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3GPP TSG RAN Meeting #75 RP-170445

Dubrovnik, Croatia, March 6 - 9, 2017

Title: Motivation for New Work Item on Enhancing Utilization of CA for LTE

Source: Nokia

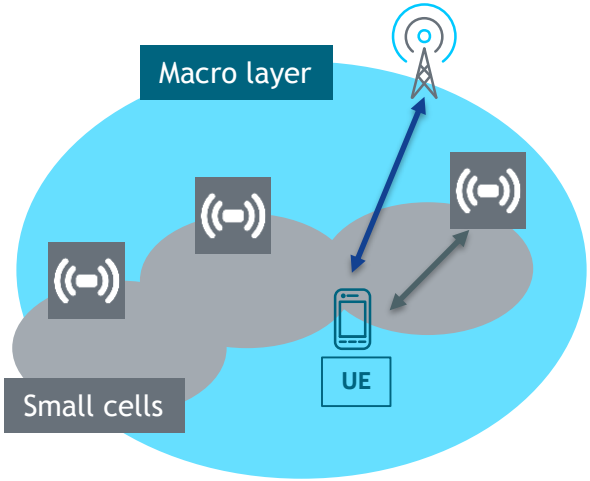
Document for: Discussion

Agenda Item: 10.1.2

Rel-15 Enhancing CA Utilization WI proposal

Motivation, Objectives and Scenario

- **Motivation and Scenario:**
  - CA extended up to 32 carriers
  - Small Cell deployments are becoming more common
  - Macro PCells as ”mobility anchors” and small SCells on different frequency(ies) with dense deployment
  - The macro cell layer is for the mobility management and the dense small cell layer(s) to increase the user plane capacity
- **Problem to solve:**
  - Practical use of CA is limited by the delays in configuring and activating SCell(s)
    - For small cells this can take longer time as the UE first needs to detect, measure and report the cell before configuration is done
    - If there is a small amount of data it is possible that it is already served before CA is activated, limitations in dynamic user plane load balancing between the cell layers
- **Key goals**
    - Reduced delays in CA set-up:
      - SCell related measurements,
      - Measurement reporting,
      - SCell configurations and activations
    - Reduced SCell configuration and activation signaling overhead
- **RAN2 led WI** with impacts in RAN3 and RAN4 as well (no RAN1 impacts)



- **Simulation Assumptions**
  - 21 macro cells with 4 small cells each, 10 + 10 MHz bandwidth on two separate frequencies
  - UEs move within small cell deployment area with 3 km/h
  - Traffic model: FTP model 1 with filesizes: 0.1, 0.5, 1, 5, 10 Mbytes
  - Offered Load: 20 Mbps per macro area
  - SCell configurations/activations using events A4 + A1. Activation if data available
  - Two modes: UE released/not-released to idle during long reading times
  - Total Delay:
    - Delay before SCell configuration including cell detection, measurements and Scell configuration
      - Mode: UE released to idle: 500, 1000, 4000 ms
      - Mode: UE not released to idle: 0, 100 ms
    - SCell activation delay 24 ms

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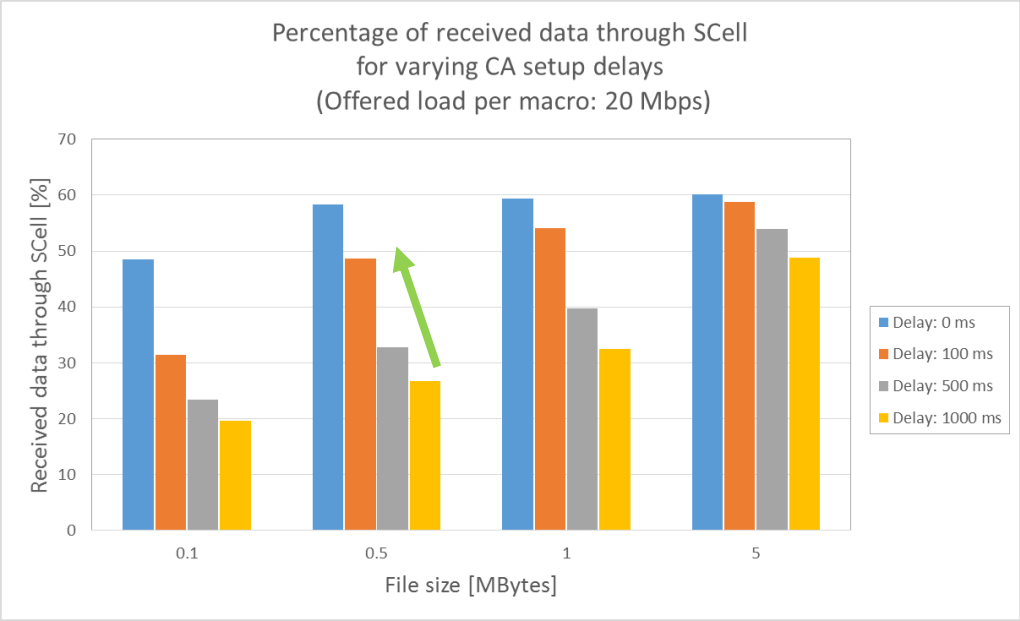
Percentage of received data through SCell

System Simulation Results

- Delay limits the usage of SCell even with larger file sizes but especially with smaller file sizes.
- In case of small file sizes data may be served by PCell before SCell is activated



Noticeable improvements in SCell usage by reducing delays in SCell configurations and activations

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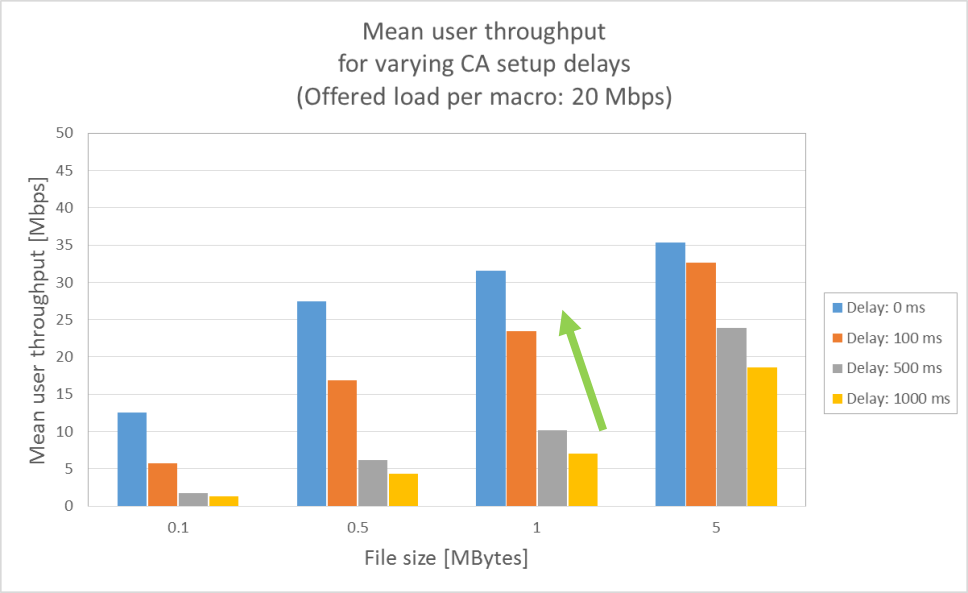
Mean User Throughputs

System Simulation Results

- CA configuration and activation delays have noticeable negative impacts on user throughputs with small and larger file sizes



Delay reductions will be directly noticeable for users (as user throughput)

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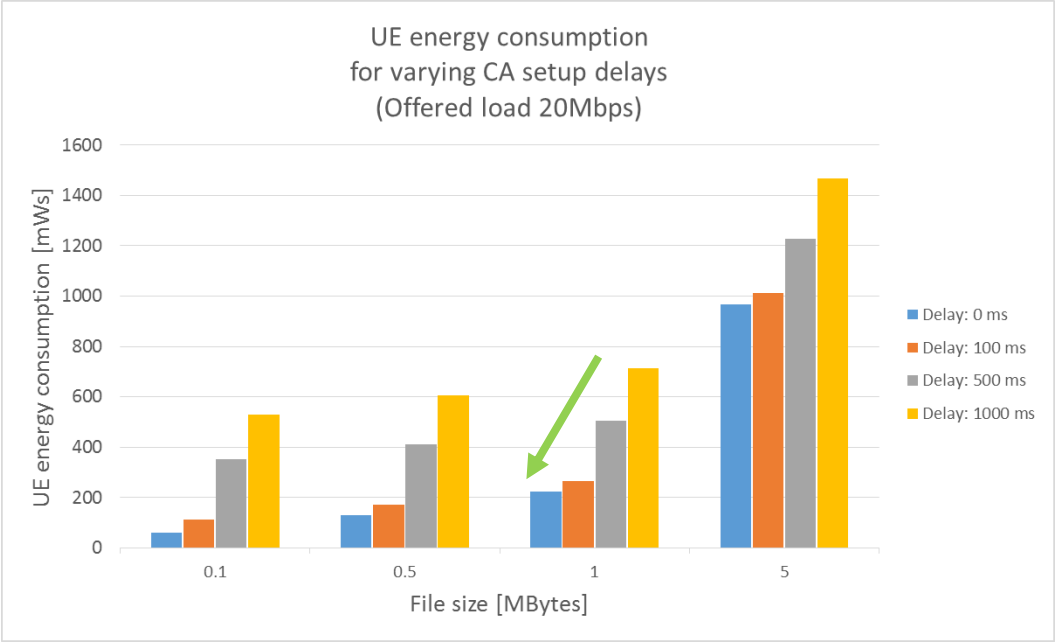
UE energy consumption

System Simulation Results

- UE power consumption per file transfer
- More efficient transmission with shorter CA setup delay
  - This allows performing additional small cell measurements to enable faster setup



Faster CA setup means more energy-efficient data transmission

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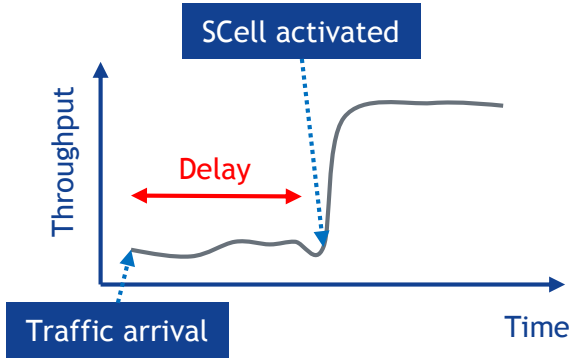
Benefits
New WID for Enhancing CA Utilization

Benefits of CA delay and signalling overhead reductions:

- Faster CA configurations and activations
- Better SCell usage (more data through SCell instead of PCell)
- Faster data offloading from PCell to SCell
- Better resource utilization in the CA network
- Improved user throughput
- Enhanced capacity (especially when PCell capacity is limiting and wide BW available for SCell)
- UE power savings



CA enhancements beneficial for ”traditional” licensed band CA, LAA, LTE Dual Connectivity and Dual Connectivity between LTE and 5G NR

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