



Why use FTS?

3rd ESCAPE DIOS Workshop - <https://indico.in2p3.fr/event/26307/>

Steven Murray on behalf of the CERN FTS team

Tuesday 22nd March 2022

The FTS team and other contributors



FTS
File Transfer Service

The FTS team

- **CERN, Switzerland**
 - **Mihai Patrascoiu - Project leader**
 - **Joao Lopes - C++ / Python developer**
 - **Steven Murray - Service manager**
- **Indiana University Bloomington, USA**
 - **Edward Dambik - C++ / Python developer**

Other contributors

- **CBPF, Brazil**
 - **Eraldo Silva Junior - Python developer**

Many thanks to all of our contributors!

What is the File Transfer Service (FTS)?



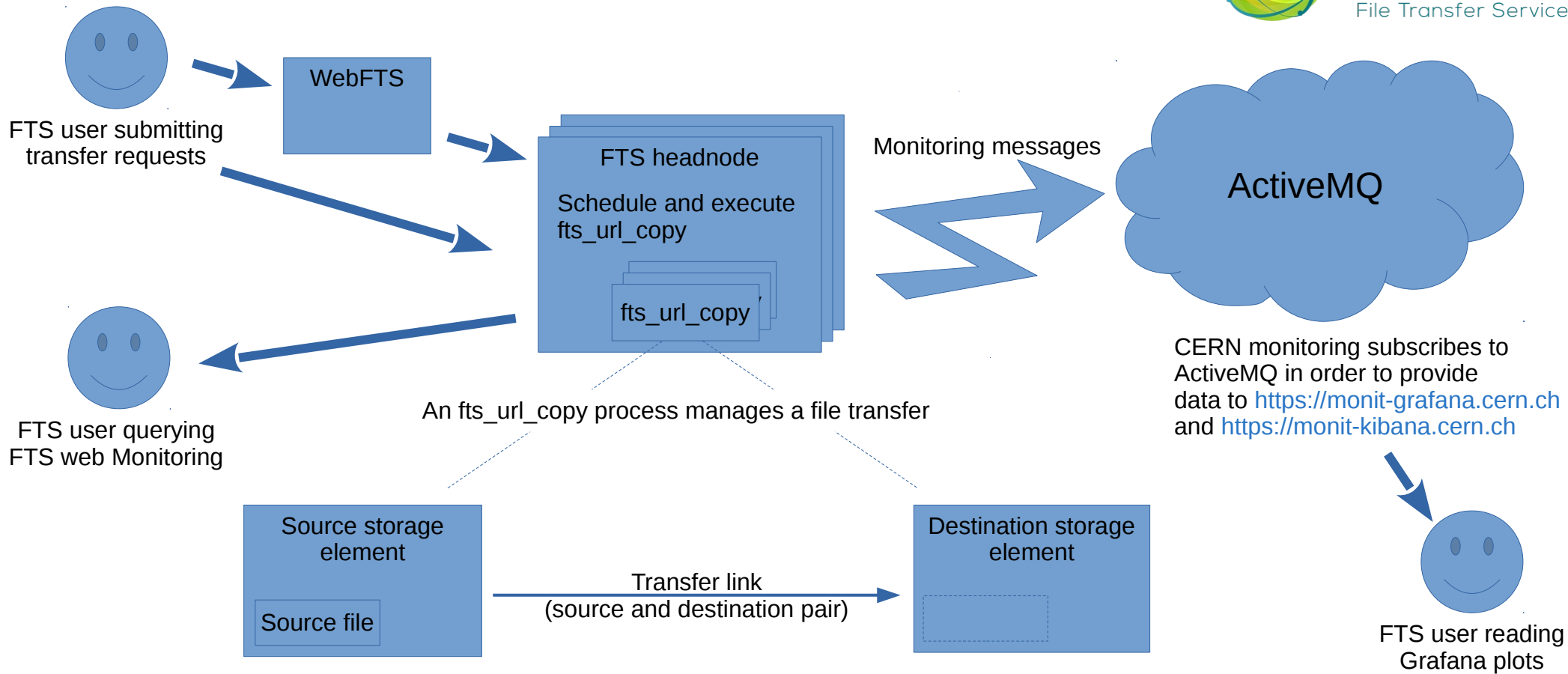
A collection of servers and clients that allow for the automated scheduling and execution of remote files transfers.

What does FTS do?



- **Queues end-user transfer requests**
- **Schedules file transfers taking into account**
 - **Storage endpoint constraints**
 - **Inbound: maximum transfers and throughput**
 - **Outbound: maximum transfers and throughput**
 - **Link (source and destination pair) constraints**
 - **Minimum and maximum active transfers**
 - **Real-time errors**
- **Executes file transfers**
 - **3rd party transfers are the default to avoid bottle necks**
 - **Transfers can fall back to “streaming” through FTS machines if needed**
- **Supports a variety of protocols against a variety of storage endpoints**
- **Supports X509 certificate authentication**
- **Supports OIDC token authentication - “proxy-less transfers”**
 - **ESCAPE, HIFIS and WLCG with EGI coming soon**
- **Publishes monitoring information about transfers**

FTS in action



FTS command-line tools

- `fts-rest-transfer-submit -s https://fts3-devel.cern.ch:8446 gsiftp://source.host/file gsiftp://destination.host/file`
- `fts-rest-transfer-status -s https://fts3-devel.cern.ch:8446 c079a636-c363-11e3-b7e5-02163e009f5a`
- `fts-rest-transfer-cancel -s https://fts3-devel.cern.ch:8446 c079a636-c363-11e3-b7e5-02163e009f5a`
- `fts-rest-transfer-list -s https://fts3-devel.cern.ch:8446 -o atlas`

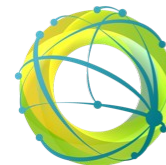
FTS python client library

- Python 2 - to be deprecated
- Python 3 - the future

WebFTS web application

- You favourite web browser

WebFTS the web based GUI to FTS



FTS
File Transfer Service

You are authenticated as **Steven Murray** No delegation detected

WebFTS *Simplifying power*

[Home](#) [My jobs](#) [Submit a transfer](#)

Grid SE
Grid Storage Element

Endpoint path Load

Create Folder ✕ Delete Rename

Select All Files None Refresh Show filters

Name	Mode	Date	Size
0 File(s) Selected			

➤

➤

Overwrite Files

Compare Checksums

LFC Registration

Grid SE
Grid Storage Element

Endpoint path Load

Create Folder ✕ Delete Rename

Select All Files None Refresh Show filters

Name	Mode	Date	Size
0 File(s) Selected			

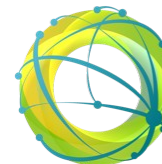
FTS uses GFAL2 to support multiple transfer protocols



FTS
File Transfer Service

- **FTS uses version 2 of the Grid File Access Library (GFAL2)**
- **GFAL2 wraps the different file access protocols of the Grid**
- **Supported protocols include:**
 - **HTTP/WebDav**
 - **GridFTP**
 - **SRM**
 - **XRootD**

FTS web monitoring - Overview page



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File Transfer Service

Generated at 5:31:17 PM on public-002.cern.ch

Overview Jobs Optimizer Error reasons Statistics Configuration Job id

- All - Source storage → Destination storage 1 hour Apply Reset

Overview

Showing 1 to 25 out of 25 from the last 1 hour

First Previous 1 Next Last

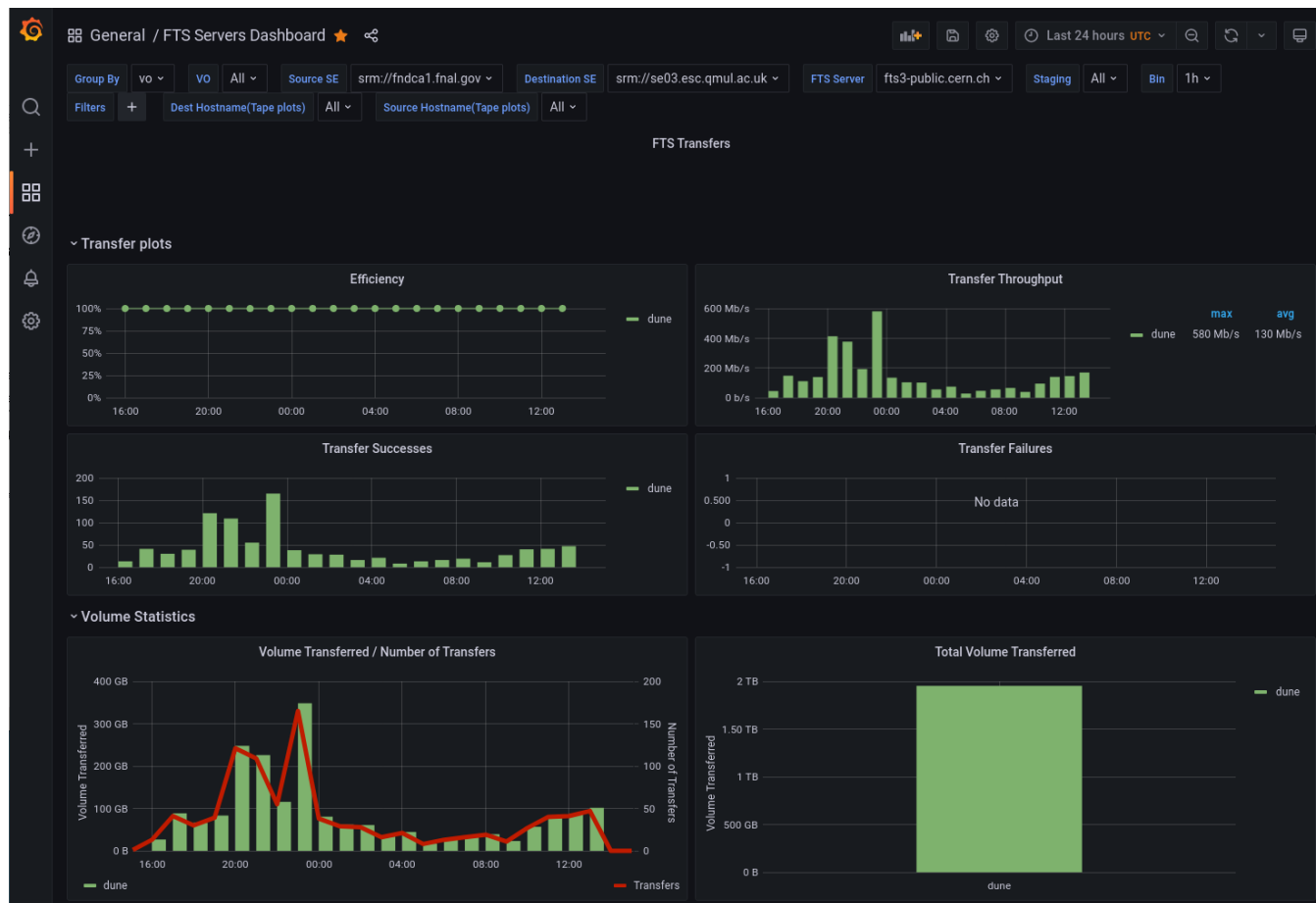
Click here to go to Grafana monitoring at CERN

FTS web monitoring can go back 6 hours

Click here to go to the optimizer web page

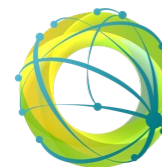
Source	Destination	V0	Submitted	Active	Staging	S.Active	Archiving	Finished	Failed	Cancel	Rate (last 1h)	Thr.
+ srm://se03.esc.qr dune srm://fndcal.fna			29985	28	40	16	-	52	-	7928	100.00 %	36.40 MB/s
Most frequent error Q												
Monitoring Link Q												
+ gsiftp://dune.dca dune srm://fndcal.fna			14167	35	47	16	-	306	-	247	100.00 %	183.30 MB/s
+ gsiftp://bohr3226 dune srm://fndcal.fna			8865	102	88	55	-	750	19	2614	97.53 %	576.19 MB/s

Grafana monitoring at CERN

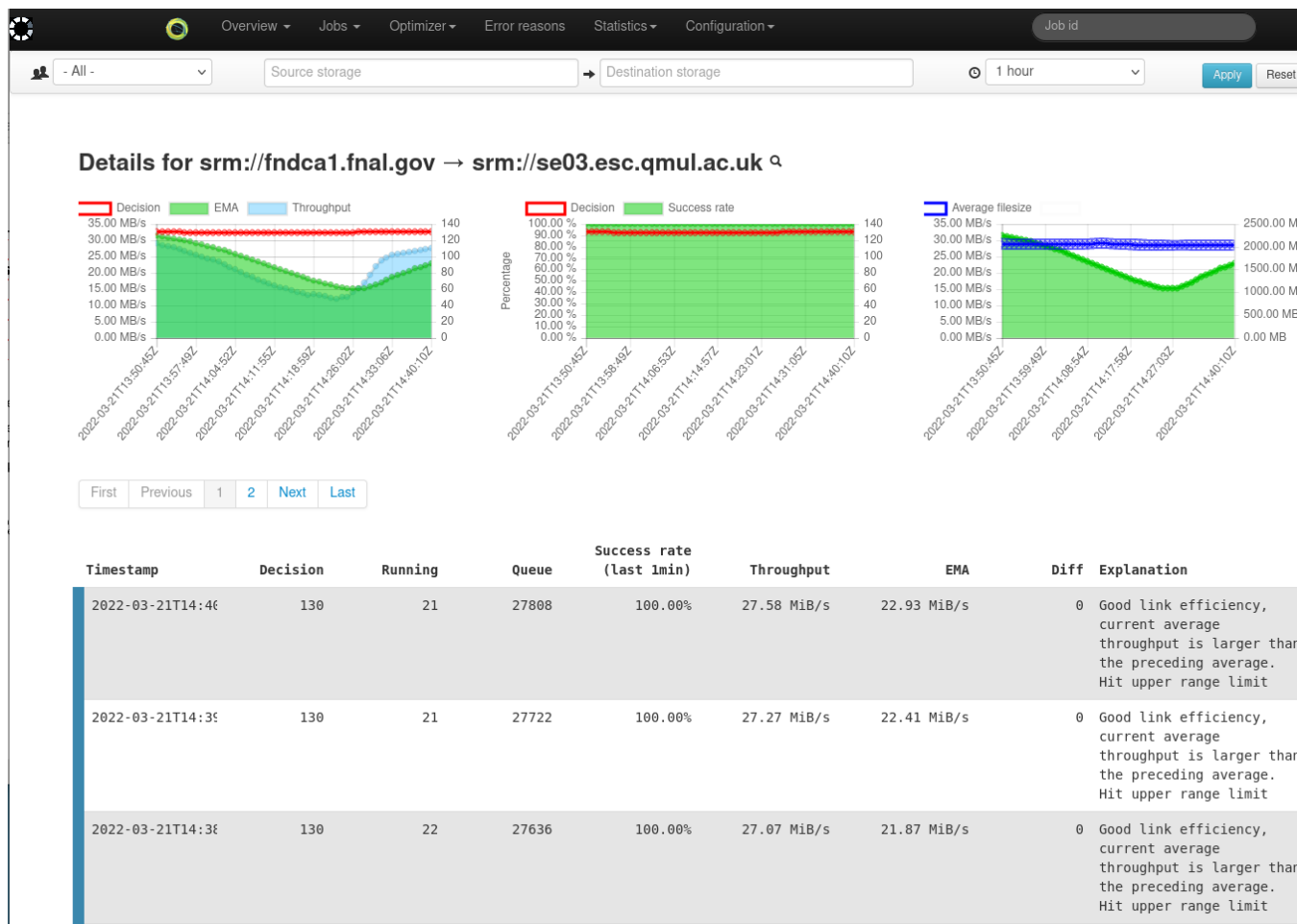


The data source of <https://monit-grafana.cern.ch> can go back 30 days

FTS web monitoring - optimizer



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File Transfer Service



FTS web monitoring - Jobs



Overview ▾ Jobs ▾ Optimizer ▾ Error reasons ▾ Statistics ▾ Configuration ▾ Job id

- All - Source storage → Destination storage 1 hour Apply Reset More filters

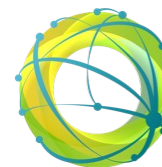
Showing 1 to 50 out of 67637

First Previous 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 ... Next Last

Job id	Submit time	Job state	VO	Source SE	Destination SE	Files	Priority	Destination space token
778bad90-a927-11ec-b625-fa163e5dcbe0	2022-03-21T14:59:12Z	STAGING	dune	srm://fndca1.fnal.gov	srm://se03.esc.qmul.ac.uk	1	3	
77ea8374-a927-11ec-8bee-fa163ecc10d8	2022-03-21T14:59:12Z	STAGING	dune	srm://fndca1.fnal.gov	srm://se03.esc.qmul.ac.uk	1	3	
772edc5a-a927-11ec-8841-fa163ecc10d8	2022-03-21T14:59:11Z	STAGING	dune	srm://fndca1.fnal.gov	srm://se03.esc.qmul.ac.uk	1	3	

Click here to drill down into a specific job

FTS web monitoring - A job



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Generated at 4:03:28 PM Overview Jobs Optimizer Error reasons Statistics Configuration Job id

Transfer 'ff9f43fe-a8f0-11ec-8cf3-fa163e5dcbe0' FINISHED

VO: dune

Delegation ID: 61f9788e983d3645
Submitted time: 2022-03-21T08:29:18Z
Job finished: 2022-03-21T14:03:37Z
Priority: 3
Bring online: 259200
Archive timeout: -1

Received by: fts-public-003.cern.ch
Job expires: 2022-03-21T13:29:18Z
Overwrite flag: Y
Job type: N
Cancel flag:
Pin lifetime: -1
Target QoS:

Metadata:

```
{"issuer": "rucio", "multi_sources": false, "auth_method": "certificate"}
```

Total size	Done	Submission time	Start time	Running time	Avg. file throughput	Current job throughput
2.01 GiB	2.01 GiB	2022-03-21T08:29:	2022-03-21T08:29:	20052 s (+7s)	1.07 MB/s	-

Showing 1 to 1 out of 1

SUBMITTED DELETED READY STAGING ARCHIVING ACTIVE STARTED CANCELED FAILED 1 FINISHED NOT_USED

First Previous 1 Next Last

File ID	File State	File Size	Throughput	Remaining	Start Time	Finish Time	Staging Start	Staging End	Archiving Start	Archiving End	Log
+ 134257634	FINISHED	2.01 GiB	1.07 MB/s	-	2022-03-21T	2022-03-21T	2022-03-21T	2022-03-21T			Log

Home: srm://fndca1.fnal.gov:8443/srm/managerv2?SFN=/pnfs/fnal.gov/usr/dune/tape_backed/dunepro/fardet-vd/full-reconstructed/2022/mc/out1/FDVPProd1/28/46/90/05/anu_numu2nue_nue2nutau_dunevd10kt_1x8x6_3view_28469005_681_20220122T002721Z_gen_g4_detsim_reco.root

Home: srm://se03.esc.qmul.ac.uk:8444/srm/managerv2?SFN=/dune/RSE/fd_vd_mc_reco/b4/2b/anu_numu2nue_nue2nutau_dunevd10kt_1x8x6_3view_28469005_681_20220122T002721Z_gen_g4_detsim_reco.root

Click here to get the logs of the fts_url_copy process

FTS in numbers



8 WLCG instances:

- BNL, CERN (4), FNAL, RAL and MIT

16 non-WLCG instances

- CERN (DAQ, Public), RAL, KEK(2), Imperial (also used by CMS), PIC, MWT2, CESNET (WebFTS + RAuth), JINR, CNAF, SARA, SLAC, IHEP, Fermilab (containers), FENIX Research Infrastructure (Human Brain Project)

Approximately 36 Virtual Organisations (VOs)

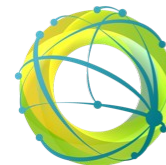
- ATLAS, CMS, LHCb, AMS, NA62, Compass, ILC, Magic, Belle, Mice, Xenon, Snoplus, Gridpp, Dune, LZ, Solidexperiment.org, SKA, Ligo, Icecube, Elixir, NP02(part of Dune), CAST, ESCAPE, Eiscat.se, Virgo, Pierre Auger Observatory, BES III, JUNO, CEPC, FENIX-RI, CTA, T2K, Project8, ICARUS, FASER, Folding@Home

Used by more than 35 experiments at CERN.

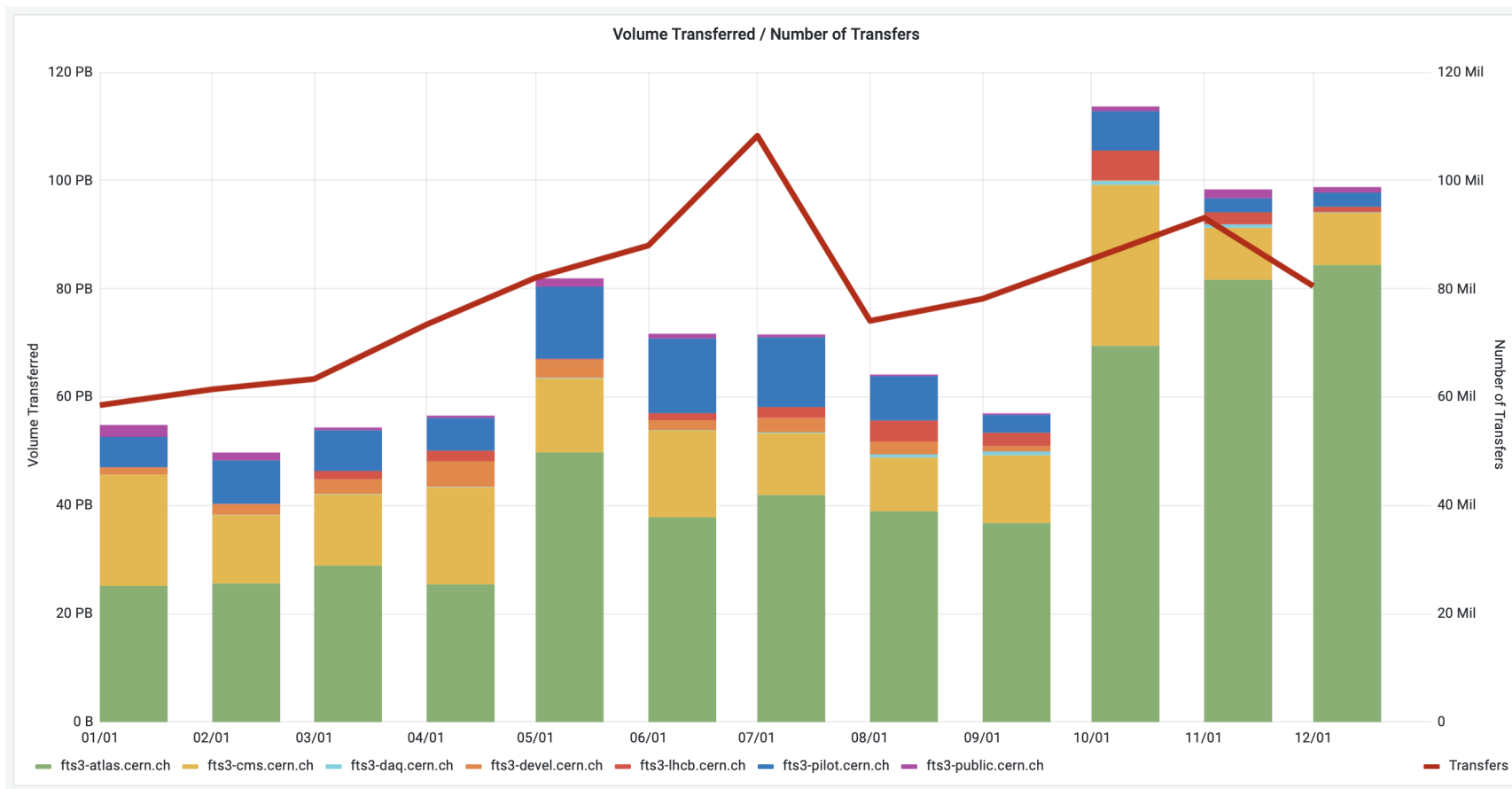
Transfers

- 2018: 848 PBs and 986M files
- 2019: 1.27 EBs and 1.08B files
- 2020: > 1.0 EBs and ~ 1B files
- 2021: > 1.0 EBs and > 1.15B files

Data moved by CERN FTS instances during 2021



FTS
File Transfer Service



Why use FTS?



Intuitive

- Simple interfaces to submit transfers
 - REST API
 - Command-line
 - Web based GUI via the WebFTS portal

Robust

- Transfers support checksumming and automatic retries

Flexible

- Support for multiple protocols: HTTPS, GridFTP, XRoot, SRM, S3 and more
- Real-time monitoring and runtime configuration

Adaptive

- Runtime optimisation: maximise throughput without overloading storage endpoints
- Transfer classification using priorities and activity types

Contacts and links



Main website: <https://fts.web.cern.ch/fts/>

Support questions: fts-support@cern.ch

Technical questions: fts-devel@cern.ch

CERN support ticket: <https://cern.service-now.com>

Operations forum: fts-ops-forum@cern.ch

FTS git repository: <https://gitlab.cern.ch/fts/fts3>

GFAL2 git repository: <https://gitlab.cern.ch/dmc/gfal2>

WebFTS git repository: <https://gitlab.cern.ch/fts/webfts>

Installation instructions: <https://fts3-docs.web.cern.ch/fts3-docs/docs/install.html>



home.cern