

Overview of Research in Dependable Computing Systems Lab

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<http://shay.ecn.purdue.edu/~dcs1>

Dependable Computing Systems Lab

- **Sponsors**

- National Science Foundation
- Indiana 21st Century Research and Technology Fund
- Purdue Research Foundation
- Avaya Labs
- Intel

- **Members**

- Bingrui Foo
- Gunjan Khanna
- Padma Varadharajan
- Yu-Sung Wu
- Issa Khalil
- Mark Krasniewski
- Bryan Rabeler

Welcome to:

- Yu-chun Mao
- Ravish Khosla
- And hopefully some of you who are here today ...

Where is DCSL?

- **EE 34**
 - 5 Linux machines
 - 2 PCs
 - HP Laserjet 1500 printer
- **Physics 50**
 - Sensor network testbed with 8 Berkeley Mica motes
 - 1 Linux machine (ibase5)
- **Civil G239**
 - Sensor network testbed with 16 Berkeley Mica 2 motes
 - 2 Linux machines (pyxis & carina)

Who's Who in DCSL?

- Provision keeper: Gunjan (Spring 04), ? (Fall 04)
- Librarian: Issa (Spring 04), ? (Fall 04)
- Webmaster: Hank (Spring 04), Hank (Fall 04)

Going-away party last semester



Logistics

- DCSL group home page at: shay.ecn.purdue.edu/~dcs1
- Planning document detailing goals, deliverables (publications, code) to be submitted by each of you by Sep 10 (1 week from today). Find the document from the group home page under “Internal”
 - Applicable to those who are currently in a project
 - I will be available for special meetings to discuss the planning document week of Sep 6 on M, T, R 5:00-6:30 pm
 - For new members, they would fill the planning form once they are assigned to a project
- Code checkin to CVS on pegasus (/home/cvs)
 - At every major point in the project, typically at least once a month
- Writeups
 - 3-5 page writeups on work to be submitted 2nd and 4th Monday of the month
 - I will review the writeups and send back to you with edits and comments

More Logistics

- The Group Champ competition: Earn points for activities during the semester. The one with the maximum number of points at the end of the semester gets the “Group Champ” award.
 - Points for conference or journal paper: 3 (Submitted), 5 (Accepted); Proposal: 3 (Submitted), 2 (Accepted); Presentations: 4 (External), 3 (Internal); Mentoring: 2; Departmental award: 2 (Applied), 3 (Won); Special initiatives: 2.
- DCSL group logo design
 - Logo for presentations, posters, documents, and publicity material
 - Jpeg file to be submitted by Sep 15
 - Prize to winning entry
- Weekly socializing
 - Play some social sports at RSC: Wallyball to start
 - Then go out for dinner
 - Schedule: Wednesday 6:30-7:30 pm

Project #1: Distributed Disruption Tolerant System

- **Members:** Yu-Sung Wu, Bingrui Foo, Yu-chun Mao, Gene Spafford, (from Avaya) Navjot Singh, Sachin Garg.
- Distributed e-commerce platform subjected to natural failures and malicious attacks to services, collectively called disruption
- Objective is to tolerate disruptions, not just detect
- Different phases: Detection, Diagnosis, Containment, Response.
- Status:
 - Testbed with different services
 - Algorithms for containment and survivability computation
 - Experiments with simulated attacks

Project #1: Distributed Disruption Tolerant System

- **Next steps:**
 - More realistic testbed and extensive experimentation
 - Coping with unanticipated disruptions
 - Containment boundary through modification of service interactions
- **Related project:** SCIDIVE on disruption tolerance in Voice over IP environments
- **Current status:** End-point based design and implementation
- **Next steps:**
 - Distributed detection infrastructure with correlation of alerts
 - Integration as a module within Snort
- **Paper:**
 - “SCIDIVE: A Stateful and Cross Protocol Intrusion Detection Architecture for Voice-over-IP Environments”
 - Appeared at IEEE Dependable Systems & Networks (DSN) in Italy June 28-July 1, 2004.
- **Goals for this semester:**
 - **CONFERENCE**
 - DSN: Deadline – Nov 19; URL: www.dsn.org
 - Security & Privacy: Deadline – Nov 5; URL: www.ieee-security.org/TC/SP2005/oakland05-cfp.html

Project #2: Self-Checking Network Protocols

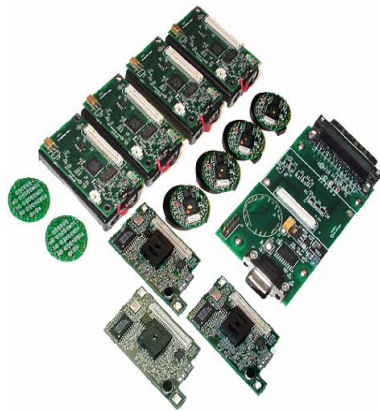
- **Members**
 - Here: Gunjan Khanna, Padma Varadharajan
 - Outside: Ravi Iyer, Zbigniew Kalbarczyk (UIUC), Paulo Verissimo (U. of Lisbon)
- **Goal is to provide highly available network services (e.g., SIP, reliable multicast) in distributed environment**
- **Challenges in today's distributed systems**
 - Large number of network protocol participants
 - No access to source code or machine on which code is running
 - Often soft real-time guarantees
- **Our Approach:**
 - Distributed monitor to observe external interactions and diagnose misbehavior or malfunction
 - A rulebase using temporal logic and fast matching algorithms
 - Hierarchical monitor structure to monitor local and global interactions

Project #2: Self-Checking Network Protocols

- **Status:**
 - Detection with single and multi-level Monitor
 - Experiments (scalability and accuracy) performed with system running reliable multicast
- **Next steps:**
 - Making the Monitor infrastructure more robust
 - Diagnosis of misbehavior
- **Papers**
 - “Self Checking Network Protocols: A Monitor Based Approach,” Gunjan Khanna, Padma Varadharajan, and Saurabh Bagchi. Accepted for publication in the 23rd International Symposium on Reliable Distributed Systems (SRDS 2004), Brazil, October 2004. (Acceptance rate: 27/117)
 - “Distributed Monitors for Detection of Misbehavior in Large Scale Distributed Systems”, In submission to IEEE Transactions on Parallel & Distributed Systems.
- **Goals for this semester**
 - DSN: Deadline – Nov 19; URL: www.dsn.org

Project #3: Dependable Ad-hoc and Sensor Networks

- **Project Members:**
 - Ness Shroff, Mark Krasniewski, Issa Khalil, Bill Chappell, Ravish Khosla, Chin-Lung Yang
- **Testbed of 20 Berkeley motes**



Project #3: Dependable Ad-hoc and Sensor Networks

- **Ad-hoc and sensor networks built of unreliable components and deployed in hostile or uncertain environments**
- **Goal is to provide middleware that provides a robust platform keeping environment constraints in mind**
 - Location determination
 - Robust communication protocols based on hybrid push-pull
 - Secure communication primitives
- **Status**
 - Sensor network testbed with directional antennas and switching
 - Reliability measurements on testbed
 - Location determination with directional antennas simulated and implemented
 - **Secos**: protocol for secure communication resilient to DoS, authentication, and eavesdropping attacks

Project #3: Dependable Ad-hoc and Sensor Networks

- **Next steps:**
 - Design of optimized remote code upload facility
 - Design of failure optimized SPMS
 - Design of secure communication primitive with different classes of attacks (e.g., wormhole)
- **Papers:**
 - "Fault Tolerant Energy Aware Data Dissemination Protocol in Sensor Networks", Appeared in IEEE Dependable Systems & Networks (DSN) in Italy June 28-July 1, 2004. (Acceptance rate: 25/101)
 - "Analysis and Evaluation of SECOS, a Protocol for Energy Efficient and Secure Communication in Sensor Networks," Submitted to Elsevier's Ad-hoc Networks Journal.
- **Goals for this semester:**
 - One paper on location determination: ICDCS. Deadline – Oct 8. URL: <http://www.cse.ohio-state.edu/icdcs05/>
 - One paper on reliability of sensor network links
 - One paper on SPMS: DSN. Deadline – Nov 19. URL: www.dsn.org
 - One paper on SECOS: Security & Privacy. Deadline – Nov 5; URL: www.ieee-security.org/TC/SP2005/oakland05-cfp.html

Project #4: Reliability in Parallel Applications

- **Project Members:**
 - Bryan Rabeler, Rudi Eigenmann
- **Goal**
 - A parallel application may need to execute some portions in reliable execution mode
 - Available processors may be partitioned for fault tolerance and speedup for different parts of code
 - Reliability requirements may vary in different portions of code
 - Required reliability of a portion of code may be user specified or derived from end variable reliability specification
- **Status**
 - OpenMP directive to indicate spatially redundant execution on multiple processors
 - Quantification of performance degradation for different sizes of reliable section

Project #4: Reliability in Parallel Applications

- Next steps
 - Automatic determination of critical sections
 - Handling more complicated reliable modes of execution
- Goals for this semester
 - DSN paper