OCS: An Open Communicating System

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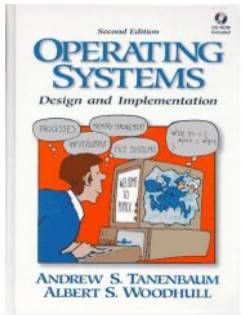
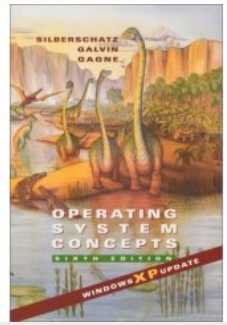
Network Research

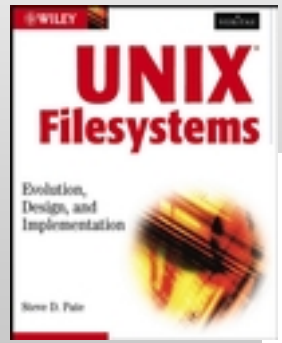
- Past progress = point solutions
  - Channels (sockets)
  - Resource discovery
  - Resource reservation
  - Programmability
  - Virtualization
- Current obstacle?
  - More point solutions

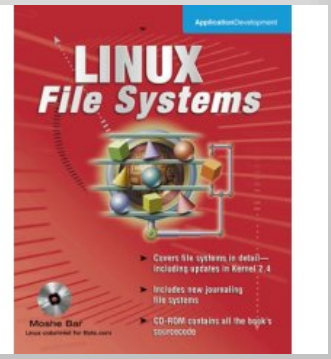
Systems…

- Operating Systems
  - Virtual memory
  - Abstract machine
  - Multiprocessing
- File Systems
  - Storage model
  - Coherency/consistency control









Information Sciences Institute

A Communicating System

- Open, BSD-style program
  - Integrate and cooperate
  - Based on *research* $$
- Real ideas for research
  - New work starts with new *ideas*

Communicating System

	OS	CS
Context space	VM	Overlays
Context ptrs	Page table	Clonable Stacks
Time slice	Scheduler	Packet mux.
Protection, Resource mtg.	Kernel	X-Bone NetFS
API	system calls	xb-api
?	?	?

Why an Open CS?

- OS research:
  - Open hardware: PCs, PCI cards
  - Open apps: Mozilla, XFree86, OpenOffice
  - *Closed OS* – MS, Apple
  - *Open OS* – BSD, Linux
- Network research:
  - Open hardware: Emulab, Gigabit Kits
  - Open applications: P2P
  - Open CS: ?

Key Steps to an OCS

- Reference implementation
  - Integrate components
- Incremental evolution
  - Simple version first
  - Augment with full capabilities later
- Leverage existing playgrounds
  - Kernel-based protocol design
  - Netgraph extensions, KLMs

OCS Relation to…

- NSF OS-FIND:
  - OCS extends the Internet architecture
    - Adding dimensions to a model > incremental
  - OCS integrates orphan network pieces
    - Configuration, coordination, management
- NSF GENI:
  - Testbeds motivate OCS capabilities
- DARPA:
  - ?

Some of the Other Q's

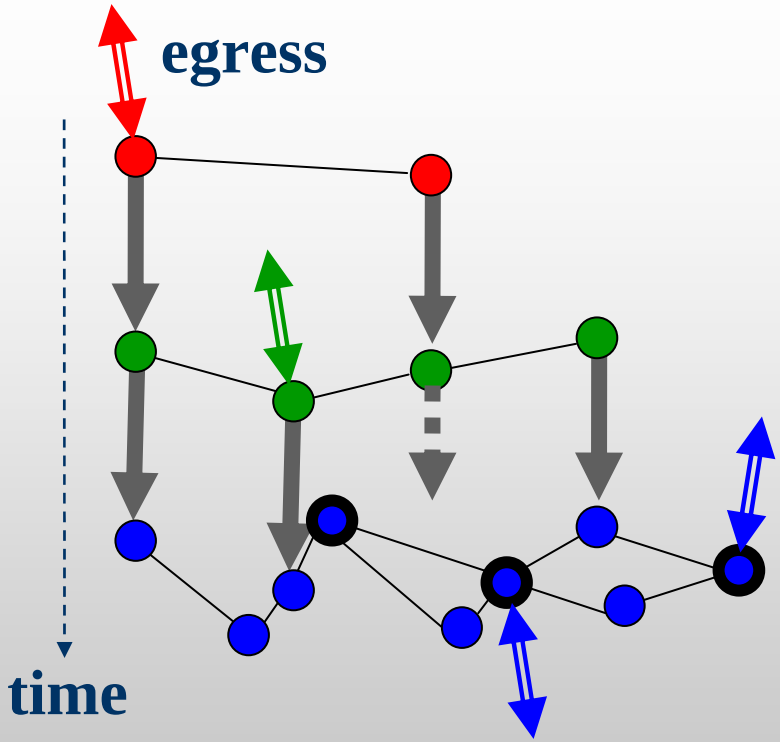
- Need new archs, paradigms?
  - We have some, we need more.
  - We need to *fund* research in a few too.
- Where's the control plane?
  - In the OCS ;-)
  - It should be automatic and adaptive; if that *looks* like cognition, it's accidental

What Way Forward?

- Stop answering the questions before us
  - Start *questioning the assumptions*
- Less is more
  - Less mechanism
  - Less automation
  - More emergent behavior

E.g.: Network Configuration

- Current assumptions:
  - Global address coordination
  - Blind configuration
- New assumptions:
  - Revocable decisions
  - Try things: ask forgiveness rather than permission
  - Be aware of surroundings



Instant Infrastructure

- Current solutions:
  - Renumber
    - Requires coordination infrastructure
  - Multihome transport protocols
    - Requires coordination protocol
- Instant Infrastructure solutions
  - Renumbering creates new context
    - Old numbering becomes overlay; avoids renumbering
  - All connections stay with context
    - No restarting or multihoming needed

E.g.: IPsec

- Current assumptions:
  - All-or-none security levels
  - Full authentication of parties
  - “One level” of protection / performance
- New assumptions:
  - Something is better than nothing
  - Speed, CPU load kill deployment
  - Predeployed infrastructure kills deployment

Better Than Nothing Sec.

- Current solutions
  - Assumes authentication
  - Requires preshared key, CA infrastructure, or key ID brokerage
  - Automate CAs (PKI4IPsec)
  - Embed keys (Opportunistic Encrypt.)
- New solution
  - Allow authentication-free IPsec