Protection is a Software Issue

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Protection revisited

Confusion :

All operating systems use software for protection

Controversy :

Protection can be enforced entirely in software

Compelling point :

Software gives better performance and flexibility than hardware

Protection is an end-to-end issue

- Resources should be protected at the level they are defined and managed
- Operating systems define and manage software abstractions
- Consequently, software protects software

How is it done?

user space

```
halt();
```

system call interface

kernel

```
if  ( uid == 0 ) {
  /* halt the machine */
} else {
  /* coredump the offender */
}
```

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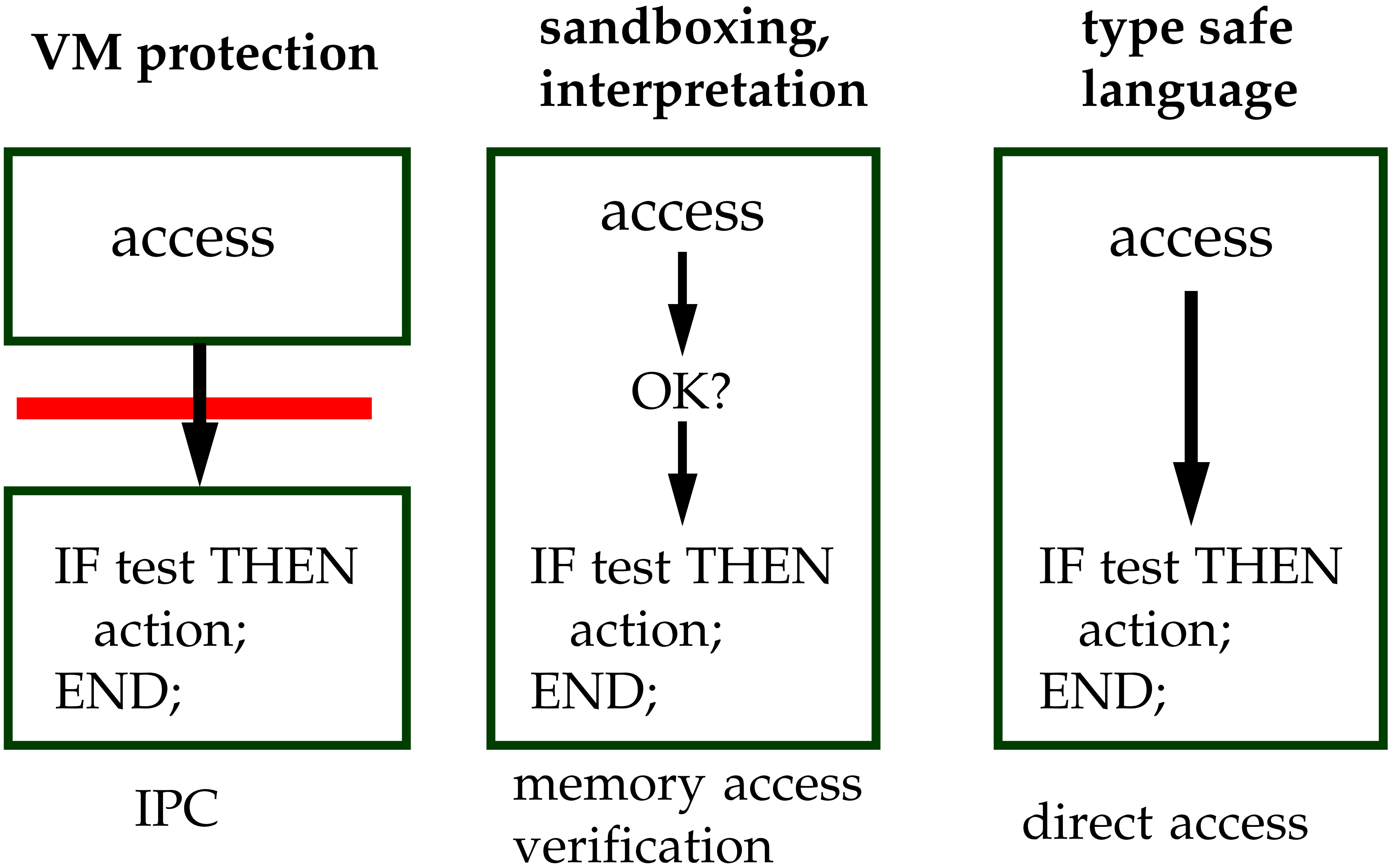
Implementing protection



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Protection : software vs. hardware

- Hardware memory protection for course-grained protection of big ranges of memory
- Software protection for low latency access to resources
- Software protection enables further optimizations

Ease of programming

- Protection is expressible within the language.

Resource management

- Better control over access to a resource
- Protection enforcement may be combined with access code
- Low-latency access enables finer-grained sharing
- A software resource protected by VM is effectively protected twice

Protection vs. extensibility

- Protection is orthogonal to extensibility (any mechanism can be used) but ...
- The cost of communication between extensions and the systems determines usability of the extensibility mechanism
- Software protection helps extensibility by providing low latency access to resources

Extensibility in SPIN