**Identifying traffic differentiation on cellular data networks**

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**Introduction**

Define traffic differentiation as any attempt to change the performance of network traffic traversing an ISP's boundaries.

ISPs may implement differentiation policies for a number of reasons, including:
- load balancing.
- bandwidth management
- business reasons.

Specifically, we focus on detecting whether certain types of network traffic receive better (or worse) performance.

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**Related work**

Previous work explored this problem in limited environments.

<table>
<thead>
<tr>
<th>Switzerland</th>
<th>Glasnost</th>
<th>Us</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applications Tested</td>
<td>BitTorrent Only</td>
<td>P2P and Video</td>
</tr>
<tr>
<td>Desktop App</td>
<td>Yes</td>
<td>Browser Plugin</td>
</tr>
<tr>
<td>Customized Tests</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Smartphone App</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

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**Objectives**

1. **Identify and expose** differentiation
2. **Measure** how differentiation affects performance
   Delaying, throughput throttling, jitter, packet dropping
3. **Classify** differentiation for popular applications
   VoIP, Media Streaming, File Sharing, Cloud Storage

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**Assumptions**

We assume that ISPs will differentiate traffic based on properties such as hostname, IP addresses, ports, total number of connections, payload signatures, total bandwidth and time of day.

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**Methodology and challenges**

- **Record** target application traffic using meddle and tcpdump
- **Parse** pcap and create transcript of packets
- **Replay** traffic alternately, tunneled and untunneled
- **Analyze** Xput, RTT, jitter, packet loss

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**Feasibility**

- **Replay** produces very similar results to the original traffic
- Can detect differentiation in a controlled environment (%3 loss and 10ms delay).

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**Initial results**

Currently tests are performed by researchers using PCs tethered to mobile devices.

Spotify (left) and Netflix (left) Verizon in Boston. No differentiation detected.

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**Future work**

- Create a **mobile app** to enable wider adoption of the test (in progress).
- Run on networks we know there is differentiation to **validate** our techniques.
- Allow users to **record and replay** custom traces (longer term).
- Create a **Differentiation Watch** website and blog to report the results for different networks and blog about newly detected differentiation.
- **Source-spoofing** to detect destination IP-based differentiation.

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**References**