D2D communication for commercial use cases

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Motivation (1/2)

A number of commercial use cases could benefit from D2D operation (and specifically from the sidelink relay procedure):

- To minimize power consumption of devices in bad coverage
- To increase data rates of devices at cell edge allowing a more uniform user experience
- To increase network capacity via the realization of short range hot spots and via network offloading

Only in-coverage operation under network control (and using licensed bands) is assumed

Motivation (2/2)

Support for MTC devices:

- Transfer of UL/DL data for MTC devices via a relay UE to optimize power consumption
- Wearable devices could connect via PC5 to a smartphone (relay UE) and then to the network

Support for MBB applications:

- Relay UEs may be used to realize low range hotspots for MBB applications
- Network offloading via PC5

MTC devices could connect to the network directly or via a relay UE

Wearable devices could connect to the network via a smartphone

MBB hotspot via a relay UE

Work Item scope

One main assumption is that all the devices are in coverage:

- All UEs read system information from the eNB
- Paging and other control signaling (common and dedicated) are directly received from the eNB

However, cell-edge / bad coverage UEs suffer from low throughput and high power consumption:

- Data transmission is then relayed via a relay UE

Compared with the Rel-13 D2D communication solution for Public Safety use cases, commercial scenarios require support for higher data rates, capacity and reliability:

- L1/L2 improvements are needed for sidelink unicast communication

The feature should not require additional functionalities outside E-UTRAN:

- New signaling procedures need to be handled in the AS layer

Sidelink unicast communication enhancements

Objective:

- Power efficiency, higher data rate and reliability

Basic ideas:

- Instead of fixed number of transmissions, the transmitting UE may receive the ACK/NACKs from receiving UE to determine whether a re-tx should be performed
- The transmitting UE may adjust its MCS and transmission power used for sidelink communication based on the feedback from receiving UE

Specification impact:

- AM mode sidelink transmission / HARQ feedback
- Adjustable MCS and transmission power control
- Sidelink quality measurement and feedback

Signaling procedures (connection to a relay)

Uu link PC5 link

Objective:

- Better network control for simultaneous PC5 and Uu connections for remote UEs

Basic ideas:

- Remote UEs keep their IP address and remain directly reachable by the network. Control signaling is received from the eNB. Remote UEs connect to a relay UE for UL/DL user plane data transfer.
- AS layer access control and admission control to support massive connections from MTC devices

Specification impact:

- Enhancements to PC5 signaling procedures, with AS layer access control and admission control
- eNB aware PC5 connection setup and parameter configuration (eNB should record the routing info for the remote UE so that when a DL data packet arrives for the remote UE, it should route it via the corresponding relay)

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Network offloading via PC5

Objective:

- Power efficiency and capacity enhancements

Basic idea:

- The network may perform path selection and path switch between Uu and PC5 based on UE request

Specification impact:

- Network controlled signalling procedure design for path switch
- Sidelink quality measurement configuration and report to aid the path switch
- PC5 based network offloading indication to the Core

Path switch between D2D and WAN

Path switch from WAN to D2D

Overview of the objectives

Sidelink unicast communication with higher data rate and reliability:

- AM mode sidelink transmission / HARQ feedback
- Adjustable MCS and power control optimizations
- Sidelink quality measurement, measurement configuration and report
- Enhancements to PC5 signaling procedures
- Network controlled PC5 connection setup and parameter configuration

Network offloading

- Network controlled path selection and switch between Uu and PC5 and related signaling procedure design
- Network offloading indication to the Core

Thank you

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