TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Computer Science Institute for System Architecture, Operating Systems Group

Protection and the Control of Information Sharing in Multics

Paper Reading Group
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MULTICS - an ambitious project

- Multiplexed Information and Computing Service (1964-2000)
- Goals: 100% reliability and scalability, multi-purpose system
- Power plant notion
- PL/1 instead of machine language
- Virtual memory (segmentation and paging)
- Dynamic linking

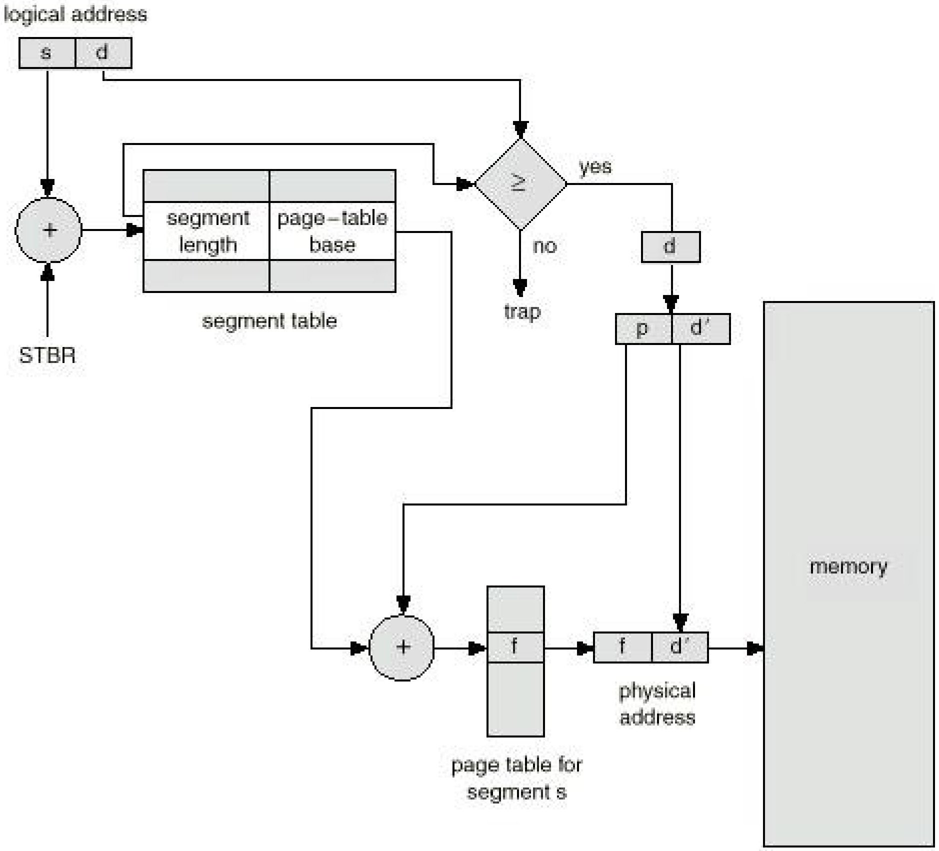
Security design principles

- Permission vs. exclusion
- Check every access to every object
- Open design
- Principle of least privilege
- Usability of protection mechanisms
- *Decentralization of protection specifications*
- *Support of protected subsystems*

Storage system

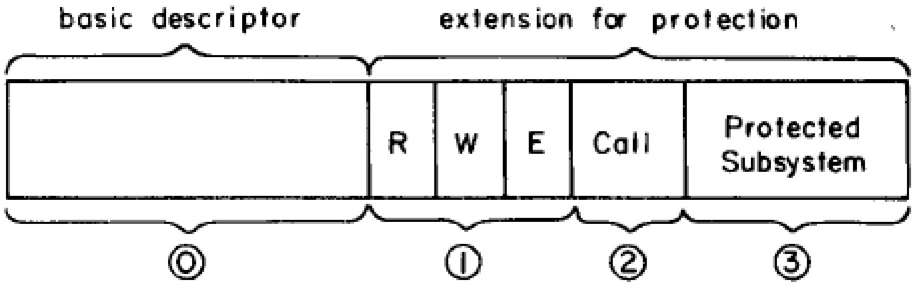
- Hierarchical structured
- “Everything is a segment”
- Open-ended ACLs per segment
- Access mode: *r, rw, re, rew, none*
- ID: *principal#project#compartment*
- Initial ACLs per directory
- Trap extension for flexible access control

Memory Model



Primary memory protection

- Hardware segmentation and rings of protection
- A segment descriptor (SD) contains: read, write and execute flags
- Every SD has an own ring number
- For “ring downgrading” a gate extension and gate list resides in a SD



Further notes

- For sandboxes use protected subsystems
- Immediate revocation through back-pointers
- Supervisor uses descriptor segments itself
- All authentication happens interactively

Weaknesses (out of the paper)

- “Complex TCB”, ~ 300 modules (~6000 LOC) *(partially results from ring software emulation)*
- Proposal: argument-range checking hardware
- Complexity of the user interface (price of high flexibility)
- Overprivileged system administrator in the actual implementation
- IDS and Honeypots are missing

Questions

- Science fiction useful?
- Supervisor really to complex?
- Immediate revocation, is it practical?
- Segmentation and clean virtual memory