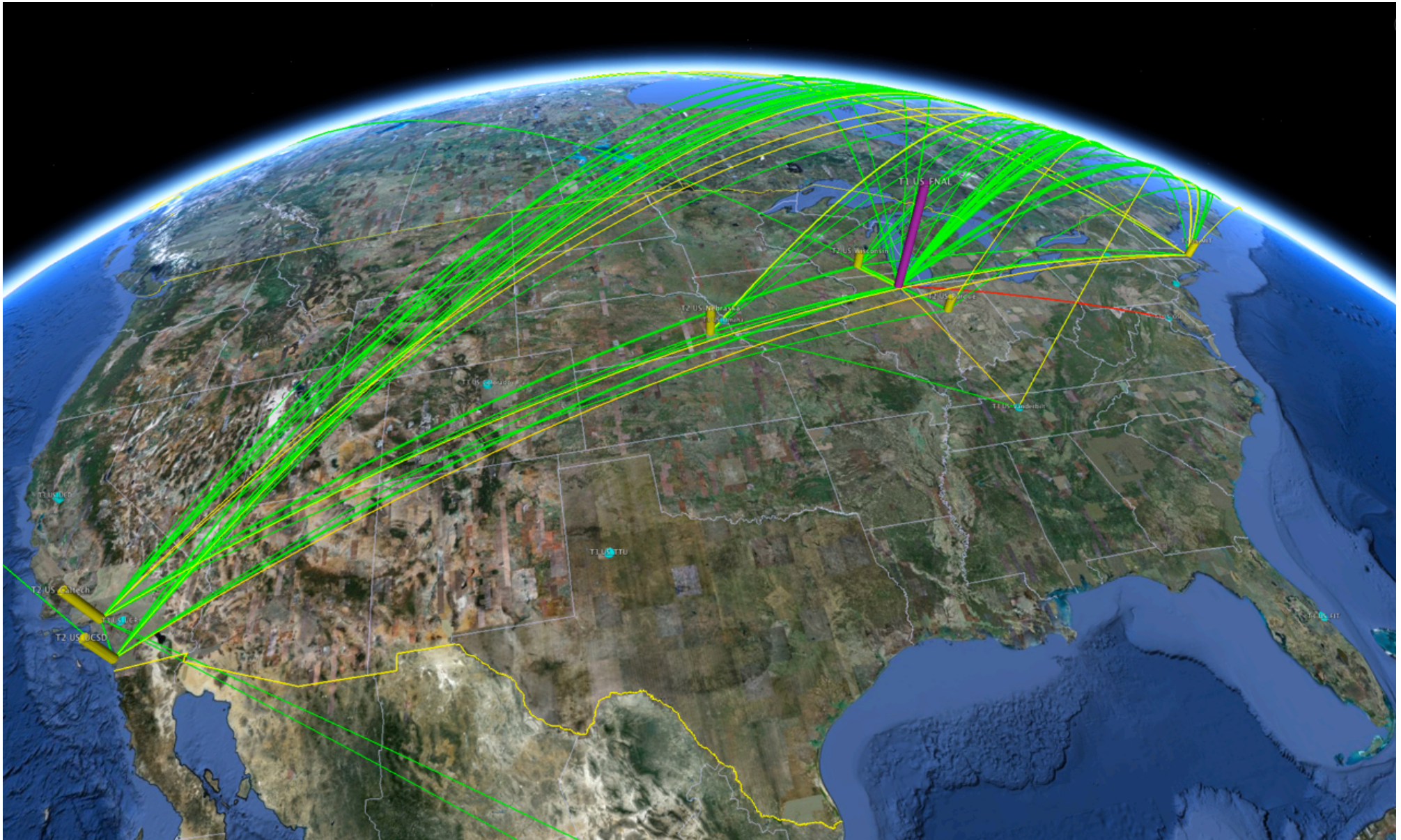


# Introduction to PhEDEx for OSG Tier-3s

Paul Rossman

# Global CMS Data Network



# What is PhEDEx?

- ➔ PhEDEx is short for **Physics Experiment Data Export**
- ➔ PhEDEx was developed to manage the movement of data within CMS
  - Centralized system for making global data movement decisions
  - Provides site and data managers and users a realtime view of the global CMS data transfer state
- ➔ PhEDEx automates for CMS many of low level tasks typically found in HEP experiments such as
  - large-scale data replication
  - tape migration
  - consistency
- ➔ In production since mid-2004



# What is a PhEDEx agent?



- ➔ PhEDEx is composed of a series of autonomous, robust, persistent, stateless processes or in PhEDEx terms agents
- ➔ These agents share information about replica and transfer state through a database and other agents at CERN
- ➔ Each instance is comprised of several agents, for example
  - FileDownload
  - FileExport
  - FileRemove
  - BlockDownloadVerify
- ➔ Not all sites require all agents
  - For instance, sites without a tape system do not require the FileStager agent

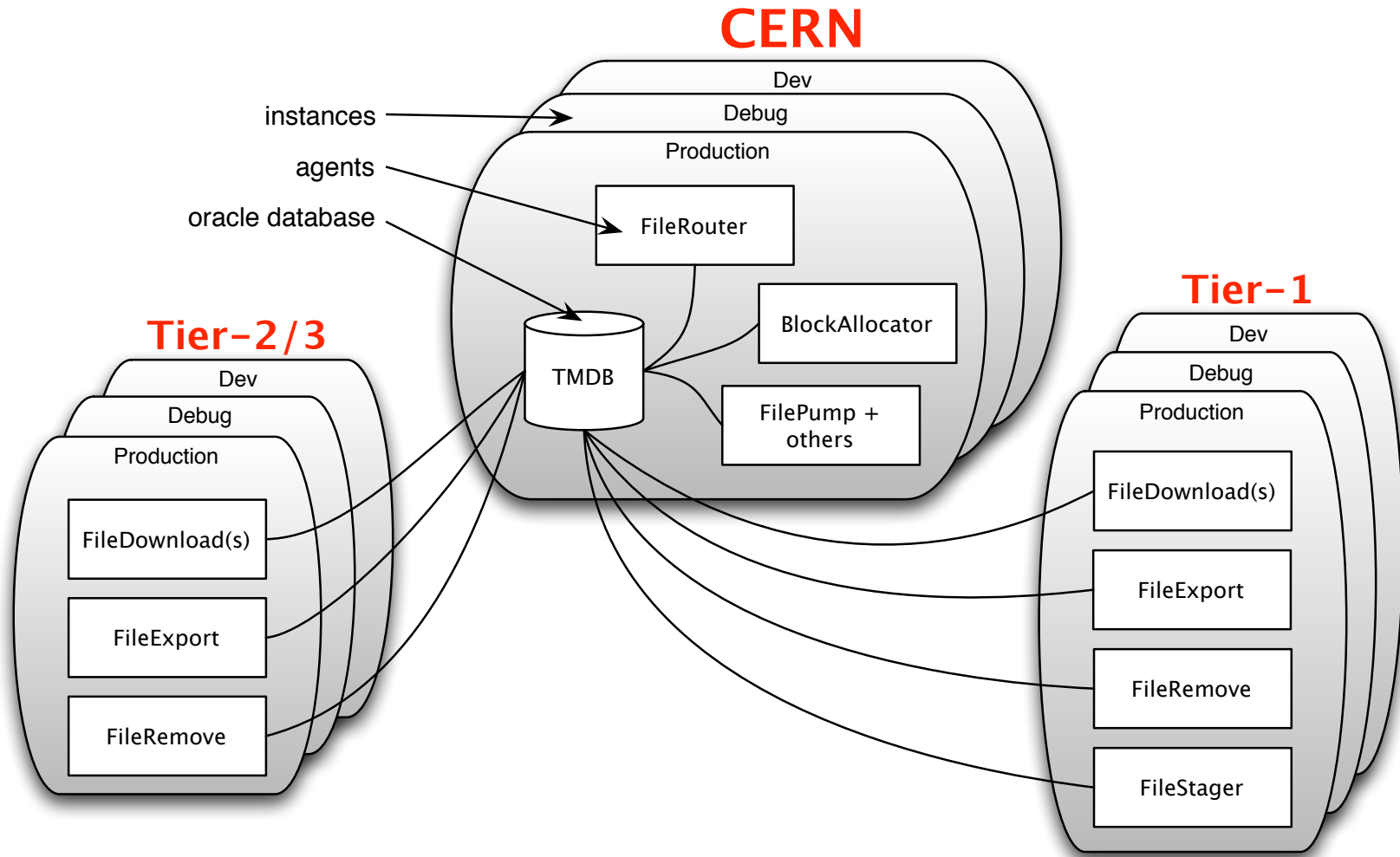
# What is a PhEDEx instance?

- ➔ Agents when combined form an instance
- ➔ There are currently 3 instances in use today
  - Production
  - Debug
  - Development
- ➔ Instances are independent and do not share information between each other

# Instances in-depth

- ➔ Production instance (Prod)
  - All CMS experiment data is transferred using this instance
  - For a T3, should try and be operational 24x7
- ➔ Debug instance (Debug)
  - Critical instance used for site commissioning and readiness
  - Tier-1 and Tier-2 sites transfer links can be decommissioned if transfer problems in this instance are not resolved
  - The primary focus of this instance was until recently to *debug* transfer agents and links
  - For a T3, should try and be operational 24x7
- ➔ Development instance (Dev)
  - Was historically used during testing and validation of PhEDEx software releases
  - Plans are being developed to re-task this instance to debugging

# Putting it all together

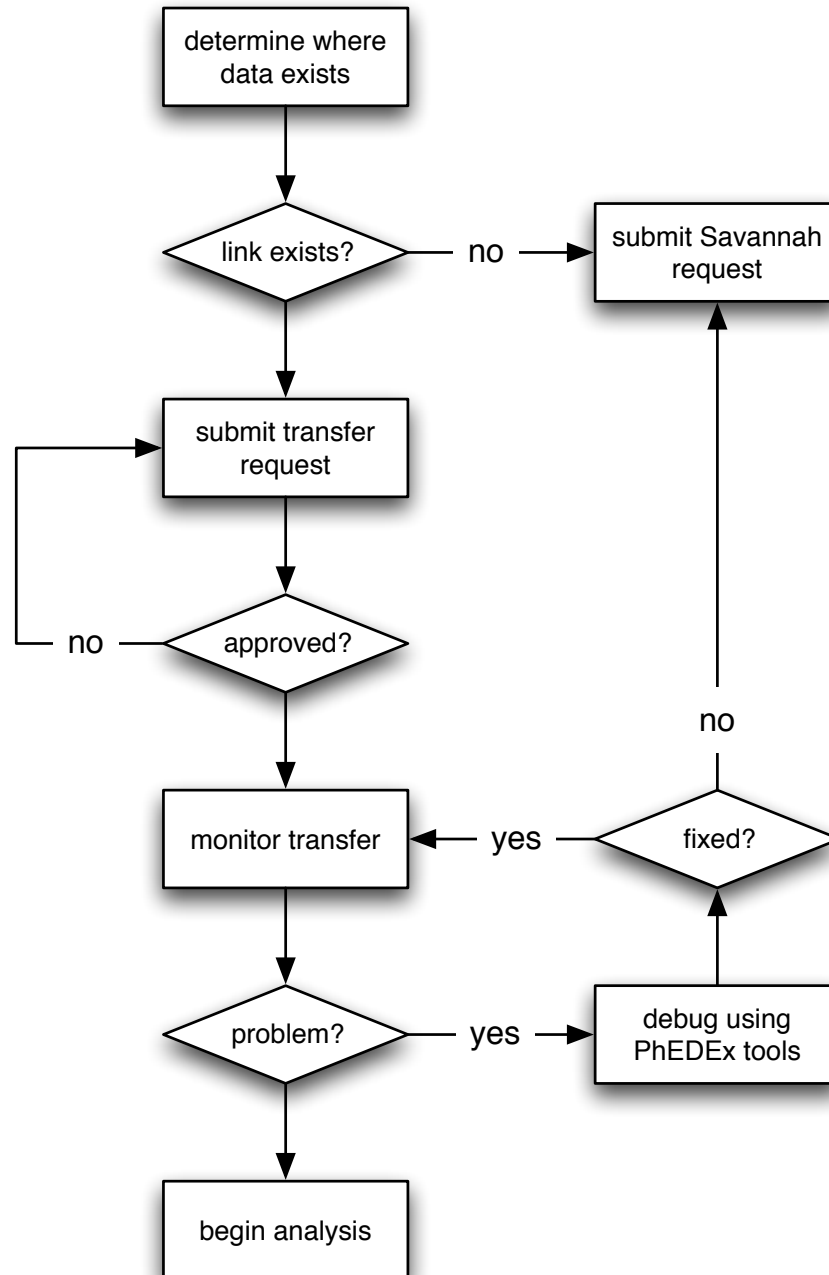


# So you're probably wondering...





# Transfer Request Process

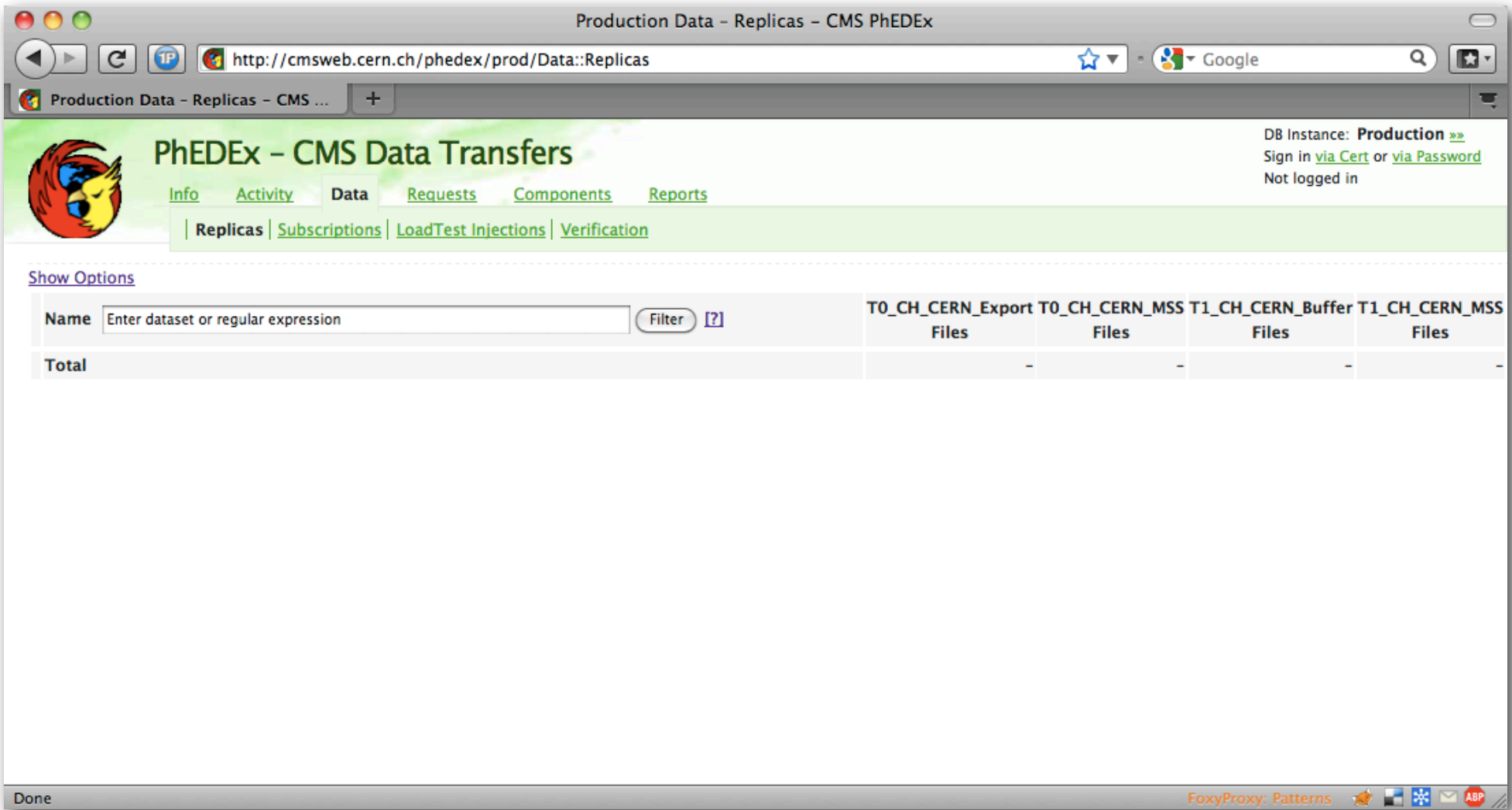


# Find an available replica



- ➔ <http://cmsweb.cern.ch/phedex/prod/Data::Replicas>
- ➔ You can use either DBS or PhEDEx

determine where data exists



The screenshot shows the PhEDEx - CMS Data Transfers interface. At the top, there's a navigation bar with links for Info, Activity, Data, Requests, Components, and Reports. Below this, there are sub-links for Replicas, Subscriptions, LoadTest Injections, and Verification. A search bar is present with the text "Enter dataset or regular expression" and a "Filter" button. The main content area displays a table with the following structure:

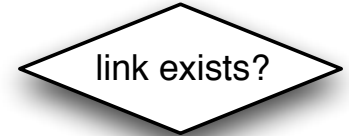
Name	TO_CH_CERN_Export Files	TO_CH_CERN_MSS Files	T1_CH_CERN_Buffer Files	T1_CH_CERN_MSS Files
Total	-	-	-	-

The browser's address bar shows the URL <http://cmsweb.cern.ch/phedex/prod/Data::Replicas>. The page title is "Production Data - Replicas - CMS PhEDEx".

# Do I have a link?



➔ <http://cmsweb.cern.ch/phedex/prod/Components::Links>




Production Components - Links - CMS PhEDEx

http://cmsweb.cern.ch/phedex/prod/Components::Links?from\_filter=.\*

PhEDEx - CMS Data Transfers

DB Instance: **Production** »  
 Sign in [via Cert](#) or [via Password](#)  
 Not logged in

Info Activity Data Requests Components Reports

Status Processes Links

Show links matching from  and  Update

**Legend**

- Link exists and is valid
- Link exists, but agents are down
- Link exists, but is excluded
- Link is deactivated
- Link does not exist
- Self-reference

This page displays links between nodes in PhEDEx. Valid links are required for transfers to be possible. Links are invalid when the source/destination node agents are down or they actively exclude the other node with the `-ignore/-accept` options. Links may also be deactivated by the PhEDEx administrators. **Warning:** Nodes that have never connected to the database are marked as excluded, which is not correct.

From Node ↓	To Node →	T3_US_Colorado
T1_IT_CNAF_Buffer		
T1_US_FNAL_Buffer		
T2_US_Florida		
T2_US_MIT		
T2_US_Nebraska		
T2_US_Purdue		
T2_US_UCSD		
T2_US_Wisconsin		
T3_US_FNALLPC		

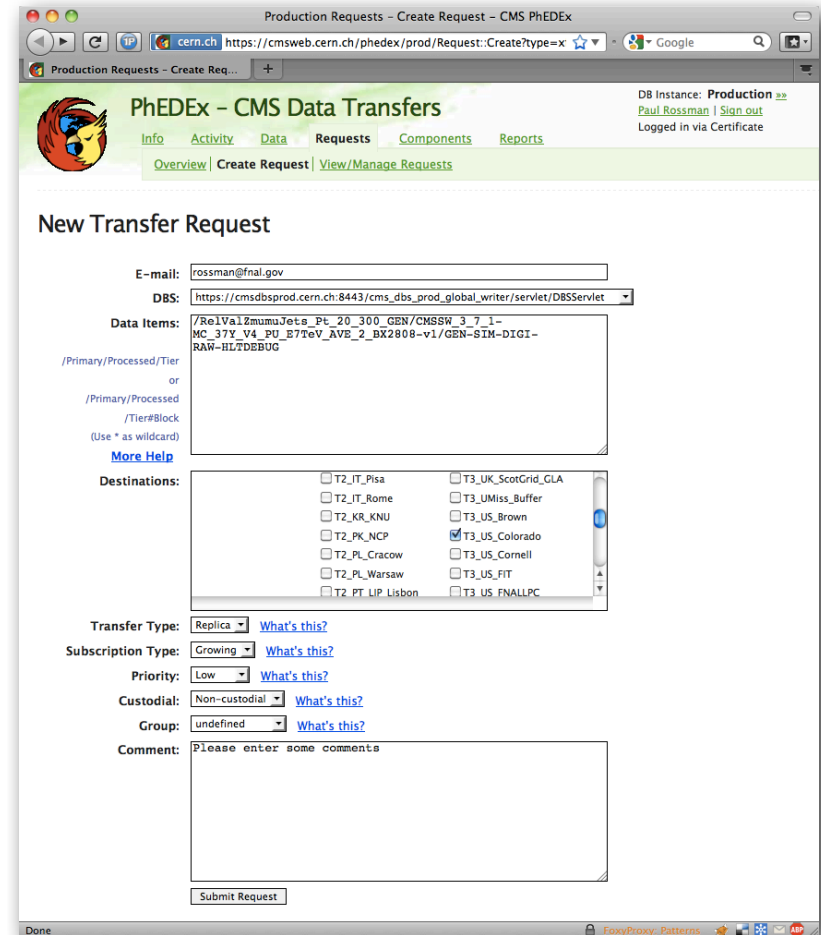
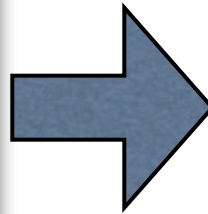
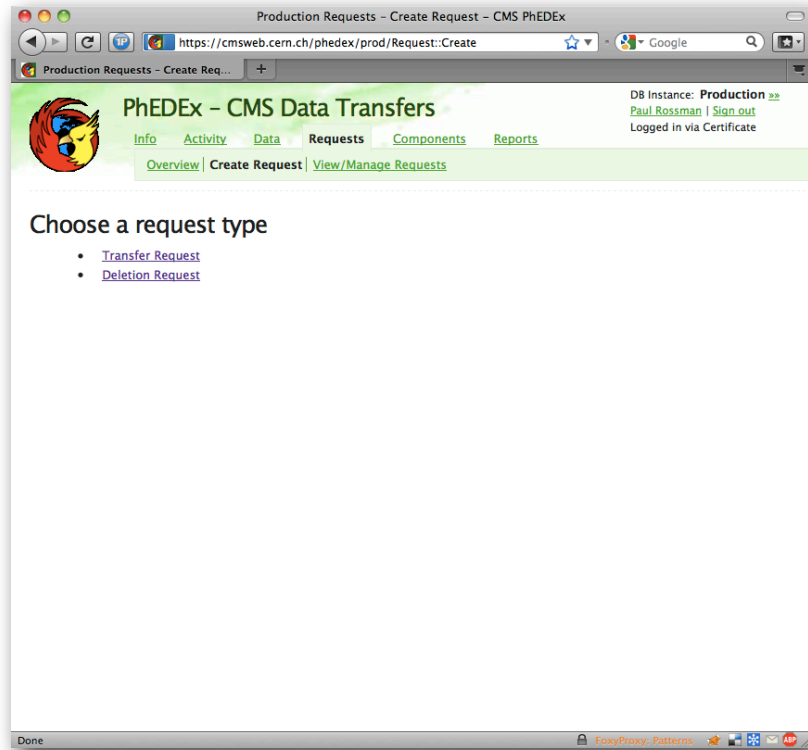
Done FoxyProxy Patterns

# Submit a transfer request



- ➔ <https://cmsweb.cern.ch/phedex/prod/Request::Create>
- ➔ Transfer and delete requests follow similar procedures

submit transfer  
request





submit transfer  
request

Production Requests - Submit Request - CMS PhEDEx

cern.ch https://cmsweb.cern.ch/phedex/prod/Request::Confirm

Production Requests - Submit Req... +

**PhEDEx - CMS Data Transfers**

DB Instance: **Production** >>  
Paul Rossman | Sign out  
Logged in via Certificate

Info Activity Data **Requests** Components Reports

Overview | Create Request | View/Manage Requests

Please review these request details and confirm below. If you would like to change your request, use the back button in your browser.

### Request Information

**Requestor:** Paul Rossman  
**E-mail:** rossman@fnal.gov  
**DBS:** https://cmsdbsprod.cern.ch:8443/cms\_dbs\_prod\_global\_writer/servlet/DBSServlet  
**Data:** /RelValZmumuJets\_Pt\_20\_300\_GEN/CMSSW\_3\_7\_1-MC\_37Y\_V4\_PU\_E7TeV\_AVE\_2\_BX2808-v1/GEN-SIM-DIGI-RAW-HLTDEBUG  
**Destinations:** T3\_US\_Colorado  
**Is Move?:** No  
**Is Static?:** No  
**Priority:** Low  
**Custodial:** No  
**Group:** undefined

### Data Item Lookup

The following table summarizes an attempt to look for your requested data items in PhEDEx.

Data Level	Data Item	Files	Size	Known to PhEDEx	Known to DBS	Sources (current)	Comment
Dataset	/RelValZmumuJets_Pt_20_300_GEN/CMSSW_3_7_1-MC_37Y_V4_PU_E7TeV_AVE_2_BX2808-v1/GEN-SIM-DIGI-RAW-HLTDEBUG	64	65.40 GB	Yes	Yes	T1_CH_CERN_Buffer : 63 files, not subscribed T1_CH_CERN_MSS : 63 files, subscribed T1_US_FNAL_Buffer : 64 files, not subscribed T1_US_FNAL_MSS : 64 files, subscribed	None
		64	65.40 GB				

Confirm

Done

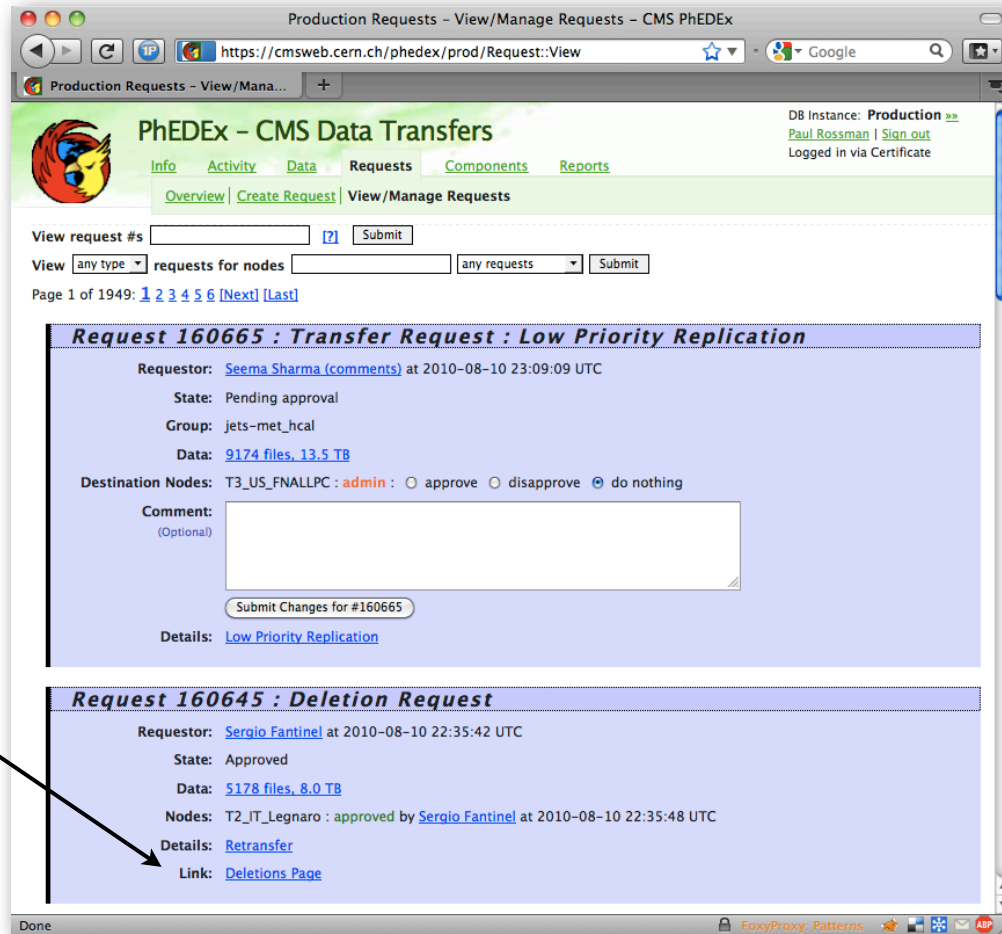
FoxyProxy: Patterns

# Find your request



- ➔ <https://cmsweb.cern.ch/phedex/prod/Request::View>
- ➔ You'll find additional notes from approvers here

monitor transfer



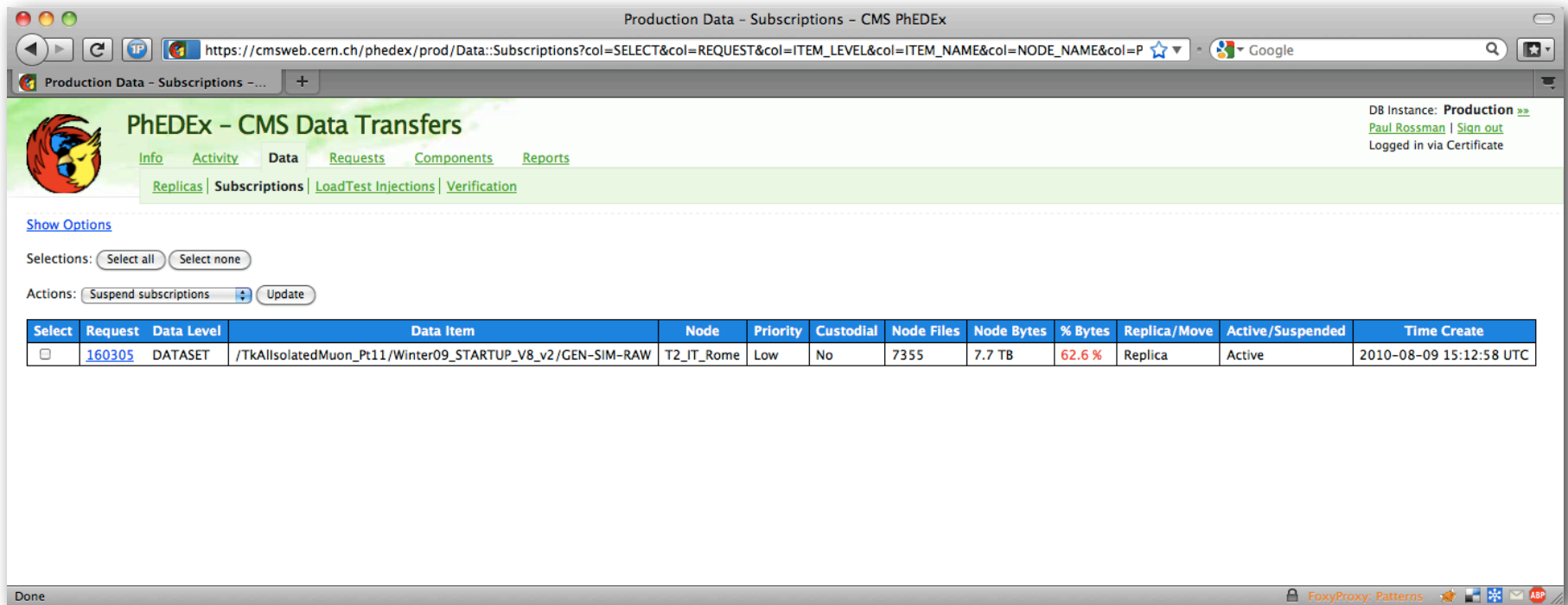
click here

# Details on your request



➔ <https://cmsweb.cern.ch/phedex/prod/Data::Subscriptions>

monitor transfer



Production Data - Subscriptions - CMS PhEDEx

DB Instance: **Production** >>  
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PhEDEx - CMS Data Transfers

Info Activity **Data** Requests Components Reports

Replicas | **Subscriptions** | LoadTest Injections | Verification

Show Options

Selections:

Actions:

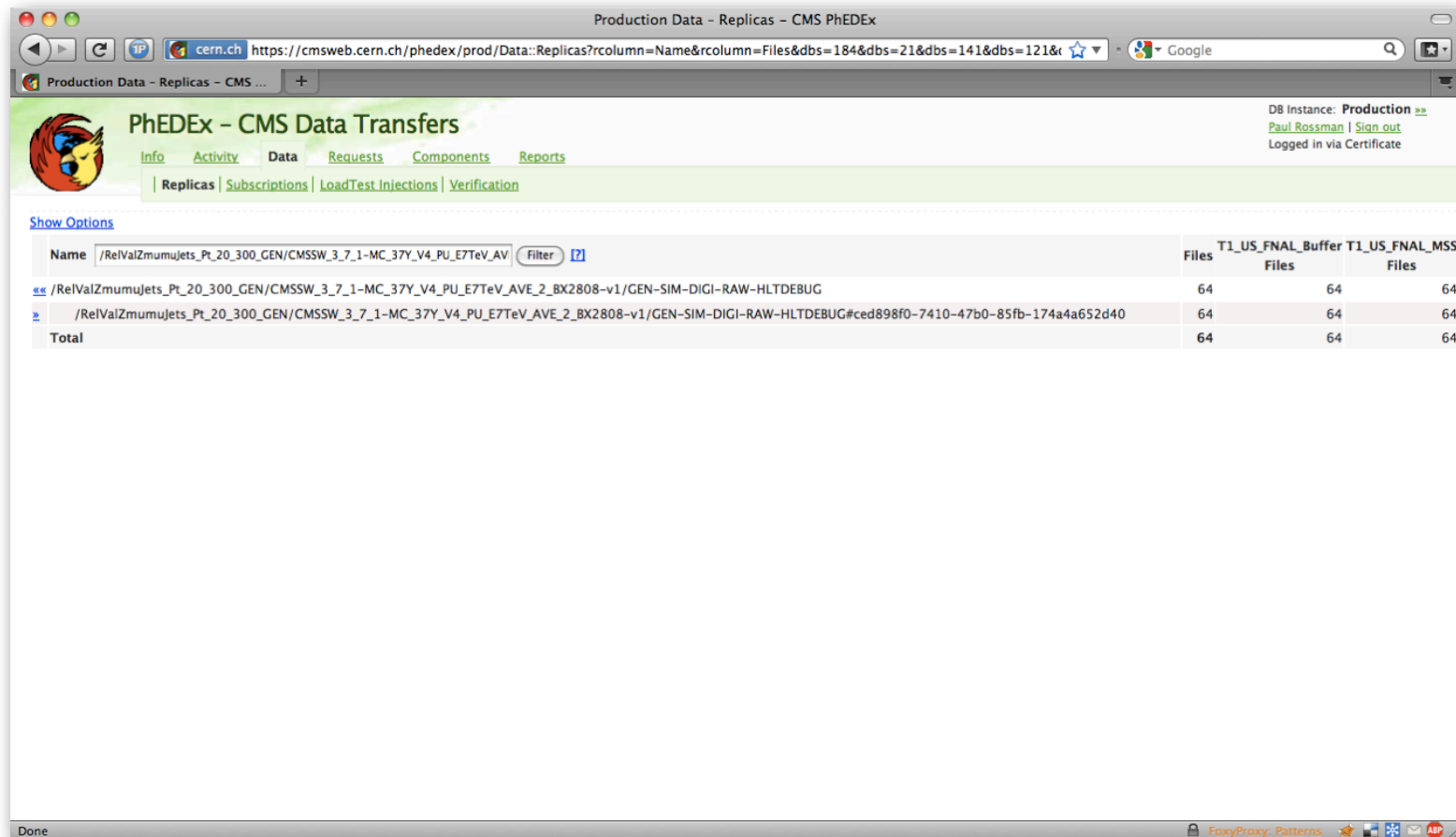
Select	Request	Data Level	Data Item	Node	Priority	Custodial	Node Files	Node Bytes	% Bytes	Replica/Move	Active/Suspended	Time Create
<input type="checkbox"/>	<a href="#">160305</a>	DATASET	/TkAllisolatedMuon_Pt11/Winter09_STARTUP_V8_v2/GEN-SIM-RAW	T2_IT_Rome	Low	No	7355	7.7 TB	62.6 %	Replica	Active	2010-08-09 15:12:58 UTC

Done

# Checking the progress of your transfer

- ➔ You can also find info on the replicas page
- ➔ <https://cmsweb.cern.ch/phedex/prod/Data::Replicas>

monitor transfer



The screenshot shows the PhEDEx CMS Data Transfers interface. The page title is "Production Data - Replicas - CMS PhEDEx". The URL in the browser is <https://cmsweb.cern.ch/phedex/prod/Data::Replicas?rcolumn=Name&rcolumn=Files&dbs=184&dbs=21&dbs=141&dbs=121&>. The page displays a table of replication data for the production database instance.

Name	Files	T1_US_FNAL_Buffer Files	T1_US_FNAL_MSS Files
/RelValZmumujets_Pt_20_300_GEN/CMSSW_3_7_1-MC_37Y_V4_PU_E7TeV_AVE_2_BX2808-v1/GEN-SIM-DIGI-RAW-HLTDEBUG	64	64	64
/RelValZmumujets_Pt_20_300_GEN/CMSSW_3_7_1-MC_37Y_V4_PU_E7TeV_AVE_2_BX2808-v1/GEN-SIM-DIGI-RAW-HLTDEBUG#ced898f0-7410-47b0-85fb-174a4a652d40	64	64	64
<b>Total</b>	<b>64</b>	<b>64</b>	<b>64</b>

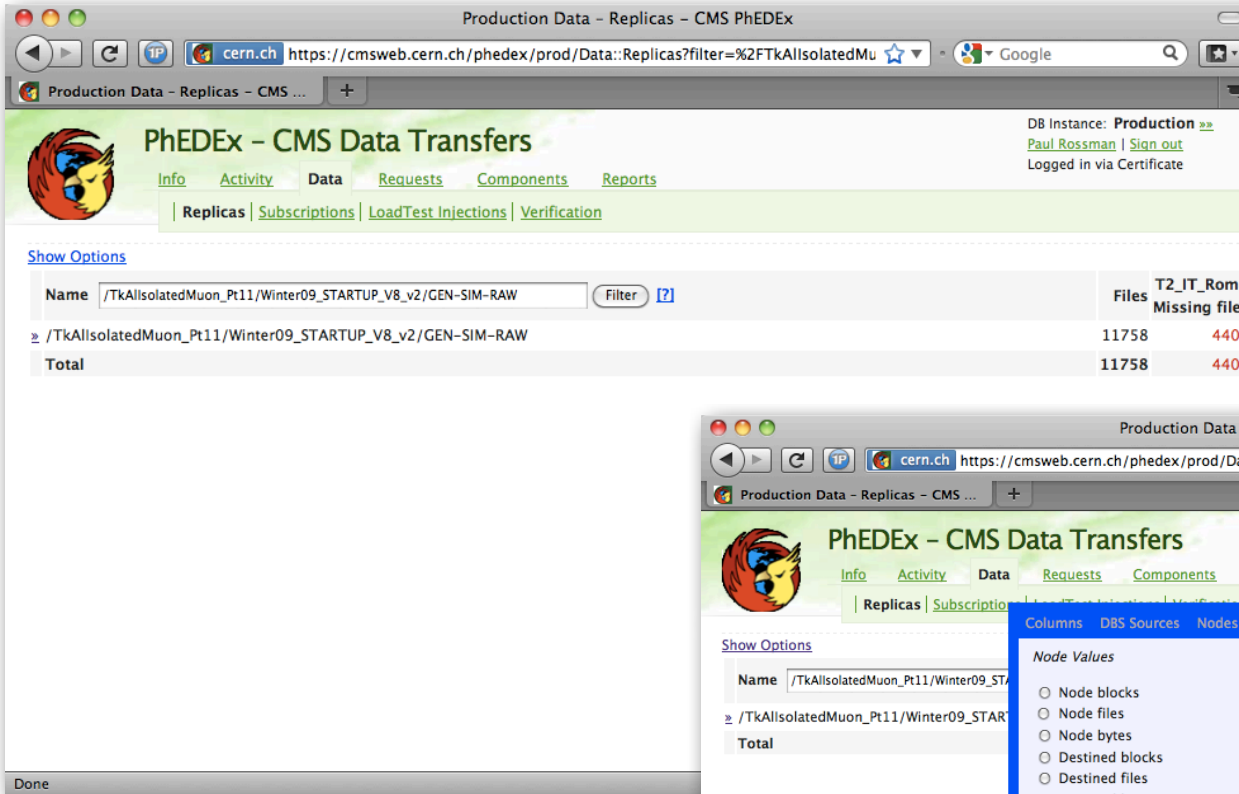


# What files are still in transfer?



➔ Options for this example are not the default!

monitor transfer



Production Data - Replicas - CMS PhEDEx

DB Instance: **Production** >>  
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PhEDEx - CMS Data Transfers

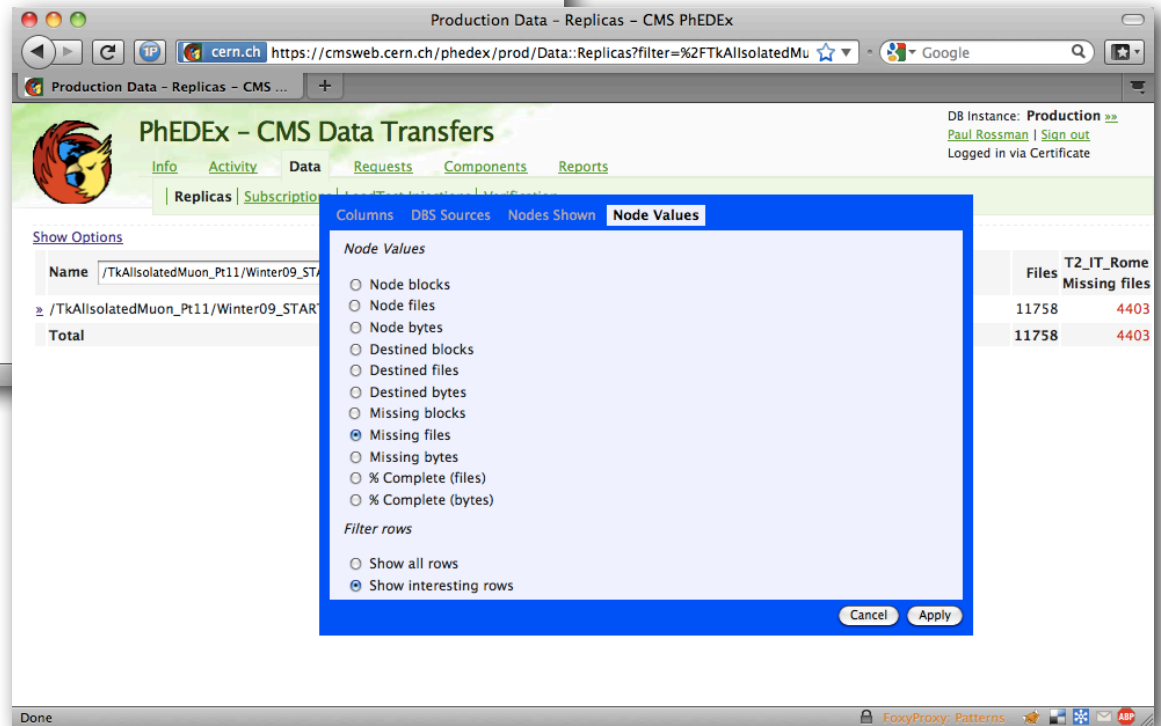
Info Activity Data Requests Components Reports

Replicas Subscriptions LoadTest Injections Verification

Show Options

Name: /TkAllisolatedMuon\_Pt11/Winter09\_STARTUP\_V8\_v2/GEN-SIM-RAW Filter [?]

Name	Files	T2_IT_Rome Missing files
/TkAllisolatedMuon_Pt11/Winter09_STARTUP_V8_v2/GEN-SIM-RAW	11758	4403
<b>Total</b>	<b>11758</b>	<b>4403</b>



Production Data - Replicas - CMS PhEDEx

DB Instance: **Production** >>  
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PhEDEx - CMS Data Transfers

Info Activity Data Requests Components Reports

Replicas Subscriptions LoadTest Injections Verification

Show Options

Name: /TkAllisolatedMuon\_Pt11/Winter09\_STARTUP\_V8\_v2/GEN-SIM-RAW Filter [?]

Name	Files	T2_IT_Rome Missing files
/TkAllisolatedMuon_Pt11/Winter09_STARTUP_V8_v2/GEN-SIM-RAW	11758	4403
<b>Total</b>	<b>11758</b>	<b>4403</b>

Columns DBS Sources Nodes Shown **Node Values**

Node Values

- Node blocks
- Node files
- Node bytes
- Destined blocks
- Destined files
- Destined bytes
- Missing blocks
- Missing files
- Missing bytes
- % Complete (files)
- % Complete (bytes)

Filter rows

- Show all rows
- Show interesting rows

Cancel Apply



➔ Web-based

monitor transfer

- <https://cmsweb.cern.ch/phedex/>
- We've been using this already
- Make sure you have selected the instance you want to monitor

# Overall transfer quality



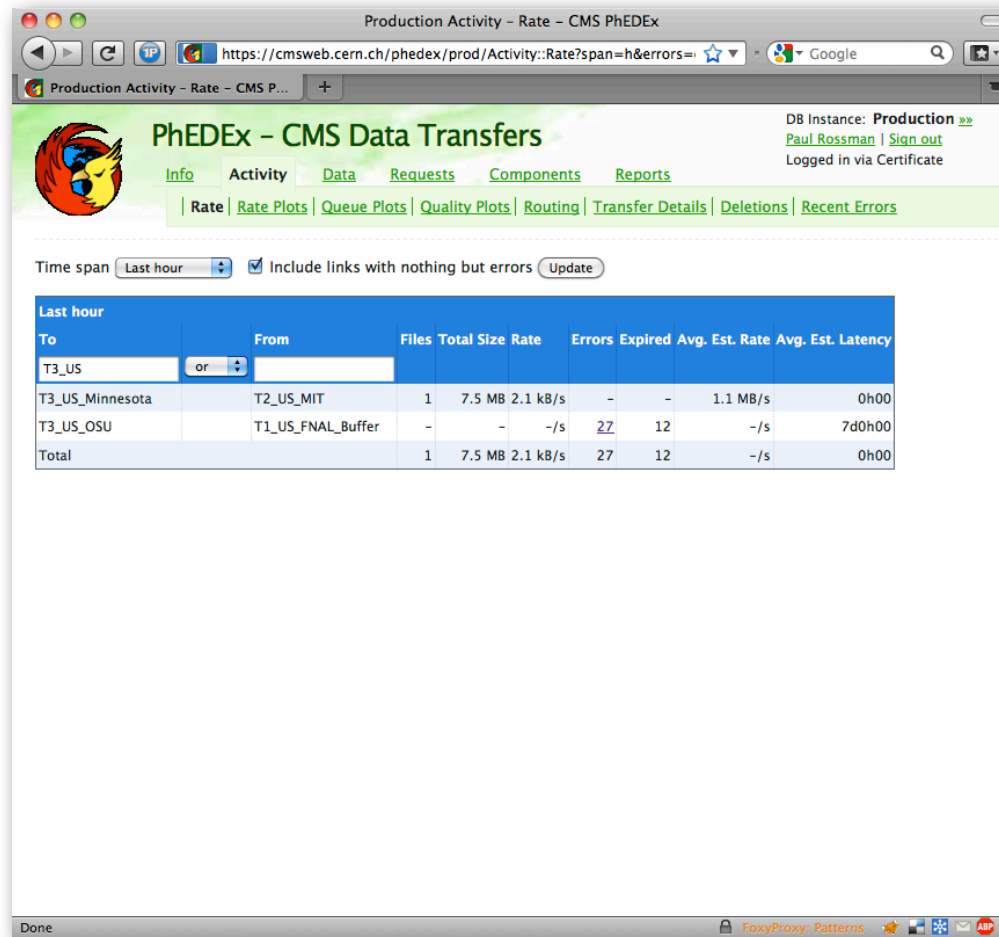
monitor transfer



# Watching your rate



monitor transfer



Production Activity - Rate - CMS PhEDEx

https://cmsweb.cern.ch/phedex/prod/Activity::Rate?span=h&errors=

PhEDEx - CMS Data Transfers

DB Instance: **Production** »  
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Info Activity Data Requests Components Reports

Rate | Rate Plots | Queue Plots | Quality Plots | Routing | Transfer Details | Deletions | Recent Errors

Time span: Last hour |  Include links with nothing but errors | Update

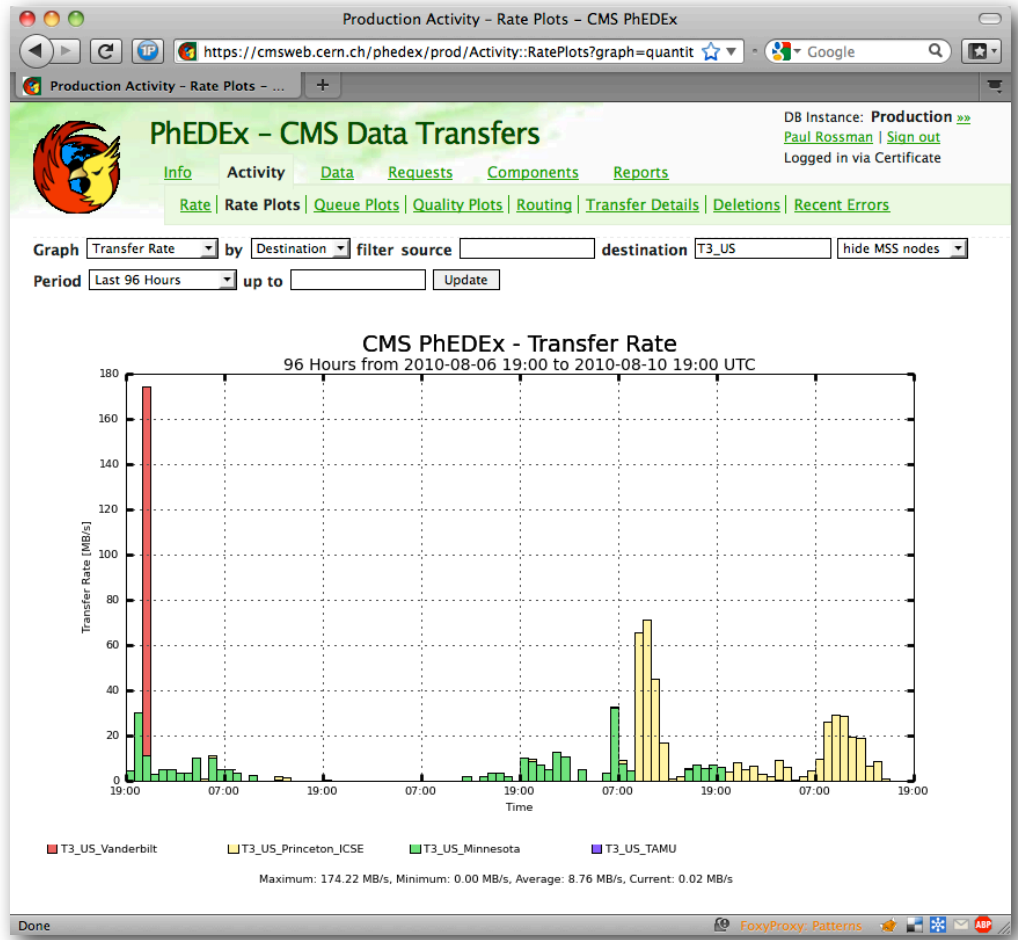
To	From	Files	Total Size	Rate	Errors	Expired	Avg. Est. Rate	Avg. Est. Latency
T3_US	or							
T3_US_Minnesota	T2_US_MIT	1	7.5 MB	2.1 kB/s	-	-	1.1 MB/s	0h00
T3_US_OSU	T1_US_FNAL_Buffer	-	-	-/s	27	12	-/s	7d0h00
<b>Total</b>		1	7.5 MB	2.1 kB/s	27	12	-/s	0h00



# Watching your rate



monitor transfer



## ➔ Data Service

monitor transfer

- <http://cmsweb.cern.ch/phedex/datasvc/doc>
- Programmatically query PhEDEx and retrieve data in xml, json or perl formats

## ➔ Shell Example

monitor transfer

```
curl http://cmsweb.cern.ch/phedex/datasvc/xml/prod/transferqueuefiles
?from=T1_US_FNAL_Buffer&to=T1_US_FNAL_MSS&priority=high&state=transferring
```

format
instance
api call

↑  
options

## ➔ Perl Example

```
#!/usr/bin/perl -w

use XML::Simple;
use LWP::Simple;
use Data::Dumper;

$xml = new XML::Simple;

$data = $xml->XMLin( get("http://cmsweb.cern.ch/phedex/datasvc/xml/prod/transferqueuefiles
to=T1_US_FNAL_Buffer&priority=normal&state=transferring"), forcearray => ["block"] );

print Dumper($data);
```





# Debugging your transfer



➔ <https://cmsweb.cern.ch/phedex/prod/Activity::TransferDetails>

debug using  
PhEDEx tools

Production Activity - Transfer Details - CMS PhEDEx

PhEDEx - CMS Data Transfers

DB Instance: **Production** [»](#)  
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[Info](#) [Activity](#) [Data](#) [Requests](#) [Components](#) [Reports](#)

[Rate](#) | [Rate Plots](#) | [Queue Plots](#) | [Quality Plots](#) | [Routing](#) | [Transfer Details](#) | [Deletions](#) | [Recent Errors](#)

Update

Transfer State Details								
Age	To Node	From Node	State	Transfer	Priority	N Files	Size	Detail
	T3_US_OSU	or						
current	T3_US_OSU	T1_US_FNAL_Buffer	exported	remote	high	2	9.1 GB	<a href="#">(Files)</a>
current	T3_US_OSU	T1_US_FNAL_Buffer	transferring	remote	normal	2	2.2 GB	<a href="#">(Files)</a>
<b>Total</b>					<b>exported</b>	<b>2</b>	<b>9.1 GB</b>	
					<b>transferring</b>	<b>2</b>	<b>2.2 GB</b>	
					<b>All</b>	<b>4</b>	<b>11.3 GB</b>	

Destined Data							
Last Change	Node	Destined	On Site	In Transfer			
		N	Size	N	Size	N	Size
Current	T3_US_OSU	11834	11.7 TB	2612	4.6 TB	4	11.3 GB
	<b>Total</b>	<b>11834</b>	<b>11.7 TB</b>	<b>2612</b>	<b>4.6 TB</b>	<b>4</b>	<b>11.3 GB</b>

Replica State Details					
Age	Node	State	Custodial	Files	
				N	Size
Current	T3_US_OSU	at node	non-cust.	2612	4.6 TB
	<b>Total</b>	<b>at node</b>		<b>2612</b>	<b>4.6 TB</b>
		<b>All</b>		<b>2612</b>	<b>4.6 TB</b>

<https://cmsweb.cern.ch/phedex/prod/Activity::FileInfo?priority=3;state=trans...>

Production Activity - File Info - CMS PhEDEx

PhEDEx - CMS Data Transfers

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[Rate](#) | [Rate Plots](#) | [Queue Plots](#) | [Quality Plots](#) | [Routing](#) | [Transfer Details](#) | [Deletions](#) | [Recent Errors](#)

Files transferring from T1\_US\_FNAL\_Buffer to T3\_US\_OSU.

- ifn=/store/mc/Spring10/Wmunu/AODSIM/START3X\_V26\_S09-v1/0005/E8DA4905-FA44-DF11-8E89-001D0967CE69.root  
 size=1063175916  
 from\_pfn=srm://cmsrm.fnal.gov:8443/srm/manager?SFN=/11/store/mc/Spring10/Wmunu/AODSIM/START3X\_V26\_S09-v1/0005/E8DA4905-FA44-DF11-8E89-001D0967CE69.root  
 to\_pfn=srm://cms-0.mps.ohio-state.edu:8443/srm/v2/server?SFN=/data/se/store/mc/Spring10/Wmunu/AODSIM/START3X\_V26\_S09-v1/0005/E8DA4905-FA44-DF11-8E89-001D0967CE69.root  
 time\_assign=2010-08-11 15:09:41 UTC
- ifn=/store/mc/Spring10/Wmunu/AODSIM/START3X\_V26\_S09-v1/0016/7E35509B-3A45-DF11-BCED-001D0967D238.root  
 size=1268102119  
 from\_pfn=srm://cmsrm.fnal.gov:8443/srm/manager?SFN=/11/store/mc/Spring10/Wmunu/AODSIM/START3X\_V26\_S09-v1/0016/7E35509B-3A45-DF11-BCED-001D0967D238.root  
 to\_pfn=srm://cms-0.mps.ohio-state.edu:8443/srm/v2/server?SFN=/data/se/store/mc/Spring10/Wmunu/AODSIM/START3X\_V26\_S09-v1/0016/7E35509B-3A45-DF11-BCED-001D0967D238.root  
 time\_assign=2010-08-11 15:09:41 UTC



- ➔ PhEDEx documentation and other documents can be found at
  - <https://twiki.cern.ch/twiki/bin/view/CMS/PhEDEx>
- ➔ Questions regarding PhEDEx can be posted to one of these HyperNews forums
  - [hn-cms-phedex@cern.ch](mailto:hn-cms-phedex@cern.ch)
  - [hn-cms-osg-tier3@cern.ch](mailto:hn-cms-osg-tier3@cern.ch)
- ➔ Other transfer or site related questions can be posted to these
  - [hn-cms-dataops@cern.ch](mailto:hn-cms-dataops@cern.ch)
  - [hn-cms-facilitiesOps@cern.ch](mailto:hn-cms-facilitiesOps@cern.ch)
- ➔ Transfer problems should be posted to Savannah
  - <https://savannah.cern.ch/projects/cmscompinfrasup/>
- ➔ Bug reports and feature requests should be posted to Savannah
  - <https://savannah.cern.ch/projects/phedex/>
- ➔ Please make sure you have both a HyperNews and Savannah account before posting (please don't post anonymously to Savannah)

# Additional resources and links

- ➔ Very good Tier-3 specific links
  - <http://hep-t3.physics.umd.edu/HowToForAdmins.html>
  - [http://hep.phys.utk.edu/wiki/PhEDEx\\_Installation](http://hep.phys.utk.edu/wiki/PhEDEx_Installation)
  
- ➔ Example configurations
  - [http://cmssw.cvs.cern.ch/cgi-bin/cmssw.cgi/COMP/SITECONF/T3\\_US\\_UMD/PhEDEx/](http://cmssw.cvs.cern.ch/cgi-bin/cmssw.cgi/COMP/SITECONF/T3_US_UMD/PhEDEx/)
  
- ➔ <https://cmsweb.cern.ch/phedex/datasvc/doc>
- ➔ <https://cmsweb.cern.ch/overview/session>
  
- ➔ There are many others, apologies for the omission!

# Questions?

