Implementation of a Communication Protocol between a Geo-location Database and TV White Space Devices

4th Workshop of IC0902 Action, Rome, October 10th, 2013
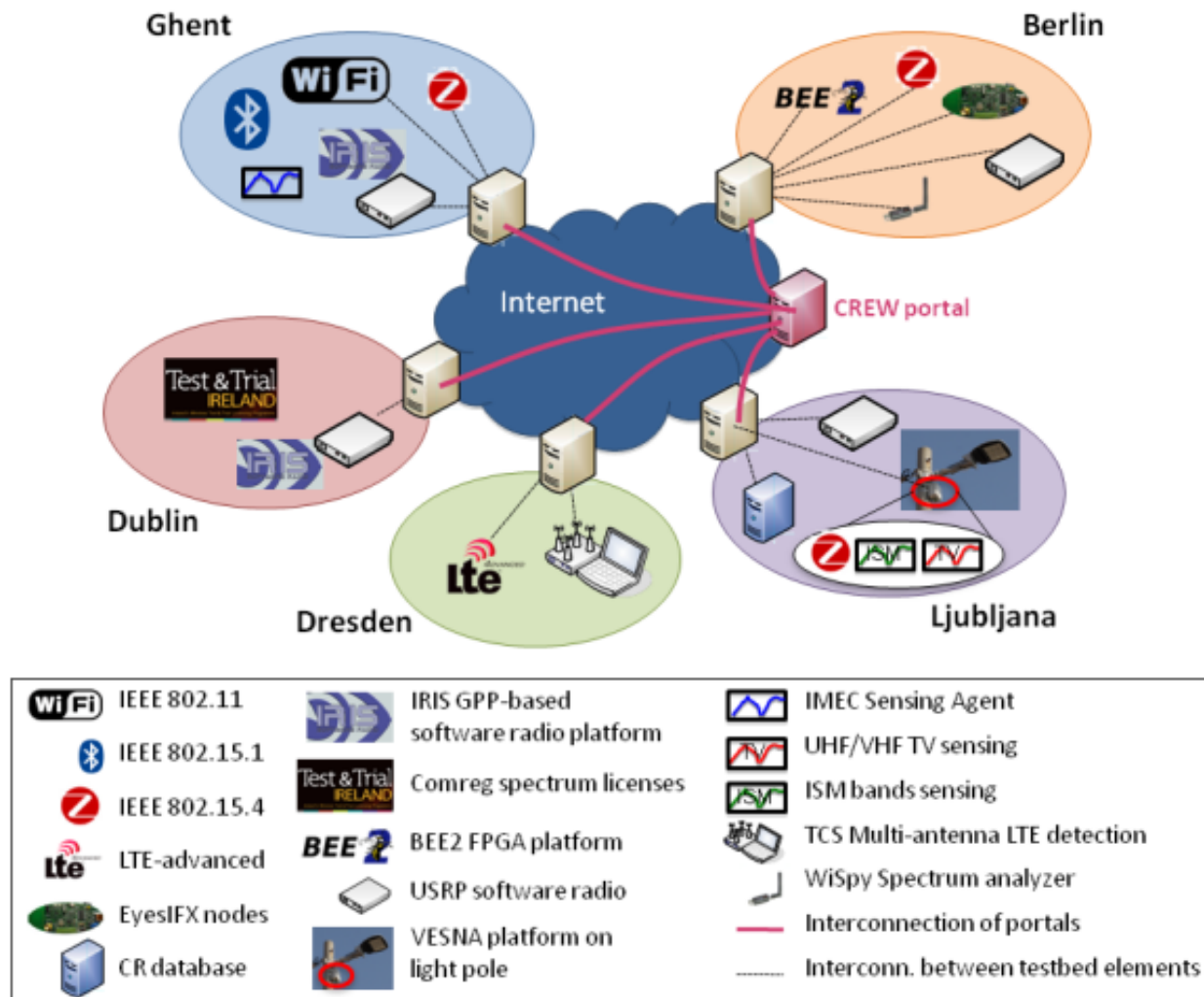
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- Motivation
- Problem Statement
- Proposed Solution
- Implementation and Demo
- Future developments

- CREW – Cognitive Radio Experimentation World

- **TVWS transmission trials using CREW facilities**
  - Assess the benefits of combining a white spaces database with a distributed sensing network for wireless microphones.
 - LOG-a-TEC: An outdoor testbed located in Slovenia.
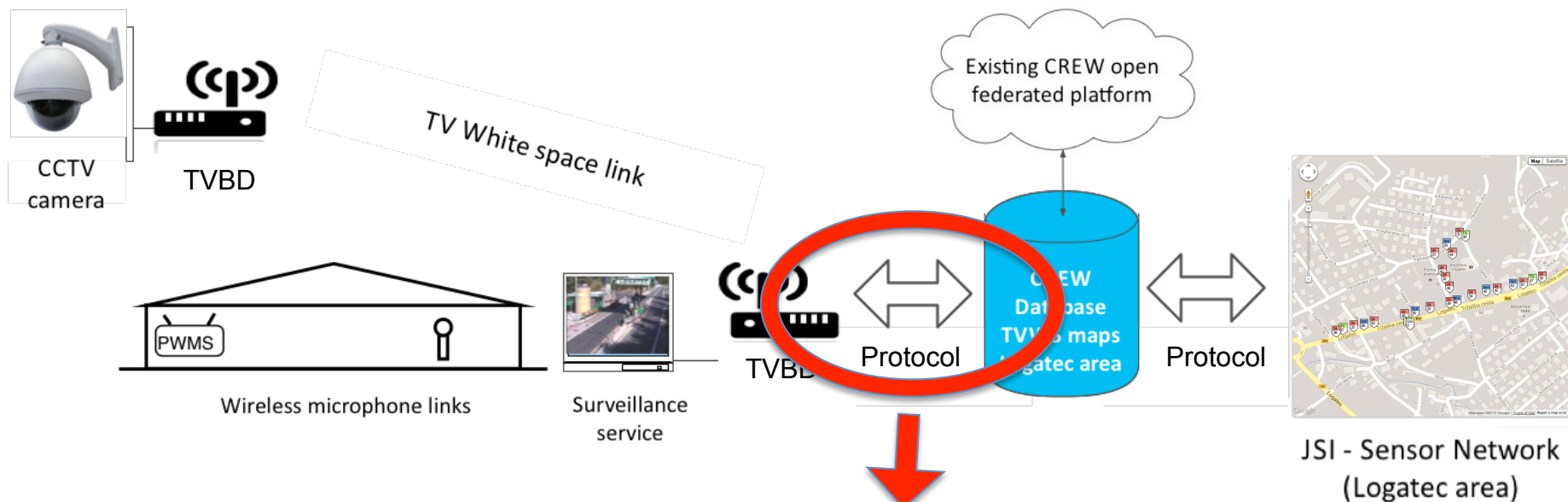
  - The TVBD queries the TVWS database for available channels.

■ Define a secure **communication protocol** for TV Band Devices (TVBDs) to access Whitespace Database (WSDB) services over the Internet.

White space link

Protocol

CREW
Database
TVWS maps

Ongoing research

- **Several organizations are working on this subject:**
  - **IETF** – Internet-Draft **PAWS** (2013-06)
    "Protocol to Access Spectrum Database"

  - **ETSI** - Draft ETSI EN 301 598 V1.0.0 (2013-07)
    "White Space Devices (WSD); Wireless Access Systems
    operating in the 470 MHz to 790 MHz frequency band;
    Harmonized EN covering the essential requirements
    of article 3.2 of the R&TTE Directive"

  - **ECC** - Report 186 (2013-01)
    "Technical and operational requirements for the operation of
    white space devices under geo-location approach "

Solution: Inspired from IETF PAWS
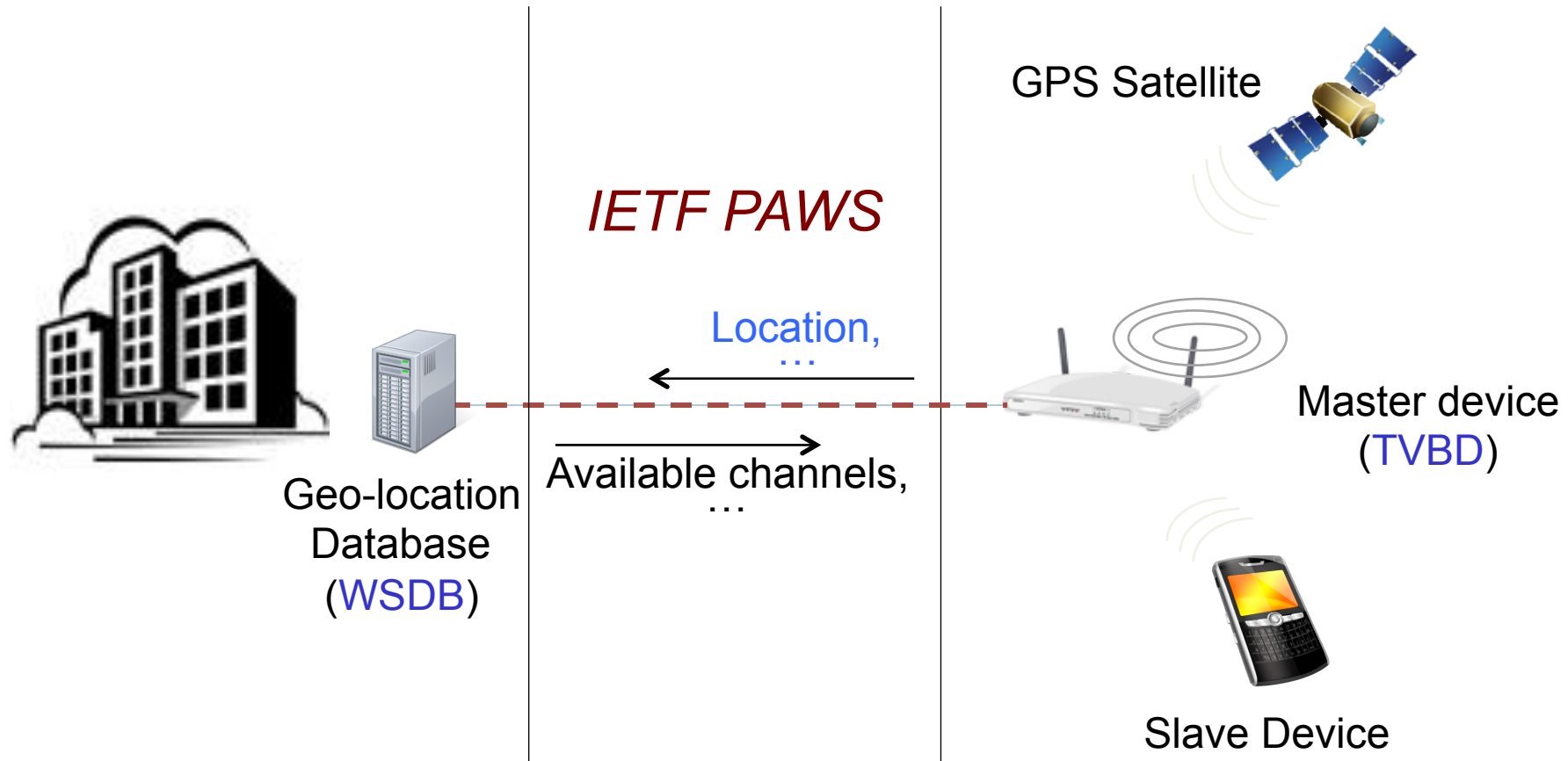
- The WSDB primary service is to provide a list of available channel to TVBDs

Protocol stack

■ **The Application Protocol uses the following protocol stack for communication between the WSDB and TVBD:**

- **Application Layer** : HTTPS

- **Presentation Layer** : XML

- Session Layer : Undefined

- **Transport Layer** : TCP

- **Network Layer** : IP

- Data Link : Undefined

- Physical Layer : Undefined
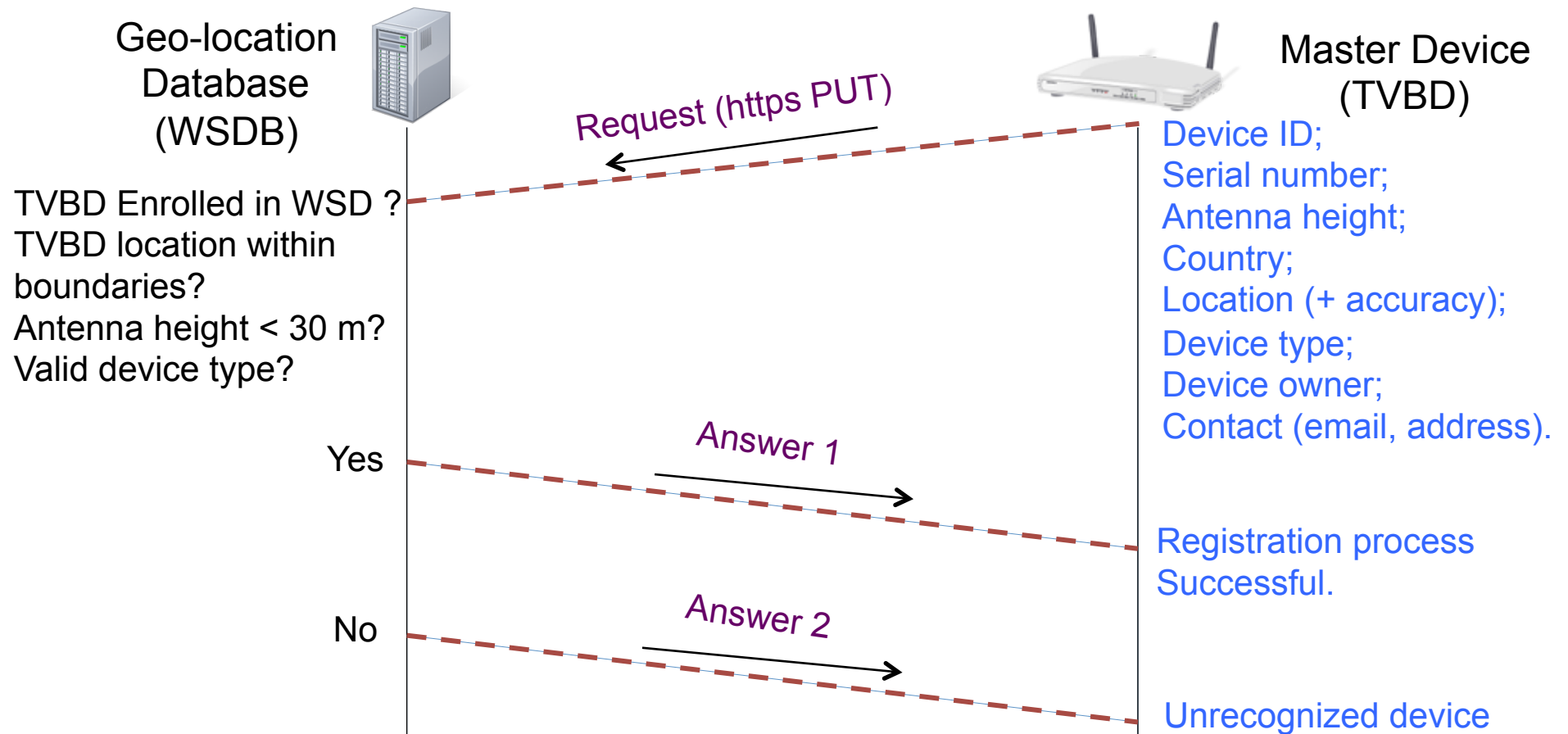
Protocol Requirements

- **The protocol must enable a TV band device to complete the following tasks:**
  - Connect to the database using a well-defined access method.

  - Register with the database using a well-defined protocol.

  - Provide its geo-location and other data to the database using a well-defined format for querying the database.

  - Receive in response to the query a list of currently available white space channels, maximum power and sensing requirements, using a well-defined format for the information.

- **Services not considered in the current implementation:**

  - Database discovery;

  - White space devices enrolment in the database.

Protocol Implementation

- **Three services are implemented between the WSDB and TVBD:**

  - Service 1: Registration

  - Service 2: Channel List Request

  - Service 3: ID Verification

- **Several timers are implemented and used by the protocol during operation:**

  - CLRP (1440 minutes): **Channel List Refresh Period**. The channel list must be refreshed at least once per day.

  - CRT (5 seconds): **Channel list Request Timer**.

  - VRT (5 seconds): **ID Verification Request Timer**.

  - RVP (90 days): **Registration Valid Period** (reduced to 60 seconds for demonstration purposes).

Geo-location
Database
(WSDB)

Master Device
(TVBD)

Request (https PUT)

TVBD Enrolled in WSD ?
TVBD location within
boundaries?
Antenna height < 30 m?
Valid device type?

Device ID;
Serial number;
Antenna height;
Country;
Location (+ accuracy);
Device type;
Device owner;
Contact (email, address).

Yes

Answer 1

Registration process
Successful.

No

Answer 2

Unrecognized device

- A successful registry will timeout, after a period of inactivity from the TVBD.

Service 2: Channel list request
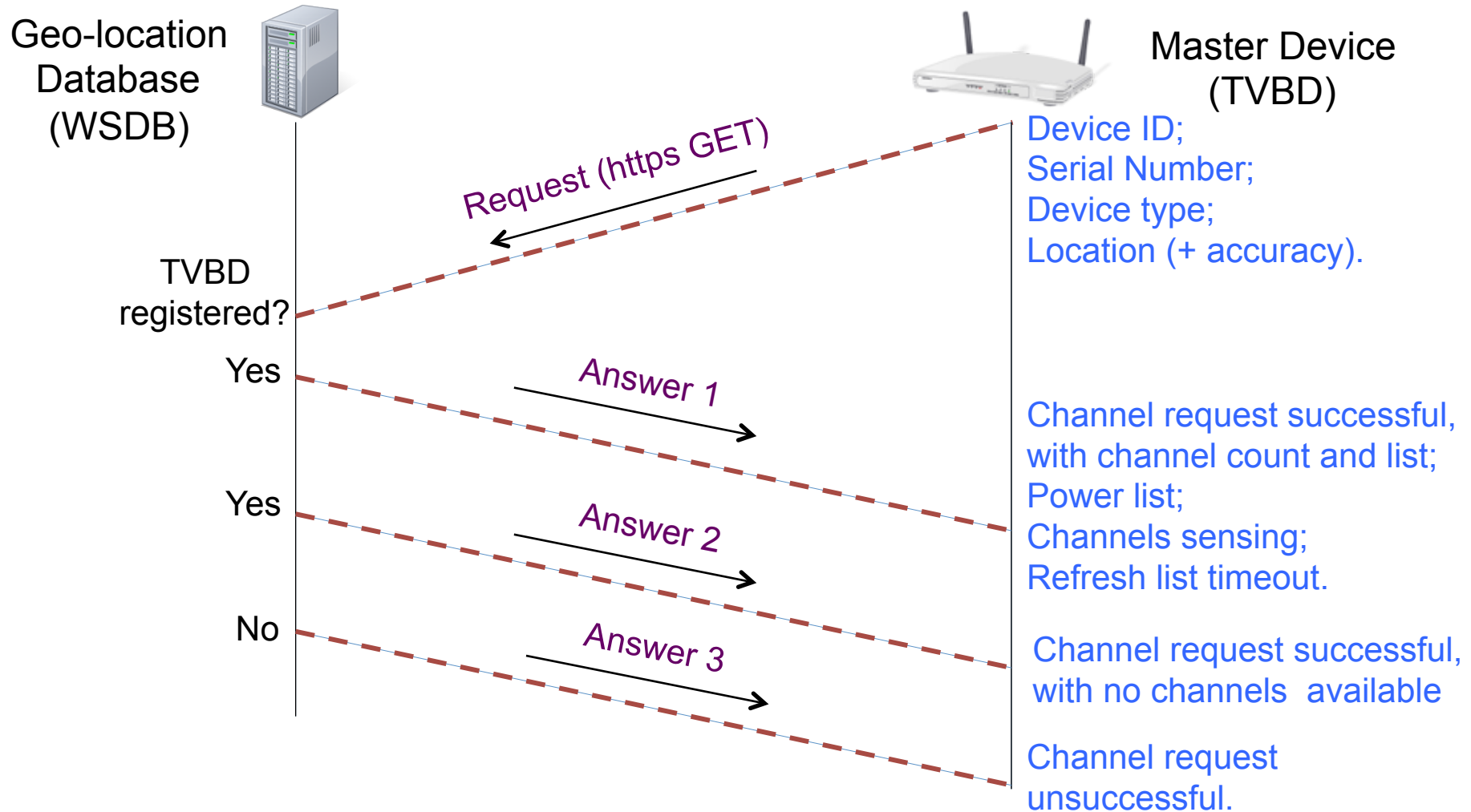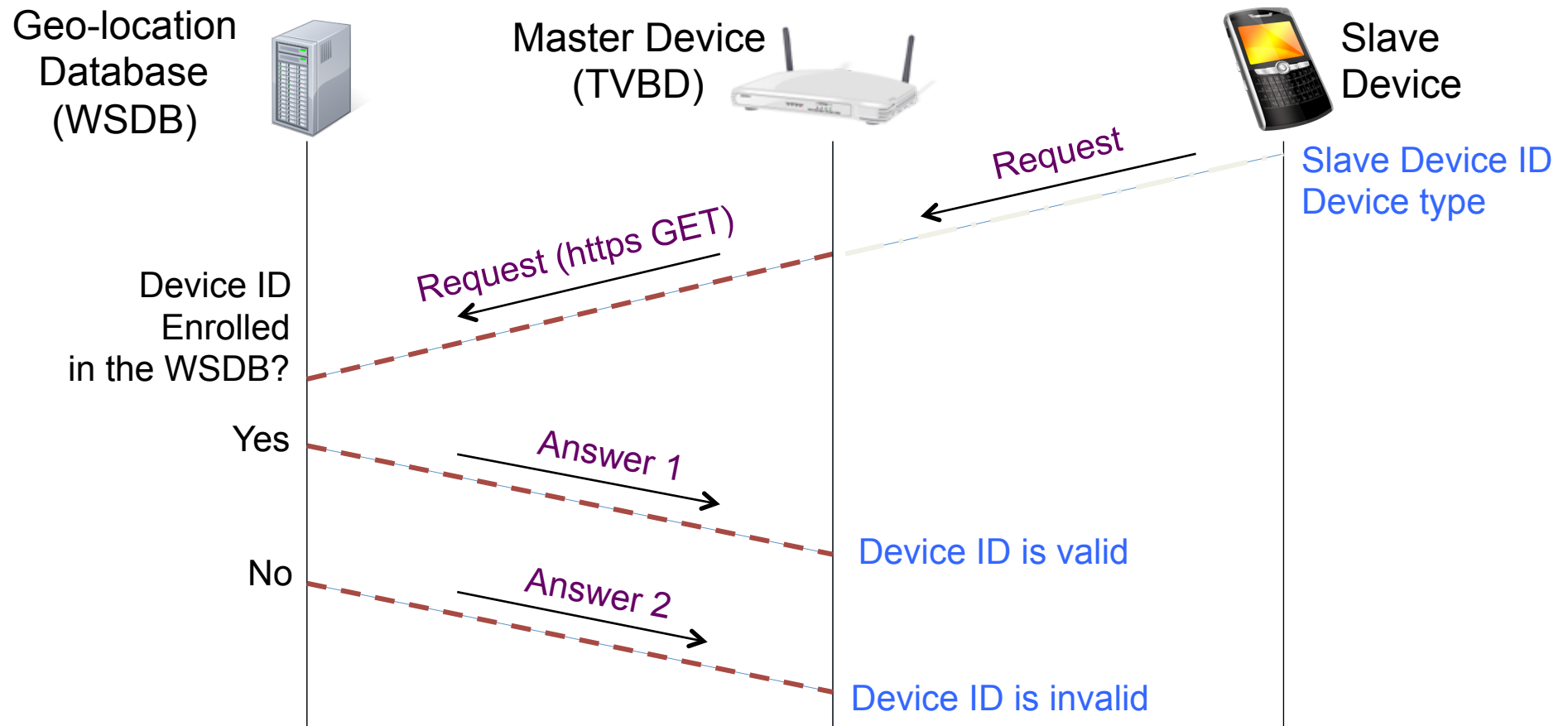
- The ID Verification Request, provides a method for TVBDs to verify the validity of slave TVBDs that are dependent upon a master TVBD for channel lists. The WSDB will respond whether a requested ID is valid or not.

Demo

Future work

- Implement additional functionalities from the present PAWS draft protocol, such as:
  - Database discovery;
  - "AVAIL_SPECTRUM_BATCH_REQ" (and response) – this message allows multiple locations to be specified (e.g. different location event or a circuit).
  - "SPECTRUM_USE_NOTIFY" – This is the message where the Master WSD informs the DB of the spectrum in use.

- Test the protocol in real scenarios (TVWS transmission trials in Slovenia).

Workshop Announcement

Future Networks 12th FP7 Concertation
RAS Cluster Meeting
22 October 2013, Brussels
Avenue de Beaulieu 25 – Room S1
13h00 – 17h30

Workshop
Worldwide perspectives in flexible spectrum use and opportunities for standardization

This workshop will bring together well-known speakers from both the radio access research and the standards communities. The main objective is to challenge the stakeholders on the introduction of dynamic spectrum sharing in Europe. Moreover the workshop will disseminate results of ongoing standardization work and opportunities for collaboration with the FP7 RAS cluster projects.

■ Keynote speakers:

- **William Lehr**, MIT (USA): Coordinating the disruptive wireless future;

- **Martin Weiss**, University of Pittsburgh (USA): A US perspective to evolutions in flexible spectrum use;

- **Hiroshi Harada**, NICT (Japan): Overview of cognitive radio developments in Asia

Acknowledgements

■ **CREW –** Cognitive Radio Experimentation World (FP7-258301)

http://www.crew-project.eu

■ **CRS-i –** Cognitive Radio Standardization-initiative (FP7- 318563)

http://www.ict-crsi.eu

THANK YOU FOR YOUR ATTENTION!
QUESTIONS ?