

SURFNET8

Evolving from Device Automation to
Service Orchestration

peter.boers@surf.nl

A long time ago in an NREN far,
far away....

Who am I?

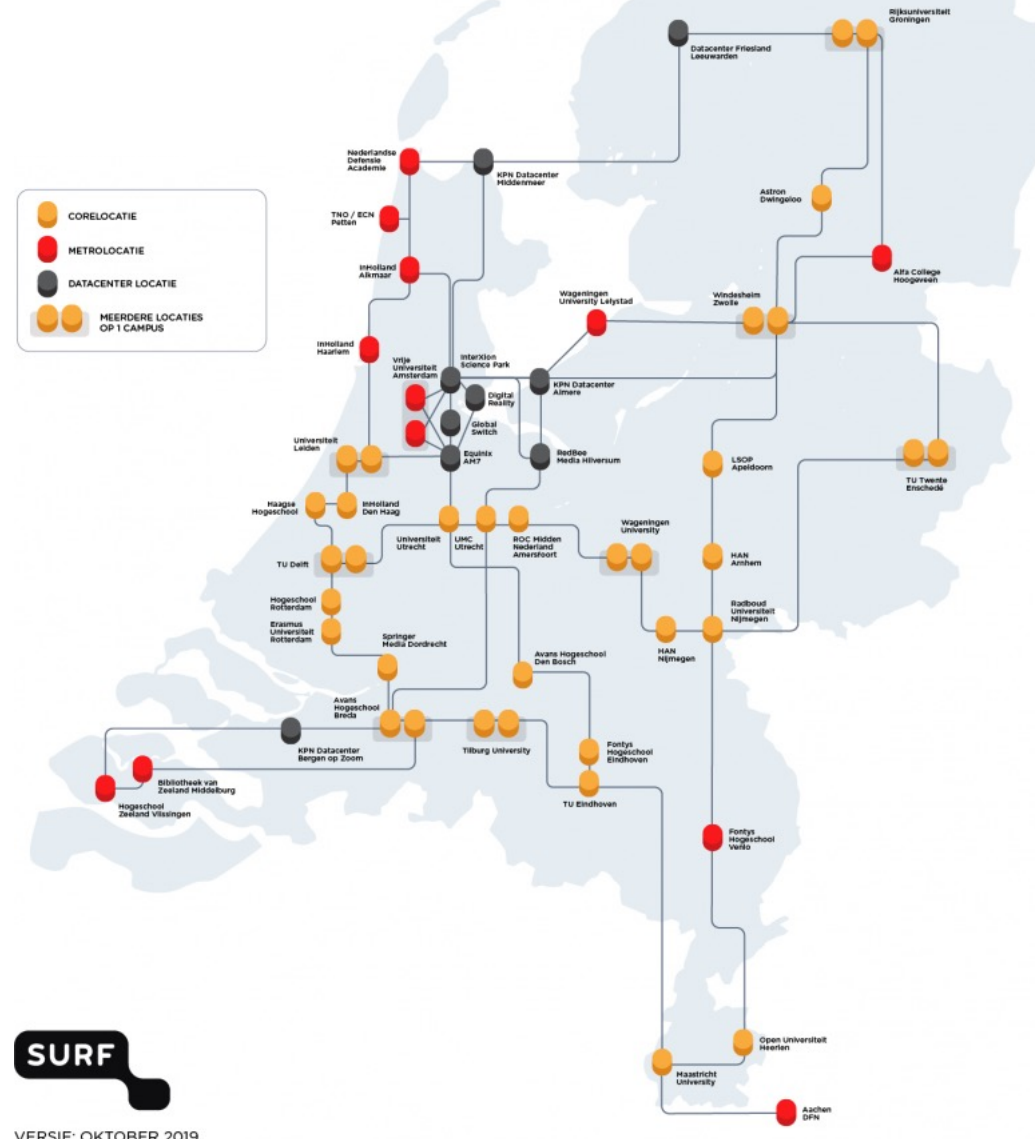
- Peter Boers (32)
- Software Architect and Software Engineer
- Master in System and Network Engineering from the University of Amsterdam
- Background in S.R.E
- Started at SURF 5 years ago working on the Automation and Orchestration solution for the network department.

Quick re-cap... SURF network vital statistics

- SURF's network provides internet to around 1.5 million students, teachers and scientists every day.
 - 280 Gb/s peak commodity IP traffic load (Sept, 2021)
 - Total network peak load +/- 1.1Tb/s (Sept, 2021)
- It provides data transport services for experiments with large data flows
 - LHC, LOFAR, etc
- +/- 13000km of dark fibre in NL and Europe
- +/- 350 locations in NL and Europe
- **Recently migrated from SURFnet7 to SURFnet8**

SURFs Network

- Juniper MX series
- SR-MPLS
- 100G backbone
- Most import PoP's
 - Amsterdam
 - NetherLight Open Exchange
- Member of the GNA-G and AutoGOLE



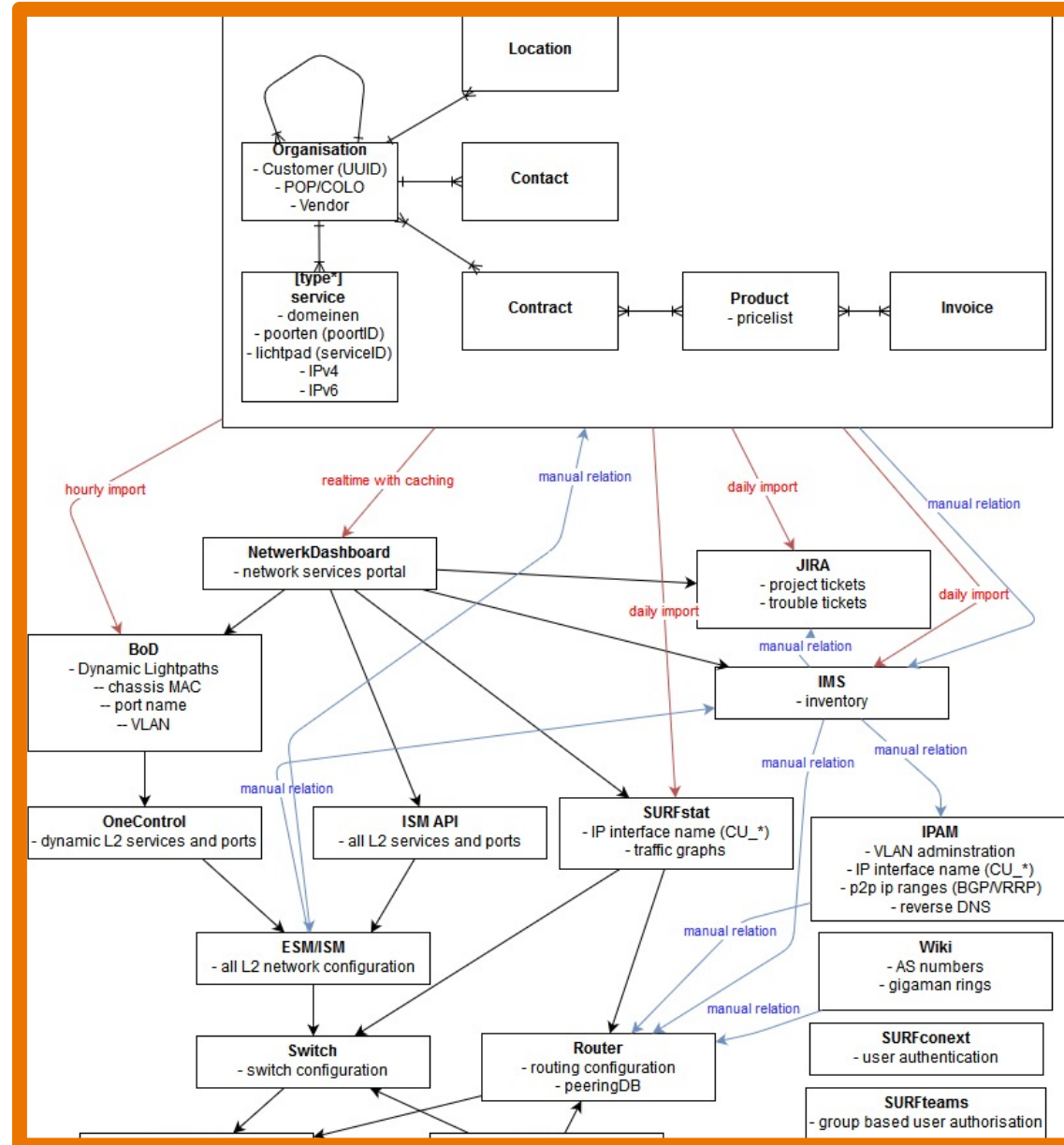
VERSIE: OKTOBER 2019



How does an NREN build a network?

- A network not only encompasses fibre's, optics, routers, switches etc
- It also contains ten's of thousands of lines of configuration
- Multiple configuration databases need to be kept up to date
 - Inventory
 - IP address management
 - Metrics
 - Etc
- Change preparation takes a long time and keeping all databases in sync is a full time job.
- **A network of configuration, not of services.**

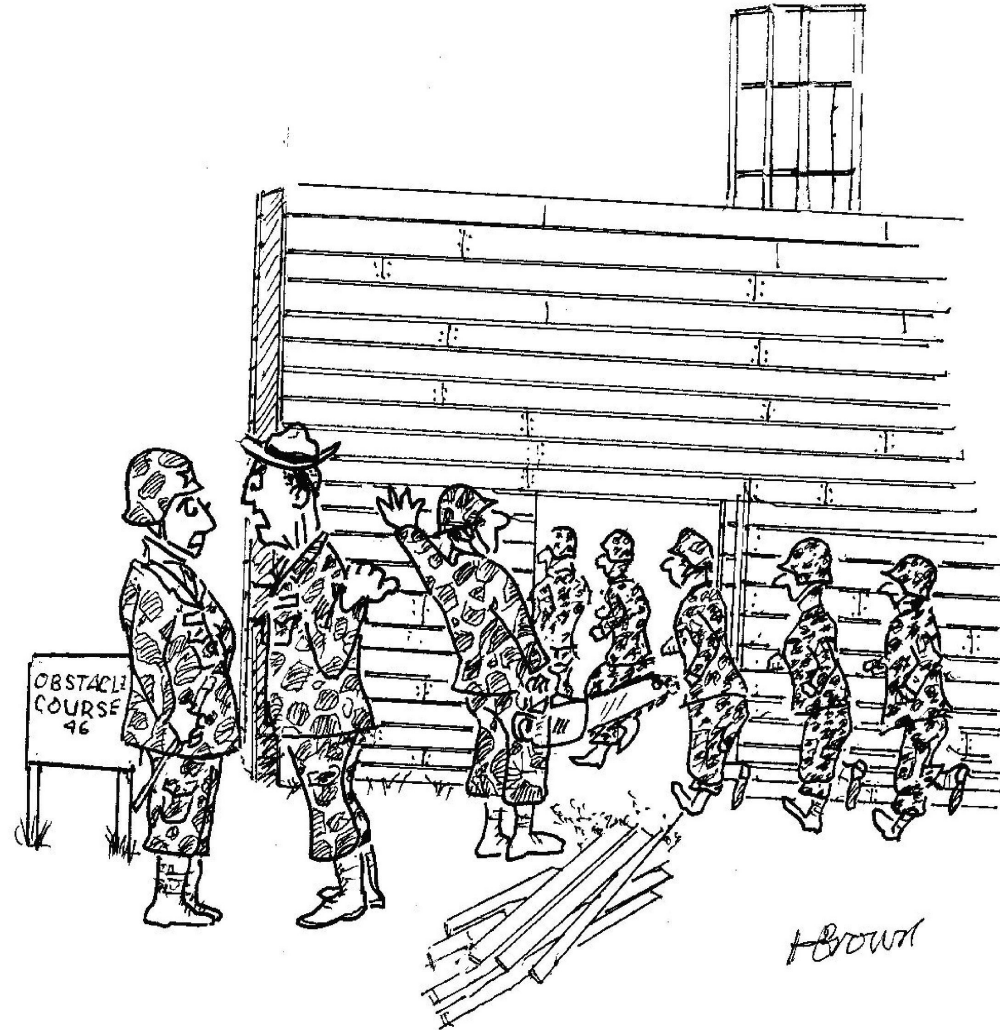
A long time ago in an NREN far, far away



An analogy for a network change....



What actually happens...



"GENERAL, SIR, IT'S THOSE DAMN ENGINEERS."

Customer experience??



How the customer explained it



How the Project Leader understood it



How the Analyst designed it



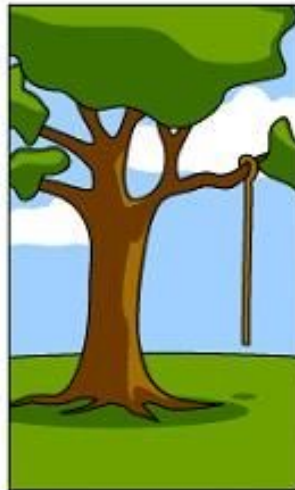
How the Programmer wrote it



How the Business Consultant described it



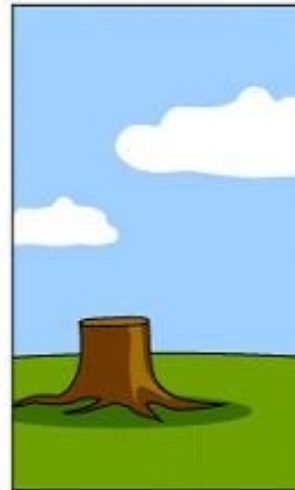
How the project was documented



What operations installed



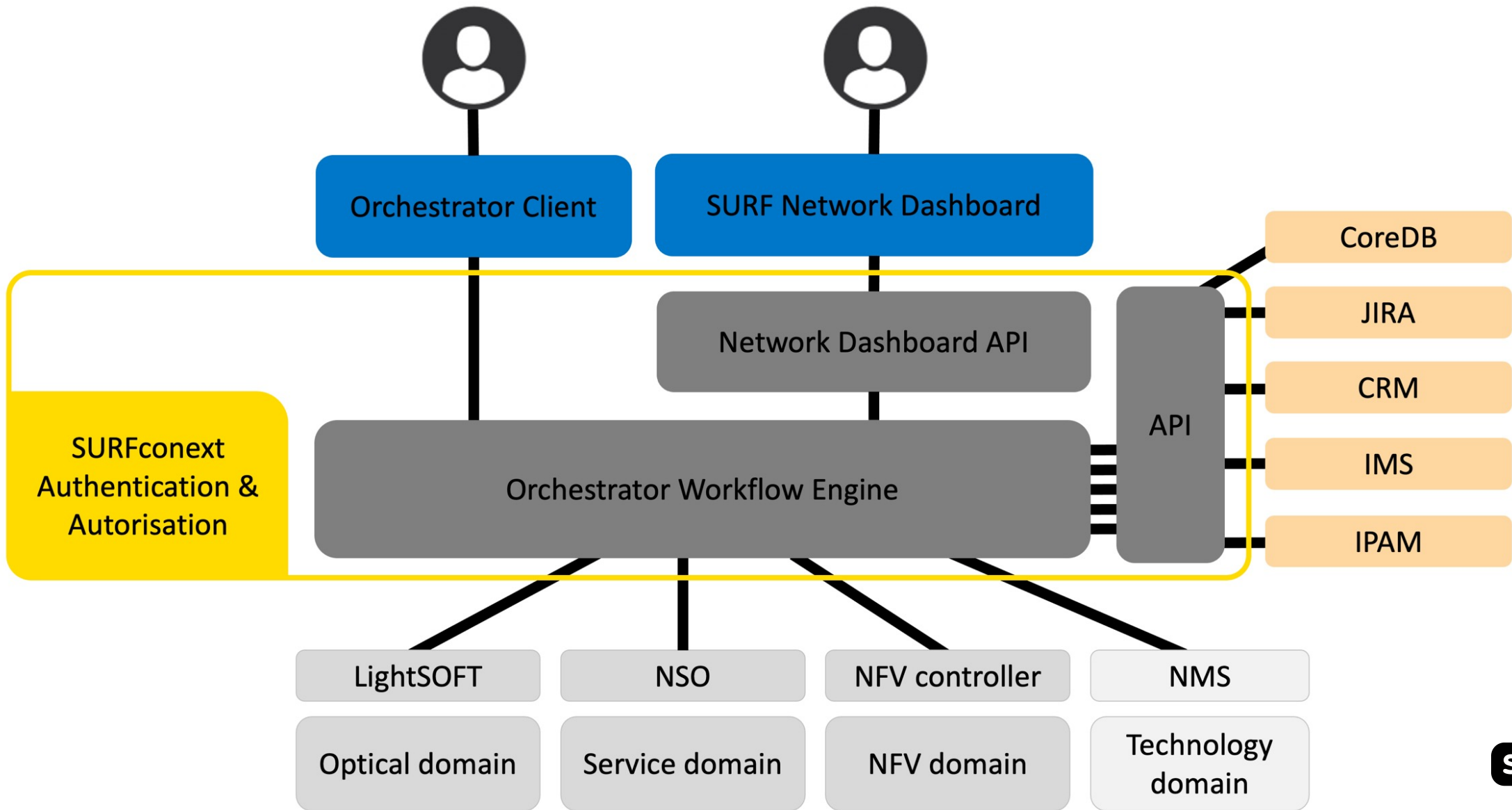
How the customer was billed



How it was supported



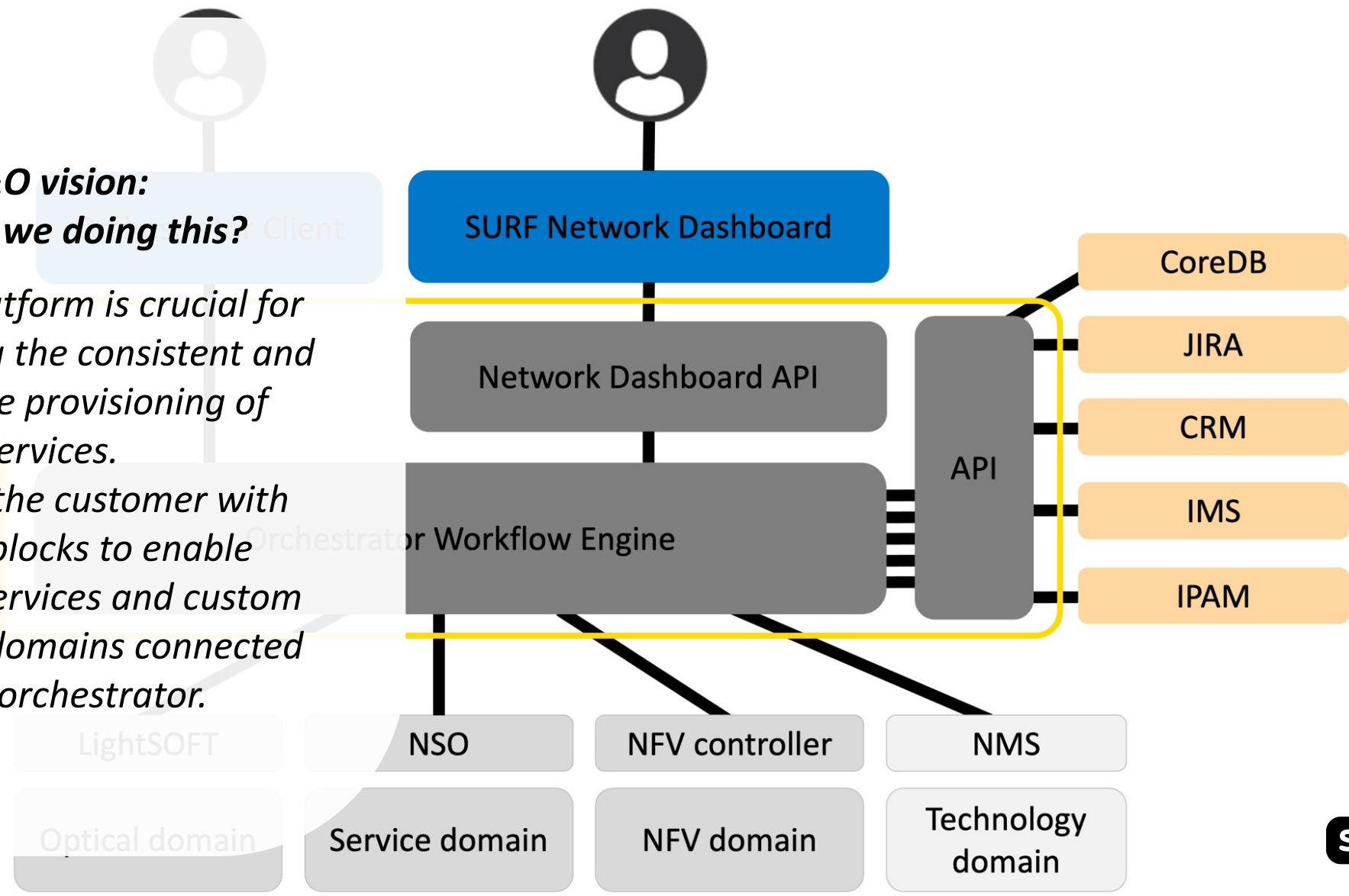
What the customer really needed



A&O vision:
Why are we doing this?

The A&O platform is crucial for guaranteeing the consistent and predictable provisioning of services.

It provides the customer with building blocks to enable composed services and custom services on domains connected to the orchestrator.



How long ago, is a long time ago?


- The Automation & Orchestration (A&O) effort at SURF started in earnest early **2017**
 - All changes must go through automation
 - No more CLI provisioning on SURFnet8
 - All customer services needed to be migrated with Automation
 - Ready in time for SURFnet8: Greenfield?!

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- The last customer service was migrated from SURFnet7 on **January 27th 2021**

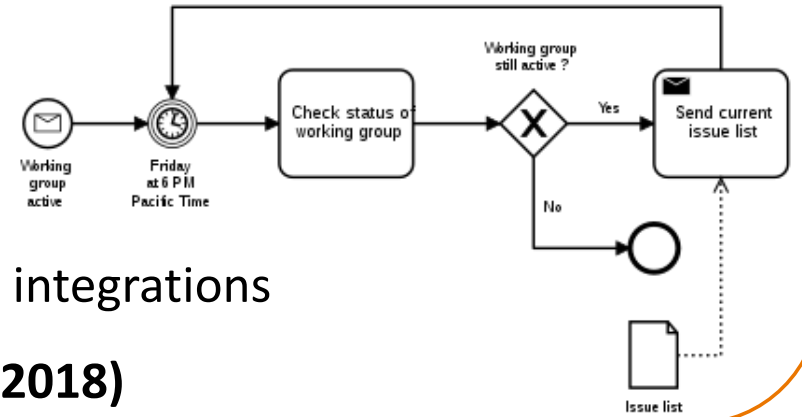


“The first rule of any technology used in a business is that automation applied to an efficient operation will magnify efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency.”

Bill Gates

A condensed timeline from 2017 until now...

- Evaluation of automation engines (**2017**):
 - BPMN or **Home grown**
 - An orchestrator is an orchestrator, 95% of the work is done in the integrations
- Standardisation of the datamodel and software – tmforum or not? (**2018**)
 - Make sure you clean-up your data and keep it clean
 - Define your data-model around the service you would like to provide
- Automating SURFnet7 (**2018 - 2019**)
- Migrating to SURFnet8 (**2019 – 2021**)
- Fixing our internal processes
 - Sometimes you need to start over
- Opensource release of our orchestrator-core



tmforum



SURF

Challenges along the way?

- Changing the way we think about services
- Orchestration can only be achieved by cleaning up your OSS/BSS administration and maintaining **data integrity**
- Orchestration requires **new internal processes**
- A new way of working for all parties involved in the network (including **our customers**)
- *"Our network does not handle that many changes"*
- No **CLI provisioning** for SURFnet8

```
ssh ut042a-jnx-01.dcn.surf.net
=====
SURFnet router ut042a-jnx-01.surf.net

Problems: noc@surfnet.nl
+31 88 7873000

Authorized access only !!!

=====
Password:
--- JUN05 19.3R3.6 Kernel 64-bit JNPR-11.0-20200710.a76c78d_buil
pboers@ut042a-jnx-01-re0>
```



NETWORK AUTOMATION Orchestrator

Engine is Running ● Help Logout Peter Boers

Processes Subscriptions Metadata Tasks Settings LIR Prefixes New Process

Active Processes ● ⚙️ ← →

| Assignee | Status | Workflow | Target | Abbr. | Subscription(s) | Started | Modified |
|-------------------|--------|----------|--------|-------|-----------------|---------|----------|
| No RESULTS FOUND. | | | | | | | |

Rows per page: 10

Completed Processes ● ⚙️ ← →

| Workflow | Target | Customer | Product(s) | Tag(s) | Subscription(s) | Modified |
|----------------------|--------|---------------------------------|-------------------------|--------|----------------------------------|----------|
| modify_sn8_ip_static | MODIFY | Hogeschool der Kunsten Den Haag | SN8 SURFInternet Static | IPS | HKDH IP GV047A 10 Gbit/s | 8-9-2021 |
| modify_note | MODIFY | Testaccount Netwerkdashboard | SN8 Service Port 10G | SP | TESTACCOUNT SP ASD001B 10 Gbit/s | 8-9-2021 |
| modify_note | MODIFY | Testaccount Netwerkdashboard | SN8 Service Port 10G | SP | TESTACCOUNT SP ASD001B 10 Gbit/s | 8-9-2021 |
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“Our network does not handle that many changes”

(Number of workflows run since early 2017 until the 9th of september 2021)

- 14361** reliable changes on subscriptions through **workflows**
- 4657** **subscriptions** in the database; nodes, corelinks, prefixes, services
- ~5000** background jobs **per day** that check the network
- 87** available **workflows**
- 39** **products** available in the **orchestrator**
- 2068** active **SURFnet8** customer services
- 1** other **NREN** that has implemented the SURF orchestrator core in their network (**ESnet**)

Demo

- A network change that will update a customer services
 - Applies changes in all subsystems
 - Applies the change on the network
 - Less than one minute

NETWORK AUTOMATION Orchestrator Engine is Running ● Help Logout Peter Boers

Processes Subscriptions Metadata Tasks Settings LIR Prefixes New Process

Active Processes ● ⚙️ ← → ?

| Assignee | Status | Workflow | Target | Abbr. | Subscription(s) | Started | Modified |
|----------|--------------------------------------|------------------|--------|-------|-----------------|---------|----------|
| | ✔ | workflow name... | | | description... | | |

No RESULTS FOUND.

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Completed Processes ● ⚙️ ← →

| Workflow | Target | Customer | Product(s) | Tag(s) | Subscription(s) | Modified |
|---|--------|------------------------------|----------------------|----------|--|-----------|
| workflow name... | | | product name... | | description... | |
| + modify_sn8_ip_bgp | MODIFY | Testaccount Netwerkdashboard | SN8 SURFinternet BGP | IPBGP | TESTACCOUNT IP ASD001B-UT042A 25 Mbit/s | 16:17 CET |
| + modify_sn8_ip_bgp | MODIFY | Testaccount Netwerkdashboard | SN8 SURFinternet BGP | IPBGP | TESTACCOUNT IP ASD001B-UT042A 25 Mbit/s | 16:16 CET |
| + modify_core_link_isis_metric | MODIFY | SURFnet netwerk | SN8 Corelink | Corelink | Corelink gen002a-jnx-01_ae22--asd001b-jnx-06_ae4 | 15:50 CET |
| + modify_sn8_ip_bgp | MODIFY | Testaccount Netwerkdashboard | SN8 SURFinternet BGP | IPBGP | TESTACCOUNT IP ASD001B-UT042A 25 Mbit/s | 14:56 CET |
| + modify_sn8_ip_bgp | MODIFY | Testaccount Netwerkdashboard | SN8 SURFinternet BGP | IPBGP | TESTACCOUNT IP ASD001B-UT042A 25 Mbit/s | 14:54 CET |

Rows per page: 5

SURF NETWORK DASHBOARD SERVICES MALFUNCTION & MAINTENANCE SUPPORT NL / EN

Dashboard Testaccount Netwerkdashboard

Welcome Peter Boers

Nieuwe features beschikbaar per 1-9-2021
De laatste update van het netwerk dashboard biedt de gebruiker de mogelijkheid om via self-service functies dienstparameters aan te passen. Zie voor meer informatie <https://edu.nl/kunet>

Current faults

No notifications

SURFinternet
1 firewalls
No notifications

✔ 0 ➔ 1 ⚠ 2

SURFlichtpaden
Work planned

✔ 0 ➔ 0 ⚠ 8

L2VPN
No notifications

✔ 0 ➔ 0 ⚠ 2

Planned work

Geplande werkzaamheden - SNNP-87668
29 Sep, 10:00 until 18:00

Geplande werkzaamheden - SNNP-87606
30 Sep, 00:00 until 06:00

Geplande werkzaamheden - SNNP-87524
24 Sep, 00:00 until 06:00

[GO TO ALL MESSAGES](#)

Ports
No notifications

✔ 0 ➔ 0 ⚠ 7

SURFfirewall
No notifications

✔ 0 ➔ 1 ⚠ 0

IP prefixes
4 active

[SEE OVERVIEW](#)

SURFwireless
Wifi as a Service. Reliable wifi, maintained by SURF.

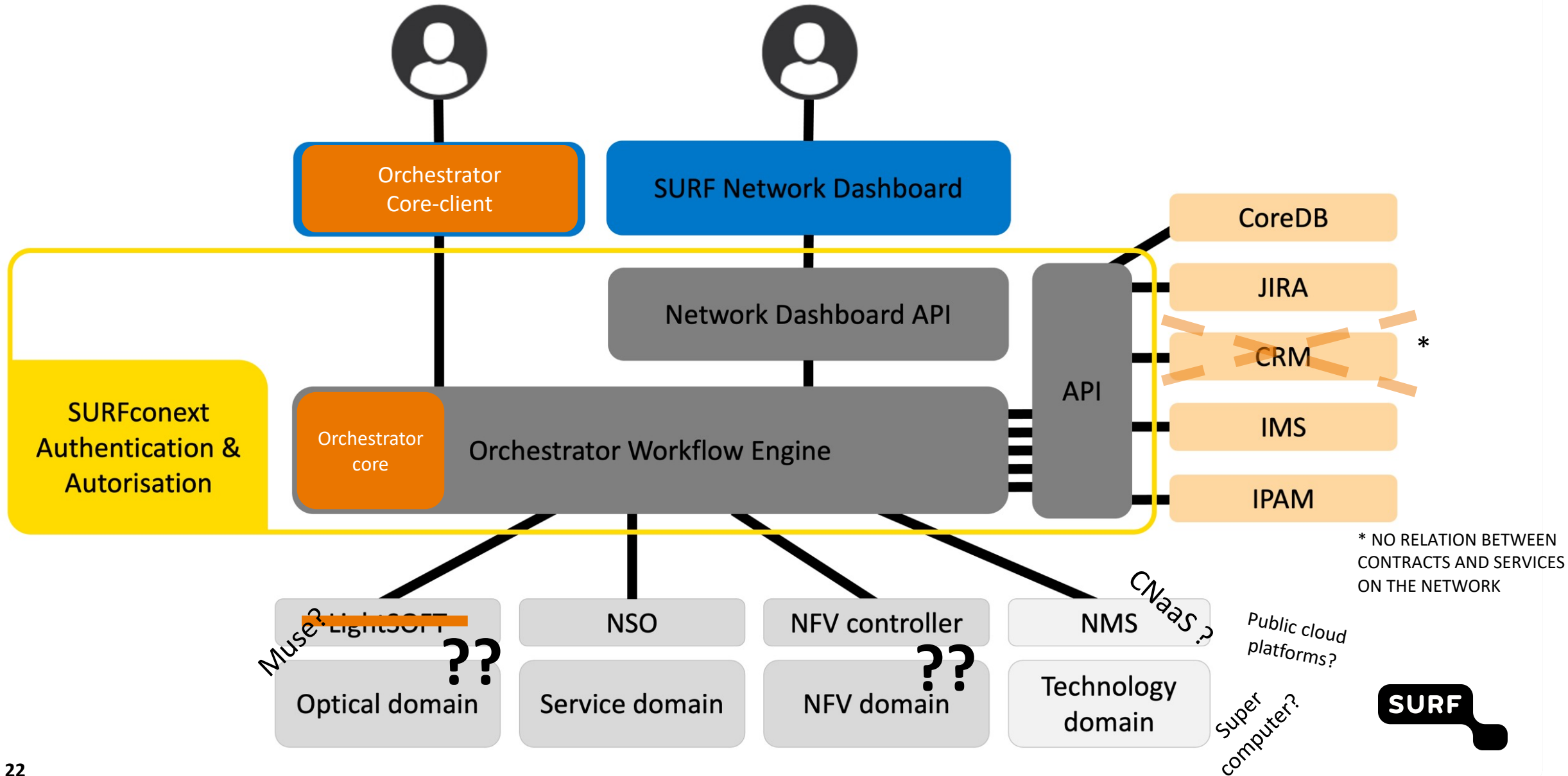
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Future work? The future is now!

- We believe that orchestration and integrated services across many technology domains is the future
 - HPC
 - Cloud computing
 - Firewall
 - Edu services
 - Security services
- The added value of our network is no longer just its capacity or performance, but how well it is integrated in SURF's service portfolio and landscape through software
- Multi-domain resource provisioning is necessary to stay ahead of the curve and add more value for our institutions

2021 and beyond: Architecture – Orchestrator v4.1



**QUESTIONS?,
COMMENTS?**

Gbps

10
Gbps

100
Gbps

400
Gbps



Peter Boers



E-mail: peter.boers@surf.nl



workfloworchestrator.org



[linkedin.com/in/boerspeter](https://www.linkedin.com/in/boerspeter)

MANY THANKS TO:

- HANS TROMPERT
- MIGIEL DE VOS
- WOUTER HUISMAN
- GERBEN VAN MALENSTEIN
- MANY OTHERS @SURF

NFV

F₃

Driving innovation together

SURF