Digital Storage Architectures
91.520  Fall Semester  2010

Time and Location:       Wednesday 5:30 - 8:00, OS-401
Instructor:             Prof. W. Moloney
Office and Telephone:  Olsen 222 ,  978-934-3640
Office Hours:          MWF 9:00 – 9:50, W 1:00 -  2:00 and by appt.
Email and Web:         bill@cs.uml.edu      www.cs.uml.edu/~bill/cs520

1  Course Description:

This course will focus on existing and proposed technologies for storing digital information. Both hardware and software issues will be examined, beginning with device and controller organization and proceeding through aggregation techniques, interconnect architectures and host considerations. At each level, specific components will be evaluated with respect to critical storage criteria, including:

- robustness and fault tolerance
- MTBF and MTTR
- recovery strategies
- bandwidth, latency and general performance
- modeling and analysis
- scalability
- architectural constraints and limits.

2  Prerequisites:

Permission of instructor.

3  Text:

Currently there is no required text for the course.

A collection of readings will be posted on the course web site at:
www.cs.uml.edu/~bill/cs520
and several supplemental papers will be distributed during the semester. In addition to various reading assignments, we will have a set of programming assignments due during the semester. It is expected that programming assignments will be written in either the C or C++ programming language for either the Windows or Linux environment as directed.
4 Grading:
Final grades will be based as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Hour Exams</td>
<td>2</td>
<td>60%</td>
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<tr>
<td>Weekly readings and programming assignments</td>
<td>approx. 5 prog’s.</td>
<td>40%</td>
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5 Academic Dishonesty:
In this course all work is to be each student's own. Students should therefore be familiar with the University's rules on academic dishonesty, which can be found in the Graduate School Catalogue and in the Schedule of Classes. In particular, plagiarism will not be tolerated! Any student caught plagiarizing another’s work will automatically receive a grade of F for the course. If you are unsure as to what constitutes plagiarism, it is your responsibility to check with the instructor. Other forms of dishonesty will result in similar actions.

6 Topical Outline:
- Storage device technology
  - magnetic media
  - optical media
  - magneto-optical media
  - system bus interconnects and performance issues
  - PCI
- Legacy block channel device controllers
  - protocols
  - buffer management
  - error control and optimization
  - SCSI
  - IDE
- Aggregation methods
  - space – time considerations
  - concurrency and synchronization
  - subsystem implementations
  - RAID technologies
    - performance
    - cost
    - reliability
    - modeling and performance assessments
- Contemporary busses, controllers and fabrics
• PCI Express bus architecture
• Fibre Channel
  • Controllers
  • Switches
  • Fabrics
• Infiniband
  • Byte striping
  • Fabric topology
• peripheral bus performance limits
• bottlenecks
• storage area networks (SANs)
• Network connection strategies
  • Network protocols and Network Attached Storage (NAS)
  • NFS
  • CIFS
• Embedded channel protocols
  • iSCSI
  • Other protocols over IP
  • FCOE
• Host side issues
  • device driver architectures
  • intelligent controllers
  • HBA to memory paths
  • block and networked file system access
  • general performance issues and limits
  • models for the next generation systems

7 Notes:

Wednesday November 10 is a Thursday schedule, we will not have class.
Wednesday November 24 is the night before Thanksgiving, we will not have class
Exam#1 Wed Oct 13
Exam#2 Wed Dec 8