



QoS & Mobility in Cognitive Communications (QMCC'11)

C-PMSE – Improving frequency utilization and coexistence for PMSE systems by cognitive procedures

Concept of the System Architecture

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A research project in co-operation of industry and science

Publicly sponsored by



C-PMSE Project - Data Sheet

Duration: 1.4.2011 – 31.5.2013 (26 months)

Budget: about 7.5 mil. € (about 4.5 mil. € gov. funding)

Partner:

- beyerdynamic
- eesy-ID
- RF mondial
- Robert Bosch
- Sennheiser
- Institut für Rundfunktechnik
- University Nuremberg-Erlangen
- University Bochum
- University Hannover

Project Office: Robert Bosch (project lead)
Sennheiser (consortium lead)

Publicly funded by German Ministry of Economics and Technology (BMW i)

Project Management Agency: German Aerospace center (DLR)

PMSE – Programme Making Special Event

Definition for PMSE

- Services Ancillary for Programme-Making (SAP)
- Services Ancillary for Broadcasting (SAB)
- Electronic News Gathering (ENG) and Outside Broadcasting (OB)

As defined in ERC Report 38 and ERC Report 42 (see also ITU-R Report BT.2069 and ECC Report 002) including wireless production tools used for front-end solutions (audio, video, data) in the field of professional multimedia production (from radio and television to art, culture, conferences, trade fairs, entertainment applications, education, sport events and much more).

Examples for PMSE Components:

- Video cameras
- Microphones
- In-ear monitors
- Conference systems
- Intercom devices
- Data links (e.g. for remote control)



Challenges

Spectrum Scarcity (PMSE operates mainly in 470-862 MHz)

- Digital Dividend in Germany: PMSE lost 72 MHz of spectrum, 790-862 MHz
- (Digital Dividend II: Under discussion for Public Safety Services and other)
- More Digital TV (DTV) Transmission: DVB-T and DVB-T2 in parallel
- PMSE: more events, more productions, higher quality in video and audio

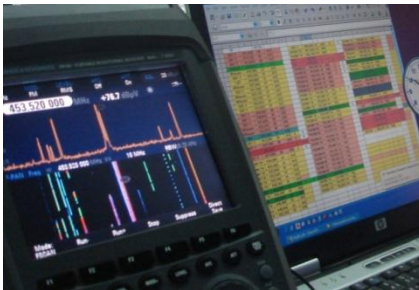
Existing Coexistence of PMSE with

- Analogue / Digital TV Transmission
- Cellular Mobil Services
- Radio Astronomy
- Other PMSE
- New challenges:
 - New kinds of TV Band Devices (ECMA-392, IEEE 802.11af) ?
 - TV White Space Devices ?

Objectives of C-PMSE Project 1/3

R&D on the cognitive system and procedures for PMSE

- Development of system components, like antennas, scan receiver, scan controller, cognitive engine, data base and so on.
- Measurement- and test procedures as well as channel-, interference- and co-existing models as reference for the standardization and regulation activities



Objectives of C-PMSE Project 2/3

Field trial platform

- Setting up a field trial platform for cognitive PMSE applications at the fair grounds of Messe Berlin
- Technical and economical proof of concept of the cognitive methods for PMSE
- Realizing an open and modular R&D platform for future research



Objectives of C-PMSE Project 3/3

Frequency regulation and standardization

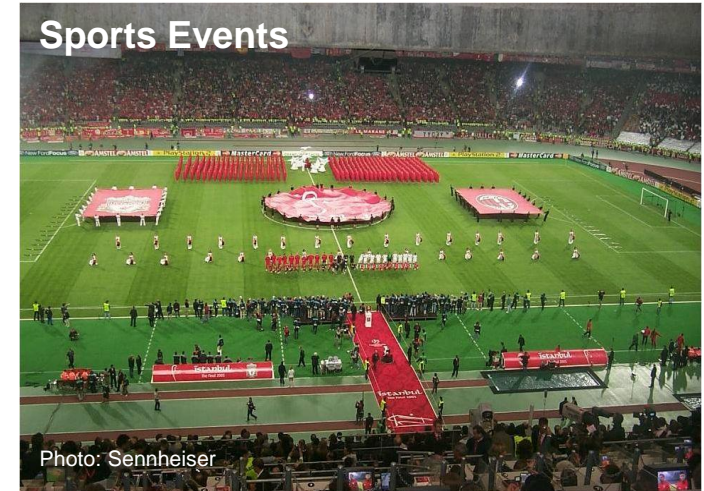
- Setting up a forum to discuss and prioritize necessary actions concerning cognitive PMSE on national, European and worldwide level
- Active collaboration in meetings of ITU, ETSI, CEPT/ECC and Bundesnetzagentur by using the project results and the preparatory work of the Specialist Task Force ETSI STF 386



Use Cases of the C-PMSE System

Covering:

- **frequency utilization models** (primary, secondary),
- **type of installations** (fixed, nomadic, mobile) and
- **size of installations.**



Electronic News Gathering (ENG)



Requirements of the C-PMSE System

Automation of the frequency utilization within the assigned frequency spectrum

- Adjustable system parameter for the frequency utilization, free-/occupied recognition, adaptable transmission parameter during operation, compatible with traditional frequency access mechanisms (duty cycle, detect and avoid, listen before talk, ask before talk, ...)

Securing a coordinated coexistence of different user in the same frequency range

- Coexistence with a traditional PMSE systems and with other CR Systems, avoidance of interferences, continuous quality surveillance of the transmitted signals, surveillance of the frequency spectrum condition, emergency management in case of frequency interferences

Efficient frequency utilization

- Increase of the efficiency of frequency utilization and frequency allocation compared to traditional PMSE-systems

Scalability to cover all use cases

- Modular system concept

Basic Architecture and Principle of Operation

Geo-location Database

Frequency allocations from national administrations (low dynamic) and registrations for frequency bands from users directly or spectrum broker (high dynamic)

C-PMSE System

Base station and wireless components

Scanning Subsystem (optional)

Shared Scanning receiver network, Shared Local Radio Environment Map

Local Spectrum Portfolio Management (optional)

Proxy for the C-PMSE system

Scope of the Project

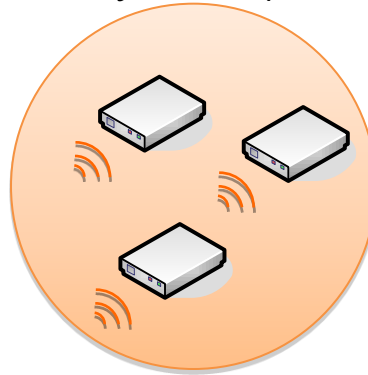
C-PMSE Operation – Case A

Step 1 & 2:

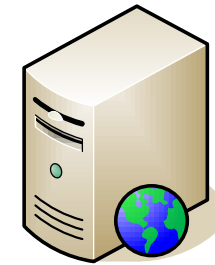
Ask for available frequencies
at system location at a certain time.

- GDB access by internet or manually

Scanning
Subsystem (SCS)



Geolocation
Database (GDB)



1. Ask

2. Info



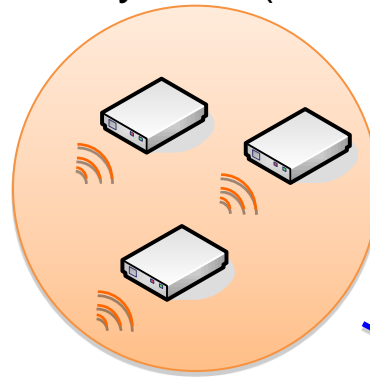
C-PMSE Operation – Case A

Step 3 & 4:

Scan the available frequencies and select the best to be used.

- Scanning can be done by external/internal scanning receivers or manually

Scanning
Subsystem (SCS)



Geolocation
Database (GDB)



3. Ask
4. Info

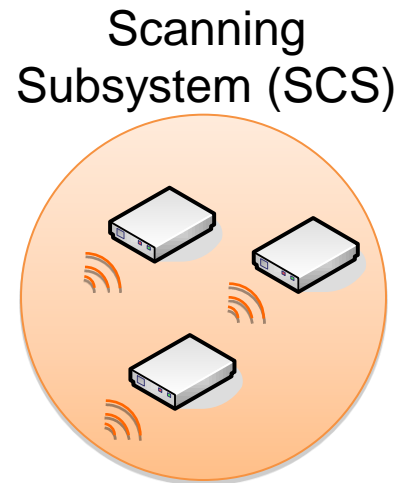


C-PMSE Operation – Case A

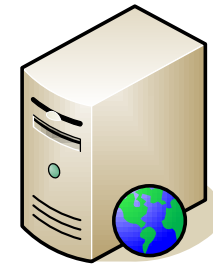
Step 5 - 7:

Register frequencies and start operation.

- Registration will be done for a certain location and duration of time



Geolocation Database (GDB)



5. Register

6. Grant



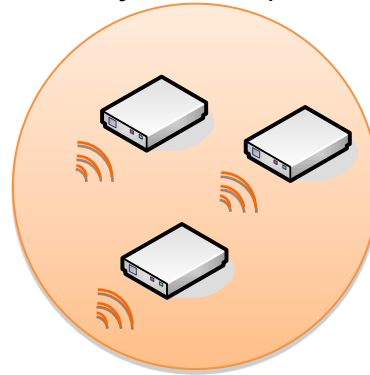
7. Configure & Operate

C-PMSE Operation – Case A

Continuous operation:

Check continuously against interferences and reconfigure if necessary.

Scanning
Subsystem (SCS)



Check
Info

Geolocation
Database (GDB)

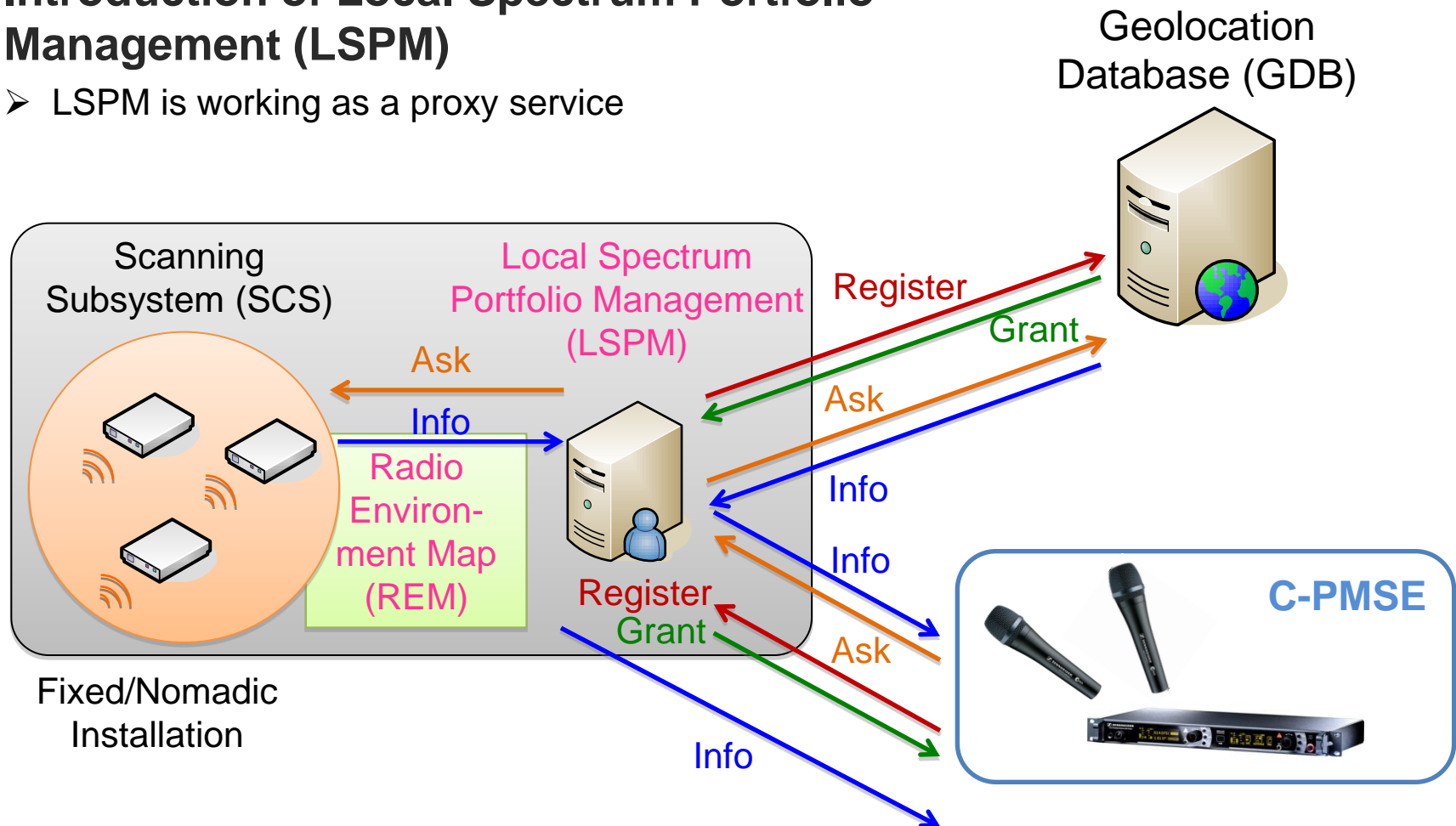


Reconfigure if necessary

C-PMSE Operation – Case B

Introduction of Local Spectrum Portfolio Management (LSPM)

- LSPM is working as a proxy service

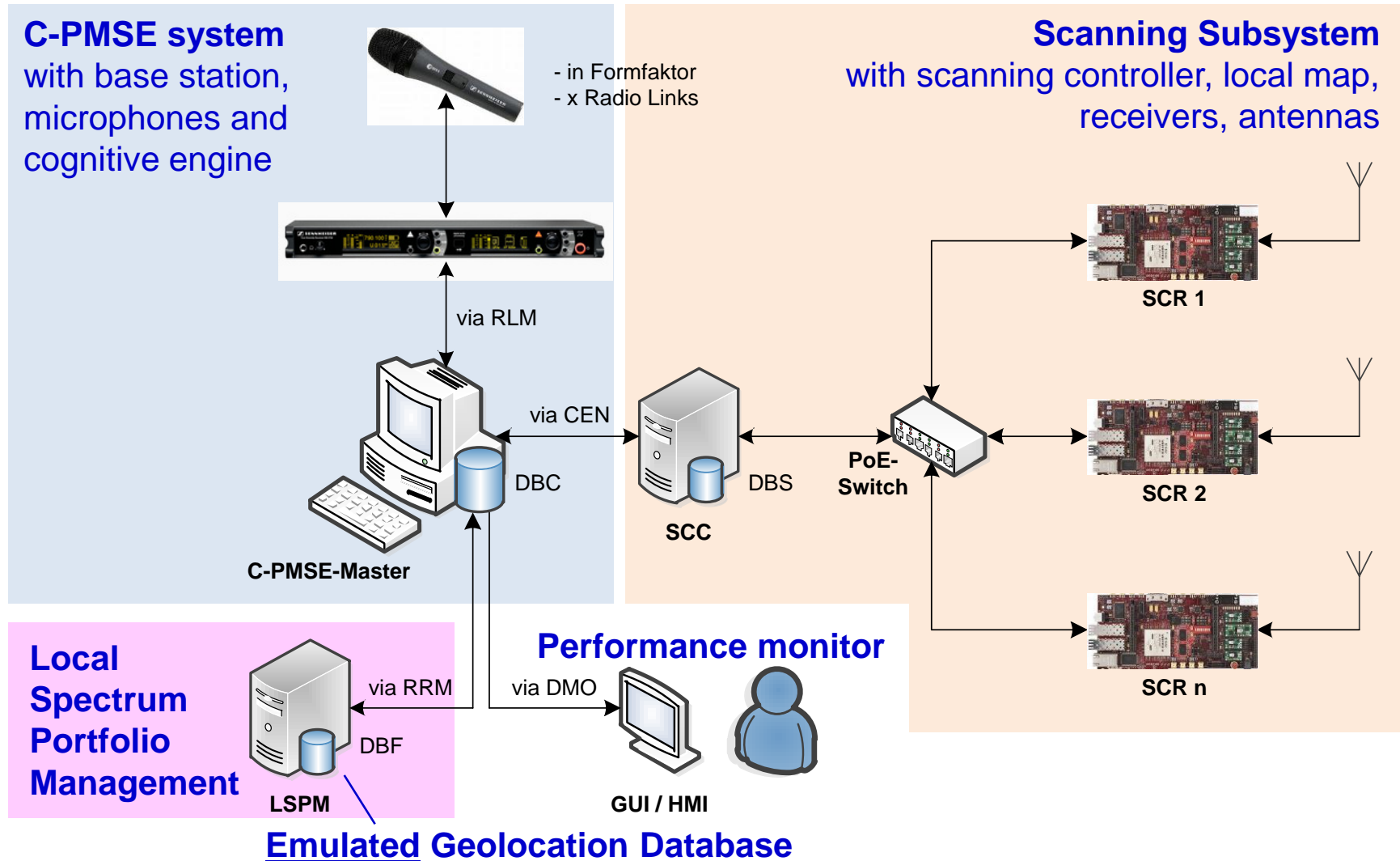


Field Trial Platform – Location at „Messe Berlin“

- The C-PMSE system will be installed in Hall 18 yellow circle
- The scanning subsystem area for a potential interferer will cover the red circle (three halls and outside area)



Field Trial Platform – System Overview



Characteristics of the C-PMSE System Concept

- Acknowledges and integrates solutions currently proposed in research and standardization & regulation
 - Geolocation Database (GDB) / Spectrum Broker ← Spectrum Access
 - Scanning Subsystem (SCS) ← Shared Spectrum Quality and Risks (opt)
 - Radio Environment Map (REM) ← Shared Local Spectrum Information (opt)
 - Local Spectrum Portfolio Management (LSPM) ← Shared Local Management (opt)
 - PMSE registration among other secondary users (in exchange for priority)
 - “Safe Harbor” channels, especially required for mobile or ad-hoc PMSE operation
- Compatible with existing PMSE systems
- Provides a future proof product development path by meeting all use cases, providing modularity, scalability and potentially enables new spectrum sharing scenarios

Questions?

Workshop on the Concept of Cognitive PMSE Systems
December 7, 2011 - Berlin, Germany

Registrations still possible at:
www.c-pmse.research-project.de

Acknowledgement

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