3GPP TSG RAN Meeting #70
Sitges, Spain, 7th – 10th December 2015

RP-151946

Motivation for WI on D2D based MTC

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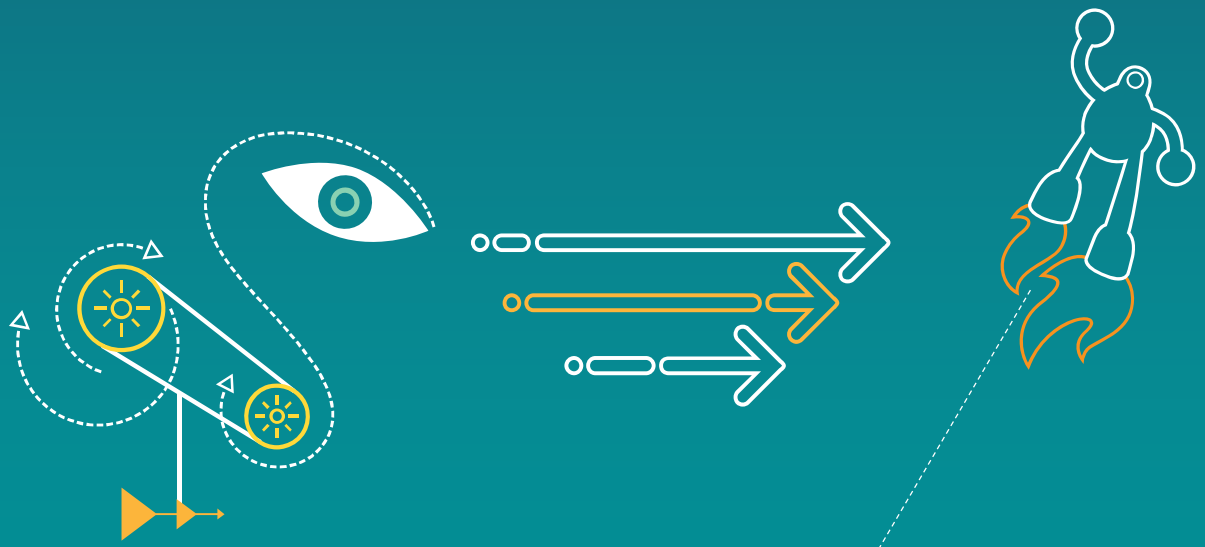


Motivation

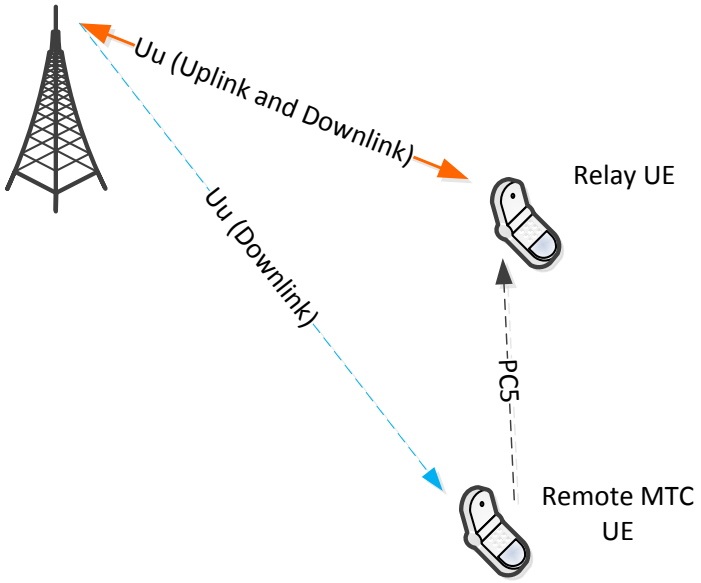
Power efficient link budget enhancement

- Massive TTI bundling is required for deep coverage MTC support
  - Massive TTI bundling can lead to significant power penalty
- D2D relay can save resources and power by avoiding TTI bundling
- Unidirectional D2D link between MTC UE and Relay UE for uplink
  - Relay only UL data from Remote MTC UE.
  - Zero additional device cost for Remote MTC UE
- Bidirectional D2D link between Remote MTC UE and Relay UE.
  - Relay UE is utilised to relay both UL and DL data to/from Remote MTC UE.

Unidirectional D2D Relay for Uplink data

Power efficient uplink link budget enhancement

- Focus on uplink link budget enhancements
- Objective
  - Minimize additional device complexity
  - Make D2D transmissions more reliable
    - Minimize changes to physical layer
- Basic Idea: Remote UE uses D2D relay for uplink data but receives downlink using WAN
  - Can use RLC level Ack to get more reliability



Cost Consideration + RLC Level Ack

In-band D2D transmission comes for free

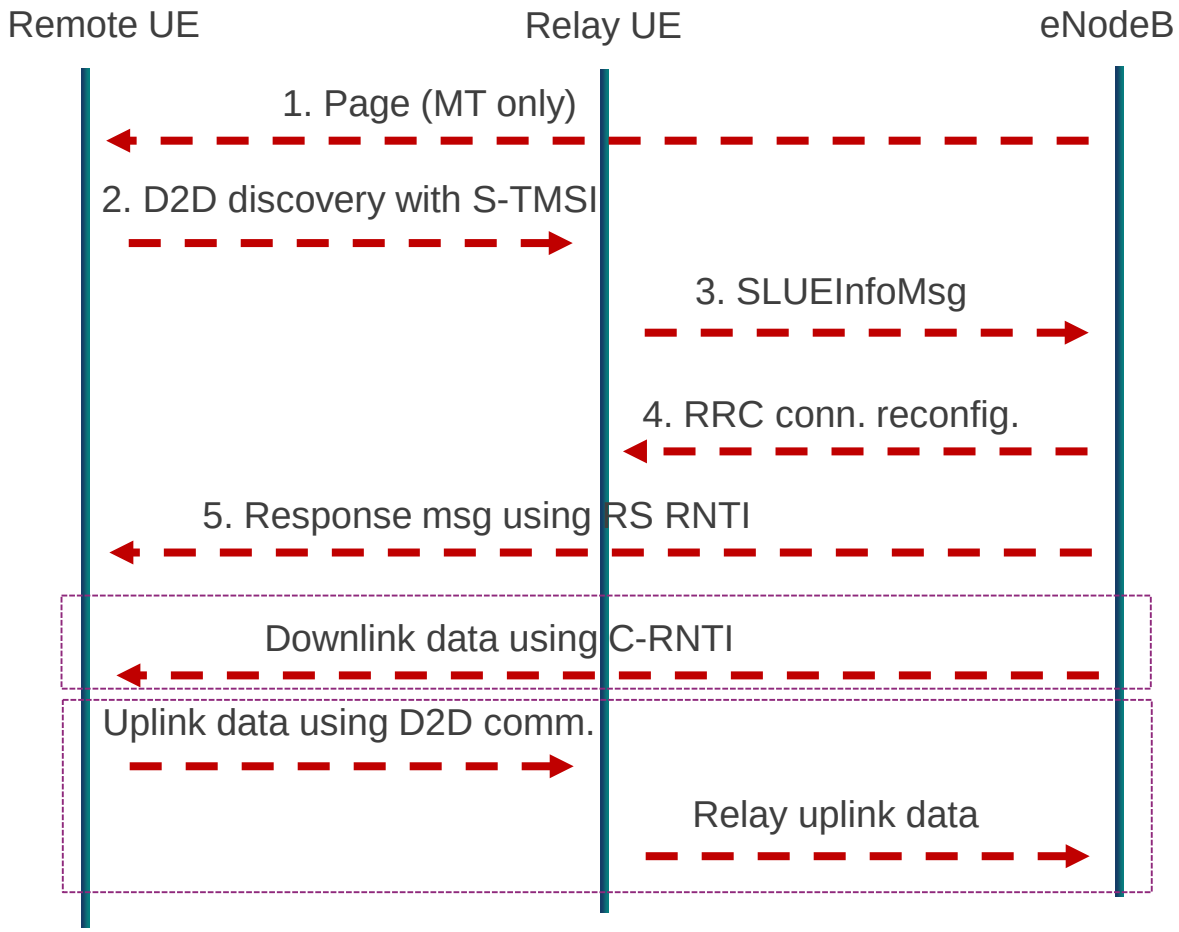
- Several configurations possible – different Remote UE cost

Remote UE cost	FDD	TDD
D2D & WAN co-channel, i.e., same carrier	D2D-Tx: Free D2D-Rx: Adds cost	D2D-Tx: Free D2D-Rx: Free
D2D & WAN not co-channel, i.e. different carrier	D2D-Tx: Adds cost D2D-Rx: Adds cost	D2D-Tx: Adds cost D2D-Rx: Adds cost

- Co-channel D2D & WAN relay design with remote UE only transmitting
  - Relay UE still needs to rx on D2D
- Can introduce RLC level ACK using RLC AM mode over D2D comm.
  - RLC AM information is encapsulated on the relay link
- Layer 2 Relay to assist uni-directional relaying.

Connection Setup -- Timeline

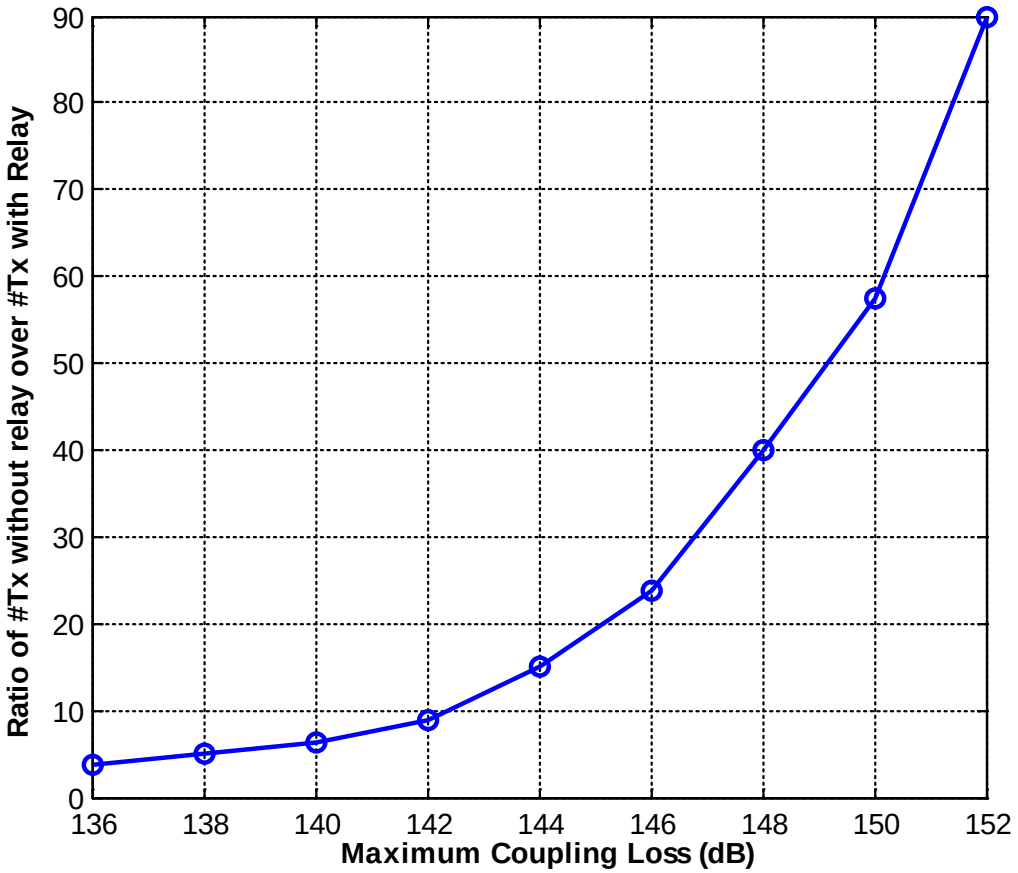
Both for mobile originated (MO) and mobile terminated (MT) cases



- L2 based relay
- Message 5 is sent using a reserved "RS-RNTI"
- Contains C-RNTI and Relay L2 ID

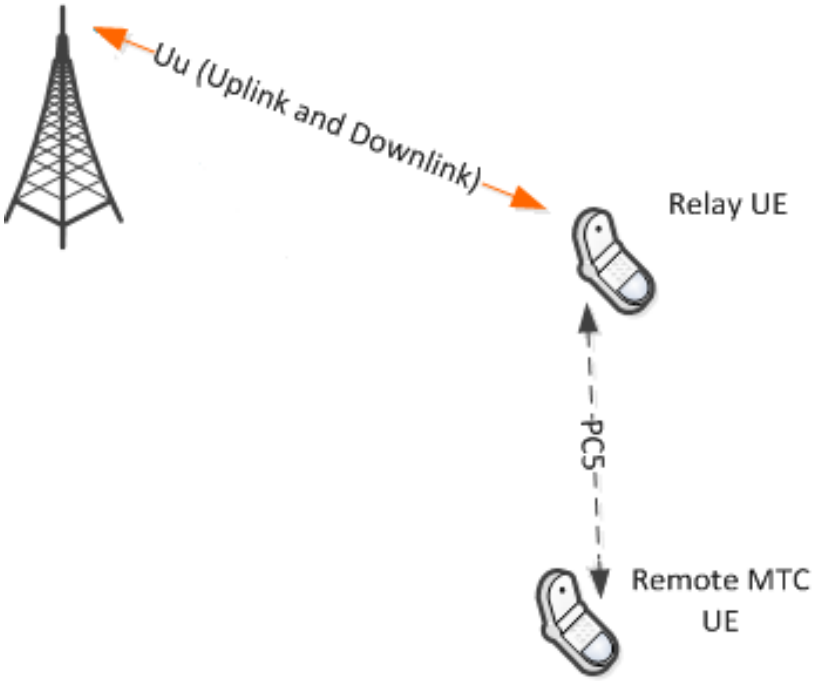
Initial Results : First Order Gains

Ratio of #Tx needed with and without relay



- Maximum D2D link budget : 130dB
- D2D # Tx: 4
- PUSCH 1 RB, TB 328
- Additional power consumption at relay UE unaccounted for
- Other overheads need to be accounted for

Bi-Directional Relays

Allow for both downlink and uplink link budget enhancements

- Downlink and uplink link budget enhancements but with additional device cost for MTC device
- MTC device needs to perform both D2D tx and rx
- Rel-13 ProSe UE-to-Network Relay can be used as baseline
  - Enhance to Layer 2 relay to make it consistent with uni-directional relay
- Enhance D2D link reliability using RLC
- Enhanced efficiency by using HARQ feedback.
- Can also consider slow loop rate and power control for D2D