BMX6

a routing protocol with social aspects

- Coming from Batman routing protocol
- Forke: BMXd (BatMan-eXperimental)
- After a while thinking, this must be all done different!
- And I recognized, we can learn a lot from human networks...
- New Version: BMX6
  - No technical details today :-)

17. 3. 2011 - Wireless Battle Mesh V4 - Sant Bartomeu del Grau - Catalunia

www.bmx6.net  Axel Neumann  <neumann at cgws dot de>
Human and Social Networks

• Real life
  • World population ~6 billion
  • I spend > 99% of social live with < 0.0001%
  • And even more with an even smaller subset
  • 100% of my life is related to myself (some egoism helps)

• Why good
  • most of my time with the same friends & neighbors
  • I know their: weaknesses, strength, reliability, friends
  • Trust and easy communication
  • Tolerance, others even accept my strange way of doing...
  • Narrowing my mind - But acting as a team makes you stronger
Mesh- versus Human- Networks

Similarities and Assumptions:

- Number of “good” NBs is limited and usually small compared to network size
- “Good” Neighborhood often not related to geographically close individuals
- Common prosperity requires social measures
  - Some nodes hardly perceive NBs and are solar powered...
- Different opinions, objectives (situation dependent)

Focus on transportation of information:
  - Speed, reliability, size, range → Routing algorithm and parametrization
Social Aspects of BMX6

- Regarding being egoistic
- Regarding behaving social within neighborhood
- Regarding tolerance within whole mesh cloud
Social Aspects of BMX6

Regarding being egoistic

- Internally organizes topology knowledge optimized for itself
  - Individual vocabulary (identifiers)
    - reference nodes & NB
  - Exports knowledge using own vocabulary (but common grammar)
Measurements in virtual network

CPU load depending on network size

CPU@Fonera2100, 2 perfect neighbors, 1 – 100 nodes mesh (4-NBs grid)

<table>
<thead>
<tr>
<th>Nodes</th>
<th>1</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU max [%]</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>CPU avg [%]</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Social Aspects of BMX6

- Regarding being egoistic
  Thats reasonable!
  - Because Node has to deal with itself all life long!
- Regarding behaving social within neighborhood
- Regarding tolerance within whole mesh cloud
Social Aspects of BMX6

Regarding behaving social within neighborhood

- Invest lots of efforts to learn about NBs
  - Learn their vocabulary (identifiers)
  - Afterwards benefit from perfectly optimized vocabulary
    - Less overhead and processing
      Known as: Statefull Compression

Measurements: CPU-load and protocol traffic overhead:
# Measurements in virtual network

## CPU-load depending on Neighbors

<table>
<thead>
<tr>
<th>Neighbors</th>
<th>CPU @ Fonera2100, 2 – 10 perfect neighbors, 100 nodes mesh (4NBs grid)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Neighbors</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neighbors</th>
<th>CPU @ Fonera2100, 10 – 30 100%-33%-LQ neighbors, 100 nodes mesh (4NBs grid)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Neighbors</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>
IPv4 Protocol overhead measurement in virtual mesh

- IPv4 discovery phase and long term phase
- 60-nodes, 8NBs (4x80%NBs 4x66%NBs)
- 2 interfaces
- OLSR-0.6.1 versus BMX6-20110317
IPv4 Protocol overhead in weak-links mesh network

- IPv4 discovery phase and long term phase
- 60-nodes, 8NBs (4x50%NBs 4x33%NBs)
- 2 interfaces
- OLSR-0.6.1 versus BMX6-20110317
IPv4 Protocol overhead in BAD-links mesh network

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- 60-nodes, 8NBs (4x66%NBs 4x50%NBs)
- 2 interfaces
- OLSR-0.6.1 versus BMX6-20110317
IPv6 Protocol overhead measurement in virtual mesh

- **IPv6** discovery phase and long term phase
- 60-nodes, 8NBs (4x80%NBs 4x66%NBs)
- 2 interfaces
- **OLSR-0.6.1** versus **BMX6-20110317**
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Measurements: CPU-load and protocol traffic overhead:

- **Learn about NB weaknesses, strength, reliability**
  - Connectivity to Neighbors and Wold (links-, paths- qualities)
  - Willingness to quickly forward routing information
  - Usefull for me? Does NB need my help?

Measurement: Flipping link
Re-Convergence Measurement due to altering link quality

- 4x10 nodes (node 100...149)
- Direct on/off link between node 100<->149
- Ping probes send between 112 ↔ 128

Convergence time (due to flipping long shot in 40-nodes mesh)

<table>
<thead>
<tr>
<th>Protocol</th>
<th>1th icmp</th>
<th>total</th>
<th>102 new path</th>
<th>209 old path</th>
<th>303 new path</th>
<th>403 old path</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLSR 0.6.1</td>
<td>23</td>
<td>421/500</td>
<td>33 secs</td>
<td>27 lost, 6 TTL=0</td>
<td>33 secs</td>
<td>27 lost, 5 TTL=0</td>
</tr>
<tr>
<td>BMX6</td>
<td>8</td>
<td>472/500</td>
<td>20 secs</td>
<td>11 lost</td>
<td>25 secs</td>
<td>12 lost</td>
</tr>
</tbody>
</table>
Social Aspects of BMX6

• Regarding being egoistic
  Thats reasonable!
  • Because Node has to deal with itself all life long!

• Regarding behaving social within neighborhood
  Thats worth!
  • Because nodes' team consists of same few NBs most of the time

• Regarding tolerance within whole mesh cloud
Social Aspects of BMX6

Regarding tolerance within whole mesh

(Mesh networks: routing objectives)

- Support routing objectives of each node
  - Identify other nodes' routing algorithm (TQ, ETX,..)
    learn desired parametrization (sliding window size,..)
  - Treat each nodes' packets respectively
  - Do NOT break global routing
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  Thats reasonable
  • Because Node has to deal with itself all life long!
- Regarding behaving social within neighborhood
  Thats worth
  • Because nodes' team consists of same few NBs most of the time
- Regarding tolerance within whole mesh cloud
  Thats pluralism...
Thanks

...http://www.bmx6.net