Capability-based Systems
Intel iAPX 432

Presented by Dan Amelang

Capabilities

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

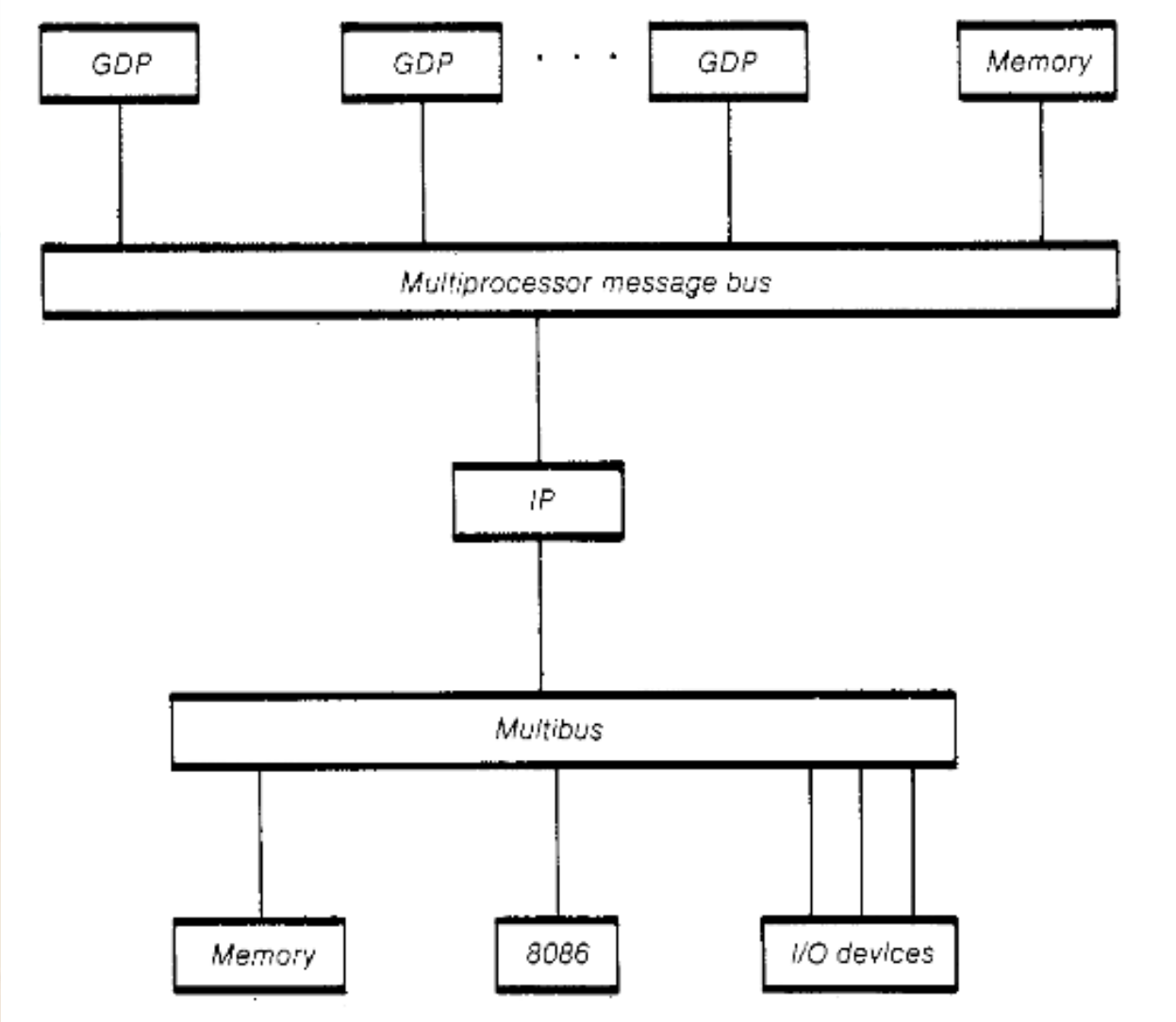
Capabilities

- 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

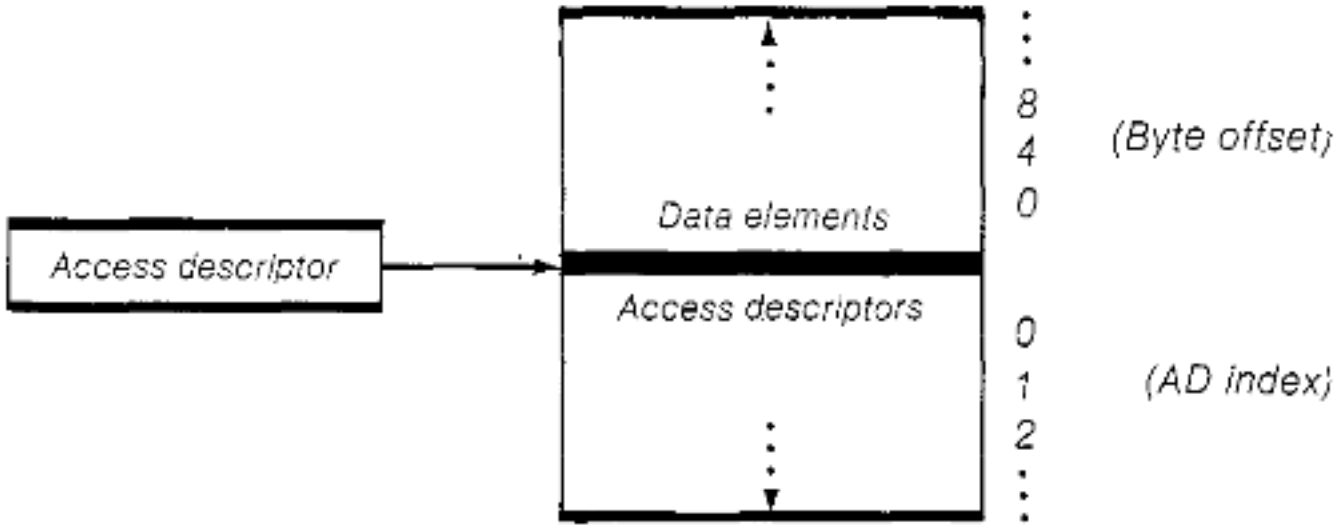
IAPX Architecture



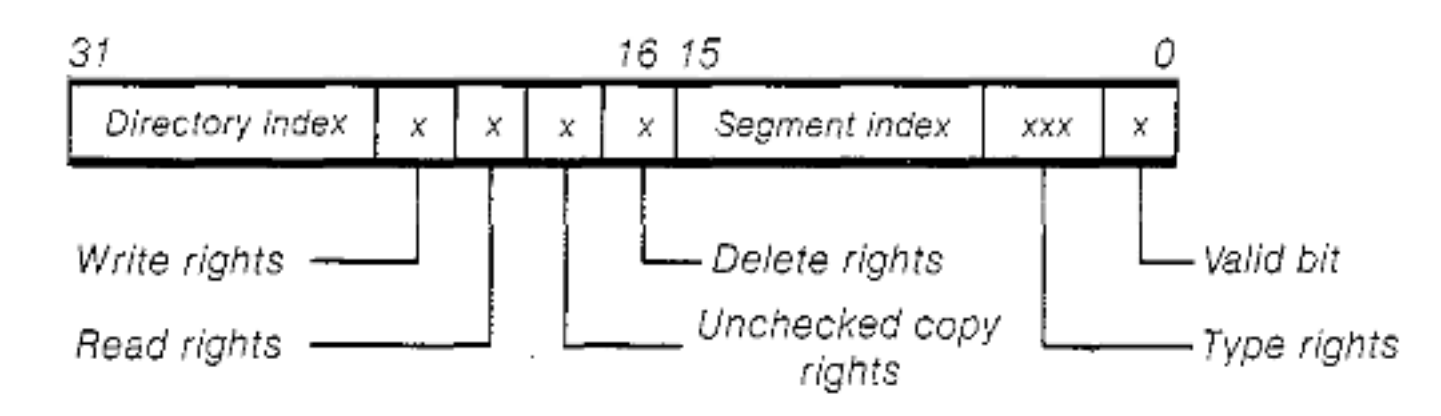
Data Types

- 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)

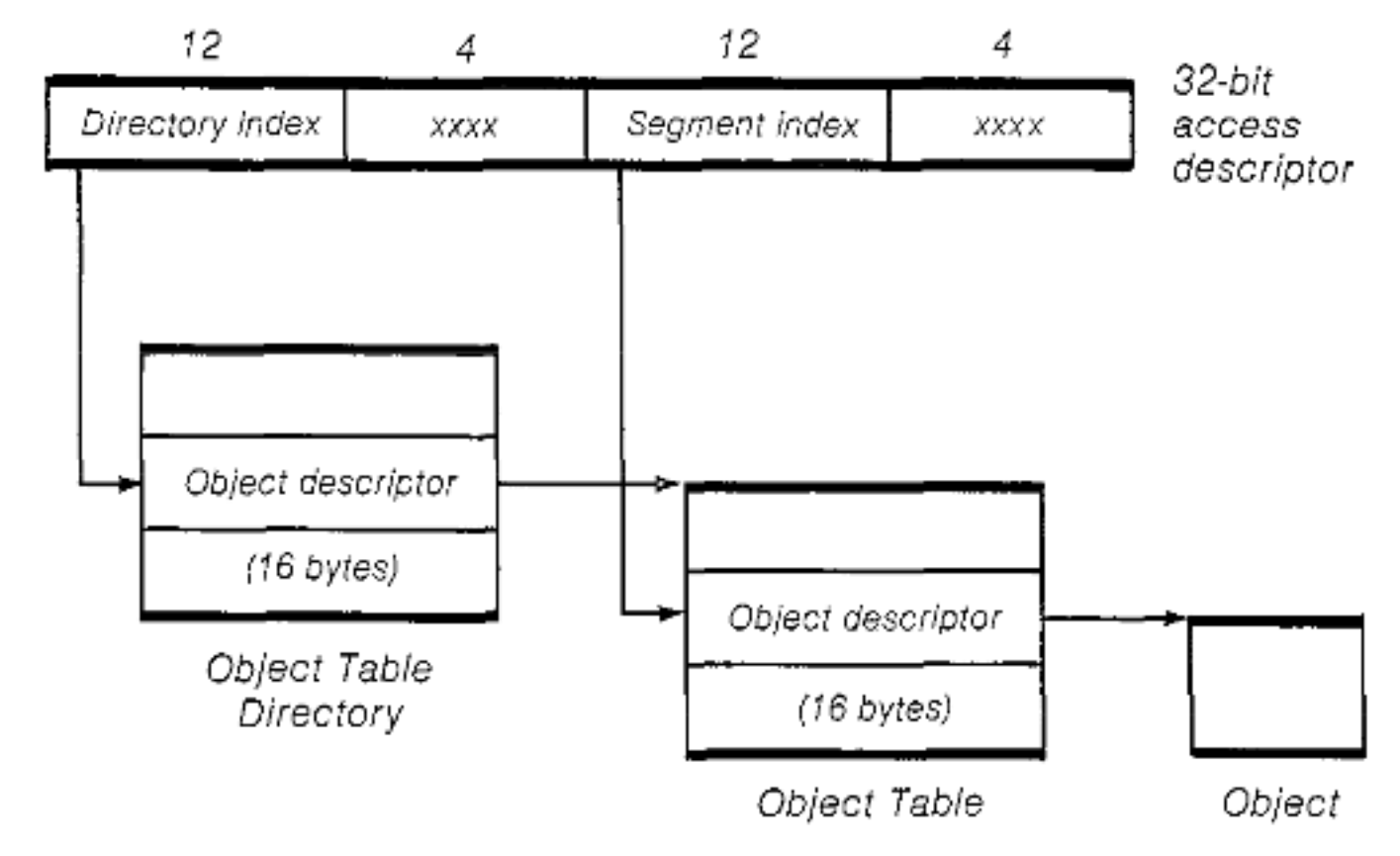
Segments


Access descriptor
Data elements
Access descriptors
8
4
0
(Byte offset)
0
1
2
(AD index)

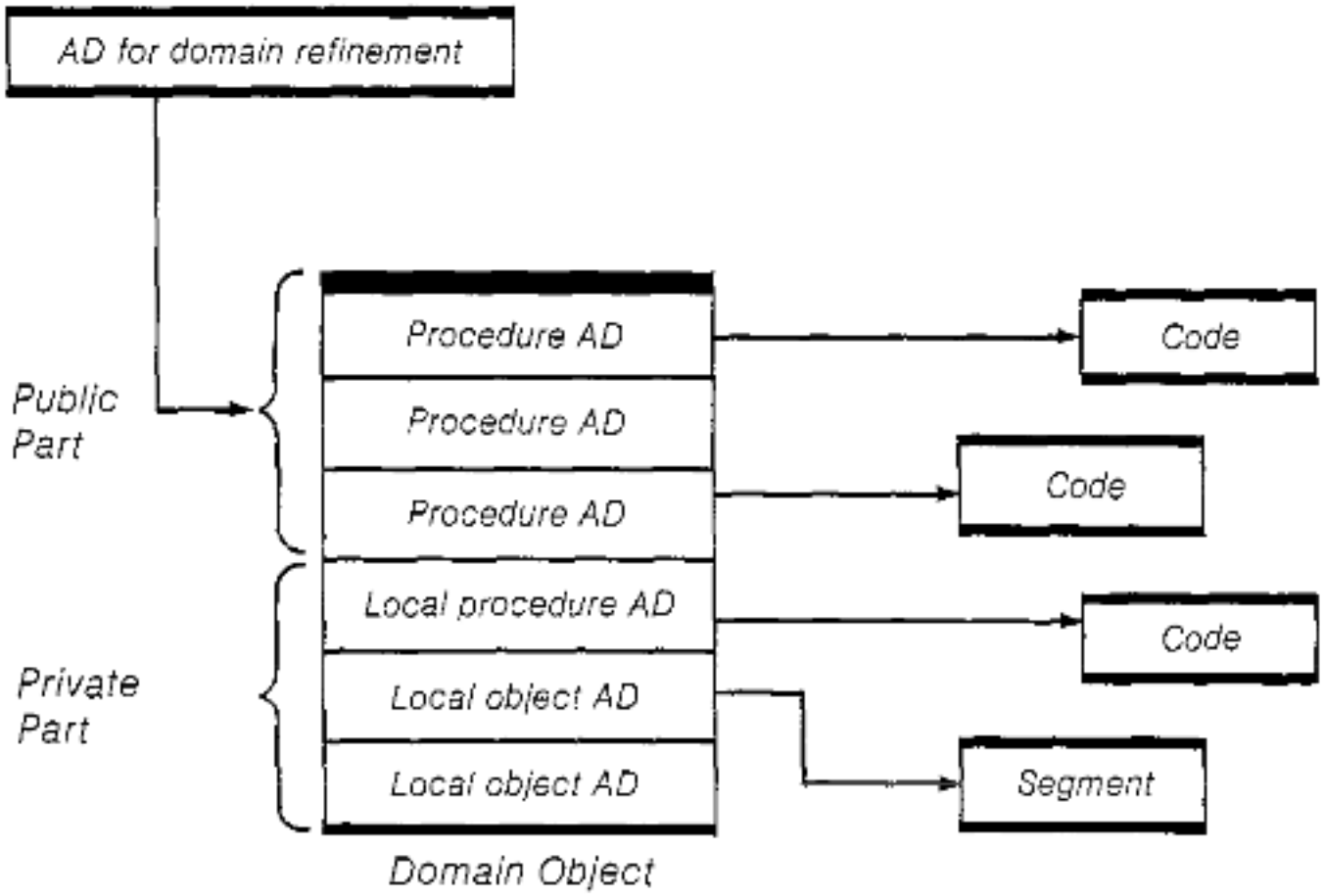
Access Descriptor



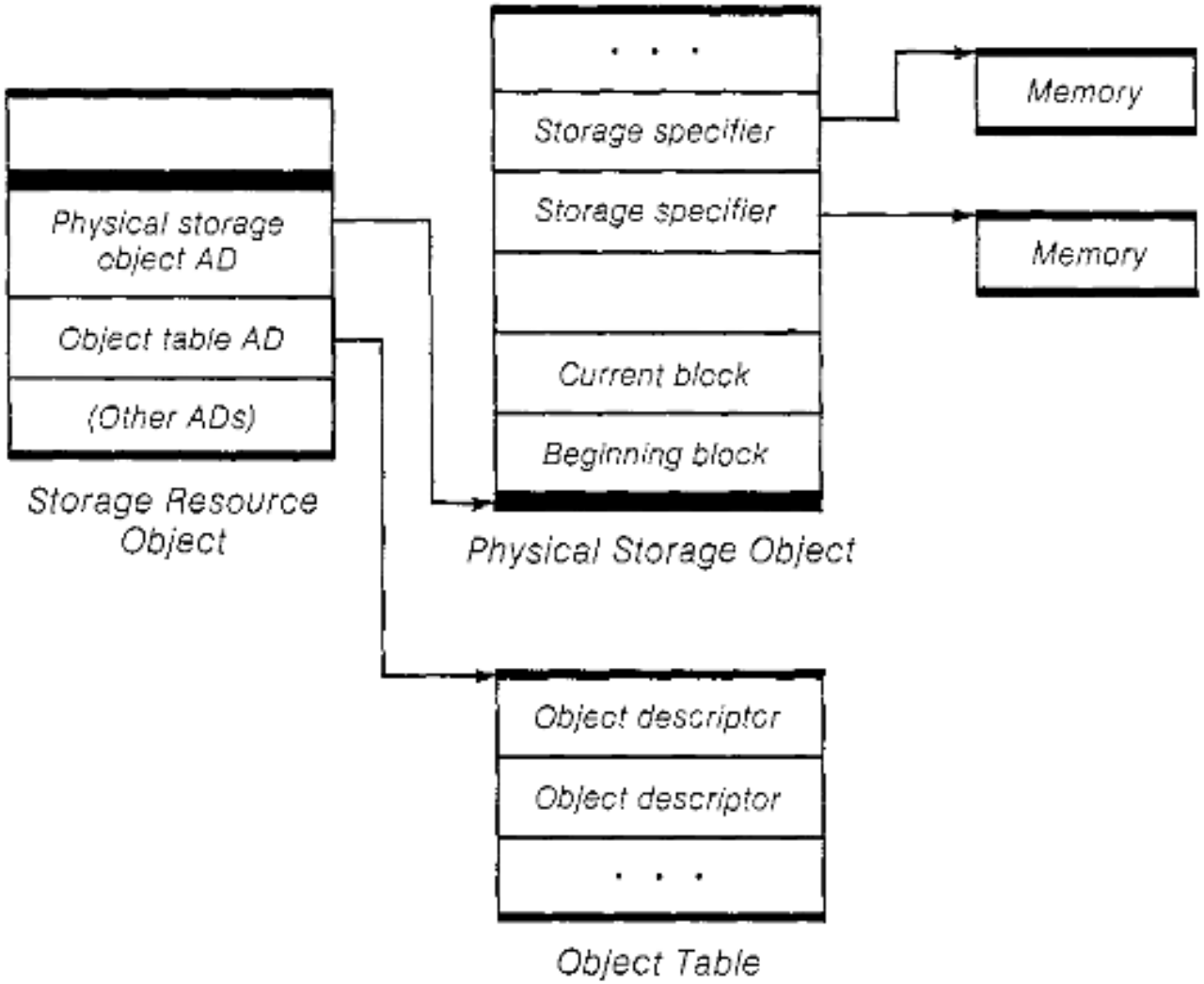
Object Reference



Domain Refinement

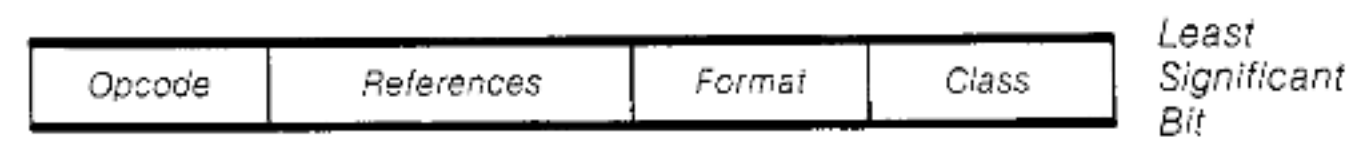


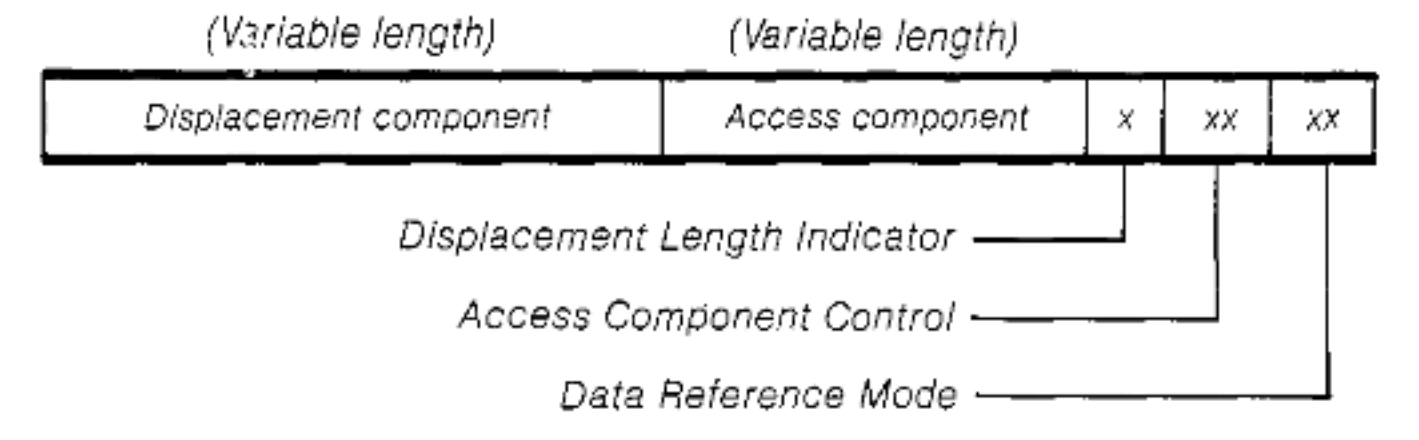
Memory Management



Instructions

- Bit variable/aligned
- No registers, only stack and memory





What ever happened to the Intel 432?