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- Why do we need an instance inventory?
- Device Registry
- Instance Value
- Data Storage Cost
- Summary & Outlook

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Why III ?

Instance Inventory Implementation

3

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EOS

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- **EOS** didn't provide a good estimator for cost & value of data and

3

Device Registry

Device Registry

- Each device which has ever had an assigned filesystem id in **EOS** is now forever tracked under

`/eos/<instance>/proc/devices/<device-id>.<fs-id>`

```
rw-r--r--    0 root      root                 0 Nov 28 13:20 59F0A16NF95G.27779
rw-r--r--    0 root      root                 0 Nov 28 13:20 59F0A16SF95G.27786
rw-r--r--    0 root      root                 0 Nov 28 13:20 59F0A19YF95G.27768
rw-r--r--    0 root      root                 0 Nov 28 13:20 59F0A1CXF95G.27778
rw-r--r--    0 root      root                 0 Nov 28 13:20 59F0A1FMF95G.27784
rw-r--r--    0 root      root                 0 Nov 28 13:20 59F0A1FNF95G.27788
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```

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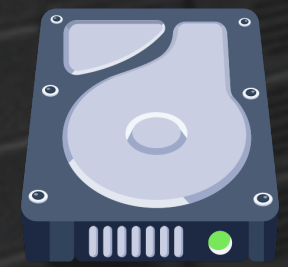
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```
EOS Console [root://localhost] |/eos/cms/proc/devices/> attr get sys.smart.status Z6L4K81EFTMB.23300
sys.smart.status="OK"
```

Device S.M.A.R.T. information collection
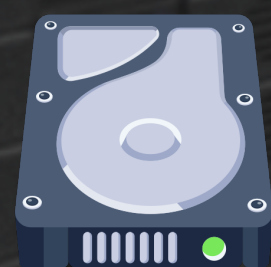
FST

FST

Shared Hash

MGM

*to be changed to hourly or daily

5

Hard disk icons created by vectorsmarket15 - Flaticon

Device S.M.A.R.T. information collection

smartctl -x -j

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FST

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EOS

CERN
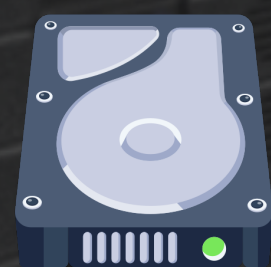
smartctl -x -j

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stat.health.z64smart   := zbase64:MDAwMGEzMjl4nO1d5XPbOBa+51egdOqpshyuktg3t6zEqfGSkZROzXSlWDAJSexwKyGW3V357wOAG0iBWixaNjvMIaYIEHjA9zaAD49/vwOg92foufrCCxwY6r
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FST

compressed + b64 encoded JSON

at startup of FST and then every
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Shared
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jt9R+Z6z+L6/cmengfmobXKw0IPVqRHkYwikPcLhnsDzpHuLZloGKGXOiQX0wzaQOEXH2jFPwxu5h/y+pETz4tDmGUT1bgRZ7hEQx6F/0LXt6x45nIzhv8ejkG40uXq6EkKqJycT0ZXCfT1QtRYEFcMXbuUUCqatdXV4P
mxeu1yxIPBO817dqLLfxLloZKNgQT/xZfQZAFWR1pak7LwgqcNQwQwIK968uPt1+layHpJsZk6Ab0oWFFT0WH9xi772RCpaGsKMO8okmjDO5nCJESUREEQRW1gSKLB1Dv0vaWFoZdpy3ooFUXmQZV1Gihv3oKN0sVQRvQ
MMJk6gGM5MFQEoRkHIQrF9CIvKCgEUZQf4B2TGpKZ2WUSXMVWK6xwpTm1FmunnGbbuKH72FI6i6gHSJagTaYT1TaSxgF1ruKKI9nfekMYLBHfXwWkSqL8XhxoWv8SZBIFc1Fw4J9ekJMnCpKQFVguU6CIOXnhju4xP14A+
siHrqrMECMU4HlCeugjZBbNOPAx/5H31RGn5DJW9DY4F8DH+/dhIX+xa0Wh7mN2CZHhuaTxgZCX3mefpBodcfqPVviR0mzEQYDcqJYU+eUpYRiVMGJkOYySIL90+tBQEMWhMhxlsMHQSKv25jECt94DkEZAlH+V5V8FAU
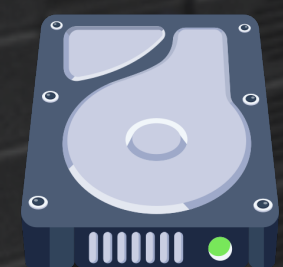
FST

compressed + b64 encoded JSON

at startup of FST and then every hour

Shared Hash
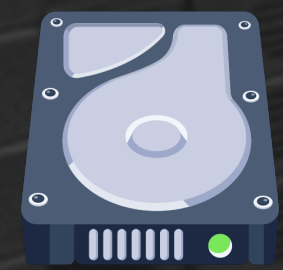
Devices Thread

MGM

Device MEM Table

FST

5

EOS Workshop 21 – EOS III - Dr. Andreas-Joachim Peters

Hard disk icons created by vectorsmarket15 - Flaticon

Device S.M.A.R.T. information collection
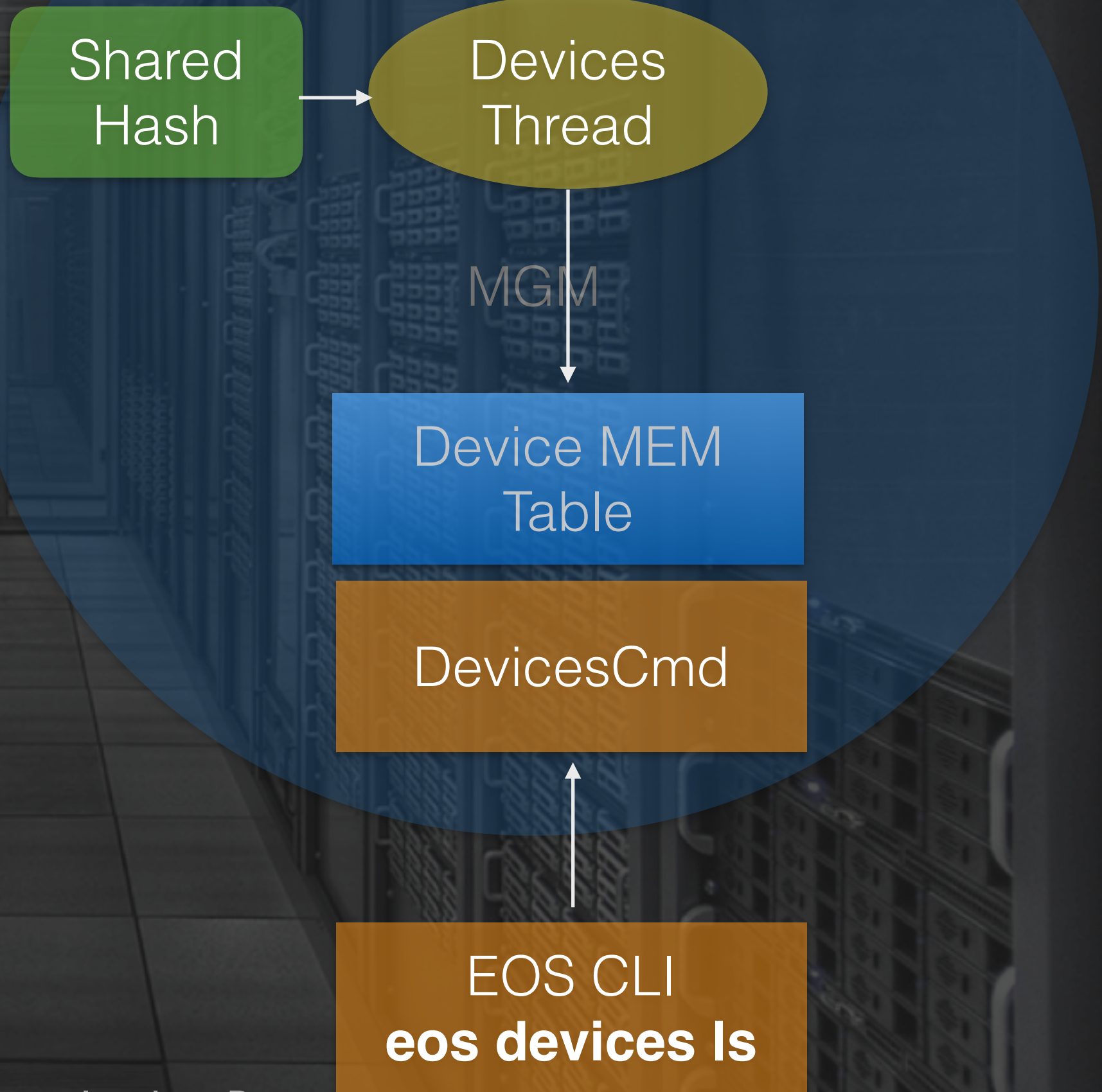
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C3P7f0K/sBFAIhn9I+A//9GLnuhA4PIiGxc429a1Ks+AsDwLL0Q6N9vyc9e+ODqAXqw0to9ZTSSe2mZb80IkKBb7sIjhY+jgT5Q+rblxo99+VwUzoW+KA6E8+HgXDxH9vA8qZE1cB9btpk//YvtGdAG90a/siowWD4wVB
jt9R+Z6z+L6/cmengfmobXKw0IPVqRHkYwikPcLhnsDzpHuLZloGXGXO1QX0wzaQOEXH2jFPwxu5h/y+pETz4tDmGUT1bgRZ7hEQx6F/OLXt6x45nIzhv8ejkG40uXq6EkKqJycT0ZXCfT1QtRYEFcMXbuUUCqatdXV4P
mxeulyxIP80817dqLLfxLloZKNgQT/xZFQZAFWR1pak7LwgqcNQwQw1K968uPt1+LayHpJsZk6Ab0oWfFT0wH9x1772RCpaGsKMOBokmjDO5nCJESUREEQRW1gSKL81Dv8vaWFoZdpy3ooFUXmQZV1Gihv3oKN0sVQRvQ
MMJk6gGM5MFQEoRkHIQrF9CIvKCgEUZQf4B2TGpKZ2WUSXMVWK6xwpTmlFmunnGbbuKH72FI6i6gHSJagTaYT1Ta5xqF1ruAKI9nfekMYLBHfXwAk5qL8XhxoWv8SZBIFcLFwAJ9ekJMnCpKQFVguU6C1OXnhju4xP14A+
siHrqrMECMU4HlCeugjZBbNOPAx/5H31RGn5DJW9DY4F8DH+/dhIX+xa0Wh7mN2CZHhuaTxgZCX3mefpBodcfqPVviR0mzEQYDcqJYU+eUpYRiVMGJkOYySIL90+tBQEMWhMhxlsMHQSKv25jECt94DkEZAlH+V5V8FAU

FST → compressed + b64 encoded JSON → Shared Hash → Devices Thread

at startup of FST and then every hour

FST

MGM

Device MEM Table

DevicesCmd

EOS CLI
eos devices ls

*to be changed to hourly or daily

5

EOS Devices CLI
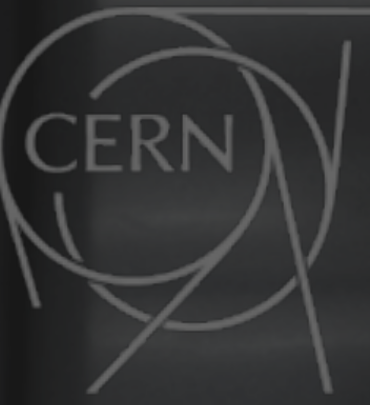
Summary mode: **eos devices ls**

EOS Devices CLI

Summary mode: **eos devices ls**

space	model	avg:age[years]	bytes	count	hours	smrt:ok	smrt:noctl	smrt:na	smrt:failing	smrt:check	smrt:inval	smrt:unknown
default	HGST:HMS5C4040BLE640	8.70	900.18 TB	225	17.14 Mh	225	0	0	0	0	0	0
default	HGST:HUH721212ALE600	4.50	6.23 PB	519	20.46 Mh	519	0	0	0	0	0	0
default	HGST:HUS724020ALA640	8.74	26.01 TB	13	995.09 Kh	13	0	0	0	0	0	0
default	HGST:HUS726040ALE610	2.32	4.00 TB	1	20.33 Kh	1	0	0	0	0	0	0
default	HGST:HUS726060ALE610	6.51	10.53 PB	1.75 K	100.07 Mh	1754	0	0	0	0	0	0
default	HGST:HUS726060ALE614	4.41	42.01 TB	7	270.25 Kh	7	0	0	0	0	0	0
default	HGST:HUS726T6TALE6L4	3.54	24.00 TB	4	124.03 Kh	4	0	0	0	0	0	0
default	INTEL:SSDSC2BB960G7	6.60	48.97 TB	51	2.95 Mh	51	0	0	0	0	0	0
default	ST4000NC001-1FS168	8.03	640.13 TB	160	11.25 Mh	160	0	0	0	0	0	0
default	ST4000NM0035-1V4107	5.30	20.00 TB	5	232.36 Kh	5	0	0	0	0	0	0
default	ST4000NM0115-1YZ107	5.28	4.00 TB	1	46.23 Kh	1	0	0	0	0	0	0
default	TOSHIBA:MG04ACA600E	6.53	10.08 PB	1.68 K	96.06 Mh	1679	0	0	0	0	0	0
default	TOSHIBA:MG06ACA600E	3.64	12.00 TB	2	63.77 Kh	2	0	0	0	0	0	0
default	TOSHIBA:MG07ACA12TE	3.90	47.28 PB	3.94 K	134.56 Mh	3940	0	0	0	0	0	0
default	TOSHIBA:MG07ACA14TE	2.25	4.00 PB	286	5.62 Mh	286	0	0	0	0	0	0
default	WDC::WUH721414ALE6L4	2.11	25.31 PB	1.81 K	33.46 Mh	1808	0	0	0	0	0	0
default	WDC::WUH721818ALE6L4	0.91	3.44 PB	191	1.51 Mh	191	0	0	0	0	0	0

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EOS Devices CLI

Details mode: **eos devices ls -l**

EOS Devices CLI

Details mode: **eos devices ls -l**

default	model	serial	type	capacity	rpms	poweron[h]	temp[degrees]	S.M.A.R.T	if	rla	wc
15425	INTEL:SSDSC2BB960G7	PHDV648501Z6960FGN	sat	960.20 GB	0	58.06 Kh	18	ok	6.0:Gb/s	true	true
15426	HGST:HUS726060ALE610	NCHEV6BS	sat	6.00 TB	7200	57.75 Kh	29	ok	6.0:Gb/s	true	true
15427	HGST:HUS726060ALE610	K1HAP7DB	sat	6.00 TB	7200	57.75 Kh	28	ok	6.0:Gb/s	true	true
15429	HGST:HUS726060ALE610	K1HD72WD	sat	6.00 TB	7200	57.75 Kh	29	ok	6.0:Gb/s	true	true
15431	HGST:HUS726060ALE610	NCHE4SUS	sat	6.00 TB	7200	57.75 Kh	29	ok	6.0:Gb/s	true	true
15433	HGST:HUS726060ALE610	NCHEV7ZS	sat	6.00 TB	7200	57.75 Kh	30	ok	6.0:Gb/s	true	true
15435	HGST:HUS726060ALE610	K1HEEHVD	sat	6.00 TB	7200	57.75 Kh	30	ok	6.0:Gb/s	true	true
15437	HGST:HUS726060ALE610	K1HE412D	sat	6.00 TB	7200	57.75 Kh	31	ok	6.0:Gb/s	true	true
15439	HGST:HUS726060ALE610	K1HBS9ZB	sat	6.00 TB	7200	57.75 Kh	31	ok	6.0:Gb/s	true	true
15441	HGST:HUS726060ALE610	NCHEV4HS	sat	6.00 TB	7200	57.75 Kh	30	ok	6.0:Gb/s	true	true
15443	HGST:HUS726060ALE610	K1HDMBED	sat	6.00 TB	7200	57.75 Kh	31	ok	6.0:Gb/s	true	true
15445	HGST:HUS726060ALE610	NCHEV61S	sat	6.00 TB	7200	57.75 Kh	30	ok	6.0:Gb/s	true	true
15447	HGST:HUS726060ALE610	NCHENHSS	sat	6.00 TB	7200	57.75 Kh	31	ok	6.0:Gb/s	true	true
15449	HGST:HUS726060ALE610	K1H9D21D	sat	6.00 TB	7200	57.75 Kh	29	ok	6.0:Gb/s	true	true
15451	INTEL:SSDSC2BB960G7	PHDV648502JC960FGN	sat	960.20 GB	0	58.06 Kh	19	ok	6.0:Gb/s	true	true
15452	HGST:HUS726060ALE610	K1HAN32B	sat	6.00 TB	7200	57.75 Kh	30	ok	6.0:Gb/s	true	true
15454	HGST:HUS726060ALE610	K1HE8Y0D	sat	6.00 TB	7200	57.75 Kh	30	ok	6.0:Gb/s	true	true

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EOS Devices CLI

Instance **Value** output: **eos devices ls**

Cost-Matrix	TB*Years	Avg-Drive-Hours	Tot-Drive-Hours	Cloud$-Replica	Cloud$-Erasure
▮▮▮▮▮▮	426.26 K	39.91 K	424.84 M	53.28 M$	88.81 M$

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- the longer disks are running, the more value they create!
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  - replication factor configurable (default 2)
  - erasure coding overhead configurable (default 1.2 = RS 10+2)

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EOS Physics Instances

[10th of march]

Instance	Drive Hours	TB*Years
eosams	92 Mh	132k
eosalice	440 Mh	441k
eosaliceo2	222 Mh	364k
eosatlas	416 Mh	388k
eoscms	344 Mh	326k
eoslhcb	166 Mh	207k
eospilot	18 Mh	17k
eospublic	365 Mh	357k
SUM	2,061 Gh	2,232M

EOS Data Storage Inventory

How to bill users … using `eos inspector ls`

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- **cost** of currently stored data **by**
  - **user**
    - *on disk*
    - *on tape*
  - group
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COST/file = **Age**(y) * Physical**Size**[TB] * **Price** [$/TB/y]

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EOS Data Storage Inventory

Volume output: **eos inspector ls**

```
========================================================================
Storage Bytes — User View [ disk ]
------------------------------------------------------------------------
Total Bytes : 80.63 PB
------------------------------------------------------------------------
01. atlas003                          : 53.63 PB
02. atlascdr                          : 10.30 PB
03. atltzp1                           : 9.41 PB
04.       ada                         : 613.64 TB
05.       lib                         : 320.16 TB
06.                                   : 301.88 TB
07.                                   : 199.13 TB
08.      i                            : 147.88 TB
09.       uch                         : 133.71 TB
10. beastsrv                          : 120.85 TB
```

EOS Data Storage Inventory

Cost output: eos inspector ls

```
==========================================================================
Storage Costs – User View [ disk ]
--------------------------------------------------------------------------
Total Costs : 195.02 kEOS
--------------------------------------------------------------------------

01. atlas003                              : 112.10 kEOS
02. wguan                                 : 17.70 kEOS
03. atltmp1                               : 6737 EOS
04. jt                                    : 4213 EOS
05. jb                                    : 1736 EOS
06. 40                                    : 1683 EOS
07. 77                                    : 1519 EOS
08. 16                                    : 1213 EOS
09. 16                                    : 1177 EOS
10. clstr                                 : 1137 EOS
```

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EOS Data Storage Inventory

Cost output: **eos inspector ls**

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Storage Costs — User View [ disk ]
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✓CLI allows to retrieve values for all users …

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✓Currency can be changed to EUR, CHF, US$, YEN
✓Disk & Tape PRICE/TB/YEAR can be configured or can be reported neutrally as TB/y

Summary & Outlook

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- Devices interface gives you insight into your hardware and it's value

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- option could be to create monthly billing report per *user/group/app* about IO and meta-data usage, quota & occupancy

December 2023
Here is your monthly EOS invoice

# Files	**1.8 M**
# Directories	**204k**
Cost of your currently stored data	**1.503 EOS**
Cold data	**89%**
meta-data usage	**1.3 M OPS**
EGRESS	**15.3 TB**
INGRESS	**3.5 TB**

Advice: archive your cold files !

Sincerely CERN-IT Cost Working Group

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Try it out!

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Sincerely CERN-IT Cost Working Group

Useful Links

Web Page   https://eos.cern.ch

GITLAB Repository   https://gitlab.cern.ch/dss/eos

GITHUB Mirror   https://github.com/cern-eos/eos
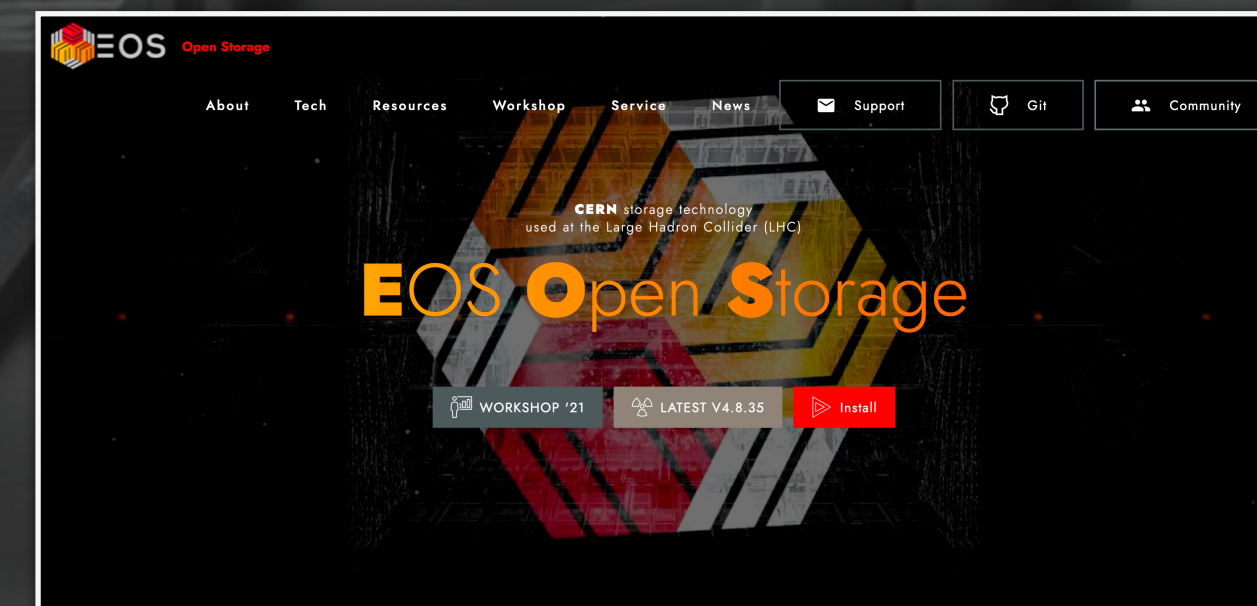
Community Forum   https://eos-community.web.cern.ch/
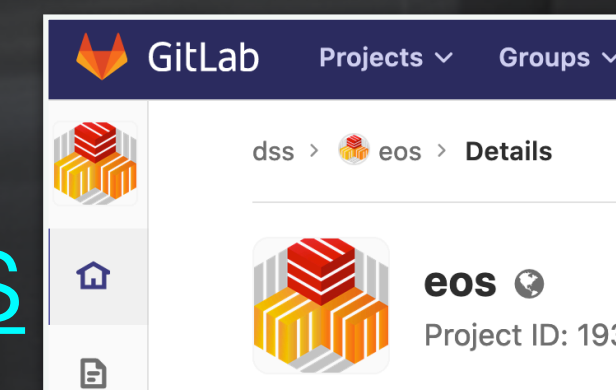
email: eos-community@cern.ch

Documentation   http://eos-docs.web.cern.ch/eos-docs/
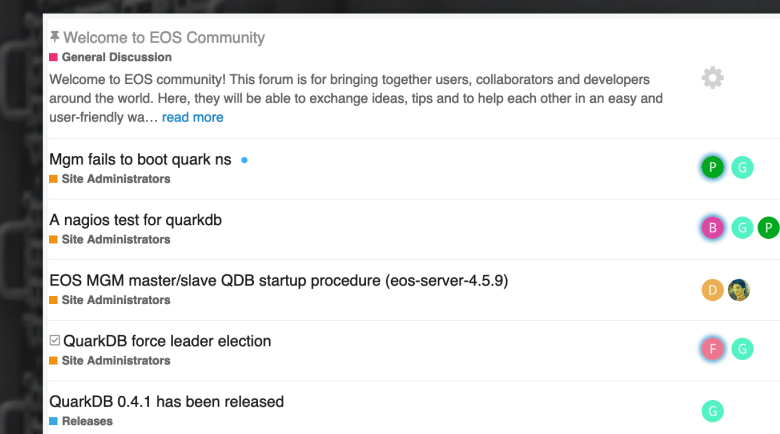
Support   email: eos-support@cern.ch

Thank you for your attention!
Questions?