

# **Motivation for UE CSI Signaling in Inter-eNB CoMP for LTE**

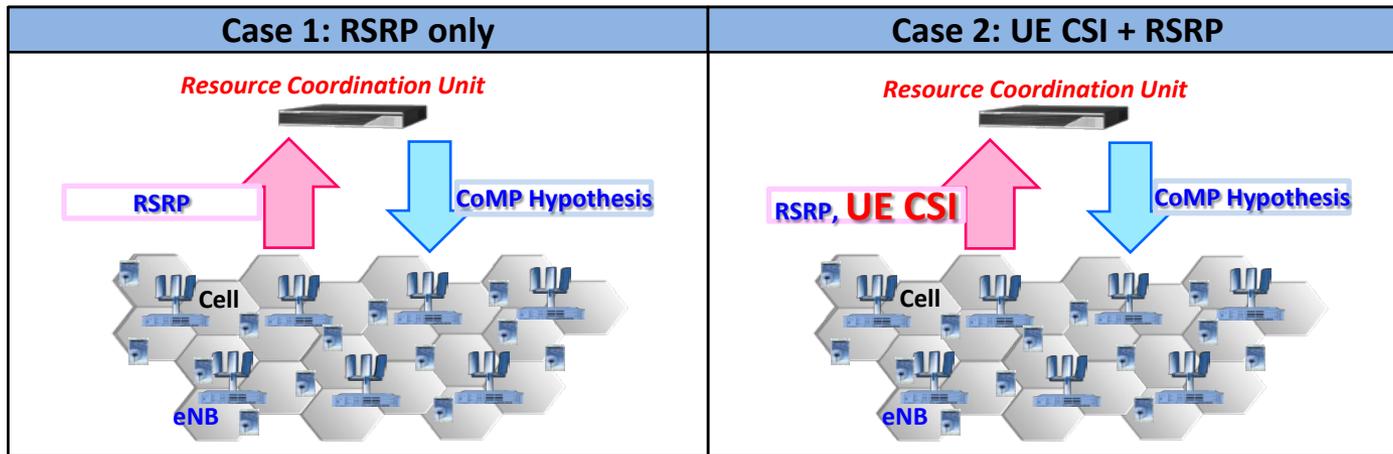
Samsung

# Inter-eNB CoMP Signaling for Rel-12

- Signaling parameters agreed in RAN1#76bis
  - **CoMP hypothesis**: hypothetical resource allocation associated with a cell ID
  - **Benefit metric** associated with CoMP hypothesis/es: benefit that a cell of the sender node expects in its scheduling
  - **RSRP** measurement reports of one or more UEs
- Proposal:
  - Optional signaling of one or more sets of **CSI information (RI, CQI)** of a set of UEs
    - Signaling period
      - Same as CoMP hypothesis for periodic exchange
      - Mechanism to provide CSI reports upon request from an eNB should be made available
    - Per CSI process per subband per UE per cell (1 subband = 6 RBs)

# Performance Results

- Evaluation Cases



- Evaluation Results (presented in R1-141867)

	Backhaul delay	RU 40%		RU 60%	
		5% UPT	Average UPT	5% UPT	Average UPT
Case 1 (RSRP only)	5 ms	+7.6%	-4.3%	+9.1%	-2.9%
	10 ms	+5.2%	-9.4%	+9.8%	-6.7%
Case 2 (UE CSI + RSRP)	5 ms	+13.0%	+9.5%	+25.7%	+12.9%
	10 ms	+13.2%	+3.4%	+22.1%	+7.2%

\* Reference scheme for performance comparison: intra-eNB CoMP

- Observation:

- UE CSI is an essential signaling parameter in providing inter-eNB CoMP gain

# Analysis of X2 Signaling

- Required bit rates for inter-eNB CoMP signaling:

Parameter	Required bit rate	Note 1	Note 2
RSRP	13675X + 1300 bps (685Kbps when X=50)	$\{[16 \text{ bits} + 9 * (52 \text{ bits} + 7 \text{ bits})] / \text{UE} * X \text{ UEs/cell} + 52 \text{ bits/cell}\} * 3 \text{ cells} * 1000\text{ms/s} * 1/120\text{ms}$	- X: Number of UEs in a cell whose measured RSRPs are included for each transmission - 16 bits: Length of the UE ID (C-RNTI) - 9: Number of RSRP MR per UE - 52 bits: Length of the cell ID (ECGI) - 7 bits: RSRP size (INTEGER (0..97)) - 120ms: Periodicity of the RSRP MR - 1 bit: Length of the per PRB CH - Y: Number of cells in the coordination area - 9 bits: Length of the per PRB BM - 5ms: Periodicity of the CH and BM
CoMP Hypothesis (CH) & Benefit Metric (BM)	361200Y + 3001200 bps (10 Mbps when Y=21)	$\{[(52 \text{ bits} + 110 \text{ PRBs/subframe} * 1 \text{ bit/PRB/subframe} * 5 \text{ subframes}) * Y + 110 \text{ PRBs/subframe} * 9 \text{ bits/PRB/subframe} * 5 \text{ subframes}] / \text{cell} + 52 \text{ bits/cell}\} * 3 \text{ cells} * 1000\text{ms/s} * 1/5\text{ms}$	- Z: Number of UEs in a cell whose CSI reports are included for each subframe - CSI-Process-Index: 5 bits - 5ms: Periodicity of the CSI reports - Sub-CQI size: 2 bits - Wide-CQI size: 4 bits - RI size: 3 bits
UE CSI	648000Z + 31200 bps (6.5 Mbps when Z=10)	$\{[16 \text{ bits} + 4 \text{ CSI processes} * (\text{CSI-Process-Index/CSI process} + 19\text{subbands} * \{\text{sub-CQI size}\} / \text{subband/CSI process} + \text{wide-CQI/CSI process} + \text{RI size/CSI process})] / \text{UE} * Z \text{ UEs/cell/subframe} * 5 \text{ subframes} + 52 \text{ bits/cell}\} * 3 \text{ cells} * 1000\text{ms/s} * 1/5\text{ms}$	

- Observation

- Required bit rate for inter-eNB CoMP signaling is dominated by CH/BM, not UE CSI
- Required bit rate for inter-eNB CoMP signaling is acceptable to Fiber Accesses 1-3 as per TR 36.932:

Backhaul Technology	Latency (One way)	Throughput
Fiber Access 1	10-30ms	10M-10Gbps
Fiber Access 2	5-10ms	100-1000Mbps
Fiber Access 3	2-5ms	50M-10Gbps

# Conclusions

- Observation
  - X2 signaling of UE CSI can provide significant system performance enhancement for inter-eNB CoMP
  - UE CSI can be exchanged within acceptable required bit rate
- In our view, specifications should allow operators to choose a preferred way to get performance improvement by inter-eNB CoMP
- We propose to include optional signaling of one or more sets of CSI information (RI, CQI) of a set of UEs in Rel-12 specifications