Capability-based Systems
Intel iAPX 432

Presented by Dan Amelang
Capabilities

• Resources are represented by objects
  • Hardware
    • Memory
    • Processor
    • IO
  • Software
    • Services
    • Contexts
    • Ports
Capabilities

• These objects can only be accessed with a capability
• A capability is the object identifier + access rights
• Each user, program, procedure, etc. has a list of capabilities
• Manipulation of one's own capability list is prohibited
Intel iAPX 432

- Ambitious hardware/software project in early 1980's
- Directly support OO programming at the hardware level
- Use OO for system-level programming to implement sophisticated, fine-grained capability-based OS
IAPX Architecture
Data Types

• Hardware-level distinction between scalars and objects
• No pointers!
• Objects are
  • Implemented by memory segments
  • Referenced by object descriptors
  • Stored in object tables
  • Accessed via access descriptors (capabilities)
Segments
Access Descriptor

![Access Descriptor Diagram](image_url)
Object Reference
Domain Refinement

- AD for domain refinement
  - Public Part
    - Procedure AD
    - Procedure AD
    - Procedure AD
  - Private Part
    - Local procedure AD
    - Local object AD
    - Local object AD

- Domain Object
- Code
- Code
- Segment
Memory Management
Instructions

• Bit variable/aligned
• No registers, only stack and memory
What ever happened to the Intel 432?