

Preetam Ghosh

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RESEARCH SUMMARY:

- *Stochastic Modeling, Analysis and Simulation of complex Biological Systems – currently working on the development of a discrete event simulation tool (iSimBioSys2.0) for a quantitative understanding of complex processes in life sciences (<http://crewman.uta.edu/dynamic/bone.php>).*
- *Pricing, resource management and job scheduling issues in distributed systems with an emphasis on mobile grid computing (<http://crewman.uta.edu/dynamic/mug.php>).*
- *Architecture design, time-slot scheduling and performance analysis of optical burst switched (OBS) core transport network.*
- *Generic optimization problems in wireless networks*
 - *Optimal topology design in radio access network using genetic algorithms.*
 - *QoS support for wireless gaming.*
 - *Overload control algorithms for telecom.*
 - *Performance analysis of JAVA based CSCF processes in an IMS network.*
 - *Slot scheduling algorithms in multi-rate wireless systems.*

RESEARCH INTERESTS:

Areas: Systems Biology, Distributed Computing, Wireless/Mobile Computing, Optical Networks.
Skills: Stochastic modeling techniques, ODE/PDE based modeling, Discrete event simulation, Monte Carlo Simulation, Linear/Non-linear Optimization techniques, Applications of game theory/queueing theory/scheduling theory/control theory/collision theory/graph theory/differential equations.

EDUCATION:

PhD in Computer Science & Engineering, University of Texas at Arlington: Sep, 2004 – Dec, 2007 (expected)

· Stochastic models for In-Silico Event-based Biological Network Simulation.

Advisor: Dr. Sajal K Das and Mr. Kalyan Basu.

Date: December 2007, GPA: 4.00

MS in Computer Science & Engineering, University of Texas at Arlington. Sep, 2002 – Aug, 2004.

· An Optical Burst Switched (OBS) Transport Network to Support Long-Haul Traffic at the Core.

Advisor: Dr. Sajal K Das and Mr. Kalyan Basu.

Graduation Date: August 2004, GPA: 3.82

Bachelor in Computer Science & Engineering, Jadavpur University, Kolkata, INDIA. July, 1996 – June 2000

· Design, implementation and testing of the Indian Language Interface With Database (ILID) Software: involving VC++ and Microsoft Access database concepts.

Advisor: Dr. Shibaji Bannerjee, Jadavpur University.

Graduation Date: June 2000, GPA: 3.75

RESEARCH STATEMENT

My research interests are broadly in the areas of modeling and simulation of complex network systems with a focus on biological networks, distributed computing, wireless/mobile computing and optical networks.

My research experience outside my PhD dissertation area span various network modeling and simulation techniques in distributed systems and wireless/optical networks. I have worked on resource management and job scheduling problems in distributed computing with a focus on mobile grid computing. We proposed an IEEE 802.11 based mobile grid infrastructure and developed a novel game-theoretic pricing strategy that can lead to cost-optimal job scheduling algorithms in this environment. I have also worked in the area of topology design and performance analysis of wireless mesh networks, focusing on genetic algorithm based approaches for designing optimal connectivity in an arbitrary mesh deployment scenario. The same concept was extended to design a reliable Virtual Private Network (VPN) later on. During my internship at Nokia Research Center, I focused on designing a hybrid architecture to support massively multiplayer games incorporating mobile device users. Also, I worked on designing and implementing a dynamic packetization algorithm and proposed a TCP-friendly transport layer protocol that incorporates adaptive Forward error control and rate control techniques to improve throughput in such wireless gaming infrastructures. During my internship at Nortel Research Labs, I worked on developing an analytical framework for performance evaluation and capacity planning for Nortel's IP Multimedia Systems that reduces the complexity of OPNET based modeling. I also worked on an adaptive overload control algorithm for generic telecom switches that can maximize the revenue of the wireless service providers. My Master's thesis work was in the area of Optical Networks. I worked on developing a novel photonic container switched architecture using the Optical Burst Switching concept, and also devised

centralized scheduling algorithms to implement a zero packet loss all-optical core network. Some other research works include combinatorial reverse-auction based slot scheduling algorithms in multi-rate wireless systems.

I am currently working on modeling and simulation of complex biological networks. I work in the Biological Networking group, where our core goal is to apply system modeling techniques for holistic understanding of cellular processes. My thesis work is centered around developing generic, stochastic, parametric and computationally fast models of basic biological processes like biochemical reactions, molecule/ion diffusion, ligand-protein docking, protein-DNA binding and protein synthesis. These models are plugged into a discrete event based simulation framework, iSimBioSys, for studying the dynamics of gene regulatory and metabolic networks in bacterial cells (both E. coli and Salmonella typhimurium). I am also developing a Markov chain based stochastic simulator that can handle a system of biochemical reactions and overcomes the stiffness problem of the classical Gillespie simulator. These simulators are more flexible and scalable than the standard ODE based system simulators.

PROFESSIONAL EXPERIENCE:

Industry Experience:

Pfizer Global Research & Development, PGRD-Groton, USA

Exploratory Medicinal Sciences-Computational Biology Intern, June 2007 – Aug 2007

Worked on automating the pocket mining activity by integrating bioinformatics tools (e.g., TIP-EVE, Pharmamatrix, Ingenuity Pathway Analysis) for drug target discovery using PERL scripts. This initiated the TIP integration of the Pfizer internal protein database project where we store the publicly available and Pfizer proprietary proteins in a complex ORACLE database to be able to generate pdb files against specific PDB-Ids or protein sequences and apply the Sitesorter, Siteseeker and Sequence Alignment algorithms for various pocket mining activities e.g., pathway/target identification.

Also worked on a systems biology project for the RNA interference system using the Gillespie Stochastic Simulator and ODE based simulators (from the SimBiology toolkit of Matlab) for in silico prediction of the potency effects of siRNAs. This involved a chemical kinetic theory based reaction model to approximately study the difference in the rate constant of the siRNA-RISC complex formation reaction for 2-nt 3' overhangs and blunt-ended siRNA molecules. Experiments are underway at PGRD-Groton for validating the model and the system simulation results as we plan to publish this work shortly.

Nortel Research Lab, Richardson, USA

Wireless Core Systems Engineering Intern, Feb 2006 – May 2006

Worked on data sanity checking for Large office testing of PMSC13 and proposing new KPIs (Key Performance indicators) for voice quality improvement in Nortel switches. Also worked on a novel overload control algorithm for revenue maximization in wireless switches and performance analysis for the CSCF based IMS subsystem for Nortel's converged core network.

Nokia Research Centre, Irving, USA

Research Intern, June 2004 – August 2004

Propose and implement enhancements on existing Snap architecture to support massively multiplayer online networked games on wireless devices. This include changes in the gaming architecture (a hybrid of peer-to-peer and client-server architectures), identifying an efficient decentralized load balancer, modifying the transport layer protocols (RUDP) for efficient and reliable delivery of game packets, and proposing efficient algorithms for synchronization and fairness issues.

Tata Consultancy Services, India (<http://www.tcs.com>)

Assistant Systems Engineer, TCS-Kolkata, India, July 2000 – August 2002

Worked on a Real Time Kernel development for Embedded Systems applications.

Academic Experience:

- 1) Research Assistant at CreWMaN lab under Dr. Sajal Das and Mr. Kalyan Basu (Fall 2005): Worked on developing an analytical tool for performance evaluation and capacity planning of Nortel's IP Multimedia Systems (IMS) that can reduce the complexity of OPNET based modeling in complicated server architectures. The work considered Intel's blade server architecture on which Nortel is implementing the Java based Call Server Control Functions (CSCFs) of the IMS.
- 2) Teaching Assistant:
 - CSE 2320: Datastructures & Algorithms (Fall 2002, Spring 2003, Fall 2003, Spring 2004, Fall 2005, Fall 2006)
 - CSE 1320: C/C++ programming (Summer 2003)
 - CSE 3315: Digital Logic & Programming (Fall 2004, Spring 2005)
 - CSE 5311: Advanced Algorithms (Summer 2005)

TECHNICAL SKILLS:

Programming Platforms & Languages: C, C++, Java, PERL, ORACLE, Assembly Languages (8085/8086/), HP-UX (10.XX & 9.XX), VxWorks, DSP-BIOS (in-built kernel for TMS320C54X processor).

Tools: Dizzy, Matlab, SQL-PLUS, TIP-EVE, Pharmamatrix, Ingenuity Pathway Analysis, XPPAUT, and **R** statistical package.

PUBLICATIONS (Peer Reviewed): (Conferences: C*, Journals: J*, Book Chapters: B*)

Research Area: Systems Biology

- C1) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu and Sajal K Das, A Diffusion Model to Estimate the Inter-arrival Time of Charged Molecules in Stochastic Event based Modeling of Complex Biological Networks. (poster paper) IEEE Computational Systems Bioinformatics Conference (CSB) 2005, Stanford University, USA.
- C2) Samik Ghosh, **Preetam Ghosh**, Kalyan Basu and Sajal K Das, iSimBioSys: An 'In Silico' Discrete Event Simulation Framework for Modeling Biological Systems. (poster paper) IEEE Computational Systems Bioinformatics Conference (CSB) 2005, Stanford University, USA.
- C3) Samik Ghosh, **Preetam Ghosh**, Kalyan Basu, S. Daeffler and S. Das, "iSimBioSys: A Discrete Event Simulation Platform for 'in silico' Study of Biological Systems", accepted for publication at the IEEE 39th Annual Simulation Symposium, 2006.
- C4) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu, Sajal Das and Simon Daeffler, "An Analytical Model to Estimate the time taken for Cytoplasmic Reactions for Stochastic Simulation of Complex Biological Systems", accepted for publication at the IEEE Granular Computing Conference, 2006.
- C5) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu, Sajal Das and Simon Daeffler, "Stochastic Modeling of Cytoplasmic Reactions in Complex Biological Systems", accepted for publication at the International Conference on Computational Science and its Applications, ICCSA 2006.
- C6) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu, Sajal Das and Simon Daeffler, "Modeling the Diffusion process in Stochastic Event based Simulation of the PhoPQ system", International Symposium on Computational Biology and Bioinformatics (ISBB 2006), December, 2006, Bhubaneswar, India.
- C7) Samik Ghosh, **Preetam Ghosh**, Kalyan Basu and Sajal K Das, A Hybrid Simulation Framework for genome scale study of molecular dynamics in Escherichia Coli. Seventh International Conference on Systems Biology (ICSB 2006), Oct 9-13, Japan.
- C8) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu, Sajal Das and Simon Daeffler. A Model to estimate the time taken for protein-DNA binding in Stochastic Discrete Event Simulation of Biological Processes. To appear at the 2007 IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB), 2007, Hawaii, USA.
- C9) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu, Sajal Das and Simon Daeffler. A stochastic model to estimate the time taken for protein-ligand docking. To appear at the 2006 IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB), 2006, Toronto, Canada.
- C10) Kalyan Basu, Samik Ghosh, **Preetam Ghosh** and Sajal Das. Genome scale cell modeling using stochastic discrete event simulation. (poster paper) accepted for publication at the Conference on Stochastic Networks (SNC 2006), UIUC, 2006.
- C11) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu and Sajal K Das, Parametric and Stochastic Modeling of Molecular Reactions in the Cell. (poster paper) Dallas Area Bioinformatics and Computational Biology Workshop (DABC) 2006, U.T. SouthWestern Medical Centre, USA.
- C12) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu and Sajal K Das, A Markov Model based Analysis of Stochastic Biochemical Systems. LSS Computational Systems Bioinformatics Conference (CSB) 2007.
- C13) Samik Ghosh, A. R Mazloom, **Preetam Ghosh**, Kalyan Basu and Sajal K Das, Connecting the dots: An integrated database for studying cellular dynamics. Eighth International Conference on Systems Biology (ICSB), Oct 1-6, CA, USA. 2007.
- C14) Samik Ghosh, **Preetam Ghosh**, Kalyan Basu and Sajal K Das, Modeling the stochastic dynamics of gene expression in single cells: A Birth and Death Markov Chain Analysis. IEEE International Conference on Bioinformatics and Biomedicine (BIBM), 2007.
- C15) Samik Ghosh, **Preetam Ghosh**, Kalyan Basu and Sajal K Das, Modeling the stochastic dynamics of protein synthesis: A discrete event simulation approach. Biotechnology and Bioinformatics Symposium (BIOT-2007), Colorado Springs, 2007.
- J1) Samik Ghosh, **Preetam Ghosh**, Kalyan Basu, Sajal Das and Simon Daeffler, *A stochastic discrete event simulation approach to study system level dynamics of biological processes*, to appear at ACM Transactions on Modeling and Computer Simulation (TOMACS), special issue on Successes In Modeling and Simulation Methodologies, 2007.
- J2) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu and Sajal Das, *Holding Time Estimation for Reactions in Stochastic Event-based Simulation of Complex Biological Systems*, to appear at Elsevier Simulation Modelling Practice and Theory, 2007.
- J3) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu, Sajal Das and Simon Daeffler, *A Computationally Fast and Parametric Model to estimate Protein-Ligand Docking time for Stochastic Event based Simulation*, to appear at LNCS Transactions on Computational Systems Biology, 2007.
- J4) **Preetam Ghosh**, Samik Ghosh, Kalyan Basu, Sajal Das and Simon Daeffler, *Parametric modeling of protein-DNA binding kinetics: A Discrete Event based Simulation approach*, (under 2nd round reviews at Journal of Discrete Applied Mathematics, special issue on Networks in Computational Biology).

J5) Samik Ghosh, **Preetam Ghosh**, Kalyan Basu, Sajal Das, *Capturing the stochasticity in prokaryotic gene expression : A Birth and Death Markov Chain Approach*, journal paper under review at *IEEE/ACM Transactions in Computational Biology and Bioinformatics*, 2007.

B1) Samik Ghosh, A. R Mazloom, **Preetam Ghosh**, Kalyan Basu, Sajal Das, *Stochastic simulation of cellular dynamics: A Discrete Event based Approach*, book chapter accepted for review at Springer-Verlag series in "Studies in Computational Intelligence", *Applications of Computational Intelligence in Bioinformatics and Biomedicine: Current Trends and Open Problems* (vol. 2), 2007.

Research Area: Distributed Computing

C16) **Preetam Ghosh**, Nirmalya Roy, Sajal Das and Kalyan Basu, A Game Theory based Pricing Strategy for Job allocation in Mobile Grids. 18th IEEE International Parallel & Distributed Processing Symposium (IPDPS), 2004, Santa Fe, USA.

C17) **Preetam Ghosh**, Kalyan Basu and Sajal Das, Cost-Optimal Job Allocation Schemes for Bandwidth-Constrained Distributed Computing Systems. 12th Annual IEEE International Conference on High Performance Computing (HiPC), 2005, Goa India.

C18) **Preetam Ghosh**, Nirmalya Roy and Sajal Das, Mobility-based Cost-efficient Job Scheduling in Mobile grids. 1st IEEE International Workshop on Context-Awareness and Mobility in Grid Computing (held in conjunction with CCGrid 2007), 2007, Brazil.

J6) **Preetam Ghosh**, Nirmalya Roy, Sajal Das and Kalyan Basu, *A Pricing Strategy for Job Allocation in Mobile Grids using a Non-cooperative bargaining Theory Framework*, in Special Issue on Design and Performance of Networks for Super-Cluster and Grid-Computing, JPDC, 2005

J7) **Preetam Ghosh**, Kalyan Basu and Sajal Das, *A Game Theory based Pricing Strategy to support Single/Multi-Class Job Allocation Schemes for Bandwidth Constrained Distributed Systems*. IEEE Transactions on Parallel and Distributed Systems, 2007.

Research Area: Optical Networks

C19) **Preetam Ghosh**, Kalyan Basu and Sajal Das, A Novel Photonic Container Switched OBS Architecture and Nonpreemptive Scheduler for the Core Transport Network. 19th International Teletraffic Congress (ITC19), 2005, China.

C20) **Preetam Ghosh**, Kalyan Basu and Sajal Das, A Photonic Container Switched Transport Network to Support Long-Haul Traffic at the Core. Second IEEE International Conference on Broadband Networks (Broadnets Optical networking Symposium), 2005, Boston, USA.

C21) **Preetam Ghosh**, Amin R Mazloom, Kalyan Basu and Sajal K Das: A Centrally-Scheduled Photonic Container Switched Architecture For The Core Transport Network. Pacific Telecommunication Council Conference, 2006, Hawaii, USA.

J8) **Preetam Ghosh**, Kalyan Basu and Sajal Das, *A Novel Photonic Container Switched Architecture and Scheduler to Design the Core Transport Network*. IEEE Transactions on Computers, 2007.

J9) Amin R Mazloom, **Preetam Ghosh**, Kalyan Basu and Sajal Das, *CoCONet: A Collision-free Container-based Core Optical Network*, (under 2nd round reviews at Elsevier Computer Networks Journal).

Research Area: Optimization problems in Wireless Networks

C22) Soumya Sanyal, **Preetam Ghosh**, Kalyan Basu and Sajal Das, Towards the Optimal design of an Enterprise Network: A genetic algorithm perspective. XVth International Symposium on Services and Local Access (ISSLS), 2004, Scotland, UK.

C23) Samik Ghosh, **Preetam Ghosh**, Kalyan Basu and Sajal Das, GaMa: An Evolutionary Algorithmic Approach for the Design of Mesh-Based Radio Access Networks. 30th IEEE Conference on Local Computer Networks (LCN), 2005, Sydney, Australia.

C24) **Preetam Ghosh**, Kalyan Basu and Sajal Das, A Cross-Layer Design to Improve Quality of Service in Online Multiplayer Wireless Gaming Networks. Second IEEE International Conference on Broadband Networks (Broadnets Applications/Services Symposium), 2005, Boston, USA.

C25) **Preetam Ghosh**, Nirmalya Roy, Kalyan Basu, Sajal K Das, Paul Wilson and Prabir Das: A Case Study-based Performance Evaluation Framework for CSCF Processes on a Blade-Server. 3rd IEEE International Conference on Networking and Services, Greece, 2007.

C26) Sourav Pal, **Preetam Ghosh**, Sumantra R. Kundu, Amin Mazloom and Sajal K. Das, Two Phase Scheduling Algorithm for Maximizing the Number of Satisfied Users in Multi-Rate Wireless Systems. IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WOWMOM 2007), Helsinki, Finland.

C27) Sourav Pal, **Preetam Ghosh**, Sumantra R. Kundu and Sajal K. Das, Energy-Efficient Access time Minimization in Wireless Data Broadcasting. Submitted to International Conference on Distributed Computing and Networking (ICDCN), 2008.

C28) Sourav Pal, Sumantra R. Kundu, **Preetam Ghosh**, Kalyan Basu and Sajal K. Das, Emancipating the IEEE 802.11 Network from Handoff Delay. To appear at DialM-POMC Workshop on Foundations of Mobile Computing, 2007.

J10) Haitao Lin, **Preetam Ghosh** and Prabir Das, Wireless Networks Revenue Optimization through Overload Control with Priority Services, in the Journal of Communications (JCM), issue 4, 2006, ISSN 1796-2021.

J11) **Preetam Ghosh**, Kalyan Basu and Sajal Das, *Improving End-to-End Quality of Service in Online Multiplayer Wireless Gaming Networks*. Elsevier Computer Communications, special issue on End-to-end Support over Heterogeneous Wired-Wireless Networks, 2007.

TECHNICAL REPORTS (Non-Peer Reviewed):

- 1) **Preetam Ghosh**, S. Ghosh, K. Basu, S. Das, S. Daefler, "Estimation of the holding Time for Cytoplasmic Reactions in Stochastic Event Based Modeling of Complex Biological Networks", TR CSE-2005-09.
- 2) **Preetam Ghosh**, S. Ghosh, K. Basu, S. Das, S. Daefler, "Transient analysis of Diffusion for charged molecules to model the input process in a stochastic event based simulation framework for the PhoPQ signal transduction system ", TR CSE-2005-07.
- 3) **Preetam Ghosh**, Shashikant Maheshwari and Giridhar Mandyam, *A Dynamic Packetization Scheme to Improve Transport Layer Performance in Online Multiplayer Wireless Gaming*. Technical Report, Nokia Research Centre, Irving, Dallas.

Relevant Courses: Advanced Algorithms, Advanced Operating Systems, Graph Theory and Combinatorics, Telecommunications Network Design, Computational Geometry, Local Area Networks, Advanced Wireless Networks, Cross-Layer Optimization in Wireless Networks, Multi-Service Switching Architecture, Local Area Networks, Computer System Performance (with emphasis on Queueing Theory), Parallel Processing, Advanced Bioinformatics Database, Bioinformatics, Computational Geometry, Advanced Topics in Bioinformatics, Modeling Biological Networks, Advanced Biostatistics.

PRESENTATIONS:

- . "Parametric and Stochastic models for Discrete Event based biological system simulations", seminar talk at **Pfizer Inc., PGRD-Groton, CT**, June 2007.
- . "Applications of Systems Biology in the Pharmaceutical Industry: Some studies on the RNA Interference technology and Pocket Mining Activities", seminar talk at **Pfizer Inc., PGRD-Groton, CT**, August 2007.

PROFESSIONAL ACHIEVEMENTS/AFFILIATIONS:

- . Recipient of the **Nokia sponsored Best Master's thesis award** for academic year 2003-2004.
- . **2nd place in IDEAZ 2005**, Graduate Research Competition, at UTA.
- . **2nd prize in Pacific Telecommunication Council (PTC) essay prize competition 2005**
http://www.ptc.org/resources/essay2005_winner.html
- . Recipient of the **Who's Who Among American Students Award**, 2006.
- . Recipient of the **University Scholar Award**, 2007 at UTA.
- . Recipient of **Dean's Fellowship** at UTA: Fall 2002 – till present.
- . Recipient of **TxTec scholarship** at UTA: Fall, 2004 – Summer 2006.
- . Recipient of the **Nokia Scholarship**: Fall 2004.
- . Recipient of **Graduate Teaching Assistantship** at UTA: Fall 2002 – Summer 2005, Fall 2006 - present.
- . Recipient of **Graduate Research Assistantship** at UTA: Fall 2005-Summer 2006.
- . Nominated for **Tau-Beta-Pi**, National Engineering Honor Society, Fall 2003
- . Reviewer of **IEEE** and **ACM** conferences and journals
- . Student Member, **IEEE Computer Society**.
- . Recipient of National Scholarship and Merit Awards at both Secondary and Higher Secondary (Plus Two) Levels

References:

Available upon request