Unlicensed Carrier Selection and User Offloading in Dense LTE-U Networks

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PROBLEM

- eNodeB-1 wants to select a channel and it has both the channel CH2 and CH3 free.
- Selecting best channel among free channels is necessary as CH2 is better compared to CH3 (Less user affected).
- As it is unlicensed channel it can be used by different operators and RATs (No cooperation).

Hence, A distributed and uncoordinated approach is proposed for dynamic channel selection.

SIMULATION SCENARIO

![Fig. 1: Motivational example scenario.](image)

RESULTS WITHOUT USER MOBILITY

![Fig. 3: Positions of 20 eNodeBs with 400 UEs in the network.](image)

RESULTS WITH USER MOBILITY

![Fig. 4: CDF of avg SINR of all users in the network.](image)

![Fig. 5: Variation in avg SINR across cells in the network.](image)

USER OFFLOADING

![Fig. 6: av SINR of all users in the network with mobility.](image)

TRIGGERING DECISION

- UCCS algorithm can be run periodically or based on channel condition we can trigger the UCCS algorithm.
- Our proposed triggering algorithm triggers UCCS if channel quality degrades beyond certain threshold.

CONCLUSIONS

- The proposed dynamic UCCS algorithm selects unlicensed channel that improves overall system performance and gives fairness among users.
- Results show that the UCCS can be used in dense deployment of LTE-U.

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PROPOSED WORK

A dynamic UCCS algorithm is proposed which uses CQI feedback given by UEs.

![Fig. 2: System model.](image)

UCCS ALGORITHM

Inputs: f, N ure, CQIj,i Outputs: CCS, MCUEj,i, CQIavgFinal
1. Initialization: \(\alpha_{max} \leftarrow 0\), MCUEj,i \leftarrow 0;
2. for \(i = 1 \rightarrow k\) do
3. \(CQI_{cum} \leftarrow 0\);
4. for \(j = 1 \rightarrow N_u\) do
5. \(CQI_{cum} \leftarrow CQI_{cum} + CQI_{j,i}\);
6. /* Find Max CQI of UE over channels */
7. if \(CQI_{j,i} > MCUE_j\), then
8. \(MCUE_j \leftarrow CQI_{j,i}\);
9. end if
10. end for
11. \(CQI_{avg} \leftarrow CQI_{cum} / f_j\);
12. if \(\alpha_{max} < \alpha_{j,i}\), then
13. \(\alpha_{max} \leftarrow \alpha_{j,i}\);
14. CCS \leftarrow 1;
15. \(CQI_{avgFinal} \leftarrow CQI_{avg}\);
16. end if
17. end for

Where, \(\Delta_LR = \frac{D_{min} + S_B_{duration}}{C_0 + \beta_{CUE}}\) (1)

Table 1: Simulation Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Cell</td>
<td>20</td>
</tr>
<tr>
<td>UEs per Cell</td>
<td>20 (Random Deployment)</td>
</tr>
<tr>
<td>Transmit Power</td>
<td>20 dBm</td>
</tr>
<tr>
<td>Traffic</td>
<td>Downlink (Full Buffer)</td>
</tr>
<tr>
<td>Free Channels, BW</td>
<td>3, 20 MHz</td>
</tr>
<tr>
<td>Pathloss Model</td>
<td>37 + 30log10(diameter)</td>
</tr>
<tr>
<td>UE Mobility, TH(_{time})</td>
<td>1 ms, 100 ms</td>
</tr>
<tr>
<td>(\alpha_{max}, \lambda_{max})</td>
<td>1.15, 126</td>
</tr>
</tbody>
</table>

INPUTS: UE Offload from unlicensed to licensed.

CONCLUSIONS

- The proposed dynamic UCCS algorithm selects unlicensed channel that improves overall system performance and gives fairness among users.
- Results show that the UCCS can be used in dense deployment of LTE-U.