

Lessons learned PoC Structura-X with Liqo

June 13, 2023

TNO innovation
for life

SURF

bit
internet technology

intermax

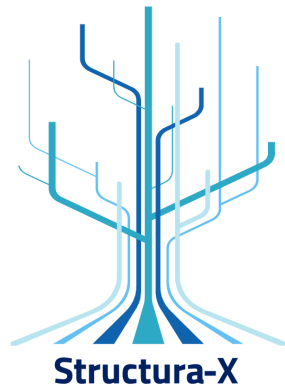
infoSupport
Solid Innovator

amsix
amsterdam internet exchange

Structura-X

gaia-x
Hub Netherlands

Final agenda lessons learned session June 13



Location: SURF
Amsterdam,
Science Park 140

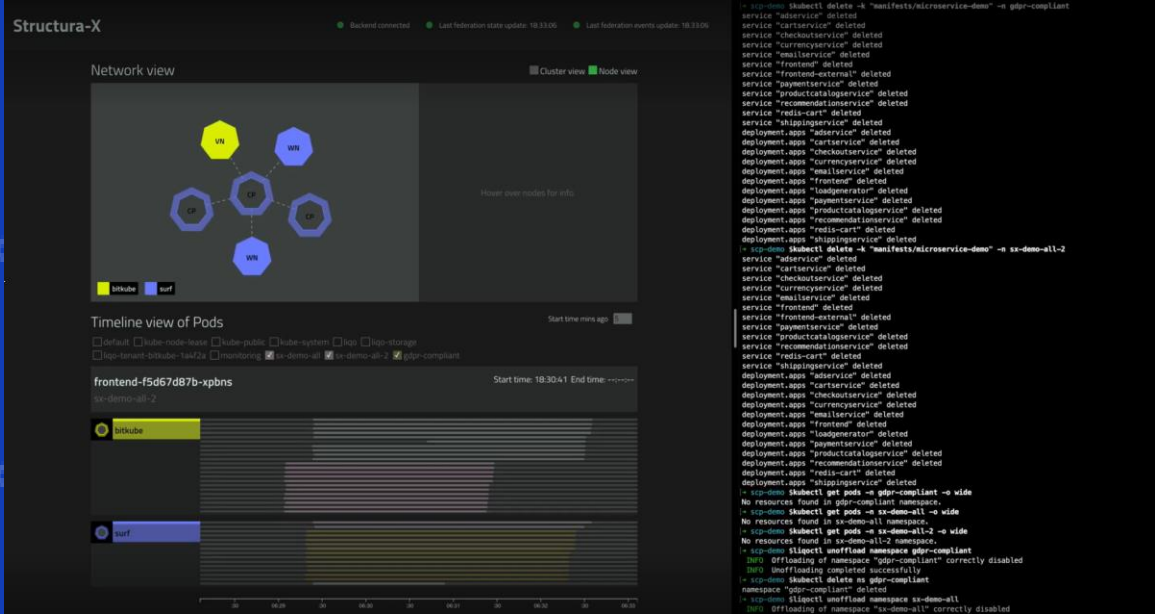
1. 12.00-12.30 walk-in with lunch in VK3
2. 12.30-15.00 Meeting in VK1/VK2
 - 12:30 – 12:45: Online - Welcome by Ron Augustus (*Chief Innovation Officer at SURF*)
 - 12:45 – 13:15: PoC Demo (*TNO*)
 - 13:15 – 14:15: Lessons learned, 10 min per participant (*Bit, Intermax, Info Support, AMS-IX, SURF, TNO*)
 - *Why is this PoC important for your organization?*
 - *Which lessons did you learn from this PoC?*
 - 14:15 – 15:00: Discussion: looking forward and next steps (*all, introduction by TNO*)
3. 15.00-16.00 Tour at SURF Datacenter/Snellius (HPC)
 - Intro to [PPS EuroCC HPC program](#) and tour by Carlos Teijeiro Barjas (SURF)

Welcome by Ron Augustus (online)

Ron Augustus (Chief Innovation Officer - SURF)



Demonstrator



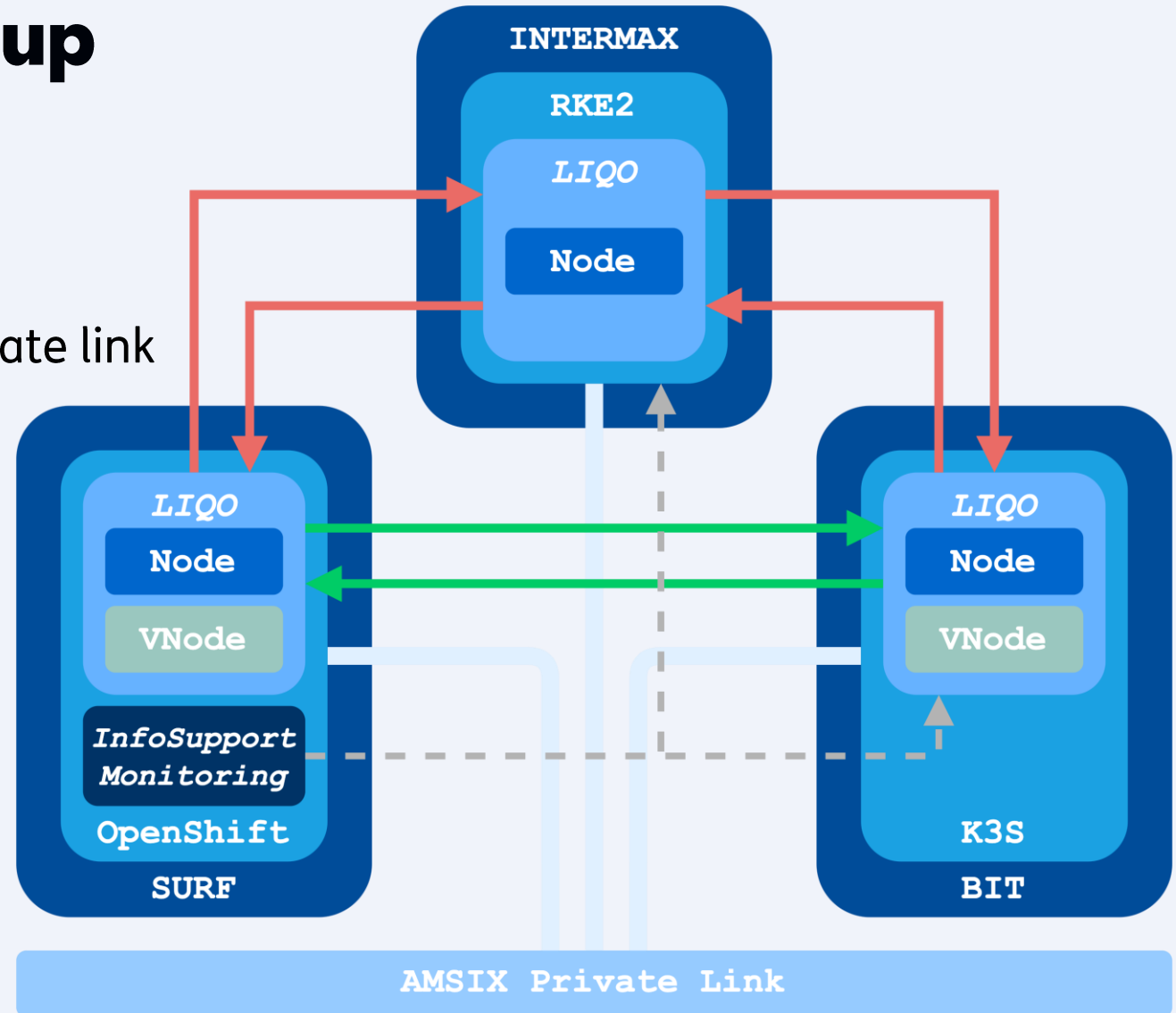
Proof-of-Concept Setup

Heterogeneous technology stacks

Connected by a Netherlands-only private link

Federated with LIQO

Various perspectives



Demo Application

Google's microservice demo

Digital storefront

Runtime constraints



Demonstrator

2 clusters

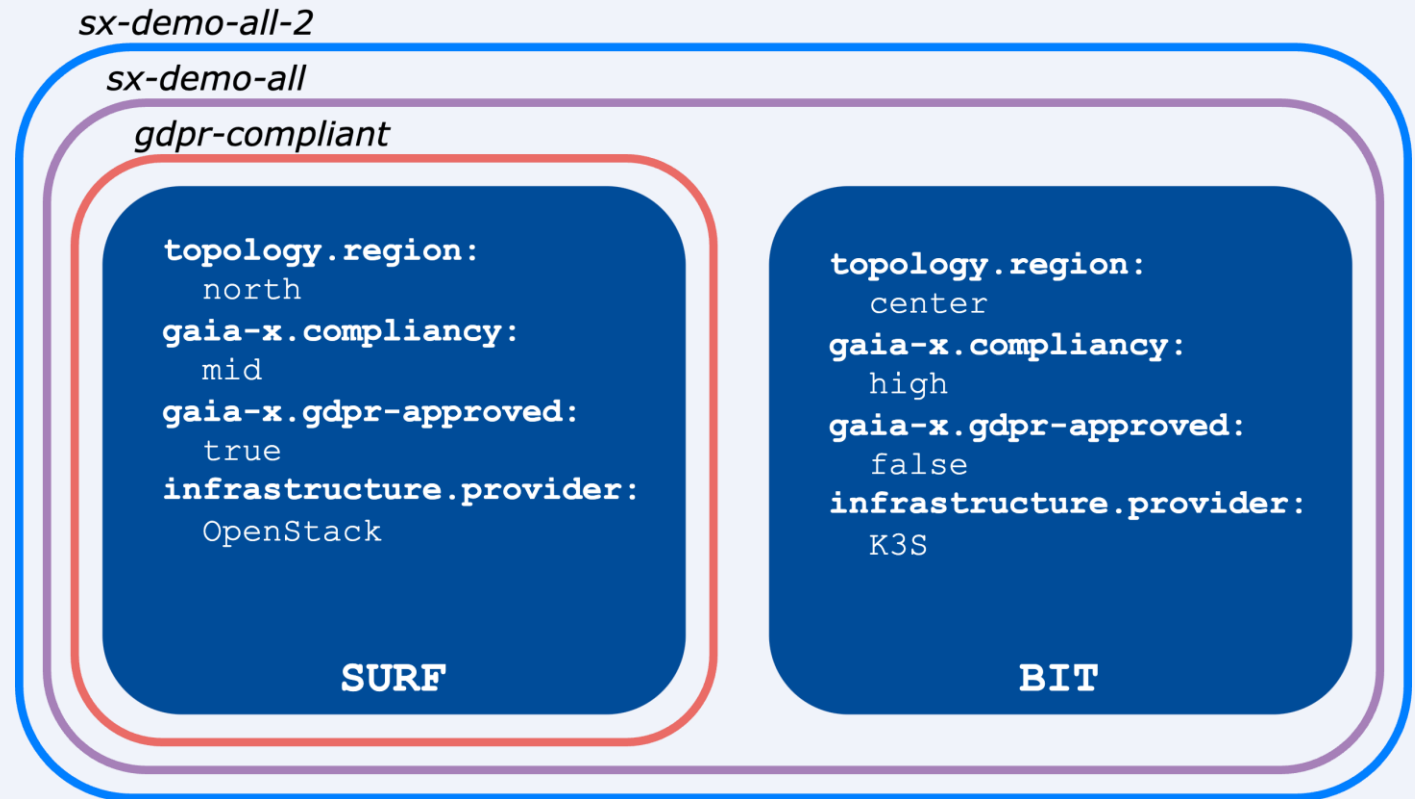
Cluster labels

Namespace offloading

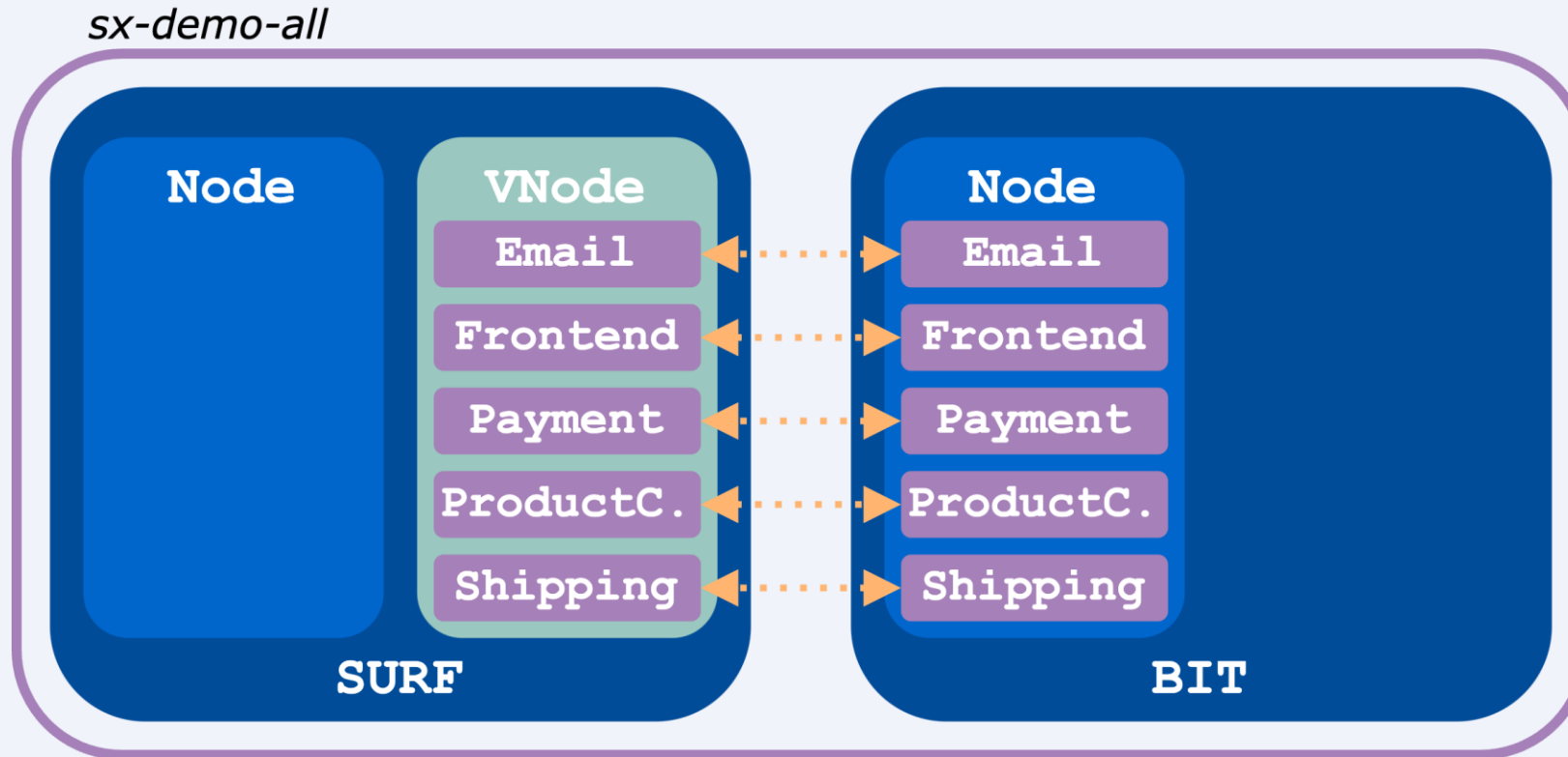
Constraints

Node affinity

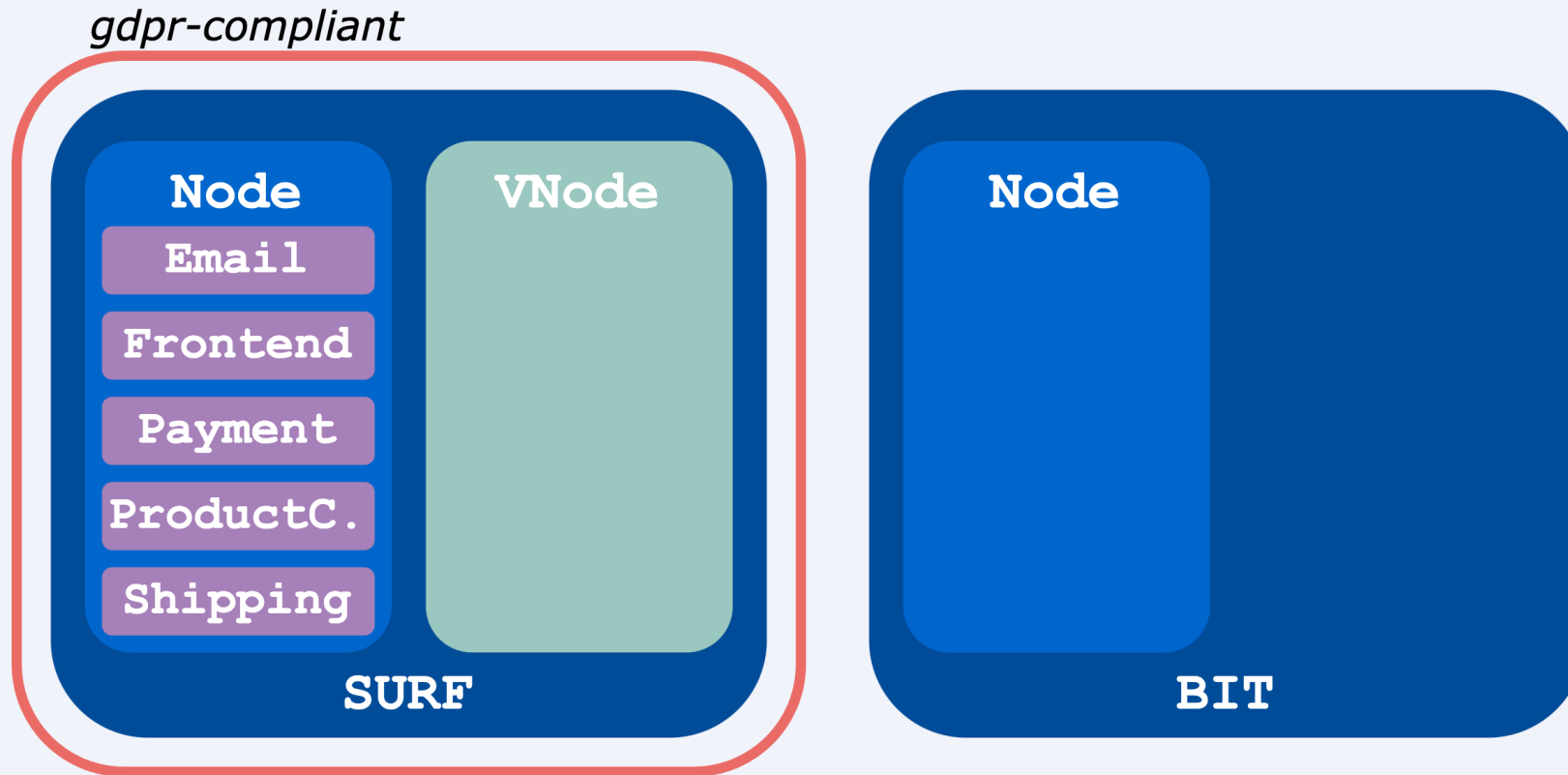
Taints



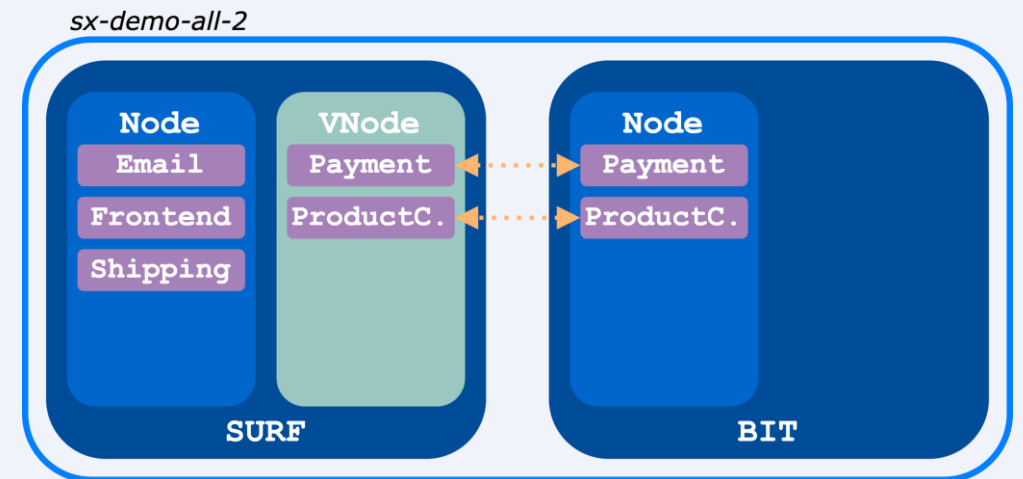
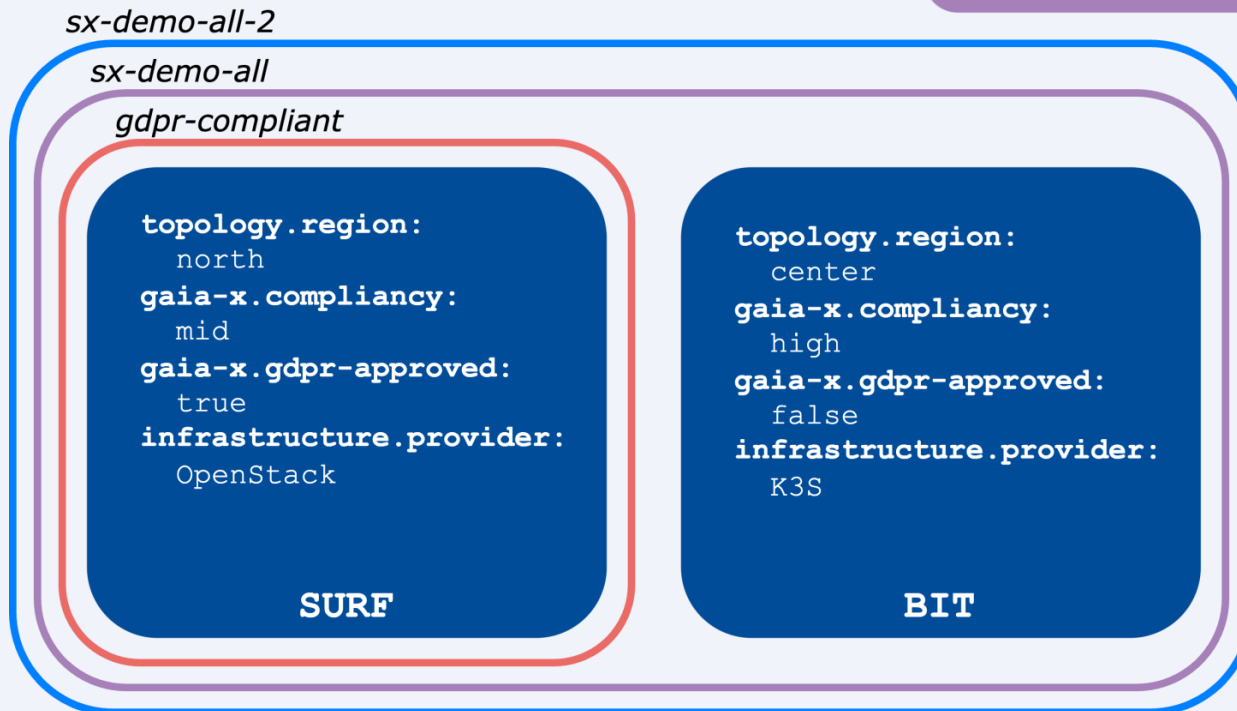
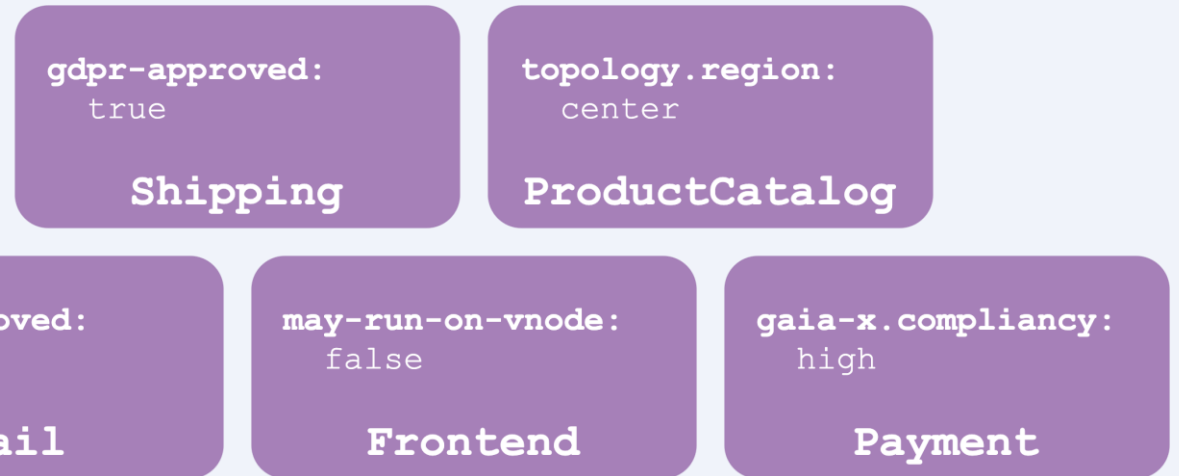
Scenario #1: Anything Goes



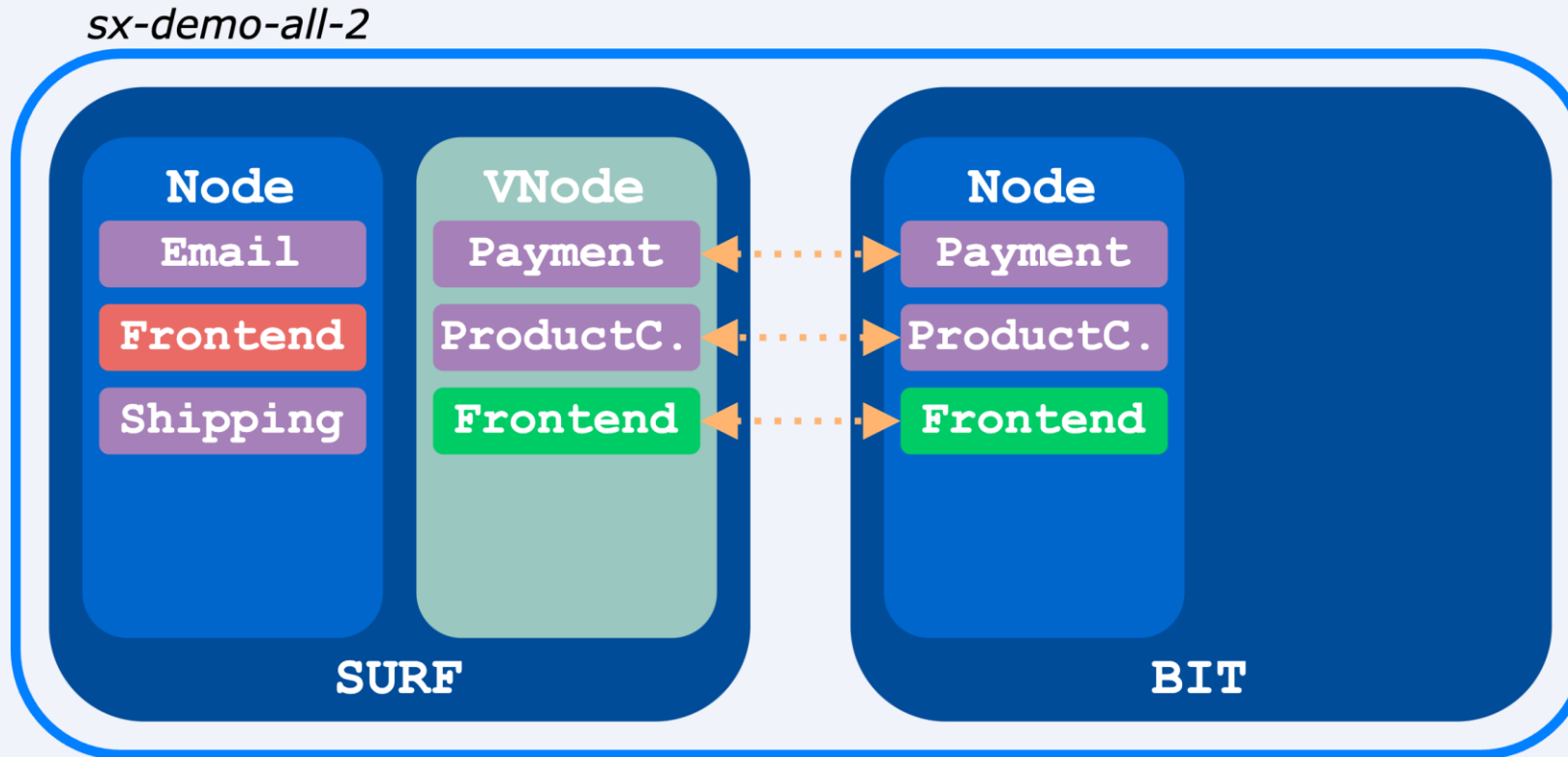
Scenario #2: LIQO Namespace Offloading



Scenario #3: Constraints

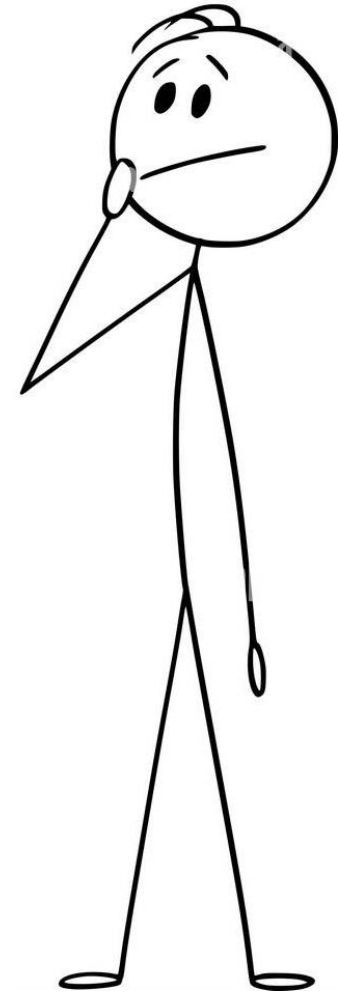


Scenario #3b



Some lessons learned by TNO

- Communication & Coordination
- Network Configuration
- System Heterogeneity (e.g. Rancher, Openshift, K3S)
 - Labels and annotations
 - Intermax RKE2 setup
- Early-adopter's tax
 - Configuration vs reality
 - Version management
 - Cluster labels
 - Hanging resources
- Opaque errors due to many layers of complexity



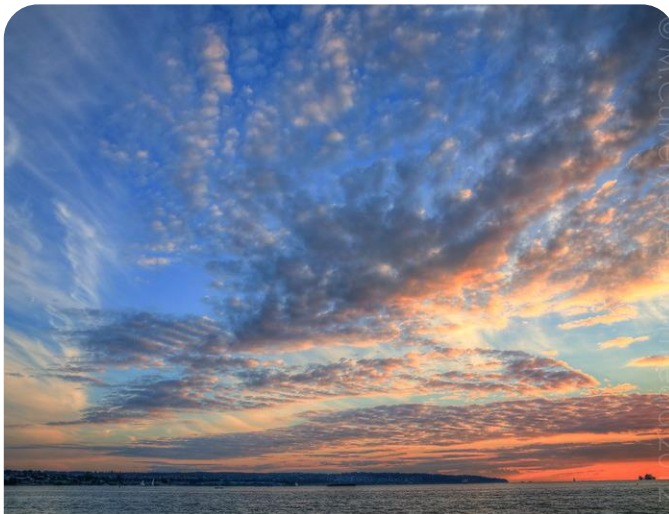
The SURF logo is a black speech bubble with the word "SURF" in white, bold, sans-serif capital letters. The background of the slide is a photograph of a port at sunset. In the foreground, there are large bundles of rebar (steel reinforcement bars) lying on the ground, secured with green and purple straps. Behind them, there are several stacks of colorful shipping containers (red, blue, green, and yellow) with logos like "MAERSK" and "HAMBURG SÜD". In the background, there are port cranes and a tall lattice tower under a clear sky with a few clouds.

SURF

Lessons Learned: Structura-X PoC

Erik Kentie & Tim Kok

| Why is this PoC important to SURF?



Independent cloud

How would this work technically and organizationally?



User experience

Seamless shifting of workloads, ease of use



Available solutions

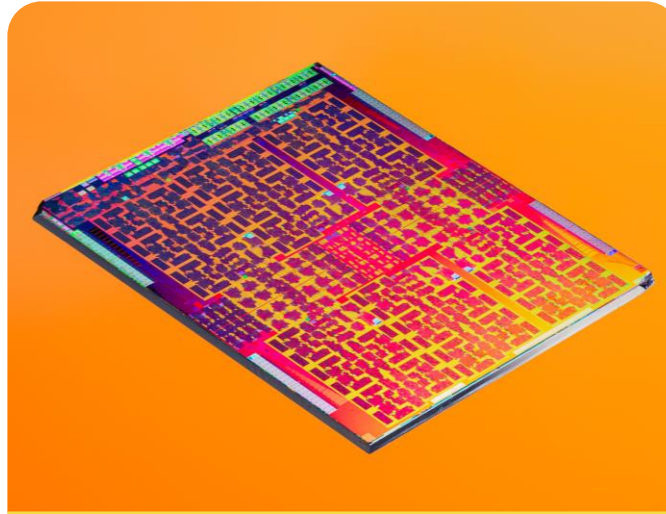
What are the experiences with current tools?

| Why is this PoC important to SURF?



Scale out / cloud bursting

Peak capacity, high
availability



Specialized hardware

GPUs, quantum compute,
storage, cloud functionality

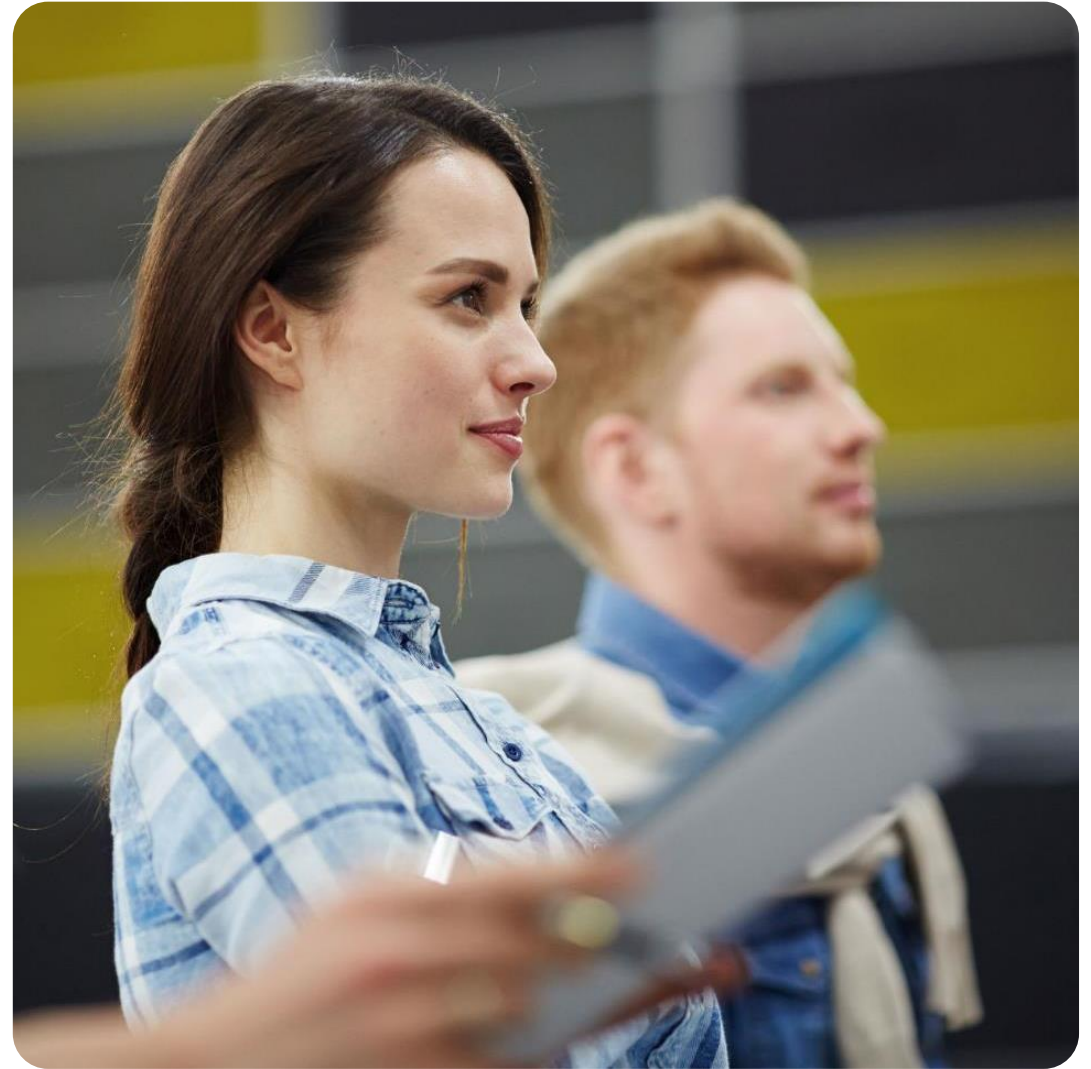


Cost and energy efficiency

Schedule workloads where
compute is cheaper and/or
more energy efficient

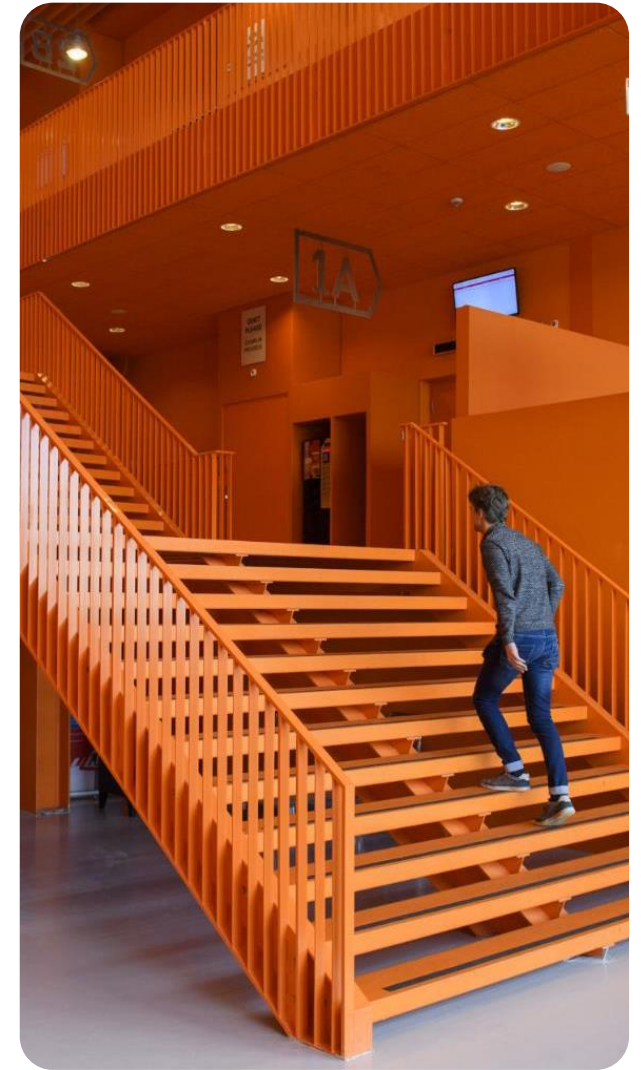
| Lessons Learned

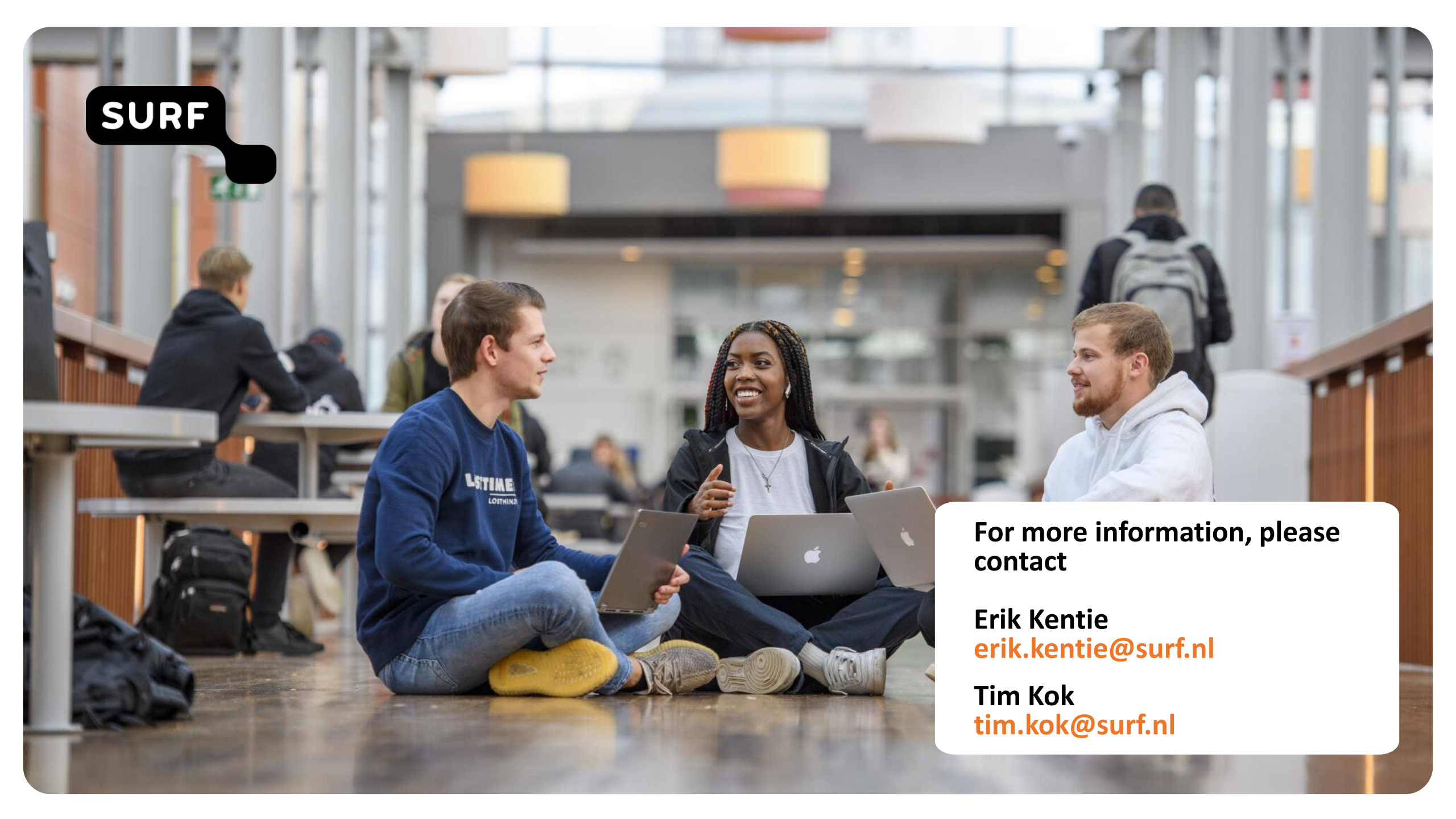
- Alignment is tricky
 - Networking set up between 3 CSPs
 - Corresponding Kubernetes and Liqo versions
- At face value, Liqo works well
- Positive collaboration
 - the PoC was a good way for sharing knowledge and skills
- ...



| Potential next steps

- Further exploration of Ligo
 - Stress testing / What are the limitations
 - Data gravity and data migrations
 - Federated batch processing
 - Security
- Comparisons with similar technologies
- Automating (network) federation between CSPs
- Standardizing onboarding
 - shared quality standards, protocols





SURF

**For more information, please
contact**

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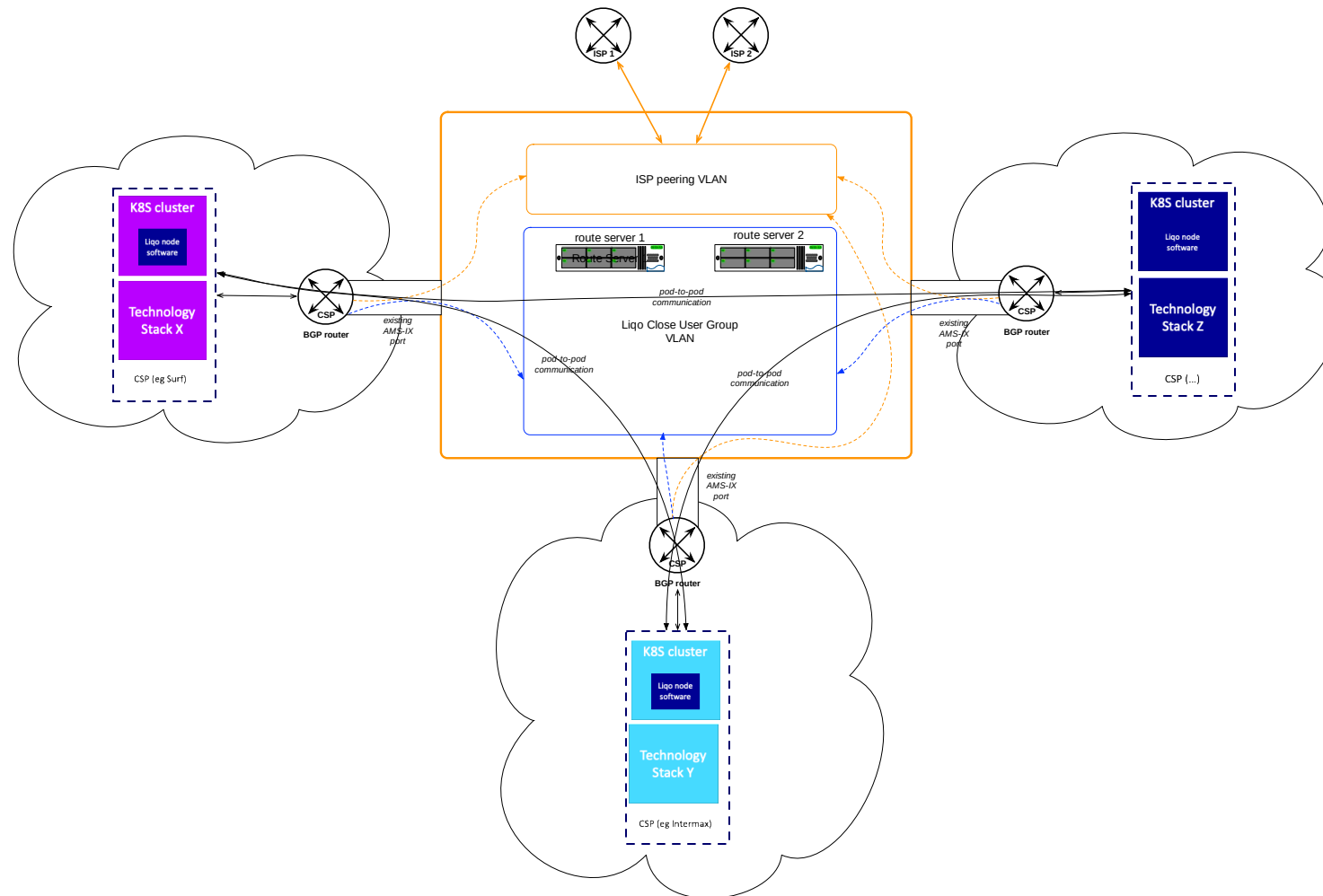
AMS-IX Lesson Learned Structura-X/Liqo PoC

- Preparing connectivity is faster with existing AMS-IX connection, **SURF** and **Intermax** were able to do it with short notice with minimal effort just by adding an extra VLAN tag on their existing interface.
BIT decided against using their production port for safety reason and took more time to connect to the test bed.

But all participants were able to connect smoothly at Layer-2 via AMS-IX platform, this proves the ease of providing service via central hub.

- However, setting up BGP between members take sometime**, so we should deploy the route-servers for the peering LAN. Essentially the member does not have to set up multiple BGP sessions but with 2 x central route-servers and exchange prefixes via the route-servers, same.
Also we can provide additional service like looking glass to facilitate peering debugging. With the looking glass members can look at what IP prefixes being sent/received on the route-server to coordinate debugging with other members.
More about route-server <https://www.ams-ix.net/ams/documentation/ams-ix-route-servers>

AMS-IX LIQO Closed User Group VLAN - NL only





Structura X PoC & Info Support



Info Support facts



Helps customers move forward significantly as the software partner that delivers top quality



Established in 1986



500+ employees



32 speakers



Microsoft MVP's and Java Groundbreakers



24 years Top Employer



Part of the Info Support International Group



Offices in The Netherlands & Belgium



50+ satisfied customers

▲ Contents



OUR CONTRIBUTIONS



OUR LESSONS
LEARNED

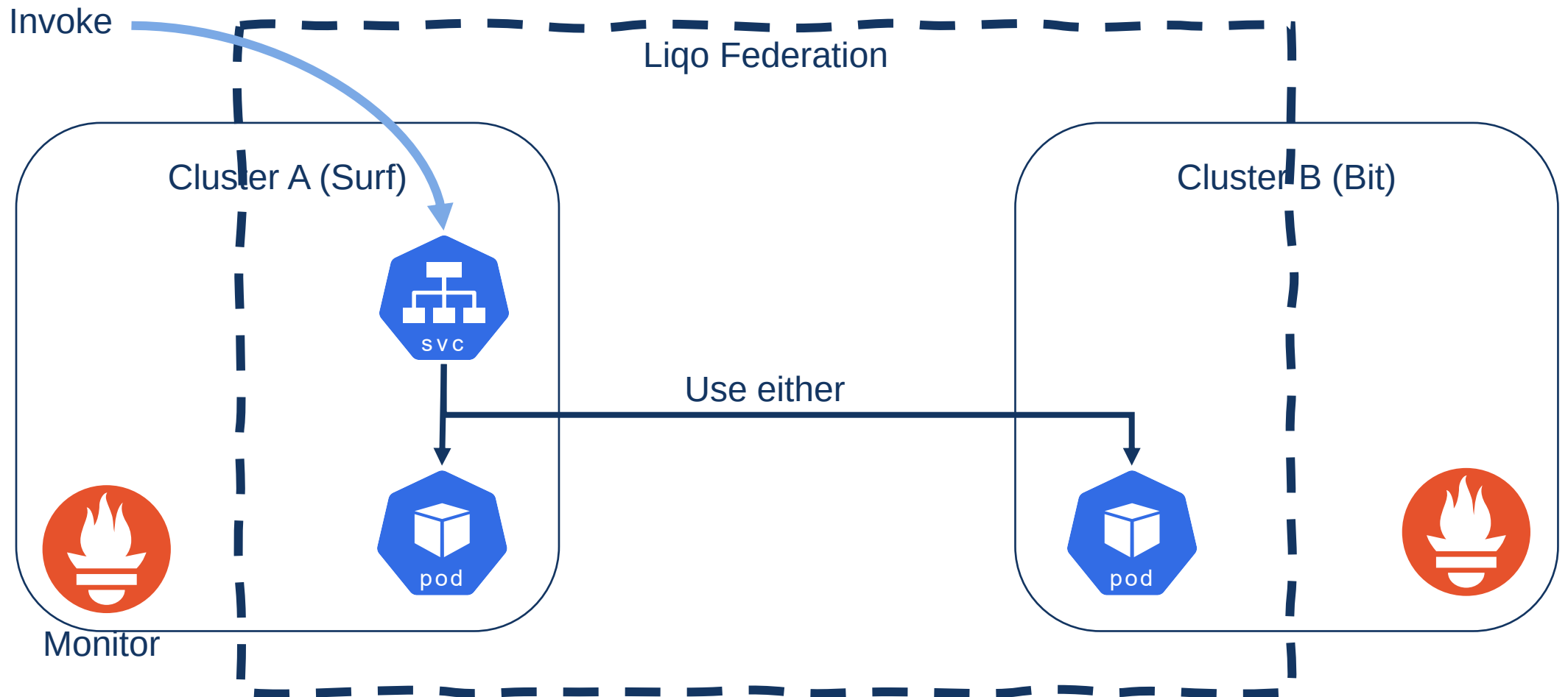


▲ Our contributions

- Focus on adding observability
 - ☒ Use prometheus
 - ☒ Use exposed liqo metrics
 - ☒ Set up dashboard, monitor usecases
 - ☐ Nice to have: Prometheus federation across clusters
 - ☐ Nice to have: Alerts/notifications on liqo prometheus metrics



▲ Our (simple) test case



▲ Our results

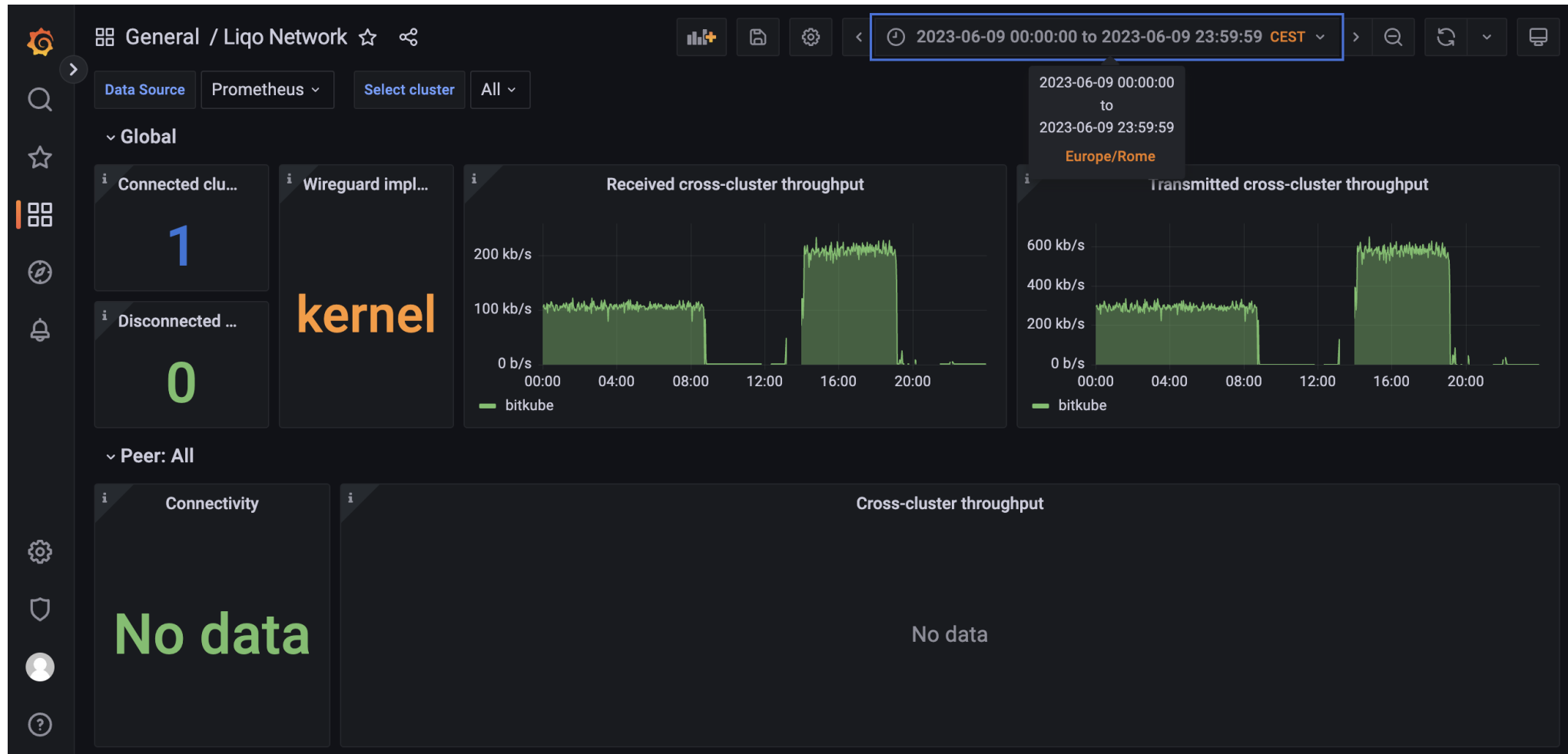
Troubles in setting up Liqo pairing, lead to a 'late' start time

Basics monitoring scenarios works

Too little time left to do more exploring with metrics and other workloads



Prometheus Liqo Dashboard





▲ Our lessons learned (technical)

- No standardized solution for setting up interconnectivity and networking between various CSP's
 - Very time consuming and error prone
 - Difficult to troubleshoot
 - A lot of time spent on networking, too little spent on Ligo or Kubernetes
- Access to each CSP's Kubernetes cluster from a user perspective is not standardized, leading to an undesired experience.
 - IP filter? SSH jump host?, all requiring different setup steps.
 - Even if the workload would be federated, this means that using different CSP's would still be different ways of working

▲ Our lessons learned (organisational)

- No clear ownership or desired design
 - Each CSP makes its own unique choices with (too) little communication if it would work
 - If it doesn't work after a significant amount of time, consider changing paths and see how much of the goal you can salvage still
- Very little discussion on the 'How'
 - A weekly standup, and ad-hoc work meeting
 - What can be expected from different parties? How much time are they investing? And on what days?
 - There seemed to be just a gitlab project, not something like a shared teams or slack space
 - Made it hard to take initiative besides reaching out by email, or just 'saving' the thoughts for the next standup next week.



Intermax

Why is this PoC important for your organization?

- We want to use these sort of projects as a form of 'cloud liberation platform' - move workloads freely and easily.
- To gain experience with these types of techniques and projects.

Which lessons did you learn from this PoC?

- Initially it took a long time to interconnect the networks.
- Unfortunately, we are still running into (certificate) issues for which we have not yet found a solution.
- Next step: To bring the involved participants together in a next debugging session including participants from the Ligo Project.



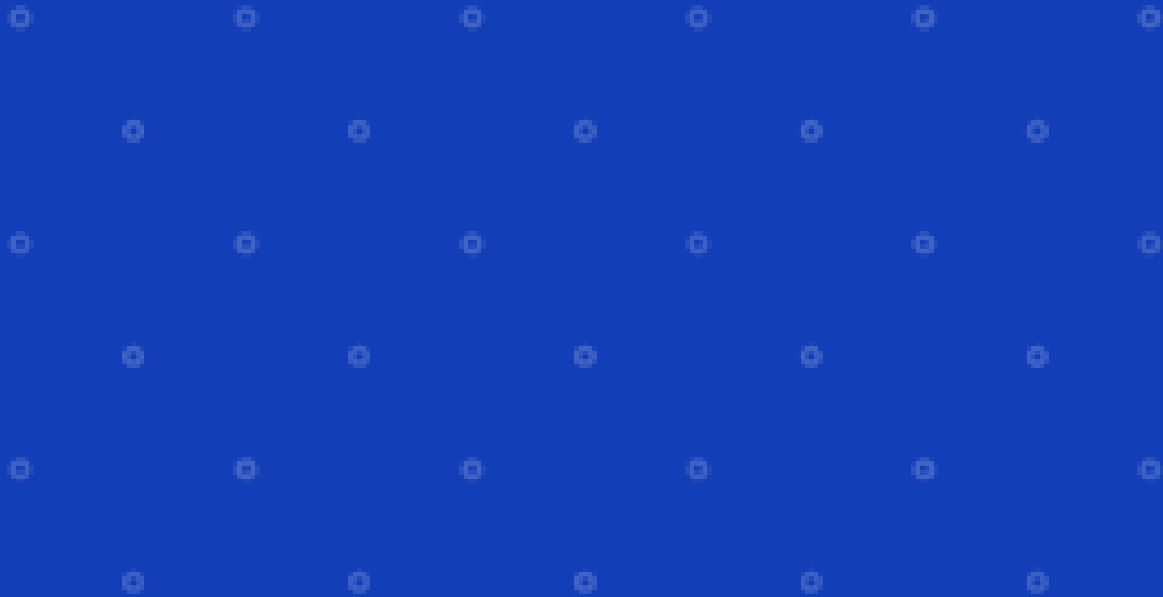
Lessons learned BIT

- Use fixed ip-adresses (not only for endpoints but also for other network gateways (return path) in firewalls, cluster route configuration, etc)
- A quick way to return to last known working state
 - quick cluster redeploy/access to cluster network settings/short lines between cluster backend engineers and application devs)
- Micro versions matter (coordinate software versions to match)

=> Communicate all standards above early via shared gitlab repo, along with timepath, etc.

- We choose BGP peering and out of band, this requires 3 ip-adresses
- We could also choose inband-peering + gateway (1 IP address)
 - ~ may increase private participation

Looking forward and next steps



Getting visibility for the invisible infrastructure

- Media attention via news postings
- Initially via TNO.nl and Gaia-X Hub NL
 - <https://www.tno.nl/nl/newsroom/2023/03/nederlandse-partijen-bouwen-testomgeving/>
 - <https://gaia-x.nl/nieuws/nederlandse-partijen-bouwen-testomgeving-voor-gaia-x-clouddiensten/>
 - <https://www.intermax.nl/resources/gaia-x-testomgeving-europese-federatieve-cloud/>
 - [Nederlandse partijen bouwen testomgeving voor Gaia-X clouddiensten | Info Support B.V.](https://www.surf.nl/nieuws/nederlandse-partijen-bouwen-testomgeving-voor-gaia-x-clouddiensten)
 - <https://www.surf.nl/nieuws/nederlandse-partijen-bouwen-testomgeving-voor-gaia-x-clouddiensten>
 - <https://ibestuur.nl/nieuws/testomgeving-voor-gaia-x-clouddiensten-in-mei-2023-klaar>
 - [Data-infrastructuurproject Gaia-X krijgt Nederlandse testomgeving - AG Connect](https://www.surf.nl/nieuws/nederlandse-partijen-bouwen-testomgeving-voor-gaia-x-clouddiensten)
 - <https://www.surf.nl/nieuws/nederlandse-partijen-bouwen-testomgeving-voor-gaia-x-clouddiensten>
 - <https://www.computable.nl/artikel/nieuws/cloud-computing/7483718/250449/nationale-testomgeving-voor-gaia-x-start-in-mei.html>
 - <https://www.ams-ix.net/ams/news/dutch-gaia-x-hub-builds-gaia-x-test-environment>
 - <https://www.infosupport.com/resources/nederlandse-partijen-bouwen-testomgeving-voor-gaia-x-clouddiensten/>
 - <https://www.techzine.nl/nieuws/infrastructure/520108/nederlandse-partijen-bouwen-nationale-gaia-x-testomgeving/>

Spin-off articles:

- [Werkt Gaia-X ook in praktijk? Nederlandse organisaties proberen het uit - AG Connect](#)
- [Telecom paper - Kansen voor telecom met data en cloud volgens Europese spelregels](#)
- Under review: publication at “Platform voor Informatiebeveiliging”
- extended version news item, 700 words agconnect.nl/artikel/werkt-gaia-x-ook-de-praktijk-nederlandse-organisaties-proberen-het-uit



Discussion: looking forward and next steps (1/2)

- Started in Jan 19 on informal basis and on own cost
 - Up until now: light weight meeting structure with weekly stand-up
 - There is a lot of value in “getting our hands dirty” with federation technology
 - Look for funding mechanism? (e.g. TKI, ...)
- Until now only scratched the surface with Ligo
 - Explore Ligo deeper with **more and extended use cases?**
 - Can we keep the Ligo-infrastructure running longer? (at least end of the year)

Discussion: looking forward and next steps (2/2)

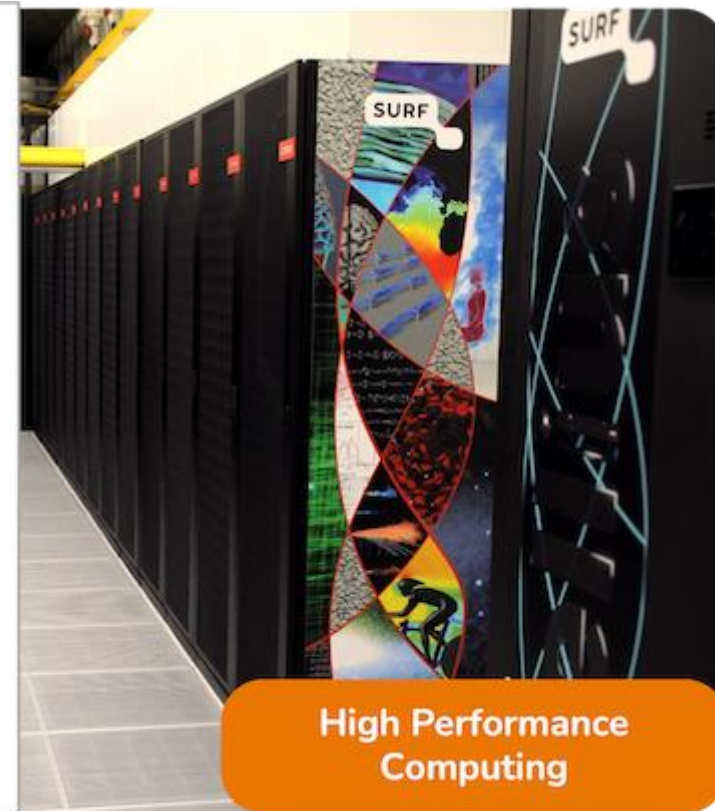
- **Further collaborate** with Ligo developers **TOP-IX** team and **Politecnico di Torino**
 - Connect with Italian PoC-setup of **Top-IX**
 - Good contact with Leonardo Camiciotti (director TOP-IX). Elected for Board of Directors Gaia-X. Leads Structura-X Lighthouse within Gaia-X
 - Top-IX team helped us with current setup
 - Good contact with **Turin university group** (possibly will be ArubaKube spin-off)
- Extend system **monitoring** of a federated cluster
 - Metrics for customers, if my application runs at 3 CSPs how do I monitor that?
- What is needed for Gaia-X Compliancy? Dive into - and experiment with **Gaia-X Clearing House**
 - What is needed to offer Gaia-X compliant Cloud Services?
 - Aruba.it will present demo setup end of June (in monthly Structura-X Engineering call)
- Next to Ligo: explore **other types of federation technology** (e.g. Nomad, Karmada, Gardener, Threefold, ...)

Tour at SURF Datacenter/Snellius

Carlos Teijeiro Barjas (SURF)

Snellius

The dutch
national
supercomputer



High Performance
Computing