Management of mobile systems

Red Hat Satellite 6 AND Ansible Tower

Sascha Berger
System Engineer
SBB AG

Olivier Hugi
Senior Network Engineer
SBB AG

Gianfranco Sigrisi
Senior Infrastructure Consultant
Red Hat

May 9, 2019

SBB CFF FFS

AGENDA

- PROJECT SUMMARY
- REQUIREMENTS
- THE CONSULTANTS VIEW
- SATELLITE
- NETWORK INFRASTRUCTURE
- ANSIBLE FOR EMBEDDED DEVICES
- WHAT'S NEXT?

SBB CFF FFS

ABOUT US

Sascha Berger
System Engineer
SBB AG

Olivier Hugi
Senior Network Engineer
SBB AG

Gianfranco Sigrisi
Senior Infrastructure Consultant
Red Hat

SBB CFF FFS

PROJECT SUMMARY

ICT Systems on Rolling Stock


Mobile Router (LTE/GPS)

TFT Displays

Emergency Phones


Ethernet Backbone

LED Displays


User Terminals


Wi-Fi


Audio Systems


CCTV

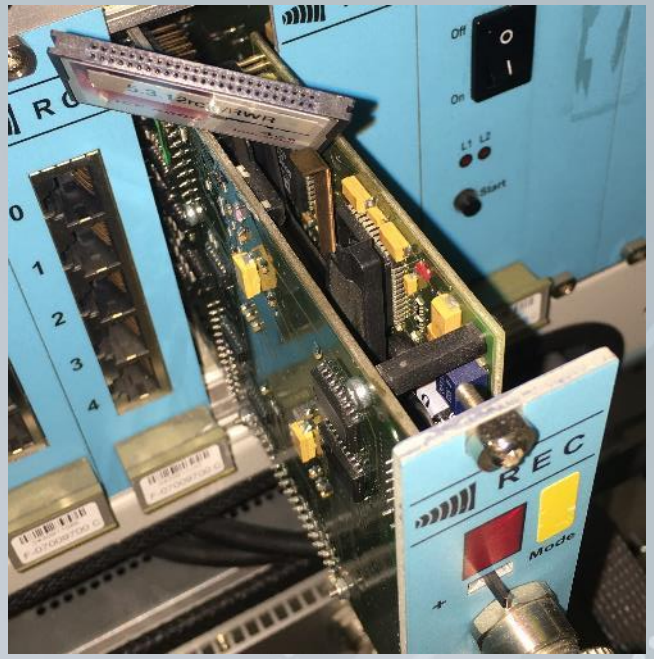

Inter Vehicle Network


Board computer


Passenger Counter

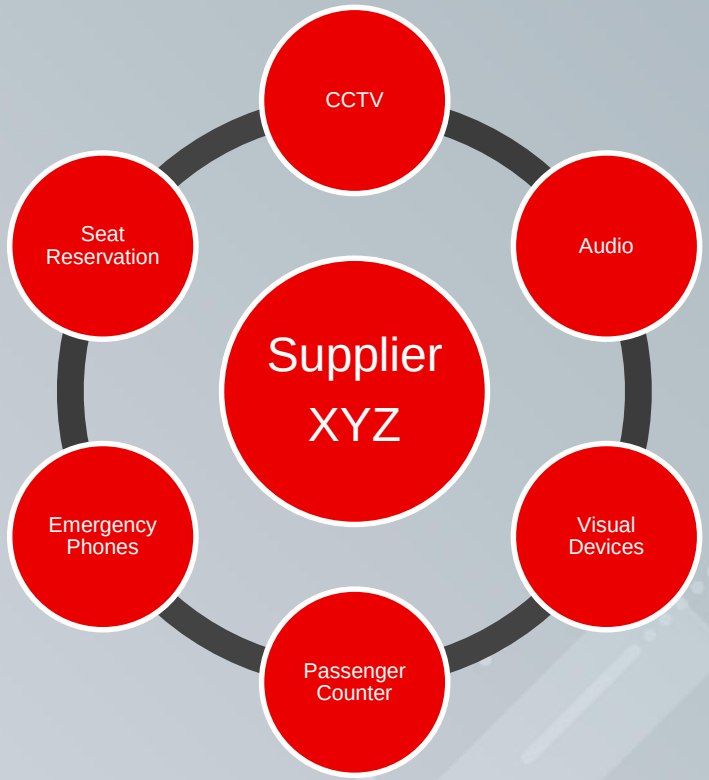
SBB CFF FFS

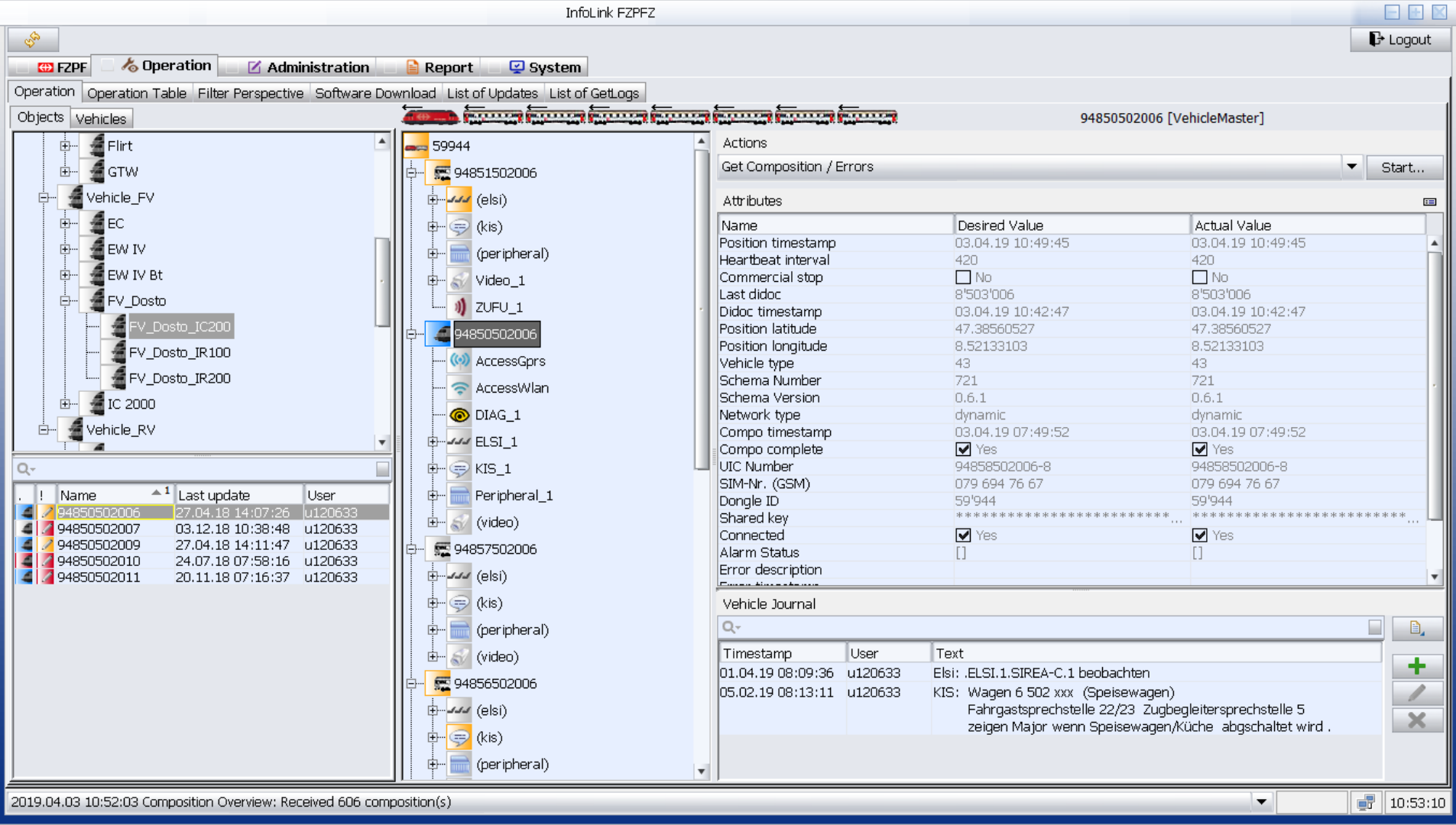
PROJECT SUMMARY



SBB CFF FFS

PROJECT SUMMARY




InfoLink FZPFZ
Logout
FZPF
Operation
Administration
Report
System
Operation
Operation Table
Filter Perspective
Software Download
List of Updates
List of GetLogs
Objects
Vehicles
Flirt
GTW
Vehicle_FV
EC
EW IV
EW IV Bt
FV_Dosto
FV_Dosto_IC200
FV_Dosto_IR100
FV_Dosto_IR200
IC 2000
Vehicle_RV
Name
Last update
User
94850502006 27.04.18 14:07:26 u120633
94850502007 03.12.18 10:38:48 u120633
94850502009 27.04.18 14:11:47 u120633
94850502010 24.07.18 07:58:16 u120633
94850502011 20.11.18 07:16:37 u120633
59944
94851502006
(elsi)
(kis)
(peripheral)
Video_1
ZUFU_1
94850502006
AccessGprs
AccessWlan
DIAG_1
ELSI_1
KIS_1
Peripheral_1
(video)
94857502006
(elsi)
(kis)
(peripheral)
(video)
94856502006
(elsi)
(kis)
(peripheral)
94850502006 [VehicleMaster]
Actions
Get Composition / Errors
Start...
Attributes
Name
Desired Value
Actual Value
Position timestamp 03.04.19 10:49:45 03.04.19 10:49:45
Heartbeat interval 420 420
Commercial stop No No
Last didoc 8'503'006 8'503'006
Didoc timestamp 03.04.19 10:42:47 03.04.19 10:42:47
Position latitude 47.38560527 47.38560527
Position longitude 8.52133103 8.52133103
Vehicle type 43 43
Schema Number 721 721
Schema Version 0.6.1 0.6.1
Network type dynamic dynamic
Compo timestamp 03.04.19 07:49:52 03.04.19 07:49:52
Compo complete Yes Yes
UIC Number 94858502006-8 94858502006-8
SIM-Nr. (GSM) 079 694 76 67 079 694 76 67
Dongle ID 59'944 59'944
Shared key
Connected Yes Yes
Alarm Status []
Error description
Vehicle Journal
Timestamp
User
Text
01.04.19 08:09:36 u120633 Elsi: .ELSI.1.SIREA-C.1 beobachten
05.02.19 08:13:11 u120633 KIS: Wagen 6 502 xxx (Speisewagen)
Fahrgastsprechstelle 22/23 Zugbegleitersprechstelle 5
zeigen Major wenn Speisewagen/Küche abgeschaltet wird .
2019.04.03 10:52:03 Composition Overview: Received 606 composition(s)
10:53:10

SBB CFF FFS

PROJECT SUMMARY

Standard hardware

Standard software

Standard protocols

SBB CFF FFS

PROJECT SUMMARY

Lower costs

Enhanced security

Less bugs

Supplier independency

REQUIREMENTS

Long term support

40 years

10 years

SBB CFF FFS

REQUIREMENTS

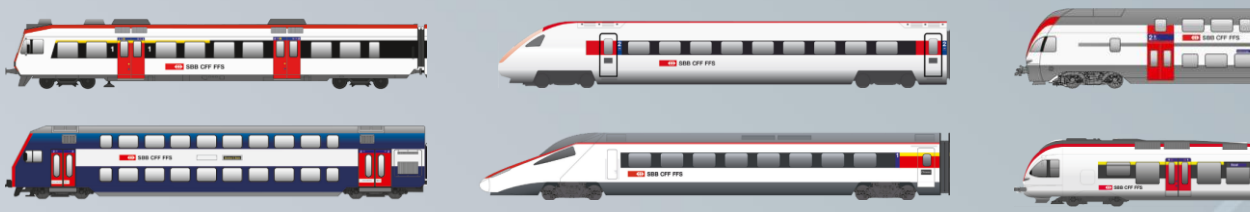
Fully automated provisioning process over the air

SBB CFF FFS

REQUIREMENTS

Scalable management solutions

- 700 vehicles/hosts
- 10 different fleets



- 3 different Life Cycles

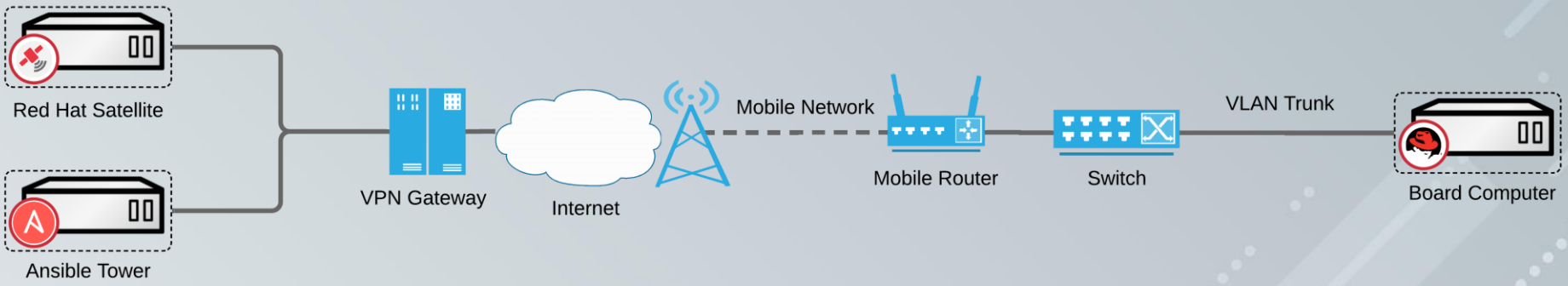
SBB CFF FFS

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.

SBB CFF FFS

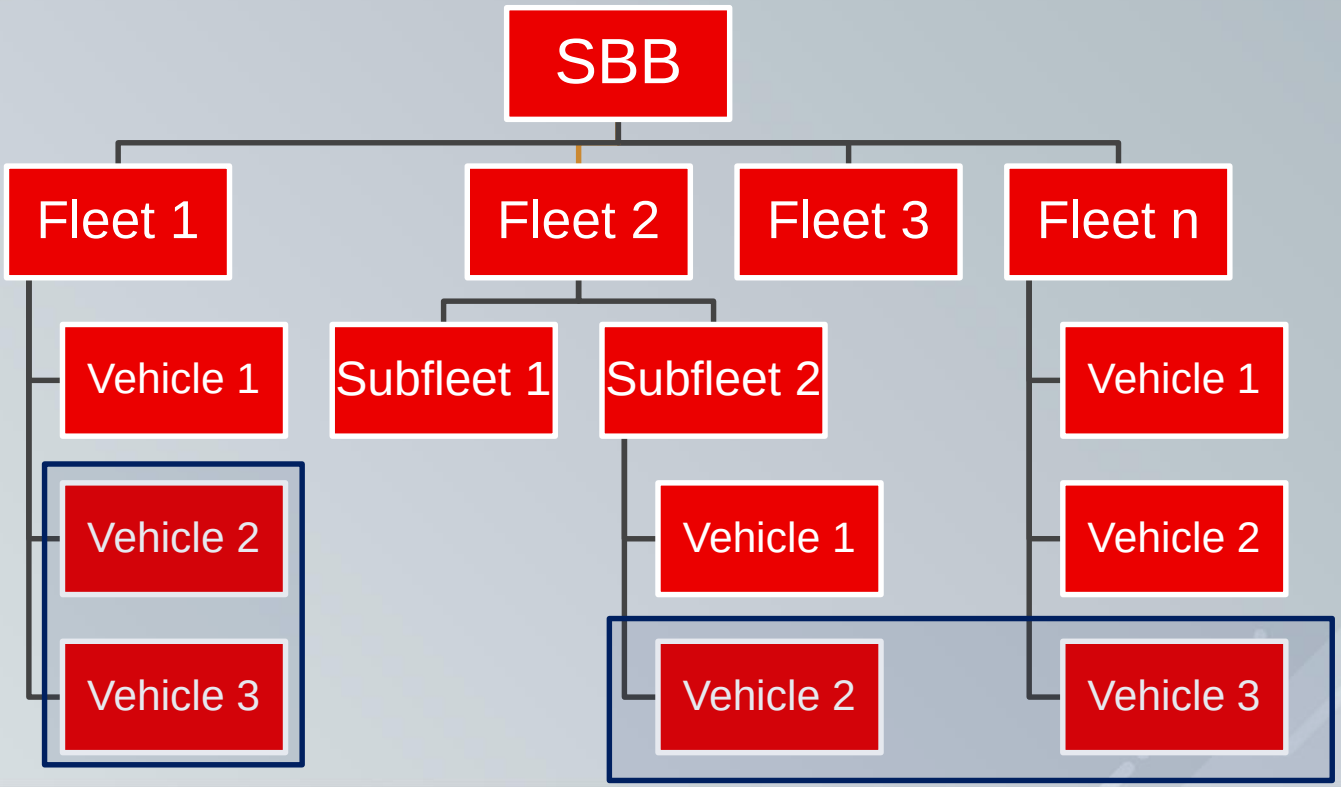
THE CONSULTANT'S SOLUTION



SBB CFF FFS

SATELLITE

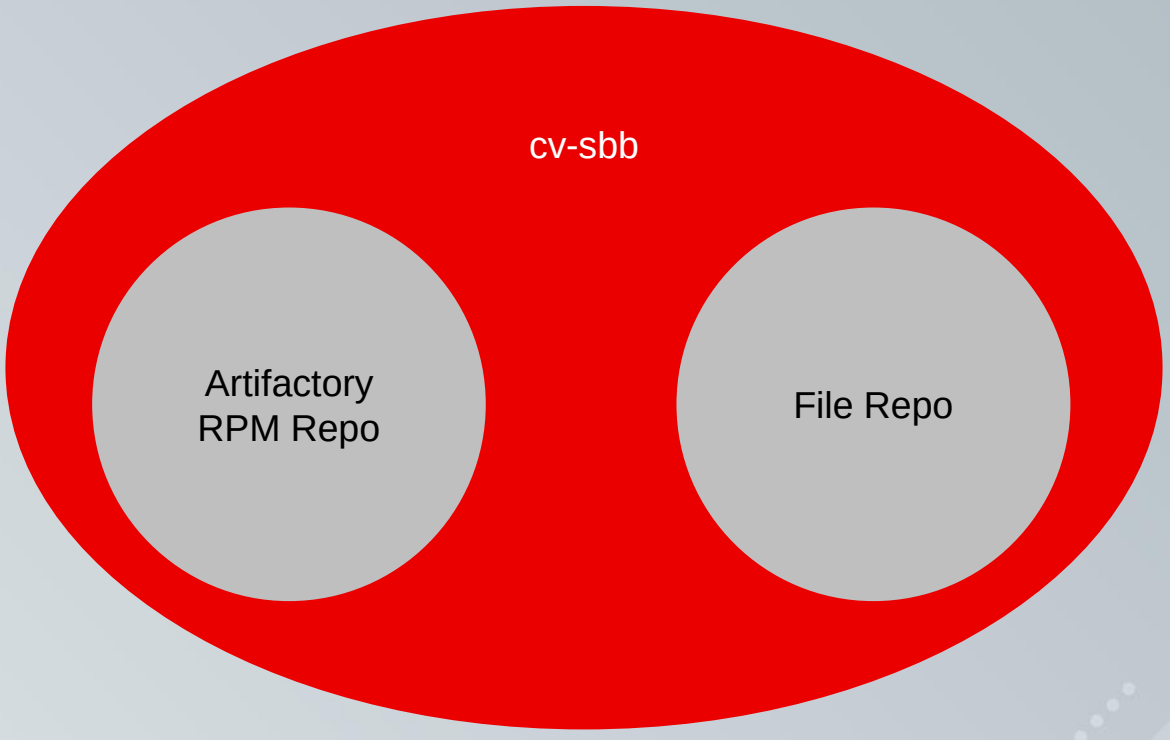
Inventory



SBB CFF FFS

SATELLITE

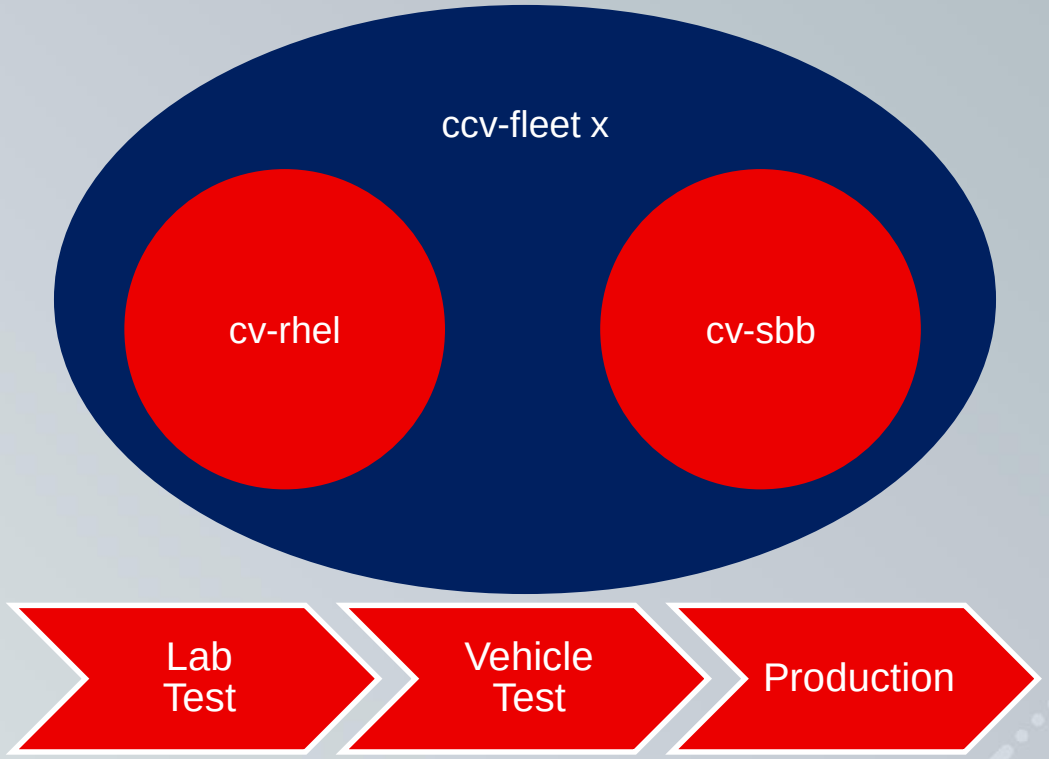
Repositories



SBB CFF FFS

SATELLITE

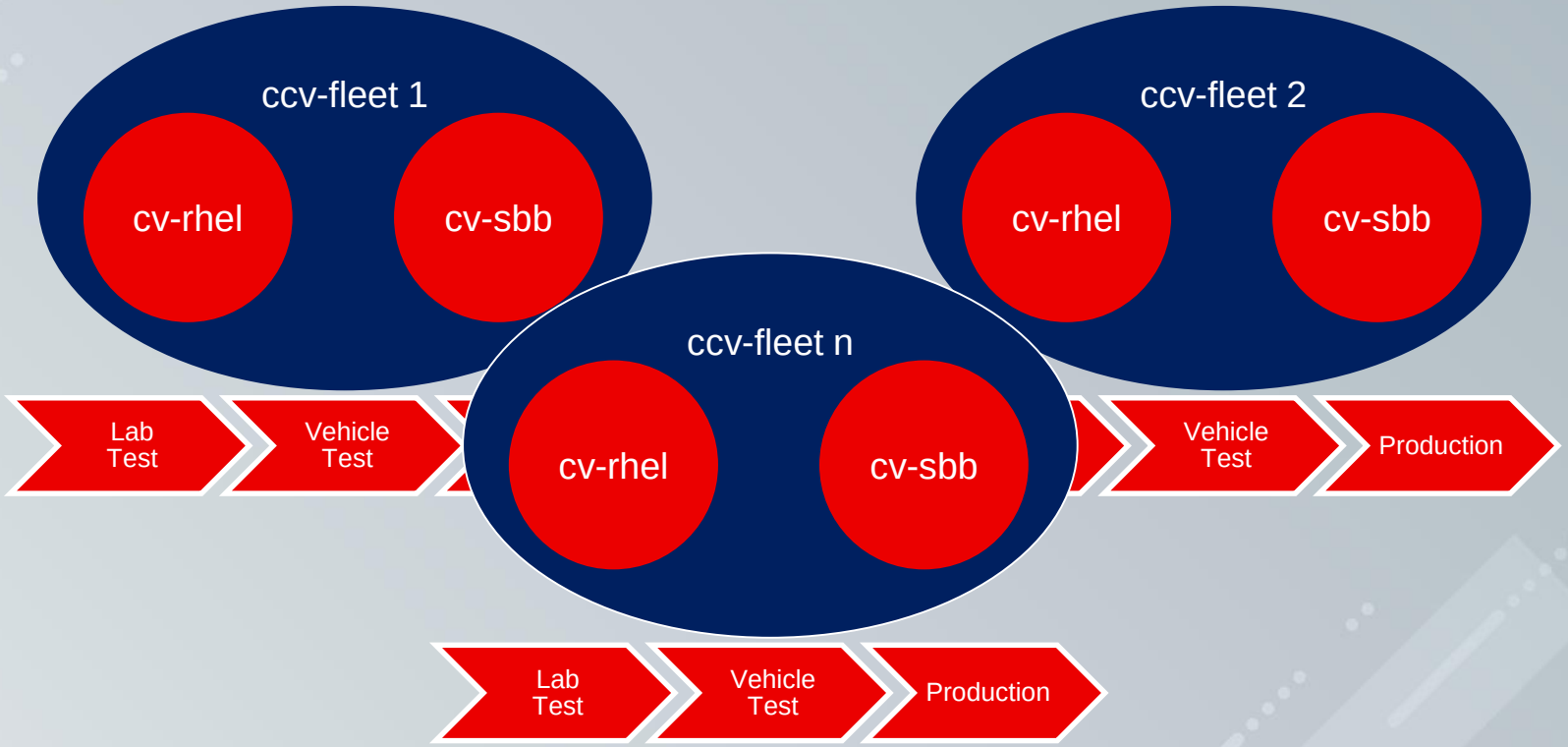
Content View & Lifecycle Mgmt



SBB CFF FFS

SATELLITE

Content View & Lifecycle Mgmt



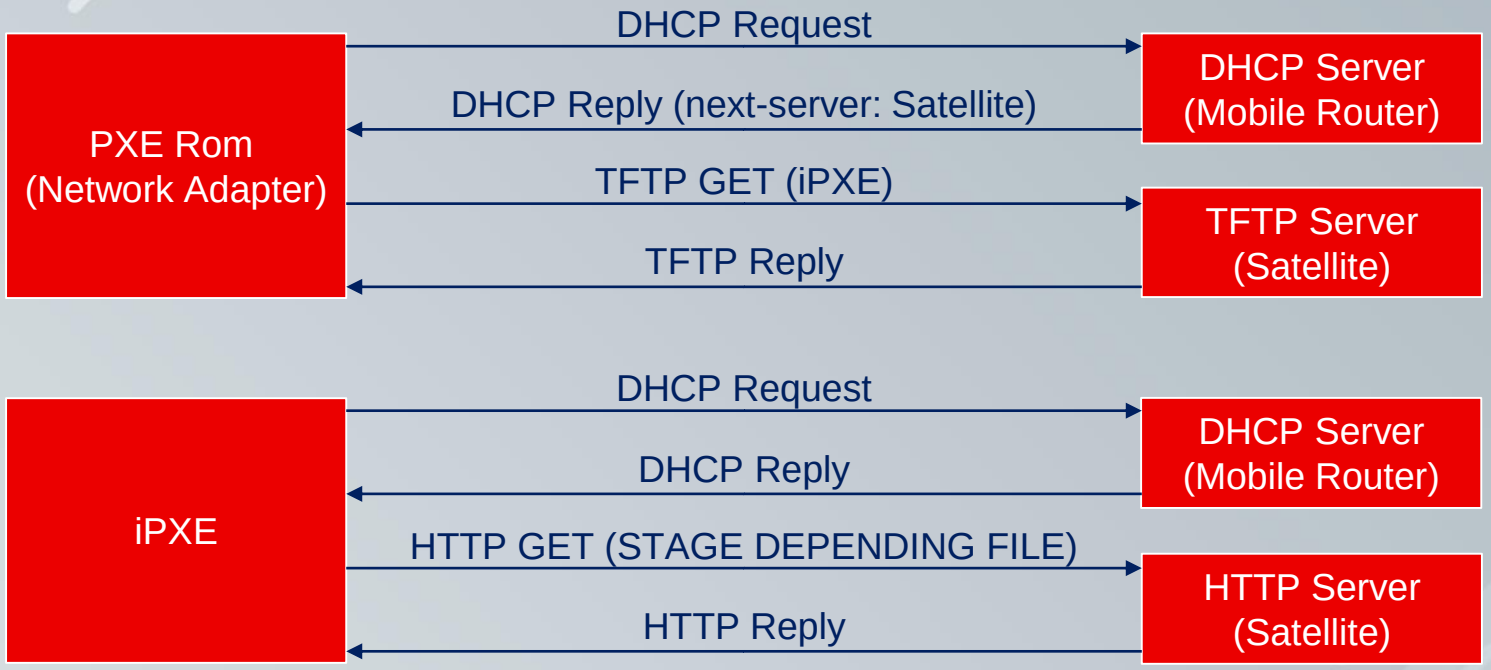
SBB CFF FFS

SATELLITE

Provisioning

SATELLITE

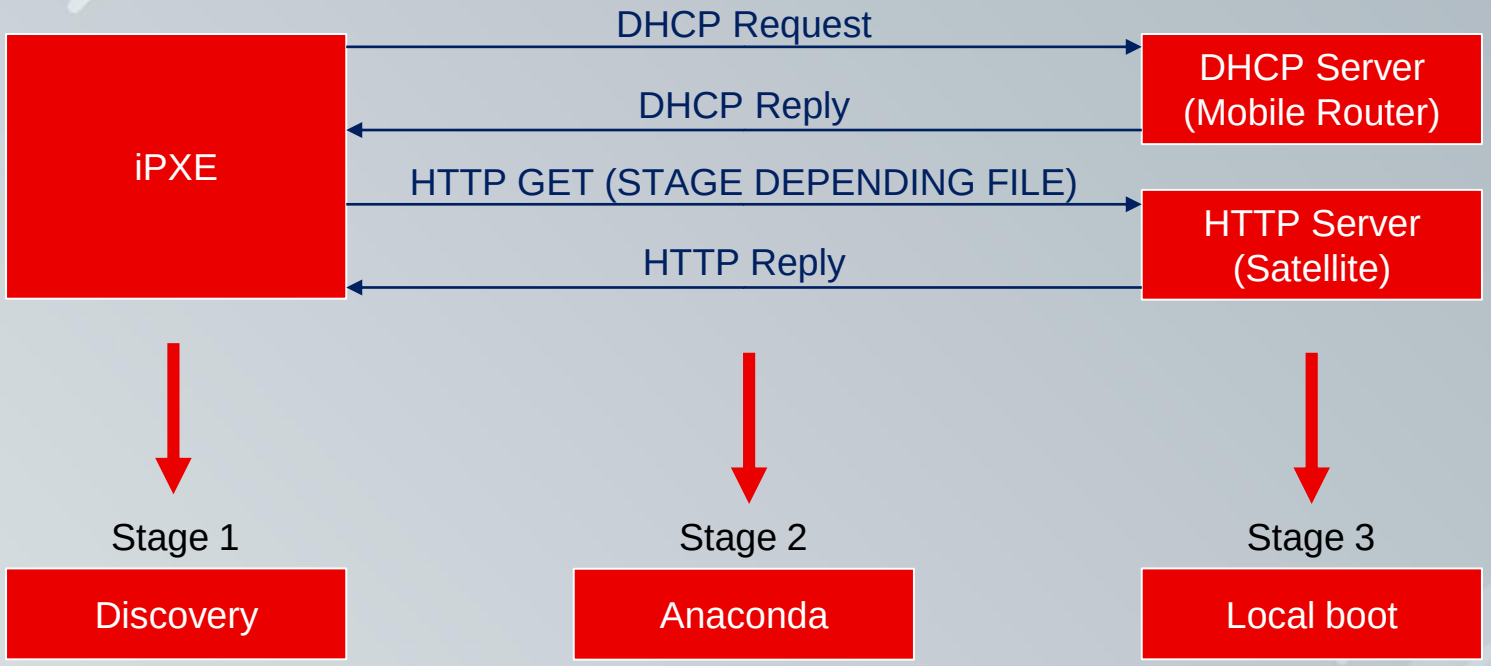
Provisioning



SBB CFF FFS

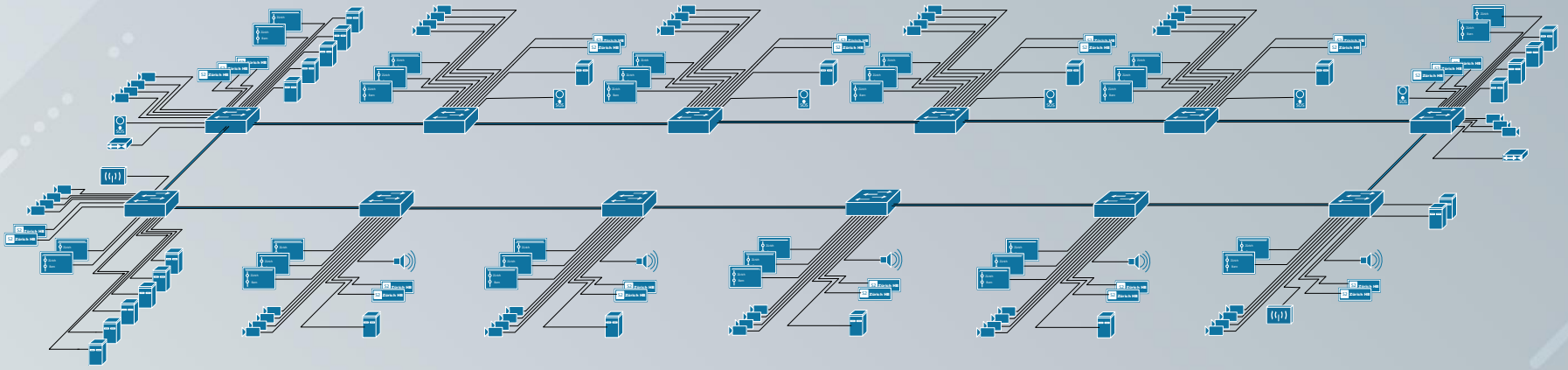
SATELLITE

Provisioning



SBB CFF FFS

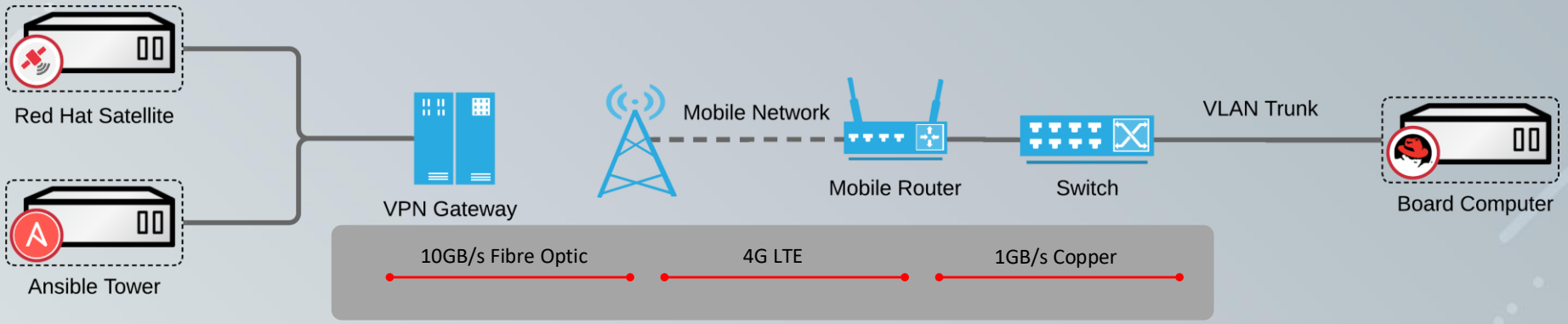
VEHICLE NETWORK



- 100 – 400 Ethernet devices in one train set
- All devices interconnected

SBB CFF FFS

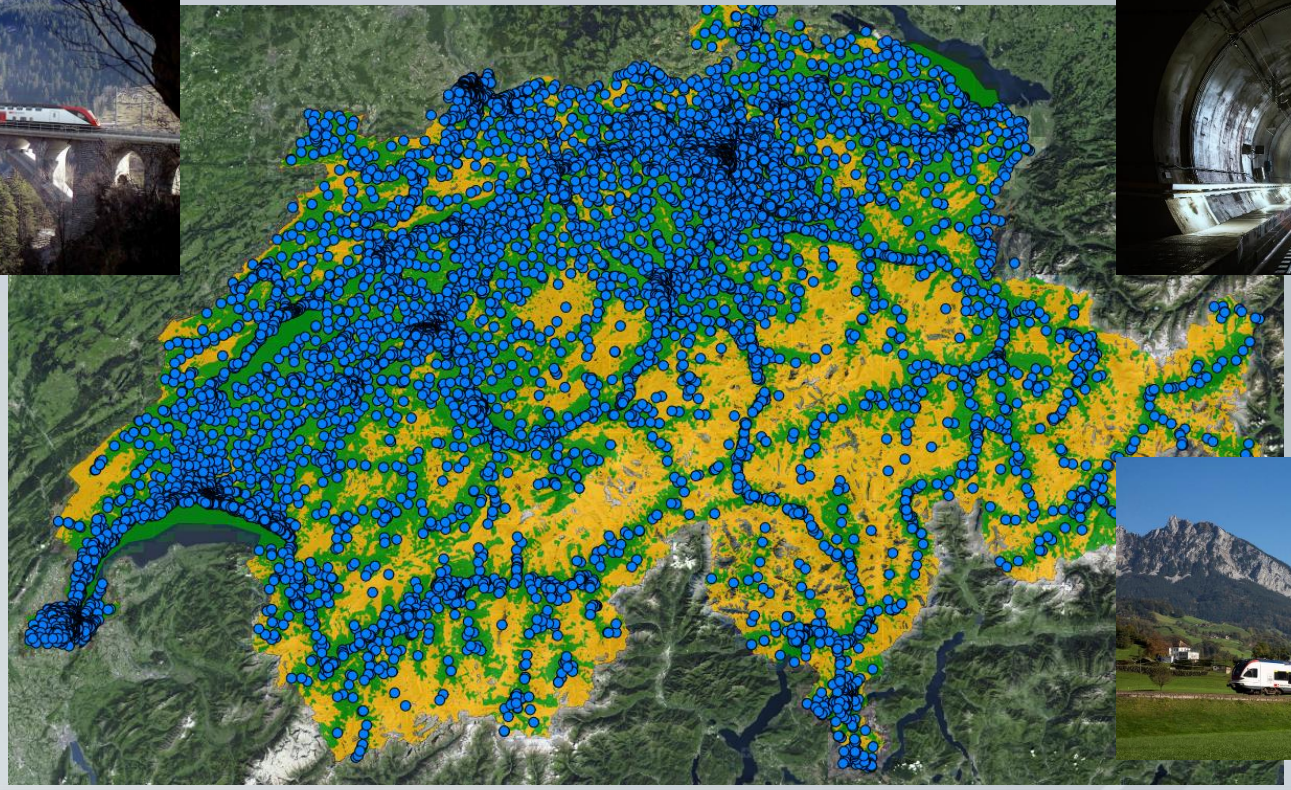
NETWORK ARCHITECTURE



- 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)

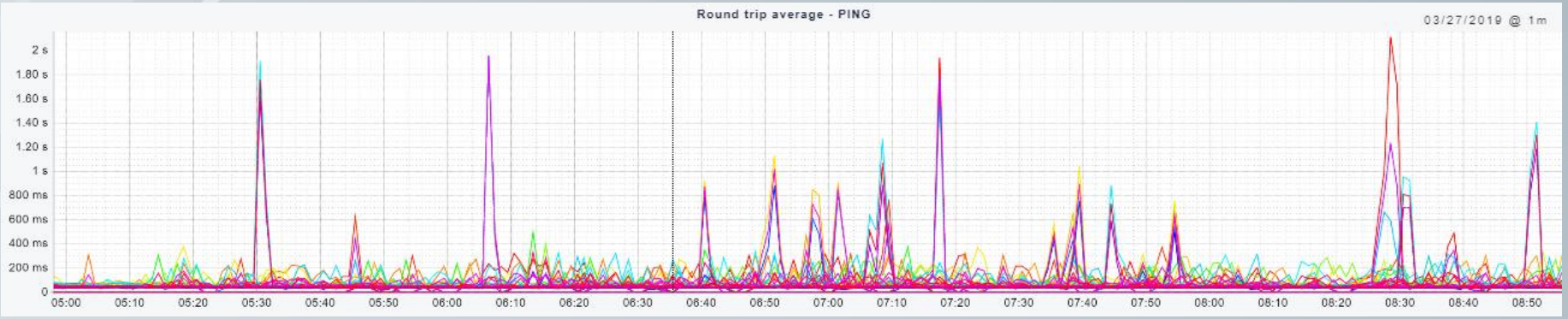
SBB CFF FFS

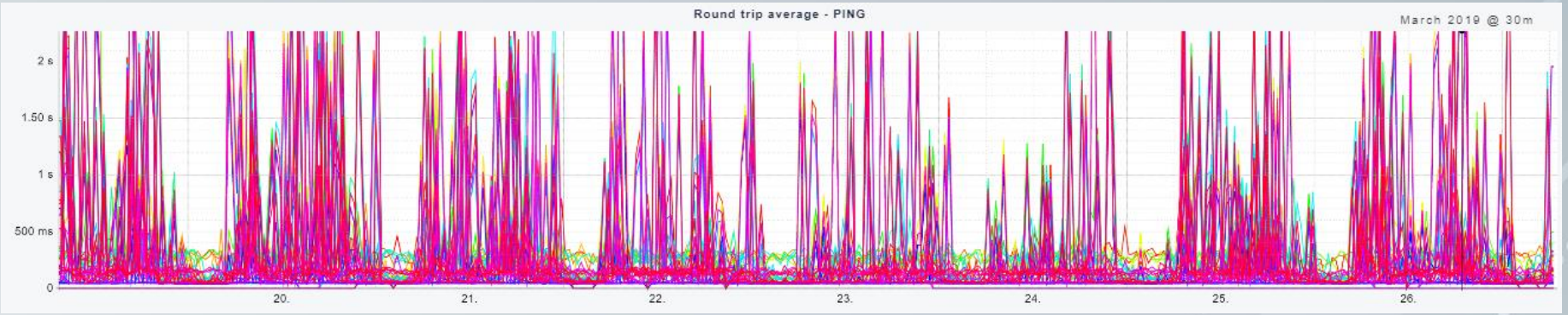
MOBILE NETWORK



SBB CFF FFS

MOBILE NETWORK





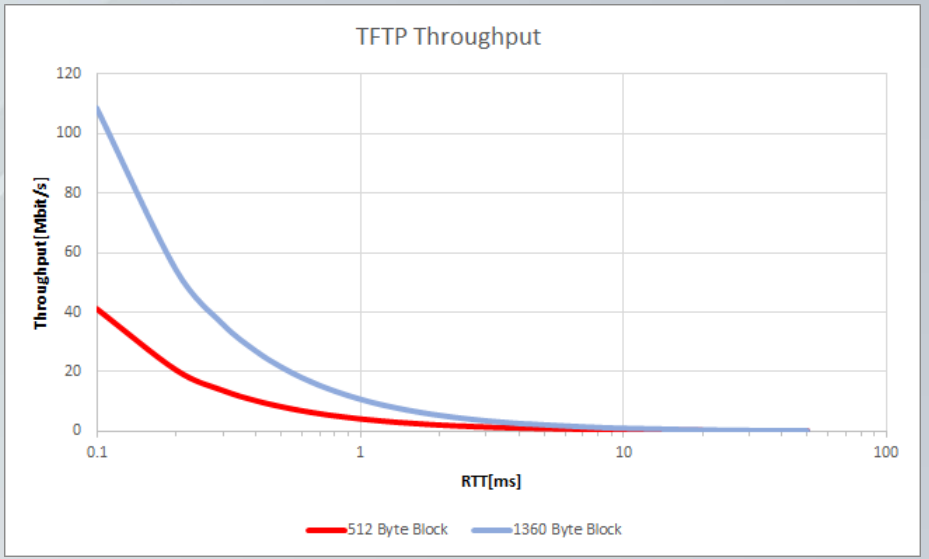
SBB CFF FFS

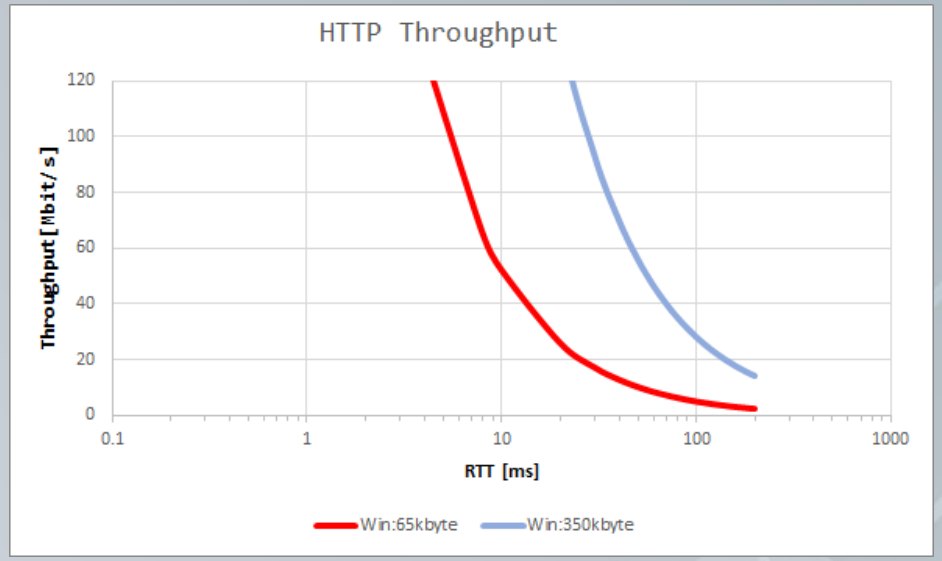
PXE TFTP vs. iPXE HTTP

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

SBB CFF FFS

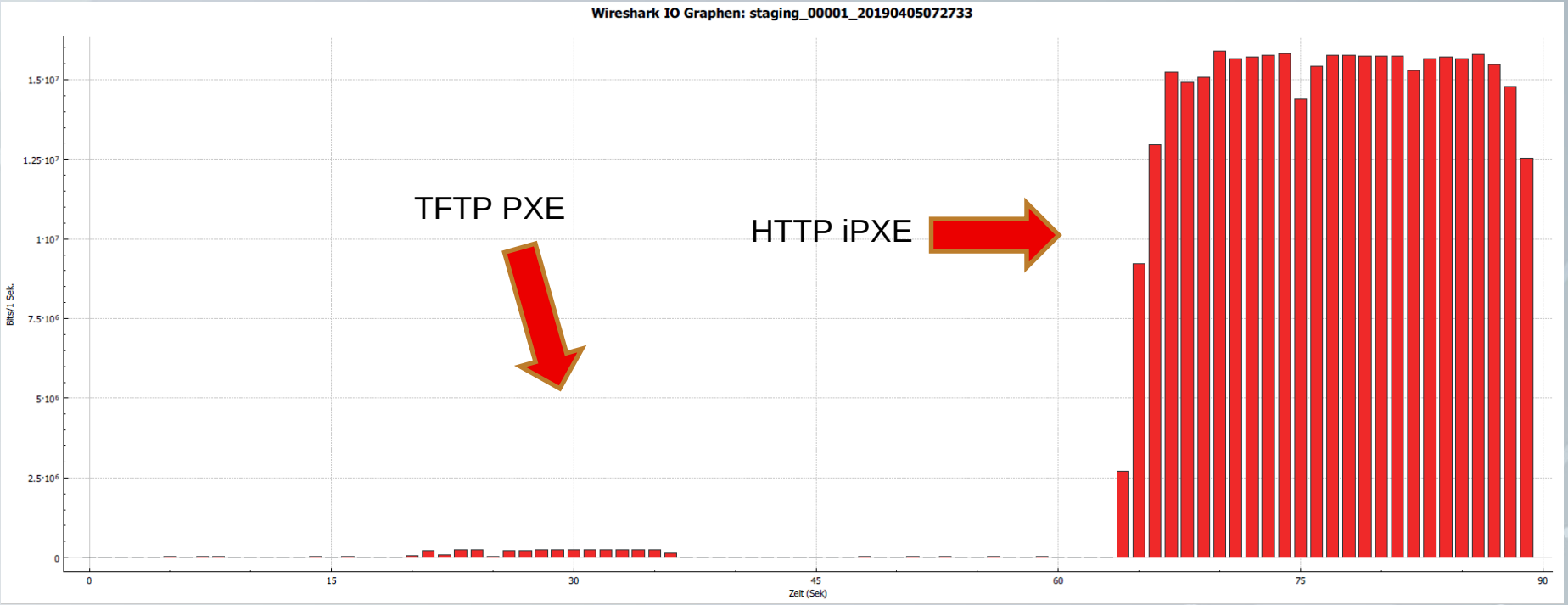
PXE TFTP vs. iPXE HTTP





SBB CFF FFS

PXE TFTP vs. iPXE HTTP



SBB CFF FFS

TFTP-HTTP CONCLUSION

- Optimize network parameters
- Take care when choosing protocols to maximize throughput
- Detailed analysis of low-level protocol performance

  (TCP functions)

SBB CFF FFS

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

SBB CFF FFS

ANSIBLE FOR EMBEDDED

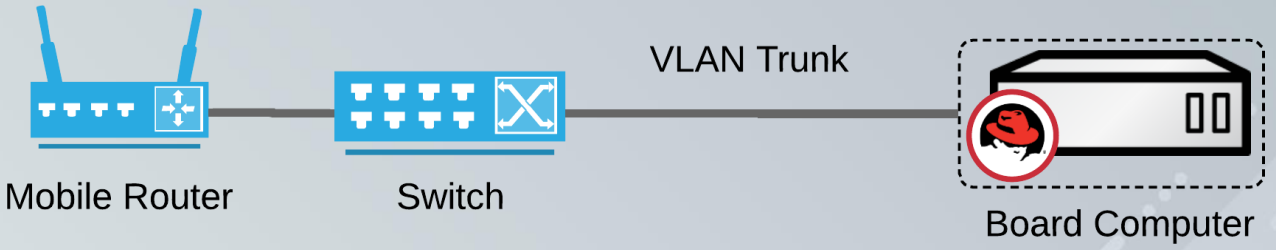
- Gathering facts
- Firmware update
- Installation of User Modules
- Firewall configuration
- Certificate management with corporate CA
- …

WHAT'S NEXT?

SBB CFF FFS

WHAT'S NEXT?

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



SBB CFF FFS

Thank you.