

3GPP TSG RAN WG1 #55-bis
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Agenda Item: 12.6

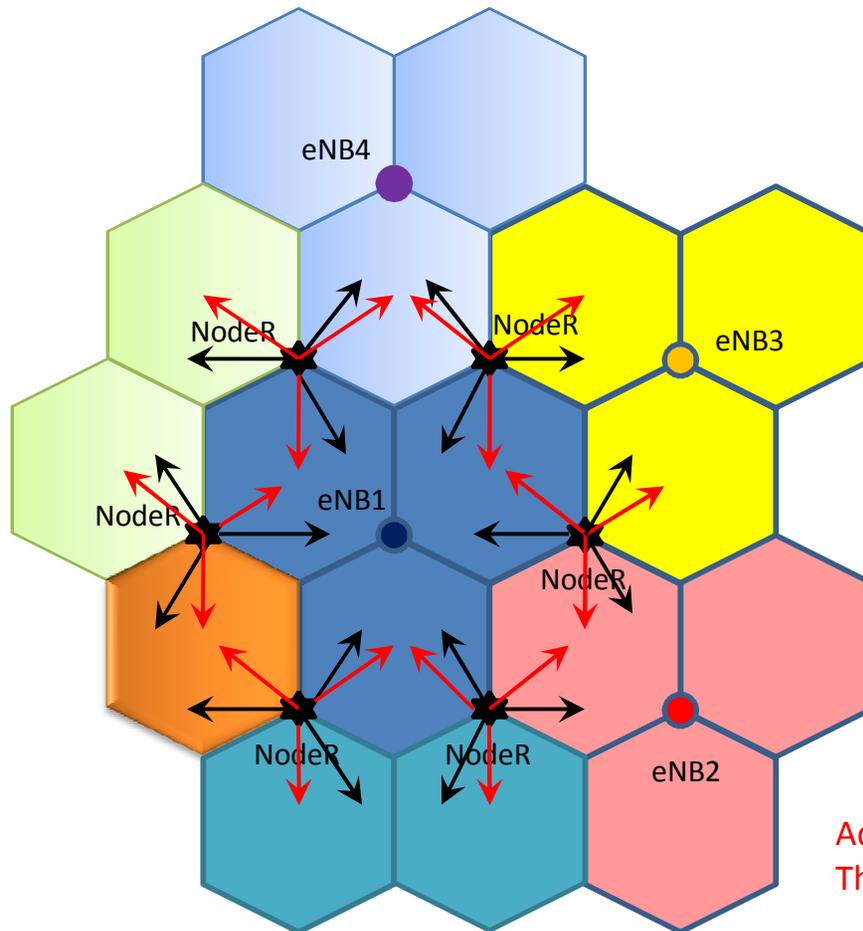
R1-090074

A System Simulation Study of Uplink L2 Relay Network

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Locations and Antennas of NodeRs

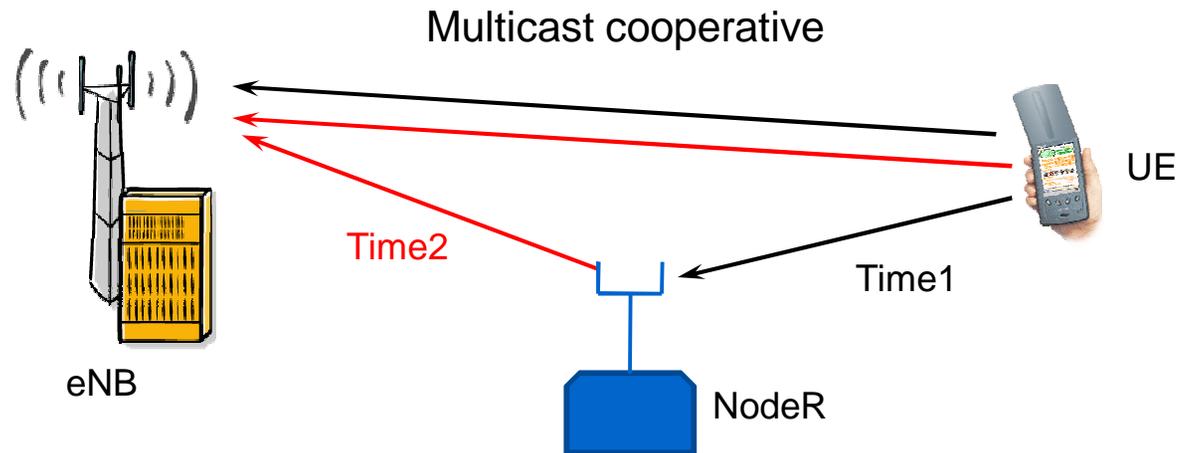
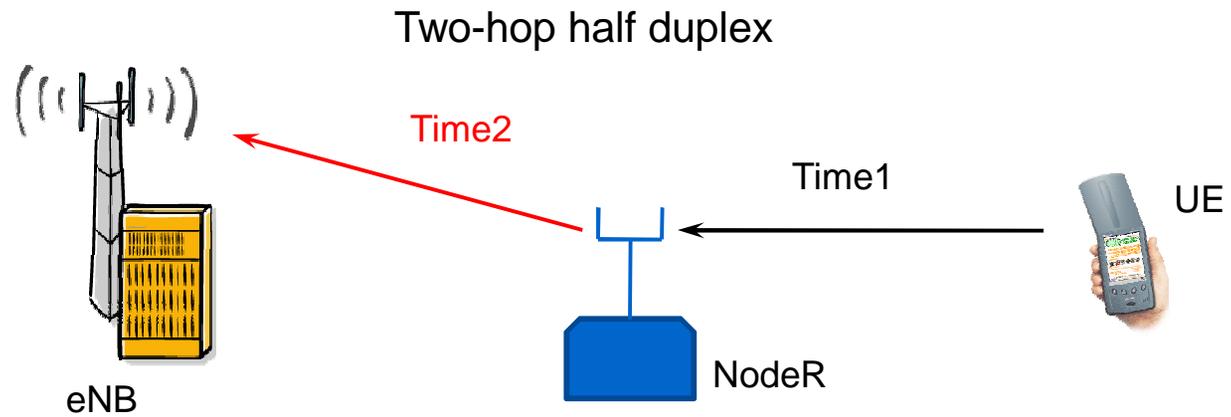


NodeR antenna direction

- NodeR - UEs
- NodeR - eNB

Adjacent three NodeRs are co-located as shown.
They can be separated in real deployment

Two Transmission Modes Considered



Pro and Con of Half Duplex vs. Multicast Cooperative

■ Two-hop half duplex:

- Pro:
 - UE is idle in Time 2 for assigned PRBs, less processing
 - Less other interference caused by UEs, improve system performance in general
 - Suitable for very poor geometry UE where PDCCH/PUCCH detection is unreliable
- Con:
 - More likely to have lower overall channel rate

■ Multicast cooperative

- Pro:
 - More likely to have higher overall channel rate
- Con
 - UE transmitting in both Time 1 and Time 2, more processing and other cell interference
 - Little advantage in effective channel rate for very poor geometry UEs
 - Not suitable for very poor geometry UEs due to the unreliable PDCCH/PUCCH detection

Simulation Parameters

Parameters		Values
Inter-site distance		500 m, 1732 m
Distance-dependent path loss		eNB-UE: $L=128.1 + 37.6 \log_{10}(R)$ eNB-NodeR: $L=103.2 + 37.6 \log_{10}(R)$ NodeR-UE: $L=132.3 + 39.6 \log_{10}(R)$, R in kilometers
Shadowing standard deviation		8 dB (UE), 4 dB (NodeR)
Shadowing correlation	Between cells	0.5
	Between NodeB and NodeR	0.4
Building penetration Loss		20 dB (eNB/NodeR-UE), 0 dB (eNB-NodeR)
NodeR antenna beamwidth (horizontal), gain		70 degree, 15 dBi (including 2 dB cable loss)
Carrier Frequency		2 GHz
Channel model		eNB/NodeR-UE: Typical Urban (TU), 3kmph eNB-NodeR: AWGN
UE Max Tx power – operating bandwidth		24 dBm - 10 MHz
Noise figure (eNB and relay)		5 dB
Average number of UEs per cell		20 (UEs dropped uniformly in entire network)
NodeR and UE pairing		Downlink measurement
L2 relay transmission mode		Mixed: half-duplex and cooperative

Cell Average Throughput Results

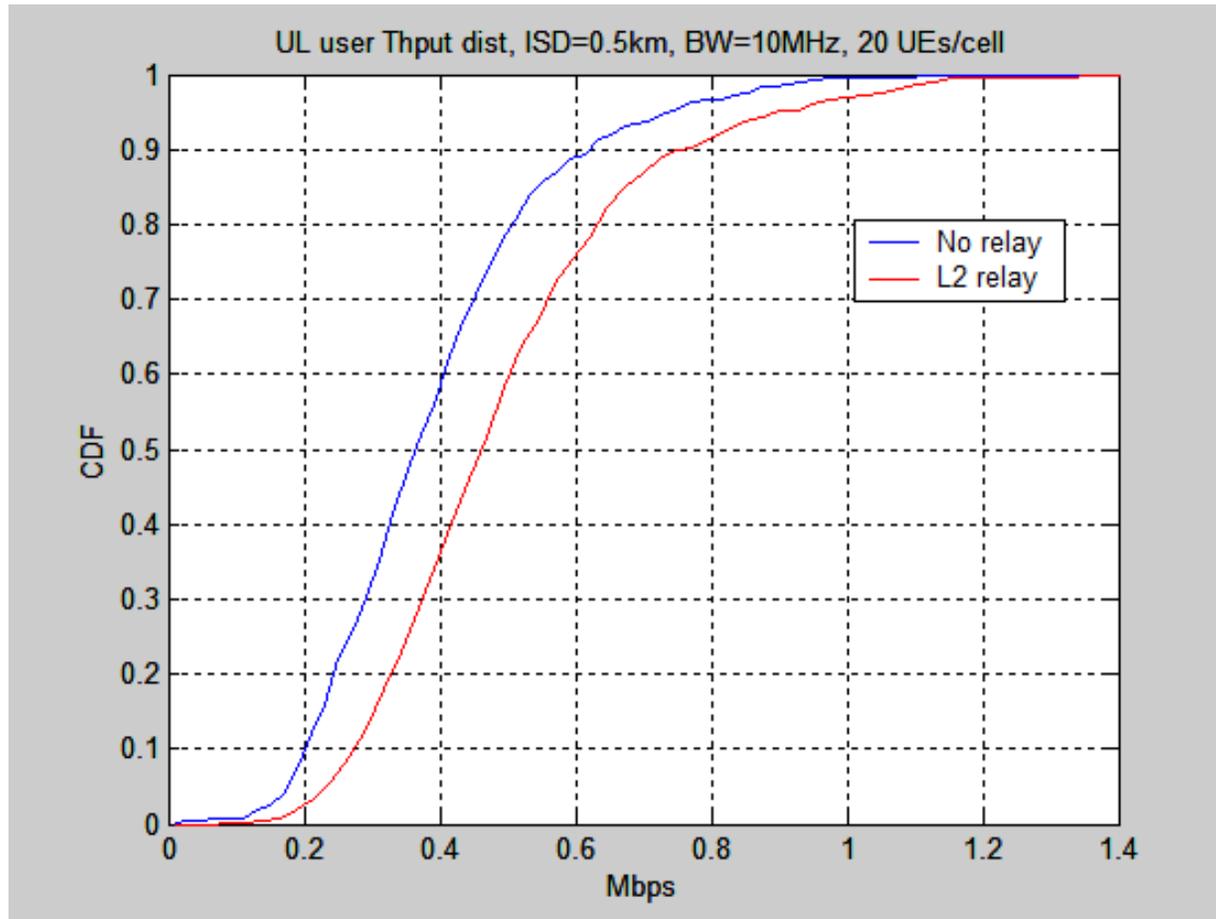
Data rate (Mbps)	ISD=0.5 km	ISD=1.73km
No relay	8.04	6.68
L2 relay	10.15	8.07
Average throughput gain	26%	21%

Cell Edge (5%) Throughput Results

Data rate (kbps)	ISD=0.5 km	ISD=1.73km
No relay	176	50
L2 relay	234	135
Edge throughput gain	33%	170%

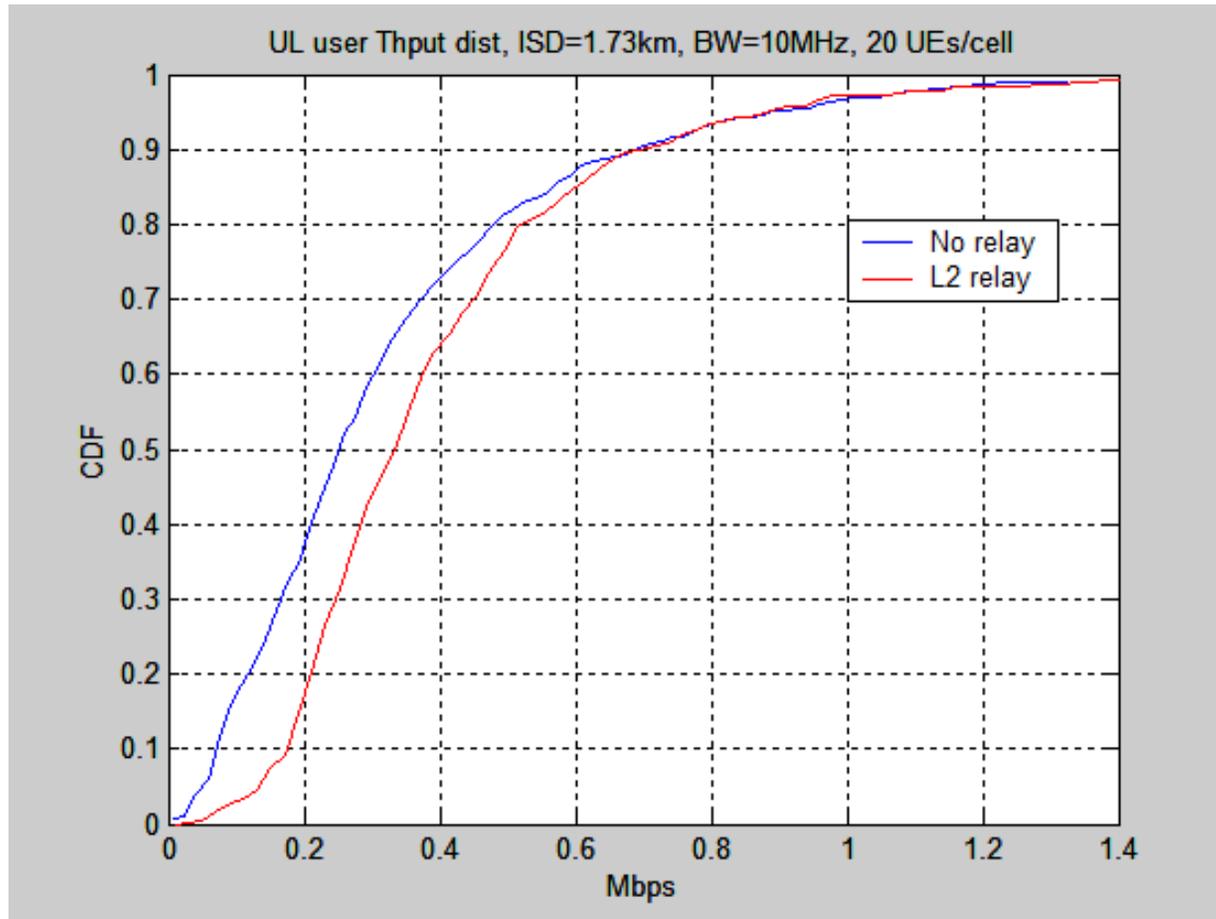
- Edge throughput gain is more significant with large cell size

User Throughput CDFs (ISD=500 m)



Most users benefit from the relay when cell size is small

User Throughput CDFs (ISD=1732 m)



Low to medium geometry users benefit from the relay -> system is more fair for larger cell size

Conclusions

- A cost-effective relay scenario has been proposed where each cell has only two L2 relay nodes
- Significant gain in cell throughput observed from system simulations
- System fairness is improved in terms of user throughput

References

- [1] R1-082975 “Application scenarios for LTE-Advanced relay”, China Mobile (CMCC), Vodafone, Huawei
- [2] R1-084017 “Text proposal for evaluation methodology”
- [3] R1-083205 “Application of L2 Relay in an Interference Limited Environment for LTE-A”, InterDigital
- [4] R1-083778 “System simulation evaluation for link from eNode-B to RN”, Fujitsu
- [5] R1-083533 “Decode and forward relays for E-UTRA enhancements”, Texas Instruments
- [6] R1-084117 “A system simulation study of downlink L2 relay network”, ZTE
- [7] R1-084118 “Simulation methodology update for relay study”, ZTE

Thanks

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