Management of mobile systems

Red Hat Satellite 6 AND Ansible Tower

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AGENDA

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• REQUIREMENTS
• THE CONSULTANTS VIEW
• SATELLITE
• NETWORK INFRASTRUCTURE
• ANSIBLE FOR EMBEDDED DEVICES
• WHAT’S NEXT?
ABOUT US

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PROJECT SUMMARY

ICT Systems on Rolling Stock

- Mobile Router (LTE/GPS)
- Ethernet Backbone
- Wi-Fi
- Inter Vehicle Network
- TFT Displays
- LED Displays
- Audio Systems
- Board computer
- Emergency Phones
- User Terminals
- CCTV
- Passenger Counter
PROJECT SUMMARY

Supplier ABC
- CCTV
- Audio
- Visual Devices
- Passenger Counter
- Emergency Phones

Supplier XYZ
- CCTV
- Audio
- Visual Devices
- Passenger Counter
- Emergency Phones
PROJECT SUMMARY
Where do we come from
PROJECT SUMMARY

Standard hardware
Standard software
Standard protocols
PROJECT SUMMARY

Lower costs
Enhanced security
Less bugs
Supplier independency
REQUIREMENTS

Long term support

40 years

10 years
REQUIREMENTS

Fully automated provisioning process over the air

Power On → Provision → Configure

24/7
REQUIREMENTS

Scalable management solutions

- 700 vehicles/hosts
- 10 different fleets
- 3 different Life Cycles

Lab Test  Vehicle Test  Production
THE CONSULTANT’S VIEW

- **Complexity / Environment**: Unique environment with high security standard involved together with very strict network requirements.
- **Rail Industry**: Focus on how to automatically deploy and re-deploy systems without any manual intervention.
- **Engineering involved**: Due to complexity/importance, very useful to have consultant on site working directly with engineering to resolve issues efficiently.
- **Outcome**: Demonstrated that with Satellite and Ansible Tower together with a fully customized setup we were able to deploy a complete "train" in less than 40 minutes. Customer expectations were met.
THE CONSULTANT’S SOLUTION

Red Hat Satellite

VPN Gateway

Internet

Mobile Network

Mobile Router

Switch

VLAN Trunk

Board Computer

#redhat #rhsummit
SATELLITE

ccv-fleet x

cv-rhel

cv-sbb

Lab Test
Vehicle Test
Production

Content View & Lifecycle Mgmt

#redhat #rhsummit
SATELLITE

Provisioning

Discover → Provision → Configure
SATellite Provisioning

**PXE Rom (Network Adapter)**
- DHCP Request
- DHCP Reply (next-server: Satellite)
- TFTP GET (iPXE)
- TFTP Reply

**iPXE**
- DHCP Request
- DHCP Reply
- HTTP GET (STAGE DEPENDING FILE)
- HTTP Reply

**DHCP Server (Mobile Router)**
- DHCP Request
- DHCP Reply

**TFTP Server (Satellite)**
- TFTP GET (iPXE)
- TFTP Reply

**HTTP Server (Satellite)**
- HTTP GET (STAGE DEPENDING FILE)
- HTTP Reply
SATCHELITE

DHCP Request
DHCP Reply
HTTP GET (STAGE DEPENDING FILE)
HTTP Reply

DHCP Server (Mobile Router)
DHCP Server (Satellite)

iPXE

Provisioning

Stage 1
Discovery

Stage 2
Anaconda

Stage 3
Local boot
• 100 – 400 Ethernet devices in one train set
• All devices interconnected
The network is NOT what you expect from datacenter or cloud
The properties like bandwidth, latency and packet loss are important
In the end, our servers are moving at a speed of 250km/h (155 mph)
MOBILE NETWORK
MOBILE NETWORK
# PXE TFTP vs. iPXE HTTP

<table>
<thead>
<tr>
<th></th>
<th>PXE TFTP</th>
<th>iPXE HTTP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transmission</strong></td>
<td>Uses UDP as transmission protocol and thus there is no handling of lost or corrupted packets.</td>
<td>Uses TCP as transmission protocol. The full reliability and control functions of the stack are available.</td>
</tr>
<tr>
<td><strong>Flow Control</strong></td>
<td>The transmission is of a &quot;lock-step type&quot;. Each packet must be acknowledged. (Exception see IETF RFC 7440 TFTP window size option)</td>
<td>The transmission is controlled by the underlying TCP Layer. TCP guarantees maximum throughput (flow control, congestion control) and error control.</td>
</tr>
<tr>
<td><strong>Footprint</strong></td>
<td>Small</td>
<td>Large</td>
</tr>
<tr>
<td><strong>Authentication</strong></td>
<td>No</td>
<td>HTTP(S)</td>
</tr>
</tbody>
</table>
PXE TFTP vs. iPXE HTTP
PXE TFTP vs. iPXE HTTP
**TFTP-HTTP CONCLUSION**

- Optimize network parameters
- Take care when choosing protocols to maximize throughput
- Detailed analysis of low-level protocol performance (TCP functions)
ANSIBLE FOR EMBEDDED

- Embedded Linux industrial networking gear
- Specialized CPU's, mostly SoC's
- Linux vendor specific kernel running BusyBox
- Not many tools available
- Very limited resources
- None or limited vendor support

...but we are root 😊

1. Compile small footprint Python 3.7 for target
2. Write modules
3. Write roles and playbooks
4. Finally manage the device using Ansible Tower
ANSIBLE FOR EMBEDDED

• Gathering facts
• Firmware update
• Installation of User Modules
• Firewall configuration
• Certificate management with corporate CA
• ...
WHAT’S NEXT?
WHAT’S NEXT?

1. UEFI HTTP Boot from A-Z
2. VLAN trunk support
3. IPv6
4. SecureBoot
Thank you.