

Mahesh Balakrishnan

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Education

- 2003 - :** | PhD Student in Computer Science, Cornell University.
Advisor: Ken Birman.
- 2000 - 2003 :** | BS in Computer Science, Georgia Institute of Technology.

Research Interests

- Thesis* | Time-Critical Applications in Datacenters
- Relevant Foci* | Datacenters, Reliable Multicast, Replication, Consistency Models, Ordering Protocols, Group Membership, Forward Error Correction (FEC), IP Multicast, Epidemic/Gossip protocols, Web Services.
- Other Areas* | Overlay Networks, P2P Substrates, Content/Topic-based Publish-Subscribe, Content Delivery Networks, Mobile Ad-Hoc Networks.

Research Experience

- Fall 2005...* | **Tempest: Time-Critical Services in Datacenters:** I am building a collection of protocols and mechanisms aimed at enabling *time-critical* datacenters. Tempest arms programmers with replicated data storage primitives that expose simple APIs while providing fast average performance and worst-case timing guarantees. Tempest uses techniques such as redundant querying, parallelized state-transfer and light-weight edge-caching to combat *timing faults* caused by node crashes, slowdowns and congestion.
With Ken Birman and Amar Phanishayee
- Fall 2004...*
Fall 2005 | **Slingshot/Ricochet: Time-Critical Multicast for Clustered Services:** Slingshot uses *receiver-based Forward Error Correction* to recover within milliseconds from packet loss in datacenter settings. Ricochet extends this idea to multiple groups, providing a reliable multicast primitive that allows each node to belong to hundreds of lightweight groups without sacrificing timely recovery of lost packets. These protocols support replication with *time-critical eventual consistency*, where the period of inconsistency for each update is in the milliseconds. Implementations available for download.
With Ken Birman, Stefan Pleisch and Amar Phanishayee
- Summer 2005* | **Mistral: Efficient Flooding in Mobile Ad-hoc Networks:** We combine probabilistic forwarding with error recovery codes in mobile ad-hoc networks to provide a simple yet effective reliable broadcast mechanism. Senders initially use a probabilistic broadcast to disseminate information; receivers that fail to receive a message via this initial broadcast recover it by exchanging FEC packets with neighbors.
With Stefan Pleisch, Ken Birman and Robbert Van Renesse
- Spring 2004* | **Multi-Group GMS:** Designed and evaluated (through simulation) a hierarchical Group Membership Service that provides tunable levels of consistency while optimizing for heavily overlapping group patterns.
With Ken Birman
- Spring 2002...*
Fall 2002 | **DUSC: Dynamic Updating of Software Classes:** Undergraduate research project; co-wrote a byte-code manipulator that takes in normal class files as input and separates them out into wrapper/implementation pairs, which allows them to be hot-swapped during execution.
With Alex Orso and Mary Jean Harrold

Publications

<i>In Submission</i>	Ricochet: Low-Latency Multicast for Scalable Time-Critical Services. ¹ <i>Mahesh Balakrishnan, Ken Birman, Amar Phanishayee, Stefan Pleisch.</i>
<i>Mobihoc 2006</i>	Mistral: Efficient Flooding in Mobile Ad-hoc Networks. <i>Stefan Pleisch, Mahesh Balakrishnan, Ken Birman, Robbert Van Renesse.</i>
<i>IEEE NCA 2005</i>	Slingshot: Time-Critical Multicast for Clustered Applications. <i>Mahesh Balakrishnan, Stefan Pleisch, Ken Birman.</i>

Research Related Activities

<i>Fall 2004...</i>	Part of a team of 4 students responsible for installing and maintaining a 252-node cluster at Cornell (with initial help from Werner Vogels). Co-wrote infrastructure for co-ordinating experiments and collecting data.
<i>Fall 2005</i>	Successfully demonstrated the Ricochet Protocol to an adversarial external team of software auditors, as part of DARPA's SRS Funding Program.

Presentations

<i>Fall 2005</i>	<i>Cornell Systems Seminar: Presented</i> Vigilante: End-to-End containment of Internet Worms, SOSP 2005.
<i>Summer 2005</i>	<i>IEEE NCA Conference: Slingshot: Time-Critical Multicast for Clustered Applications.</i>
<i>Spring 2005</i>	<i>Cornell Systems Seminar: Presented</i> An Algebraic Approach to Practical and Scalable Overlay Network Monitoring, SIGCOMM 2004.
<i>Spring 2004</i>	<i>CS614 Class Presentation: Large Scale Sharing: GFS and PAST.</i>

Work Experience

<i>Fall 2004...</i>	Research Assistant with Prof. Ken Birman
<i>Spring 2005</i>	Teaching Assistant, CS514 Intermediate Distributed Systems
<i>Spring 2004</i>	Teaching Assistant, CS211 Discrete Mathematics
<i>Fall 2003</i>	Teaching Assistant, CS100M Introductory Computer Science

Course Work

<i>Cornell</i>	CS614 Advanced Systems, CS681 Analysis of Algorithms, CS612 Compiler Design for High-Performance Architecture, CS714 Seminar on Peer-to-Peer Systems, CS411 Programming Languages, CS481 Automata Theory, NCC556 Managerial Finance
<i>Gatech</i>	CS4230/6236 Parallel and Distributed Simulation Systems, CS4290/6290 High Performance Computer Architecture, CS4451 Graphics, CS4600 Artificial Intelligence

Awards/Honours

<i>Fall 2002</i>	Georgia Tech President's Undergraduate Research Award
<i>2002</i>	3rd in ACM Programming Contest South-East Regionals, 2002
<i>2000</i>	Ranked First in Computer Science in India in CBSE High School Graduation Exam
<i>1999</i>	Led a 3-person team that won a national programming competition organized by the Computer Society of India and represented India at the SEARCC international programming contest
<i>1998</i>	Microsoft Certified Systems Engineer at age 16

¹Paper title changed; in submission to blinded Conference. I can provide actual details on request.