RELAYING IN 3GPP LTE

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ITG FACHTAGUNG – IMT ADVANCED

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CONTENT

- Motivation and Scenarios
- 3GPP LTE Relaying
  - Architecture
  - Radio Protocols
- Performance
- Summary & Conclusion

MOTIVATION

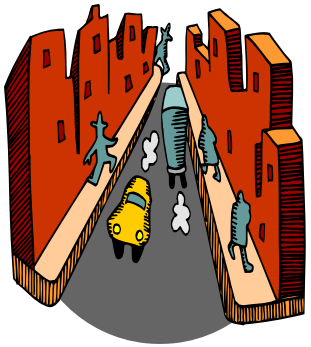
Relaying promises…

Coverage-area extension *Data-rate extension*

- increased coverage and/or cell-edge performance
  - which is especially useful since
    - LTE will operate on high carrier frequencies, i.e., 2.6GHz
    - UL SINR becomes Tx power limited when transmitting broadband at the cell edge
    - Majority of mobile traffic is generated indoor
- cost efficient operation and reduced site acquisition costs
  - which is especially useful since the future demand for high capacity will result in ultra-dense deployments of network nodes

DEPLOYMENT SCENARIOS

Urban Broadband (Improved Indoor)



- Improve (UL) cell edge data rate
- SINR noise limited due to severe shadowing, e.g., indoor, in street canyons …
- New sites, planned indoor/outdoor deployment below rooftop
- Possible in case of low/medium load

  → Future evolution to Picos

Rural Coverage (Initial Roll-out)

- Extend coverage
- SINR noise limited due to large distances
- New sites, planned outdoor deployment above rooftop
- Can be addressed with other solutions e.g. microwave

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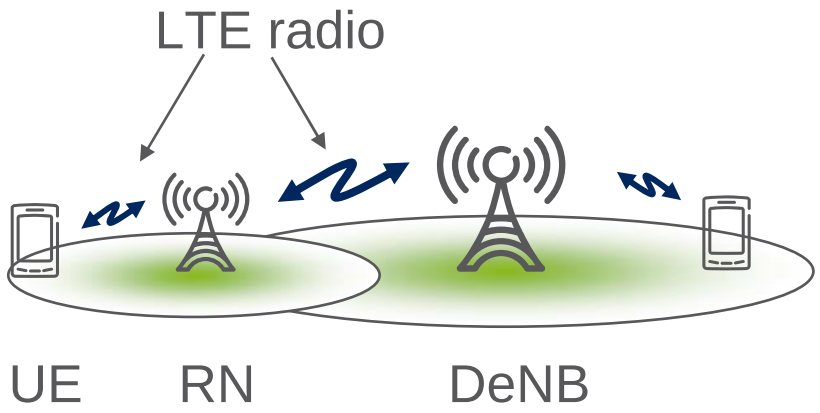
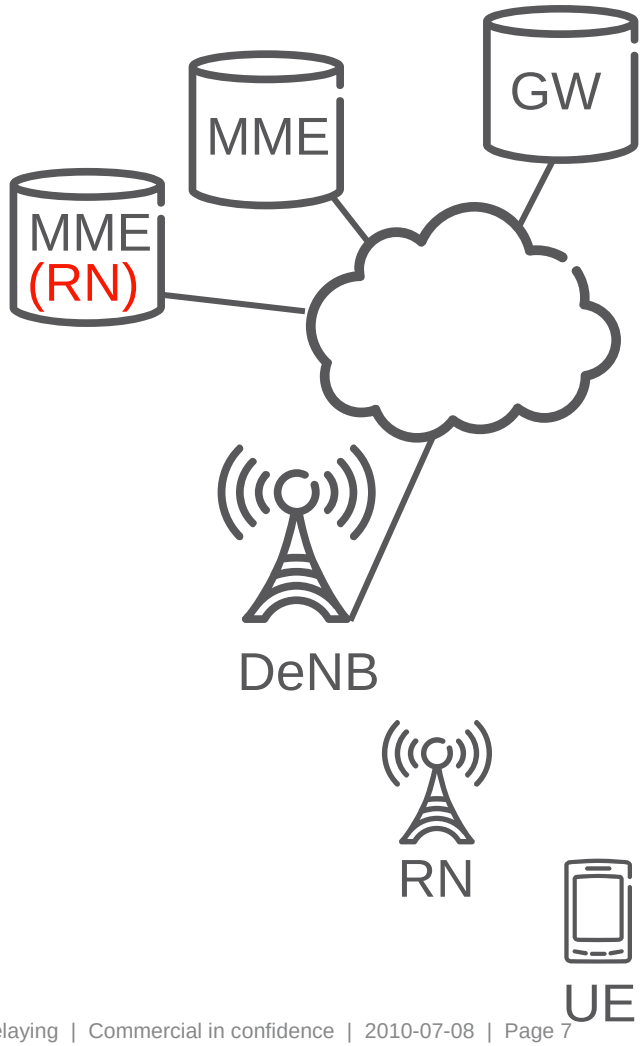
RELAYING IN 3GPP LTE

- History
  - Studied during 2009
    - Study Item on LTE-Advanced
  - Standardization during 2010
    - Ericsson is LTE Rel.10 Work Item Rapporteur



- Objective
  - Inband and outband relaying
    - Access and backhaul on same or different carrier
  - Relay Node (RN) cell appears as a regular cell distinct from the donor eNB (DeNB) cell
    - Backward compatible access link
  - Radio protocols terminate in the relay
  - UEs should be able to connect to the donor cell

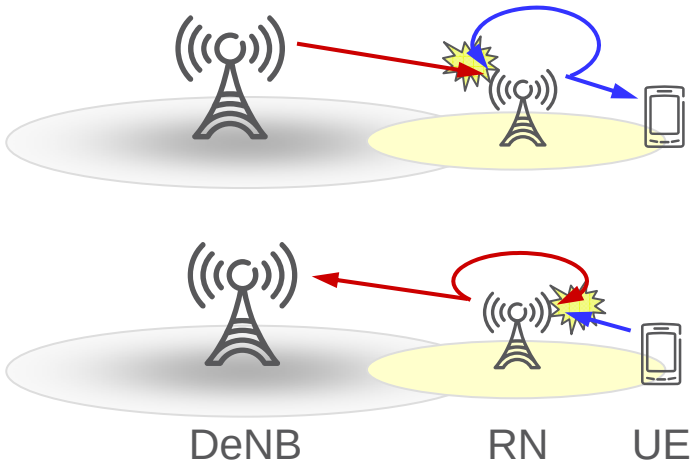
3GPP ARCHITECTURE



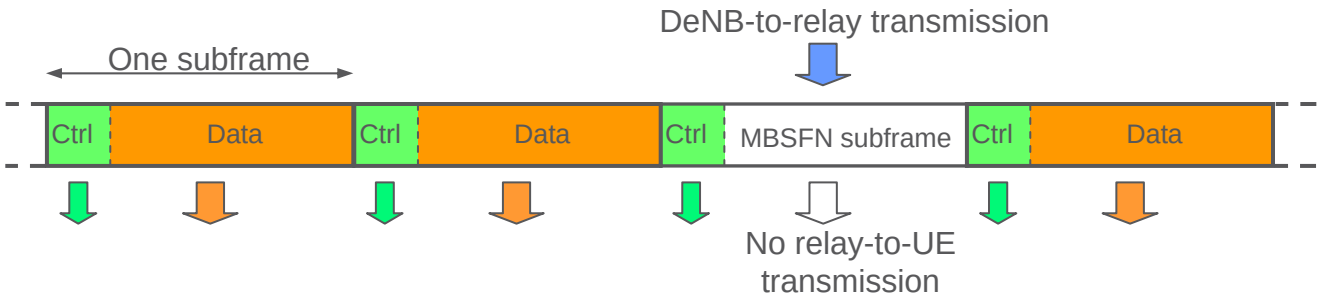
- DeNB provides proxy functionality, hiding the RNs from MMEs / GWs serving the UEs
  - The RN is seen as a new cell under the DeNB
  - The DeNB appears to the RN as an MME (for S1) and as an eNB (for X2)
- DeNB provides Gateway-like functionality for the RN
  - creates a session for the RN
  - manages EPS bearers for the RN
- MME (RN) functionality for MMEs serving the RNs are supported by the “normal” MMEs

INBAND RELAY

- Due to self-interference RNs cannot simultaneously
  - Transmit on access (DL) and receive on backhaul (DL)
  - Receive on access (UL) and transmit on backhaul (UL)

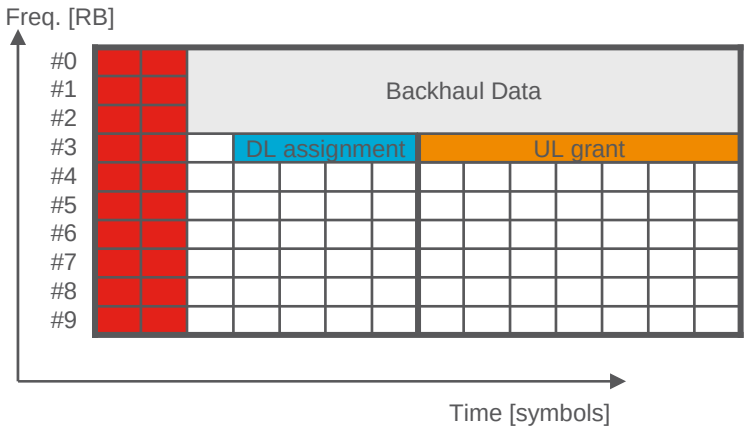


- RN separates backhaul and access in time
  - Access (backhaul) link operates on access (backhaul) subframes only



IMPACT OF INBAND RELAYING

- Backhaul Control Channel (R-PDCCH)
  - For control information to RNs which are not able to read the normal PDCCH



- Relay Timing
  - DeNB-RN synchronization
  - Tx-RX switching at RN
- RRC configuration of backhaul subframes
- The RN might not be able to listen to paging and system information updates
  - Dedicated signaling

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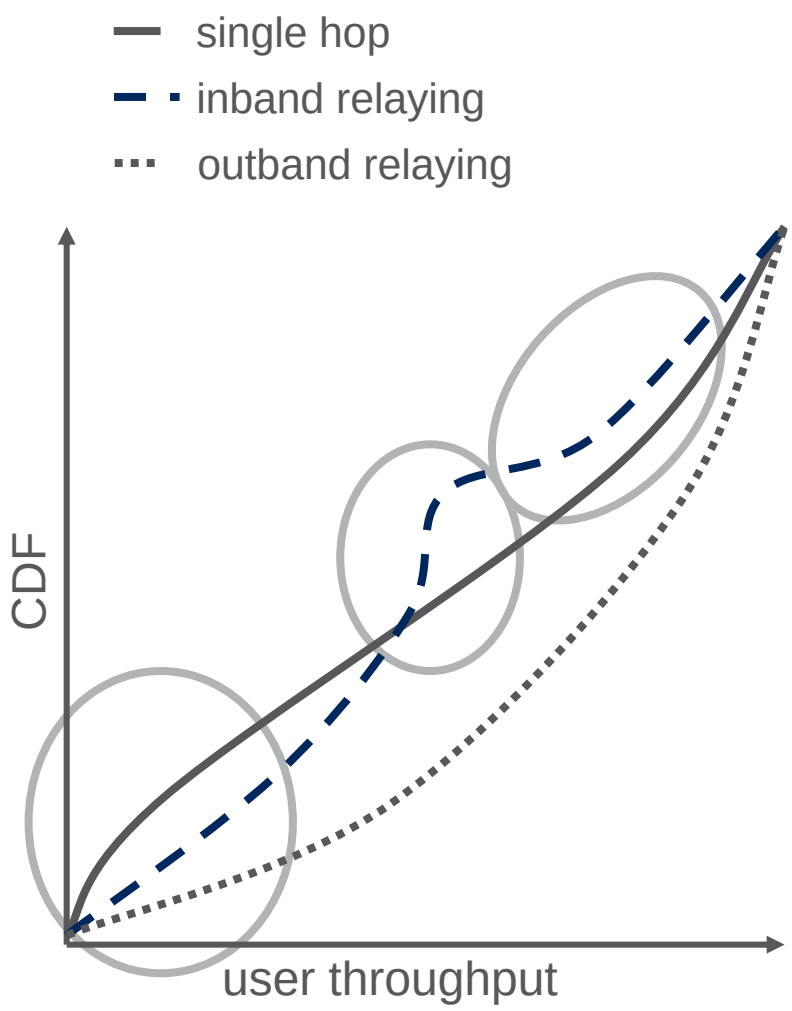
QUALITATIVE PERFORMANCE



- Inband relaying
  - Improved coverage and cell-edge bit rate due to signal regeneration
  - Reduced peak rate for relay users due to backhaul subframes
  - Degraded throughput for non-relay users due to increased interference
- Outband relaying
  - Improved capacity
  - But larger spectrum demand
  - Even better when migrating to Pico

CONTENT

SUMMARY & CONCLUSION

- Future mobile radio networks need to provide
  - wide area coverage
  - excellent (cell-edge) data rates
  - low costs per bit
- Relaying is one feature (among others) to meet those requirements
- Relaying will be introduced in LTE Rel.10
  - Inband relaying extends coverage
  - Outband relaying increases capacity in addition
  - Potential evolution path to Pico basestations

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