RVS Seminar FS 09

GUI for ADAM (Administration and Deployment of Adhoc Mesh networks) / MARWIS

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Overview

- Introduction
- Motivation / Goals
- GUI for ADAM
- MARWIS
- Conclusion, outlook, questions
Introduction

Web-GUI for ADAM and MARWIS
- presentation
- configuration

MARWIS
- Wireless sensor node networks

ADAM image-builder
- Buildsystem for Linux-Images
- for WRAP, ALIX (PCEngines), Meraki, Xen

Management profile
Motivation / Goals

> Wireless mesh networks (ADAM)
  — Graphical management and configuration
    - Support for generation of network configs
  — Graphical presentation of the network and the mesh nodes
  — Updating kernel and config images

> Wireless sensor networks (MARWIS)
  — Graphical presentation of the network and the measured data
  — Updating sensor nodes with new images and software
How to achieve the goals

> Management functionality on one or more mesh nodes
  — Storage of network and node information in sqlite databases
  — Webserver, php, sqlite, graphviz for GUI functionality
  — Using olsrd as routing protocol.

> MARWIS for communication between mesh nodes and sensor nodes
  — Storage of measurement in databases
  — Update the sensor nodes
Functionality of the ADAM GUI

- Generation and modification of WMN configurations and SSL keys
- Distribution of new or modified network configurations and SSL keys
- Graphical presentation of WMN
- Update mesh nodes with new images and software
Network presentation (1)

> Parallel map and tree for complete network overview
> 3 different map views:
  — WMN with connected WSN (no individual sensor nodes)
  — Mesh node with connected sensor nodes
  — Sensor node with measured data and other information
Network presentation (2)
Network presentation (3)
Network presentation (4)
Network presentation (5)

- Presentation in a 3-dimensional way
- Free adjustable mesh node positions

<table>
<thead>
<tr>
<th>Meshnode</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>alix03</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>alix04</td>
<td>90</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>alixmgmt</td>
<td>100</td>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>meraki01</td>
<td>20</td>
<td>70</td>
<td>5</td>
</tr>
<tr>
<td>meraki02</td>
<td>0</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>alix01</td>
<td>35</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>alix02</td>
<td>95</td>
<td>70</td>
<td>5</td>
</tr>
</tbody>
</table>

Info: Positions in meter, allowed are only positive integers

Update Positions
Network configuration (1)

> Until now:
  — Complete configuration done through command line
    - For each node: configuration file, public key, private key
  — No possibility to store different configurations
  — Generation of a compressed archive

> With ADAM GUI
  — Fast and easy to configure many nodes
  — Kind of wizard
  — Automatic generation of configuration files and SSL keys
  — Possibility to store and load different configurations
Network configuration (2)

```
# /etc/conf.d/network.conf
GLOBAL_SYSTYPE="alix"
AVAIL_DEVICES="eth0 ath0 ath1"
GLOBAL_WIFI_DEVICES="ath0 ath1"
GLOBAL_CFNET_PREFIX="fd49:3799:623e"
GLOBAL_UPDATE_TYPE="save"
GLOBAL_MGMT="no"
GLOBAL_CFNET_DEVICE="ath0"
GLOBAL_CFNET_MAC="00:0b:6b:84:a8:7a"
GLOBAL_DEVICES="eth0 ath0 ath1"
GLOBAL_CFHOPS="1"
GLOBAL_GW6=""
GLOBAL_GW6_IF=""
GLOBAL_GW=""
GLOBAL_GW_IF=""
GLOBAL_DNS0=""
GLOBAL_DNS1=""
```

```
# device ath0
ath0_DHCP="no"
ath0 OVERRIDE_ROUTE="no"
ath0 OVERRIDE_DNS="no"
ath0 OVERRIDE_NTP="no"
ath0_IP=""
ath0_MASK=""
ath0_DOMAIN=""
ath0_IP6=""
ath0_MASK6=""
ath0_DOMAIN6=""
ath0_RADVD_PREFIX=""
ath0_STANDARD="g"
ath0_ESSID="fd49:3799:623e"
ath0_TXPOWER=""
```
Network configuration (3)

> Managing different network configurations
  — Create and deploy new config, edit current config
  — Save and load to/from USB stick
Network configuration (3)

**Configuration Management**

**Deployed Network Configuration**
- ali01
- ali02
- ali03
- ali04
- ali0mgmt
- meraki01
- meraki02

**Actual Configuration**

**Actual Configuration:** config01

**Create New Configuration:** config01

- **Edit**
- **Discard**
- **Generate Configuration Archive**
- **Create**

**Saved Configurations (USB-Stick)**

No device found. 

**Mount** a previously inserted USB storage device.
Network configuration (4)

> Configuration of a network
  — Edit network settings
  — Add / remove nodes of different types (Alix, Meraki, etc...)
Network configuration (4)

Create new configuration 'config01'

Network

Root password: **********
Verify: **********
IPv6 Prefix: fd49:3799:623e
Network configuration (4)

Nodes

Add new Nodes:

Number: 1
Type: meraki-mini
Name (prefix): meraki

Name

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>alix00</td>
<td>alix-3d</td>
</tr>
<tr>
<td>alix01</td>
<td>alix-3d</td>
</tr>
<tr>
<td>alix02</td>
<td>alix-3d</td>
</tr>
<tr>
<td>meraki00</td>
<td>meraki-mini</td>
</tr>
<tr>
<td>meraki01</td>
<td>meraki-mini</td>
</tr>
</tbody>
</table>

Edit...    Remove
Edit...    Remove
Edit...    Remove
Remove
Remove

Save    Cancel
Network configuration (5)

> Configuration of an individual node
  — Network / connection settings
  — Configuration of different services
  — Interface settings
### Network configuration (5)

#### Node Settings

**Connection**

- **Node is Management station:** ✔
- **Default Route IPv4:**
- **Default Route IPv6:**
- **DNS:**
- **Syslog:**

**Gateway:**

- **Gateway:**
- **Server 0:**
- **Server 1:**
- **Server:**

**via interface**

- **via interface ath0**
- **via interface ath0**

**Cfengine**

- **Cfengine Device:**
- **Search over**

**its MAC address:**

- **00:0b:6b:84:a8:7a**
Network configuration (5)

Netfilter (IPv4/IPv6)

Log Netfilter: [on]

Start Netfilter: [on]
Allow Local In TCP: 22 443
(Separated by spaces)
Allow Local In UDP: 67 123
(Separated by spaces)
Allow Forwarding: [off]
Allow Local Out: [on]
SNAT to Interface: }

IPv4

IPv6

22 443 5308
123 33434:33999
Network configuration (5)

<table>
<thead>
<tr>
<th>Interface</th>
<th>Configuration: Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interface ath0</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Configuration:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IP settings</strong></td>
<td></td>
</tr>
<tr>
<td>RADVD Prefix:</td>
<td></td>
</tr>
<tr>
<td>IPv4</td>
<td>IPv6</td>
</tr>
<tr>
<td>IP Address:</td>
<td>192.168.1.10</td>
</tr>
<tr>
<td>Netmask:</td>
<td>24</td>
</tr>
<tr>
<td>Domain:</td>
<td>wireless2</td>
</tr>
<tr>
<td><strong>WIFI Settings</strong></td>
<td></td>
</tr>
<tr>
<td>ESSID:</td>
<td>fd49:3799:623e</td>
</tr>
<tr>
<td>Standard:</td>
<td>g</td>
</tr>
<tr>
<td>TXPower (pos. integer in mW):</td>
<td></td>
</tr>
</tbody>
</table>
Distribution of new network configuration

- GUI stores the new network configs in /etc/network.d/
- GUI stores the new SSL keys in /var/cfengine/newkeys/
- Distribution by cfengine
Distribution with cfengine

New network configuration
Looking for new configuration
Copy new configuration
Distribution of new images

- Upload of the new image file with the GUI

**Updating Kernel Images**

Upload new Image:  

- GUI stores the new image file in /var/lib/update/
- GUI touches a new file “update” in /var/lib/update/
  - Content: “<nodetype> <imagename> <sha1sum>”
  - Example: “alix alix-image-1.1.bin.gz b826e48b848f4d94b....”
- Cfengines connect to the neighbor nodes and copy the new image to themselves
- The neighbor node reboots with the new image.
MARWIS server/client on every mesh and sensor node

- update/upload software
- request data/infos
- request measurements

- provide measurements
- provide node data/infos
- provide network infos

Connection:
- usb/serial
- TUN/TAP
- TCP/IP
- tunslip
Conclusion, outlook

> Conclusion
  — Easy way to create, configure and manage large wireless mesh networks with connected sensor networks
  — Ease of use with standard notebook and browser

> Outlook
  — Real location coordinates (GPS) to place the nodes on the 3D map
  — Uploadable/configurable 3D map.
  — Detailed statistics of the network, the nodes and the measured data
  — Improved web front end (more AJAX functionality)
Discussion

Any questions?