Billions of IoT devices in use by 2022 in various application areas.
Constrained devices are limited in memory, bandwidth and power.
Typically use batteries which may be expensive and hard to replace.
Need to maximize device lifetime while ensuring data quality.
IoT protocols:
- Utilize full reliability with TCP e.g., MQTT or
  no reliability with UDP e.g., CoAP
- Have custom reliability at IoT application
Depending on the IoT application, reliability requirements may vary over time

Objective and Methodology
- Design an Adaptive Reliability Transport (ART) protocol to allow an IoT application to dynamically request variable levels of reliability.

Applications
- Wildfire detection
- Crop monitoring
- Remote surveillance

Objective and Methodology
- An adaptive reliability protocol can provide energy savings that extend device lifetime.
- Energy savings depend on the reliability level
- 50% reliability increases lifetime by 15.29% while 10% reliability increases lifetime by 31.55% which is close to lifetime using UDP
- IoT applications request required reliability
- Application requirements should be taken into account when determining the required reliability level

Future Work:
- Complete protocol development in NS3
- Compare performance of IoT protocol CoAP with and without ART

Summary FSM

Preliminary Results
- Distance between IoT device and proxy=200ft
- Measured energy to send 10,000 packets with TCP and UDP with RP3, Wi-Fi AP and iperf3 as an estimate for ART energy cost
- Lifetime increase is with respect to TCP
- Initial energy=10Wh

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Lifetime (days)</th>
<th>% Lifetime increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>UDP</td>
<td>560</td>
<td>35.92</td>
</tr>
<tr>
<td>TCP</td>
<td>412</td>
<td>0</td>
</tr>
<tr>
<td>ARP(10%)</td>
<td>542</td>
<td>31.55</td>
</tr>
<tr>
<td>ARP(50%)</td>
<td>475</td>
<td>15.29</td>
</tr>
</tbody>
</table>

Adaptive reliable mode:
if Energy>E_r, use reliable transmission
else use unreliable transmission

Device Lifetime