



# Notes on noted

Coralie Busse-Grawitz

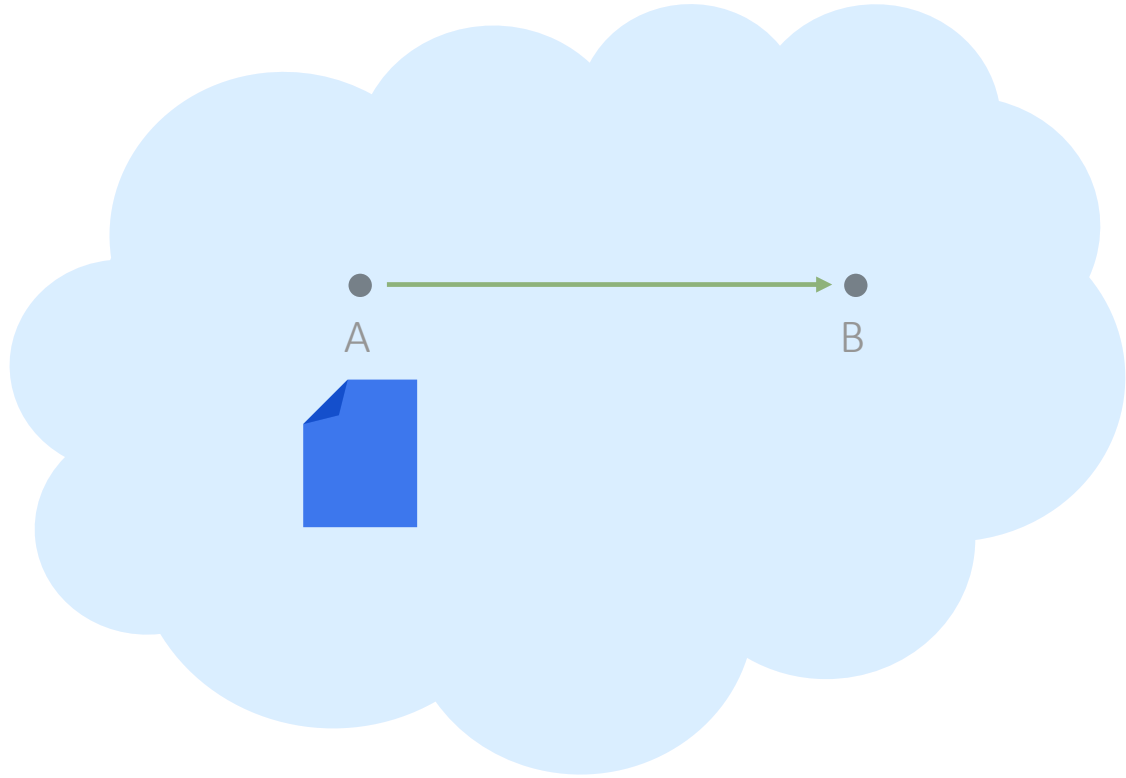
Supervisor: Edoardo Martelli



Richard

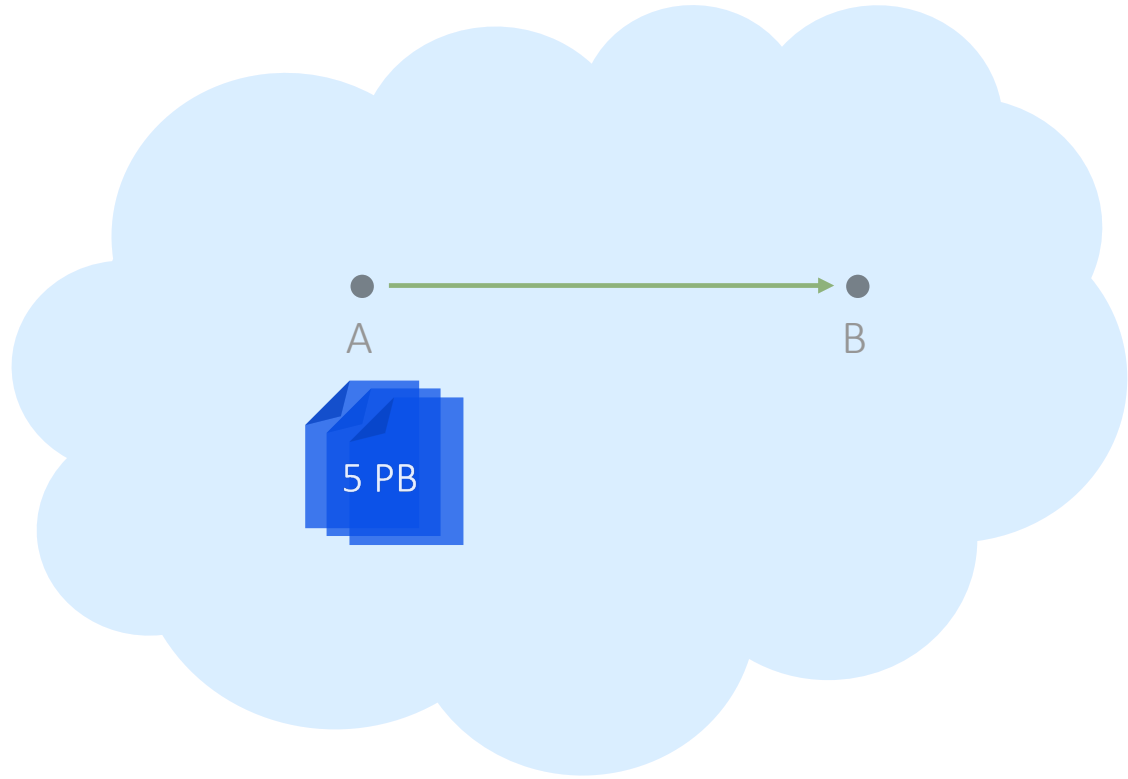


Richard



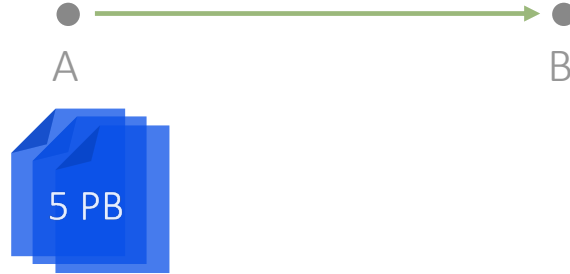


Richard  
The Physicist



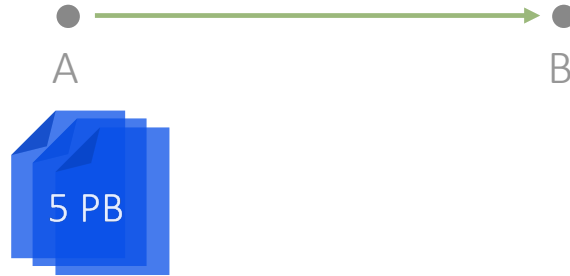


Progress





Progress

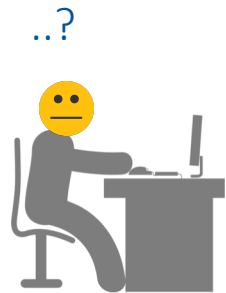






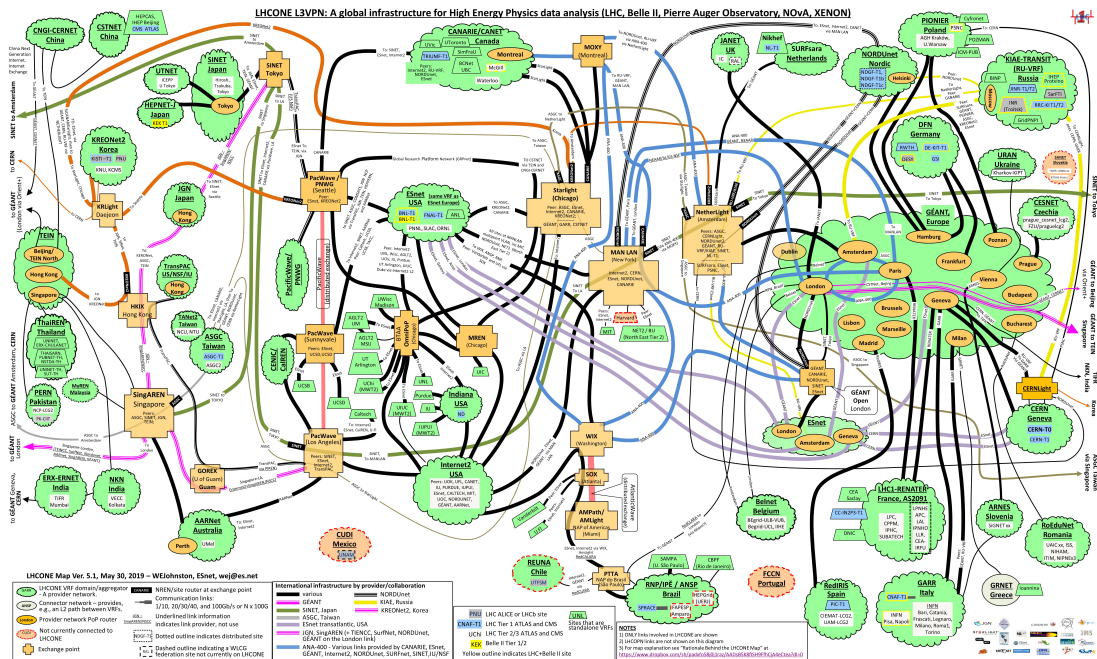
LHCONE..?







### LHCONE L3VPN: A global infrastructure for High Energy Physics data analysis (LHC, Belle II, Pierre Auger Observatory, NOVA, XENON)

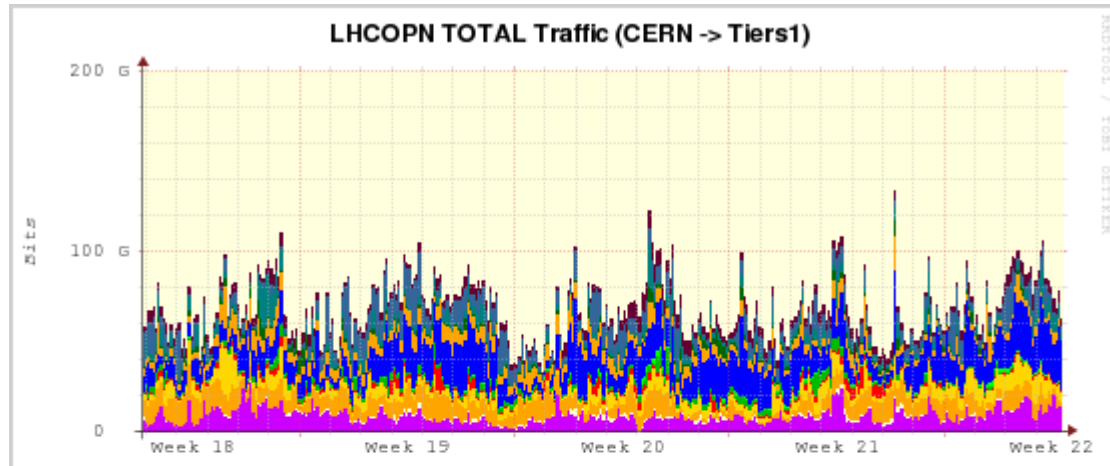


We could load-balance...

NOTED.

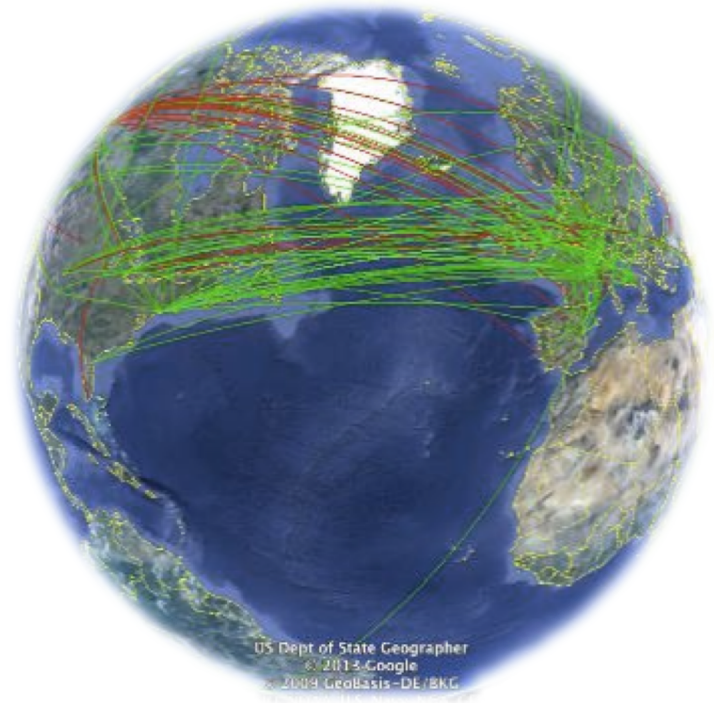


The luminosity upgrade causes  
higher bandwidth usage (peaks)



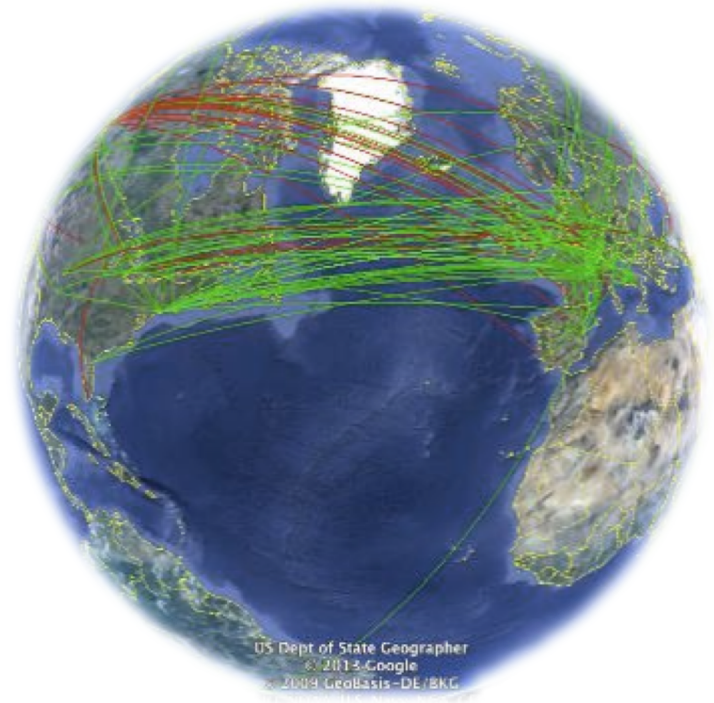
[https://netstat.cern.ch/monitoring/network-statistics/ext/cache/LHCOPN\\_00-Total-Traffic-1-LHCOPN\\_TOTAL-OUT\\_Yearly.png](https://netstat.cern.ch/monitoring/network-statistics/ext/cache/LHCOPN_00-Total-Traffic-1-LHCOPN_TOTAL-OUT_Yearly.png)

Smooth and large data transfers  
need network optimization



# Smooth and large data transfers need network optimization

**N**etwork  
**O**ptimized  
**T**ransfer of  
**E**xperimental  
**D**ata



To load-balance dynamically,  
we tackle these **key challenges**

**when** to do

Obtain transfer start & size information

**what**, and

Load-balance only during the transfer

**how**, and

Find load-balancing mechanism

**how well**

Measure impact



To load-balance dynamically,  
we tackle these **key challenges**

Obtain transfer start & size information

Load-balance only during the transfer

Find load-balancing mechanism

Measure impact

To obtain transfer information,  
we interface with **Richard's transfer tool**



To obtain transfer information,  
we interface with Rucio and FTS



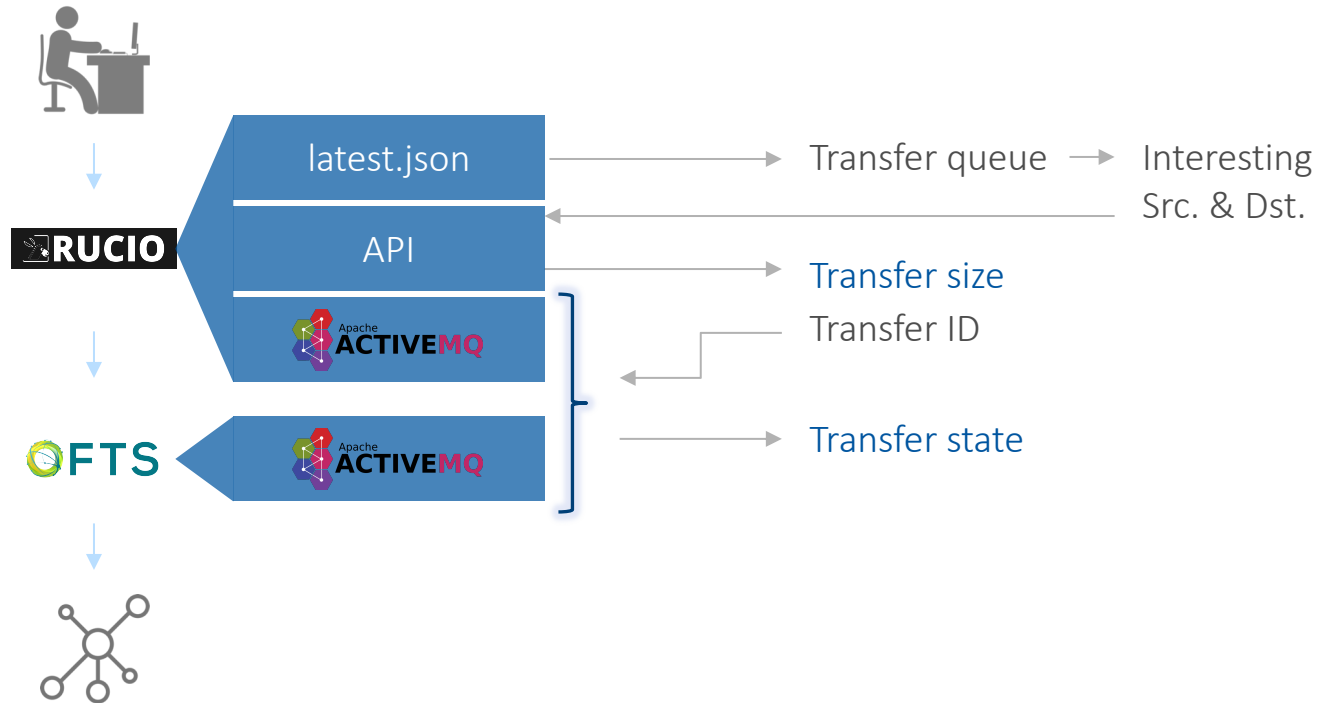
 **RUCIO**



 **FTS**



To obtain transfer information,  
we interface with Rucio and FTS



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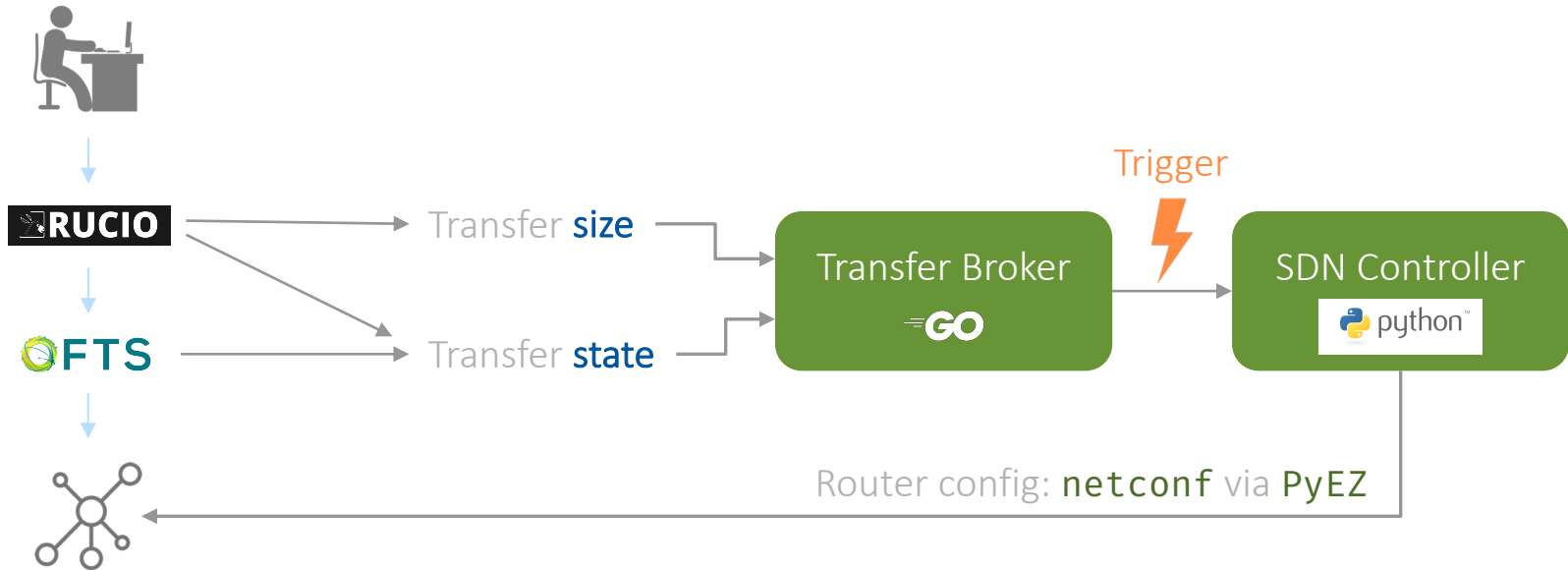
Obtain transfer start & size information

Load-balance *only during* the transfer

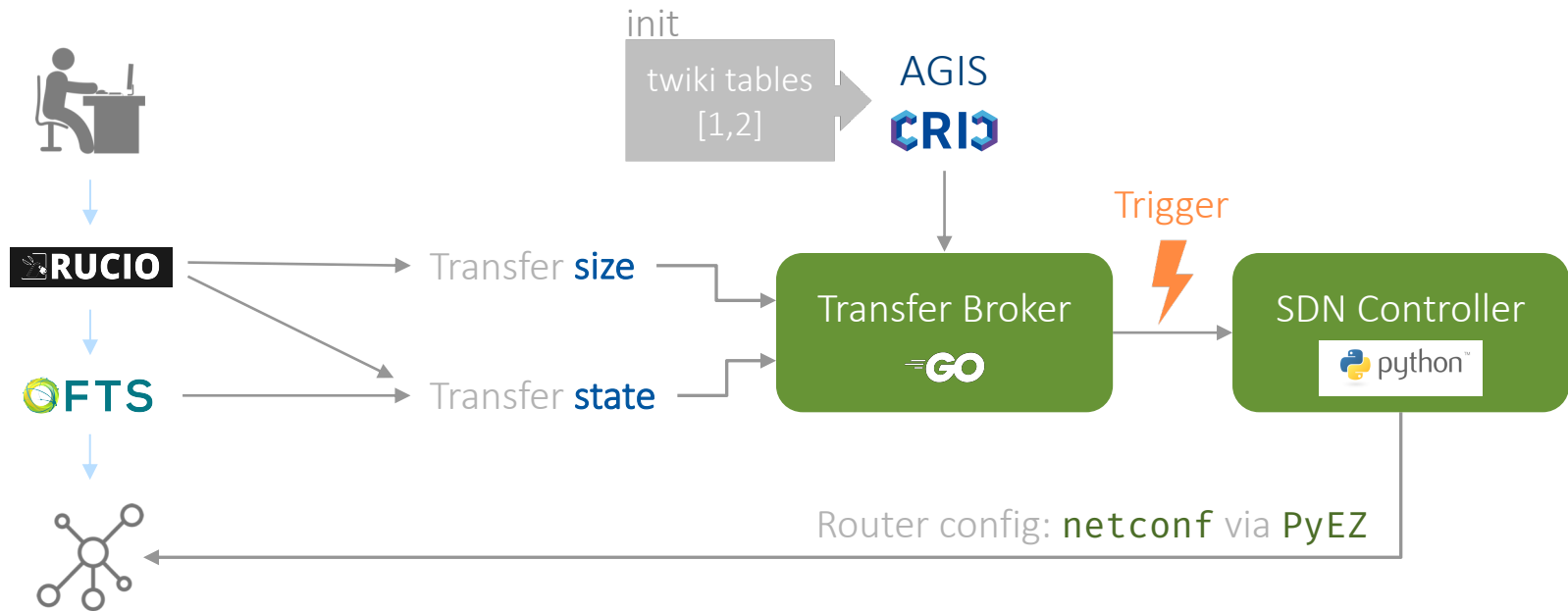
Find load-balancing mechanism

Measure impact

When a **large** transfer starts,  
we **trigger** a SDN controller



We construct the SDN action  
with IP prefixes from AGIS/CRIC





To load-balance dynamically,  
we tackle these **key challenges**

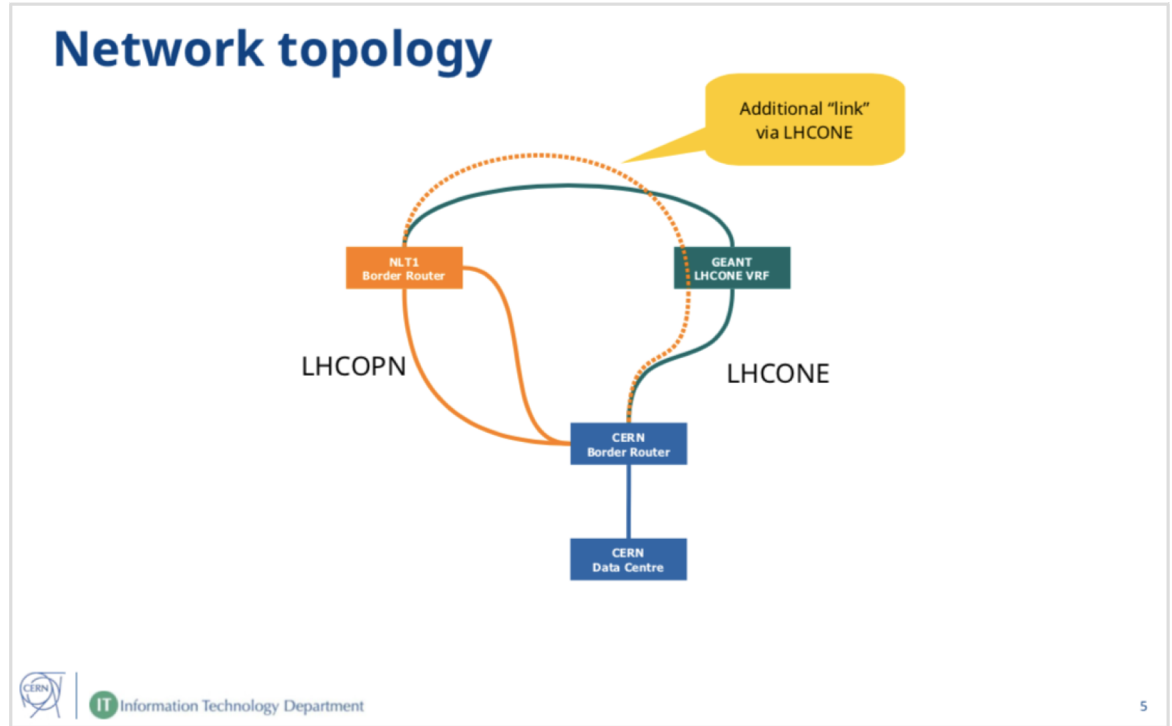
Obtain transfer start & size information

Load-balance *only during* the transfer

**Find load-balancing mechanism**

Measure impact

As a first load-balancing mechanism,  
we automated BGP multipath to NL-T1



To load-balance dynamically,  
we tackle these **key challenges**

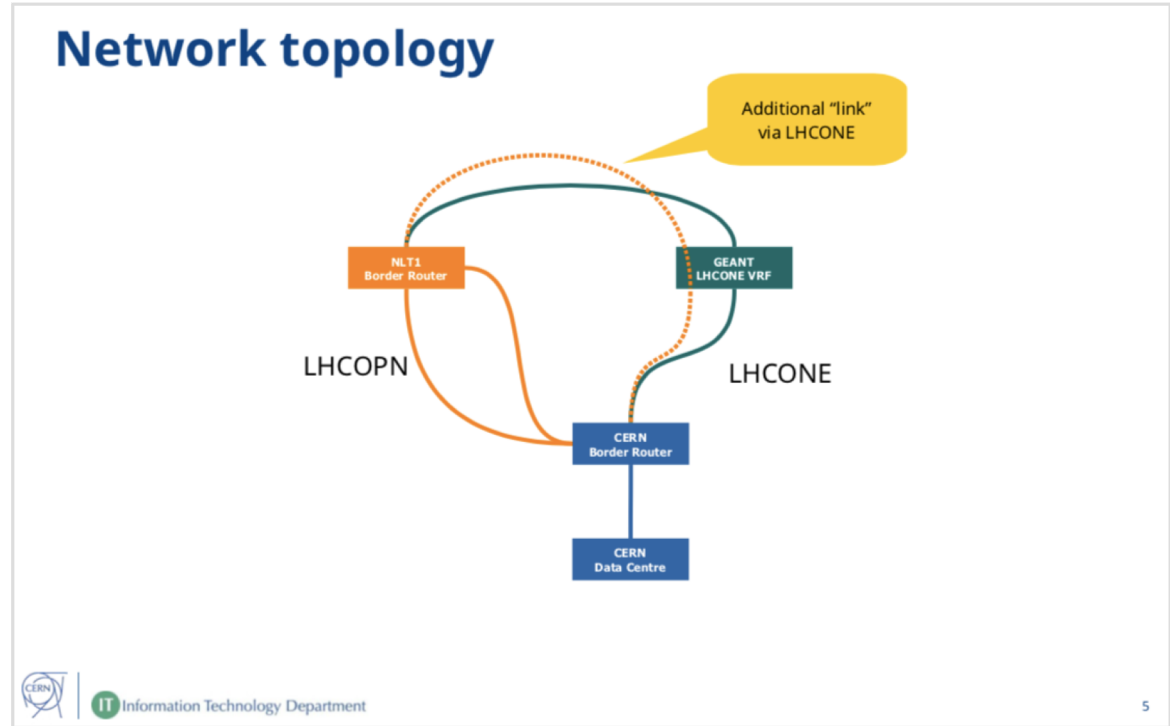
Obtain transfer start & size information

Load-balance *only during* the transfer

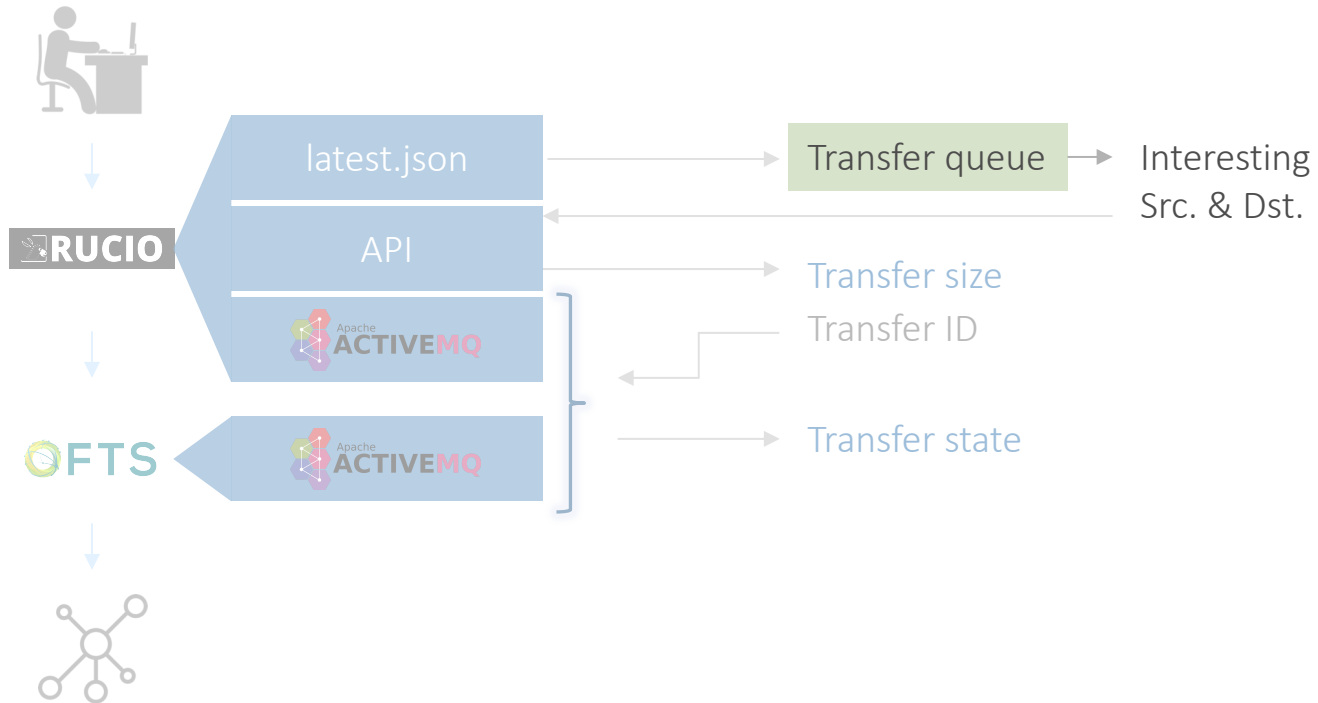
Find load-balancing mechanism

**Measure impact**

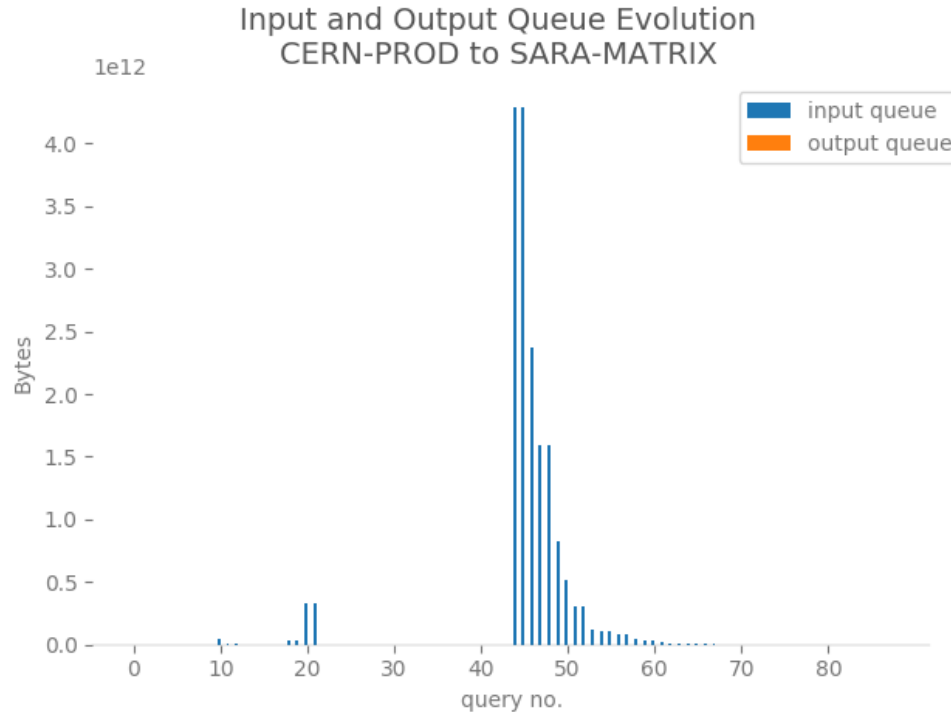
To demonstrate the impact measurements,  
we transferred 200 TB from CERN to NL-T1



To obtain transfer information,  
we interface with Rucio and FTS



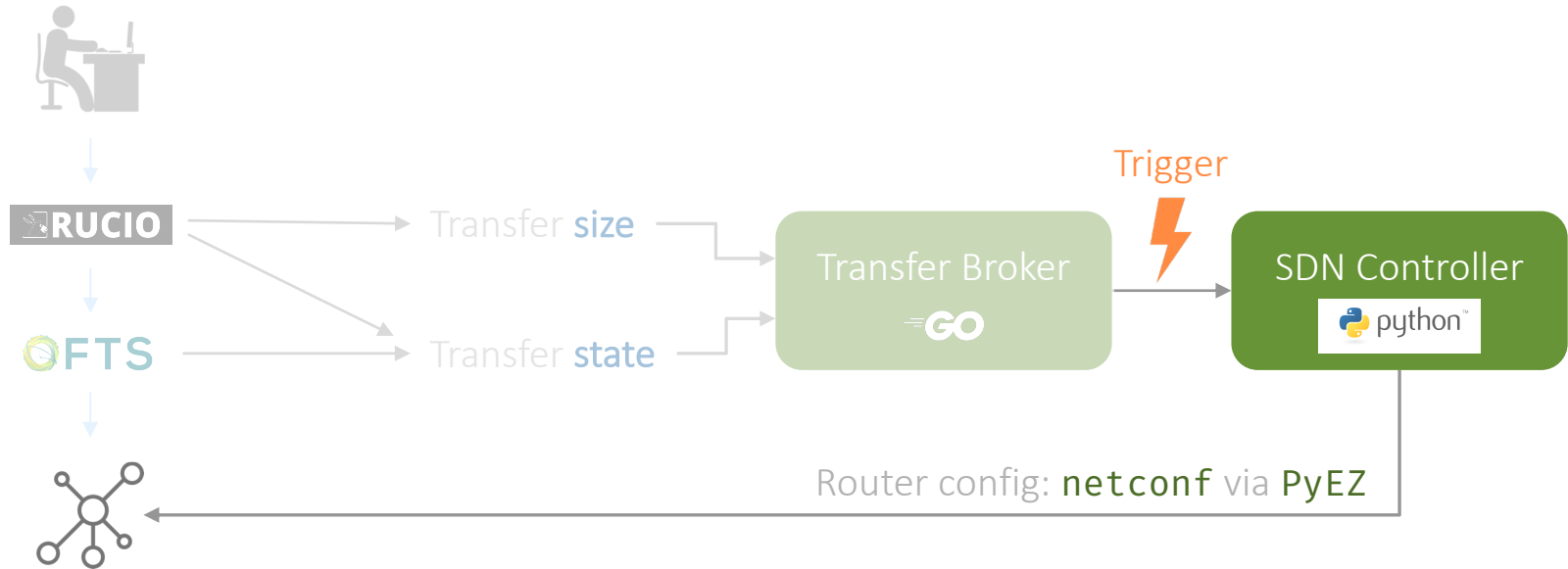
# The Transfer Broker successfully observed **how the Rucio queue fills up**



The Transfer Broker successfully observed **how the FTS queue fills up**



We **trigger** the load-balancing...



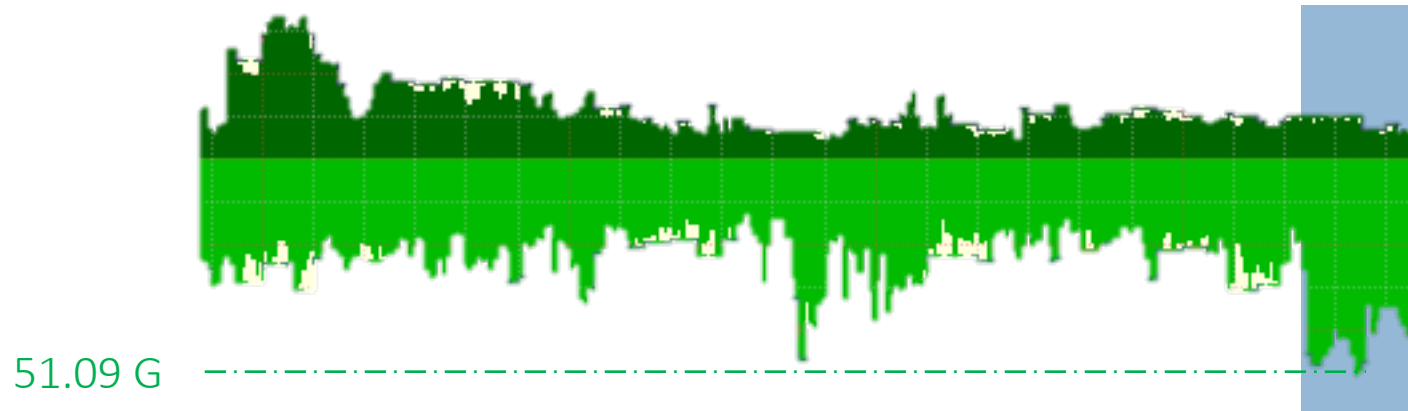


We trigger the load-balancing,  
and see how the traffic shifts

Load-balancing

Simultaneously: traffic in LHCOPN from 50 G to 25 G

From GEANT



To GEANT



To load-balance dynamically,  
we tackle these **key challenges**



Obtain transfer start & size information

Load-balance *only during* the transfer

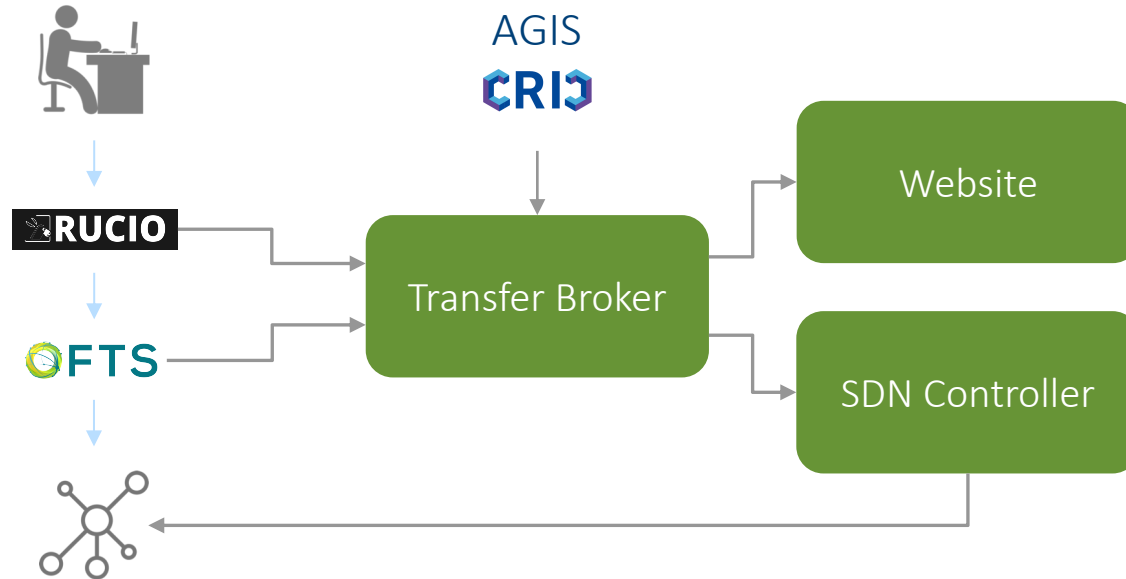
Find load-balancing mechanism

Measure **& show** impact

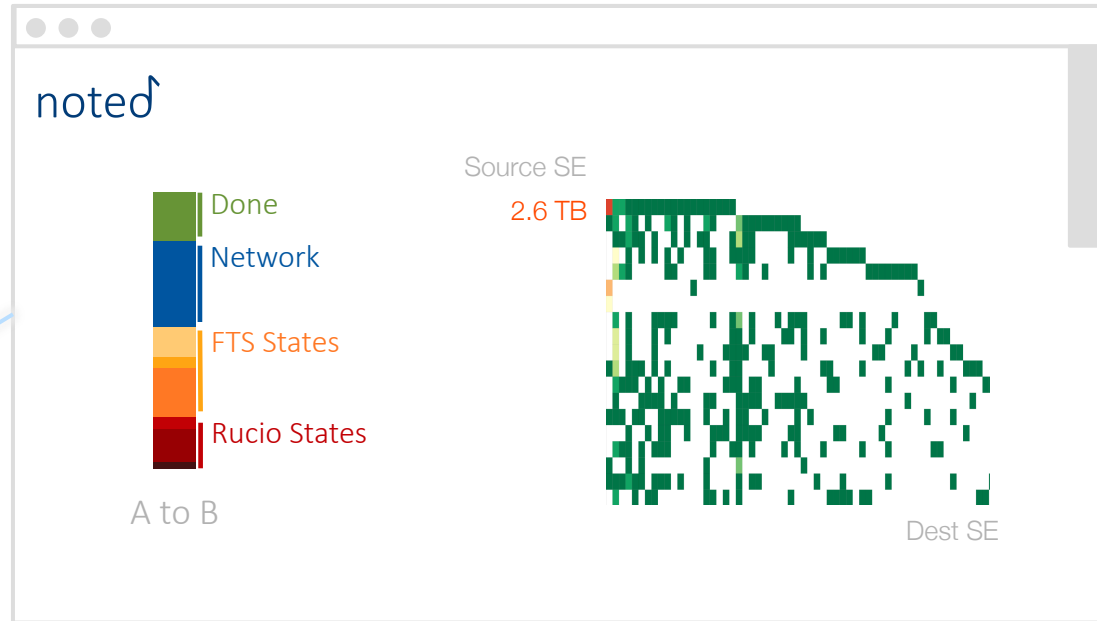
With the Transfer Broker info,  
we can improve the progress graphs



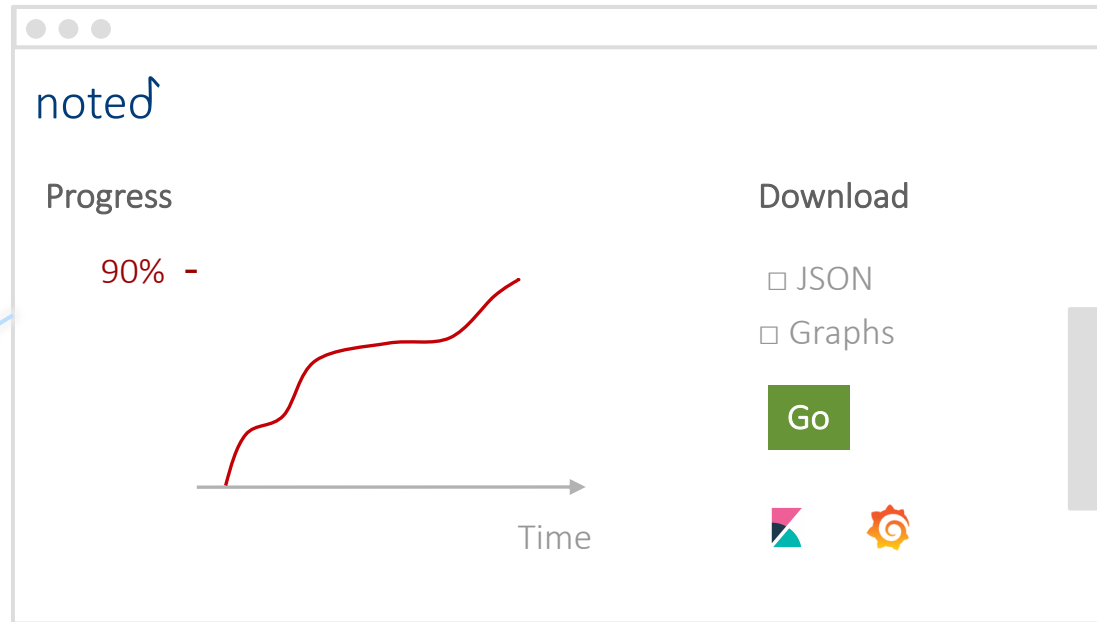
With the Transfer Broker info,  
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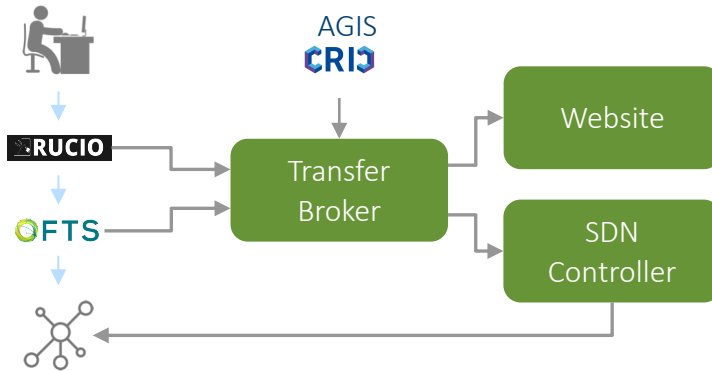
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With the Transfer Broker info,  
we can **improve the progress graphs**



To load-balance dynamically,  
we tackled these key challenges



Obtain transfer start & size information

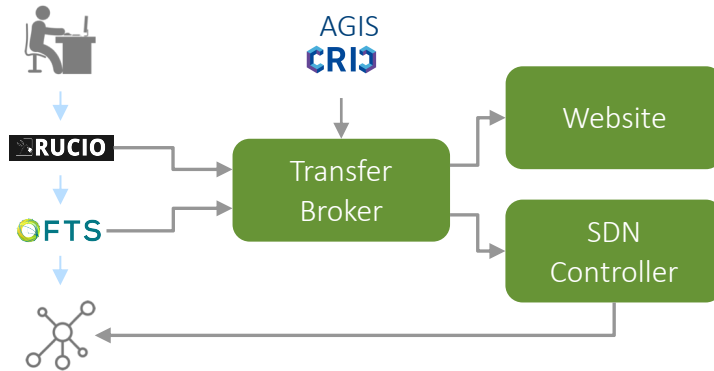
Load-balance *only during* the transfer

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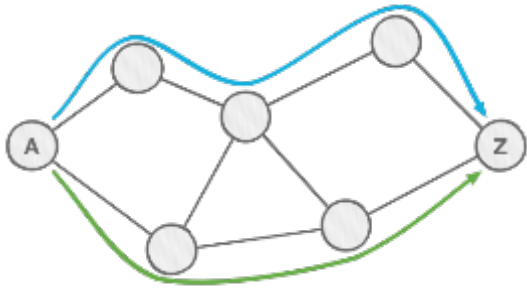
Load-balance *only during* the transfer

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*We would love to hear your feedback!*

## Future work...



Load-balancing:  
segment routing in MPLS

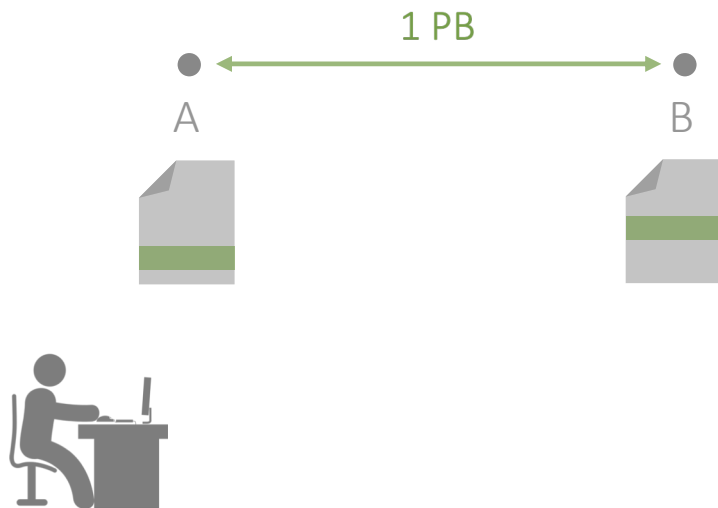
## Future work...



Load-balancing:  
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Use StackStorm as  
SDN controller

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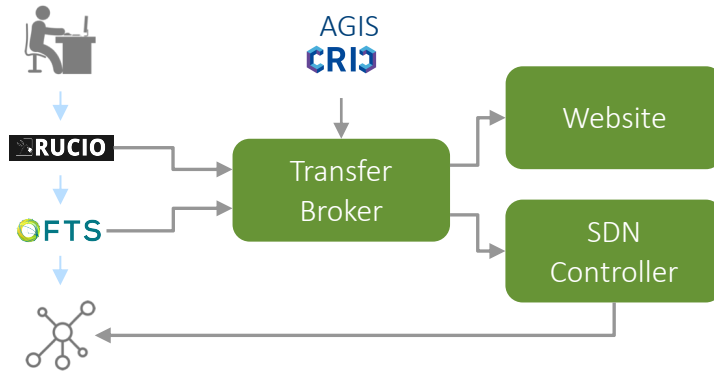
Also cover remotelO/WMAgent  
(some jobs produce ~1PB load,  
heavily used by e.g. CMS)

*Questions?*

*edoardo.martelli@cern.ch*

*coralie.busse-grawitz@cern.ch*

To load-balance dynamically,  
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Obtain transfer start & size information

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