Background and Motivation

By the end of the decade, it is expected that the US Department of Transportation (DOT) will require all new vehicles to be capable of communicating with other vehicles and roadside infrastructure through wireless connections. Dedicated Short Range Communications (DSRC) is a promising solution for the scenarios of high-speed communications. Such connectivity enables various beneficial connected vehicle (CV) applications. Figure [1] illustrates a simple CV scenario. Vehicles 1–3 arrive to find an unexpected event in the road (e.g., accident or perhaps an object blocking the lane). Vehicle 1 might detect the event, and send a message to Vehicle 2 through DSRC, which forwards to Vehicle 3. The RSE (Road Side Equipment) would be informed and could broadcast a message alerting Vehicle 4 of the situation.

Implementation Details

The test-bed for the connected highway is to be built in partnership with the South Carolina Department of Transportation (SCDOT) along the I-85 near Clemson’s International Center for Automotive Research (CUICAR) and two WiMax base stations located in Greenville. Figure[2] shows the location.

Figure [3] demonstrates the overall structure of the testbed to be built in this research. Vehicle information will be collected through various communication technologies such as LTE, WiMAX, and DSRC and be processed at various levels such as the edge controller and global controller for CV applications.

Demo Configuration & Results

Figure [4] illustrates the demo testbed on our campus. The figure shows how messages of two applications are forwarded through two types of communication technologies, namely LTE and DSRC.

Table [1] shows the results of delays in three scenarios:

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay (ms)</td>
<td>41.237</td>
<td>328.232</td>
<td>180349.432</td>
</tr>
</tbody>
</table>

Future Work

Our demonstration shows an working concept of an advanced connected vehicle testbed using two exemplar CV applications. We would like to further extend our testbed deployment, and optimize the delays based on the research in resource controllers at different levels.