Multiple Concurrent Security Modules? Really?

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Please Consider As We Go

- Is this a good idea?
- Is this the right approach?
- What would be better?

Motivation

- Security models are changing
- Monolithic modules take too long
    - Driving security into user space
    - Or worse, “drivers”

- We’re doing it anyway with Yama

Design Choices

- All combinations allowed
- All hooks called every time
- Infrastructure replaced
- Modules minimally changed

Module Ordering

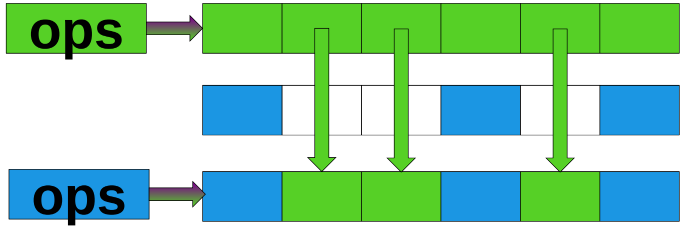
- Modules must be compiled in

- Invoked in order configured
  - `CONFIG_DEFAULT_SECURITY=“apparmor,smack,yama”`

- Overridden by boot option
  - `security=“apparmor,smack”`

How it used to work

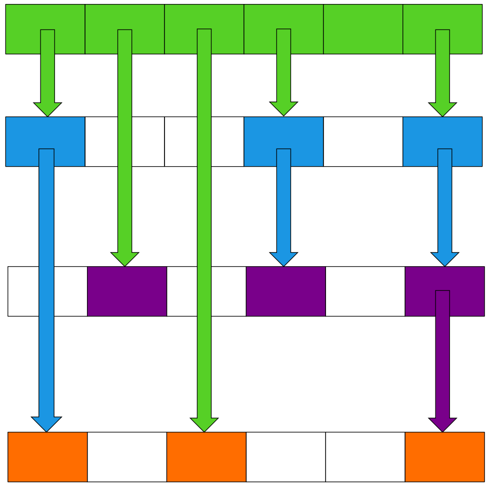
- Default vector with capabilities module
- New vector has gaps
  - Filled from default vector
  - Each module calls capabilities
- Replace default vector
- Special case Yama stacking



Call hook from vector
Hook calls cap hook
Call Yama hook

The new scheme

- Infrastructure calls capabilities code
- Each hook has a list of security operations
- Registration puts operations on these lists
- Each hook gets called in order
  - No shortcutting
- Success or last error is returned



Do cap check
Call hooks from list

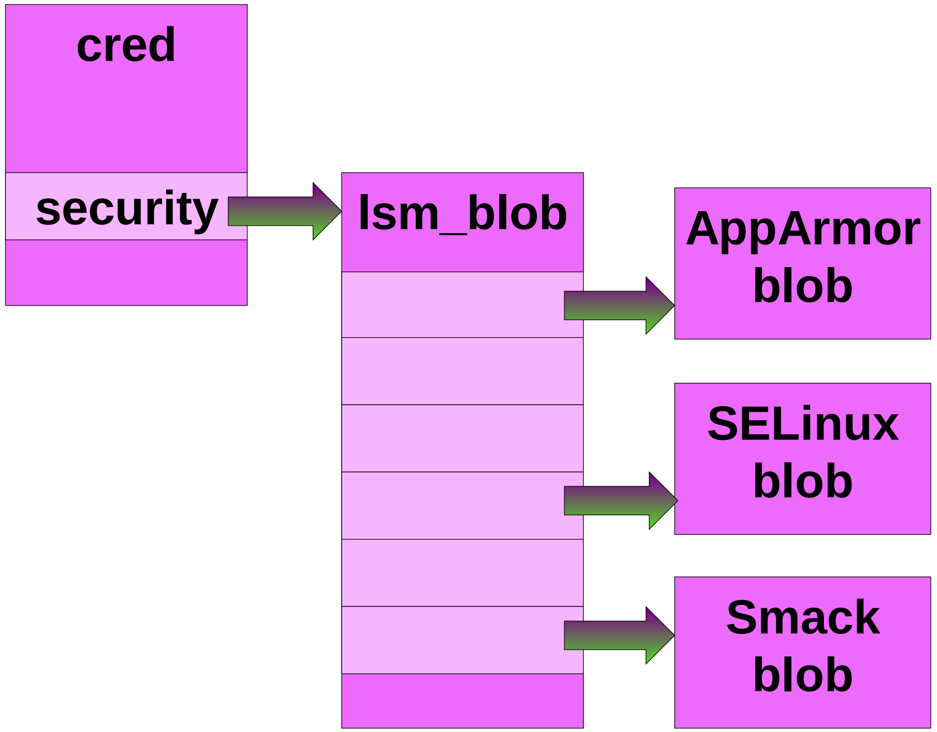
New module data

- `list`
  - List headers for hook processing
- `order`
  - This module’s place and slot
- `features`
  - The special facilities supported

Present
NetLabel
XFRM
secmark
PEERSEC

Security Blobs

- Modules maintain their own
- Infrastructure maintains its own
  - Allocate when necessary
  - Delete when empty



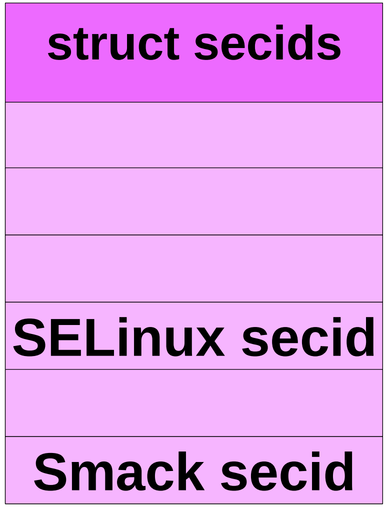
Inside the security modules

- `isp = inode->i_security;`
- `isp = lsm_get_inode(inode, &smack_ops);`

- `cred->security = value;`
- `lsm_set_cred(cred, value, &apparmor_ops);`

Security IDs - secids

- Modules maintain their own
- Infrastructure maintains an array of secids
- Audit uses `struct secids`



Security Information Import and Export

- User visible attributes
- Networking controls

- Backward compatibility
- Complete reporting

Security Context Format

- <lsmname>=‘<value>’[<lsmname>=‘<value>’]…
- **`smack=‘User’selinux=‘unconfined_t’apparmor=‘unconfined’`**
- No commas
    - Syntactic sugar
- Output when necessary
- Always respected on input

- If y’all don’t like it, propose something better

The Present Configuration

- Compatibility for **`/proc`** interfaces
  - **`CONFIG_PRESENT_SECURITY=`**“*<lsmname>*”
  - **`CONFIG_PRESENT_SECURITY=`**“**`(all)`**”
  - **`CONFIG_PRESENT_SECURITY=`**“**`(first)`**”
- Legacy entries in the **`attr`** directory only
- Use Context Format only if required

New `/proc` Interfaces

- **`/proc/…/attr/context`**
  - The complete context, unaffected by present
- Directory per module
  - **`attr/apparmor/current`**
  - **`attr/apparmor/exec`**
  - **`attr/apparmor/prev`**
  - **`attr/smack/current`**
  - **`attr/selinux/current`**
  - …

New securityfs Interfaces

- `/sys/kernel/security`
- Read only
- `lsm`
- `present`

Networking Features

- NetLabel
  - One CIPSO header
- Secmark
  - One 32 bit value
- XFRM
  - Interfaces based on secids

Networking handling

- Identify module by operations
- Explicitly configured
- First available otherwise
- SO_PEERSEC
  - Module explicitly configured
  - Security context format available

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