

European Science Cluster of Astronomy & Particle physics ESFRI research Infrastructures

# DOMA-TPC testing

ESCAPE F2F meeting 2019-07-01 Amsterdam https://indico.in2p3.fr/event/19214/





# Background: we move data wholesale!

- WLCG relies heavily on third-party copy (TPC) to move data
  - A coordinating service (FTS) instructs one endpoint to send data, the other to receive data.
  - Data flows **directly between endpoints**: **not** relayed through the coordinating service.
- Currently TPC mostly done with (an extension of) the FTP protocol: GridFTP
  - Due to control/data channel separation, FTP support TPC out-ofthe-box
  - GridFTP adds extra features, such as multi-stream support, persistent data channels, and data integrety verification.





Why work on something that's been a robust production solution for ~20 years?

In Spring 2017, Globus announced they are ending support for the Globus Toolkit (GT) in 2018-01-01.

Almost all WLCG software stacks (client & server) use GT for GridFTP support:

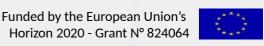
dCache doesn't 🖤

There is now a community effort to support the GT software by the Grid Community Forum.

3

... however, people nervous about future support effort.

Good opportunity to evaluate alternatives.





### A problem with two solutions

• Two contenders for a replacement protocol: xrootd-TPC and HTTP-TPC

- xrootd is a proprietary protocol, championed within WLCG
- HTTP is an industry standard, but HTTP-TPC is a proprietary extension
- Both xrootd-TPC and HTTP-TPC have multiple implementations.
- Our of the second se GridFTP.

4

Tests are needed to make an informed decision.





#### DOMA-TPC

**DOMA-TPC** is an activity within the DOMA working group.

- Charged with the investigation of xrootd-TPC and HTTP-TPC and to oversee the roll-out of these alternatives to a production environment.
- WLCG sites responded to a call for resources and have deployed new versions of software and allocated resources.
- Together, they form the DOMA-TPC testbed within which we can evaluate the different protocols and software implementation.

It has evolved over time, but currently we have two main testbeds:

"**Proving ground**" (32 sites, 40 storage systems) "**Stress testbed**" (7 sites/storage systems)





# Rucio testing: our work-horse

Rucio is software that coordinates data placement, using FTS to handle data movement (when needed)

- Used to test **both** HTTP-TPC and xrootd-TPC
- Storage systems registered in Rucio with a single protocols (not a limitation in Rucio, a testing choice by DOMA-TPC).

#### Proving ground:

once an hour, a single file is uploaded to an endpoint and registered in Rucio. This file is requested at another endpoint, retrying as needed.

Stress-test:

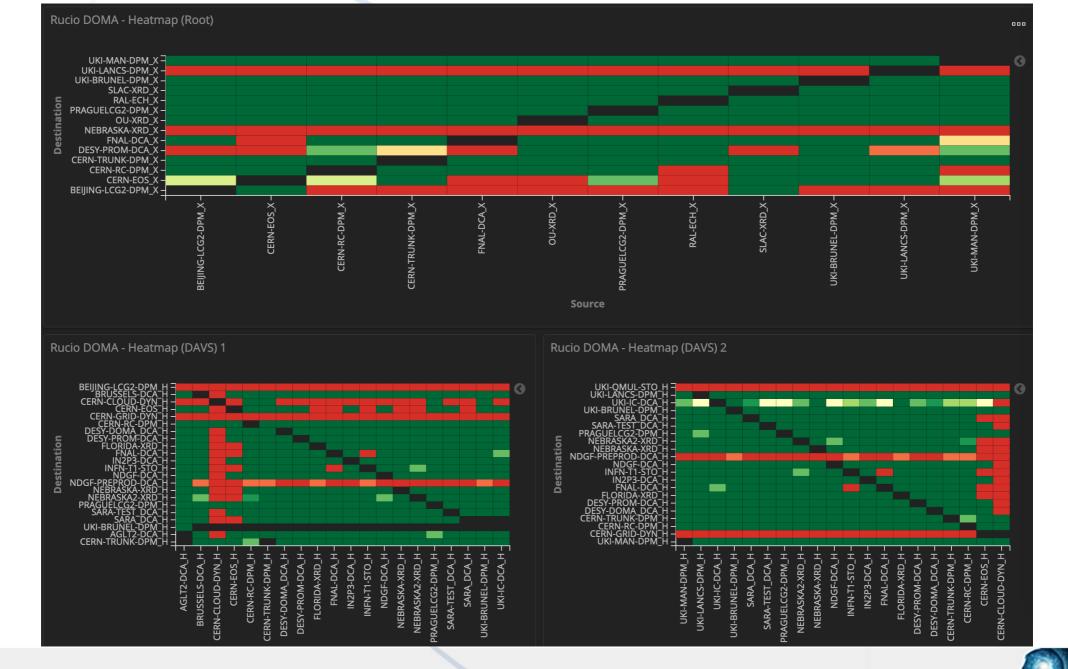
More data is registered in Rucio  $\rightarrow$  more transfers and higher load.



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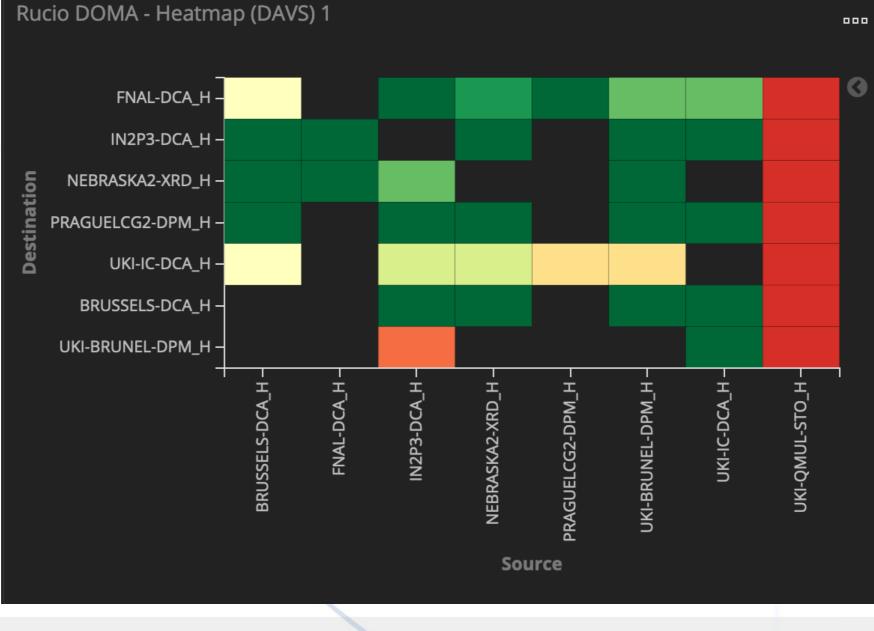


7













# HTTP smoke tests:

Originally written to overcome some limitations with the Rucio/FTS testing.

• A "simple" script, just runs different **curl commands**.

Limited requirements, relatively easy to deploy

- Two groups of test: direct tests and TPC tests:
  - Direct tests simulate an HTTP-TPC transfer (test each interface),
  - TPC tests test if HTTP-TPC transfers work.
- Two modes: "overview" and "stop-on-failure"

Includes some work-rounds for problems/bugs in server software where a solution is not yet available.

9

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#### HTTP smoke tests: example

Target: https://dcache-se-doma.desy.de:2880/dteam/smoke-test-discordia.desy.de-4117

DIRECT TRANSFER TESTS

Checking 131.169.191.70 (1 of 2)

Uploading to target with X.509 authn: SUCCESS Downloading from target with X.509 authn: SUCCESS Obtaining ADLER32 checksum via RFC 3230 HEAD request with X.509 authn: SUCCESS Deleting target with X.509 authn: SUCCESS Request DOWNLOAD,UPLOAD,DELETE,LIST macaroon from target: SUCCESS Uploading to target with macaroon authz: SUCCESS Downloading from target with macaroon authz: SUCCESS Obtaining ADLER32 checksum via RFC 3230 HEAD request with macaroon authz: SUCCESS Deleting target with macaroon authz: SUCCESS

Checking 2001:638:700:10bf::1:46 (2 of 2)

Uploading to target with X.509 authn: SUCCESS Downloading from target with X.509 authn: SUCCESS Obtaining ADLER32 checksum via RFC 3230 HEAD request with X.509 authn: SUCCESS Deleting target with X.509 authn: SUCCESS Request DOWNLOAD,UPLOAD,DELETE,LIST macaroon from target: SUCCESS Uploading to target with macaroon authz: SUCCESS Downloading from target with macaroon authz: SUCCESS Obtaining ADLER32 checksum via RFC 3230 HEAD request with macaroon authz: SUCCESS Deleting target with macaroon authz: SUCCESS THIRD PARTY PULL TESTS

Initiating an unauthenticated HTTP PULL, authn with X.509 to target: SUCCESS Deleting target with X.509: SUCCESS Initiating an unauthenticated HTTP PULL, authz with macaroon to target: SUCCESS Deleting target with macaroon: SUCCESS Requesting (from prometheus) DOWNLOAD macaroon for a private file: SUCCESS (doesn't count) Initiating a macaroon authz HTTP PULL, authn with X.509 to target: SUCCESS Deleting target with X.509: SUCCESS Initiating a macaroon authz HTTP PULL, authz with macaroon to target: SUCCESS Deleting target with X.509: SUCCESS Deleting target with macaroon: SUCCESS

THIRD PARTY PUSH TESTS

Third party push target: https://prometheus.desy.de:2443/VOs/dteam/smoke-test-push-discordia.desy.de-4117

Requesting (from prometheus) UPLOAD,DELETE macaroon to third party push target: **SUCCESS** (doesn't count) Uploading target, authn with X.509: **SUCCESS** Initiating a macaroon authz HTTP PUSH, authn with X.509 to target: **SUCCESS** Deleting file pushed to third party, with X.509: **SUCCESS** Initiating a macaroon authz HTTP PUSH, authz with macaroon to target: **SUCCESS** Deleting file pushed to third party, with X.509: **SUCCESS** Deleting file pushed to third party, with X.509: **SUCCESS** Deleting file pushed to third party, with X.509: **SUCCESS** 

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Of 32 tests: 32 successful (100%) Work-arounds: (none)



# Daily smoke tests

Smoke tests proved popular, now done daily with reports sent to mailing list.

Initially done manually, now fully automated.

Recent innovations:

- Testing each interface (IP address) registered in DNS,
- Integration with GOCDB: don't test endpoints in downtime.
- Point system: endpoints have between 0 points (bad) and 20 points (good).





#### Example daily smoke tests

DOMA-TPC smoke test 2019-06-28T13:03+0200

PROBLEMATIC ENDPOINTS

SCORE	ENDPOINT	SOFTWARE	WORK-AROUNDS	
12	AGLT2	dCache		[in 02:
12	BEIJING-TEST	DPM	[S]	[in 01:
12	BNL	dCache		[in 00:
12	DESY-DOMA	dCache		[in 00:
12	DESY-PROM	dCache		[in 00:
12	FLORIDA	xrootd/Lustre		[in 01:
12	KIT	dCache		[in 00:
12	LRZ-LMU	dCache		[in 00:
12	NEBRASKA2	xrootd/HDFS	[L]	[in 01:
12	TRIUMF-PPS	dCache		[in 01:
12	UKI-MAN	DPM	[S]	[in 00:
11	SARA	dCache		[in 02:
10	IN2P3	dCache		[in 00:
10	NEBRASKA	xrootd/HDFS		[in 00:
10	PRAGUELCG2	DPM		[in 00:
10	SARA-test	dCache		[in 00:
10	UKI-LANCS	DPM	[S]	[in 00:
9	FNAL	dCache		[in 01:
9	NDGF-PREPROD	dCache		[in 00:
8	CERN-TRUNK	DPM		[in 00:
8	INFN-T1	StoRM		[in <u>00</u> :
6	PIC-PPS	dCache		[in <mark>17:</mark>
4	UKI-BRUNEL	DPM	[S]	[in <mark>00:</mark>
3	BRUSSELS	dCache		[in 01:
2	PIC-PROD	dCache		[in 02:
1	FLORIDA2	xrootd/Lustre	[L]	[in 01:
1	UNI-BONN	xrootd/CephFS	[L]	[in 00:

SCORE         ENDPOINT         SOFTWARE         SUMMARY           10         NDGF         dCache         Of 32 tests: 1 skipped (3%), 31 attempted (96%):           30         successful (96% of tests run, 93% of all tests), 1 failed (3% of tests run, 3% of all tests) Work-arounds: (none)         [in 10:35]           [in 02:06]         4         TRIUMF-DYNAFED DynaFed         Of 23 tests: 18 skipped (78%), 5 attempted           [in 00:39]         (none)         [in 06:31]         [in 06:31]           [in 00:23]         (34%): 1 successful (12% of tests run, 4% of all tests), 7 failed (87% of tests run, 30% of all tests) Work-arounds: (none)         [in 06:12]           [in 00:31]         0         CA-IAAS         DynaFed         Of 32 tests: 25 successful (75%), 8 failed (24%)           [in 00:40]         (21%): 0 successful (12% of tests run, 4% of all tests), 7 failed (87% of tests run, 30% of all tests) Work-arounds: (none)         [in 01:20]           [in 00:40]         [in 01:30]         [in 01:30]         [in 01:41]           [in 01:17]         0         CERN         EOS         Of 32 tests: 25 skipped (78%), 7 attempted           [in 01:30]         [in 00:30]         [in 00:31]         [in 00:31]         [in 00:32]           [in 00:32]         0         CERN         CD         Of 32 tests: 25 skipped (78%), 7 attempted           [in 01:06]		
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[in 01:17]       0       CERN       EOS       Of 32 tests: 25 skipped (78%), 7 attempted         [in 01:00]       (21%): 0 successful, 7 failed (100% of tests run, 21% of all tests) Work-arounds:       [in 00:36]         [in 00:36]       (none)       [in 00:05]         [in 02:39]       0       CERN-RC       DPM       Of 32 tests: 28 successful (87%), 4 failed (12%)         [in 00:29]       Work-arounds: (none)       [in 00:36]       [in 00:36]         [in 00:29]       0       UKI-GLASGOW       DPM       Of 23 tests: 10 skipped (43%), 13 attempted         [in 00:33]       21% of all tests) Work-arounds: F       [in 00:27]         [in 00:48]       0       UKI-GLASGOW       Of 32 tests: 9 skipped (28%), 23 attempted         [in 01:05]       (71%): 18 successful (78% of tests run, 56% of all tests), 5 failed (21% of tests         [in 00:42]       0       UKI-RAL       DynaFed/ECHO of 23 tests: 13 skipped (56%), 10 attempted         [in 00:59]       (43%): 5 successful (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 faile		
[in 01:00]       (21%): 0 successful, 7 failed (100% of tests run, 21% of all tests) Work-arounds:         [in 00:36]       (none)       [in 00:05]         [in 02:39]       0       CERN-RC       DPM       Of 32 tests: 28 successful (87%), 4 failed (12%)         [in 00:20]       Work-arounds: (none)       [in 00:36]         [in 00:53]       0       UKI-GLASGOW       DPM       Of 23 tests: 10 skipped (43%), 13 attempted         [in 00:33]       21% of all tests) Work-arounds: F       [in 00:27]       [in 00:48]       0       UKI-QMUL       StoRM       Of 32 tests: 9 skipped (28%), 23 attempted         [in 01:05]       (71%): 18 successful (78% of tests run, 56% of all tests), 5 failed (21% of tests       [in 00:17]         [in 00:27]       run, 15% of all tests) Work-arounds: (none)       [in 00:17]         [in 00:27]       run, 15% of all tests) Work-arounds: (none)       [in 00:17]         [in 00:42]       0       UKI-RAL       DynaFed/ECHO 0f 23 tests: 13 skipped (56%), 10 attempted         [in 07:50]       (43%): 5 successful (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests)       SKIPPED ENDPOINTS         [in 01:50]       SCORE ENDPOINT SOFTWARE WHY       [in 01:66]       4       UKI-IC       GCOB Downtime: Move to Slough part 2 <td>[in 01:17]</td> <td></td>	[in 01:17]	
[in 02:39]       0       CERN-RC       DPM       Of 32 tests: 28 successful (87%), 4 failed (12%)         [in 00:29]       Work-arounds: (none)       [in 00:36]         [in 00:29]       0       UKI-GLASGOW       DPM       Of 23 tests: 10 skipped (43%), 13 attempted         [in 00:33]       21% of all tests) Work-arounds: F       [in 00:27]         [in 00:48]       0       UKI-QMUL       StoRM       Of 32 tests: 9 skipped (28%), 23 attempted         [in 01:05]       (71%): 18 successful (78% of tests run, 56% of all tests), 5 failed (21% of tests         [in 00:27]       run, 15% of all tests) Work-arounds: (none)       [in 00:17]         [in 00:42]       0       UKI-RAL       DynaFed/ECHO 0f 23 tests: 13 skipped (56%), 10 attempted         [in 00:59]       (43%): 5 successful (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests), 5 failed (50% of tests run, 21% of all tests)         [in 00:52]       SKIPPED ENDPOINTS         [in 01:50]       SCORE ENDPOINT SOFTWARE WHY         [in 01:06]       4       UKI-IC	[in 01:00]	
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<pre>[in 00:25] [in 00:53] [in 00:29] [in 00:29] [in 00:29] [in 00:33] 21% of all tests) Work-arounds: F [in 00:27] [in 00:48] 0 UKI-QMUL StoRM Of 32 tests: 9 skipped (28%), 23 attempted [in 01:05] (71%): 18 successful (78% of tests run, 56% of all tests), 5 failed (21% of tests [in 00:27] run, 15% of all tests) Work-arounds: (none) [in 00:17] [in 00:42] 0 UKI-RAL DynaFed/ECH0 Of 23 tests: 13 skipped (56%), 10 attempted [in 00:59] (43%): 5 successful (50% of tests run, 21% of all tests), 5 failed (50% of tests run, [in 17:00] [in 00:52] [in 01:50] [in 02:06] SCORE ENDPOINTS [in 01:06] 4 UKI-IC dCache GOCDB Downtime: Move to Slough part 2</pre>	[in 02:39]	0 CERN-RC DPM Of 32 tests: 28 successful (87%), 4 failed (12%)
<pre>[in 00:53] [in 00:29] [in 00:29] [in 00:33] [in 00:33] [in 00:33] [in 00:48] [in 01:05] [in 01:05] [in 01:05] [in 00:42] [in 00:42] [in 00:42] [in 00:42] [in 00:59] [in 00:59] [in 00:59] [in 00:59] [in 00:50] [in 00:50] [in 00:50] [in 01:50] [in 01:50] [in 02:06] [in 02:06] [in 02:06] [in 01:06] [in 00:59] [in 01:06] [in 01:06] [in 01:06] [in 01:06] [in 01:06] [in 01:06] [in 00:050] [in 01:06] [in 00:052] [in 01:06] [in 01:06] [in</pre>	lin 00:29	
[in 00:29]0UKI-GLASGOWDPMOf 23 tests: 10 skipped (43%), 13 attempted[in 00:33](56%): 8 successful (61% of tests run, 34% of all tests), 5 failed (38% of tests run,[in 00:48]0UKI-QMULStoRM[in 01:05](71%): 18 successful (78% of tests run, 56% of all tests), 5 failed (21% of tests[in 00:27]run, 15% of all tests) Work-arounds: (none)[in 00:17][in 00:42]0UKI-RALDynaFed/ECHO Of 23 tests: 13 skipped (56%), 10 attempted[in 00:59](43%): 5 successful (50% of tests run, 21% of all tests), 5 failed (50% of tests run,[in 17:00]21% of all tests) Work-arounds: (none)[in 00:15][in 01:52]SKIPPED ENDPOINTS[in 02:06]SCOREENDPOINT SOFTWARE[in 01:06]4UKI-ICGOCDB Downtime: Move to Slough part 2		
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<pre>[in 01:05] (71%): 18 successful (78% of tests run, 56% of all tests), 5 failed (21% of tests [in 00:27] run, 15% of all tests) Work-arounds: (none) [in 00:17] [in 00:42] 0 UKI-RAL DynaFed/ECHO Of 23 tests: 13 skipped (56%), 10 attempted [in 00:59] (43%): 5 successful (50% of tests run, 21% of all tests), 5 failed (50% of tests run, [in 17:00] [in 00:52] [in 01:50] [in 02:06] SKIPPED ENDPOINTS [in 01:06] SCORE ENDPOINT SOFTWARE WHY [in 01:06] 4 UKI-IC dCache GOCDB Downtime: Move to Slough part 2</pre>		
<pre>[in 00:27] run, 15% of all tests) Work-arounds: (none) [in 00:17] [in 00:42] 0 UKI-RAL DynaFed/ECHO Of 23 tests: 13 skipped (56%), 10 attempted [in 00:59] (43%): 5 successful (50% of tests run, 21% of all tests), 5 failed (50% of tests run, [in 17:00] [in 00:52] [in 00:52] [in 01:50] [in 02:06] SCORE ENDPOINTS SOFTWARE WHY [in 01:06] 4 UKI-IC dCache GOCDB Downtime: Move to Slough part 2</pre>		
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<pre>[in 17:00] 21% of all tests) Work-arounds: (none) [in 00:15] [in 00:52] SKIPPED ENDPOINTS [in 01:50] [in 02:06] SCORE ENDPOINT SOFTWARE WHY [in 01:06] 4 UKI-IC dCache GOCDB Downtime: Move to Slough part 2</pre>		
[in 00:52] [in 01:50] [in 02:06] SCORE ENDPOINT SOFTWARE WHY [in 01:06] 4 UKI-IC dCache GOCDB Downtime: Move to Slough part 2		
[in 01:50] SKIPPED ENDPOINTS [in 02:06] SCORE ENDPOINT SOFTWARE WHY [in 01:06] 4 UKI-IC dCache GOCDB Downtime: Move to Slough part 2		21% OF ALL LESUS) WORK-AFOUNDS. (HONE) [IN 00.15]
[in 01:50] [in 02:06] SCORE ENDPOINT SOFTWARE WHY [in 01:06] 4 UKI-IC dCache GOCDB Downtime: Move to Slough part 2	[in <mark>00:52]</mark>	SKIDDED ENDDOINTS
[in 01:06] 4 UKI-IC dCache GOCDB Downtime: Move to Slough part 2	[in <mark>01:50</mark> ]	
[in 01:06] 4 UKI-IC dCache GOCDB Downtime: Move to Slough part 2	[in 02:06]	SCORE ENDPOINT SOFTWARE WHY
	[in 01:06]	
	[in 00:30]	





### DOMA-TPC future testing

Move towards production testing:

ATLAS and CMS are involved, ATLAS taking the lead.

Output A state of the state

Evaluating both HTTP-TPC and xrootd-TPC against GridFTP, in terms of performance.





# Thanks for listening



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01/07/2019

14