802.16 Enhancements to Support Direct Communications for Proximity-based Applications

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Re: Unsolicited contribution intended for Project Planning Committee

Base Contribution: None

Purpose: To instigate discussion regarding a new project for the IEEE 802.16 Working Group, and to propose a development of study report on direct communications for proximity-based services

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Introduction

• Trends of Recent Mobile Wireless Networks
  – Almost close to the Shannon limit
  – Studies and proposals on enhancing spectrum utilization
    • Multi-tier networks, multi-RAT networks, D2D, etc

• Trends of Recent Mobile Services
  – Proximity Aware Services
    • Most of mobile users are interested in sharing what they
      have/think/do with someone being NEAR ME(themselves) NOW.
    • Highly frequent packet deliveries between proximal devices
      necessitate exploiting direct communications.
    • Social networking services, social commerce and advertisement, etc
  – P2P and Content Distribution Services
    • Packets do not always need to be delivered through CSN.
    • File sharing, local cloud services, personal broadcasting, etc
Introduction

• **What is Direct Communication?**
  – Transmitting directly from a source device to a destination device without its relay by an intermediate node(s) if they can reach each other (i.e., make a direct link between them)
Introduction

• Why Direct Communication?
  – Has been studied and proposed as an efficient communication method b/w proximal devices
  – The followings are introduced as benefits of DC
    • Performance enhancement
      – High data rate, low transmission latency, low power consumption
    • Better utilization of radio resource
      – Resource reuse b/w direct links or b/w a cellular link and a direct link
      – Use of a single link instead of occupying two links (one for uplink and another for downlink) \(\rightarrow\) cellular traffic offloading
    • Efficient direct discovery and relative localization
      – Easing load spurred by location information delivery from/to the server
      – Low discovery/relative-localization latency
Use Cases

• Social Networking Services
  – Justin wants to find someone around himself to have lunch together in no time.
  – He directly discovers Eric being in close proximity via the SNS application, and directly sends a message to him.
Use Cases

• Social Commerce and Advertisement
  – Justin watched an ad on brand-new basketball shoes, Nike LEBRON 9, and he has added it into his wish list.
  – Justin passes by shopping mall, and Nike store directly discovers Justin interested in the goods sold there.
  – The store directly sends an ad message to him.
  – He gets the ad message popped up, and stops by Nike store.

Nike discovers Justin in local vicinity, who has added LEBRON 9 in the wish list, so it sends an ad message to him with its discount coupons.

Justin gets a pop-up message about sales promotion from Nike in close proximity.
Use Cases

• Augmented Reality (AR) Services
  – Eric would like to find nearby coffee shops to take a rest.
  – He turns on an AR application providing coffee shop information in local vicinity.
  – He can be aware Starbucks, Tim Hortons, and Dunkin Donuts are being proximal to himself by the AR application employing direct relative localizations to them.

Eric can search nearby coffee shops by using AR applications exploiting relative location between him and each shop
Use Cases

• P2P and Content Distribution Services
  – Local Cloud Services
    • The data synchronization or backup autonomously works among paired devices via the direct communication links between them if they are proximal to each other.
  – Personal Broadcasting
    • A user can directly stream audio or video to friends in local vicinity so as to share his/her interests with them.
  – Concert Guide Services
    • Programme or further information related to music played now can be directly provided to audiences participating in the concert.
Are there any similar standards in IEEE 802?

- YES, some WG/TGs are developing standards which support DC technologies.
  - IEEE 802.15.8 TG
    - Peer Aware Communications (PAC) in WPAN
    - Infrastructure-less communications
    - Target data rate is 10 Mbps
    - Unlicensed/licensed bands below 11 GHz
  - IEEE 802.16 GRIDMAN TG
    - BS-controlled/infrastructure-less direct communications in WMAN
    - Voice service for public safety & data service for Smart Grid
    - Licensed bands for WirelessMAN radio interface
What are Required More?

• Potential requirements to support BS-controlled DC for proximity-based applications
  – Wide coverage
  – Scalability for many devices
  – Efficient link/resource/interference management by BS
  – High data rate
  – Coexistence with cellular air interface

• Key technical features
  – Direct discovery and identification
  – Direct relative localization
  – Direct communication via a direct link
  – Security for direct communication
  – Multicast transmission via direct links
Proposals

• To start study on BS-controlled direct communication for proximity-based applications in PPC as a new study item of IEEE 802.16 WG
  – Necessities & Feasibilities
  – Differences from DC being developed in other WG/TGs
  – Technical challenges for supporting DC
  – Requirements & Standard impacts
  – If possible, issuing Call for Contributions on these items in Session #80 is preferred.