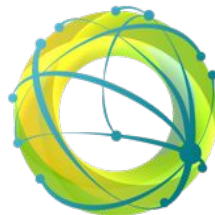*5th Rucio Community Workshop*

FTS 2023: Plans and Direction

Mihai Patrascoiu
on behalf of the FTS team

Open Source software for reliable and large-scale data transfers within WLCG

Features:
- TPC Orchestration
- Tape Operations (over multiple protocols)

- Certificate and token auth
- Multihop transfers
- Transfer Optimizer
- Cloud support
- Python bindings + CLI clients

...and many others

FTS Team

- Mihai Patrascoiu   (Project Leader)   [CERN]

- Steven Murray   (Service Manager)   [CERN]

- João Lopes   (C++ / Python developer)   [CERN]

- Ed Dambik   (C++ developer)   [ATLAS / Indiana University Bloomington, USA]

- Eraldo Silva Junior (Python developer)   [ATLAS / LHCb / CERN / CBPF, Brazil]

- *Tom Hepworth   (C++ / Python / Grafana guru)* [2022 CERN Summer Student]

…and thanks to many other past and present contributors

FTS Ecosystem

Projects under FTS umbrella

- FTS   (Server + QoS daemon)   [C++]
- FTS-REST   (Submission server)   [Python, Flask]
- FTS-clients   (Python & CLI)   [Python]
- FTS-Monitoring (Django Web UI)   [Python, Django]
- webFTS   (Submission Web page)   [PHP]

Data Management Clients

- Gfal2   (Grid file access library)   [C++]
- Gfal2-python   (Python bindings)   [C++, BoostPy]
- Gfal2-util   (Python CLI)   [Python]
- Davix   (Grid HTTP client)   [C++]
- SRM-IFCE   (SRM interface for Gfal2)   [C, gsoap]
- CGSI-GSOAP   (gsi interface for Gfal2)   [C, gsoap]

FTS and DMC clients published to PyPi, EPEL, Debian*

*Special thanks to Mattias Ellert

FTS submissions by issuer (last 30d)

All submissions vs Rucio submissions (past 30d)

FTS − v3.12.0 series

- Python2 → Python3 migration

- FTS-REST → FTS-REST-Flask rewrite

- Jump to MySQL8

- Tape REST API (**v3.12.2 RC**, September 2022)

- WebMonit "linkinfo" feature (Eraldo contribution)

- HTTP-TPC IPv4/6 flag reporting (Ed contribution)

- Improved support for S3v4 transfers

- Eviction configurable per-StorageEndpoint

- Multihop "--overwrite-hop" feature

- Deprecation notice in C++ clients

- GDPR / OC11 compliance
(VO name generation for certs w/o VOMS data)

- ActiveMQ format documentation up-to-date

- All DMC & FTS clients published to EPEL

… and many others

CERN

Web Monitoring "linkinfo" feature

- Allows transfer operators to quickly identify why a link is not progressing
(e.g.: number of transfers for a <src> → <dst> link is "subpar")
- A pain-point in a transfer operator's day-to-day life, many times
requiring assistance from the FTS team

- The answer lies in the storage and link limits,
which have now been made fully transparent
and easily accessible via the Web Monitoring
(e.g.: fts3-atlas.cern.ch:8449)

- Successfully initiated Eraldo
in the world of FTS development !
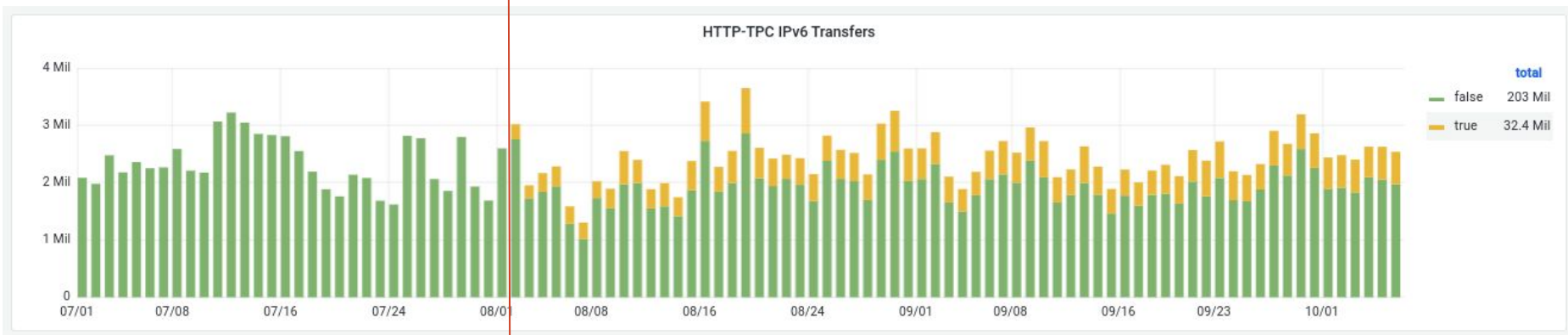
IPv6 reporting for HTTP-TPC transfers

- HTTP-TPC IP version extracted via Davix, propagated to FTS

- Change implemented by Ed across the many layers: FTS <> Gfal2 <> Davix

Change deployed in August 2022 (at CERN)

HTTP-TPC IPv6 Transfers

Immediate pipeline: evolve IPv6 reporting

Objective:

A way to tell between "not ipv6" and "no info available"

Approach:

```
ipv6  = true | false (boolean type)
ipver = ipv4 | ipv6 | ipv4+6 | unknown
          (string type)
```

- Introduce a new co-existing field `<ipver>`
- Existing dashboards / scripts won't be impacted by the addition of a new field
- Concerned dashboards / scripts **will have to adopt** the new field
- The `ipv6` is no longer guaranteed long-term longevity
  (e.g.: may disappear in 1y+)

Immediate pipeline: metadata for tape

Objective:

Allow clients to pass tape metadata for staging and archiving (per file)

```
--staging-metadata / {"staging_metadata"} = <metadata>

--archive-metadata / {"archive_metadata"} = <metadata>*
```

Staging metadata – Passed as specified in the Tape REST API
*Archive metadata – Submission ground is ready, but no action yet
(data will sit in FTS DB, workflow to be defined)

FTS – Packages and Platforms

Server

- `fts-server` / `fts-rest-server` / `fts-monitoring`
- Only available on CC7 ! (move to next platform once Linux strategy decided)
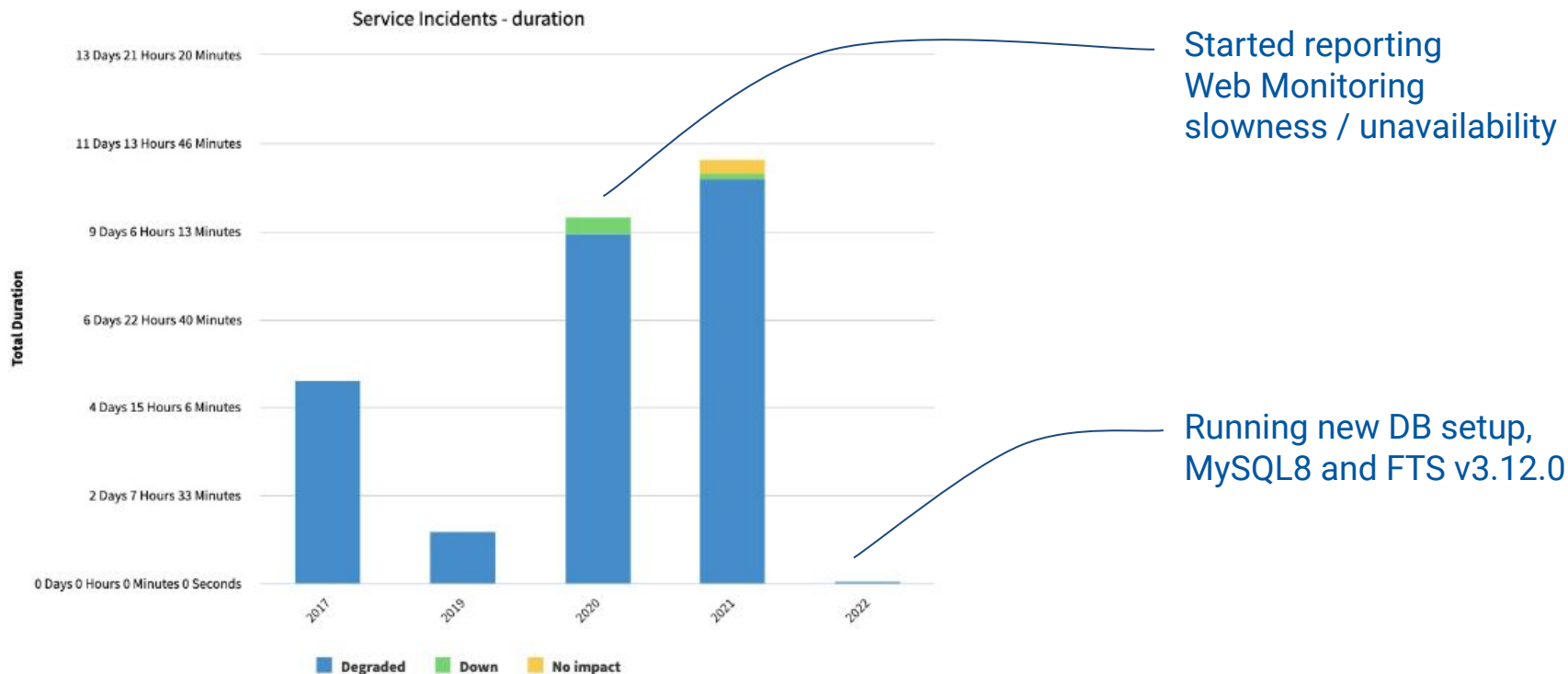- Packages only available via the FTS repositories

Clients

- `fts-rest-client` / ~~`fts-client`~~ (deprecated C++ client)
- `gfal2` / `gfal2-python` / `gfal2-util` / `davix`
- Packages available via EPEL (covers CC7, CS8, CS9, Fedora)

FTS − Releases: change of approach

- Starting with FTS v3.12.0 + MySQL8: schema upgrades
  are no longer disrupting to the service operations

- **The FTS team will treat schema upgrades as non-disruptive to the service !**
  - No more need to bundle many schema upgrades into one big change
  - Allows us to release more often, including new features in patch releases

- We encourage all FTS sites to upgrade to v3.12.0 and MySQL8 (**or equivalent***)

  ** MySQL remains the CERN FTS deployment choice, but FTS will not break other implementations
  (e.g.: MariaDB) on purpose*

FTS − Service @ CERN

Started reporting Web Monitoring slowness / unavailability

Running new DB setup, MySQL8 and FTS v3.12.0

What's next?

FTS - Token support for exascale transfers

Native support for a scalable infrastructure based on tokens for the critical workflows of all the LHC experiments

New person joining FTS team in Q1 2023

- Will liaison with WLCG AuthZ WG
- Active FTS participation in the next AuthZ workflow

- Assess current FTS software stack w.r.t. tokens
- Discuss and review main workflows with all stakeholders
- Design and develop fully integrated token support for all supported protocols
- Design and develop automated token refresh mechanism
- Design and develop fully integrated token support for cold storage
- Test individual components and service scalability
- Develop and deploy a functional testing framework
- Deploy a prototype service with full token support
- Validate main experiments' workflows
- Highlight and address shortcomings and scalability issues

FTS - ALTO Collaboration

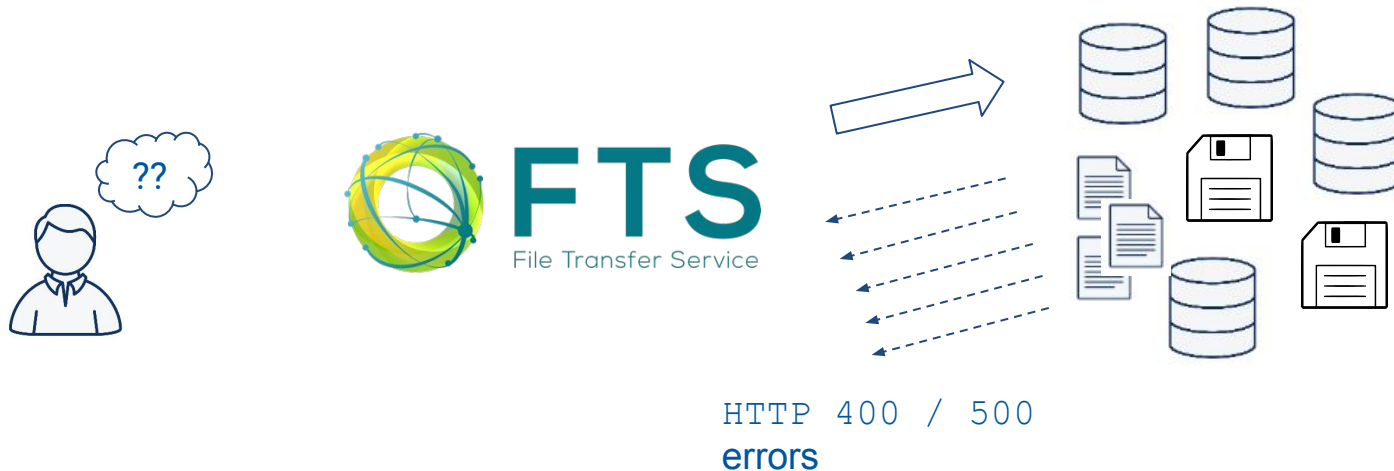Collaboration between Dr. Richard Yang's group (Yale University) and FTS team

Goal

- Incorporate networking usage information from ALTO
- Improve FTS Scheduling and Optimizer decision
- Full details explained in Richard Yang's talk

| ALTO/TCN: Rucio/FTS Control with Deeper Network Visibility ([link](#))

FTS - The error reporting storm

`HTTP 400 / 500`
errors

Too many times, HTTP errors are not clear enough
  → FTS is in the middle of it, assisting sites and users in debugging

Need a better way of HTTP error reporting across the grid !
  → Will collaborate with DOMA-BDT on achieving this

FTS - Through the user's lens

Our Documentation and Web Monitoring is too developer oriented
→ This causes confusion for our end users

Will need volunteers to "walk us" through the pages and highlight weak points !

FTS - Next development focus?

Service running
- FTS Scheduler rewrite
- Scalability concerns
- Better service health monitoring
- Reduce legacy code

Community requests
- FTS global config
- Transfer limits per Site
- Aggressive Optimizer
- Improve Cloud support
- Improve error reporting

- Need a way to prioritise between service and stakeholder requests

Lists not exhaustive

FTS - Revive the steering meetings

Last FTS Steering Meeting: *too long ago*

Ultimately, need a way to understand and prioritise what's most important to our communities…

→ …so why not simply ask?

Steps
- FTS to reach out to main stakeholder communities asking for requirements
- Gather and structure stakeholder requirements
- Organize the next FTS Steering meeting
- Negotiate with stakeholders on items

Conclusions

- Last years show a maturing FTS deployment at CERN
    - → confident in FTS abilities during Run3

- From v3.12.0: releases and schema changes are no longer painful
    - → allows us to release more frequently
        - → better meet client demands

- HTTP error reporting must be addressed
    - → we must allow our users to understand what goes on
      without needing expert intervention

- FTS continuously evolves to meet community demands
    - → revive steering discussions and establish priority items

Thank you!

- Issue tracking: JIRA FTS / DMC
- Code: Gitlab (CERN) → mirrored on Github

https://gitlab.cern.ch/fts/fts3
https://gitlab.cern.ch/dmc/gfal2
https://gitlab.cern.ch/dmc/davix

- **Non-formal communication:** ~IT-FTS (Mattermost, CERN)
- **E-mail:** fts-devel@cern.ch / dmc-devel@cern.ch
- **Announcements:** fts3-steering@cern.ch
- **FTS Service Managers:** fts-ops-forum@cern.ch
- **User support:** fts-support@cern.ch / Service Now (CERN)
  / GGUS (experiments, WLCG)

- Documentation: 📄 cern.ch/fts3-docs   🌐 cern.ch/fts
  📄 cern.ch/dmc-docs