

Avinash Kumar Chaurasia - curriculum vitae

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Research Interests My research interests lie in broad area of networked systems including network function virtualization, high speed system networks and mobile computing. I also have inclination towards Virtualization and Cloud Computing.

Education

Indian Institute Of Technology Bombay (IIT-B), India Ph.D. in Computer Science and Engineering Advisors: Bhaskaran Raman	Mumbai, India July 2016 - GPA: 8.87/10
Indian Institute Of Technology Kanpur (IIT-K), India M.Tech in Computer Science Advisors: Aditya Jagannatham and Sanjeev Saxena	Kanpur, India July 2011 GPA: 8.33/10
National Institute Of Technology Allahabad (MNNIT), India B.Tech in Computer Science BTP advisor: Sunita Agarwal	Allahabad, India May 2008 GPA: 8.06/10

- Papers**
- [1] **Avinash Chaurasia**, Anshuj Garg, Bhaskaran Raman, Uday Kurkure, Hari Sivaraman, Lan Vu, Sairam Veeraswamy, "Simmer: Rate proportional scheduling to reduce packet drops in vGPU based NF chains" ICPP, 2022.
 - [2] **Avinash Chaurasia**, Bhaskaran Raman, Praveen Kumar Gupta, Omkar Prabhu, Shashank P, Anshuj Garg, "Hummingbird: Leveraging Heterogeneous System Architecture for deploying dynamic NFV chains" CCGrid, 2022.
 - [3] **Avinash Chaurasia**, Uday Kurkure, Hari Sivaraman, Lan Vu, Sairam Veeraswamy, Bhaskaran Raman, "Network functions in virtualized GPU environment" HPCS, 15 Mar. 2021.
 - [4] Naman Mishra, **Avinash Chaurasia**, Arun Kallavi, Bhaskaran Raman, Purushottam Kulkarni, "Usage of 802.11n in Practice: A Measurement Study," COMSNETS, 6-10 Jan. 2015.
 - [5] **Chaurasia, A.K.**; Jagannatham, A.K., "Dynamic parallel TCP for scalable video streaming over MIMO wireless networks," Wireless and Mobile Networking Conference (WMNC), 2013 6th Joint IFIP , pp.1-6, 23-25 April 2013.
 - [6] **Chaurasia, Avinash**; Dubey, Utkarsh; Ghosh, R. K., "A robust key management scheme with strong connectivity for wireless sensor network," Collaboration Technologies and Systems (CTS), 2012 International Conference on , pp.190-194, 21-25 May 2012.

- Journals**
- [1] Mukulika Maity, Bhaskaran Raman, Mythli Vutukuru, **Avinash Chaurasia**, Rachit Srivastava, "Witals: AP-centric Health Diagnosis of WiFi Networks", IEEE Transactions on Mobile Computing, 2017.
 - [2] **Chaurasia, A.K.**; Jagannatham, A.K., "Parallel TCP and Scalable Video Coding for Jitter Free Video Transmission Over MIMO Wireless Networks", Special issue of Telecommunication journal, Springer, 2015.

- Demo & Poster**
- [1] Mukulika Maity, **Avinash Chaurasia**, Rachit Srivastava, Bhaskaran Raman, Mythli Vutukuru, "Witals: AP-centric Health Diagnosis of WiFi Networks", MOBICOM, 2015 (Demo).
 - [2] **Chaurasia, Avinash**; Ghosh, R. K., "One Hop Key Management Scheme for Wireless Sensor Network Using Deployment Knowledge," High Performace Computing (HiPC), 2010 (Poster).

- Scholarships**
- Awarded ACM travel grant to attend ACM SIGCOMM, Budapest, Hungary, 2018.
 - Awarded ACM travel grant for the ACM, IRTF, and ISOC Applied Networking Research Workshop, Berlin, Germany, 2016.
 - Awarded Microsoft travel grant to attend summer school on IOT, Bangalore, India 2016.
 - Awarded COMSNETS travel grant to travel and present at COMSNETS, Bangalore, India 2015.

Internships

I worked as an intern at VMware from June 2019 till Nov 2020 and again joined VMware as an intern from March 2021 till Sep 2021. At VMware I worked on NFV chaining framework on GPU or more precisely vGPU(virtualized GPU) in cloud infrastructure. As part of the work, we published a paper, another paper is under submission and two pending patents. Additionally I worked on NFV chaining framework for serverless environment, where we used knative on top of kubernetes. We also published a Radio poster as part of this work.

Research Experience and Thesis

NFV chaining framework using virtualized GPU in VMware cloud setup

Collaborators at VMware: Uday Kurkure, Lan Vu, Hari Sivaraman and Sairam Veeraswamy

In this work we tried to optimize and utilize the GPU in the virtualized environment. Based on our work we found that time-shared access to the GPU by the vGPU provides better throughput than GPU in passthrough mode. We built our framework on top of our this finding and able to achieve the chain throughput close to bottleneck NF when the NF is stand alone workload on vGPU with max resources devoted to it.

NFV chaining in serverless environment

Collaborators at VMware: Akhilesh Komireddy, Chayan Mukherjee and Sairam Veeraswamy

In this work we tried to achieve NFV chaining in serverless environment. We used knative on top of kubernetes for serverless environment. Based on our work we found that currently knative is not friendly enough for NFV chain deployment due to latency incurred in packet transfer. Hence, we tried to move packet transfer out of knative system using sockets. However, it disabled the load balancing feature of the knative.

Accelerating NFs using integrated GPUs

Supervisor: Prof. Bhaskaran Raman

In this work we tried to utilize APU(HSA or integrated GPU) for NFV chaining acceleration. Integrated GPUs aren't only affordable but also power efficient when compared to discrete GPUs. We were able to build a high throughput framework on APU that provides better throughput on per unit energy spend than any other GPU based framework (to the best of our knowledge). Our framework able to provide comparable (compared to state of the art discrete GPU based frameworks) raw throughput with affordable hardware.

Mobility analysis of MPTCP for smartphones

Supervisor: Prof. Bhaskaran Raman

Nowadays millions of people use smartphones and each of them is equipped with two prominent network interfaces namely WiFi and Cellular. MPTCP protocol is designed to efficiently use such multiple interfaces. We are analyzing the performance of MPTCP during mobility in order to answer two basic questions: (1) Whether it is a good idea to use MPTCP on smartphones? (2) If not in current form, then what improvements are required. The answer to these questions helps mobile OS makers in decision making whether to push these protocols in the kernel or not.

WiFi diagnosis from Access Point perspective for real world deployment

Supervisor: Prof. Bhaskaran Raman and Prof. Mythili Vutukuru

While market flooding with wireless devices, increasing usage of these devices gives headache to system admins. System administrators want to know what went wrong with their wireless network if indeed something happened. We presented a simple framework for this: Witals. We designed a casual graph to cover a comprehensive sets of problems that might happen over a wireless. We implemented a prototype on a commercial grade AP. With the help of experiments we showed that our framework is effective.

Throughput efficiency of WiFi in dense environments

Supervisor: Prof. Bhaskaran Raman

Smartphones and tablets gave us a new way of interacting with a class. Through these devices instructor can distribute some materials, can ask them to upload some files, can take quizzes etc. Most of the classes constitute of more than 50 students who try to access the server simultaneously. Since all of them are connected to server via WiFi, this puts a huge overload over WiFi access point. From the data collected over single client experiments we deduce that there is a discrepancy in expected throughput and measured throughput in 802.11n. We explained the discrepancy by stating that 802.11n clients are not capable of handling high aggregation. Therefore, we receive a reduction in data rate as well as throughput.

Multiple TCP Connection for scalable video coding over MIMO wireless channels *MTech Thesis,*

Advisor: Prof. Aditya K. Jagannatham and Prof. Sanjeev Saxena

Aim was to design a mechanism such that video transmission is smooth over a mimo network and can guarantee a certain level of video quality under all circumstances. We developed the scheme over mimo wireless channel, using wavelet layering and scalable video coding. Under the scheme, TCP is modified at both ends to intelligently drop the

packets to avoid jitter in the video arisen from packet transmission error. We implemented the scheme over ns2 to prove it's productivity, (1) we developed new application layer compromising wavelet layering, scalable coding, data distribution, (2) changed transport layer to support packet drop as described in the scheme and (3) modified physical layer to support MIMO wireless systems.

Key management scheme with strong connectivity for wireless sensor network

Mobile computing course project, Advisor: Prof. R. K. Ghosh

Aim was to develop a new key management scheme for WSNs that can be resilient against node capture attack(as it is supposed to be deployed in hostile environment) while keeping the energy requirement low. We developed a scheme based on assumption that base station(BS) does not suffer from resource constraints. Periodic transmissions from BS acts as a core of the scheme. Each node will be assigned a key based on a protocol inspired from blom's key management. Even when one of nodes were captured and key of the node is revealed, other keys will remain safe.

Comparison of String matching algorithms

B.Tech Thesis, Advisor: Prof. Sunita Agarwal

Expectation from this project was to implement parameterized BDM algorithm and compare it with some other string matching algorithms. We helped one phd student during the process in implementation of BDM, shift-OR, parameterized BDM and paramterized shift-OR algorithms.

Teaching Experience

- TA for cs641: Computer Networks (2016-2017, Fall), cs224: Computer Networks (2016-2017, Autumn), cs224(m): Computer Networks (2017-2018, Fall), cs653: Mobile Computing (2017-2018, Autumn) at IIT Bombay.
- TA for cs101:Computer Programming (2009-2010, Fall & Autumn), cs425: Computer Networks (2010-2011, Fall), cs625: Advanced Computer Networks (2010-2011, Autumn) at IIT Kanpur.
- Mathematics teacher at Mumbai slums as a part of Abhyasika. Abhyasika is a student initiate of IIT-B students to teach unprivileged kids who live near IIT Bombay

Course Projects

Raft: Consensus Algorithm

Advanced Distributed Computing - Engineering a Cloud

As a part of course project, we implemented RAFT a distributed consensus algorithm in golang. It handles concurrent request and replicate it at majority of servers before it respond back to client.

Improvisation of block I/O Caching

Topics in virtualization and cloud computing

Improve a block I/O caching policy currently implemented and used in linux. We designed a two different policy and both provides better read hit ratio. However only one of them provides better read miss ratio.

Design a Concurrent Data Structure

Concurrent Programming

Augmented an existing Data structure (Skip list) to perform concurrent read and exclusive write access along with deletion of node from front & end in $O(1)$ and it don't retain any shallow copy unlike Skip list.

Super resolution of Images

Computer Vision and Image Processing

Sometimes captured images (such as images from traffic camera) don't have a good resolution. So this project was aimed to create super resolved image from multiple low resolution images such that quality of images is better than all the low resolution images.

Secure transmission through Stegnography

Spring 2007

Aim was to transmit message securely over a network. In order to acheive this we transmitted the message in image format such that there will be no distortion in image after an RSA encrypted message was embedded in the image.

Skills

Programming Languages: C, C++, OpenCL, CUDA, Python, PHP, HTML, CSS

Libraries and Tools used: Wireshark, tcpdump, gdb, ns2, tinyOS, windbg, mysql

Industry Experience

Intel India

Aug 11 - July 13

- Worked as a driver developer in energy management team.
- Developed energy related solution for windows 8 based tablet.
- Developed charger driver and thermal related solution for android based smartphones.

- Owner of the Burst Control Unit(BCU) from driver side. BCU driver controls the BCU action and triggers interrupt based on system conditions to prevent it from damaging itself.
- Modified kernel to lower the CPU frequency for Intel based platforms during bootup.
- Developed debug tools (application, services and HAL in android) in order to help the team, test energy related components.

MAQ Software

July 08 - May 09

- Worked as SDE on various web projects of Microsoft and some internal projects at MAQ Software.
- Developed GenuineIncentive website in ASP.net for Microsoft.
- Added features to ContentTracker website (Microsoft intranet website and received praise for the work done).
- Designed and developed employee leave automation system.

Achievements

- **Among top 10** at IIT Kanpur in M.Tech. batch of 2011 at IIT Kanpur.
- **Ranked 5th** in 'Instant' and 10th in 'IOPC-International Online Programming contest' at Techkriti 2010 (IIT kanpur, India).
- **Among top 8** in 'Softathalon' and 4th in 'Java Cafe' at Avishkar 2006 (NIT Allahabad, India).
- **Ranked 2nd** at 'Nettech network management course'(Top 2% among 100+ students) at IIT kgp 2006 (IIT Kharagpur, India).
- MCTS (Microsoft Certified Technology Specialist) certified.
- Secured **All India Rank 2278** in AIEEE 2004 (among 4,50,000 students).
- Secured **All India Rank 287** for CSE in GATE 2009 (among 45,000 students).

Activities

- Presented lo3 (Low cost, Low power, Local Voice and Messaging) in Techfest 2014, IIT Bombay on the behalf of computer science department of IITB.
- POC (Point of Contact) for Burst Control Unit at Intel for Smartphones.
- Worked as POC for whole ContentTracker project in MAQ Software, India.
- Coordinator of 'Softathalon' (member of team of 6) at Avishkar 2007 (NIT Allahabad).