What you need to know for the final

Final Exam Topics (Very approximate)

- 20%: Crypto/authentication
- 10%: Firewalls & VPNs
- 10%: Network concepts
- 10%: Distributed file systems
- 8%: Distributed shared memory
- 8%: Clustering
  - + RPC, clocks, mutex, deadlocks, concurrency, distributed transactions, fault tolerance

Systems

- Bus versus switched interconnect
- Snoopy cache

Networking

- Connectionless vs. connection-oriented
  - Datagram, virtual circuit
- Broadband versus Baseband
- Network layer versus Transport layer
- Internet Protocol: UDP/IP, TCP/IP
  Sockets
- Protocol Control Block

Remote Procedure Calls

- Language-level construct
- Functional RPCs:
  - Sun, DCE
- Object-oriented RPCs:
  - Microsoft DCOM/ORPC, Java RMI, CORBA
- XML-based RPCs and Web services:
  - SOAP, XML RPC
  - AJAX (JavaScript + HTTPRequest), REST

Distributed File Systems

- Stateful versus stateless design
- Upload/download versus RPC model
- NFS
- AFS
  - whole-file upload
  - Session versus sequential semantics
- Coda
  - Read/write volume replication
  - Disconnected operation
- DFS
  - Consistency tokens
- SMB/CIFS
  - Strong consistency
  - Oplocks

Clocks

- Logical clocks
  - Event ordering
  - Lamport timestamps
  - Vector clocks
- Physical clocks
  - Cristian's algorithm
  - Berkeley synchronization
  - NTP/SNTP: synchronization subnet

Mutual Exclusion

- Centralized
- Ricart & Agrawala
- Lamport
- Token Ring

Distributed Shared Memory

- Implementation
  - Page fault on MMU
  - Page residence maintained by directory
- Sequential consistency
- Weak consistency models
  - Barrier
  - Release
  - Entry

Fault Tolerance

- Redundancy
  - Physical (e.g., TMR)
  - Information (e.g., Hamming codes, RAID-4/5)
  - Temporal (retransmission)
- Byzantine faults versus fail-silent faults
- Two-army problem

Cryptography

- Symmetric versus public key
- Key length & brute-force attacks
- Key exchange
  - Third-party arbiter, Diffie-Hellman, Public Keys
- Hash functions
- Digital signature (encrypted hash)

Distributed Systems
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Paul Krzyzanowski

Authentication

- Nonce-based
- Authentication + key exchange
- Certificate: signed public key
- Kerberos
- Biometrics
  - Statistical threshold
- OpenID

Security

- Problems
  - Buffer overflow
  - Denial of Service (DoS)
    - SYN flooding
  - Worms, viruses, key loggers, rootkits
- Approaches
  - Authentication, Authorization, Accounting, Auditing
  - Identification vs. Authorization
  - Code signing

Firewalls

- Screening router (packet filter)
- Application proxy
- DMZ (screened subnet)
- Bastion hosts
- VPN: tunneling (+ encryption + signatures)

Clusters

- Types:
  - HPC
  - Batch processing
  - Load balancing
  - High-availabilility
- Shared disk versus shared-nothing
  - DLM (distributed lock manager)
- Warm vs. cold failover
- Multi-directional & Cascading failover
- Load balancing

Virtualization

- Storage virtualization
- Virtual machines
  - VMM (hypervisor)
  - Privileged vs. unprivileged instructions

The End.