LTE Direct: Operator enabled proximity services

LTE “Native” Device-to-Device Solution
Uses LTE spectrum, and network; Candidate feature in 3GPP R12

“Always-ON” Privacy Sensitive Discovery
Autonomously discovers 1000s of relevant devices/services in a battery–efficient way

Enables New and Enhances Existing Apps/Services
Differentiated app/services enabled by proximate discovery; Opportunities for operators to monetize

Next-Gen Solution for Emergency Services
Robust; Cost-effectively leverages commercial LTE infrastructure and ecosystem
All devices broadcast their needs/services via “Expressions”
Services are passively identified (no user intervention)
Relevance is determined
Communication with the desired service
LTE Direct is integral to LTE

Uses LTE Uplink

- For discovery and optionally also for communication

Leverages LTE Infrastructure

- LTE network used for configuration and authentication
- Communication can be either through network or direct device to device (PS only)

LTE Direct (ProSe) work progressing well as part of 3GPP release 12
LTE Direct Discovery

Two Expression Types Defined

- Open Expressions are mapped one to one in a tree structure
  - Mapping maintained in a well known Expression Name Server (ENS)
- Restricted Expression mappings is based on a one-way hash function with a private key
  - Permissions controlled via applications
- Expressions Names are mapped to binary ~200 bit Expression codes

Open Expressions

- Shirt Sale at GAP
  - Well-known mapping
  - 11001111………..1011

Restricted Expressions

- Jane@google+
  - Association function
  - 00111001………..0101
Why a New D2D Discovery Technology?
Serious existing impediments to mainstream consumer adoption

**Huge consumer adoption costs**
- Privacy (Location Tracking)
- Battery Life (Constant ping to network)
- Signalling cost to the network

**Breadth of discovery value limited**
- Proprietary ASP specific networks

**Cloud/OTT Based**

**WiFi Direct / BTLE**

**Discovery not feasible at scale & density**
- Lack of synchronization – power inefficient
- Multi-step discovery

**Range & battery limitation**
- Not feasible for many use cases
LTE Direct: Next gen solution for Public Safety services

Robust Communications for Mission Critical Applications

- One-to-Many D2D broadcast
- One-to-One D2D unicast
- Out-of-coverage synchronization
- Out-of-coverage relay (not in R12)
- Commonality of PHY design with LTE PUSCH and commercial D2D discovery
Why a New D2D Communication Technology?

Serious existing impediments to mainstream consumer adoption

Do not “naturally” fit into a LTE system
• Hard to manage interference btn D2D and WAN

Commercial implementation
• Different signal and protocol design makes a common implementation on commercial UEs much harder

Existing D2D solutions for PS

Other D2D solutions (WiFi/Bluetooth)

Much shorter range
• At least 20 dB lower link budget than LTE D2D target

Not designed to be robust
Thank you

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