Taming the Internet of Things

JFokus 2018 Stockholm
What we do

Saving the world, one household at a time

Youtube video:

GoClimateNeutral.org

climate.crisp.se
Show ’n tell
How it all fits together

Kristina’s house

Inverter
SmartMeter
Energy events

smartmeter.se
Energy events

Energy report

Energi-myndigheten

Certificate

Energy market

Henrik Kniberg & Hans Brattberg
In houses....
On top of department stores...
On fields....

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Big Things and Small Things

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Things all over the place

er... how do we update the software?
Continuous Delivery on IoT!
Field demo
Field demo
<table>
<thead>
<tr>
<th>Lövhagen</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuvarande produktion</td>
<td><strong>1.9 kW</strong></td>
</tr>
<tr>
<td>Total produktion</td>
<td><strong>738.7 kWh</strong></td>
</tr>
<tr>
<td>Reducerad CO₂ utsläpp</td>
<td><strong>147.7 kg</strong></td>
</tr>
</tbody>
</table>
How do we get through firewalls?

Raspberry pi

Updater

GitHub

Updater hub

/config

update me

/pull

update me

update me

{status: "noUpdateNeeded"
}

{status: "updateNeeded"
  snapshotId: 4
  meter: {
    version: "v1.6.5"
  }
}
Most of our code is open source on github ... but updater and updater-protocol are probably the most useful
What can possibly go wrong?

EVENYTHING!
The time should now be:
**How hard can it be?**

<table>
<thead>
<tr>
<th>App that pushes pulses to a server</th>
<th>Server records the pulses in DB</th>
<th>Server reports to Energi-myndigheten</th>
<th>We pay customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIP</td>
<td></td>
<td></td>
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</tbody>
</table>
# Reality – where we spend our time

<table>
<thead>
<tr>
<th>Stability improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manual handling of Certificate Admin</strong></td>
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<tr>
<td><strong>UI for End Customer</strong></td>
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<tr>
<td><strong>Monitoring</strong></td>
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<tr>
<td><strong>Remote-update infrastructure</strong></td>
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<tr>
<td><strong>Security</strong></td>
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<tr>
<td><strong>Assembly process</strong></td>
</tr>
<tr>
<td><strong>Streamlined installation that works for non-techy electricians</strong></td>
</tr>
<tr>
<td><strong>Customer support.</strong></td>
</tr>
</tbody>
</table>

- **App that pushes pulses to a server**
- **Server records the pulses in DB**
- **Server reports to Energimyndigheten**
- **We pay customers**

- **WIP**
- **WE PAY CUSTOMERS**
Remember the Updater?

```
/github
{  status: "updateNeeded"
  snapshotId: 4
  meter: {
    version: "v1.6.5"
  }
}
```

```
/updateme
  deviceId = ...
  snapshotId = 3

{  status: "noUpdateNeeded"
}
```
The other way in: SSH tunnel

Reverse SSH connections

Rasp A

Rasp B

Rasp C

ssh tunnel

ssh tunnel

ssh tunnel

SSH Jumphost

Port 10200

Port 10201

Port 10202

SSH

Backend

Rasp A => Port 10200
Rasp B => Port 10201
Rasp C => Port 10202
...

SSH port numbers autogenerated and pushed to each rasp via updater

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Ansible

- name: Install node
  apt:
    name: nodejs
    state: present
    when: correct_node_version_installed == false

- name: Check newly installed node version
  command: nodejs --v
  register: node_version

- name: Assert that the correct version of node is installed now
  assert:
    that: "expected_node_version in node_version.stdout_lines[0]"

- name: "Download updater version {{ updater_version }}"
  unarchive:
    src: https://github.com/sveasart/updater/archive/v{{ updater_version }}.zip
    dest: "{{ root_dir }}/"  # Edit to change root dir
    creates: "{{ root_dir }}/updater-{{ updater_version }}"
    remote_src: True

- name: Symlink the updater
  file:
    src: "{{ root_dir }}/updater-{{ updater_version }}"
    dest: "{{ root_dir }}/updater"
    state: link
    force: yes

- name: Install the updater (npm install)
  npm:
    path: "{{ root_dir }}/updater"
    state: present
    force: yes

- name: Test the updater (npm test)
  shell: npm test
  args:
    chdir: "{{ root_dir }}/updater"

- name: Copy in the production config for updater (overwriting if it already exists)
  copy:
    src: "updater/local.yml"
    dest: "{{ root_dir }}/updater/config"
    force: yes

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2 ways in = important lifesaver!
Buy vs Build
“Couldn’t we just use <insert tool/framework here>?"

Beware vendor lock-in!

Can I use your infrastructure to replace your infrastructure with something else?

Uh... no!

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Who has this box?

Someone in Nyköping, according to the IP address...
Challenge: Who has which box?

1. Printed ID on Raspberry Box

2. Display with QR code

3. Customer Name on Screen
Box assembly - spring 2017
Today’s assembly line

Assembly

Test

Packaging
Assembly - Lean is pretty good for hardware too :)  

Single piece flow.  

Quality in delivery builds trust  

Checklists  

Standardize work  

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Scaling the production - Creating SD cards

Solution 1: Single Card
Run Ansible on a single Raspberry Pi to create SD cards, one at a time in 18 minutes

Solution 2: Raspberry Cluster
A Raspberry Pi cluster of 6
Run with Ansible to create 6 SD Cards in 18 minutes

Solution 3: SD copier
A SD card copier, with a master to copy from in 2 minutes
Cross-functional team & onsite customer!
Cloud dependency...
IoT = ?
**Not IoT = the comfy world we came from**

- Computer breaks? Not our problem.
- Customer's Internet access is not our problem
- High bandwidth, unlimited data (or high limit)
- Customer transports it, installs and configure it
- We don't care if the customer switches computer
- No human user. Tells us if there is a problem.
- Customer = our main stakeholder
- Each device must be registered to a specific customer
- Requested initiated from client-side (Pull). So firewalls aren't a problem.
- Customer Installer

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**IoT = wild west!**

- Thing breaks? Our problem!
- No human user. Problems can go undetected.
- Installer = our main stakeholder
- We are responsible for delivery, installation and configuration
- Each device must be registered to a specific customer
- Requested sometimes initiated from server-side (Push). Need to trick the firewall.
- Low bandwidth, limited data
- Customer’s Internet access is our problem
- Customer Installer

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What’s next?

Take-aways?

Talk to us about
- Data scaling
- Saving the world from climate change
- Getting solar panels
- ...

Don’t try this at home....

Henrik Kniberg & Hans Brattberg