

ADAC17: Reporting Platform for the Exascale Era

ADAC17 Symposium, Helsinki, Finland

03.09.2025 | FILIPE GUIMARÃES | HPC SUPPORT, JÜLICH SUPERCOMPUTING CENTRE

Introduction

monitor *verb*

observe and check the progress or quality of (something) over a period of time;

keep under systematic review;

maintain regular surveillance over;

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analysis of existing and real-time operation metrics of the business

focus on improving the operational nature of a business or entity

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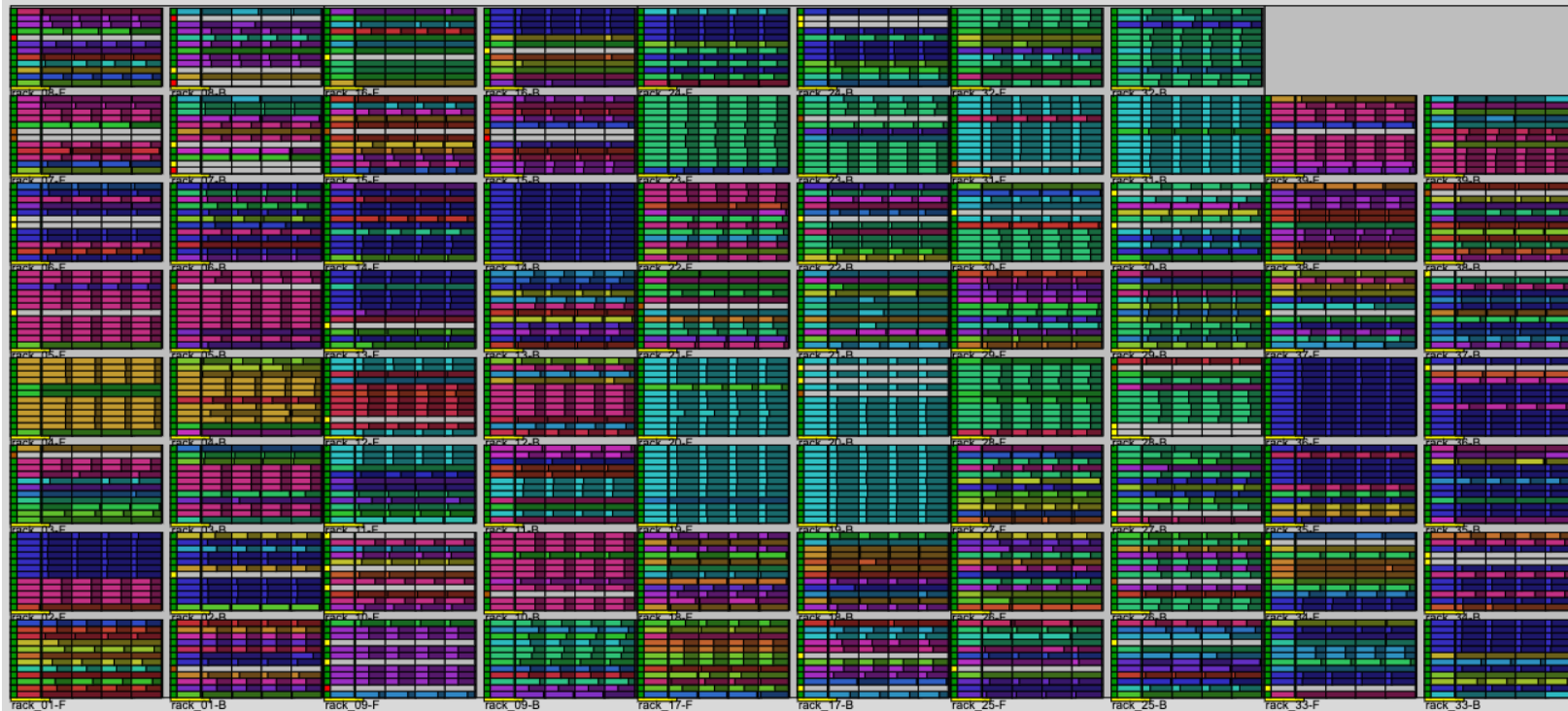


Reporting platform

Focuses on delivering structured, contextualised, role-specific reports to the different audiences

Challenges at the exascale

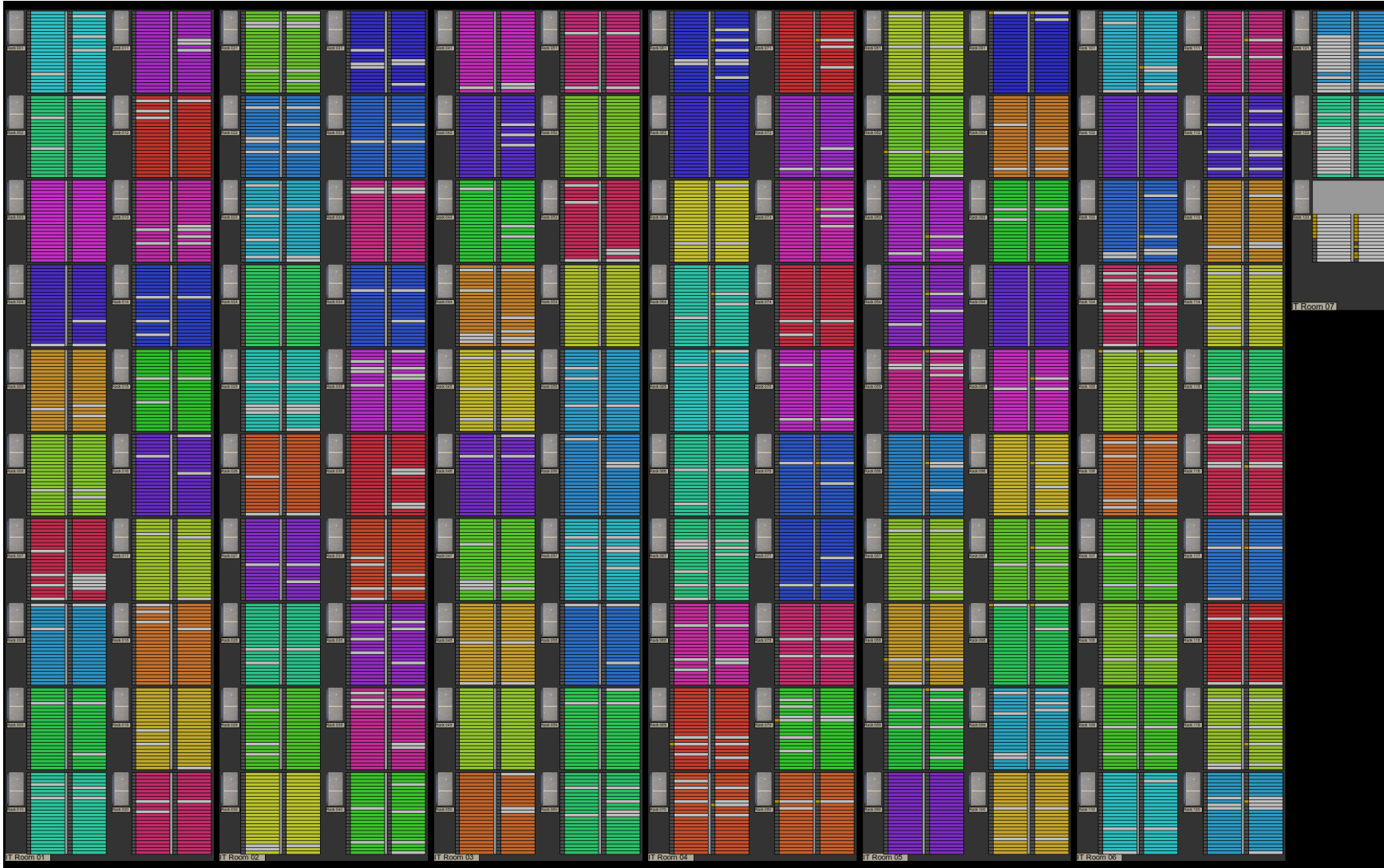
JUWELS Booster



~900 nodes

JUPITER

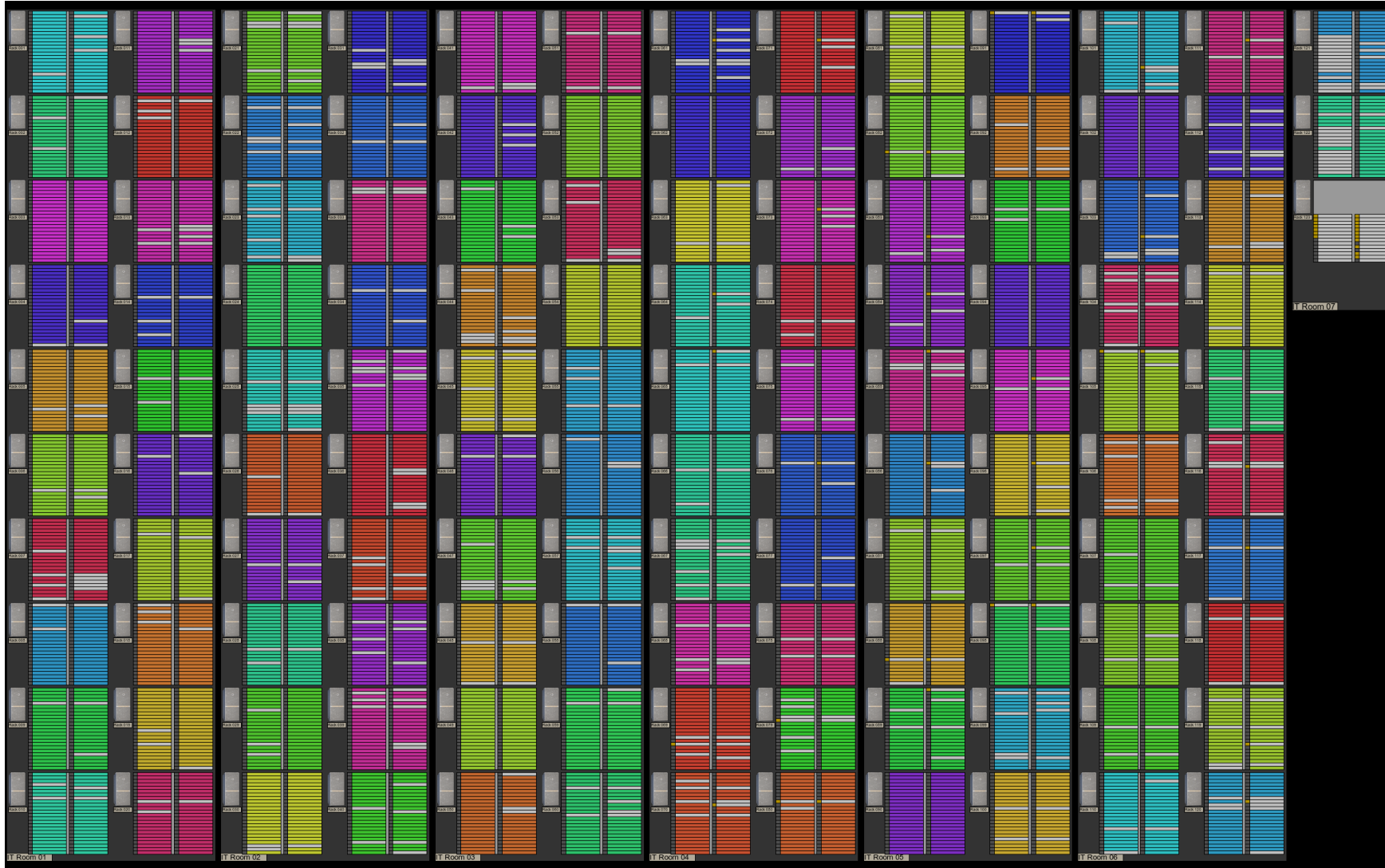
Challenges at the exascale



~6000 nodes

JUPITER

Challenges at the exascale



Lots of data!

➔ **Longer to process**

➔ **Heavier reports**

➔ **Difficult to present**

~6000 nodes

Why do we need a reporting platform?

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(including users)

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Slurm info

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Slurm info

GPU daemon



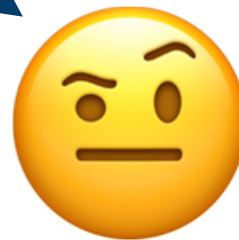
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errors



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From: <user>  
To: <sc-support>  
Subject: HELP!
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Dear SC support,

I have problems! Help!

Best regards,
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*ratios not in scale

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System log
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view

System and
Job reporting



Why do we need a reporting platform?

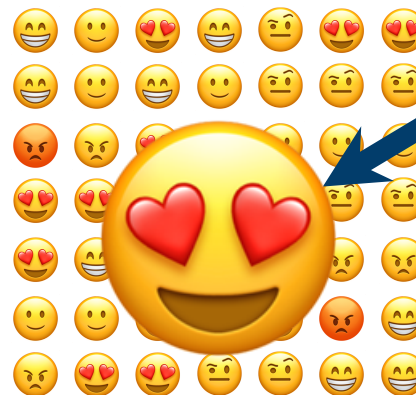
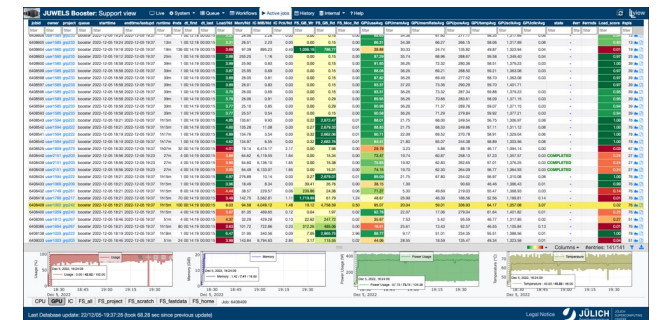
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Updates every ~1min
using existing sources

➔ Negligible overhead!
➔ Scalable!

System and
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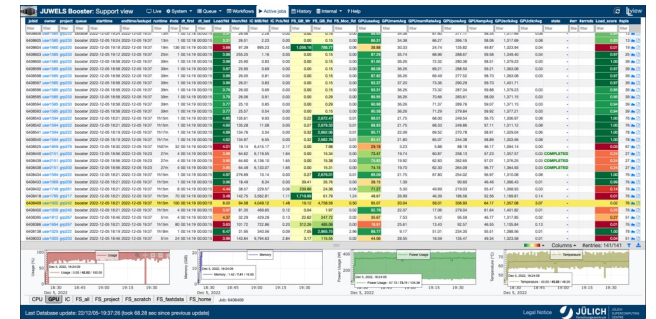
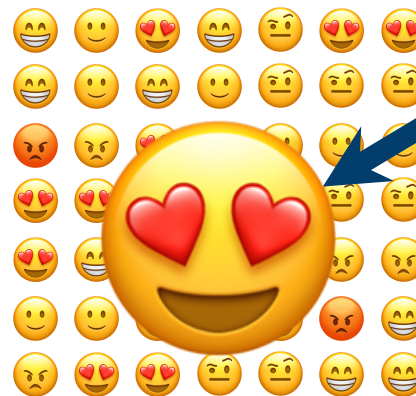
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Supporters



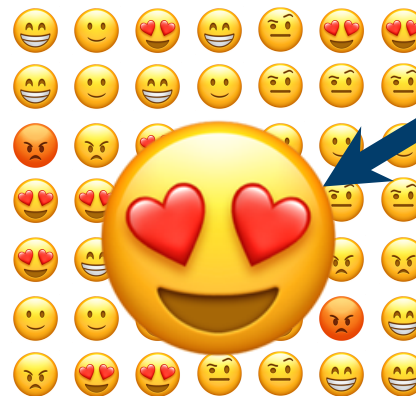
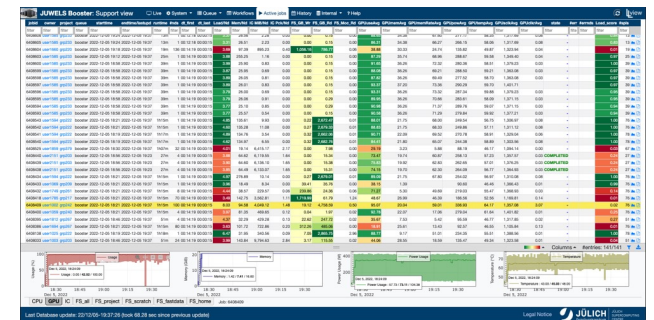
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System and
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Characteristics and features of view

- Developed in JSC since 2004
- Job reports available for all users since 2019
- Perl, Python, Javascript
- Near-real time information (also in HTML and PDF reports)
- Role-based access ([Users](#), [PI/PAs](#), [mentors](#), [support](#))
- Modular/extendable design
- Separation between data processing and visualisation
 - Static web portal (no query to internal DB is initiated by the user)

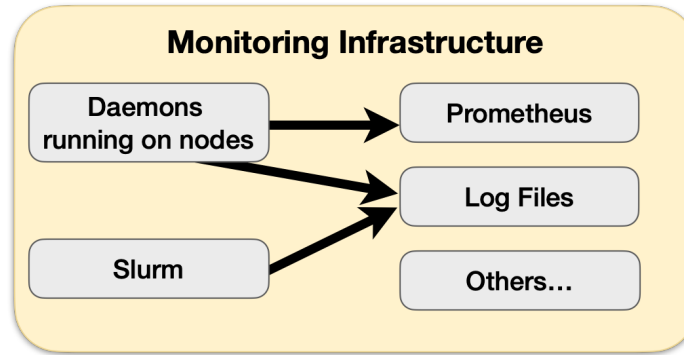
Job information

- Basic job information
- Computing time spent/estimation
- Job Status
- CPU: Load, Core, Memory usage
- GPU: Usage, Power, Temperature, ...
- I/O statistics
- Network traffic
- Node list (with interconnected cells)
- System error messages
- Timeline

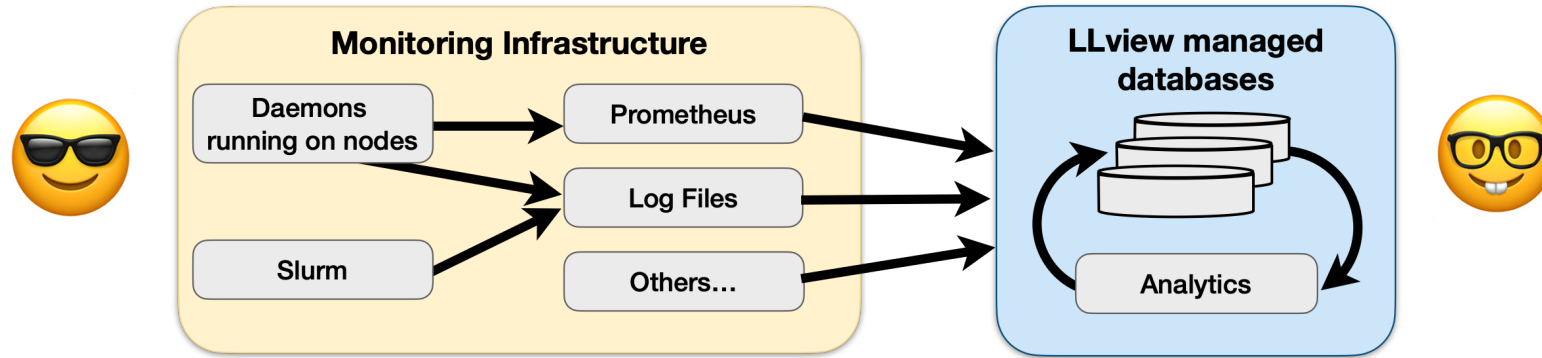
System information

- System usage overview
- Node usage, Errors

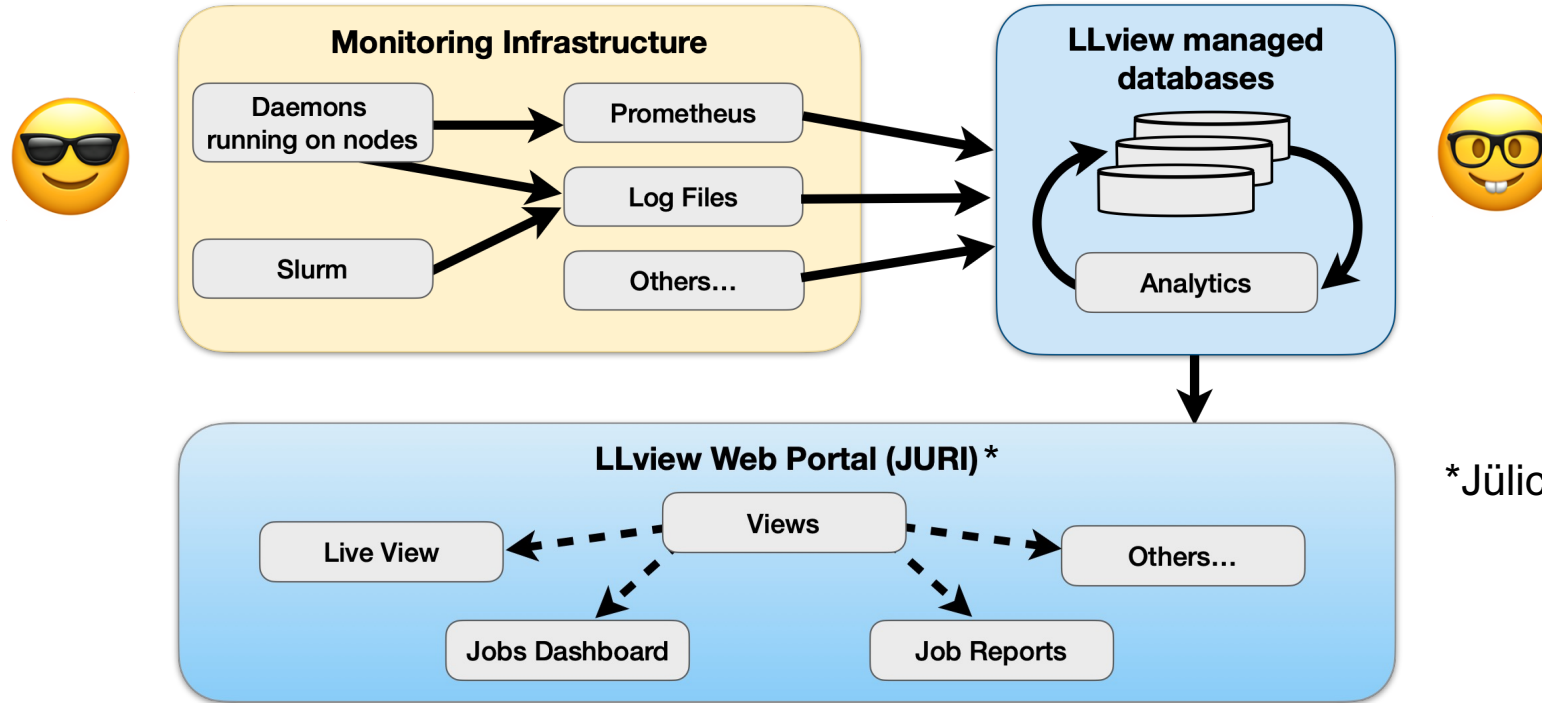
Simplified Scheme of view



Simplified Scheme of LLview

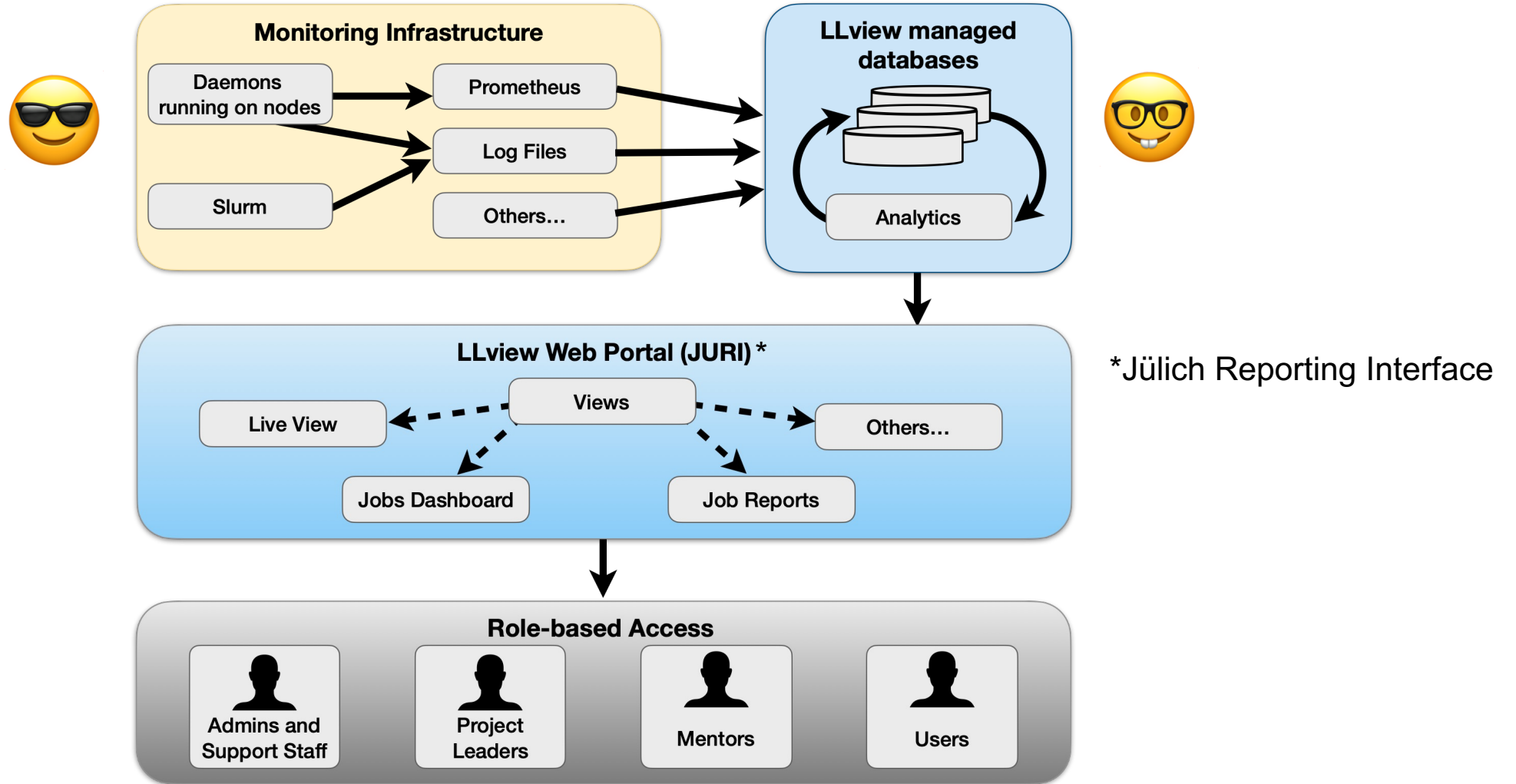


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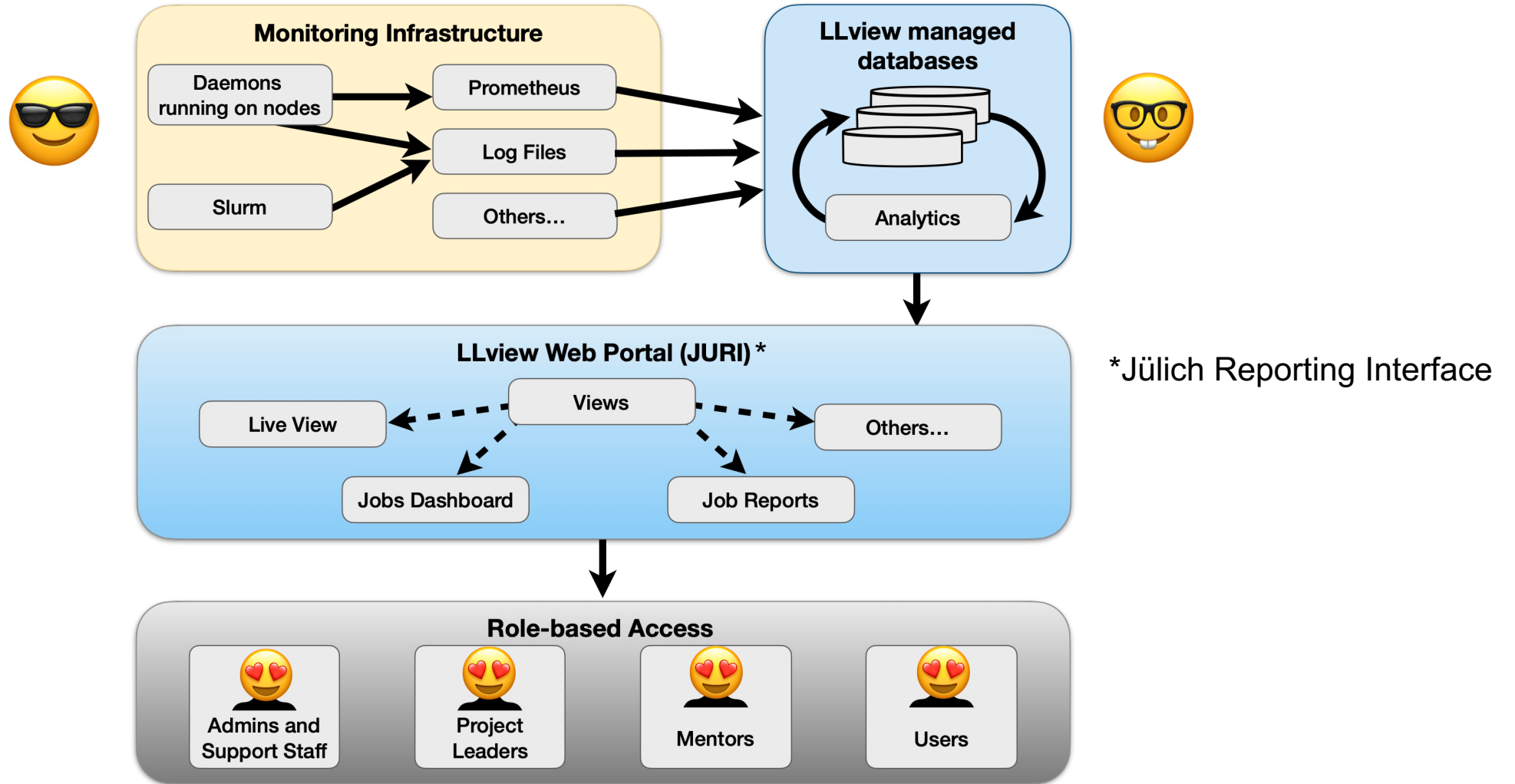


* Jülich Reporting Interface

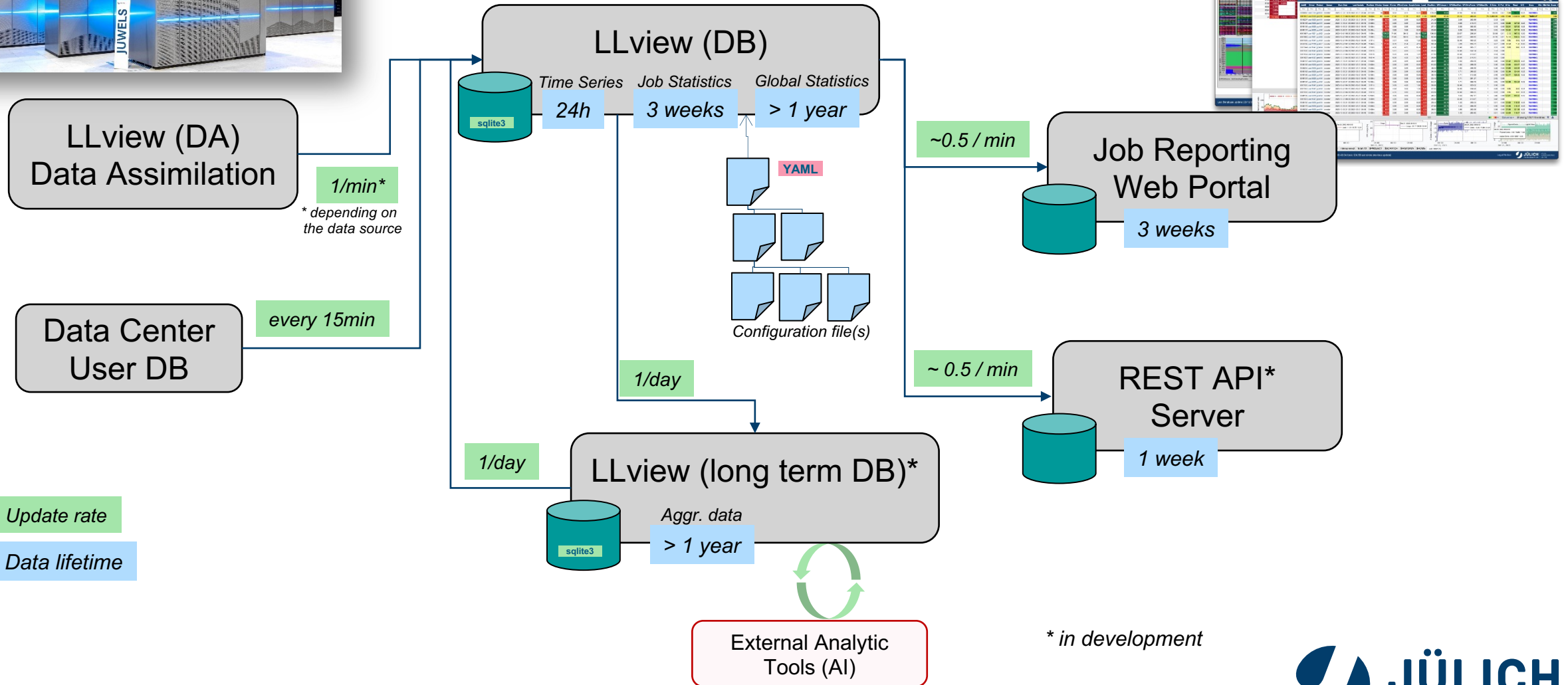
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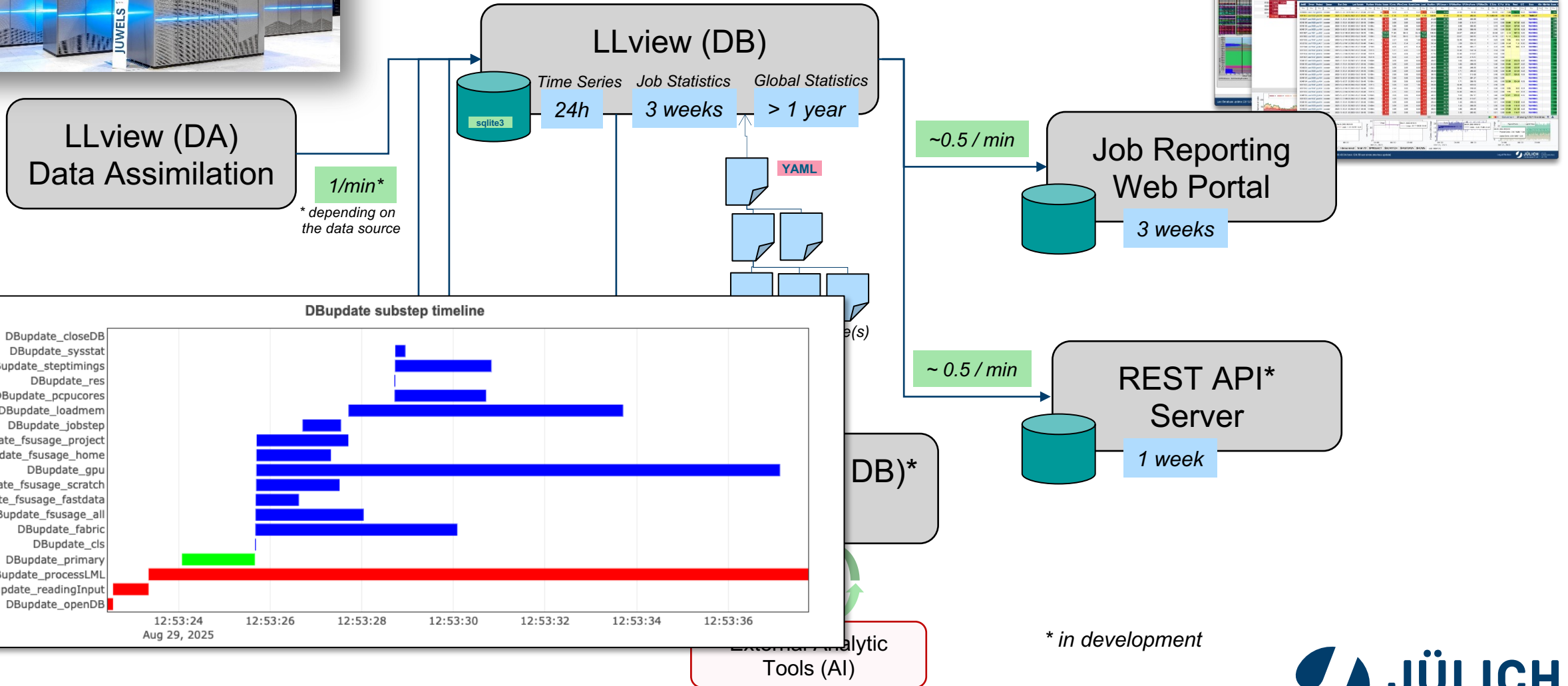
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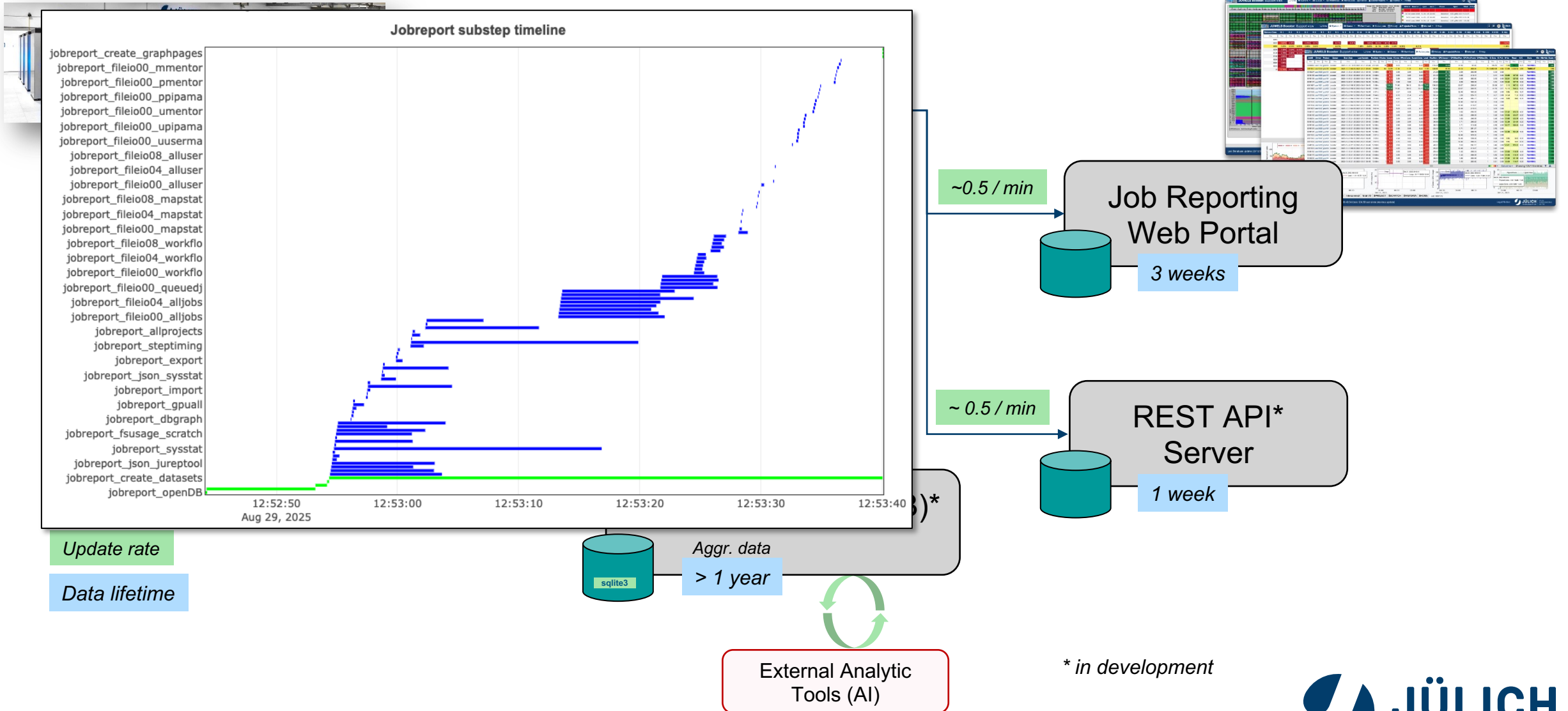
More Detailed Scheme of LLview



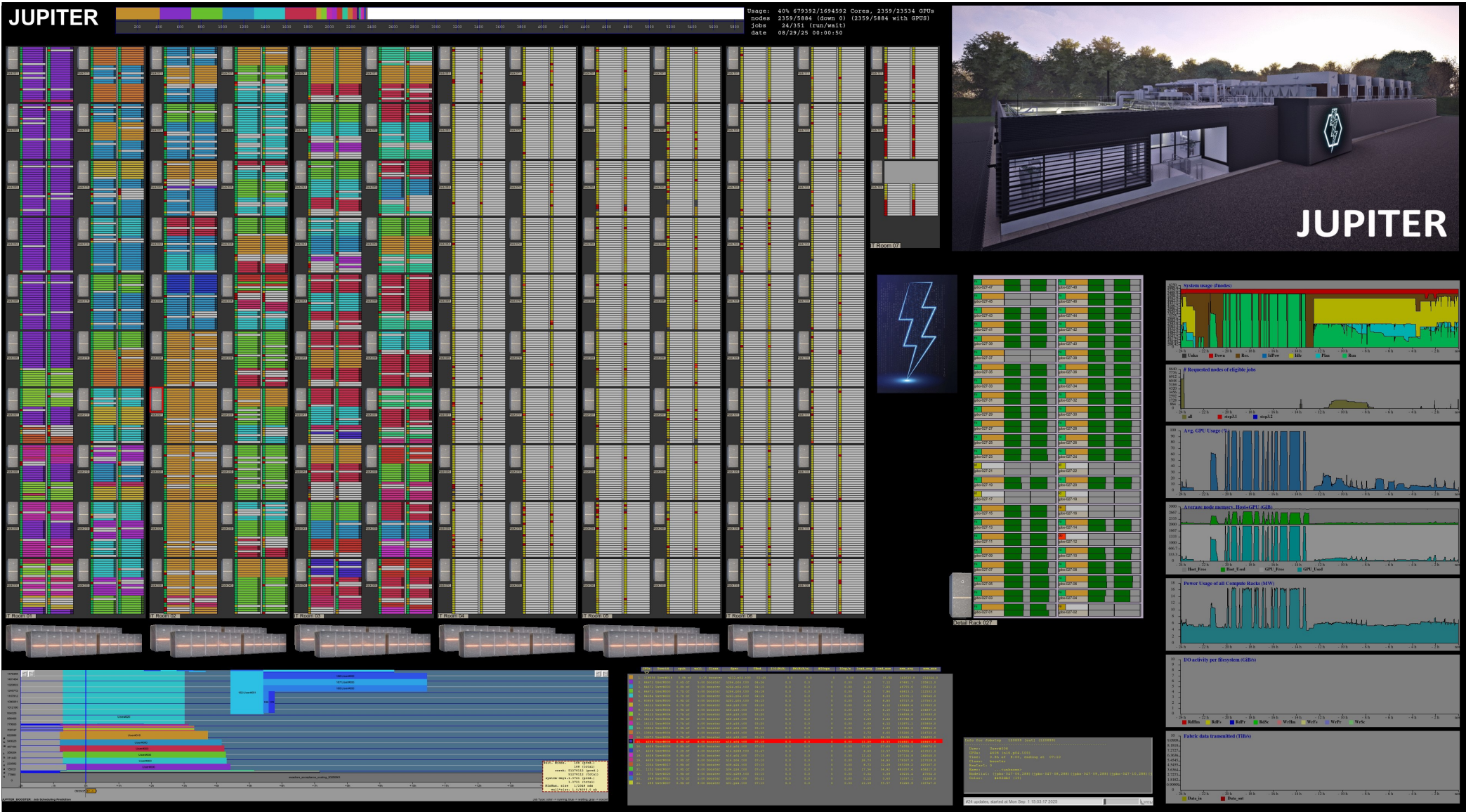
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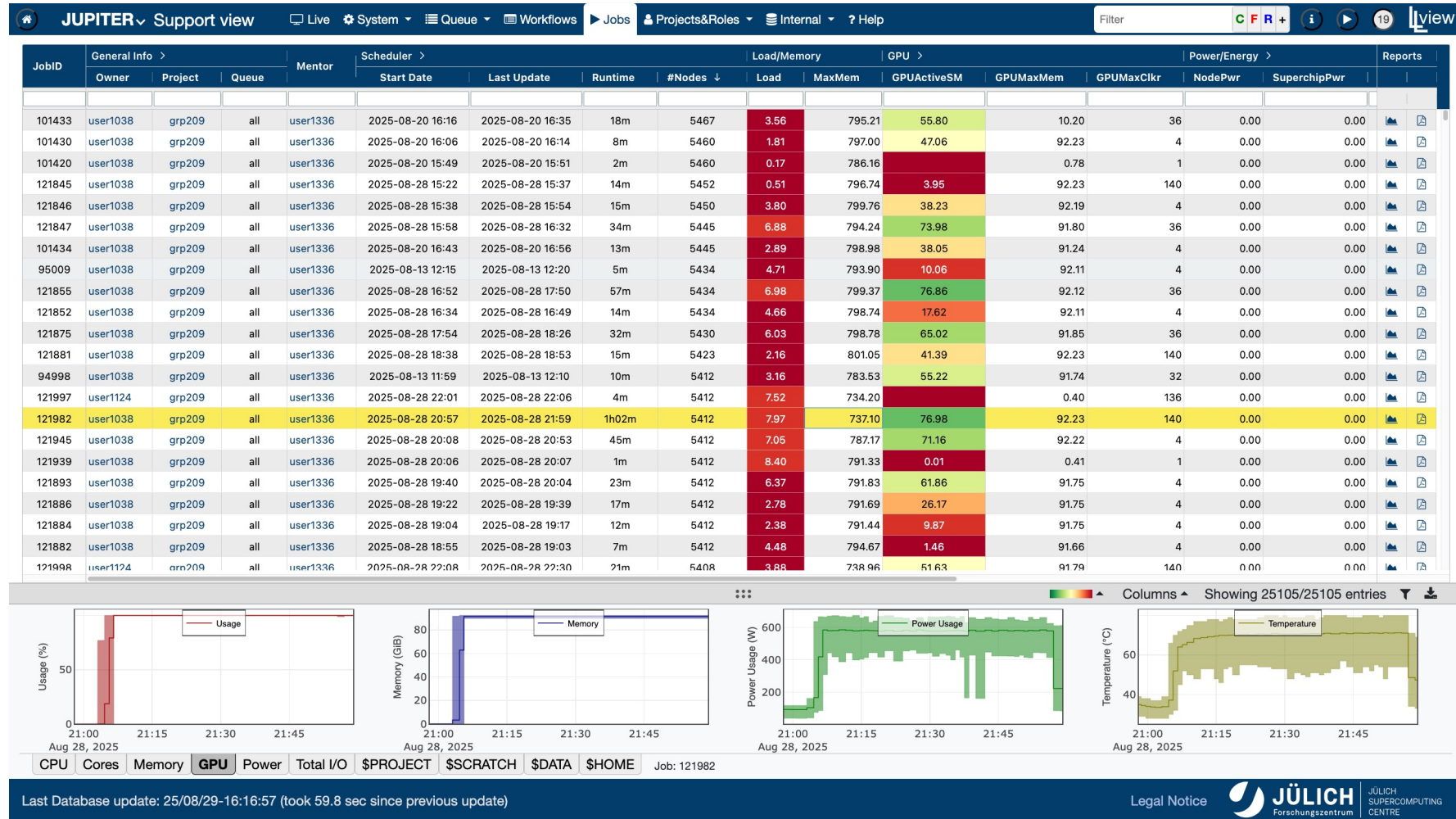
Live view shows current usage



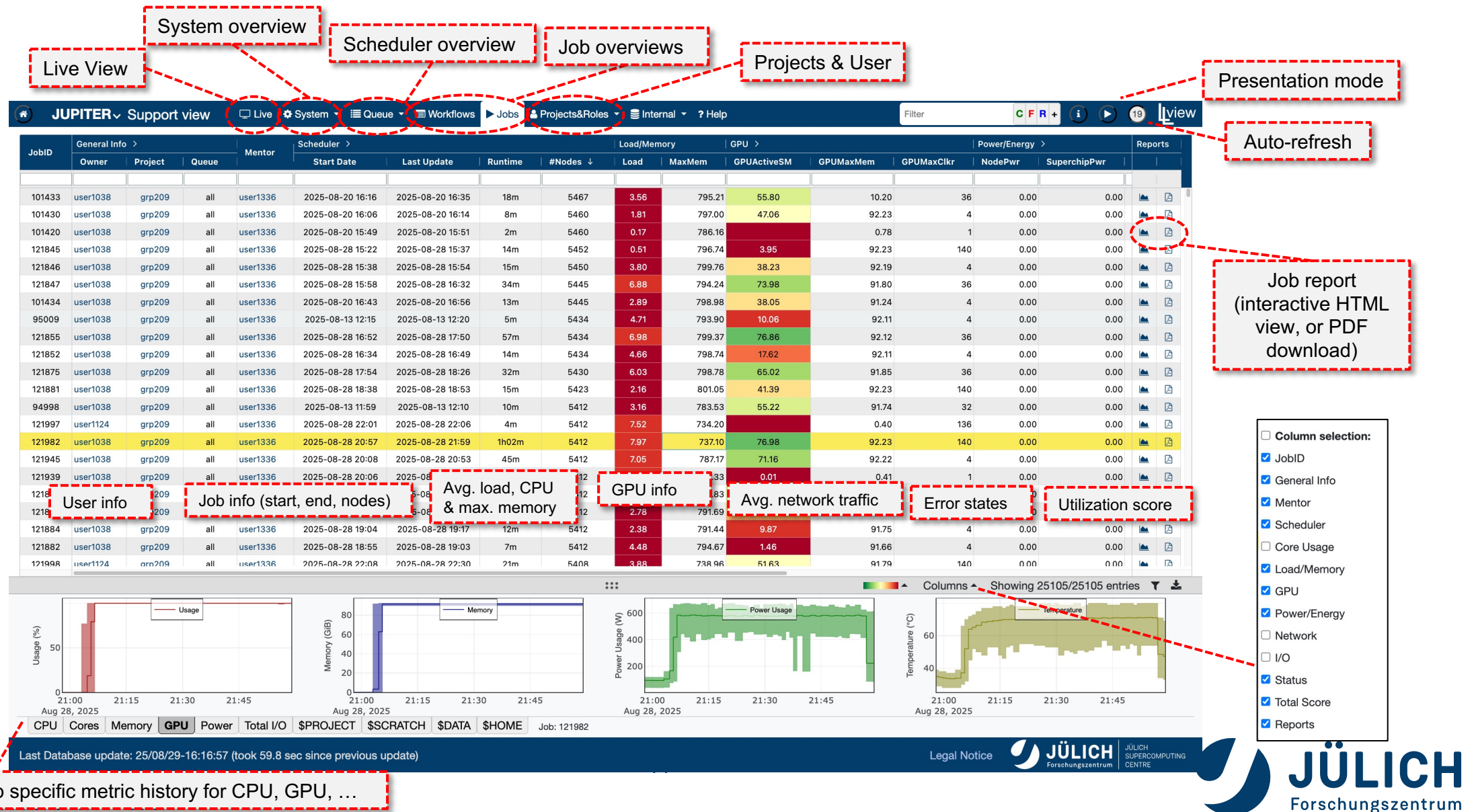
(LLview is also useful for Quantum Computers)



Dashboard with job-focused information



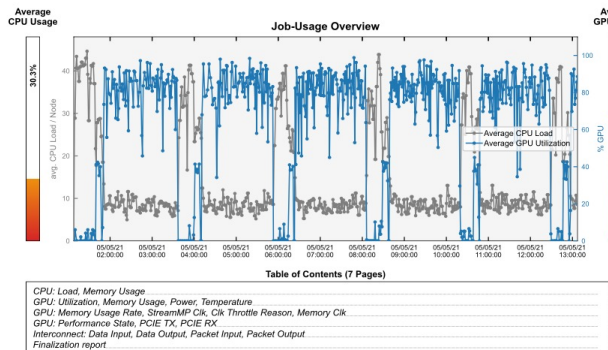
Dashboard with job-focused information



Job reports contain detailed information

- Basic job information
- General average usage
- Computing time spent/estimation
- Status
- CPU, Core
 - Usage, Load, Memory usage
- GPU
 - Usage, Power, Temperature, ...
- I/O
- Network traffic
- Nodelist (with interconnected cells)
- Error messages
- Timeline

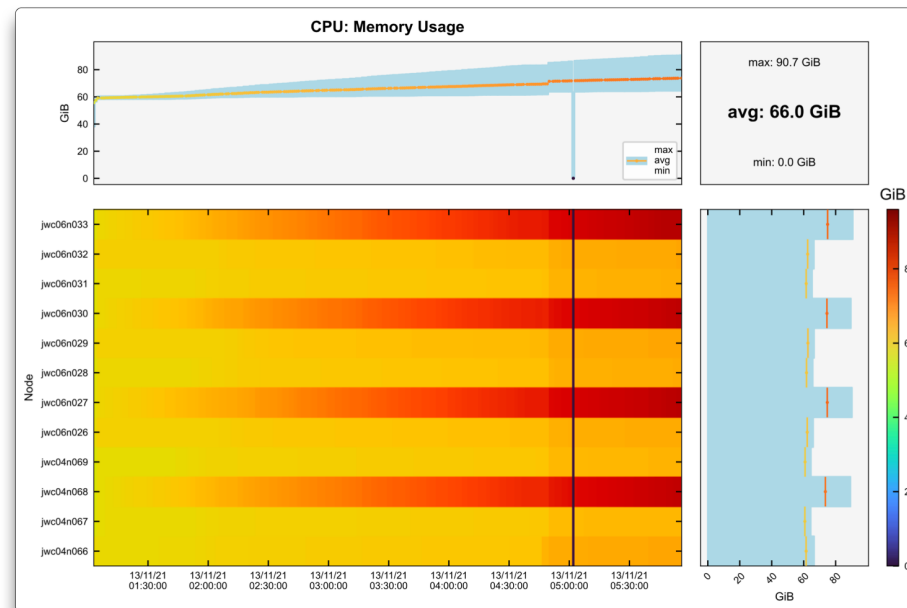
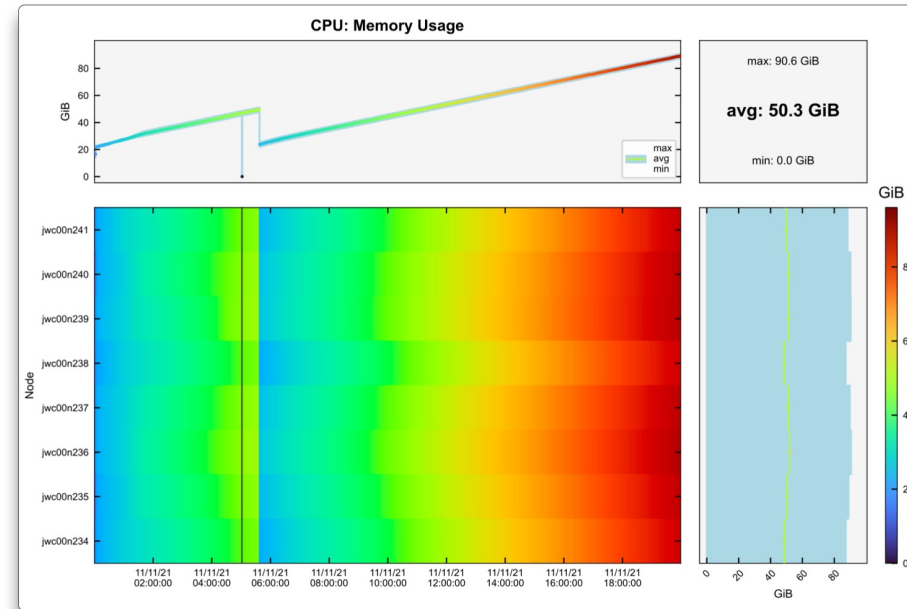
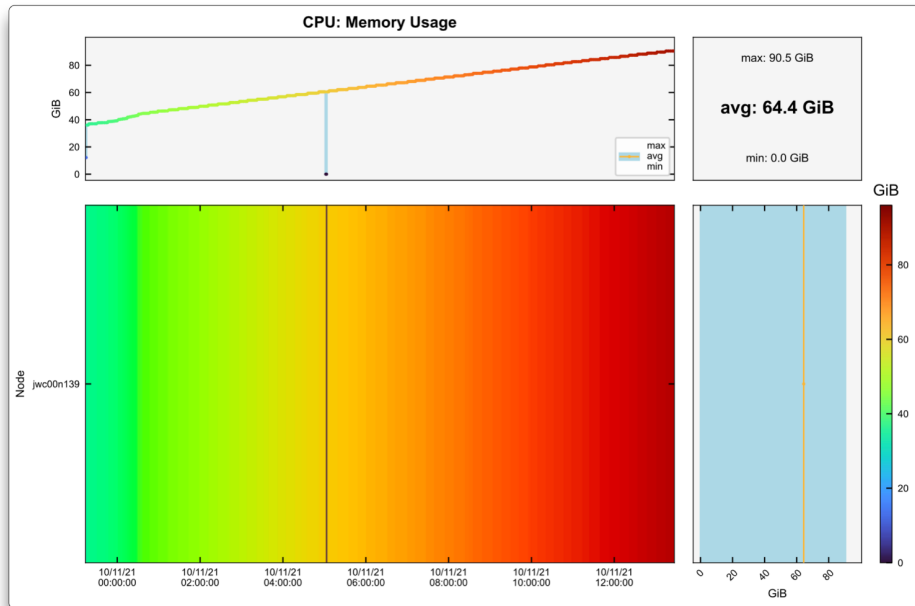
JUWELS BOOSTER Job Report						
Jobid: 3691769	User: username		Project: project	Job Name: job name		
Job Runtime: 12h00m → 100.08% of Wall: 11h59m						
Job Start Time:	2021-05-05 01:07:13		Job Performance Metrics			
Job End Time:	2021-05-05 13:08:04 (1h18m ago)		Load (CPU-Nodes):	0.00	14.55	44.64
Current Time:	2021-05-05 14:25:07		Memory (CPU-Nodes):	0.00	46482.24	53069.40 MB
Job Endtime (Est.):	2021-05-05 13:07:28		Interconnect Traffic (in):	0.00	41.72	8489.82 MB/s
			Interconnect Traffic (out):	0.00	8.65	1056.42 MB/s
Queue:	booster		Interconnect Packets (in):	0	916	60681 pck/s
Job Size, #Nodes:	1	#Data Points: 720	Interconnect Packets (out):	0	797	60846 pck/s
Job Size, #GPUs:	4	#Data Points: 621				
Job IO Statistics						
SHOME:	0.00 MB	0.00 MB	0.00 MB/s	0.00 MB/s	0.00 MB/s	0.00 MB/s
SPROJECT:	0.00 MB	0.00 MB	0.00 MB/s	0.00 MB/s	0.00 MB/s	0.00 MB/s
SCRATCH:	0.00 MB	0.00 MB	0.00 MB/s	0.00 MB/s	0.00 MB/s	0.00 MB/s
SFASTDATA:	0.00 MB	0.00 MB	0.00 MB/s	0.00 MB/s	0.00 MB/s	0.00 MB/s
Job GPU Statistics						
avg. GPU Usage:	62.84 %	avg. Mem. Usage Rate:	9.47 %	avg. GPU Temp.:	52.94 °C	avg. GPU Power: 153.37 W
max. Ck Stream/Mem:	1410/1215 MHz	max. Mem. Usage:	2678.50 MB	max. GPU Temp.:	64.00 °C	avg. GPU Power: 380.17 W
Job Finalization Report						
Job State:	TIMEOUT		Return Code:	0	Signal Number: 0	
This job has used approximately: 1 nodes × 48 cores × 11.999 hours = 575.95 core-h						



NodeList									
1	job0009	2	job0011	3	job0012	4	job0023	5	job0024
6	job0025	7	job0026	8	job0027	9	job0028	10	job0029
11	job0030	12	job0031	13	job0032	14	job0033	15	job0034
16	job0035	17	job0036	18	job0037	19	job0038	20	job0039
21	job0040	22	job0041	23	job0042	24	job0043	25	job0044
26	job0045	27	job0046	28	job0047	29	job0048	30	job0049
31	job0050	32	job0051	33	job0052	34	job0053	35	job0054
36	job0055	37	job0056	38	job0057	39	job0058	40	job0059
41	job0060	42	job0061	43	job0062	44	job0063	45	job0064
46	job0065	47	job0066	48	job0067	49	job0068	50	job0069
51	job0070	52	job0071	53	job0072	54	job0073	55	job0074
56	job0075	57	job0076	58	job0077	59	job0078	60	job0079
61	job0080	62	job0081	63	job0082	64	job0083	65	job0084
66	job0085	67	job0086	68	job0087	69	job0088	70	job0089
71	job0090	72	job0091	73	job0092	74	job0093	75	job0094
76	job0095	77	job0096	78	job0097	79	job0098	80	job0099
81	job0100	82	job0101	83	job0102	84	job0103	85	job0104
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96	job0115	97	job0116	98	job0117	99	job0118	100	job0119
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226	job0245	227	job0246	228	job0247	229	job0248	230	job0249
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551	job0570	552	job0571	553	job0572	554	job0573	555	job0574
556	job0575	557	job0576	558	job0577	559	job0578	560	job0579
561	job0580	562	job0581	563	job0582	564	job0583	565	job0584
566	job0585	567	job0586	568	job0587	569	job0588	570	job0589
571	job0590	572	job0591	573	job0592	574	job0593	575	job0594
576	job0595	577	job0596	578	job0597	579	job0598	580	job0599
581	job0600	582	job0601	583	job0602	584	job0603	585	job0604
586	job0605	587	job0606	588	job0607	589	job0608	590	job0609
591	job0610	592	job0611	593	job0612	594	job0613	595	job0614
596	job0615	597	job0616	598	job0617	599	job0618	600	job0619
601	job0620	602	job0621	603	job0622	604	job0623	605	job0624
606	job0625	607	job0626	608	job0627	609	job0628	610	job0629
611	job0630	612	job0631	613	job0632	614	job0633	615	job0634
616	job0635	617	job0636	618	job0637	619	job0638	620	job0639
621	job0640	622	job0641	623	job0642	624	job0643	625	job0644
626	job0645	627	job0646	628	job0647	629	job0648	630	job0649
631	job0650	632	job0651	633	job0652	634	job0653	635	job0654
636	job0655	637	job0656	638	job0657	639	job0658	640	job0659
641	job0660	642	job0661	643	job0662	644	job0663	645	job0664
646	job0665	647	job0666	648	job0667	649	job0668	650	job0669
651	job0670	652	job0671	653	job0672	654	job0673	655	job0674
656	job0675	657	job0676	658	job0677	659	job0678	660	job0679
661	job0680	662	job0681	663	job0682	664	job		

Examples

Memory leak



Examples

System Error Logs

Job Finalization Report	Job State: FAILED	Return Code: 9	Signal Number: 0
System Error Report	# Msgs: 2	# Nodes: 1	(Out-of-memory)
This job has used approximately: 1 nodes × 48 cores × 0.186 hours = 8.93 core-h			

System Error Report

Msgs: **2** # Nodes: **1**

Error Messages:

```
2025-04-24T19:21:29+0200 jwb0163.juwels kernel: python invoked oom-killer:
gfp_mask=0x140dca(GFP_HIGHUSER_MOVABLE!__GFP_COMP!__GFP_ZERO), order=0, oom_score_adj=0
2025-04-24T19:21:29+0200 jwb0163.juwels kernel: Out of memory: Killed process 1556003 (python) total-
vm:902572524kB, anon-rss:496358356kB, file-rss:89856kB, shmem-rss:19200kB, UID:xxxxxx pgtables:973944kB
oom_score_adj:0
```

Examples

System Error Logs

Job Finalization Report	Job State: TIMEOUT	Return Code: 0	Signal Number: 0
System Error Report	# Msgs: 2	# Nodes: 1	(Flipping Link)
This job has used approximately: 16 nodes × 48 cores × 11.973 hours = 9195.26 core-h			

System Error Report

Msgs: **2** # Nodes: **1**

Error Messages:

```
2025-06-02T03:24:56+0200 jwb0155.juwels pshealthcheck[184436]: [EE] ERROR: mlx5_2 local port (LID
4667, port 1): LinkDownedCounter = 8 (threshold = 1)
2025-06-02T03:24:56+0200 jwb0155.juwels pshealthcheck[184436]: [EE] ERROR: mlx5_2 remote port (LID
297, port 34): LinkDownedCounter = 8 (threshold = 1)
```

Examples

System Error Logs

Job Finalization Report

Job State: **FAILED**

Return Code: **0**

Signal Number: **9**

System Error Report

Msgs: **59**

Nodes: **59**

(Node Error)

This job has used approximately: 60 nodes × 48 cores × 11.328 hours = 32624.64 core-h

System Error Report

Msgs: **59**

Nodes: **59**

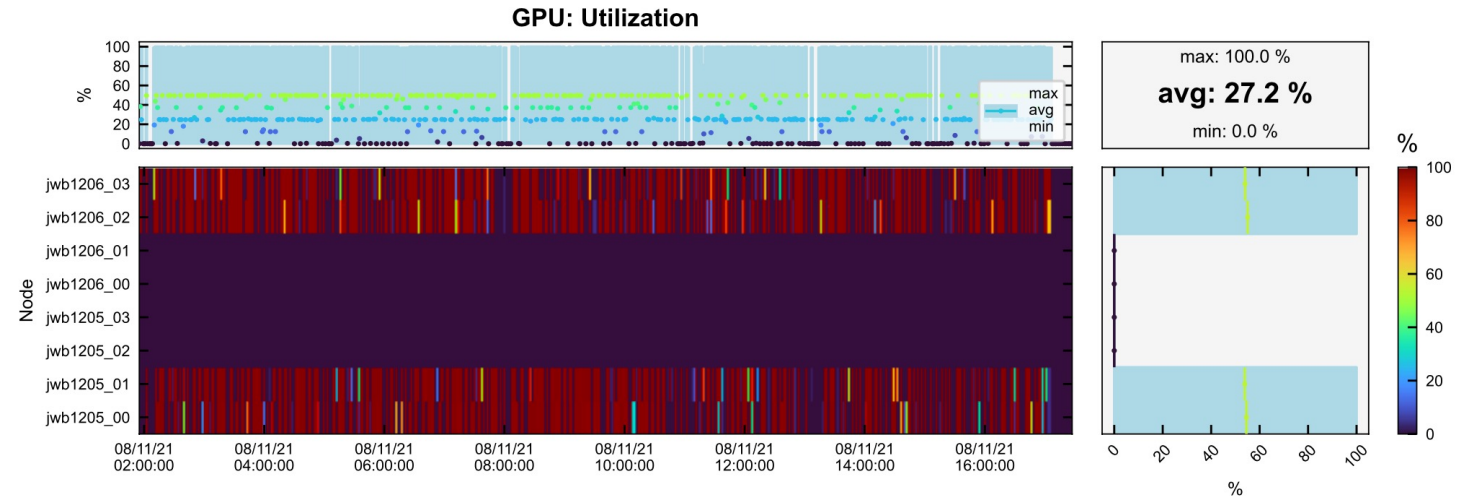
Error Messages:

```
2025-06-03T10:50:14+0200 jwb0011.juwels psid[63607]: psslurm: nodeDownAlloc: node 3764 in allocation
11584692 state A_RUNNING is down
2025-06-03T10:50:15+0200 jwb0025.juwels psid[80835]: psslurm: nodeDownAlloc: node 3764 in allocation
11584692 state A_EPILOGUE is down
2025-06-03T10:50:15+0200 jwb0036.juwels psid[62353]: psslurm: nodeDownAlloc: node 3764 in allocation
11584692 state A_EPILOGUE is down
2025-06-03T10:50:15+0200 jwb0041.juwels psid[64695]: psslurm: nodeDownAlloc: node 3764 in allocation
11584692 state A_EPILOGUE is down
2025-06-03T10:50:15+0200 jwb0054.juwels psid[62378]: psslurm: nodeDownAlloc: node 3764 in allocation
11584692 state A_EPILOGUE is down
```

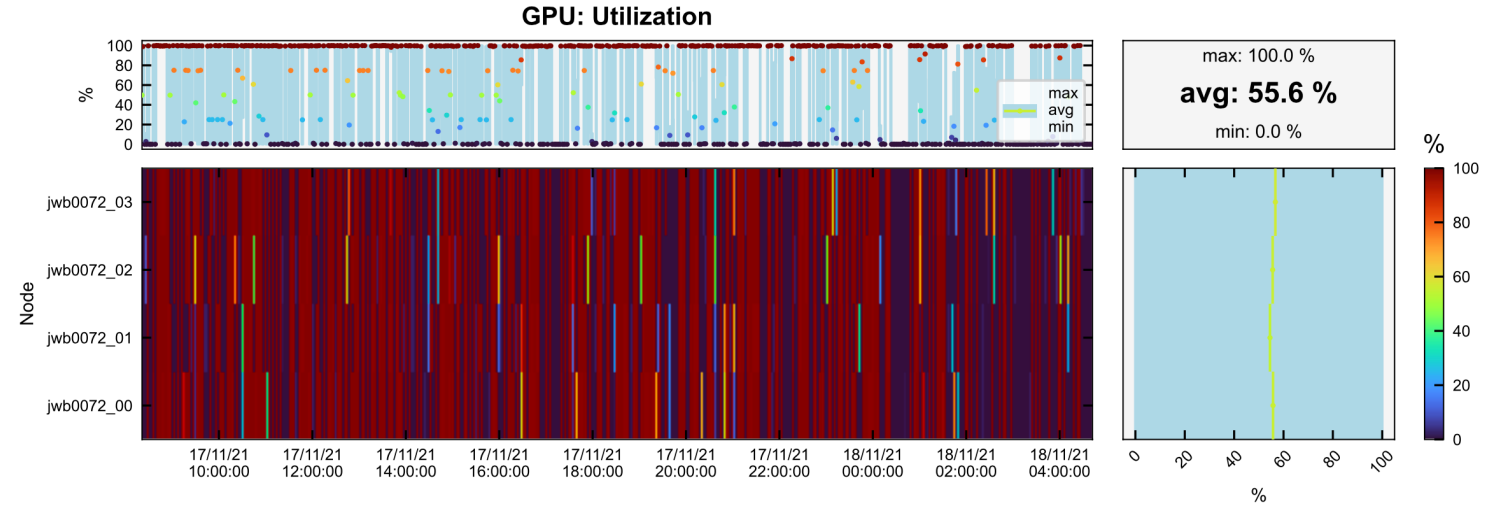
Examples

Inadequate Resource Usage

2 nodes (8 GPUs) using
only 2 GPUs each



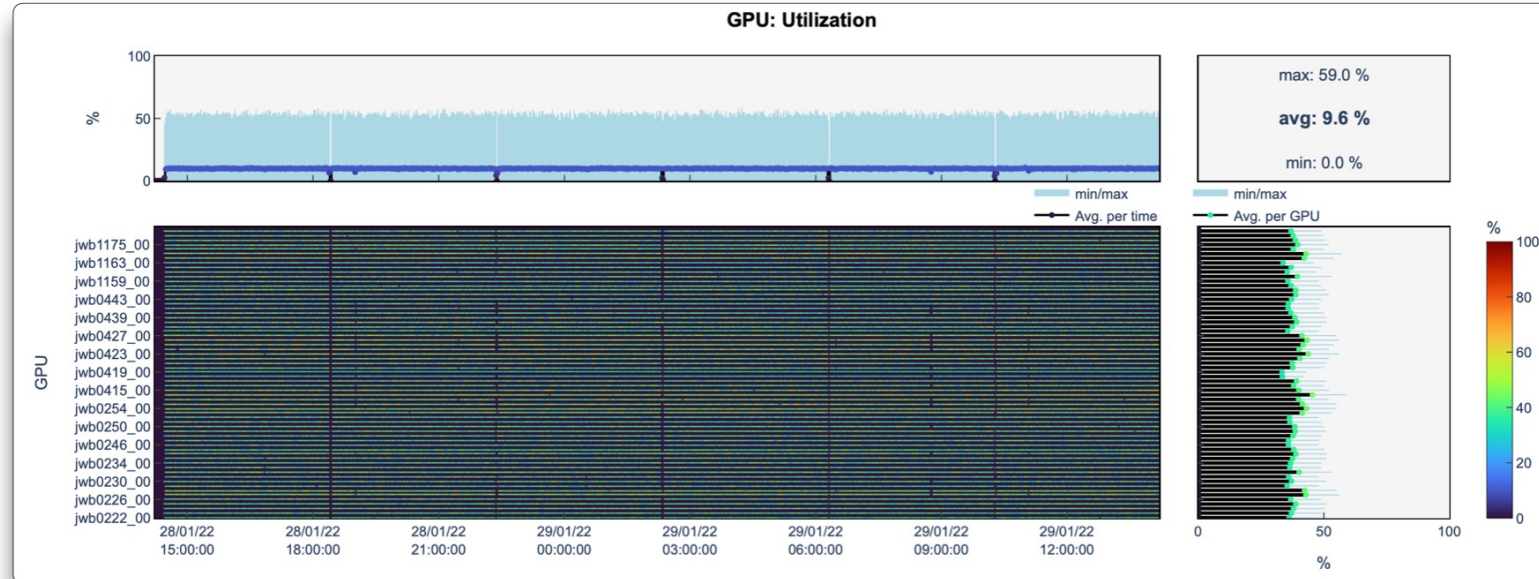
1 nodes using all 4 GPUs



Examples

Inadequate Resource Usage

1 GPU per node

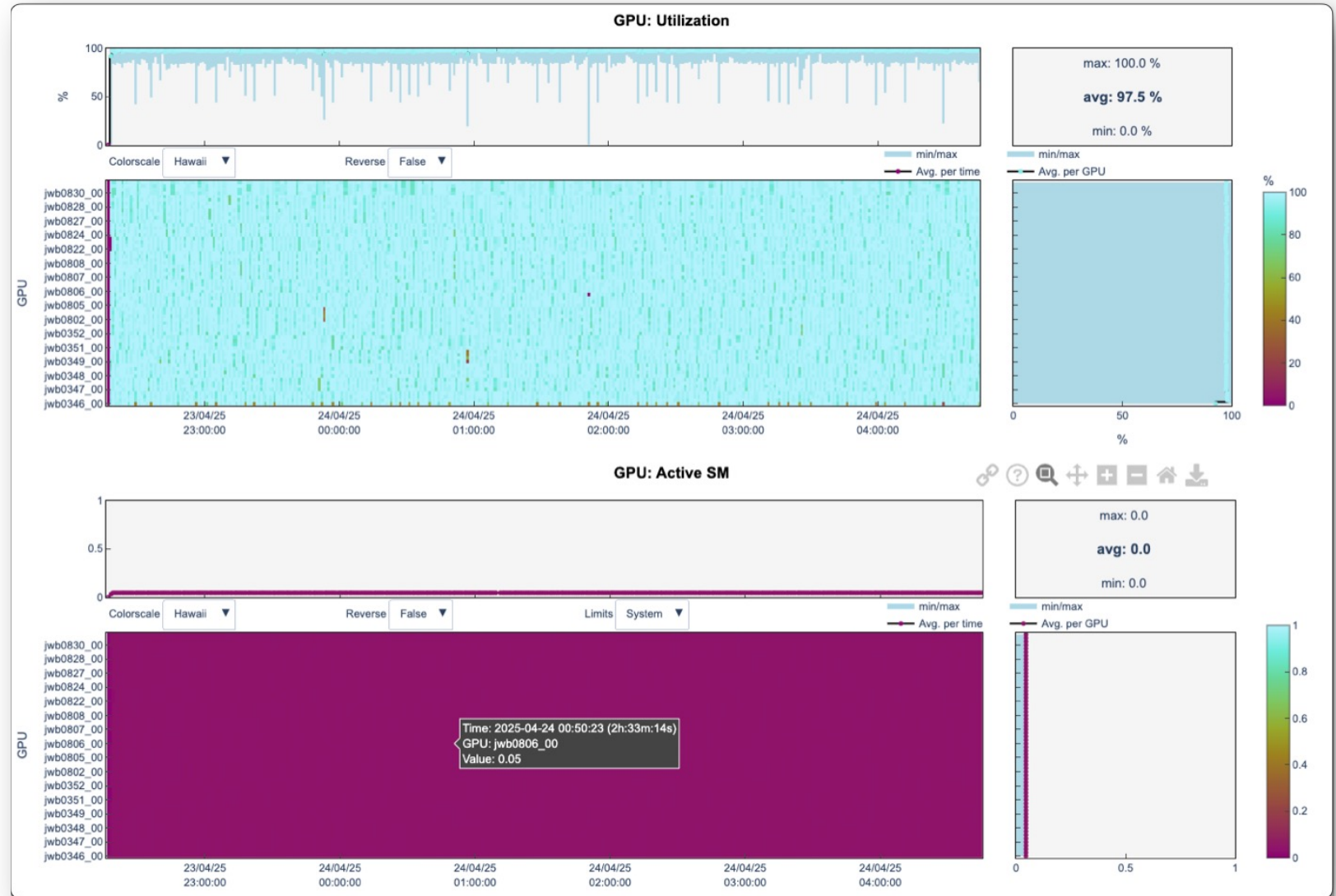


Examples

Inadequate Resource Usage

GPU Utilization ~100%

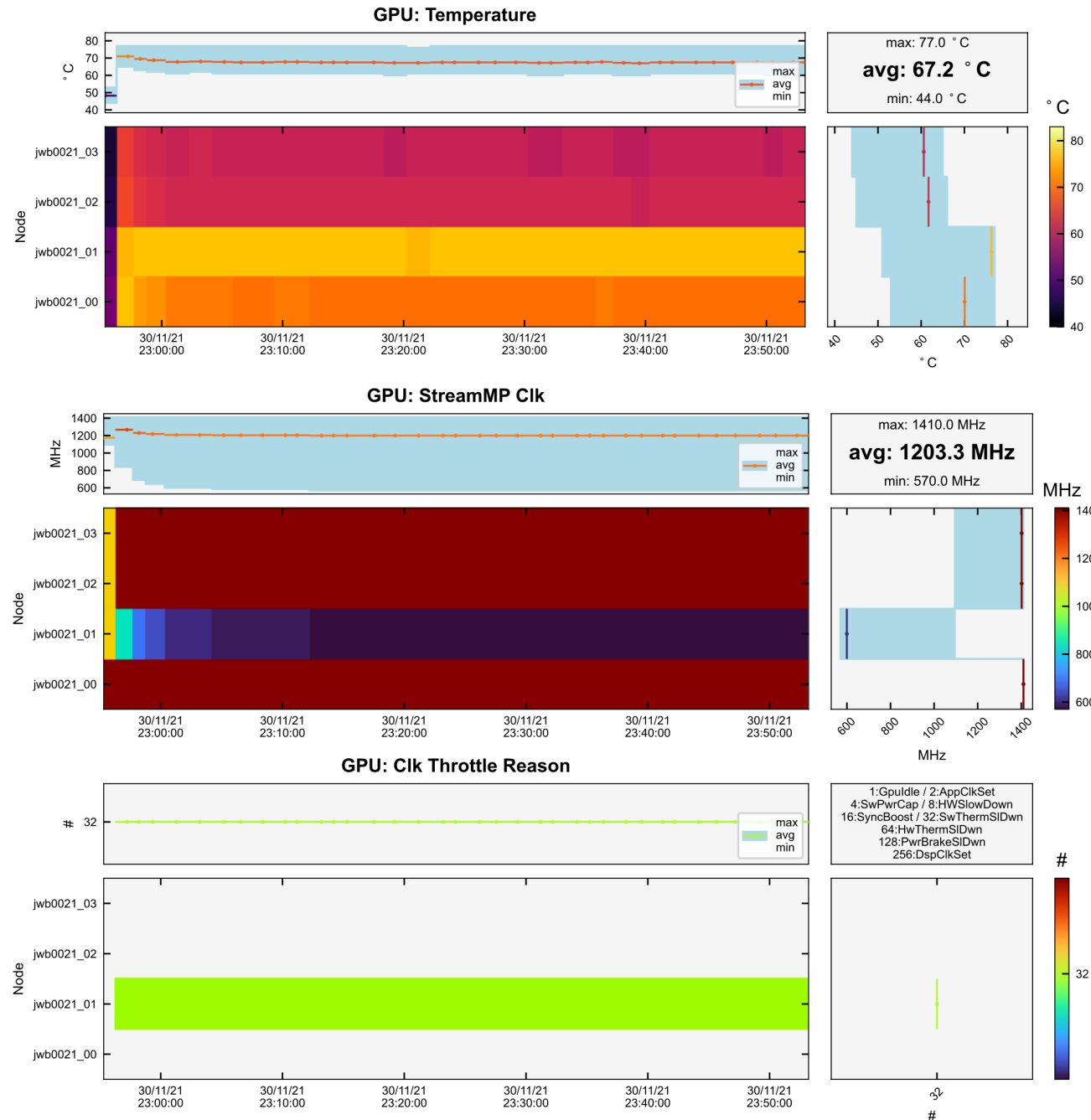
GPU Active SM ~5%



Examples

Hardware Issues

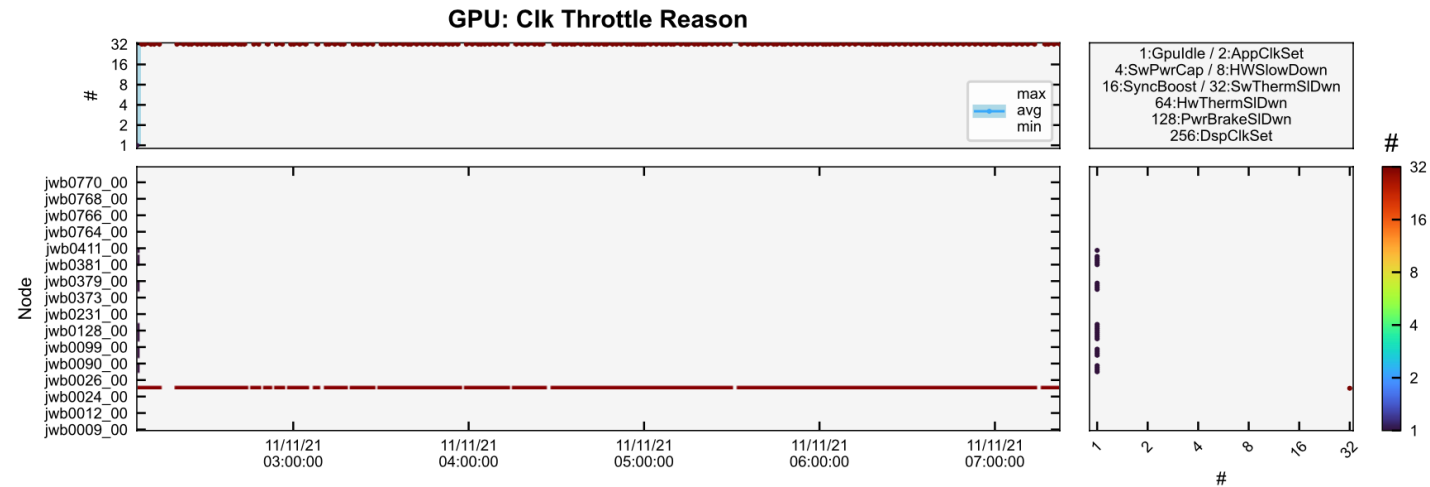
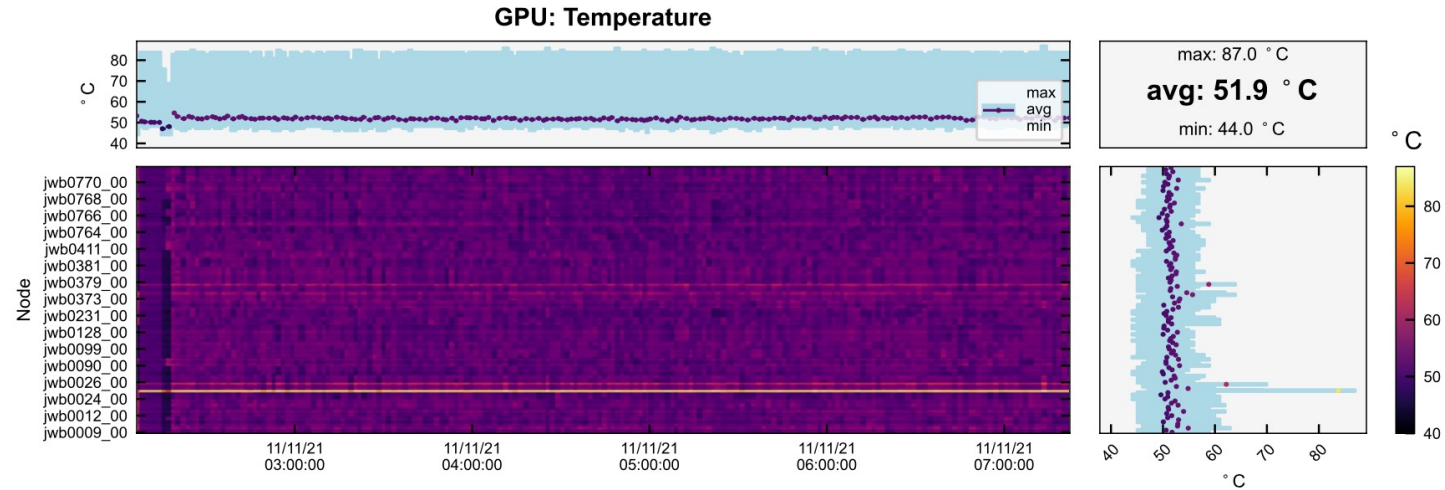
4 GPUs:



Examples

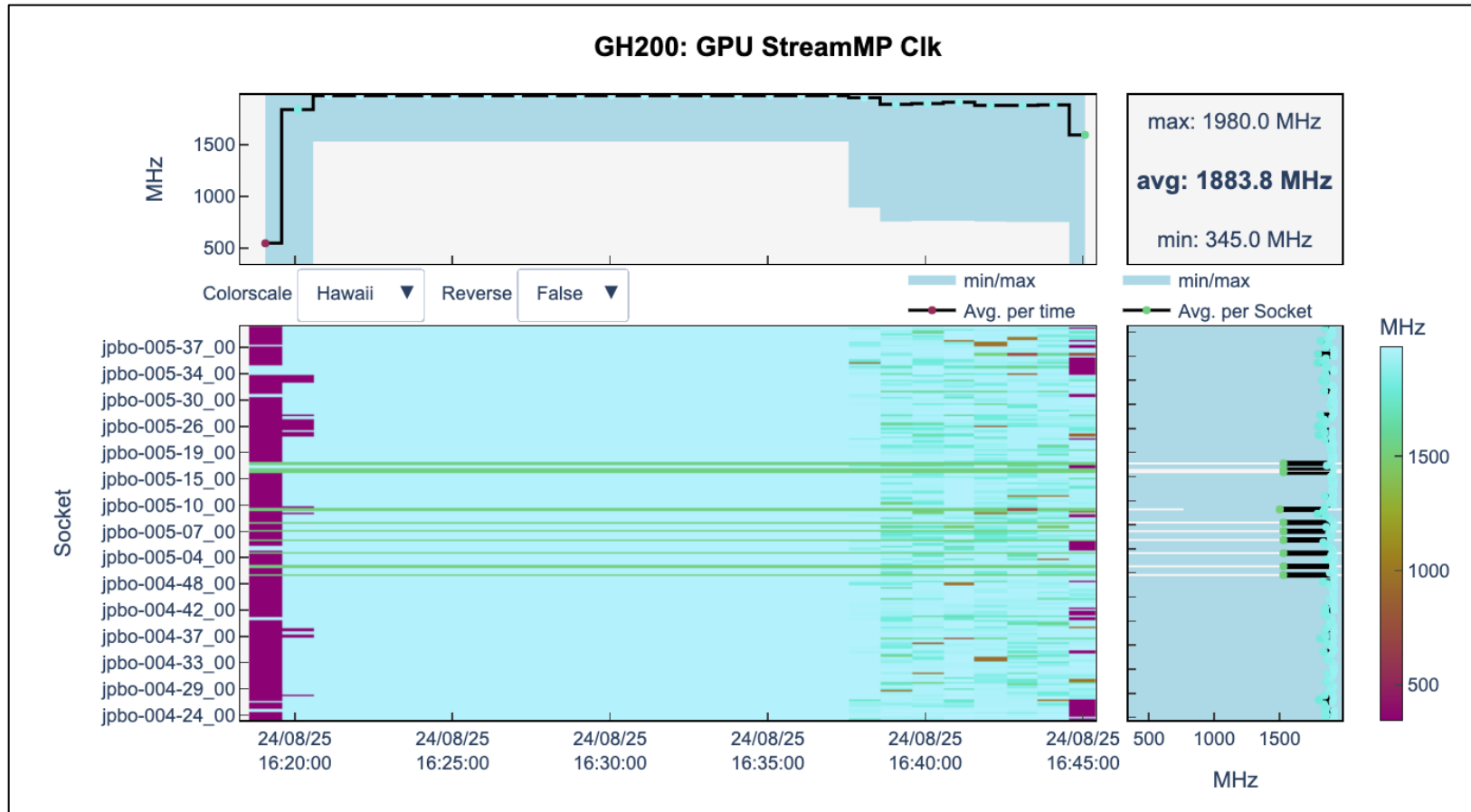
Hardware Issues

128 GPUs:



Examples

Low GPU Frequency



Current steps and Outlook

- Faster and optimized updates for JUPITER
 - Bigger cluster
 - Improved workloads
 - Optimized SQL queries
 - Further parallelization



Current steps and Outlook

- Faster and optimized updates for JUPITER

- Bigger cluster
- Improved workloads
- Optimized SQL queries
- Further parallelization



Current steps and Outlook

- Faster and optimized updates for JUPITER
 - Bigger cluster
 - Improved workloads
 - Optimized SQL queries
 - Further parallelization
- Generalisations, new metrics and data sources
- Queue view and analysis
- REST-API
- Long-term analysis
- Workflow and project reports
- ...



Conclusions

LLview...

- ...helps to identify (user and system) software and hardware issues
- ...enables users find problems on their own
- ...brings support to a higher level
- ...reduces the need for communication between users and support as well as support and admins
- ...improves the overall system utilisation
- ...is ready for exascale!

Conclusions

Thank you!

LLview...

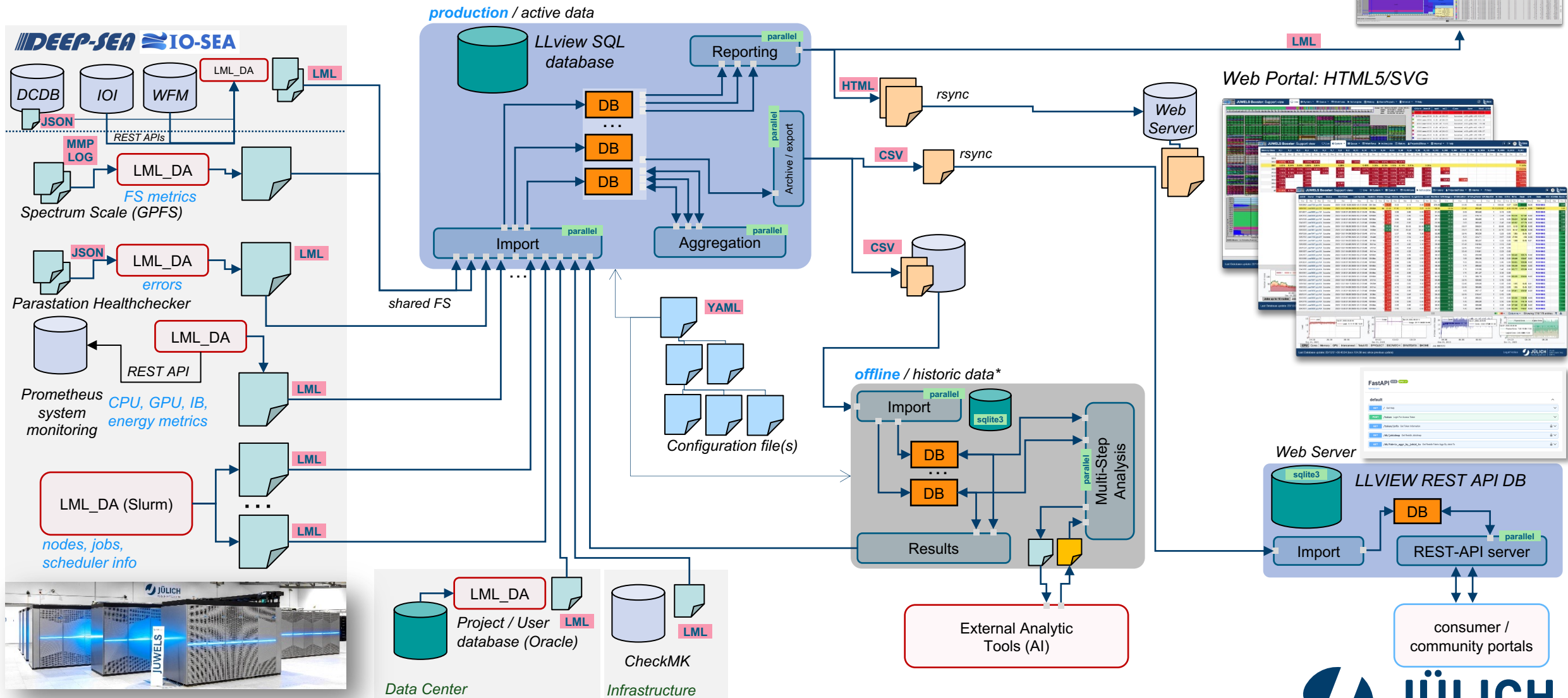
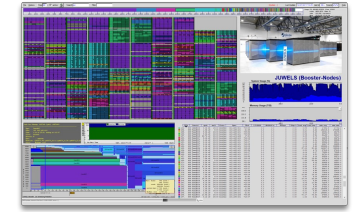
- ...helps to identify (user and system) software and hardware issues
- ...enables users find problems on their own
- ...brings support to a higher level
- ...reduces the need for communication between users and support as well as support and admins
- ...improves the overall system utilisation
- ...is ready for exascale!
- Open source GPLv3 Licence github.com/FZJ-JSC/llview
- Website: llview.fz-juelich.de
- Contact: llview.jsc@fz-juelich.de



Extra slides

Even More Detailed Scheme of LLview

LLview standalone clients



Examples

Inadequate Resource Usage

Usage	#Cores	#PhysCores	#LogicCores	Load	
<50	filter	filter	filter	filter	f
2.90	0.01	0.01	0.00	512.26	
1.37	0.37	0.27	0.10	477.35	
4.07	0.01	0.01	0.00	395.68	
0.68	0.00	0.00	0.00	158.31	
3.00	3.73	3.73	0.00	149.31	
18.90	23.98	23.98	0.00	128.64	
10.49	0.00	0.00	0.00	128.32	
18.91	24.00	24.00	0.00	127.77	
18.86	23.94	23.94	0.00	127.68	
18.88	23.98	23.98	0.00	127.68	
30.34	78.75	78.75	0.00	124.96	

Examples

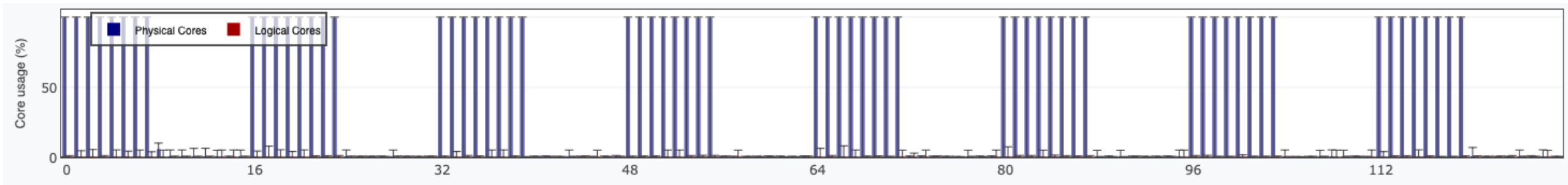
Inadequate Resource Usage

Usage	#Cores	#PhysCores	#LogicCores	Load	
<50	filter	filter	filter	filter	f
2.90	0.01	0.01	0.0	512.26	
1.37	0.37	0.27	0.1	477.35	
4.07	0.01	0.01	0.0	395.68	
0.68	0.00	0.00	0.00	158.31	
3.00	3.73	3.73	0.00	149.31	
18.90	23.98	23.98	0.00	128.64	
10.49	0.00	0.00	0.00	128.32	
18.91	24.00	24.00	0.00	127.77	
18.86	23.94	23.94	0.00	127.68	
18.88	23.98	23.98	0.00	127.68	
30.34	78.75	78.75	0.00	124.96	

Examples

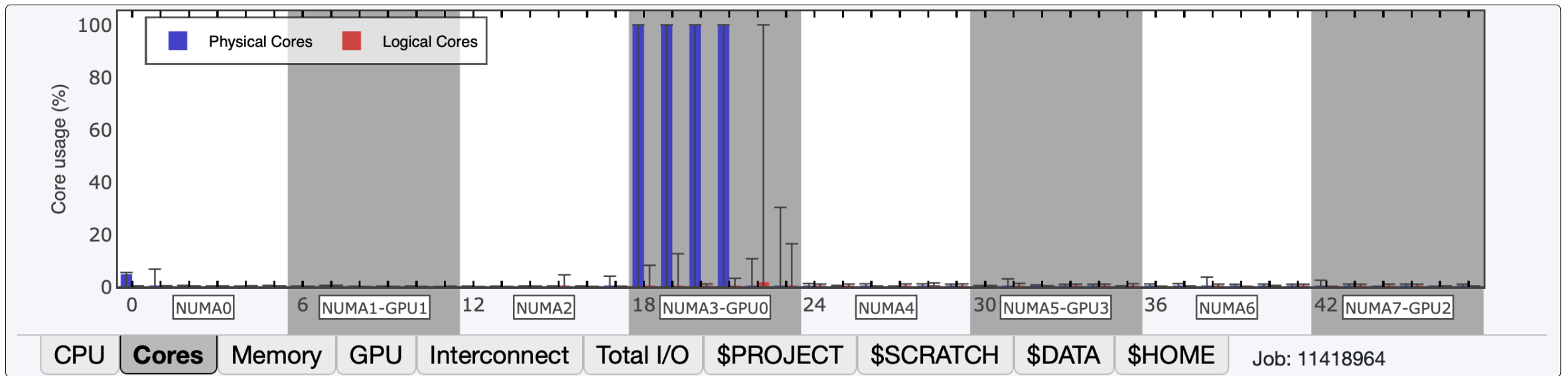
Inadequate Resource Usage

Usage	#Cores	#PhysCores	#LogicCores	Load
<50	filter	filter	filter	filter
2.90	0.01	0.01	0.0	512.26
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4.07	0.01	0.01	0.0	395.68
0.68	0.00	0.00	0.00	158.31
3.00	3.73	3.73	0.00	149.31
18.90	23.98	23.98	0.00	128.64
10.49	0.00	0.00	0.00	128.32
18.91	24.00	24.00	0.00	127.77
18.86	23.94	23.94	0.00	127.68
18.88	23.98	23.98	0.00	127.68
30.34	78.75	78.75	0.00	124.96



Examples

Inadequate Resource Usage



Examples

Inadequate Resource Usage

