Re: [IEEE 802.16-12-0384-02-Gdoc]

Purpose:
[To instigate discussion regarding a new project for the IEEE 802.16 Working Group, and to propose a development on infrastructure-independent direct communications for proximity-based services]

Notice:
This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups. It represents only the views of the participants listed in the “Source(s)” field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.

Copyright Policy:
The contributor is familiar with the IEEE-SA Copyright Policy <http://standards.ieee.org/IPR/copyrightpolicy.html>.

Patent Policy:
The contributor is familiar with the IEEE-SA Patent Policy and Procedures:

Proximity based applications
(aforementioned in [1])

• What can we get with proximity based applications?
  – Cellular traffic offloading (or data content sharing)
  – Proximity based P2P (device/service) discovery feature
  – Proximity based social commerce and advertisement
  – Proximity based social networking service (gaming, chatting, etc.)
  – Etc.

• Current issues/trends of 3GPP LTE (ProSe)
  – Network controlled proximity service
    • Discussions on supporting proximity based service are active (D2D direct
discovery & local routing)
  – Proximity service for public safety
    • Out of BS coverage case
Proximity based applications via Direct Communication

• Why traffic offloading?
  – Expected exponential increase of mobile traffic

Source: Cisco VNI Mobile, 2012
Proximity based applications via Direct Communication

• Benefits of proximity based service
  – Public information service: MS initiates direct device/service discovery
Proximity based applications via Direct Communication

- Business model of proximity based service
  - Social commerce and advertisement: MS initiates device/service discovery
Thoughts on current 802.16.1/1a standard

• Can IEEE 802.16 GRIDMAN TG’s BS-controlled/talk-around communication support proximity based services?
  – 1) Cellular traffic offloading (Inter-BS data content sharing)
    • BS-controlled DC:
      – Limited to a single BS service area (not specifically defined for inter-BS case)
    • Talk-around DC:
      – Focused on voice application (low capacity)
  – 2) Proximity based P2P (device/service) discovery
    • BS-controlled:
      – No MS initiated proximity discovery
      – No support for device/service discovery in idle mode (before MS network entry)
    • Talk-around DC:
      – Not considered, no MS initiated proximity discovery
New amendments for 802.16 standard

• In order to support proximity based direct communication (DC) services in the current 802.16 standard, we need a new amendment (not a revision of GRIDMAN TG).
  – The intent of DC feature in GRIDMAN TG is primarily focused on enhancing the link reliability, not for proximate based services.
  – Undoubtedly, the GRIDNMAN’s schedule for sponsor balloting is approaching in a few months.
  – Therefore, the DC feature for supporting proximity based service needs a new approach/enhancement different from GRIDMAN’s.
New amendments for 802.16 standard

• Technically, we can think of two hierarchically top level ways
  – **a) BS dependent way**: D2D communication with the help of BS or network
  – **b) BS independent way**: let D2D communication do discovery, resource allocation, and scheduling independently. In addition, we can extend the coverage of proximity based services.

• In this contribution, we suggest **proximity based DC PHY/MAC protocols** as an 802.16 enhancement.
  – In this contribution, **we suggest infrastructure-independent mode**
  – In the other contribution (16-12-461-00-Gcon), BS dependent mode will be presented
New amendments for 802.16 standard

• The primarily focus is on BS-dependent DC. However, technically this feature extends to out of BS coverage (infrastructure-less) situation
  – Why not exploit the licensed band for out of BS coverage area cases?
  – Can setup D2D links where an MS is located out of BS coverage area (the corresponding pair is in the BS’s coverage)
  – Can apply to the case of infrastructure failure due to disasters
New amendments for 802.16 standard

• 1) Infrastructure-independent proximity based DC’s enhanced features:
  – Direct device/service discovery
    • Within BS coverage: BS assists finding peers
    • Out of BS coverage: devices independently finds peers
New amendments for 802.16 standard

• 1) Infrastructure-independent proximity based DC’s enhanced features: (cont.)
  – Out of BS service area case
    • Distributed synchronization
    • Distributed multiple access coordination
New amendments for 802.16 standard

- 1) Infrastructure-independent proximity based DC’s enhanced features: (cont.)
  - Out of BS service area case
    - Basic large link coverage
    - Multi-hop functionality
New amendments for 802.16 standard

• 1) Infrastructure-independent proximity based DC’s enhanced features: (cont.)
  – Power saving features
    • A fixed frame structure is preferred
  – Resource reuse
    • Spatial reuse with transmit power control
  – Possible interference [2-4] reduction by new frame structures
    • Non FDM based user resource allocation could be effective
  – To be added…
New amendments for 802.16 standard

• 2) Compatibility to current standard?
  – Backward compatibility with 802.16 OFDMA based standard? Yes
  – No change required for legacy 802.16m PHY/MAC specification, but some additional amendments for proximate DC PHY/MAC protocol.

• Amendment to the 802.16 could make above possible
  – A comprehensive standard of BS dependent DC for proximity based applications supporting use cases:
    • MS to MS associated with BSs
    • MS to MS, only one of the pair is associated with a BS
    • MS to MS not associated with any BSs (out of BS coverage)
Summary

• Quite a few proximity based direct communication use cases expect MS to trigger device/service discovery.
• Proximity based direct communication could be categorized with following situations:
  • MS to MS associated with BSs
  • MS to MS, only one of the pair is associated with a BS
  • MS to MS not associated with any BSs (out of BS coverage)
• Therefore, we need a new amendment of a comprehensive BS dependent DC to support such.
Proposal of new PAR & 5C for proximate direct communication (PDC)

• Need for a new TG
  – To fully support the aforementioned proximity based applications and new features currently unavailable in the latest 802.16.1/1a standard
  – To develop a distinctive infrastructure-dependent and/or infrastructure-independent direct communication standard with backward compatibility to existing 802.16 protocols
  – To define 802.16 enhancements to support proximity based direct communication.
Suggested Tentative Timeline for TG PDC

- Forward draft PAR and 5C statement to IEEE 802  Sept. 2012
- Submit PAR and 5C to NesCom  Nov. 2012
- TG formation (IEEE 802.16 WG #83)  Jan. 2013
- IEEE 802.16 WG #84  Mar. 2013
- IEEE 802.16 WG #85  May 2013
- IEEE 802.16 WG #86  July 2013
References


