IEEE Standard 1900.4

Babak Siabi
IEEE Standard 1900.4

IEEE 1900.4

IEEE Standard 1900.4

Motivation

- Multimode reconfigurable mobile devices are increasingly being adopted within the wireless industry
- The choice among various supported air interfaces on a single wireless device is a reality today
- User devices and networks with Dynamic Spectrum Access capabilities are emerging
IEEE Standard 1900.4

Scope and Purpose
The standard defines the building blocks comprising:

- network resource managers
- device resource managers
- the information to be exchanged between the building blocks

To enable coordinated network-device distributed decision making.
IEEE Standard 1900.4

Scope and Purpose cont.

This will

- aid in the optimization of radio resource usage, including spectrum access control, in heterogeneous wireless access networks
- improve overall composite capacity and quality of service of wireless systems in a multiple Radio Access Technologies environment
IEEE Standard 1900.4

1900.4 Context

The field of application of this standard is a heterogeneous wireless environment that might include:

- Multiple operators
- Multiple radio access networks (RANs)
- Multiple radio interfaces
- Multiple Terminals
IEEE Standard 1900.4

1900.4 Context

CWN – Composite Wireless Network
OSM – Operator Spectrum Manager
NRM – Network Reconfiguration Manager
RAN – Radio Access Network
TRM – Terminal Reconfiguration Manager
F1, 2, 3, 2 – Frequency bands

CWN of operator A
OSM A
NRM A
RAN A

F1
Terminal X
TRM X

CWN of operator B
OSM B
NRM B
RAN B1
RAN B2

F2
F3
Terminal Y
TRM Y

CWN of operator C
OSM C
NRM C
RAN C

F4
Terminal Z
TRM Z

Legend:
- CWN – Composite Wireless Network
- OSM – Operator Spectrum Manager
- NRM – Network Reconfiguration Manager
- RAN – Radio Access Network
- TRM – Terminal Reconfiguration Manager
- F1, 2, 3, 2 – Frequency bands
IEEE Standard 1900.4

The heterogeneous wireless environment considered within P1900.4.
IEEE Standard 1900.4

Assumptions

The standard

- Does not specify MAC and PHY layers of RANs and Terminals
- Does not specify the way measurements are done
- Considers a heterogeneous wireless environment, including one or several CWNs
- Deals with reconfigurable terminals with or without multi-homing capability
IEEE Standard 1900.4

Reference use cases

- Dynamic spectrum assignment
  - Frequency bands are dynamically assigned to the RANs

- Example:
  - spectrum sharing, and spectrum renting between RANs
  - A new carrier is added for 3G access
  - A frequency band previously used for 3G is assigned to mobile broadband wireless access (e.g., IEEE 802.16e)
IEEE Standard 1900.4

Reference use cases

- Dynamic spectrum sharing
  - When different RANs and terminals dynamically access spectrum bands that are overlapping, in whole or in part
  - Should cause less than an admissible level of mutual Interference

- Examples:
  - Unlicensed secondary systems (e.g., IEEE 802.22) accessing licensed but locally unused VHF/UHF spectrum bands in an opportunistic fashion
  - Unlicensed wireless LANs (e.g., IEEE 802.11 in a possible future CR-like variant) accessing licensed but locally unused VHF/UHF spectrum bands in an opportunistic fashion
Reference use cases

- Distributed radio resource usage optimization
  - This is done at two levels: the network and terminals
  - The NRM, at the network level, derives radio resource usage constraints and evaluates them in order to meet a global objective (global network power minimization or load balancing)
  - Convey these radio resource usage constraints to the TRM via the RE
  - At the second Level end-user terminals optimize their use of radio resources (radio links, spectrum bands, and channels)
- Example: Users arrive/leave the CWN (changing the CWN context)
IEEE Standard 1900.4

The reference use cases for P1900.4
IEEE Standard 1900.4

System requirements

- Context awareness
  - entities on the network side and terminal side responsible for context information collection

- Decision making
  - Entity on the network side, the NRM
  - Entity on the terminal side, the TRM

- Reconfiguration
  - There shall be entities on network side and terminal side responsible for reconfiguration
IEEE Standard 1900.4

The P1900.4 system architecture

Terminal

Packet based core network
IEEE Standard 1900.4

The P1900.4 functional architecture
Thanks For Your Attention!!

Questions?