Network Stack Requirements for Keck HydroWatch Project
Overall Goals

- Deliver all data to scientists
- Collect system health data for entire operation for offline analysis
- Monitor system status in real-time
- Build/exhibit reusable HW/SW components
- Push network lifetime - 1 year of 24-hour operation
Network Stack Requirements

- Reliable Collection
- Low Power Operation
- Time Synchronization
- Management
Reliable Collection

✓ High yield
  ✓ Data points collected over maximum data points possible (49% from Redwoods)
  ✓ Objective is 100%, threshold is 90%

Able to cope with disconnected operation
Robust to topology changes (node failures)
Low-Power Operation

- Protocols must be operational in sub-2% duty cycle
- “Flurries of wake up traffic” must be avoided
- Lifetime over multiple seasons requires adaptive power management
## Time Synchronization Needs

<table>
<thead>
<tr>
<th>Node/Sensors</th>
<th>Sample Period</th>
<th>Sync Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate</td>
<td>1 minute</td>
<td>1 Second</td>
</tr>
<tr>
<td>Temp., RH, PAR, TSR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil Moisture</td>
<td>5 minutes</td>
<td>1 Minute</td>
</tr>
<tr>
<td>Sap Flow</td>
<td>30 minutes</td>
<td>1 Minute</td>
</tr>
<tr>
<td>Weather</td>
<td>1 second</td>
<td>1 Second</td>
</tr>
<tr>
<td>Precip./Drop Size, Wind Speed/Direction, Pressure, Temp., RH</td>
<td>Average of 60 samples communicated</td>
<td></td>
</tr>
</tbody>
</table>
Management

- For explicit network health awareness (implicit is receiving data)
- Allows analysis of network functionality on day of deployment
- Enables identification and diagnosis of malfunctioning nodes
Candidates

- SP/NLA + ???
- Boomerang Low Power Stack
- Logging + DTN-like Stack
- T2 - Collection and Dissemination