Application Whitelisting
In Linux Environment

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What Is The Application Whitelisting?

- Security practise
- Ability to specify and run only trusted applications
- Admin defines what is allowed and what is not

Why Is That So Important?

Why Is That So Important?

- Another level of security
- Part of the certification schemes
  - Common criteria
  - And others..

What About Red Hat?

What About Red Hat?

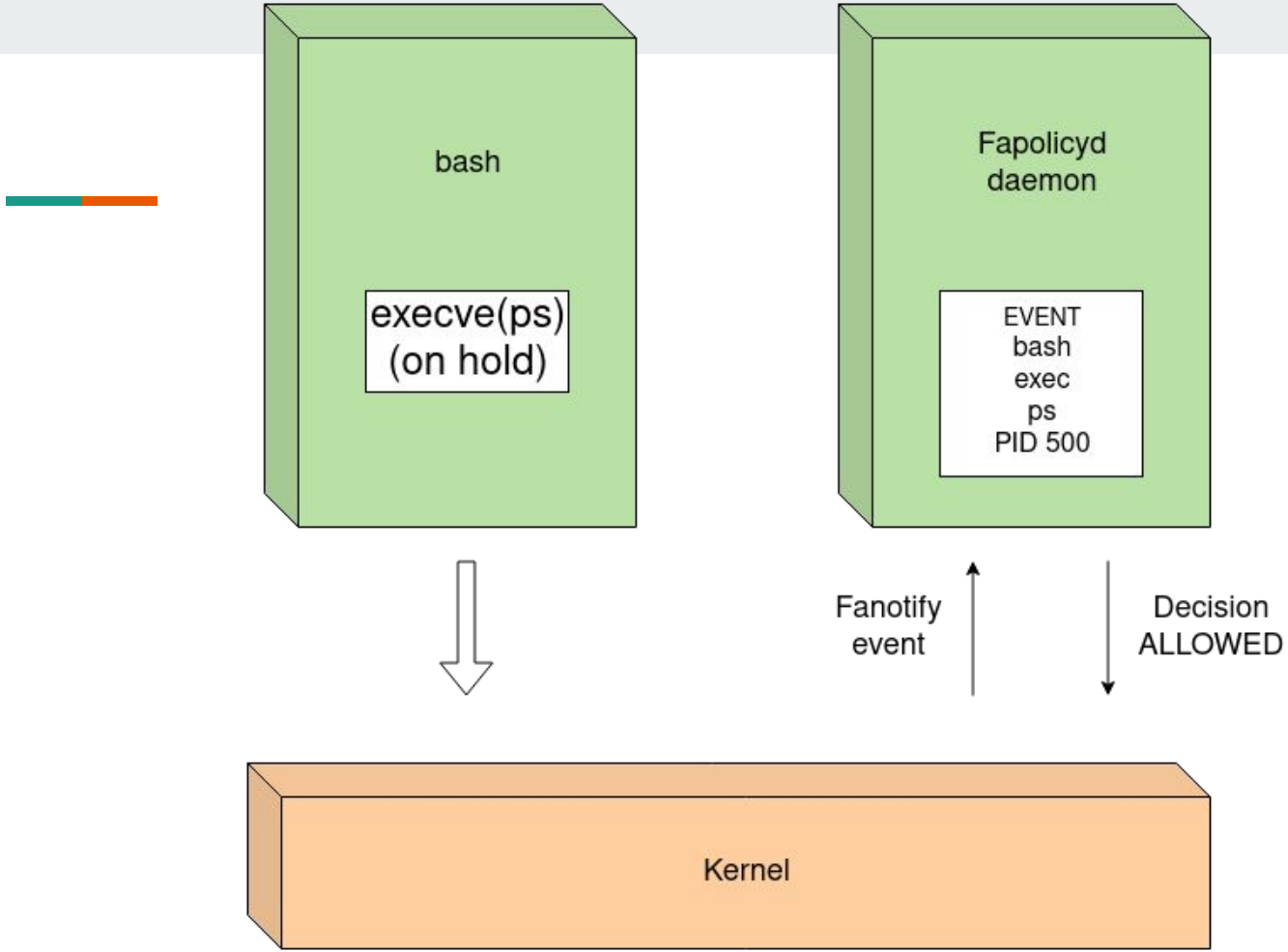
- Introduced Fapolicyd Framework

Fapolicyd Framework

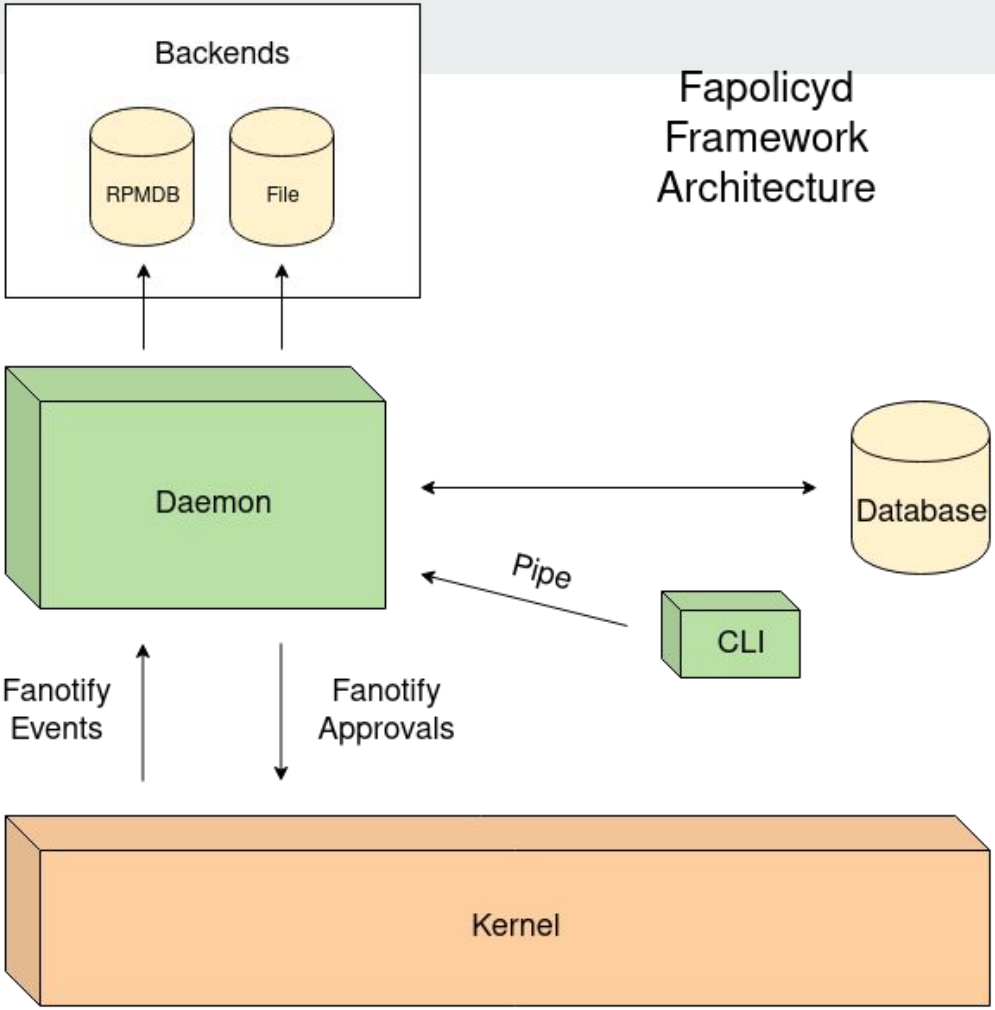
- Lightweight solution
- RPM/DNF integration
- Audit support
- Relies on fanotify API

Fanotify API

- Kernel API
- Similar to inotify
- Receiving events from open/exec system calls
- Blockable on system call side, waiting for response


bash
execve(ps)
(on hold)
Fapolicyd
daemon
EVENT
bash
exec
ps
PID 500
Fanotify
event
Decision
ALLOWED
Kernel

Fapolicyd Framework Architecture



Fapolicyd Configuration

- /etc/fapolicyd/
  - fapolicyd.rules
  - fapolicyd.conf
  - fapolicyd.trust

Fapolicyd Trust Philosophy

- Optional backends
- By default (RHEL/Fedora) everything loaded from
  - rpmdb
  - fapolicyd.trust
- is trusted
- The default set of rules ensures that trusted application is allowed to run

Rule language

- Subject/Object notation

Simple format

DECISION PERM SUBJECT : OBJECT

Decision

- allow
- allow_audit
- deny
- deny_audit

Permission

- open
- execute
- any

Simple format

DECISION PERM SUBJECT : OBJECT

Install Fapolicyd Framework

```
[root@Axis ~] dnf install fapolicyd
```

Enable Apps In Home Directory

Problem:

- Regular user would like to run his software in ~/bin
  - Enable binary
  - Enable python script

Enable Specific Binary

- ~/bin/my-bin

```
~/bin >> ls
my-bin my-app.py
```

```
~/bin >> ./my-bin
my-bin my-app.py
```

Running Daemon In Debug Mode

```
[root@Axis ~]# fapolicyd --debug 2>&1 | tee out
Loaded 24 rules
Changed to uid 980
Initializing the database
Loading rpmdb backend
Loading file backend
Checking database
...
Starting to listen for events
...
```

Enable Specific Binary

- ~/bin/my-bin

```
~/bin >> ls
my-bin my-app.py
```

```
~/bin >> ./my-bin
Zsh: operation not permitted:
./my-bin
```

Output Investigation

```
[root@Axis ~]# less out
```

```
Loaded 24 rules
Changed to uid 980
Initializing the database
Loading rpmdb backend
Loading file backend
Checking database
…
Starting to listen for events
/my-bin
```

Output Investigation

```
rule:9 dec=deny_audit  perm=execute  auid=1000 pid=600  exe=/usr/bin/zsh
: file=/home/rsroka/bin/my-bin  ftype=application/x-executable
```

Output Investigation

```
rule:9 dec=deny_audit perm=execute auid=1000 pid=600 exe=/usr/bin/zsh
: file=/home/rsroka/bin/my-bin ftype=application/x-executable
```

Rule:

```
allow perm=execute exe=/usr/bin/zsh trust=1
: file=/home/rsroka/bin/my-bin ftype=application/x-executable trust=0
```

Enable Specific Binary

- ~/bin/my-bin

```
~/bin >> ls
my-bin my-app.py
```

```
~/bin >> ./my-bin
my-bin my-app.py
```

Enable Python Script

- ~/bin/my-app.py

```
~/bin >> ls
my-bin my-app.py
```

```
~/bin >> ./my-app.py
Hello World from Python Script
```

Running Daemon In Debug Mode

```
[root@Axis ~]# fapolicyd --debug 2>&1 | tee out
Loaded 24 rules
Changed to uid 980
Initializing the database
Loading rpmdb backend
Loading file backend
Checking database
...
Starting to listen for events
...
```

Enable Python Script

- ~/bin/my-app.py

```
~/bin >> ls
my-bin my-app.py
```

```
~/bin >> ./my-app.py
zsh: operation not permitted:
my-app.py
```

Output Investigation

```
[root@Axis ~]# less out
```

```
Loaded 24 rules
Changed to uid 980
Initializing the database
Loading rpmdb backend
Loading file backend
Checking database
…
Starting to listen for events
/my-app
```

Output Investigation

```
rule:9 dec=deny_audit  perm=execute  auid=1000 pid=600  exe=/usr/bin/zsh
: file=/home/rsroka/bin/my-app.py  ftype=text/x-python
```

Output Investigation

```
rule:9 dec=deny_audit  perm=execute  auid=1000 pid=600  exe=/usr/bin/zsh
: file=/home/rsroka/bin/my-app.py  ftype=text/x-python
```

Rule:

```
allow perm=execute  exe=/usr/bin/zsh  trust=1
: file=/home/rsroka/bin/my-app.py  ftype=text/x-python  trust=0
```

Enable Python Script

- ~/bin/my-app.py

```
~/bin >> ls
my-bin my-app.py
```

```
~/bin >> ./my-app.py
zsh: operation not permitted:
my-app.py
```

Wait...What?

Output Investigation - The Second Round

```
rule:2 dec=allowed perm=execute auid=1000 pid=600 exe=/usr/bin/zsh :
file=/home/rsroka/bin/my-app.py ftype=text/x-python

rule:18 dec=deny_audit perm=open auid=1000 pid=600 exe=/usr/bin/zsh :
file=/home/rsroka/bin/my-app.py ftype=text/x-python
```

Output Investigation - The Second Round

```
rule:2 dec=allowed perm=execute auid=1000 pid=600 exe=/usr/bin/zsh :
file=/home/rsroka/bin/my-app.py ftype=text/x-python

rule:18 dec=deny_audit perm=open auid=1000 pid=600 exe=/usr/bin/zsh :
file=/home/rsroka/bin/my-app.py ftype=text/x-python
```

Rule:

```
allow perm=any exe=/usr/bin/zsh trust=1
: file=/home/rsroka/bin/my-app.py ftype=text/x-python trust=0
```

Enable Python Script

- ~/bin/my-app.py

```
~/bin >> ls
my-bin my-app.py
```

```
~/bin >> ./my-app.py
Hello World from Python Script
```

```
~/bin >> python3 my-app.py
Hello World from Python Script
```

```
rule:2 dec=allowed perm=execute exe=/usr/bin/zsh :
file=/home/rsroka/bin/my-app.py ftype=text/x-python

rule:2 dec=allowed perm=execute exe=/usr/bin/python3.7 :
file=/home/rsroka/bin/my-app.py ftype=text/x-python
```

Rule:

```
allow perm=any all trust=1
: file=/home/rsroka/bin/my-app.py ftype=text/x-python trust=0
```

Enable Directory

```
allow perm=any all trust=1 : dir=/home/rsroka/bin/ trust=0
```

Mark Files As Trusted

- Add files to fapolicyd.trust

```
# FULL PATH SIZE SHA256
/home/rsroka/bin/my-bin 15523 61a9960bf7d255a85811f4afcac51062e...
/home/rsroka/bin/my-app.py 153 e49f0c887cf5fd41d4d49808fc8042fc...
```

Enable Fapolicyd Framework

```
[root@Axis ~] systemctl enable --now fapolicyd
```

Thank You!

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- https://github.com/radosroka
- https://twitter.com/RadovanSroka
- https://github.com/linux-application-whitelisting/fapolicyd