Thrifty Tracking
Online GPS Tracking with Low Data Uplink Usage
James Biagioni, A.B.M. Musa and Jakob Eriksson
Online GPS Tracking
CTA Arrival Times

- 60: Cicero/24th Pl
- 14: Story Island/103rd
- 20: Austin
- 124: O'Hare & Union Stations
Our focus is on the uplink
<table>
<thead>
<tr>
<th>Protocol</th>
<th>Data Usage per Update</th>
<th>Data Usage per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>UDP</td>
<td>84 bytes</td>
<td>7 MB</td>
</tr>
<tr>
<td>TCP</td>
<td>168 bytes</td>
<td>14 MB</td>
</tr>
<tr>
<td>HTTP/REST</td>
<td>1218 bytes</td>
<td>100 MB</td>
</tr>
</tbody>
</table>
Extrapolation
Constant velocity
Map-based
Unified extrapolator

constant velocity  map-based
Adaptive sampling
Extrapolation gone astray
Path update
Error-bound
(with budget optimization)

or

Budget-bound
(with error optimization)
Data usage reduction

- Standard
- No delay
- With delay

Data usage (bytes/sec)

Sample interval (seconds)
Error reduction

![Error reduction chart]

- Standard
- No delay
- With delay

Mean error (meters)

Sample interval (seconds)

60 90 120
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