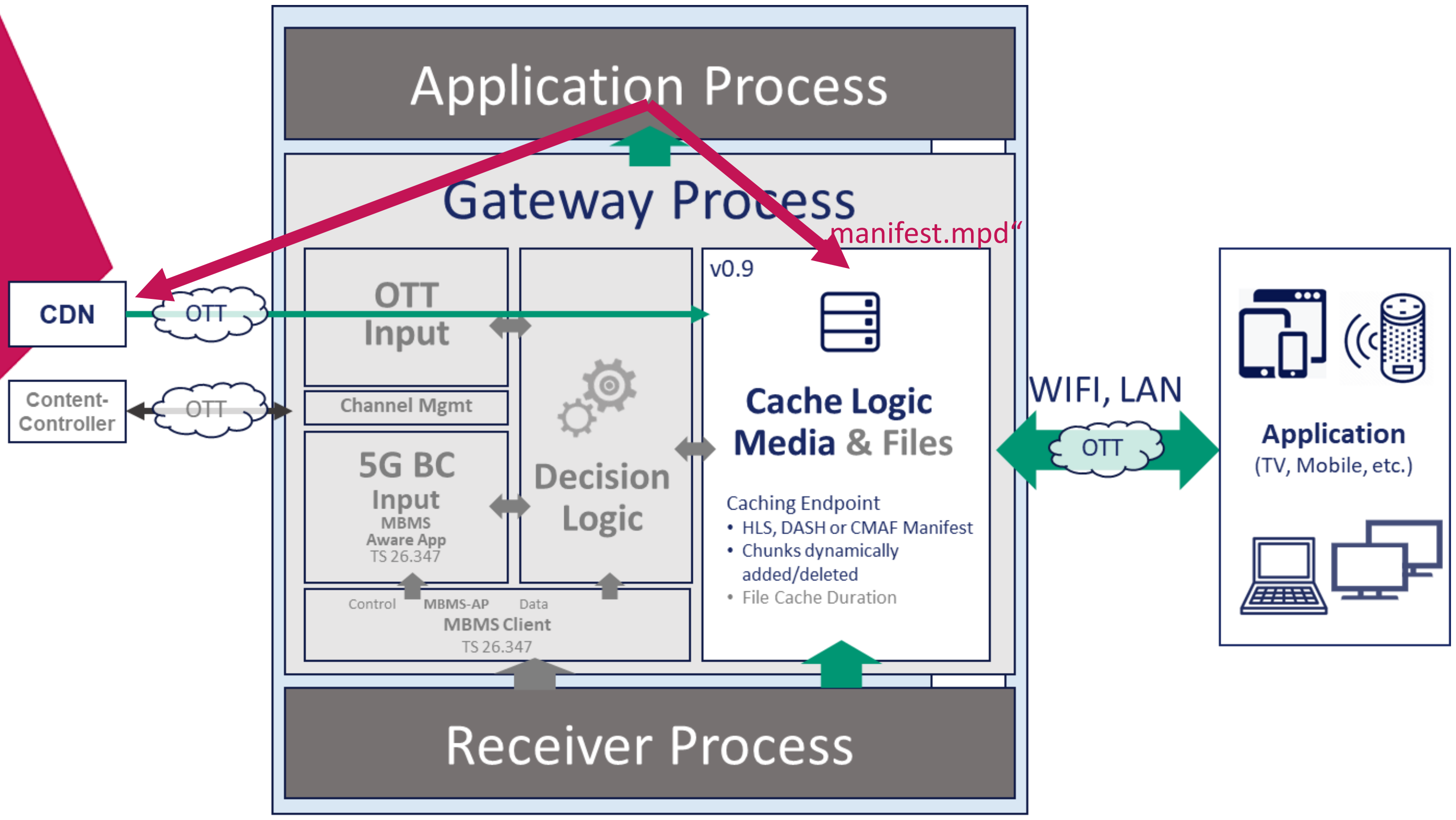
„make life easier for (existing) broadcast applications“



- **Adapting every OTT application** on all broadcasters' platforms for 5G broadcast integration incurs development costs and **creates a barrier**

Gateway Process

„make life easier for (existing) broadcast applications“

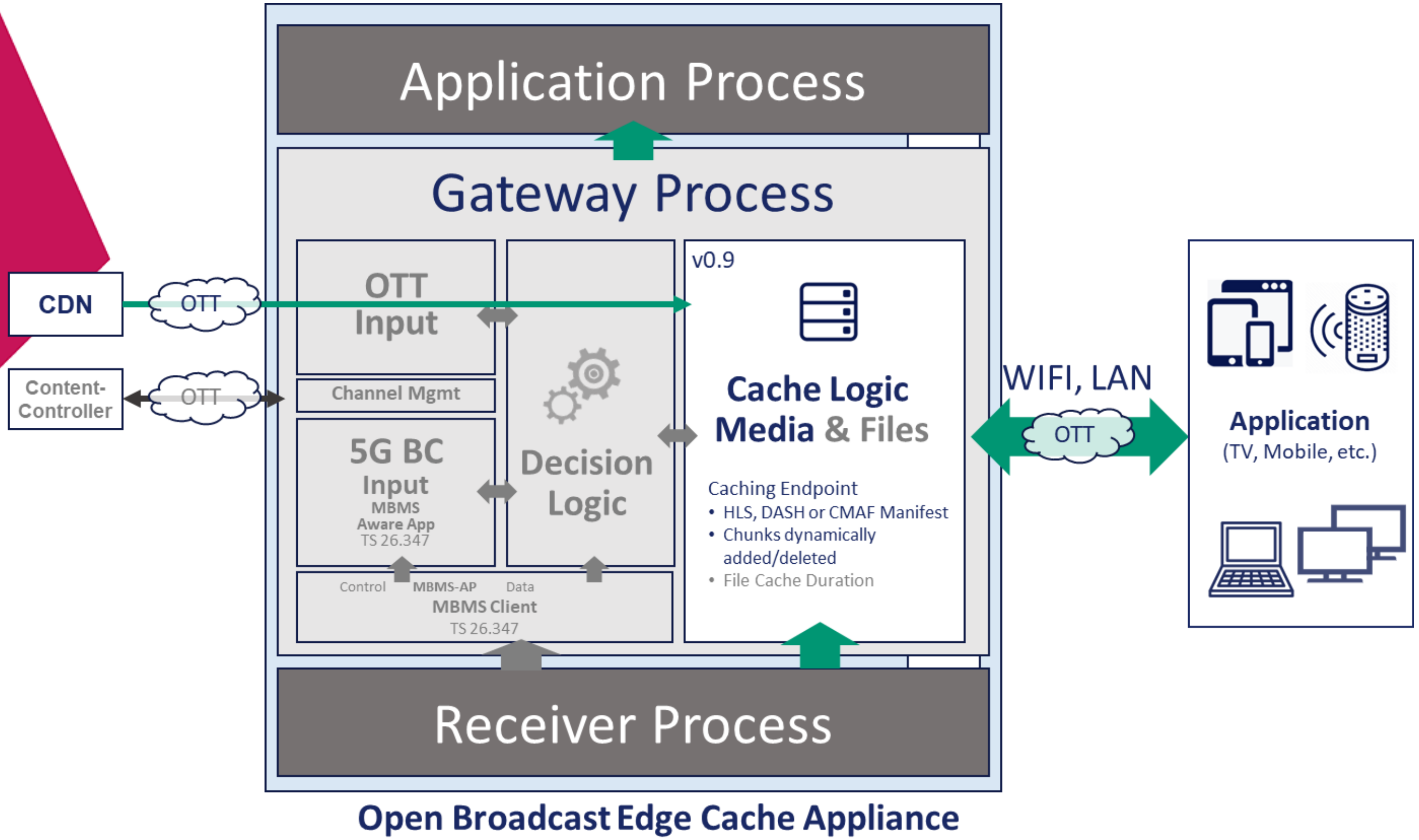


Open Broadcast Edge Cache Appliance

- **Adapting every OTT application** on all broadcasters' platforms for 5G broadcast integration incurs development costs and **creates a barrier**
- A gateway process that looks like a **CDN endpoint from the application's perspective** reduces adaptation costs and **increases adoption**.
- In addition, the gateway process should include smart **decision logic** to ensure that the **best content is always delivered** to the application, and thus to the customer.

Gateway Process

„make life easier for (existing) broadcast applications“



Open Broadcast Edge Cache Appliance

First release end of April

+ Simple Caching

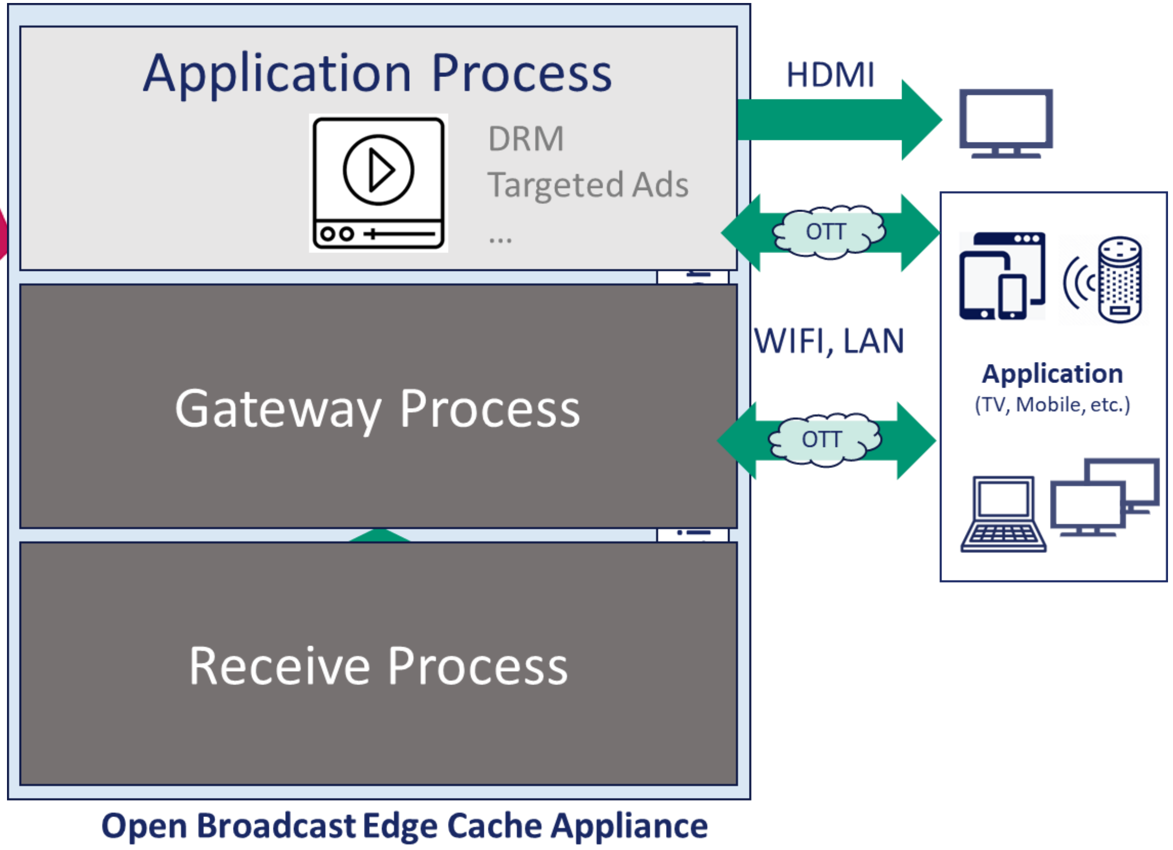
+ Payloads:
  - RTP native
  - HLS/DASH native

Backlog

- Decision logic
- File caching
- CMAF support
- Low Latency (ROUTE support?)

Application Process

„Common Playground for Broadcaster and Developer“



For the 5G broadcast community to setup their current and future (OTT) applications on top of the receiver and gateway.

First release end of April

+ Play RTP via VLC,…
+ Play HLS/DASH /w open-source player and website hosted on OBECA

Backlog

- Demos: Targeted Ads, Content Preposition, DRM,…

SIX STEPS HOW TO START

<RP />

Six steps how to start

1. Read the **Wiki**

2. Prepare **Hardware & OS**

3. Get **SDR** or **Sample Files**

<RP /> 4. Install obeca-**receive-process**

<GP /> 4. Install obeca-**gateway-process**

<AP /> 4. Install obeca-**application-process**

First Release End of April
Not part of today’s Tech Talk

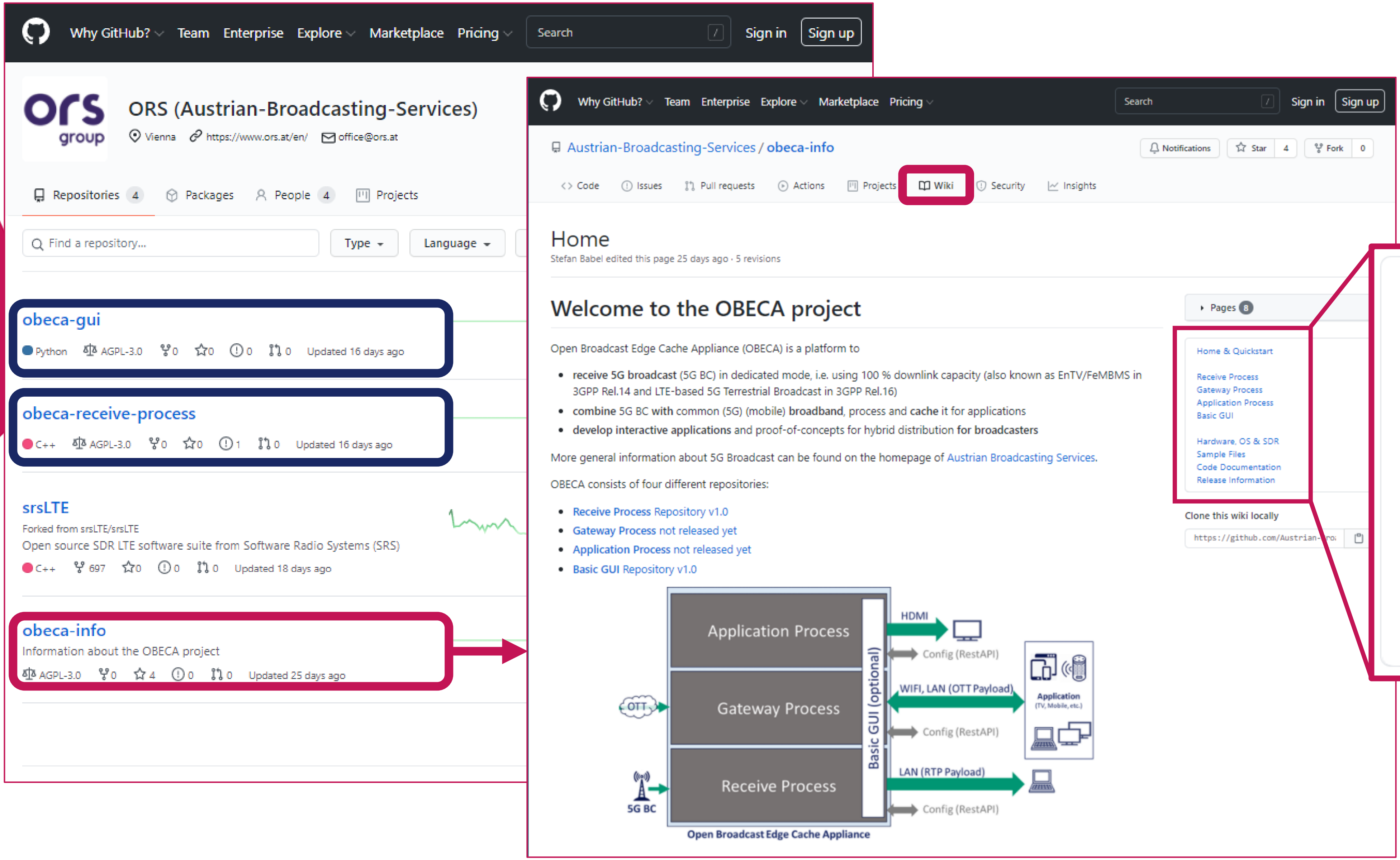
5. Special **RP features** and **configuration**

6. Run it!

7. Install and run obeca-**gui** (optional)

1. Read the wiki

Goto: https://github.com/Austrian-Broadcasting-Services



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ORS (Austrian-Broadcasting-Services)

Vienna https://www.ors.at/en/ office@ors.at

Repositories 4 Packages People 4 Projects

Find a repository… Type Language

obeca-gui

Python AGPL-3.0 0 0 0 0 Updated 16 days ago

obeca-receive-process

C++ AGPL-3.0 0 0 1 0 Updated 16 days ago

srsLTE

Forked from srsLTE/srsLTE

Open source SDR LTE software suite from Software Radio Systems (SRS)

C++ 697 0 0 0 Updated 18 days ago

obeca-info

Information about the OBECA project

AGPL-3.0 0 4 0 0 Updated 25 days ago

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Austrian-Broadcasting-Services / obeca-info

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Code Issues Pull requests Actions Projects Wiki Security Insights

Home

Stefan Babel edited this page 25 days ago · 5 revisions

Welcome to the OBECA project

Open Broadcast Edge Cache Appliance (OBECA) is a platform to

- **receive 5G broadcast** (5G BC) in dedicated mode, i.e. using 100 % downlink capacity (also known as EnTV/FeMBMS in 3GPP Rel.14 and LTE-based 5G Terrestrial Broadcast in 3GPP Rel.16)
- **combine** 5G BC **with** common (5G) (mobile) **broadband**, process and **cache** it for applications
- **develop interactive applications** and proof-of-concepts for hybrid distribution **for broadcasters**

More general information about 5G Broadcast can be found on the homepage of Austrian Broadcasting Services.

OBECA consists of four different repositories:

- **Receive Process** Repository v1.0
- **Gateway Process** not released yet
- **Application Process** not released yet
- **Basic GUI** Repository v1.0

Pages 8

Home & Quickstart

Receive Process
Gateway Process
Application Process
Basic GUI

Hardware, OS & SDR
Sample Files
Code Documentation
Release Information

Clone this wiki locally

https://github.com/Austrian-Bro

Home & Quickstart

Receive Process
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Application Process
Basic GUI

Hardware, OS & SDR
Sample Files
Code Documentation
Release Information

2. Prepare Hardware & OS

Hardware

- Depending on bandwidth (e.g. 5, 8, 10 MHz) and Modulation (MCS 0-26)
- CPU with 4 cores/8 threads, 16 GB RAM
- USB 3.0 (for live signals)
- HDMI, Wifi, LAN, SSD space for sample files (recommended)

OS

- Ubuntu, Debian (binaries)
  - Recommendation: Ubuntu 20.04 LTS (64-bit)
- Source Code
- Virtualization: Windows with Hyper-V (for quick test with sample files or app dev)

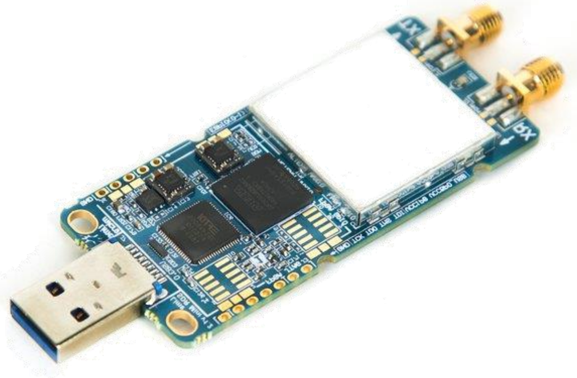
https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Hardware-Requirements#hardware-requirements

3. Get SDR or Sample Files [I/II]

Supported Software Defined Radio‘s

obeca-receive-process v1.0

- LimeSDR Mini https://www.crowdsupply.com/lime-micro/limesdr-mini
- LimeSDR



obeca-receive-process v1.1 (End of April)

- SoapySDR *„open-source generalized API and runtime library for interfacing with SDR devices “ → https://github.com/pothosware/SoapySDR/wiki*
  - Blade RF (tested)
  - Hack RF, RTL-SDR, SDRplay, Ettus, Lime Suite, …
- Dektec DTA-2131

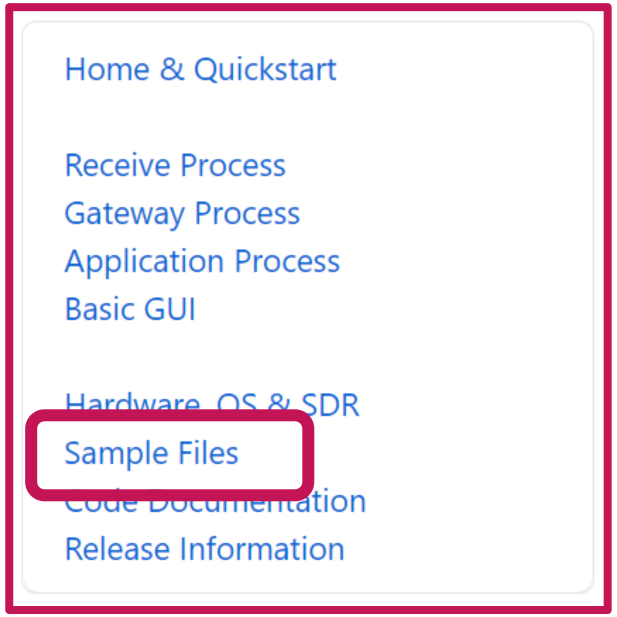
https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Hardware-Requirements#supported-sdr

3. **Get** SDR or **Sample Files** [II/II]

Get Sample Files

- Captured from a 5G BC transmitter (Feb/2021)
- "raw data" = digitized I/Q data at LimeSDR Mini output
- 5 MHz and MCS16
  - RTP 3.5 Mbps
  - HLS 1.2 Mbps
  - RTP 3.5 Mbps & HLS 1.2 Mbps
- 10 MHz
  - MCS9 HLS / RTP
  - MCS16 HLS adaptive (3 qualities) / RTP
  - MCS26 HLS / RTP
- 6, 7, 8 MHz to be recorded…
- Each file ~20 GB, 2-4 minutes, looping Big Buck Bunny

- Need more sample files? Contact obeca@ors.at



Home & Quickstart

Receive Process
Gateway Process
Application Process
Basic GUI

Hardware, OS & SDR
Sample Files
Code Documentation
Release Information

Github Wiki Menu

THE PEACH OPEN MOVIE PROJECT PRESENTS
Big Buck BUNNY
WRITTEN AND DIRECTED BY SACHA GOEDEGEBURE – ART DIRECTOR ANDREAS GORALCZYK – LEAD ARTIST ENRICO VALENZA
ANIMATORS NATHAN VEGDAHL, WILLIAM REYNISH – TECHNICAL DIRECTORS CAMPBELL BARTON, BRECHT VAN LOMMEL
MUSIC BY JAN MORGENSTERN – PRODUCED BY TON ROOSENDAAL, BLENDER FOUNDATION
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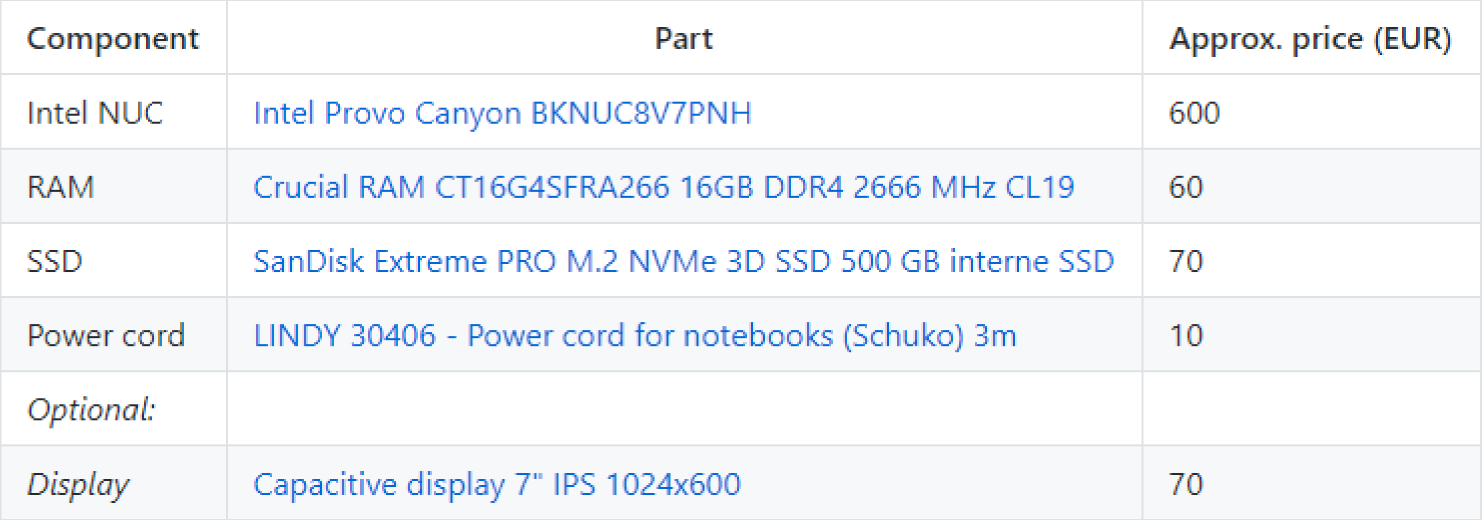
https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Sample-Files

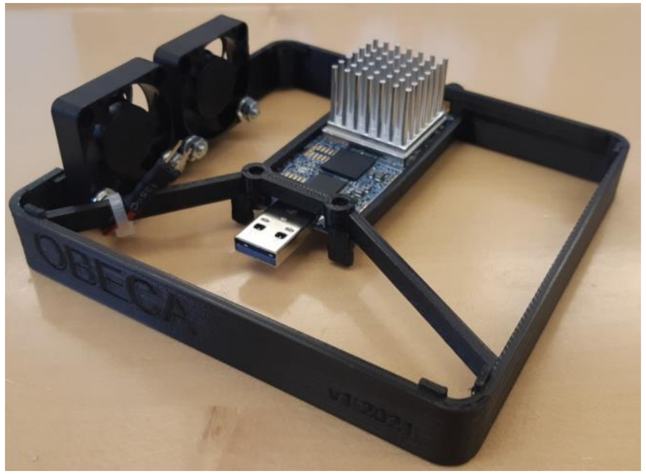
ORS Reference Setup



Component	Part	Approx. price (EUR)
Intel NUC	Intel Provo Canyon BKNUC8V7PNH	600
RAM	Crucial RAM CT16G4SFRA266 16GB DDR4 2666 MHz CL19	60
SSD	SanDisk Extreme PRO M.2 NVMe 3D SSD 500 GB interne SSD	70
Power cord	LINDY 30406 - Power cord for notebooks (Schuko) 3m	10
Optional:		
Display	Capacitive display 7" IPS 1024x600	70

OBECA casing build instructions (Casing part list, STL file for 3D print)

https://github.com/johannmika/obeca-ors-casing



To accelerate your start with OBECA, ORS is offering **reference setups**

- Small quantities for trials, tests,…
- Hardware with preinstalled OS, OBECA software plus training hours

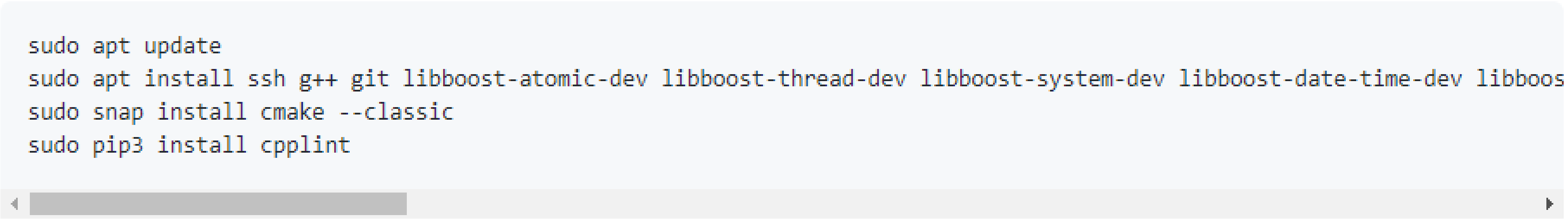
If you are interested, please contact obeca@ors.at

https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Hardware-Requirements#reference-setups

<RP /> 4. Install obeca-receive-process [I/III]

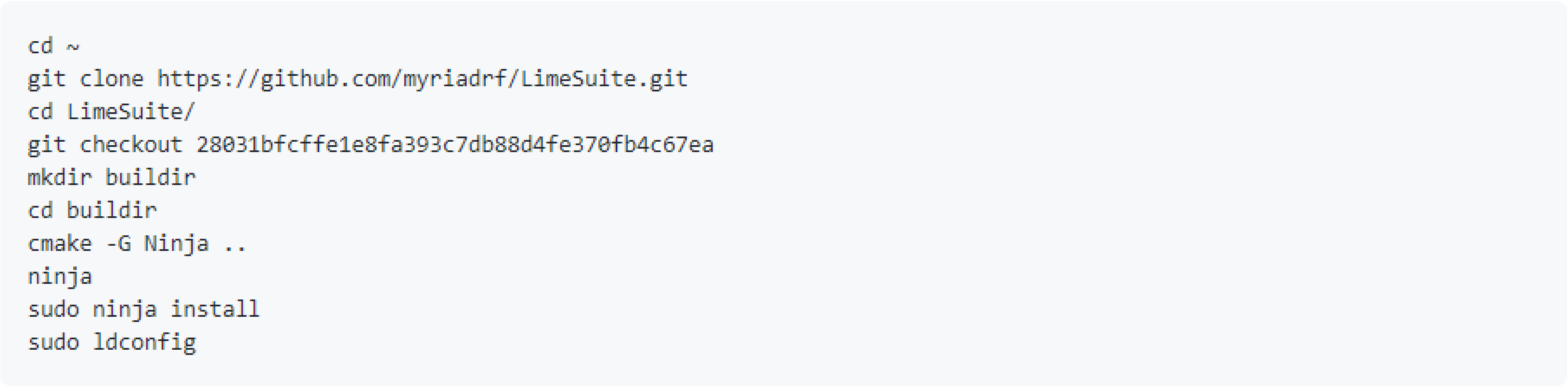
Prerequisites

- Install Dependencies



```
sudo apt update
sudo apt install ssh g++ git libboost-atomic-dev libboost-thread-dev libboost-system-dev libboost-date-time-dev libboos
sudo snap install cmake --classic
sudo pip3 install cpplint
```

- Install LimeSuite (Lime Suite needs to be built from source at a specific commit)



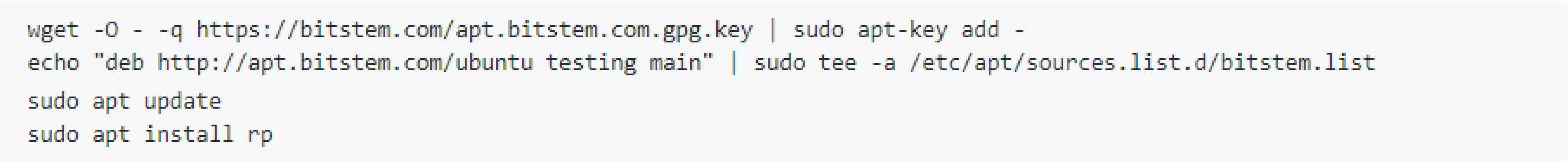
```
cd ~
git clone https://github.com/myriadrf/LimeSuite.git
cd LimeSuite/
git checkout 28031bfcffe1e8fa393c7db88d4fe370fb4c67ea
mkdir buildir
cd buildir
cmake -G Ninja ..
ninja
sudo ninja install
sudo ldconfig
```

https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Receive-Process#installation

<RP /> 4. Install obeca-receive-process [II/III]

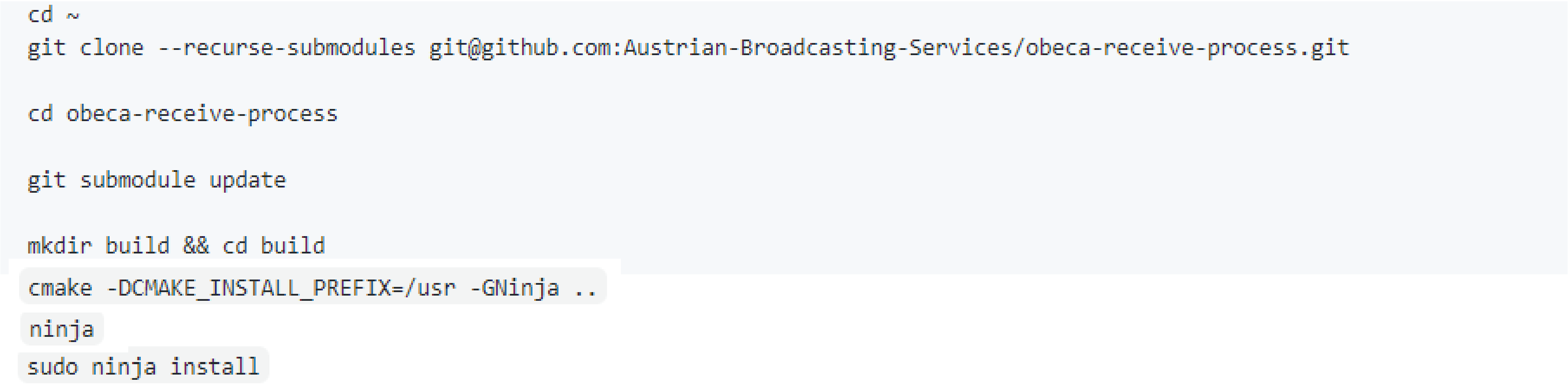
Two options for installation

- Option 1: Installation via Binaries



```
wget -O - -q https://bitstem.com/apt.bitstem.com.gpg.key | sudo apt-key add -
echo "deb http://apt.bitstem.com/ubuntu testing main" | sudo tee -a /etc/apt/sources.list.d/bitstem.list
sudo apt update
sudo apt install rp
```

- Option 2: Build from source



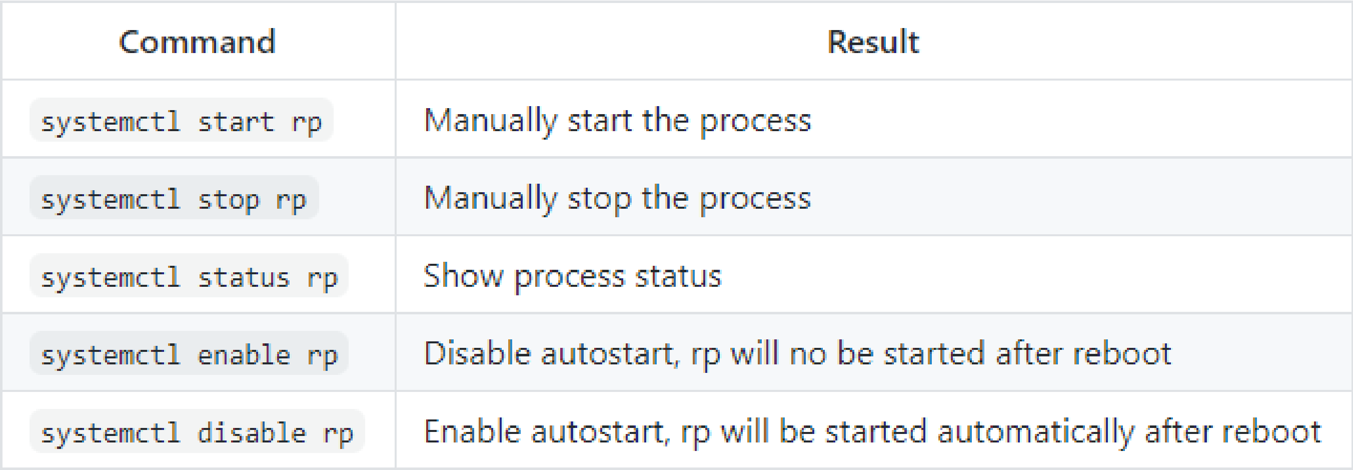
```
cd ~
git clone --recurse-submodules git@github.com:Austrian-Broadcasting-Services/obeca-receive-process.git

cd obeca-receive-process

git submodule update

mkdir build && cd build
cmake -DCMAKE_INSTALL_PREFIX=/usr -GNinja ..
ninja
sudo ninja install
```

https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Receive-Process#installation

<RP /> 4. Install obeca-receive-process [III/III]

Post-Installation

- Create „ofr“ user `sudo useradd ofr`
- Start background process `sudo systemctl start rp`
- Enable automatic boot startup `sudo systemctl enable rp`
- Stop background process (for manual use) `sudo systemctl stop rp`



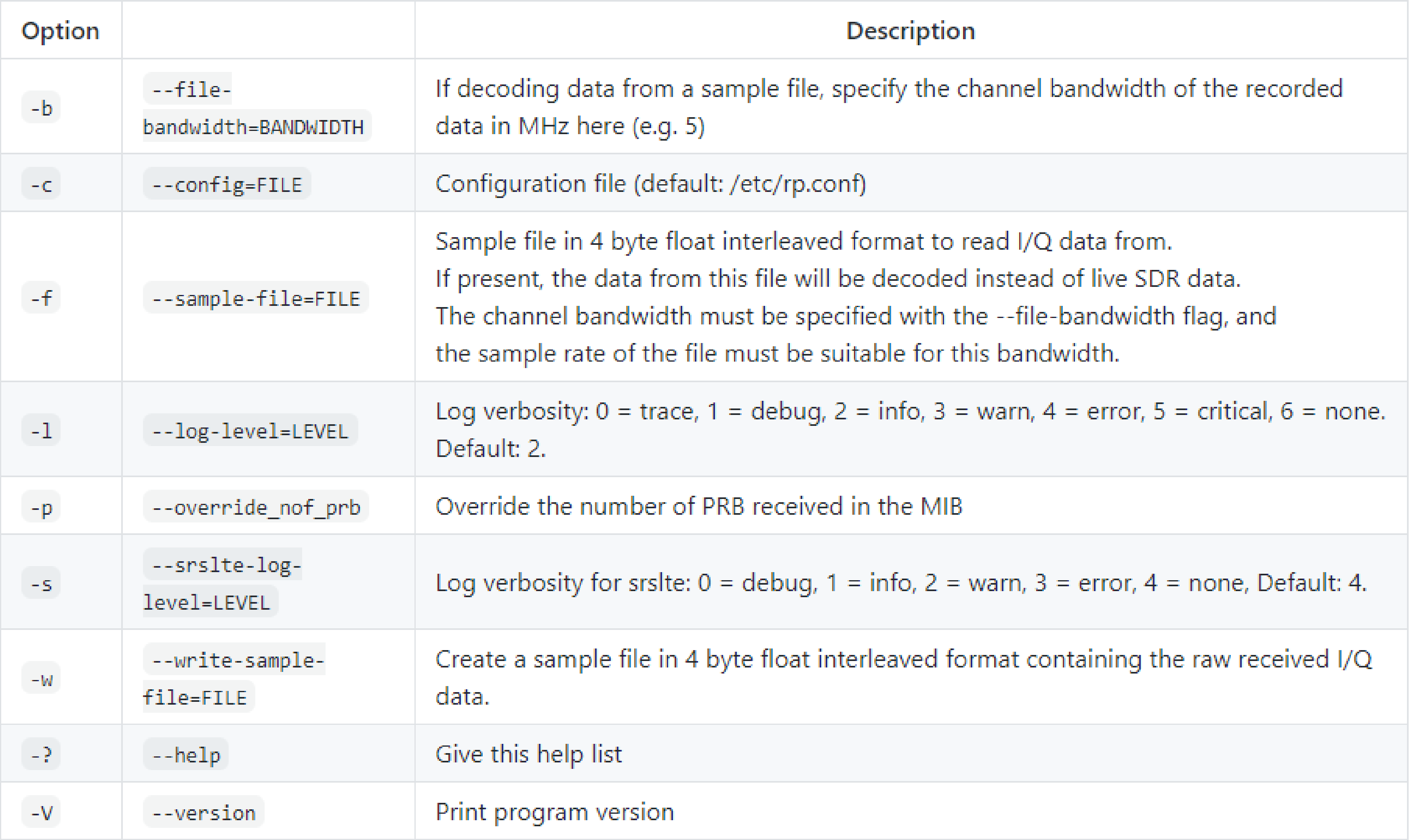
Command	Result
`systemctl start rp`	Manually start the process
`systemctl stop rp`	Manually stop the process
`systemctl status rp`	Show process status
`systemctl enable rp`	Disable autostart, rp will no be started after reboot
`systemctl disable rp`	Enable autostart, rp will be started automatically after reboot

- Logfiles `/var/log/syslog` `cat /var/log/syslog | grep "rp"`

https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Receive-Process#installation

5. Special RP features and configuration [I/III]

Parameters



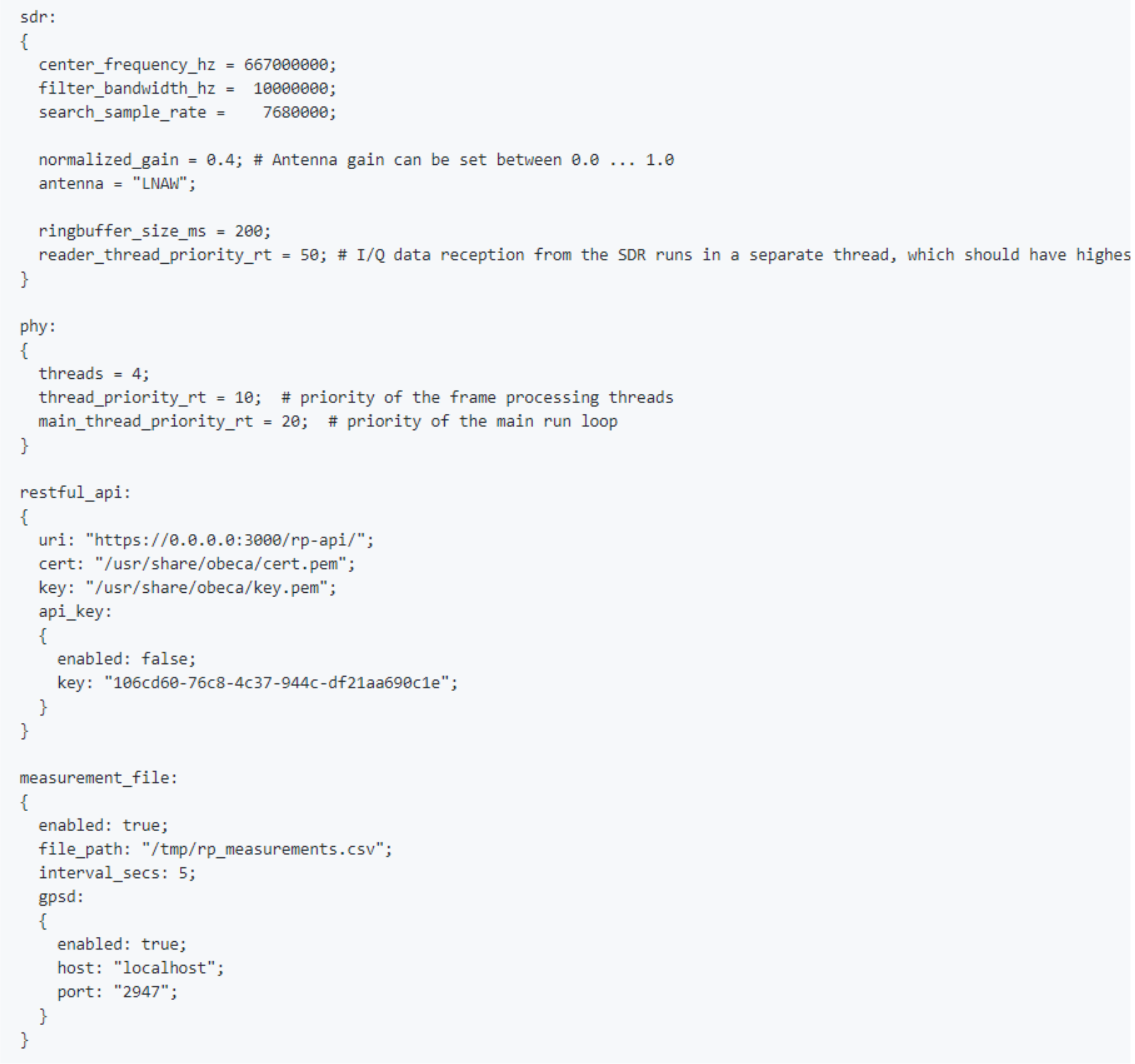
Option		Description
`-b`	`--file-bandwidth=BANDWIDTH`	If decoding data from a sample file, specify the channel bandwidth of the recorded data in MHz here (e.g. 5)
`-c`	`--config=FILE`	Configuration file (default: /etc/rp.conf)
`-f`	`--sample-file=FILE`	Sample file in 4 byte float interleaved format to read I/Q data from. If present, the data from this file will be decoded instead of live SDR data. The channel bandwidth must be specified with the --file-bandwidth flag, and the sample rate of the file must be suitable for this bandwidth.
`-l`	`--log-level=LEVEL`	Log verbosity: 0 = trace, 1 = debug, 2 = info, 3 = warn, 4 = error, 5 = critical, 6 = none. Default: 2.
`-p`	`--override_nof_prb`	Override the number of PRB received in the MIB
`-s`	`--srslte-log-level=LEVEL`	Log verbosity for srslte: 0 = debug, 1 = info, 2 = warn, 3 = error, 4 = none, Default: 4.
`-w`	`--write-sample-file=FILE`	Create a sample file in 4 byte float interleaved format containing the raw received I/Q data.
`-?`	`--help`	Give this help list
`-V`	`--version`	Print program version

https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Receive-Process#manual-startstop

5. Special RP features and configuration [II/III]

Config File

- Location: `/etc/rp.conf`
- Parameters for
  - SDR
  - Physical (thread settings)
  - RestAPI
  - Measurement file



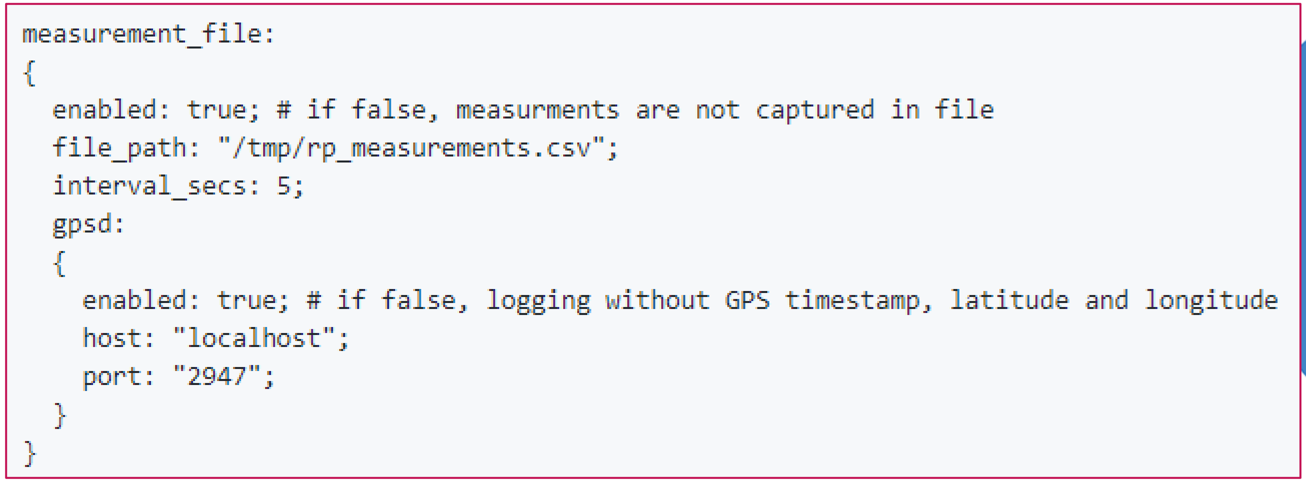
```
sdr:
{
  center_frequency_hz = 667000000;
  filter_bandwidth_hz =  10000000;
  search_sample_rate =    7680000;

  normalized_gain = 0.4; # Antenna gain can be set between 0.0 ... 1.0
  antenna = "LNAW";

  ringbuffer_size_ms = 200;
  reader_thread_priority_rt = 50; # I/Q data reception from the SDR runs in a separate thread, which should have highes
}

phy:
{
  threads = 4;
  thread_priority_rt = 10;  # priority of the frame processing threads
  main_thread_priority_rt = 20;  # priority of the main run loop
}

restful_api:
{
  uri: "https://0.0.0.0:3000/rp-api/";
  cert: "/usr/share/obeca/cert.pem";
  key: "/usr/share/obeca/key.pem";
  api_key:
  {
    enabled: false;
    key: "106cd60-76c8-4c37-944c-df21aa690c1e";
  }
}

measurement_file:
{
  enabled: true;
  file_path: "/tmp/rp_measurements.csv";
  interval_secs: 5;
  gpsd:
  {
    enabled: true;
    host: "localhost";
    port: "2947";
  }
}
```

https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Receive-Process#config-file

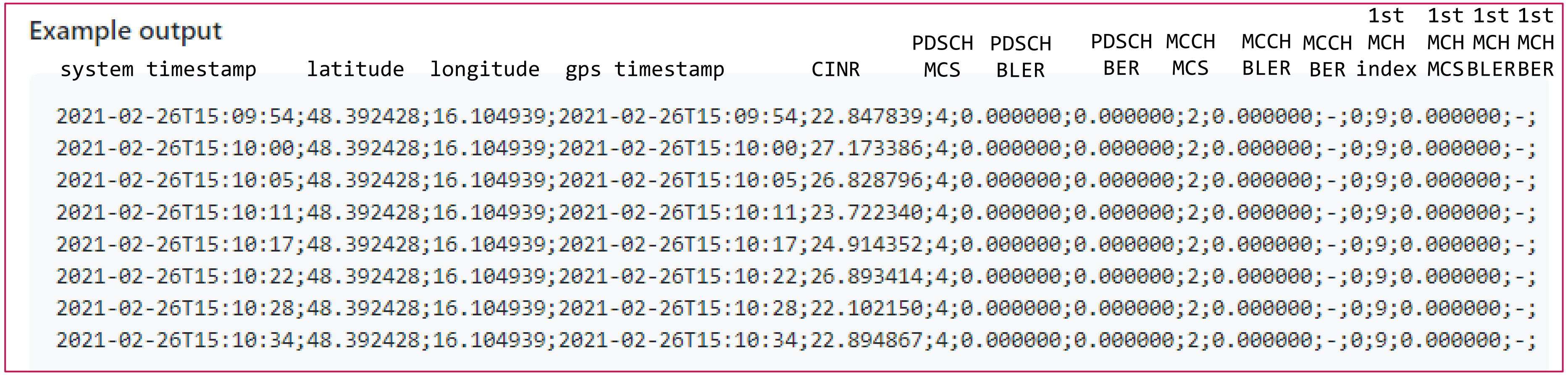
5. Special RP features and configuration [III/III]

Measurement recording

- Install GPS mouse (optional)
- Configure Measurement File `/etc/rp.conf`



```
measurement_file:
{
  enabled: true; # if false, measurments are not captured in file
  file_path: "/tmp/rp_measurements.csv";
  interval_secs: 5;
  gpsd:
  {
    enabled: true; # if false, logging without GPS timestamp, latitude and longitude
    host: "localhost";
    port: "2947";
  }
}
```



Example output

system timestamp	latitude	longitude	gps timestamp	CINR	PDSCH MCS	PDSCH BLER	PDSCH BER	MCCH MCS	MCCH BLER	MCCH BER	1st MCH index	1st MCH MCS	1st MCH BLER	1st MCH BER	2nd MCH index	2nd MCH MCS	2nd MCH BLER	2nd MCH BER	…

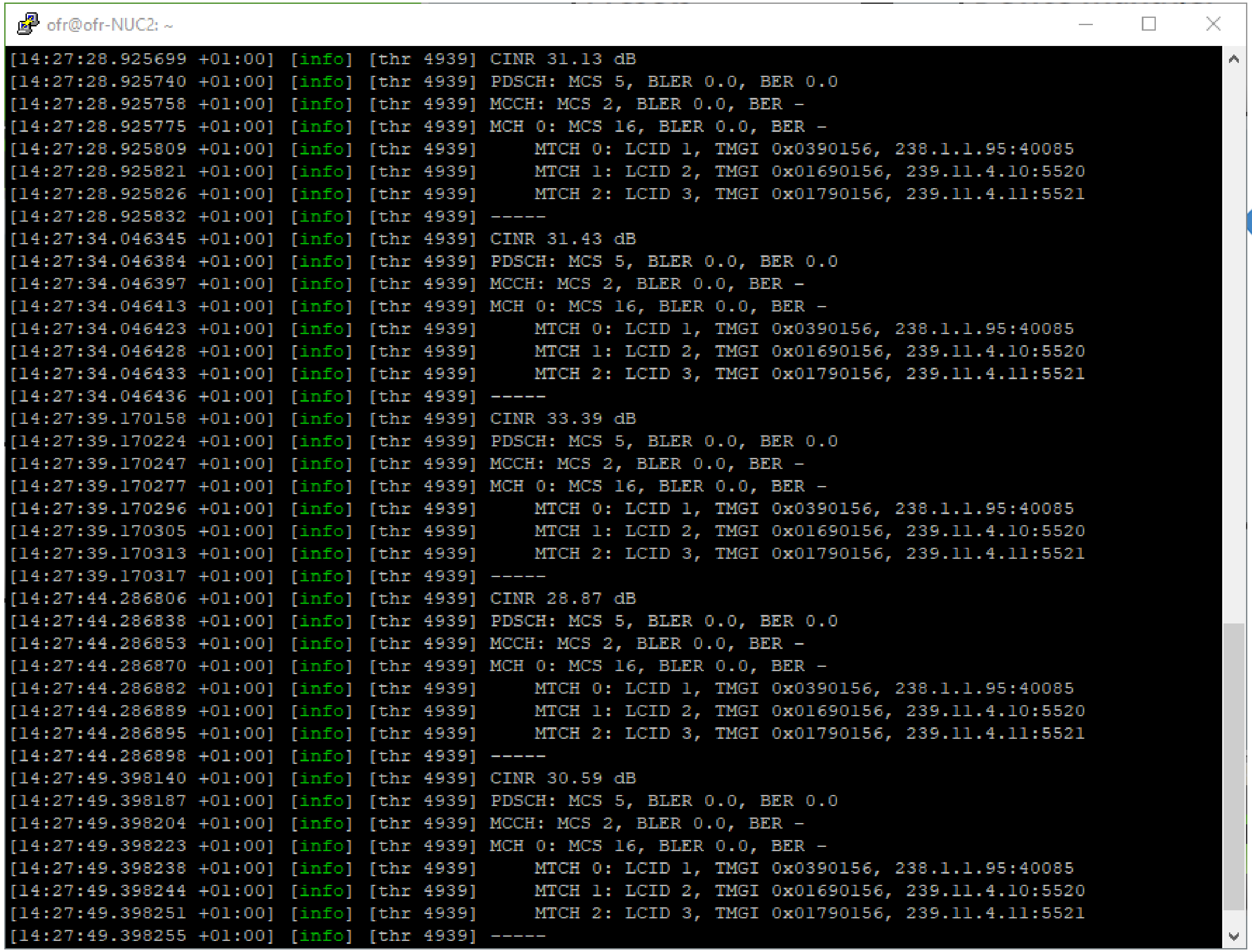
```
2021-02-26T15:09:54;48.392428;16.104939;2021-02-26T15:09:54;22.847839;4;0.000000;0.000000;2;0.000000;-;0;9;0.000000;-;
2021-02-26T15:10:00;48.392428;16.104939;2021-02-26T15:10:00;27.173386;4;0.000000;0.000000;2;0.000000;-;0;9;0.000000;-;
2021-02-26T15:10:05;48.392428;16.104939;2021-02-26T15:10:05;26.828796;4;0.000000;0.000000;2;0.000000;-;0;9;0.000000;-;
2021-02-26T15:10:11;48.392428;16.104939;2021-02-26T15:10:11;23.722340;4;0.000000;0.000000;2;0.000000;-;0;9;0.000000;-;
2021-02-26T15:10:17;48.392428;16.104939;2021-02-26T15:10:17;24.914352;4;0.000000;0.000000;2;0.000000;-;0;9;0.000000;-;
2021-02-26T15:10:22;48.392428;16.104939;2021-02-26T15:10:22;26.893414;4;0.000000;0.000000;2;0.000000;-;0;9;0.000000;-;
2021-02-26T15:10:28;48.392428;16.104939;2021-02-26T15:10:28;22.102150;4;0.000000;0.000000;2;0.000000;-;0;9;0.000000;-;
2021-02-26T15:10:34;48.392428;16.104939;2021-02-26T15:10:34;22.894867;4;0.000000;0.000000;2;0.000000;-;0;9;0.000000;-;
```

https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Receive-Process#configuring-a-gps-mouse

6. Run it!

Receive Process

- Run rp per ssh
- GitHub
  - Code documentation
  - API documentation



```
[14:27:28.925699 +01:00] [info] [thr 4939] CINR 31.13 dB
[14:27:28.925740 +01:00] [info] [thr 4939] PDSCH: MCS 5, BLER 0.0, BER 0.0
[14:27:28.925758 +01:00] [info] [thr 4939] MCCH: MCS 2, BLER 0.0, BER -
[14:27:28.925775 +01:00] [info] [thr 4939] MCH 0: MCS 16, BLER 0.0, BER -
[14:27:28.925809 +01:00] [info] [thr 4939]     MTCH 0: LCID 1, TMGI 0x0390156, 238.1.1.95:40085
[14:27:28.925821 +01:00] [info] [thr 4939]     MTCH 1: LCID 2, TMGI 0x01690156, 239.11.4.10:5520
[14:27:28.925826 +01:00] [info] [thr 4939]     MTCH 2: LCID 3, TMGI 0x01790156, 239.11.4.11:5521
[14:27:28.925832 +01:00] [info] [thr 4939] -----
[14:27:34.046345 +01:00] [info] [thr 4939] CINR 31.43 dB
[14:27:34.046384 +01:00] [info] [thr 4939] PDSCH: MCS 5, BLER 0.0, BER 0.0
[14:27:34.046397 +01:00] [info] [thr 4939] MCCH: MCS 2, BLER 0.0, BER -
[14:27:34.046413 +01:00] [info] [thr 4939] MCH 0: MCS 16, BLER 0.0, BER -
[14:27:34.046423 +01:00] [info] [thr 4939]     MTCH 0: LCID 1, TMGI 0x0390156, 238.1.1.95:40085
[14:27:34.046428 +01:00] [info] [thr 4939]     MTCH 1: LCID 2, TMGI 0x01690156, 239.11.4.10:5520
[14:27:34.046433 +01:00] [info] [thr 4939]     MTCH 2: LCID 3, TMGI 0x01790156, 239.11.4.11:5521
[14:27:34.046436 +01:00] [info] [thr 4939] -----
[14:27:39.170158 +01:00] [info] [thr 4939] CINR 33.39 dB
[14:27:39.170224 +01:00] [info] [thr 4939] PDSCH: MCS 5, BLER 0.0, BER 0.0
[14:27:39.170247 +01:00] [info] [thr 4939] MCCH: MCS 2, BLER 0.0, BER -
[14:27:39.170277 +01:00] [info] [thr 4939] MCH 0: MCS 16, BLER 0.0, BER -
[14:27:39.170296 +01:00] [info] [thr 4939]     MTCH 0: LCID 1, TMGI 0x0390156, 238.1.1.95:40085
[14:27:39.170305 +01:00] [info] [thr 4939]     MTCH 1: LCID 2, TMGI 0x01690156, 239.11.4.10:5520
[14:27:39.170313 +01:00] [info] [thr 4939]     MTCH 2: LCID 3, TMGI 0x01790156, 239.11.4.11:5521
[14:27:39.170317 +01:00] [info] [thr 4939] -----
[14:27:44.286806 +01:00] [info] [thr 4939] CINR 28.87 dB
[14:27:44.286838 +01:00] [info] [thr 4939] PDSCH: MCS 5, BLER 0.0, BER 0.0
[14:27:44.286853 +01:00] [info] [thr 4939] MCCH: MCS 2, BLER 0.0, BER -
[14:27:44.286870 +01:00] [info] [thr 4939] MCH 0: MCS 16, BLER 0.0, BER -
[14:27:44.286882 +01:00] [info] [thr 4939]     MTCH 0: LCID 1, TMGI 0x0390156, 238.1.1.95:40085
[14:27:44.286889 +01:00] [info] [thr 4939]     MTCH 1: LCID 2, TMGI 0x01690156, 239.11.4.10:5520
[14:27:44.286895 +01:00] [info] [thr 4939]     MTCH 2: LCID 3, TMGI 0x01790156, 239.11.4.11:5521
[14:27:44.286898 +01:00] [info] [thr 4939] -----
[14:27:49.398140 +01:00] [info] [thr 4939] CINR 30.59 dB
[14:27:49.398187 +01:00] [info] [thr 4939] PDSCH: MCS 5, BLER 0.0, BER 0.0
[14:27:49.398204 +01:00] [info] [thr 4939] MCCH: MCS 2, BLER 0.0, BER -
[14:27:49.398223 +01:00] [info] [thr 4939] MCH 0: MCS 16, BLER 0.0, BER -
[14:27:49.398238 +01:00] [info] [thr 4939]     MTCH 0: LCID 1, TMGI 0x0390156, 238.1.1.95:40085
[14:27:49.398244 +01:00] [info] [thr 4939]     MTCH 1: LCID 2, TMGI 0x01690156, 239.11.4.10:5520
[14:27:49.398251 +01:00] [info] [thr 4939]     MTCH 2: LCID 3, TMGI 0x01790156, 239.11.4.11:5521
[14:27:49.398255 +01:00] [info] [thr 4939] -----
```

https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/Receive-Process#run-the-receive-process

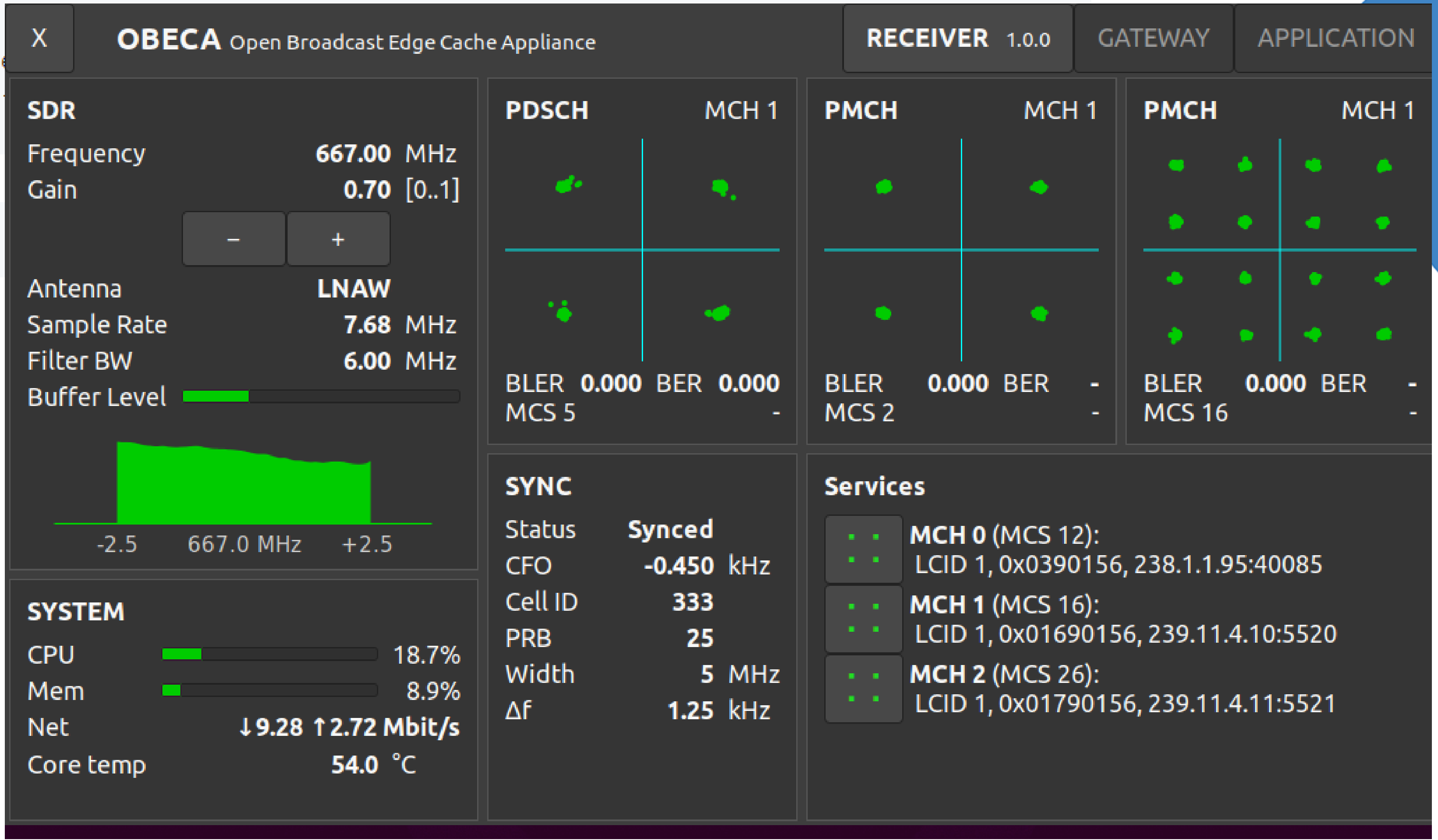
7. Install and run obeca-gui (optional)

- Collect and display useful information from the Processes
- Uses RestAPI calls
- Installation

```
sudo apt
git clone
cd obeca-
DISPLAY=
```

- Run

```
cd /usr/share/obeca
DISPLAY=:0 python3 obeca-gui.py
```



X **OBECA** Open Broadcast Edge Cache Appliance

SDR

```
Frequency        667.00  MHz
Gain               0.70  [0..1]
                 –   +
Antenna          LNAW
Sample Rate        7.68  MHz
Filter BW          6.00  MHz
Buffer Level
```

SYSTEM

```
CPU          18.7%
Mem           8.9%
Net          ↓9.28 ↑2.72 Mbit/s
Core temp    54.0  °C
```

PDSCH MCH 1

```
BLER  0.000  BER  0.000
MCS 5                 -
```

PMCH MCH 1

```
BLER    0.000  BER  -
MCS 2               -
```

PMCH MCH 1

```
BLER    0.000  BER  -
MCS 16              -
```

SYNC

```
Status     Synced
CFO        -0.450  kHz
Cell ID       333
PRB            25
Width           5  MHz
Δf           1.25  kHz
```

Services

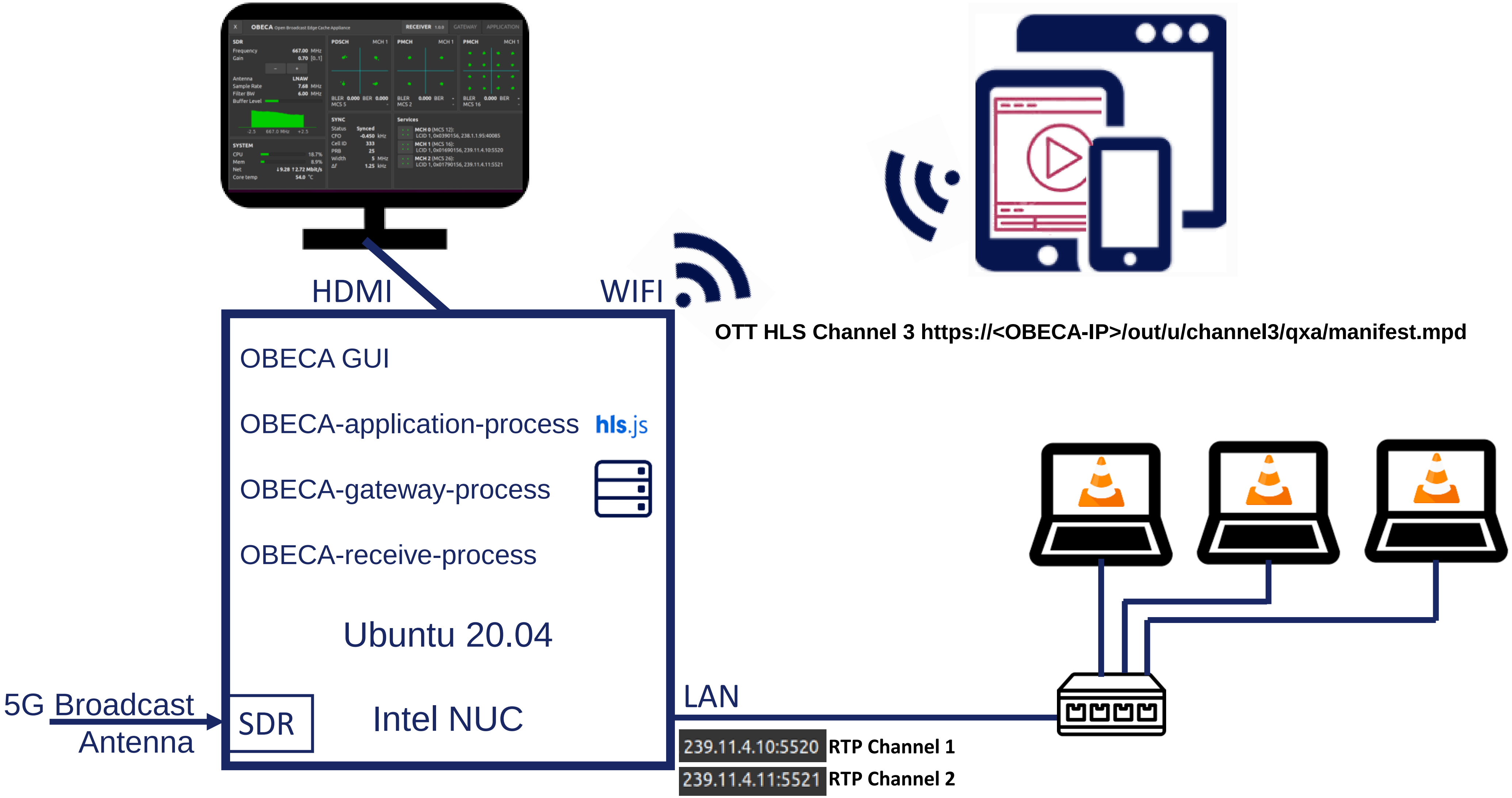
MCH 0 (MCS 12):
LCID 1, 0x0390156, 238.1.1.95:40085

MCH 1 (MCS 16):
LCID 1, 0x01690156, 239.11.4.10:5520

MCH 2 (MCS 26):
LCID 1, 0x01790156, 239.11.4.11:5521

https://github.com/Austrian-Broadcasting-Services/obeca-info/wiki/GUI

Our test and development setup



X OBECA Open Broadcast Edge Cache Appliance RECEIVER 1.0.0 GATEWAY APPLICATION

SDR
Frequency 667.00 MHz
Gain 0.70 [0..1]
Antenna LNAW
Sample Rate 7.68 MHz
Filter BW 6.00 MHz
Buffer Level

SYSTEM
CPU 18.7%
Mem 8.9%
Net ↓9.28 ↑2.72 Mbit/s
Core temp 54.0 °C

PDSCH MCH 1
BLER 0.000 BER 0.000
MCS 5

PMCH MCH 1
BLER 0.000 BER -
MCS 2

PMCH MCH 1
BLER 0.000 BER -
MCS 16

SYNC
Status Synced
CFO -0.450 kHz
Cell ID 333
PRB 25
Width 5 MHz
Δf 1.25 kHz

Services
MCH 0 (MCS 12): LCID 1, 0x0390156, 238.1.1.95:40085
MCH 1 (MCS 16): LCID 1, 0x01690156, 239.11.4.10:5520
MCH 2 (MCS 26): LCID 1, 0x01790156, 239.11.4.11:5521

HDMI

WIFI

OTT HLS Channel 3 https://<OBECA-IP>/out/u/channel3/qxa/manifest.mpd

OBECA GUI

OBECA-application-process hls.js

OBECA-gateway-process

OBECA-receive-process

Ubuntu 20.04

Intel NUC

SDR

5G Broadcast
Antenna

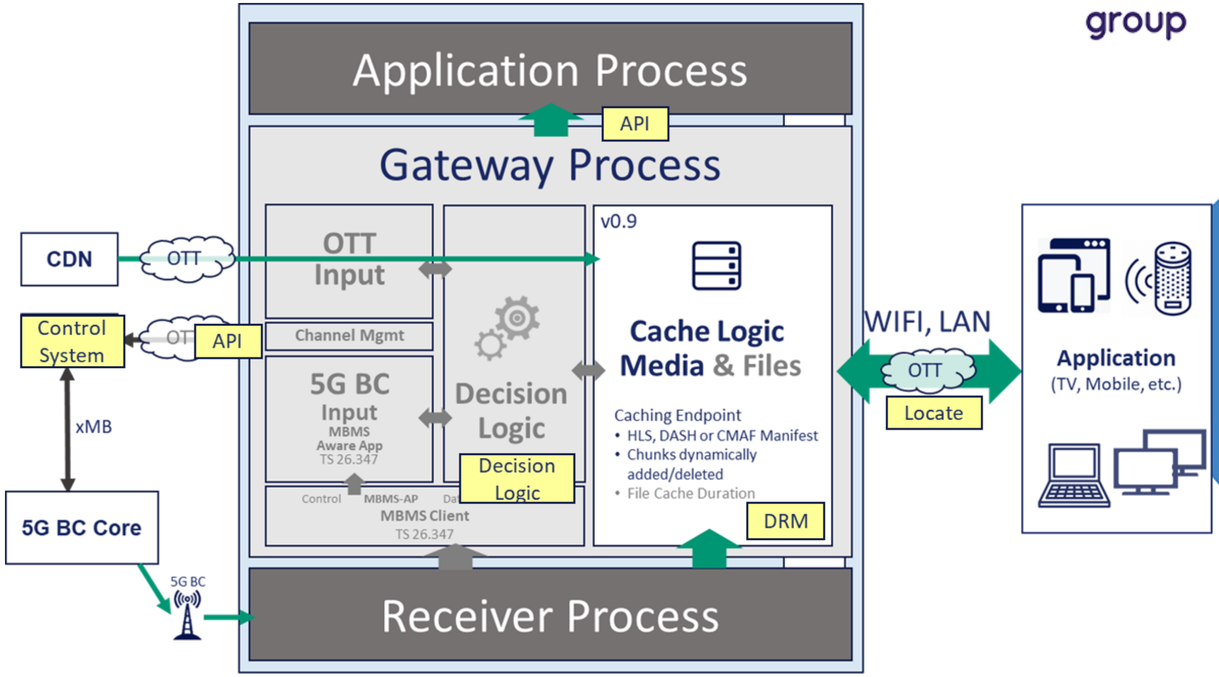
LAN

239.11.4.10:5520 RTP Channel 1

239.11.4.11:5521 RTP Channel 2

OUTLOOK

Next steps



Open Broadcast Edge Cache Appliance

- Next Release: End of April
  - obeca-receive-process v1.1
  - obeca-gateway-process v0.9
  - obeca-application-process v0.9
- Development continues
  - Gateway process: issues to be solved
  - Application process: implement hybrid use-cases according to ORS trial phase 2 (several use-cases until 2023)
- Support interested parties using and contributing to OBECA, offer trainings and reference setups
- Current discussions with 5G-MAG to integrate the project under a 5G-MAG umbrella

5G OPEN BROADCAST EDGE CACHE APPLIANCE

ORS TECH TALK

Q&A SESSION

JOHANN MIKA - 27.4.2021

Johann

Stefan

Klaus

Christoph