KoALICE National Workshop 2021

JBOD disk monitoring system using smartmon

2022. 1. 7

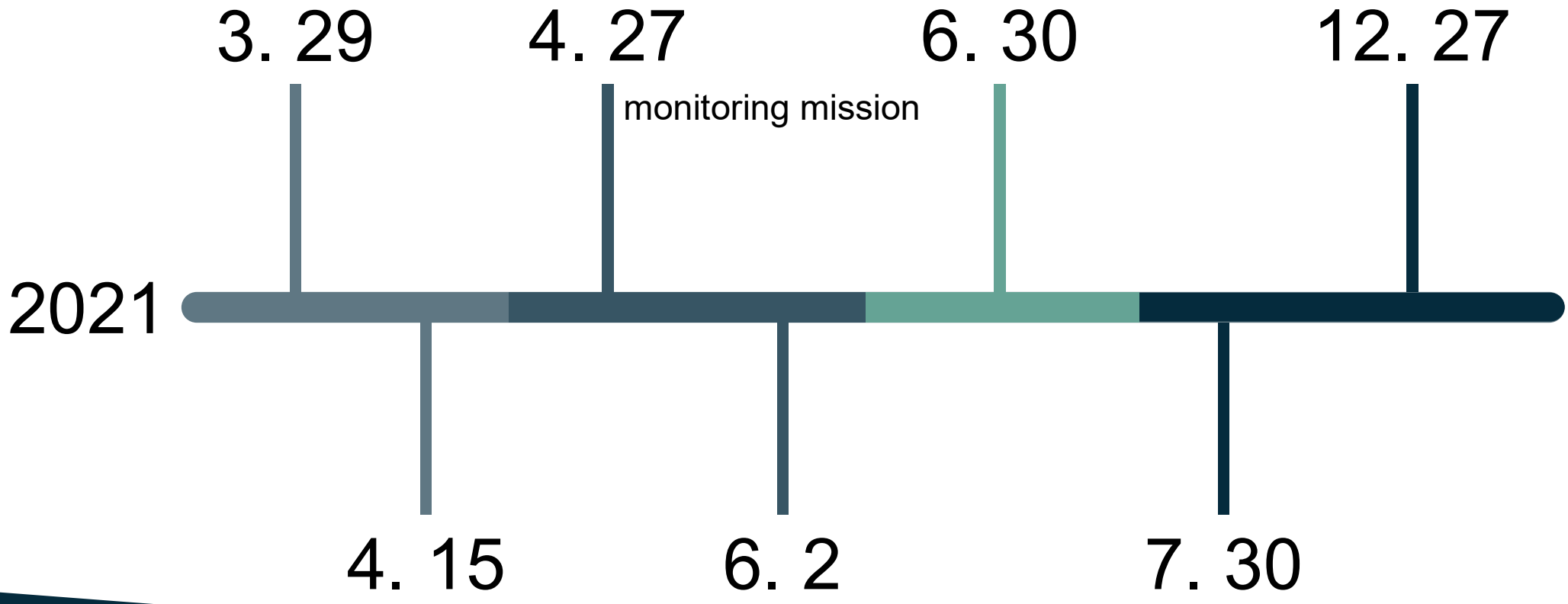
Chungbuk National University
Data Computing Laboratory
Kyeong-Jun Kim

Contents

Meetings in 2021

Meetings in 2021

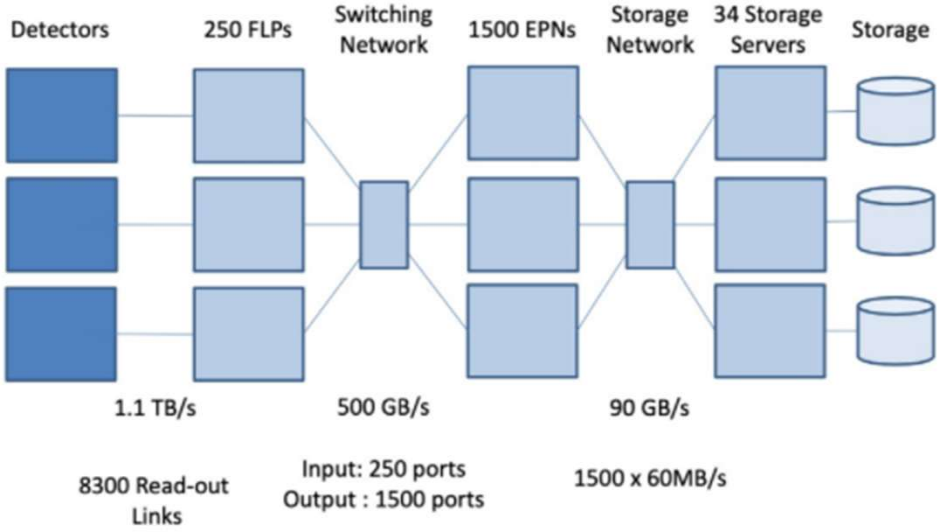
- with KISTI, CERN - Latchezar

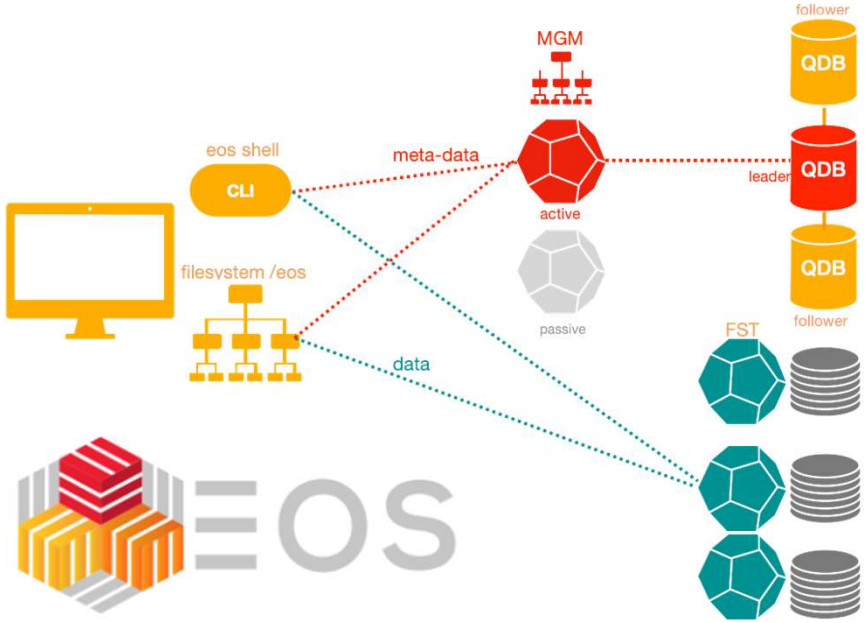


Purpose

Purpose

- Establishment of monitoring system
  1. implementation of monitoring system without smartctl command
  2. To create a prom file with minimal attributes label
  3. To add log backup function
  4. To expect disk failure – next work





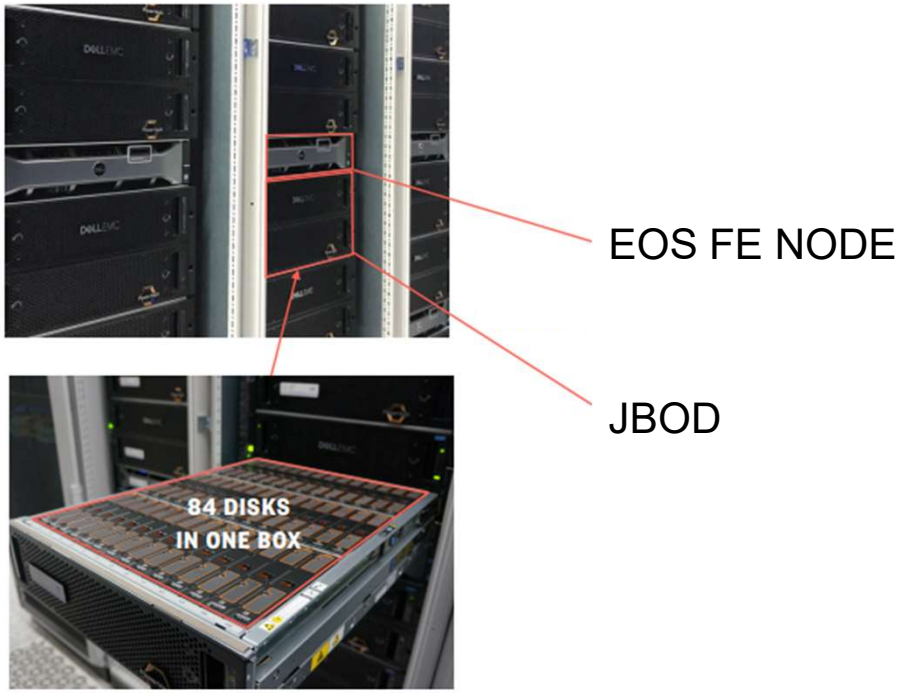
Purpose

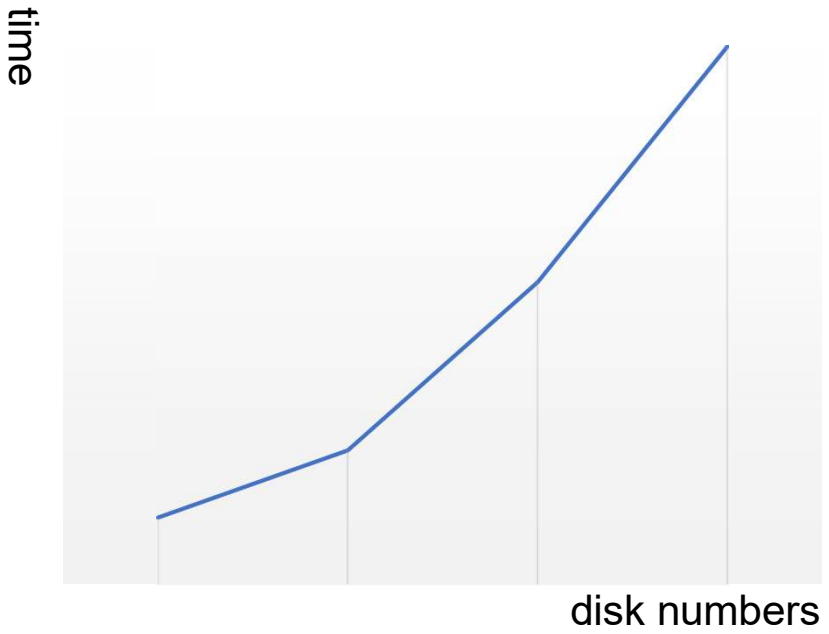
1. implementation of monitoring system without smartctl command
   - using smartctl is simple and easy but can't be used in production level

ID#	ATTRIBUTE_NAME	FLAG	VALUE	WORST	THRESH	TYPE	UPDATED	WHEN_FAILED	RAW_VALUE
1	Raw_Read_Error_Rate	0x0000	100	100	000	Old_age	Offline	-	0
5	Reallocated_Sector_Ct	0x0000	100	100	000	Old_age	Offline	-	0
9	Power_On_Hours	0x0000	100	100	000	Old_age	Offline	-	4342
12	Power_Cycle_Count	0x0000	100	100	000	Old_age	Offline	-	421
148	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	1164
149	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	103
150	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	40
151	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	77
159	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	0
160	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	0
161	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	43
163	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	14
164	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	36611
165	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	91
166	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	37
167	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	78
168	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	1500
169	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	95
177	Wear_Leveling_Count	0x0000	100	100	050	Old_age	Offline	-	0
181	Program_Fail_Cnt_Total	0x0000	100	100	000	Old_age	Offline	-	0
182	Erase_Fail_Count_Total	0x0000	100	100	000	Old_age	Offline	-	0
192	Power-Off_Retract_Count	0x0000	100	100	000	Old_age	Offline	-	34
194	Temperature_Celsius	0x0000	100	100	000	Old_age	Offline	-	40
195	Hardware_ECC_Recovered	0x0000	100	100	000	Old_age	Offline	-	0
196	Reallocated_Event_Count	0x0000	100	100	016	Old_age	Offline	-	0
199	UDMA_CRC_Error_Count	0x0000	100	100	050	Old_age	Offline	-	0
232	Available_Reservd_Space	0x0000	100	100	000	Old_age	Offline	-	100
241	Total_LBAs_Written	0x0000	100	100	000	Old_age	Offline	-	120781

Purpose

1. implementation of monitoring system without smartctl command
   - running smartctl command per disks consumes much time



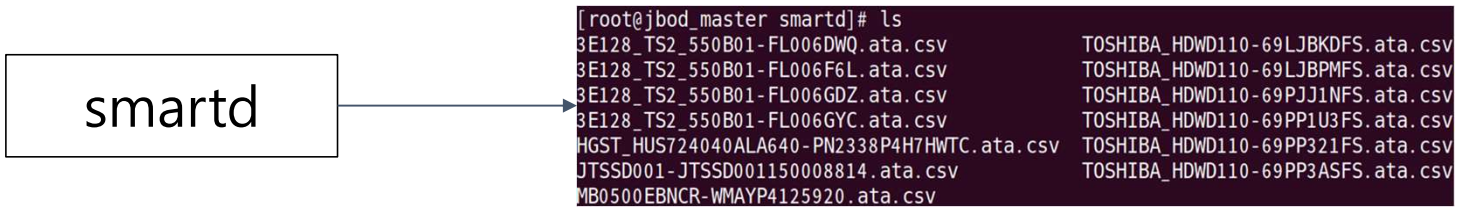


Purpose

1. implementation of monitoring system without smartctl command
   - solution : using smartd

```
smartd -A /var/log/smartd/attributes/ -i 60
```

   - smartd adds per disks attributes every 60 second

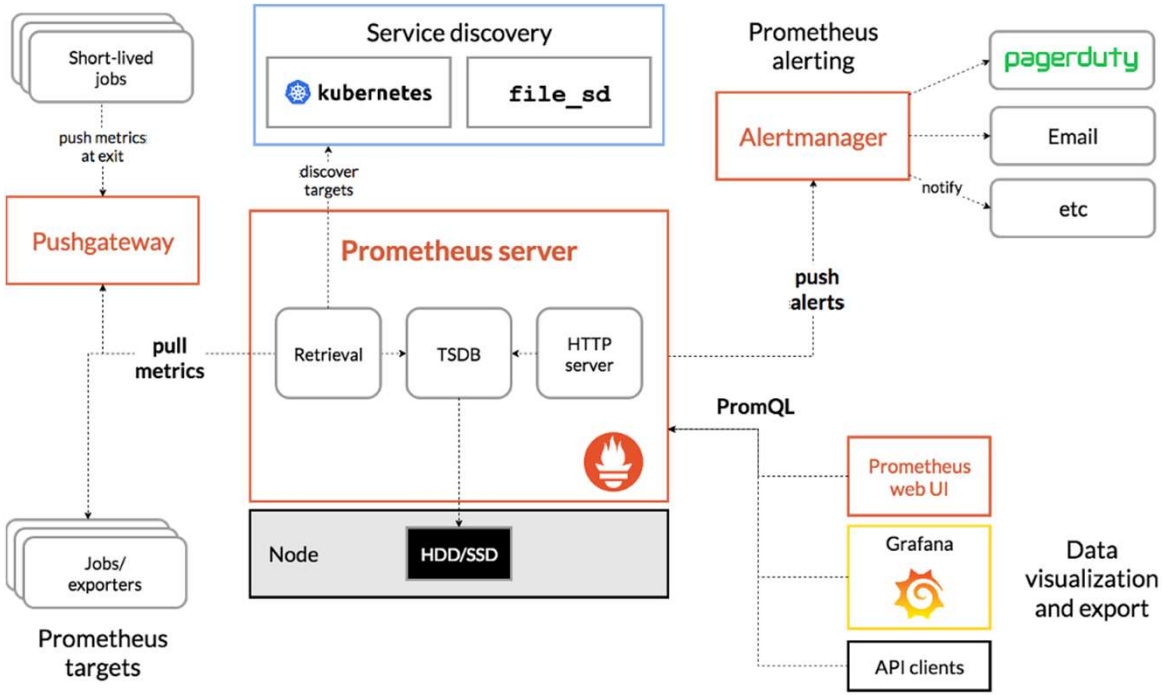


1. run smartd

2. write attr per 60 sec

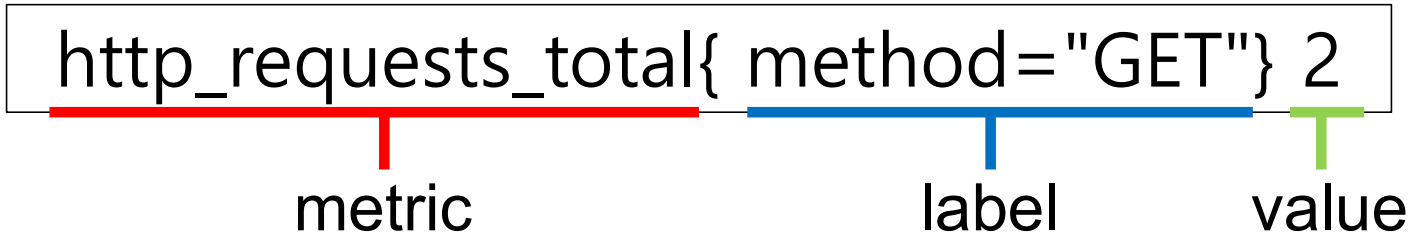
Purpose

2. To create a prom file with minimal attributes label
   - Prometheus is used in monitoring system
   - Prometheus, node_exporter, Grafana



Purpose

2. To create a prom file with minimal attributes label
   - prom file : metric, label, value

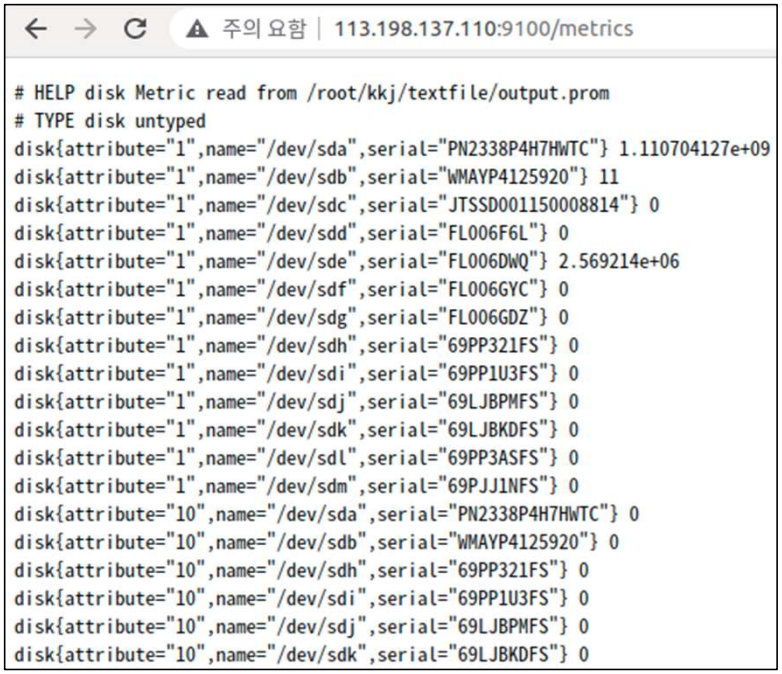


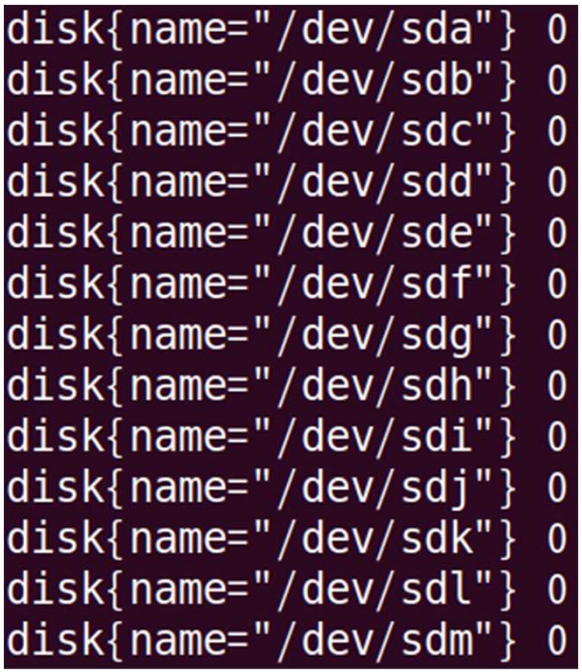
   - example

```
disk{ attr= "1" }      2
disk{ attr= "2" }      1
disk{ attr= "3" }      1
disk{ attr= "4" }      1
```

Purpose

2. To create a prom file with minimal attributes label
   - Issue : more cardinality, causes performance problem of Prometheus
   - cardinality of disk : attr(14) X name(13) X serial(13) = 2,366





Purpose

2. To create a prom file with minimal attributes label
   - select target attributes

ID#	ATTRIBUTE_NAME	FLAG	VALUE	WORST	THRESH	TYPE	UPDATED	WHEN_FAILED	RAW_VALUE
1	Raw_Read_Error_Rate	0x0000	100	100	000	Old_age	Offline	-	0
5	Reallocated_Sector_Ct	0x0000	100	100	000	Old_age	Offline	-	0
9	Power_On_Hours	0x0000	100	100	000	Old_age	Offline	-	4342
12	Power_Cycle_Count	0x0000	100	100	000	Old_age	Offline	-	421
148	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	1164
149	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	103
150	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	40
151	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	77
159	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	0
160	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	0
161	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	43
163	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	14
164	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	36611
165	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	91
166	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	37
167	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	78
168	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	1500
169	Unknown_Attribute	0x0000	100	100	000	Old_age	Offline	-	95
177	Wear_Leveling_Count	0x0000	100	100	050	Old_age	Offline	-	0
181	Program_Fail_Cnt_Total	0x0000	100	100	000	Old_age	Offline	-	0
182	Erase_Fail_Count_Total	0x0000	100	100	000	Old_age	Offline	-	0
192	Power-Off_Retract_Count	0x0000	100	100	000	Old_age	Offline	-	34
194	Temperature_Celsius	0x0000	100	100	000	Old_age	Offline	-	40
195	Hardware_ECC_Recovered	0x0000	100	100	000	Old_age	Offline	-	0
196	Reallocated_Event_Count	0x0000	100	100	016	Old_age	Offline	-	0
199	UDMA_CRC_Error_Count	0x0000	100	100	050	Old_age	Offline	-	0
232	Available_Reservd_Space	0x0000	100	100	000	Old_age	Offline	-	100
241	Total_LBAs_Written	0x0000	100	100	000	Old_age	Offline	-	120781

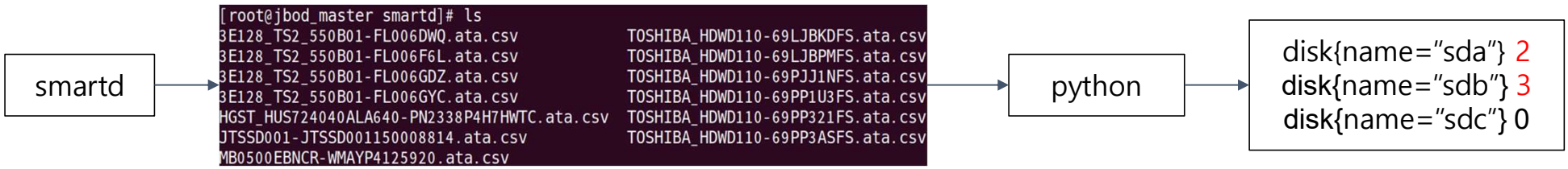
ATTRIBUTE	DESCRIPTION
SMART 5	Reallocated Sectors Count
SMART 187	Reported Uncorrectable Errors
SMART 188	Command Timeout
SMART 197	Current Pending Sector Count
SMART 198	Uncorrectable Sector Count

Purpose

2. To create a prom file with minimal attributes label
   - process 1 : checking attribute raw values using csv log file instead of smartctl

```
smartd -A /var/log/smartd/attributes/ -i 60
```

   - update status 0(normal) to 2(target attribute's raw value > 0)



1. run smartd

2. write attr per 60 sec

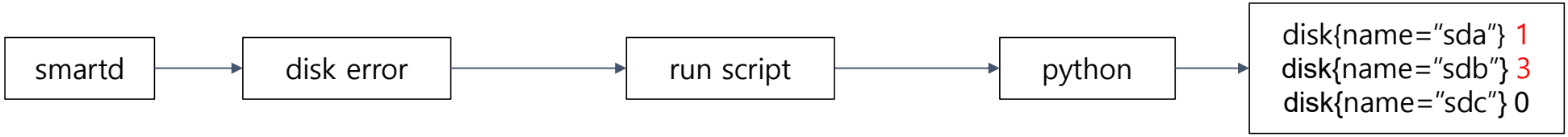
2. read attr per 60 sec from csv
3. parse attr

Purpose

2. To create a prom file with minimal attributes label
   - process 2 : checking overall status using smartd instead of smartctl

```
DEVICESCAN -H -M exec /usr/libexec/smartmontools/smartdnotify
```

   - update status 0(normal) to 1(error message includes disk name)



1. run smartd 2. error occured 3. run smartdnotify script 4. run python process

```
SMARTD_ALL : -s SMART error (CurrentPendingSector) detected on host: jbod_master kimkyeongjun273@gmail.com
SMARTD_MESSAGE : Device: /dev/sda [SAT], 12224 Currently unreadable (pending) sectors (changed +1)
```

Purpose

3. To add log backup function
   - smartd leaves a log message when an error occurs
   - storing all logs is inefficient
   - storing message and attr logs is important before the error occured

```
SMARTD_ALL : -s SMART error (CurrentPendingSector) detected on host: jbod_master kimkyeongjun273@gmail.com
SMARTD_MESSAGE : Device: /dev/sda [SAT], 12224 Currently unreadable (pending) sectors (changed +1)
```

```
[root@jbod_master smartd]# pwd
/var/log/smartd
[root@jbod_master smartd]# tree
.
├── attributes
│   ├── 3E128_TS2_550B01-FL006DWQ.ata.csv
│   ├── 3E128_TS2_550B01-FL006F6L.ata.csv
│   ├── 3E128_TS2_550B01-FL006GDZ.ata.csv
│   ├── 3E128_TS2_550B01-FL006GYC.ata.csv
│   ├── HGST_HUS724040ALA640-PN2338P4H7HWTC.ata.csv
│   ├── JTSSD001-JTSSD001150008814.ata.csv
│   ├── MB0500EBNCR-WMAYP4125920.ata.csv
│   ├── TOSHIBA_HDWD110-69LJBKDFS.ata.csv
│   ├── TOSHIBA_HDWD110-69LJBPMFS.ata.csv
│   ├── TOSHIBA_HDWD110-69PJJ1NFS.ata.csv
│   ├── TOSHIBA_HDWD110-69PP1U3FS.ata.csv
│   ├── TOSHIBA_HDWD110-69PP321FS.ata.csv
│   └── TOSHIBA_HDWD110-69PP3ASFS.ata.csv
└── python_log.txt

1 directory, 14 files
```

attributes log files of disks
(manufacturer-serialnumber-ata.csv)

Purpose

3. To add log backup function
   - when an error occurs, backup starts

```
 9    BACKUP_DATE=$(date '+%Y-%m-%d-%H%M')
10    tar cvf smartd-$BACKUP_DATE.tar /var/log/smartd/
```

   - save error message

```
[root@jbod_master smartd]# pwd
/var/log/smartd
[root@jbod_master smartd]# ls
python_log.txt
[root@jbod_master smartd]# cat python_log.txt
2021-10-07 11:35:39.428441      Device: /dev/sda [SAT], 30120 Currently unreadable (pending) sectors (changed +1)
2021-10-07 12:29:33.527177      Device: /dev/sda [SAT], 30204 Currently unreadable (pending) sectors (changed +1)
```

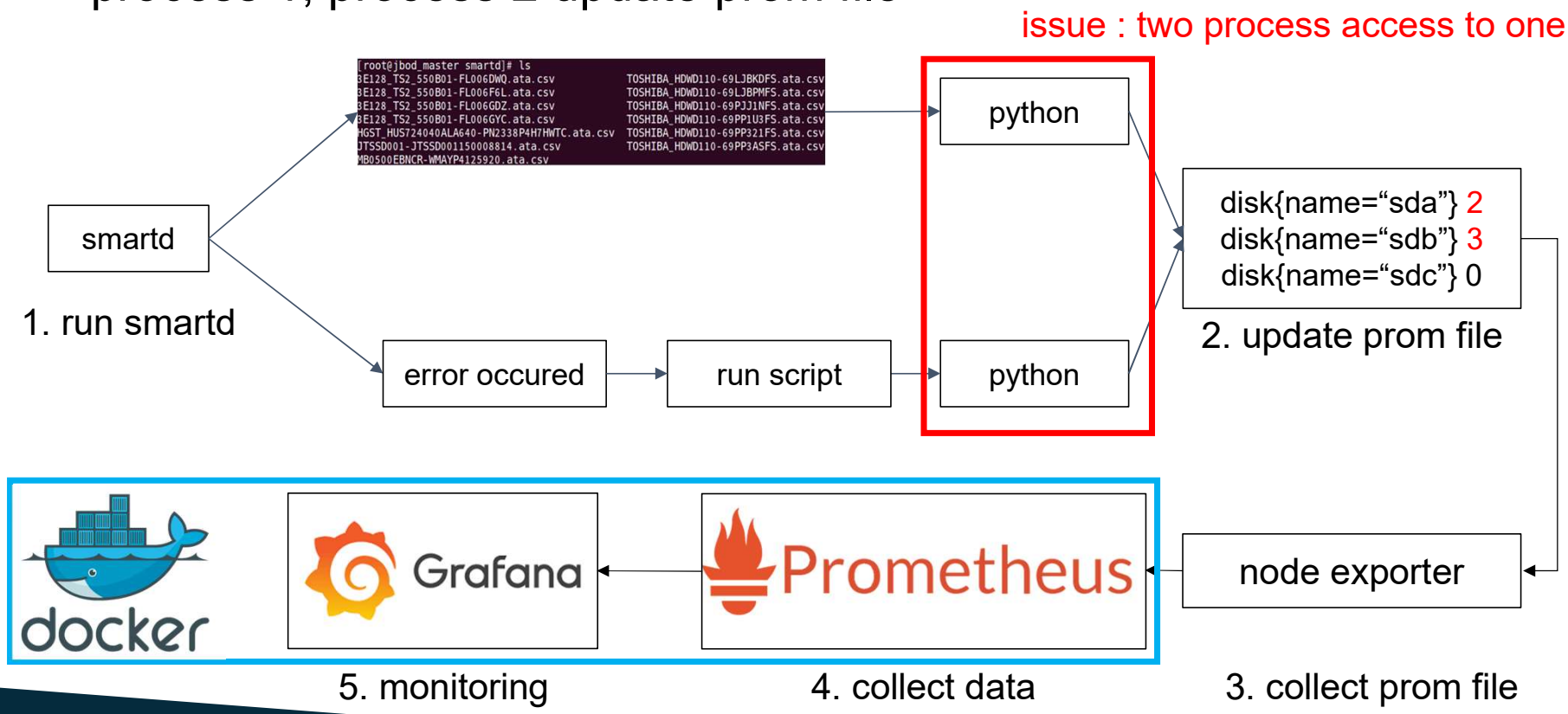
error message of smartd

Workflow and Issue

Workflow and Issue

Workflow

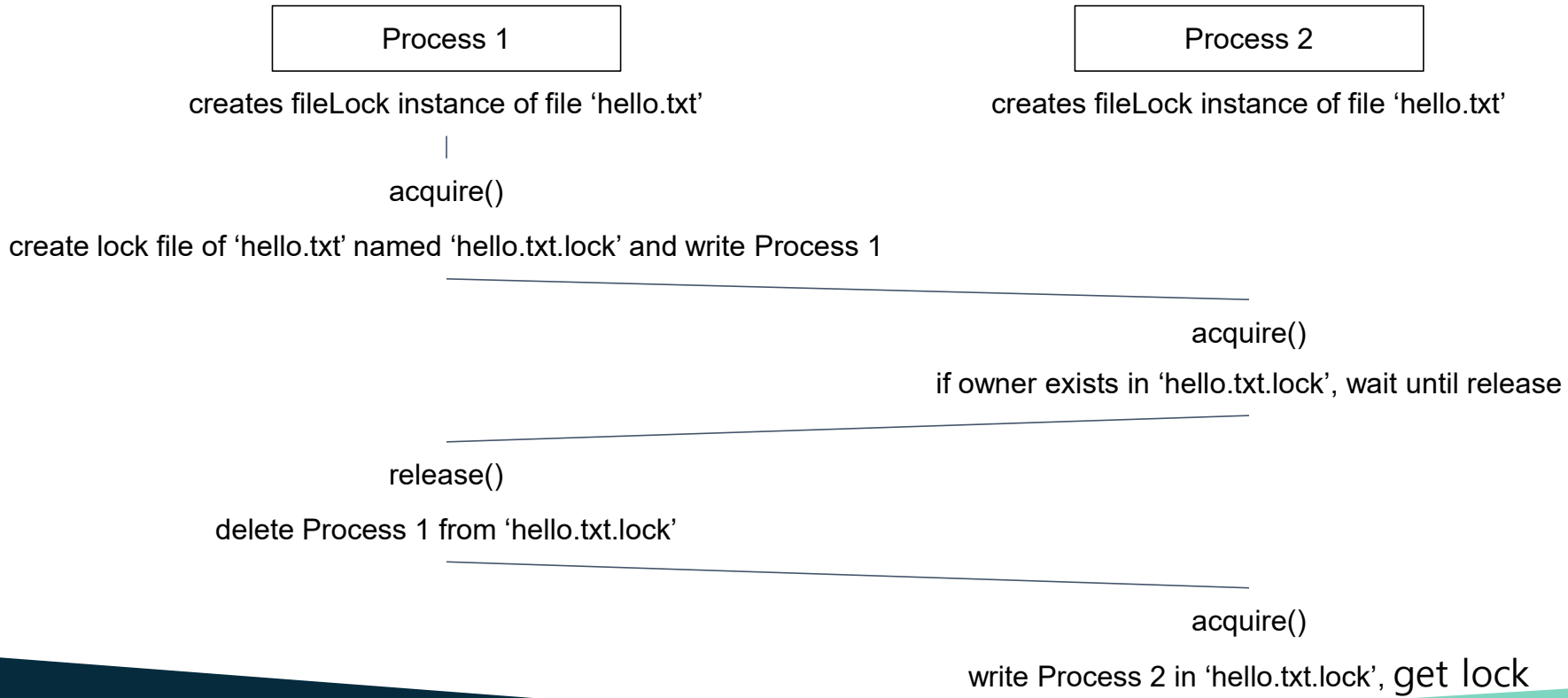
- process 1, process 2 update prom file



Workflow and Issue

Issue

- solution : using fileLock



Workflow and Issue

Issue

- solution : result of fileLock added

```
(venv) [root@jbod_master smartd]# cat disks.prom
disk{name="/dev/sda"} 1
disk{name="/dev/sdb"} 0
disk{name="/dev/sdc"} 0
disk{name="/dev/sdd"} 0
disk{name="/dev/sde"} 0
disk{name="/dev/sdf"} 0
```

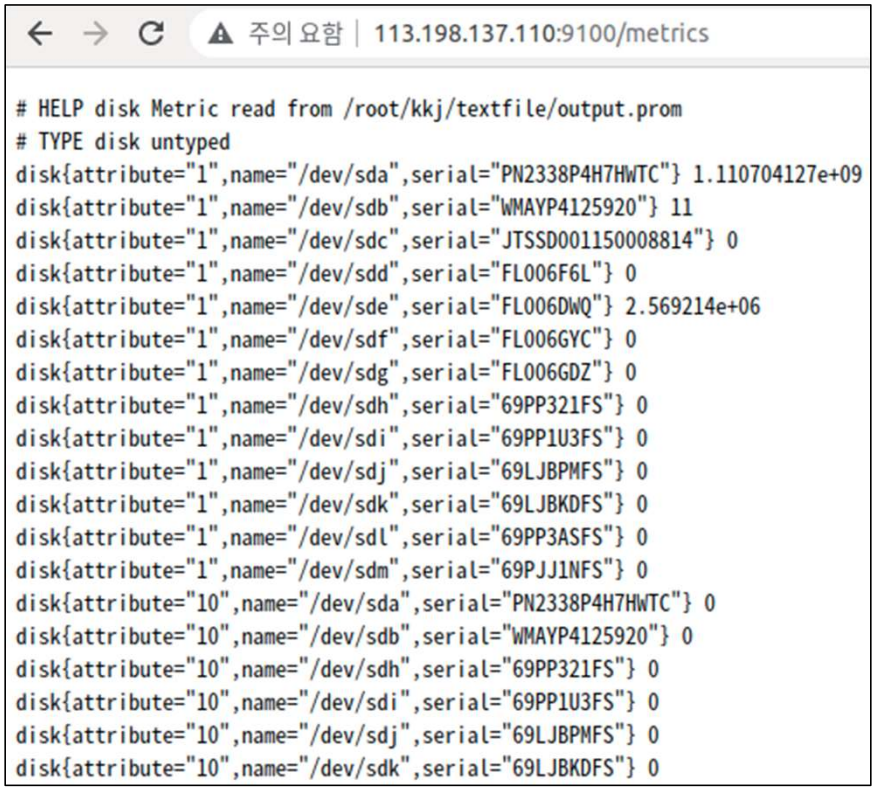
```
[root@jbod_master smartd]# cat disks.prom
disk{name="/dev/sda"} 0
disk{name="/dev/sdb"} 3
disk{name="/dev/sdc"} 2
disk{name="/dev/sdd"} 0
disk{name="/dev/sde"} 2
disk{name="/dev/sdf"} 0
disk{name="/dev/sdg"} 0
disk{name="/dev/sdh"} 0
disk{name="/dev/sdi"} 0
disk{name="/dev/sdj"} 0
disk{name="/dev/sdk"} 0
disk{name="/dev/sdl"} 0
disk{name="/dev/sdm"} 0
```

Result

Result

Node exporter

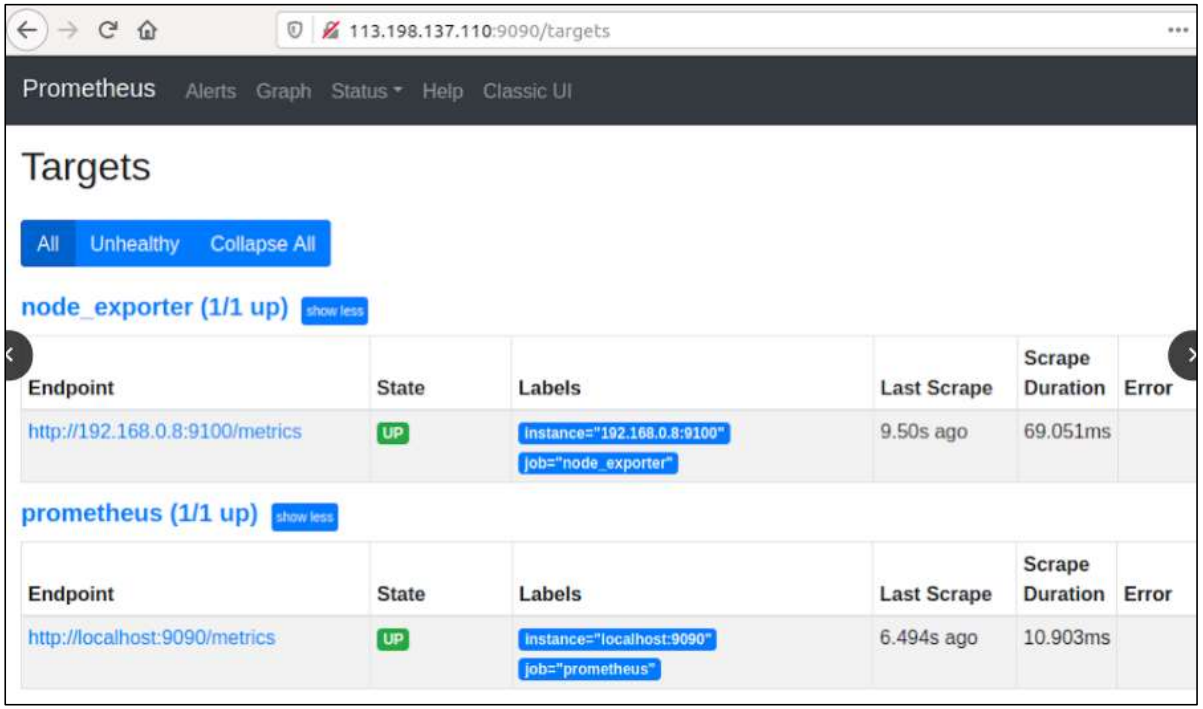
- collect prom file



Result

Prometheus

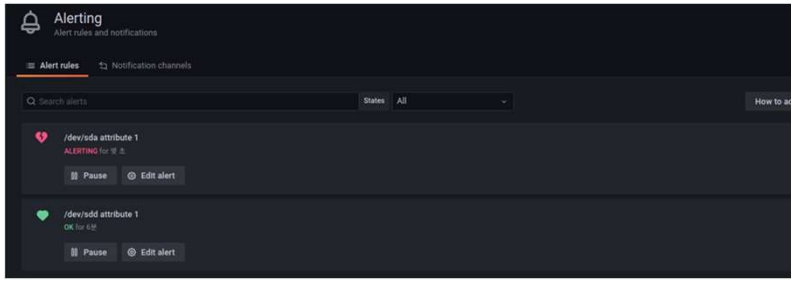
- collect data

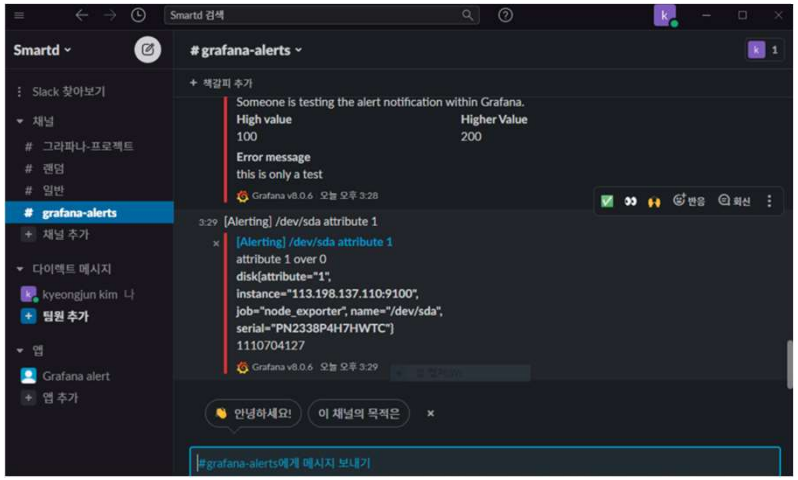


Result

Grafana

- monitoring, alerting on slack

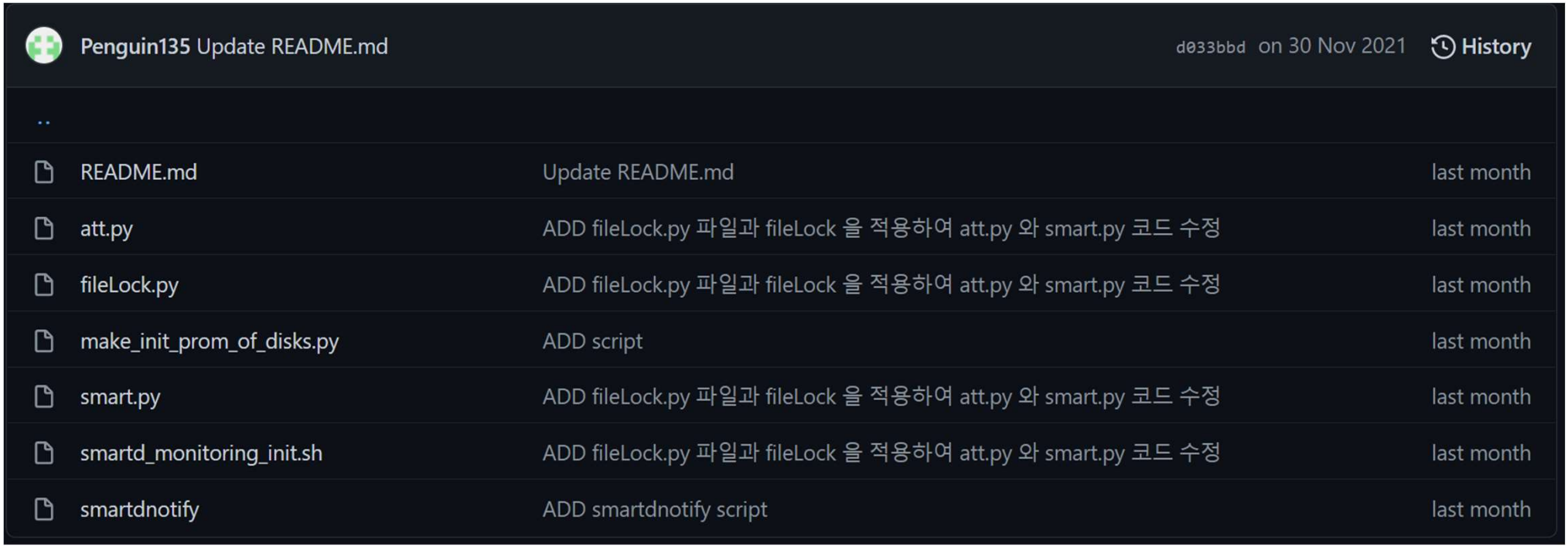




Result

Source code

- To get prom file



Penguin135 Update README.md — d033bbd on 30 Nov 2021 — History

..

README.md	Update README.md	last month
att.py	ADD fileLock.py 파일과 fileLock 을 적용하여 att.py 와 smart.py 코드 수정	last month
fileLock.py	ADD fileLock.py 파일과 fileLock 을 적용하여 att.py 와 smart.py 코드 수정	last month
make_init_prom_of_disks.py	ADD script	last month
smart.py	ADD fileLock.py 파일과 fileLock 을 적용하여 att.py 와 smart.py 코드 수정	last month
smartd_monitoring_init.sh	ADD fileLock.py 파일과 fileLock 을 적용하여 att.py 와 smart.py 코드 수정	last month
smartdnotify	ADD smartdnotify script	last month

Summary and Plan

Summary and Plan

Summary

1. implementation of monitoring system without smartctl command
2. To create a prom file with minimal attributes label
3. To add log backup function
4. implementation of monitoring pipeline
   - node exporter, Prometheus, Grafana

Plan

1. expecting disk failure using attribute data and machine learning
2. data backup
3. applying Fswatch to python script

Thank you

kimkyeongjun273@gmail.com