

CERN IT Department CH-1211 Genève 23 Switzerland WWW.cern.ch/it

# Fabric Infrastructure and Operations



## Towards end-to-end debugging for data transfers

Gavin McCance Javier Conejero Banon Sophie Lemaitre CERN IT/FIO

CHEP 2009





## Outilne



- Our problem
- Our solution



CERN

Department





## Outilne

• The challenge

- Our problem
- Our solution









- The data service model we have in the WLCG is all a bit complex
- There are many layers of software involved
  - Expt framework<->Transfers<->SRMs<->Stagers<->gridFTP<->Tape
- Individual components are quite internally complex









- WLCG planning meeting November 2008:
- Examined efficiency of the whole data management stack
  - All the files get there in the end! (multiple retries)
  - RAW transfer rate (#successes / total # attempts, per day)
    - Failure can and do happen in any layer, at both ends of a transfer
- About ¼ of all transfer *attempts* fail due to storage errors ! 😕



## How can we improve this?



 Summary "dashboards" collect 'events' and provides summary views, sliced in different ways

Fabric

and

Infrastructure

Operations

- e.g. Current quality on transfers per site

Distributed debug tracing allows you to follow a specific operation through all the middleware components that process it

Show me the transfer for this file

- Service operations staff typically use
  - the first one to look for problems
  - second one to drill down and understand them

			~	<b>C</b>	CMS	5 P	hEDEx -	Tra		ual	ity				
E Butter			9	o Hou	irs fr	om i	2008-03-09	10:00	10 2008-0	3-13	10:0				
Buffer										11111					
Buffer															
Buffer								1111							
Buffer					TTT									111111	
Buffer															
Buffer		1	/												
m_UCL				ШШ		Ш.		ш							
H_CAF		1.1													
Buffer							;								
Buffer		i.		i i				nin				i		i 🖬 🗖	
Buffer		100		- 10			والمتعالية والمتعدين والمتعاد					++++++			
oimbra		÷		- 72	1			200				1			
Lisbon															
C_HEP		1													
Buffer												:		1	
Butter								- il-							
H	FTS Rep	ort								~			_		
											~	- 10			
	Statistics co	ncerr	nded no	the tra	parsing ansfer	s per	s on it. formed during 1 00 and 2008-	last we	ek managed b	y "pro	od-ft	s-ws.c	ern.ch*		
1	Statistics co Between 20	008-0	ning all 03-03	the tra	parsin ansfer ):00	s per +01:	s on it. formed during 00 and 2008-	last we 03-10	ek managed b 00:00:00 +0 CERN-	9y "pro 01:00	Fite	s-ws.c	ern.ch" how VO de Avg. 1x	tails	
1	Statistics co Between 20 Channel Name	ncerr 108-0 Name	ing all 33-03	the tra 00:00	parsing ansfer ):00	s per +01: #fail.	s on it. formed during 00 and 2008- 1st Fallure Reason	last we 03-10 % 1st Failure Reason	ek managed b 00:00:00 +0 CERN- 2nd Failure Reason	y "pro D1:00 % 2nd Failure Reason	Fitter Fitter Size (GIII)	s-ws.c Si Avg. Duration (vec)	ern.ch" how VO de Avg. 1x Rate (MILbac)	tails Eff. Tx Bytes (Giff)	Tx Dytes (GIB)
	Channel Name	vo Name	ning all 03-03 Total	the tra 00:00 Failures	parsing ansfer ):00 Succ.	s per +01: #Fail.	s on it. formed during 00 and 2008- 1st Fallure Reason Dest SRM. Prep	last we 03-10 % 1st Failure Roasen 100	ek managed b 00:00:00 +0 CERN- 2nd Failure Reason	y "pro 01:00 % 2nd Failure Reason	Filter Filter Size (Gill)	S-WS.C Si Avg. Duration (sec) D	ern.ch" how VO de Avg. 1x Rate (MILbac)	tails Ltt. 1x Bytes (Gd1) 0	Tx Dytes (GiB)
	Channel Name CERN-CERN CERN-CERN	vo Name MIL	ended no ning all 03-03 Total 1 84863	the tra 00:00 Failures 100 84	parsin ansfer ):00 succ. 0 13646	* Fail.	s on it. formed during 00 and 2008- 1st Fallure Reason Dest SRM. Prep Source SRM. Prep	last we 03-10 Si 1st Failure Reason 100 97	ek managed b 00:00:00 +0 CEPN- 2nd Falure Reason Dest SRM Prep	oy "pro 01:00 Si 2nd Failure Reason 2	Fitter Fitter Size (Gitt) 0.27	S-WS.C Si Avg. Duration (sec) 0 188.42	ern.ch" how VO de Avg. 1x Rate (MILluec) 0 1.5	tails Lft. 1x Bytes (Gift) 0 3717 85	Tx Dytes (GIB) 3751 7
	Channel Hame Channel Hame CERN-CERN CERN-CERN	vo Name Mit Mit	ended no ning all 03-03 Total 1 84963 65578	the tra 00:00 Failures 100 94 83	parsin ansfer ):00 Succ. 0 13548 11108	robot s per +01: // Fail. 71317 54470	s on it. formed during 00 and 2008- 1st Falkere Reason Dest SRM. Prep Source SRM. Prep Transfer	last we 03-10 Si 1st Failure Reason 100 97 57	ek managed b 00:00:00 + ( CEPN- 2nd Failure Reason Dest SRM: Prep Dest SRM: Prep	y "pro D1:00 Si 2md Failure Reason 2 27	Fite Fite Nyg. Size (Gill) 0.27 1.79	5-W5.C Si Avg. Duration (vec) 0 188.42 669.29	ern.ch" how VO de Avg. 1x Rate (MB/kec) 0 1.5 4.1	tails Eff. 1x Bytes (GII) 0 3717.85 19934.78	Tx Dytes (GB) 3751.7 19939 5
	Channel Name Channel Name CERN-CERN CERN-SARA	VO Name Mil Mil alice	ring all 03-03 Total 84963 05578 19223	t to use the tra 00:00 Failures 100 84 83 30	parsin ansfer ):00 succ. 0 13548 11108 7187	robot s per +01: // Fail. 71317 54470 3036	s on it. formed during 00 and 2008- 1st Faibure Reason Dest SRM: Prep Source SRM: Prep Dest SRM: Prep Dest SRM: Prep	lost we 03-10 5 1st Failure Reasen 100 97 57 42	ek managed b 00:00:00 + ( CERN- Znd Følure Resson Dett SRM: Prep Dett SRM: Prep Transfer	y "pro D1:00 Si 2nd Failure Reason 2 27 40	Avg. Size (Gill) 0.27 1.79 1.99	5-W5.C Si Duration (wec) 0 188.42 669.29 806.37	ern.ch" how VO de Avg. 1x Rate (MIDunc) 0 1.5 4.1 3.66	tails Eff. 1x Bytes (GII) 0 3717.85 19934.78 14208.91	Tx Dytes (GB) 3751.7 19939.5 14288.9
	Channel Name Channel Name CERN-CERN CERN-SARA	VO Name Mil Mil Mil Mil Mil Mil	ring all 03-03 Total 1 84963 65578 10223 21929	t to use the tra 00:00 Failures 100 84 83 30 89	parsing parsing p:00 succ. 0 13646 11108 7187 2425	s per +01: # fail. 171317 54470 3036 19404	s on it. formed during 00 and 2008- 1st father Reason Dest SRM. Prep Source SRM. Prep Transfer Dest SRM: Prep Dest SRM: Prep	last we 03-10 % 1st Failure Reason 100 97 57 42 66	ek managed b 00:00:00 +4 [CERN- 2nd Falure Reason Dest SRM: Prep Transfer Searce SRM: Prep	by "pro D1:00 % 2nd Failure Reason 2 27 40 33	Avg. Size (Gall) 0.27 1.79 1.99 1.43	5-W5.C Si Duration (sec) 188.42 669.29 906.37 420.56	ern.ch" how VO de Avg. 1x Rate (MIDuec) 0 1.5 4.1 3.66 4.19	tails Eff. 1x Byles (car) 0 3717 85 10934 78 14208.91 3457.39	Tx Dytes (GB) 3751.7 19939.5 14299.9 3458.1
	Channel Name Channel Name CERN-CERN CERN-SARA	vo Name Mil Mil Mil Mil Mil Mil Mil Mil Mil Mil	ring all 03-03 Total 1 84963 05578 10223 21929 333 13	the tra 00:00 Failures 100 84 83 30 89 99	parsin ansfer ):00 <sup>#</sup> Succ. 0 13548 11108 7187 2425 1106	s per +01: # fail. 1 71317 54470 3036 19404 31847	s on it. formed during i 00 and 2008- Reason Dest SRM: Prep Transfer Dest SRM: Prep Transfer Dest SRM: Prep Transfer	last we 03-10 % 1st Failure Reason 100 97 57 42 66 91	ek managed b 00:00:00 +0 (CERN- 2nd Lature Reason Dest SRM: Prep Dest SRM: Prep Transfer Searce SRM: Prep Searce SRM: Prep	by "pro D1:00 % 2nd Failure Reason 2 27 40 33 5	Avg. Size (GIII) 0.227 1.79 1.99 1.43 1.46	5-W5.C Si Avg. Duratien (sec) 0 188.42 669.29 806.37 420.56 112.87	ern.ch" how VO da Avg. 1x Rate (MIDusc) 0 1.5 4.1 3.66 4.19 6.3	tails Eff. 1x Bytes (car) 0 3717.85 10934.78 14202.91 3457.99 2187.89	Tx Dytes (GB) 3751.7 19939.5 14282.9 3458.1 2192.5
	Channel Name Channel Name CERN-CERN CERN-CERN CERN-BARL	VO Name Maine Mil Mil Mil Mil Mil Mil Mil Mil Mil Mil	ring all 03-03 Total 1 84963 05578 10223 21029 333 13 103	the tra 00:00 Failures 100 84 83 30 89 96 199	parsin ansfer ):00 <sup>1</sup> <sup>1</sup> <sup>1</sup> <sup>1</sup> <sup>1</sup> <sup>1</sup> <sup>1</sup> <sup>1</sup> <sup>1</sup> <sup>1</sup>	* Fail. * Fail. 71317 54470 3036 19404 31847 103	s on it. formed during 00 and 2008- Reason Dest08tk Prep Source SRM: Prep Dest SRM: Prep Dest SRM: Prep Transfer Dest SRM: Prep Dest SRM: Prep	last we 03-10 Failure Reason 100 97 42 66 91 199	ek managed b 00:00:00 +0 (CERN- 2nd Jakure Reason Dest SRM: Prop Dest SRM: Prop Transfer Source SRM: Prop Source SRM: Prop	y "pro 01:00 \$ 2nd Failure Reason 2 27 40 33 5	Avg. Size (Call) 0.27 1.79 1.43 1.46 0	5-W5.C Si Duration (sec) 0 188.42 669.29 906.37 420.56 112.87 9	ern.ch" how VO de Rate (MILburc) 0 1.5 4.1 3.66 4.19 6.1 9	tails Eff. 1x Bytes (G40) 0 371785 1993478 14280-01 14280-01 3457.99 2187.69 2187.69 0	Tx Dytes (GB) 3751.7 19939.5 14282.9 3458.1 2192.6
	Channel Name Channel Name CERN-CERN CERN-CERN CERN-PIC	VO Name PAIL Allice allice allice pps [All]	Total 103-03 Total 1 84963 05578 10223 21929 333 13 68406	the tra 00:00 Failures 100 84 83 30 89 98 199 87	parsin ansfer ):00 Succ. 0 13546 11108 7187 2425 1106 0 222440	* Fail. * Fail. 71317 54470 3036 19404 31847 103 45986	s on R. formed during i OO and 2008- Ist father Reason Dest SRM: Prep Transfer Dest SRM: Prep Transfer Dest SRM: Prep Transfer Dest SRM: Prep Source SRM: Prep Source SRM: Prep	ast we 03-10 Faihare Reason 100 97 57 42 66 91 199 80	ek managed b 00:00:00 +t (CERN- 2nd Falure Reason Dest SRM: Prop Transfer Searce SRM: Prop Transfer Transfer	y "pro 01:00 \$ 2nd Failure Reason 2 2 27 40 33 5	ad-ft Filte Size (Call) 0 0.27 1.79 1.43 1.43 1.46 0 0.09	5-W5.C Si Avg. Duration (sec) 0 188.42 669.29 906.37 420.56 112.87 0 176.98	ern.ch" how VO de Avg. 1x Rate (MILburc) 0 1.5 4.1 3.66 6.19 6.4 9 6.3	tails Eff. 1x Bytes (cal) 0 3717 85 19934 78 14268-94 3457.99 2157.99 0 22159 59	7x Bytes (GB) 3751.7 19939.5 142929 3458.1 219025 23029.2
	Channel Hame CERN-CERN CERN-CERN CERN-BAL CERN-BAL CERN-PIC CERN-NDOF	vo Name (VI) Name (VI) (VI) alice alias Ilick eps (VI) (VI) (VI) (VI)	Total 1 84963 65578 10223 21029 233 13 68406 47024	100 - 00 5 Failures 100 84 83 30 89 96 87 65	parsin ansfer ):00 13546 11108 7187 2425 1106 9 22440 16535	* Fail. * Fail. * Fail. 171317 54470 3036 19404 31847 183 45986 30489	s on it. formed during 1 00 and 2008- 1st failure Reason Dest SRM: Prep Transfer Dest SRM: Prep Pest SRM: Prep Source SRM: Prep Source SRM: Prep	03-10 5 1st Failure Reason 100 97 57 42 66 97 42 69 12 69 12 97 77 42 69 12 97 77 42 69 12 97 77 42 69 77 77 42 69 77 77 77 77 77 77 77 77 77 77 77 77 77	ek managed b 00:00:00 +6 (CERN- 2nd Jakare Reason Dest SRM: Prep Dest SRM: Prep Dest SRM: Prep Transfer Dest SRM: Prep	y "pro 01:00 5 2nd Failure Reason 2 2 27 40 33 5 15 20	ad-ft Filte Size (Call) 0 0.27 1.79 1.43 1.46 0 0.99 1.08	S-W5.C Avg. Duration (sec) 0 188.42 669.29 906.37 420.56 132.56 133.57 135.56 1	ern.ch" how VO de Avg. 1x Rate (MIRkec) 0 1.5 4.1 3.66 4.19 4.1 9 8.44 5.02	tails Eff. Tx Bytes (GR) 0 3717 85 19934 78 14268-91 3457.99 2197.60 22159.59 17911 63	Tx Uytes (GB) 3751.7 19939.5 14282.9 3458.1 2193.5 23029.2 18032.0
	Chaenel Name Chaenel Name CERN-CERN CERN-SARA CERN-PIC CERN-NDOF CERN-NDOF	VO Nome Sul UI Sul UI Sul Sul Sul Sul Sul Sul Sul Sul Sul Sul	Total 133-03 Total 1 84963 05578 10223 21029 33313 103 58406 47024 126258	the tra 00:00 Failures 100 84 83 30 89 60 87 65 62	parsing ansfer ):00 13646 11108 7187 2425 1108 22440 16535 47644	* Fail. * Fail. 171317 54470 3036 19404 31847 183 45988 30489 78614	s on R. formed during i OO and 2008- Ital failure Reason Dest SRM: Prop Dest SRM: Prop	03-10 5 1st Failure Reason 100 97 57 42 66 91 90 80 78 64	ek managed b 00:00:00 + 6 (CERN- Znd Failure Reason Dest SRM: Prop Transfer Dest SRM: Prop Transfer Dest SRM: Prop Source SRM: Prop Source SRM: Prop Source SRM: Prop	y "pro 01:00 5 2nd Failure Reason 2 2 27 40 33 5 15 20 31	Avg. Size (Call) 0 0.27 1.79 1.99 1.43 1.99 1.43 1.99 1.08 1.52	S-W5.C Avg. Duration (sec) 0 188.42 669.29 006.37 420.56 112.87 9 176.98 309.32 164.29	ern.ch* how VO de Avg. 1x Rate (MIR/wec) 0 1.5 4.1 3.66 4.19 4.1 9 4.1 9 8.44 5.02 12.38	tails Eff. 1x Byles (cat) 0 3717 85 19934 78 14208.94 14208.94 14208.94 14208.94 2150.99 22150.99 1791163 72456.99	Tx Dytes (CiB) 3751.7 19939.5 14282.9 3458.1 2192.5 23029.2 18032.0 75866.8
	Characteria re Statistics co Between 2C Characteria Cenn-Cenn Cenn-Ban Cenn-Ban Cenn-Pic Cenn-Nuor Cenn-Nuor	VO Nome Sul USE Sul Sul Sul Sul Sul Sul Sul Sul Sul Sul	Total 103-03 Total 1 84963 05578 19223 21929 333 13 68406 47024 126258 33548	the tra 00:00 Failures 100 84 83 30 89 96 60 87 65 62 55	parsing ansfer 2:00 13648 11108 7487 2425 1006 22440 16635 47644 14001	# Fail. # Fail. 171317 54470 3036 19404 31847 103 345988 30489 78614 10747	s on R. formed during OO and 2008- 1st fellure Reason Dest SRM: Prep Boure SRM: Prep Dest SRM: Prep	03-10 5 1st Failure Reason 100 97 57 42 66 97 100 80 78 64 95	ek managed b 00:00:00 +4 (CERN- 2nd Fakure Reason Dett SRM: Prep Dett SRM: Prep Transfer Dett SRM: Prep Source SRM: Prep Source SRM: Prep Source SRM: Prep Source SRM: Prep Source SRM: Prep	y "pro D1:00 % 2nd Failure Reason 2 2 27 40 33 8 15 20 31 15	Avg. Size (Call) 0 0.27 1.79 1.99 1.43 1.99 1.43 1.99 1.08 1.08 1.52 0.3	S-W5.C Avg. Duration (sec) 0 188.42 669.29 806.37 420.56 138.42 176.98 309.32 164.29 64.7	ern.ch" how VO de Avg. 1x Rate (MILbuc) 0 15 4.1 3.66 4.19 4.1 9 4.1 9 8.44 502 12.38 1.24	tails Eff. 1x Bytes (car) 0 3717 85 19934 78 14288.91 3457.99 2187.50 0 22199.59 1791163 72456.99 4412.51	1x Dytes (GB) 3751.7 19939.5 14283.9 34534.1 2193.5 23029.2 18032.0 75966.8 4412.0
	Chennel Name Chennel Name CERN-CERN CERN-BAL CERN-BAL CERN-BAL CERN-BAL CERN-BAL CERN-BAL CERN-BAL CERN-BAL	VO Name SUS SUS SUS SUS SUS SUS SUS SUS SUS SU	Total 103-03 Total 1 84863 05578 10223 21829 33313 103 68406 47024 126258 32558 32172	to use the tra 00:00 Failures 100 84 83 30 89 96 100 87 65 53 53	parsin unsfer 2:00 13548 11108 7187 2425 100 22440 16535 47644 14001 15018	# Fail. # Fail. 1 71317 54470 3036 19404 31847 103 45988 30489 78614 10747 17154	s on R. formed during OO and 2008- Reason Dest SRM: Prep Dest SRM: Prep Transfer Dest SRM: Prep Transfer Dest SRM: Prep Source SRM: Prep Source SRM: Prep Source SRM: Prep	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	ek managed b 00:00:00 + ( CERN- 2nd Falure Reason Det SRM: Prep Det SRM: Prep Searce SId& Prep Searce SId& Prep Searce SId& Prep Source SRM: Prep Dett SRM: Prep Dett SRM: Prep Dett SRM: Prep Dett SRM: Prep	2 27 40 33 5 15 20 31 5 14	od-ftt Fitte Size (Gill) 0 0.27 1.79 1.43 1.46 0 0.99 1.08 1.52 0.18	5-W5.C Avg. Duration (sec) 0 188.42 669.29 806.37 420.56 178.98 309.32 164.29 64.29 64.7 116.3	ern.ch* how VO de Avg. 1x Rate (MILber) 0 15 4.1 3.66 4.1 9 8.44 5.02 12.38 3.64 1.38	tails Eff. 1x Bytes (cat) 0 3171 85 10934 78 14288.91 3457.99 2189.59 1791163 72450.99 4412.51 2673.18	Tx Bytes (GB) 3751.7 19339.5 14282.9 3458.5 23029.2 18032.0 75866.8 4412.8 28731
	Channel Name Channel Name CERN-CERN CERN-CERN CERN-SARA CERN-PIC CERN-NOP CERN-NOP CERN-NOP CERN-NOP	VO Name SU SU SU SU SU SU SU SU SU SU SU SU SU	Total 103-03 103-03 103-03 103-03 103 05578 10223 21029 333 13 103 058406 47024 126258 32512 32512 32512 32512	5 Failures 100 84 83 30 89 99 99 99 99 99 99 99 99 99	parsin unsfer 2:00 13546 11108 7187 2425 100 22440 16535 47644 14001 15018 38594	s per +01: * fail. t 71317 54470 3036 19404 318470 3036 30469 30469 30469 30469 30469	s on R. formed during OO and 2008- Ist failure Reason Dest SRK Prep Boure SRK Prep Transfer Dest SRK Prep Transfer Dest SRK Prep Dest SRK Prep	5 1st Failure Reasen 100 97 57 42 66 97 97 42 66 97 97 97 42 97 97 97 97 97 97 97 97 97 97 97 97 97	ek managed b 00:00:0 +4 (CERN- 2nd Reson Reson Transfer Source STAR Prop Source STAR Prop Dest STAR Prop Dest STAR Prop Dest STAR Prop Dest STAR Prop Dest STAR Prop Dest STAR Prop	5 2nd Falure Reason 2 2 27 40 33 5 15 20 31 5 14 39	od-ftt Fitte Size (Gill) 0 0.27 1.79 1.43 1.46 0 0.99 1.08 1.52 0.18 1.33	S-W5.C Avg. Duration (and) 0 188.42 669.29 806.37 420.56 133.27 9 176.98 309.32 164.29 84.7 116.3 249.16	ern.ch" how VO de Rate (MIDkec) 0 15 41 3.66 4.19 6.1 9 0 8.44 5.02 12.38 2.64 1.28 2.64 1.93	tails Eff, 1x Bytes (GM) 0 3717 85 10934 78 14200 97 3457,99 2187,80 0 22150 59 17911 63 72456 89 4412,51 261318 37 61318 37 61318 37	1x Dytes (CiB) 37517 199355 442639 34584 34566 34566 34584 34584 34584 34566 34566 34566 34566 34566 34566 34566 34566 34566 34566 34566 34566 35666 36666 366666 366666 366666 366666666
	Chemiel Name Chemiel Name CERN-CERN CERN-GRA CERN-GRA CERN-RAC CERN-NOOF CERN-NEN CERN-NEN CERN-NEN CERN-NEN	VO Name (VI) (VI) (VI) (VI) (VI) (VI) (VI) (VI)	Total 103-03 103-03 103-03 103-03 104 104 104 10578 1023 103 103 88408 47024 126258 32540 32540 32540 32540 79962 79962	5 Failures 1000:000 84 63 300 89 960 87 65 652 555 53 52 555 53 52 555	parsin pa	s per +01: // fail. // fail. / fail. //	s on it. Formed during 1000 and 2008- 111 Januar Reason Data StRik Pres Source StRik Pres Data StRik Pr	ast we 03-10 % 1st Fallure Reason 100 97 42 46 0 0 100 97 42 46 86 64 95 86 86 86 86 86 81	ek managed b 00:00:00 +0 (CERN- 2nd Enture Reason Dest SRM: Prep Dest SRM: Prep Dest SRM: Prep Source SRM: Prep Source SRM: Prep Dest SRM: Prep Dest SRM: Prep Dest SRM: Prep Dest SRM: Prep Dest SRM: Prep Dest SRM: Prep	by "pro 0 1:00 Si 2nd Failure Resson 22 27 40 33 5 15 15 20 31 5 14 99 13	Avg. Filter Avg. Size (Call) 0 0.27 1.79 1.49 1.49 1.49 1.49 1.49 1.49 1.49 1.49 1.69	S-W5.C Avg. Duration Duration Duration 188 42 669 29 806.37 420.56 189.29 106.29 806.32 106.29 806.32 116.3 209.32 164.29 64.7 116.3 249.16 218.97	ern.ch* how VO de Avg. 1x Rate (MILbuc) 0 15 4.1 3.666 4.19 6.4 9 8.44 502 12.38 2.64 1.38 6.93 3.48	tails Eff. 1x Bytes (Gal) 0 3717 85 19934 78 14286-94 3457.99 0 22199.59 17911 63 72456 89 4412.51 2873.18 61318.37 33455 92	1x Dytes (GiB) 3751.7 19939.9 3458.1 2193.6 23029.2 18032.0 75866.8 4412.9 2673.1 51946. 39946
	Channel Name Channel Name CERN-DERN CERN-BRU CERN-PIC CERN-NDOF CERN-NDOF CERN-NDOF CERN-NDOF CERN-NDOF CERN-NDOF CERN-NDOF CERN-NDOF CERN-NDOF CERN-NDOF CERN-NDOF	VO Name (VI) (VI) (VI) (VI) (VI) (VI) (VI) (VI)	Total Total 1023 103-03 103-03 103-03 103 1023 1023 1023 1023 1023 1023 102	5 to use the training of the t	parsin ansfer 2:00 13548 11108 7187 2425 100 22440 16535 47644 15018 39654 39056	s pobot s per + 01: // Fail. 17 1317 54470 3036 19404 31847 103 345988 30459 78614 10747 17154 41388 40025 11150	s on it. formed during 1000 and 2008- 1st failure Reason Dist Statk Prep Source Statk Prep	last we 03-10 5 1st. Fallure Reason 100 97 57 42 66 61 100 80 80 80 80 86 44 95 88 64 68 10 95 88 64 95 88 86 69 10 10 10 10 10 10 10 10 10 10 10 10 10	ek. managed b 00:00:00:00 +10 (CERN- 2011 Initian Reason Dest BRM: Prep Transfer Transfer Transfer Transfer Dest SRM: Prep Dest SRM: Prep	by "production of the second s	od-ft Fittes Size (call) 0 0.27 1.79 1.99 1.43 1.46 0 9 0.99 1.06 1.62 0.3 0.18 1.33 0.86 0.21	5-W5.C Our ation (vec) 0 198.42 566.2 006.37 0 176.98 306.32 0 176.98 306.32 176.98 249.56 164.29 84.7 116.3 249.16 56.54	ern.ch" how VO de Avg. 1x Rate (MILbuc) 0 155 4.1 3.66 4.19 6.19 6.19 6.19 7.238 2.64 1.28 0.844 1.28 0.93 3.69 4.79	tails Eff. 1x Bytes (Call) 0 3717.85 10934.78 14208.94 3457.99 2457.99 22159.59 17911.63 72456.99 4412.51 2673.18 51318.37 33455.92 2929.98	Tx Dytes (GiB) 3751 7 19939.5 14289.9 3454.1 2193.5 23029.2 18032.0 75966.8 4412.8 2873.1 51846. 32942.4
	Chevel Name Chevel Name CERN-CERN CERN-CERN CERN-CERN CERN-SARA CERN-NDOF CERN-ANDOF CERN-ANDOF CERN-ANDOF CERN-ANDOF CERN-ANDOF CERN-ANDOF CERN-ANDOF CERN-ANDOF	VO Name PUD8-0 Name PUD PUD PUD PUD PUD PUD PUD PUD PUD PUD	Total 103-03 Total 103-03	5 to use the training of the t	parsin ansfer 3:00 13546 11108 7187 2425 100 22440 16535 47644 14001 15018 39594 39564 13730 30747	s per +01: # fail. 171317 54470 3036 30489 30470 3070	ter i nitre formed during 000 and 2008- bases bases bink Piep Deat SRM Piep	last we 03-10 Failure Reason 100 97 77 42 66 91 90 90 90 90 90 90 90 90 90 90 90 90 90	ek, managed b 00:00:00:00 +0 (CERN- 2011 Inlure Reason Text Stark Prep Dest Stilk Prep Searce Stark Prep Dest Stilk Prep Searce Stark Prep Dest Stilk Prep	by "pro D1:00 Fabure Reason 2 277 40 33 5 5 5 14 30 31 15 5 5 14 30 9 13 4 4 33	od-ft Fitte Size (Call) 0.27 1.79 1.99 1.43 1.99 1.43 1.99 1.08 1.52 0.18 1.33 0.86 0.21 1.56	S-WS.C Mrg. Mrg. Mrg. 0 198 42 669 29 80637 420,56 420,56 420,56 420,56 423,56 164 29 164 29 164 29 164 39 164 39 168 37 168 37 169 37 16	ern.ch" how VO de Avg. 1x Rate (MIIbec) 0 15 4.1 3.66 4.19 4.1 9 4.1 9 4.1 9 8.44 5.02 12.38 3.64 1.38 8.93 3.48 4.70 0.17	tails Eff. Tx Bytes (Cal) 0 3717 85 19934 78 14288-94 3457,99 211994 78 14288-94 3457,99 22199.59 179110.81 267318 61318.37 23455.92 2920.96	1x Dytes (GiP) 3751.7 19939.5 14280.1 2458.1 2193.6 23029.2 180320 75966.8 4412.0 26731.5 1946. 32948. 2902.4 81001.3





- The challenge
- Our problem
- Our solution

#### Fabric Infrastructure and Operational cost

- Operational cost of distributed debugging is still too high
- Currently it's grep intensive over all across multiple services
  - wassh –I root –c gridfts grep reqID /var/tmp/\*failed/glite\*.log
  - wassh -I root -c gridsrm/atlas zgrep "49b4fa78-0000-1000-ad97-fa78af063a57" /var/spool/srm/log.4.gz
- This impacts sites and experiment shifters
  - Training curve is rather steep for new operations staff
  - Inaccessible files (~hours)
  - gridFTP mysteriously timing out (bouncing emails/phone calls back a couple of times to the other site) (~hours)
  - "We see reduced transfer rates, please could you check" (~hours)
  - Performance variance is typically very large and not well understood
    - Some files transfer at 10MB/s, some go a 200KB/s, same site, same time
- Better debug tools can reduce operations cost!

end-to-end debugging - 8

#### Infrastructure What we're aiming for Operations

CERN Departm<u>ent</u>

- 1. A support ticket comes in
  - "We see lots of transfers timing out"
  - Example file:

Fabric

and

- /castor/cern.ch/grid/atlas/atlasdatadisk/data08\_cosmag/ESD/data08\_cosmag.00090272.physics\_RPCwBeam.reco. ESD.o4\_r560\_tid027478/ESD.027478.\_00769.pool.root.1"
- Submit request to debug transfer for this file 2.
- Picture will be built up asynchronously as data is returned from the 3. various sources, like a web-page loading







• It's an integration problem



- Multiple logfile / database / feed formats to be parsed
- Logs located on multiple machines (O(1000) nodes @CERN)





- The challenge
- Our problem
- Our solution

### Infrastructure and Previous attempts: parse it all



- Our previous attempts focused on recording *all events* 
  - You collect all events from all sources, all the time, parse them, and put them in an index database
    - Specific debug searches can be run over the database
  - Approach used by Splunk
  - Common logging instrumentation: approach taken by netlogger
- While this does work, routine parsing, collecting and joining can be expensive
  - Parsing 10's GB's of logs from O(1000) machines
  - It's overkill for this application
    - A typical service manager will probably run no more than 0(100) debug trace queries a day, and we know what queries will be run
- We prefer to parse on demand
  - Can make use of debug trace databases if they are available



- On-demand extraction from data sources (request / response)
  - Send out requests to all data sources that might know something, get them to parse and return what they know
  - If sufficiently detailed summary or trace logging databases are available, use them
  - Integrate other feeds (fabric monitoring, network monitoring data)
- Integrate (join) the data from the various sources for that specific debug request
  - The flow is asynchronous, i.e. the picture of what happened is built up as information is returned
  - Even with missing information, the picture obtained is still useful for debugging





- Based on message-oriented middleware
- This handles the request / response reliably and easily



Point-to-point



- Send a query to all nodes that might know something
- e.g. all SRM nodes in a loadbalanced alias
- Send a query to the one diskserver that we know handled the transfer
- e.g. gridFTP logs

#### Fabric Infrastructure and Operations Architecture





 The message system handles the plumbing and the reliable delivery of the messages – local agents do the parsing

end-to-end debugging - 16

### Infrastructure Messaging technology



- Using the MSG messaging framework
  - Technology already used in WLCG production in EGEE/OSG for grid sitemonitoring data
  - See EGEE User Forum for details of MSG:
  - http://indico.cern.ch/contributionDisplay.py?contribId=136&sessionId=9&confId=40435
  - Uses Apache ActiveMQ: open source, easy to use
- Throughput requirements  $\checkmark$ 
  - Isn't really an issue for administrator initiated requests: O(100) per day
- Latency requirements

and

Operations

- Needs to deliver fast we don't want to be waiting too long
- Reliability requirements
  - We do care that the messages get there in order to build up a full picture
- Scaling requirements
  - We need it to scale up to O(1000) nodes so that we can run this over all our diskservers





- Planning to integrate all data at CERN from:
  - File Transfer Service (Tier-0 physics data export service)
  - Castor SRM and Castor core components
  - Lemon fabric monitoring service
- Aim: tool usable by service managers in summer to help with the transfer debugging problem

### • Future:

- Add data feeds from other sites (other SRMs): collaboration with external sites. Add network monitoring data
- Tool itself useful for other sites?
- Re-use components for distributed workload-management services?

## Flexible architecture

ahric

and

Infrastructure

Operations

- Future re-plumbing is easy: the architecture allows us to easily change the data sources as software develops
  - Decide we want to collect and archive gridFTP logs on 10 central machines
    - Move the gridFTP agents off all your diskservers to just these 10 machines instead, to answer the same request
    - The rest of the system remains unchanged
  - Next version of one component comes with a detailed-enough trace database?
    - Unplug all the log-mining agents and plug on an agent to answer the same request from the trace database instead
    - The rest of the system remains unchanged
  - Want to add in network flow data?
    - Write another feed to make this data available and add it in





- Aim: to reduce operations cost of running complex distributed services
- Developing a flexible architecture based on messaging for trace-debugging of distributed services
  - Parse logs as data sources
  - Use trace database sources if available
- Integrate data on-demand from various sources instead of routine parsing
- Will have a usable tool to help with the transfer debugging problem by summer





### Backup

**Presentation title - 21** 

- Using common formats and even better a common logging trace schema for all components involved is a great idea!
- Easier to do if you control all the components
  - e.g. most components of Castor drop trace info into a distributed tracing component (DLF database)
  - Netlogger calls can be added to the code to send data streams out
- Hard for other components
  - Some bits of the code we don't 'own' (Castor: LSF, gridFTP), so it can be hard to add trace info at the level needed
  - Why should FTS, dCache, Lemon, Nagios log into the same format?
- While this is a good goal we prefer to deal with the integration problem we have directly