# *Ashiwan Sivakumar*

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## Current appointment:

Post doctoral fellow in School of Computer Science, Carnegie Mellon University with Prof. Peter Steenkiste.

## Research Interests:

Computer Networking and Systems: Networked systems, protocols and applications; Mobile Web; Scalable systems; User experience in cellular networks; Content Delivery Networks; Cloud computing; Performance measurements;

## Education:

**Ph.D. in Computer Engineering, Purdue University,** December 2017
Thesis title: Scalable Redundant Execution in the Edge for Low-latency Web over Cellular Networks.
Research Advisor: Prof. Sanjay Rao

**Bachelor of Engineering, Electrical Engineering Major, Anna University, Madras Institute of Technology Campus, Chennai, India**, May 2007
Graduated with Distinction; *Dept. Rank 3*

## Publications:

### Conferences and Workshops

- *"Scalable whittled proxy execution for low-latency Web over cellular networks"*, Ashiwan Sivakumar, Chuan Jiang, Yun Seong Nam, Shankaranarayanan P.N., Vijay Gopalakrishnan, Sanjay Rao, Subhabrata Sen, Mithuna Thottethodi and Vijaykumar T.N. In *Proceedings of the 2017 ACM MOBICOM*, (Snowbird, UT), MOBICOM' 17. *(Acceptance Rate: 35/189 = 18.5%)*
- *"Reducing latency through page-aware management of web objects by content-delivery networks"*, Shankarnarayanan P.N., Yun Seong Nam, Ashiwan Sivakumar, Balakrishnan Chandrasekaran, Bruce Maggs and Sanjay Rao. In *Proceedings of the 2016 ACM SIGMETRICS International Conference on Measurement and Modeling of Computer Science*, (Juan-les-Pins, France, 2016), SIGMETRICS' 16. *(Acceptance Rate: 28/208 = 13%)*
- *"Measuring and characterizing the performance of interactive multi-tier cloud applications"*, Mohammad Hajjat, Shankarnarayanan P.N., Ashiwan Sivakumar and Sanjay Rao. In *Proceedings of the 21$^{st}$IEEE International Workshop on Local and Metropolitan Area Networks* , (Beijing, China, 2015), LANMAN '15. *(Invited paper)*
- *"PARCEL: Proxy Assisted bRowsing in Cellular networks for Energy and Latency reduction"*, Ashiwan Sivakumar, Shankaranarayanan P.N., Vijay Gopalakrishnan, Seungjoon Lee, Sanjay Rao and Subhabrata Sen. In *Proceedings of the Tenth ACM Conference on Emerging Networking Experiments and Technologies* (Sydney, Australia, 2014), CoNEXT '14. *(Acceptance Rate: 37/186 = 20%)*
- *"Cloud is not a silver bullet: A case study of cloud-based mobile browsing"*, Ashiwan Sivakumar, Vijay Gopalakrishnan, Seungjoon Lee, Sanjay Rao, Subhabrata Sen and Oliver Spatscheck. In *Proceedings of the 15th Workshop on Mobile Computing Systems and Applications* (New York, NY, USA, 2014), HotMobile '14. *(Acceptance Rate: 22/72 = 30%)*

- *"Performance Sensitive Replication in Geo-distributed Cloud Datastores"*, Shankaranarayanan P.N., Ashiwan Sivakumar, Sanjay Rao and Mohit Tawarmalani. In *Proceedings of the 44th Annual IEEE/IFIP International Conference on Dependable Systems and Networks* (Atlanta, GA, USA, 2014), DSN '14. *(Acceptance Rate: 56/185 = 30%)*
- *"Closer to the Cloud - A Case for Emulating Cloud Dynamics by Controlling the Environment"*, Ashiwan Sivakumar, Shankaranarayanan P N and Sanjay Rao. In *Proceedings of the First GENI Research and Educational Experiment Workshop* (Los Angeles, CA, USA, 2012), GREE' 12.

**Posters and Demos**

- *(Acceptance Rate: 28/208 = 13%) "Demo (PARCEL): Proxy Assisted bRowsing in Cellular networks for Energy and Latency Reduction."*,
  *AT&T Research Academic Summit 2016 (AT&T Labs – Research), Bedminster, NJ.*
- *"D-Tunes: Self tuning datastores for geo-distributed interactive applications"*, Shankaranarayanan P. N., Ashiwan Sivakumar, Sanjay Rao and Mohit Tawarmalani.
  *ACM SIGCOMM 2013, HongKong.*
  *USENIX NSDI 2013, Lombard, IL.*
- *"Emulating cloud dynamics and evaluating schemes for adapting to cloud dynamics using GENI"*, Ashiwan Sivakumar, Shankaranarayanan P.N., Mohammad Hajjat and Sanjay Rao.
  *GENI Engineering Conference 2011, Denver, CO.*
  *First DFG/GENI Doctoral Consortium 2011, San Juan, PR.*

## Research Experience:

- **Purdue University** — **Graduate Research Assistant**
  **Internet Systems Laboratory** — **Fall 2012 – present**
  I worked on improving the mobile web performance in cellular networks along with my colleagues and collaborators in AT&T labs, which evolved from my internships in AT&T labs. We argued for optimizing the last-mile network delays that dominate client latency in cellular settings, owing to the dramatic increase in mobile processor speeds. I led the effort developing an end-to-end proxy-based browsing solution, where the proxy interprets HTML, CSS and executes Javascript on behalf of a mobile client and proactively pushes the objects to cut network latencies. Further, I developed and actively maintained an infrastructure to evaluate end-to-end browsing performance from a client's perspective in live LTE settings. As a follow up, along with professors Mithuna and Vijaykumar at Purdue, we addressed the scaling challenge associated with the Javascript computational overhead at the proxy that must support millions of users by applying techniques from programming languages and computer architecture. Along with my main project, I actively worked with my colleagues on multiple projects in the web and cloud computing space. We proposed a page-aware management of CDN caches to reduce web application front-end latencies as well as optimize back-end latencies through intelligent replica placements taking application characteristics and consistency requirements into account. Along with my colleague I drove the initiative to evaluate GENI as a tested for our cloud computing project, in particular deploying multi-tier enterprise applications in a geo-distributed setting using GENI. We actively participated in GENI workshops and provided feedback to NSF as part of their GENI testbed effort.
- **AT&T Labs – Research** — **Technical Research Intern II**
  **Florham Park, NJ** — **Summer 2012, Summer 2013**
  I conducted a measurement study comparing the performance of popular cloud-based mobile browsers like Opera Mini, Amazon Silk, pagespeed compression proxy to that of a traditional browser and identified drawbacks of a cloud-heavy thin-client approach for browsing in cellular networks. Consequently, I developed a proxy-assisted browsing system for latency reduction in cellular networks by judiciously refactoring browsing functionality between the client and the cloud. The internships led to publications in ACM HotMobile 2014, ACM CoNEXT 2014 and one which is under submission for publication.
  Mentors: Vijay Gopalakrishnan (AT&T labs), Seungjoon Lee (Google), Subhabrata Sen (AT&T labs) and Oliver Spatscheck (AT&T labs)

## Industry Experience:

- **Cisco Systems** **Software Development Engineer (Grade 6)**
  **Bangalore, India** **June 2007 – August 2010**
  I was hired by Cisco Systems in my undergraduate senior year through an on-campus career fair. I joined the Edge Routing Business Unit under the Routing and Switching Technology Group after graduation. I was responsible for developing protocol features for the 7600, a distributed edge router platform. I was involved in the design and implementation of control-plane and management protocols such as Y.1731, BGP Prefix-Independent Convergence(PIC), Bridging of Routed Encapsulation for ATM interfaces (RFC 1483) and MPLS with traffic-engineering tunnels on top of the Cisco Internetworking Operating System (IOS) platform. I was also responsible for developing unit and regression test suites for my implementation and maintaining the features that I developed. I completed the following networking certifications at Cisco – Cisco Certified Network Associate (CCNA) and Building Scalable Cisco Internetworks (BSCI). I was awarded the Cisco achievement program award for my contribution to the development of the ATM BRE shared port adapter card and the associated software drivers.

## Teaching Experience:

- **Purdue University** **Teaching Assistant**
  Senior course, "Operating Systems Engineering" **Spring 2011 and Spring 2012**
  This course was taught by Prof. Y. Charlie Hu. My responsibilities included developing and conducting the course project where students implemented features of an operating system viz., process, memory and file system management. I gave guest lectures for the course project during the lab session on virtual memory, thread synchronization etc. as well as graded the course project and examinations.
- **Purdue University** **Teaching Assistant**
  Sophomore course, "Advanced C Programming" **Fall 2010 and Fall 2011**
  My responsibilities involved teaching weekly recitations as well as developing the programming projects, conducting the lab sessions and grading the projects. The assignments involved sorting algorithms, data structures like linked list, binary (search) trees and hash table, string and pointer manipulation, recursion etc.
- **Guest lecture** on the $HTTP$ protocol (evolution leading to $HTTP/2$) in the undergraduate and graduate computer networks courses taught by Prof. Sanjay Rao (**Fall 2016 and Spring 2017**). **Guest lecture** on Threaded web server and client (Java) in the graduate networking course (**Spring 2016**).

## Mentoring Experience:

**Purdue University**
**Internet Systems Laboratory** **Summer 2014, 2015, 2016**
I have worked closely with several undergraduate students as part of the mobile web project and interacted with a few Masters students in the cloud computing project. Specifically, I have supervised two undergraduate projects on 'measuring energy profile of SPDY protocol on cellular devices' (part of the Purdue Summer Undergraduate Research Fellowship program, an article published in the SURF symposium) and 'improving robustness of a web page replay and test framework'.

## Technical Talks:

- "NutShell: Scalable Whittled Proxy Execution for Low-Latency Web over Cellular Networks" in *ACM MobiCom'17, Snowbird, UT, US*
- "Cheap and Fast : Scalable Redundant Execution for Low-Latency Mobile Web" *Talks in Microsoft Research India, AT&T Labs Research, UC Berkeley, CMU*
- "Measuring and characterizing the performance of interactive multi-tier cloud applications" *Invited talk in IEEE LANMAN'15, Beijing, China*
- "PARCEL: Proxy-assisted Browsing in Cellular networks for Energy and Latency reduction" in *ACM CoNEXT'14, Sydney, Australia*

- "Cloud is not a silver bullet: A case study of cloud-based mobile browsing" in *ACM HotMobile'14, SantaBarbara, CA, US*
- "Closer to the cloud: A case for emulating cloud dynamics by controlling the environment" in *1st GENI Research and Educational Experiment Workshop 2012, Los Angeles, CA, US.*

## Patents submitted:

- Provisional patent application with GM research and CMU on 'Method and apparatus of using cloud as an extended service for high-precision Simultaneous Location and Mapping' Dr. Ashiwan Sivakumar, CMU. Dr. Fan Bai, GM and Prof. Peter Steenkiste, CMU.
- Utility or design application with AT&T labs and Purdue on 'Scalable Whittled Proxy Execution for Low-Latency Web Over Cellular Networks' Vijay Gopalakrishnan, Subhabrata Sen, Shankaranarayanan Puzhavakath Narayanan (AT&T Labs); Ashiwan Sivakumar, Sanjay Rao, Mithuna Thottethodi, T.N. Vijaykumar (Purdue University).
- Utility or design patent application with AT&T labs and Purdue on Patent number 20160150006 'Device Data Transfer Via a Wireless Interface' Subhabrata Sen, Vijay Gopalakrishnan, Oliver Spatscheck, Seungjoon Lee (AT&T Labs); Sanjay Rao, Ashiwan Sivakumar and Shankaranarayanan Puzhavakath Narayanan (Purdue University).

## Professional Service:

- Reviewer for journals IEEE/ACM Transactions on Networking, IEEE Transactions on Vehicular Technology (2018)
- External reviewer for IEEE INFOCOM (2016), ACM MobiHoc 2016, IEEE Cloud 2016, USENIX NSDI 2014, ACM CoNEXT 2013, ACM NOSSDAV (2012).
- Student organizer for ACM SIGCOMM 2014 – configured and released Whova mobile application used by conference attendees.
- Technical program scribe for USENIX NSDI 2013.

## Academic Achievements:

- Received the Purdue ECE Magoon outstanding teaching assistant award for ECE 469 (Operating Systems Engineering) for the year 2011-2012.
- Student travel grant award recipient for ACM CoNEXT'14, MobiSys'14, HotMobile'14 and NSDI'13 conferences.
- Indian chamber of commerce award for topping the academic district in the high school exam (2003-2004).
- National scholarship for academic excellence from Reynolds India Ltd. (cash award of 20K INR) (2002-2003).
- Honored with a merit certificate and cash award for being among the top 0.1% high score in Mathematics in the All India Secondary School Certificate Examination (2000-2001).

## References:

Would be provided upon request.