“Real” Caller ID
Project Update and Demonstration

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Project Review

• We would like a means of identifying a caller passively (through normal use).
• Don’t want to force users to authenticate in order to place or accept calls
  – Repeated auth is too cumbersome
  – How frequently is auth done?
• Alternative: use what we can observe of calls passively to determine caller identity

Passive Caller ID

• Leverage biometrics (voice) and other context to passively establish caller identity
• Each party still authenticates the other by
  – sound of voice
  – common knowledge
• Passive caller ID is not a substitute for user authentication! (MITM threats exist)

Jan 12 2011 Meeting

• Showed speaker recognition using MARF
• Mixed results using speech alone
• Showed need for exploiting caller context

• Focus since has been exploiting context
### Approach

- Build a Bayesian network for caller ID
- Treat MARF output as one piece of evidence
- Consider more evidence:
  - CALLEE (which number was dialed?)
  - CALLER-EXT (which ext placed the call?)
  - CALL-TIME (when was call placed?)
  - EXT-LOC (where was CALLER-EXT located?)

### Naïve Bayes Net

![Naïve Bayes Net Diagram]

Evidence provided by Asterisk call server

### Example

\[
P(CALLEE = c | CALLER = v) \cdot P(CALLER-EXT = e | CALLER = v) \cdot P(CALLER = v) = \sum_{c=2002}^{2004} P(CALLEE = c | CALLER = v) \cdot P(CALLER-EXT = e | CALLER = v) \cdot P(CALLER = v)
\]

### Bayes Net with MARF and LOC

![Bayes Net with MARF and LOC Diagram]
### MARF Conditional Probabilities

<table>
<thead>
<tr>
<th>Call</th>
<th>Ext</th>
<th>2003</th>
<th>2004</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARK</td>
<td>AM</td>
<td>0.6</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>BN</td>
<td>0.5</td>
<td>0.6</td>
<td>0.8</td>
</tr>
</tbody>
</table>

### Demo Conditional Probabilities

#### Call Ext

<table>
<thead>
<tr>
<th>Call</th>
<th>Ext</th>
<th>2003</th>
<th>2004</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>Ext 1003</td>
<td>0.6</td>
<td>0.8</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>Ext 1004</td>
<td>0.65</td>
<td>0.01</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Ext 2002</td>
<td>0.49</td>
<td>0.1</td>
<td>0.01</td>
</tr>
</tbody>
</table>

#### MKEC

<table>
<thead>
<tr>
<th>Call</th>
<th>Ext</th>
<th>2003</th>
<th>2004</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext 1003</td>
<td>0.8</td>
<td>0.03</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Ext 1004</td>
<td>0.65</td>
<td>0.15</td>
<td>0.6</td>
<td></td>
</tr>
</tbody>
</table>

### Demo CALLEE distribution

- MARK (2004) with probabilities 0.1 and 0.01
- MIKE (2002) with probabilities 0.1
- DENNIS (2003) with probabilities 0.01

### Demo CALLER EXT distribution

- Ext 1002 (issued to Mike)
- Ext 1003 (issued to Dennis)
- Ext 1004 (issued to Mark)
Demo

- Updated call server with Bayes net
- Bayes net built using Hugin 7.3
- Hugin produces executable Bayes net
- Bayes net and MARF run after every call
- Before only MARF ran
- MARF output is evidence into Bayes net

New System Architecture

Contacts

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