Security Module Stacks That Don't Fall Over

Casey Schaufler

Intel Open Source
Technology Center

Casey Schaufler

- Kernel developer from the 1970's
- Supercomputers in the 1990's
- Smack Linux Security Module
- Security module stacking

Photo Curtesy Ann Forrister

Linux Security Module

- Collection of security hooks
- Additions to traditional access controls

You security people are insane.

Security Module Stack

- A collection of security modules
- Called in order
- Bail on fail policy

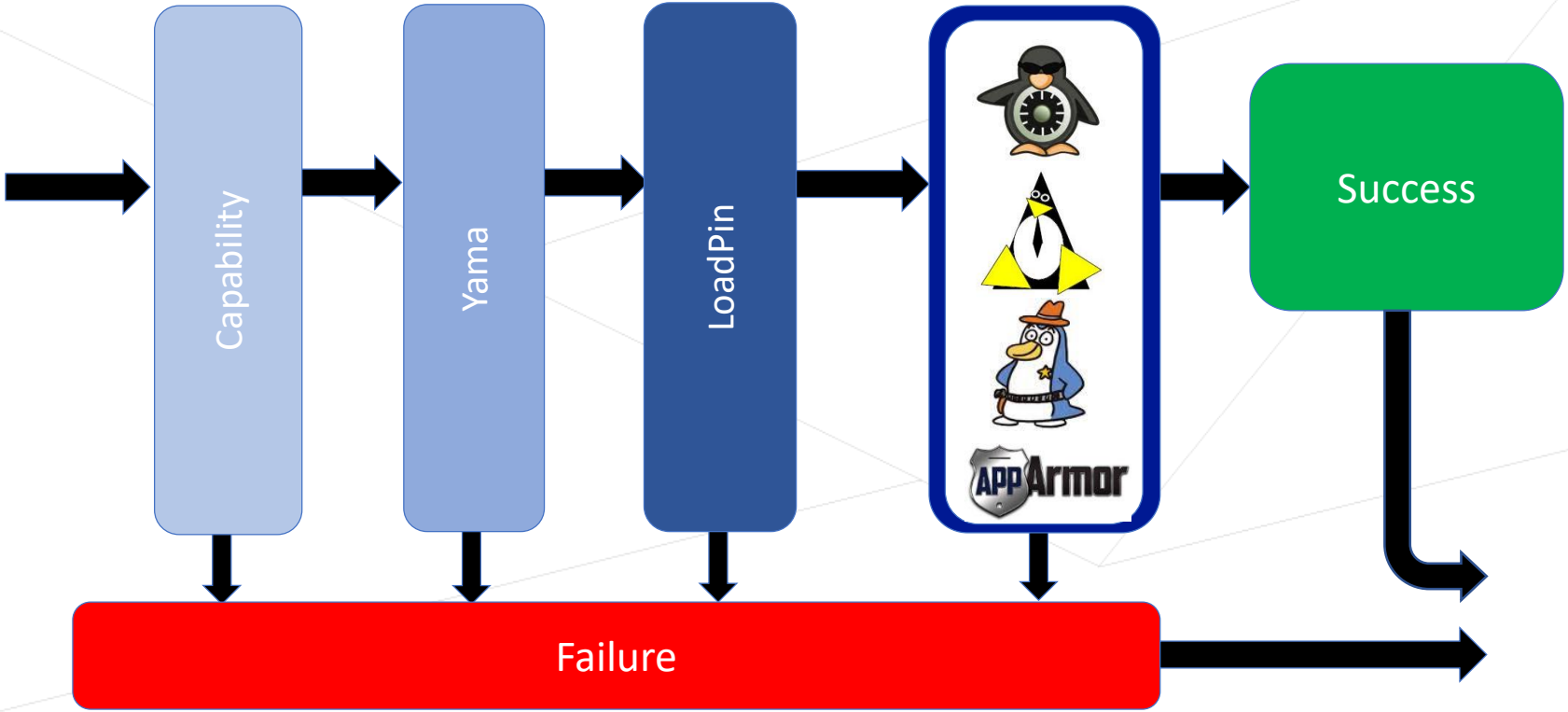
Minor Security Module

- Checks based on available state

Major Security Module

- Checks on module managed state
- System managed security blobs
- Netlabel and/or secmarks

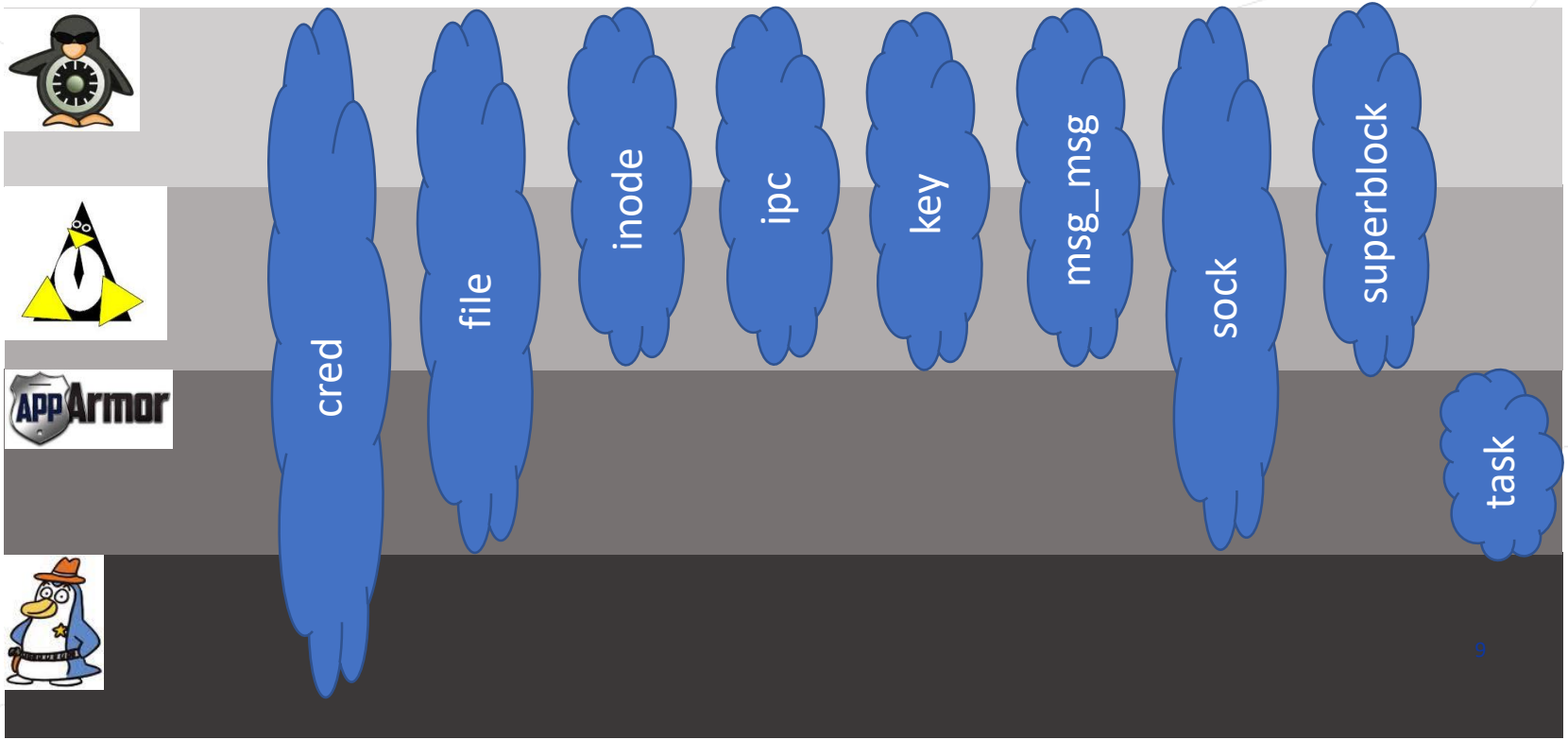
Stacking as of 4.18



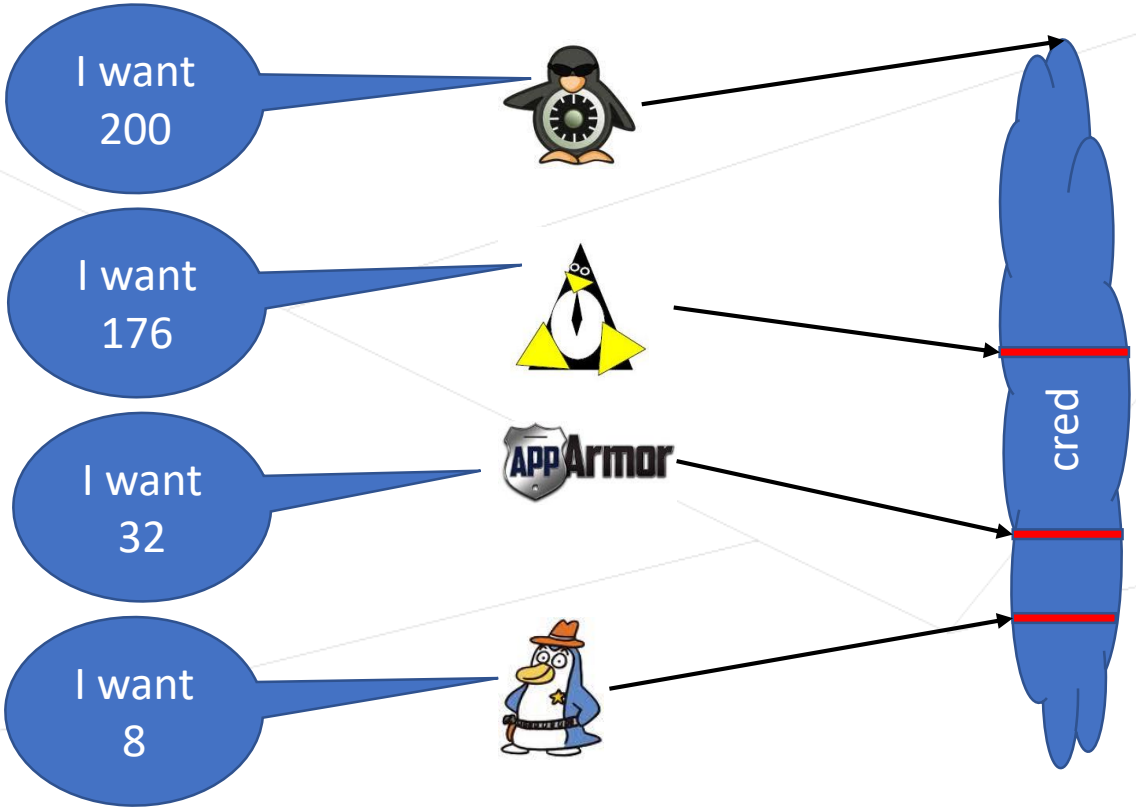
Stumbing Block

Blob Pointers

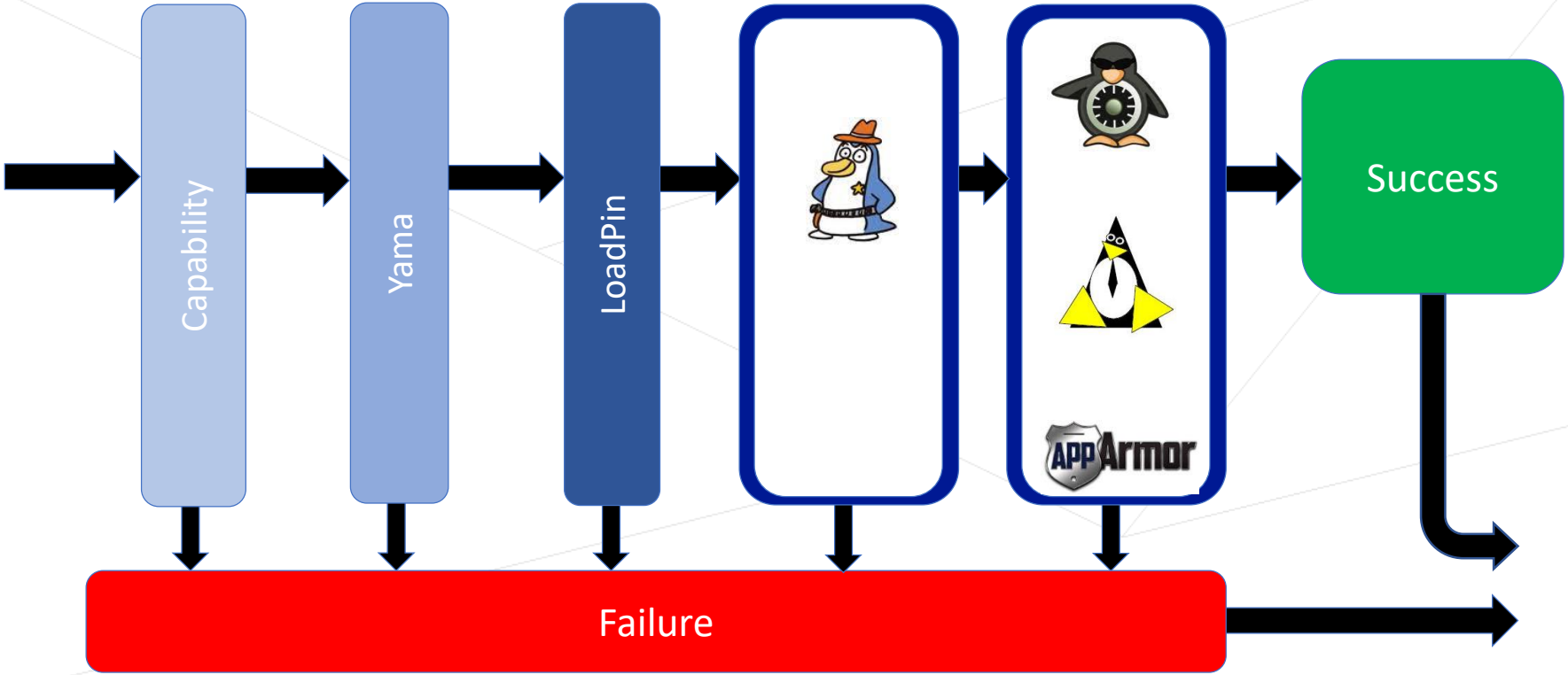
Security Blobs



Infrastructure Managed Blobs



Stacking with infrastructure managed blobs



Stumbling Block

secids

32 bits allows one module's data

```
rc = security_cred_getsecid(cred, &secid);

rc = security_secctx_to_secid(ctx, ctxlen, &secid);

rc = security_secid_to_secctx(secid, &data, &datalen);
```

Replace u32 with struct secids

With stacking …

```
struct secids {
        u32  selinux;
        u32  smack;
        u32  apparmor;
};
```

Without stacking …

```
struct secids {
        union {
                u32  selinux;
                u32  smack;
                u32  apparmor;
        };
};
```

Identify which to use

- Within a security module

```
sec->sid = secid->selinux;
```

Identify which to use

- In netfilter

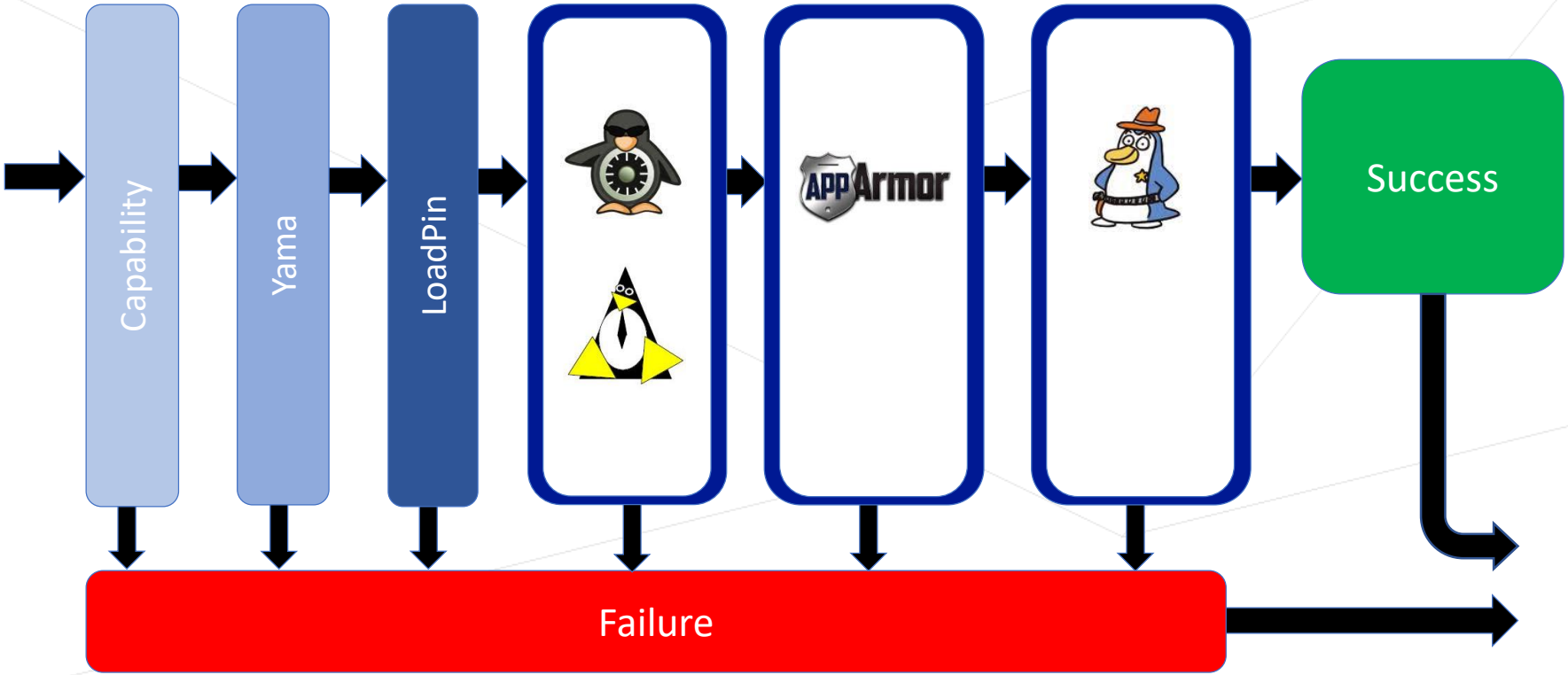
```
case SECMARK_MODE_SEL:
     info->secid = secid.selinux;
     break;
case SECMARK_MODE_SMACK:
     info->secid = secid.smack;
     break;
```

Identify which to use

- Select by task attribute

```
prctl(PR_SET_DISPLAY_LSM, “selinux”, 7, 0, 0);
```

Stacking with struct secids



Stumbling Block

Mount Options

Unrecognized Option

- `mount -o seclabel,smackfsroot="*"`
- Stop failing on unknown options
- Multiple mount option structures

Stumbling Block

netlabel

Packet Labeling

- One CIPSO tag
- Security modules must agree

Pushed attributes

- Security modules push data to netlabel
  - Other sub-systems pull data
- Attributes stored in socket
  - In network format
- May not be used in the end

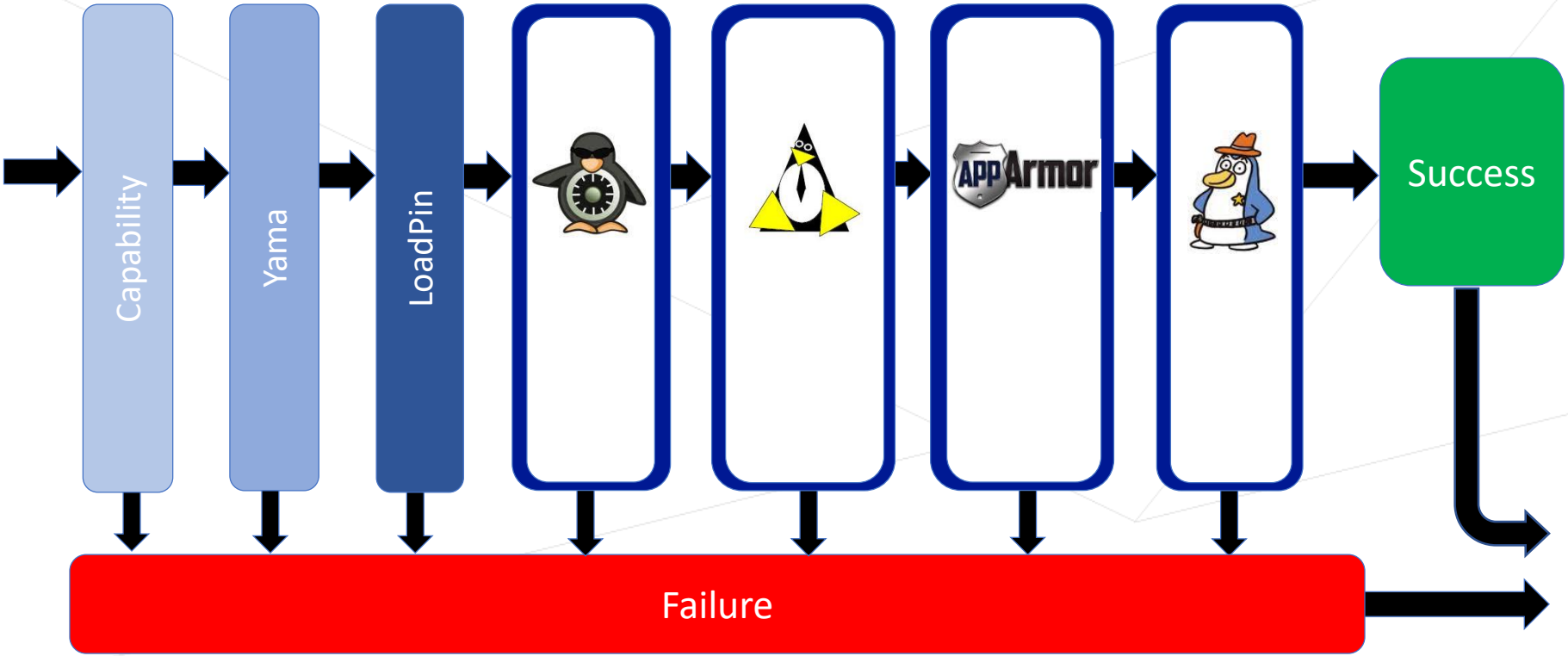
Netlabel Configuration

- Unlabeled networks
  - Default for SELinux
- Labeled networks
  - Default for Smack
- Address selectors
  - Defers labeling until delivery

Granularity

- Security modules won’t be synchronized
- May change after socket creation

Stacking with netlabel equality



What Can Still Cause Problems?

Redundant purpose

- Don’t use SELinux and Smack together
- Do use Smack and AppArmor together

Networking

- Don’t confuse IP
- Use one network enabled module

User Space

- May get confused
- /sys/kernel/security/lsm
- Updates needed for real support
  - systemd
  - id
  - ls

Advice For New Security Modules

Networking

- Make netlabel optional
- Read the netlabel code before trying to use it
- Define sane behavior on unlabeled networks

Process Attributes

- Create a subdir in **`/proc/…/attr`**
- Create user space wrappers for **`SO_PEERSEC`**

Think twice about using secids

- Do you need audit events?
- What about tmpfs?

Be careful with state

- Module hooks may not get called
- Avoid additional memory management
  - Let the infrastructure do it

Summary

- Stacks of dissimilar modules are good
- Stacks should avoid fighting over the network
- Modules should color within the lines

Thank You