

# HYOGI SIM

Oak Ridge National Laboratory, Virginia Tech  
*simh@ornl.gov, (540) 391-0202*

## CURRENT POSITION

**Postmasters Research Assistant:** Technology Integration Group, Oak Ridge National Laboratory  
**Ph.D. Student:** Department of Computer Science, Virginia Tech

## EDUCATION

**Ph.D. in Computer Science, Virginia Tech, VA** — *present*

- Advisor: Dr. Ali R. Butt

**M.S. in Computer Science, Virginia Tech, VA** — *Dec. 2014*

- Advisor: Dr. Ali R. Butt

- Thesis: AnalyzeThis: An Analysis Workflow-Aware Storage System

**M.S. in Electronics and Computer Engineering, Hanyang University, S. Korea** — *Feb. 2008*

- Advisor: Dr. Jaehyuk Cha and Dr. Sooyong Kang

- Thesis: A Study of Performance Impact of Merging Storage Layers on Flash-Based DBMS

**B.S. in Urban Planning, Hanyang University, S. Korea** — *Feb. 2005*

## SKILLS & EXPERTISE

Skillful in Linux application/system/kernel programming, parallel/distributed file systems, database systems.

- **Programming Languages:** C (*proficient*), C++, Python, JAVA, PHP, C#, BASH
- **File & Storage:** Linux VFS, Device Mapper, FUSE, SCSI OSD-2, Linux TGT, blktrace, exofs, ext3
- **Parallel & Distributed File Systems:** GlusterFS, Ceph, Lustre, HDFS
- **Non-Volatile Memory & SSD:** Linux MTD, Flash Translation Layer
- **Databases:** MySQL, PostgreSQL, SQLite, MS SQLServer, IBM DB2, WiSS, HyperDex
- **Parallel Programming:** MPI, Pthread, OpenMP, Spark
- **I/O Benchmarks:** fio, mdtest, IOR, TPC-C, TPC-H
- **Tools:** gcc, gdb, cscope, ctags, autotools, git, svn, eclipse, glade, visual studio, latex, gnuplot
- **Web Development:** HTML, CSS, PHP, Javascript, JQuery, ASP.NET

## CURRENT PROJECTS

**Multi-Tiered Storage System in High Performance Computing** — *2016-present, Oak Ridge National Laboratory*

- Designing a software-defined storage system that orchestrates heterogeneous storage tiers based on user-specified workflow execution policies.
- Designing and developing a NoSQL store-based global metadata manager that provides a unified namespace abstraction over heterogeneous storage tiers.
- Developing a client-side shared library that allows applications to interact with the metadata manager.  
(FUSE, Lustre, Ceph, MySQL, HyperDex)

**Scientific User Behavior Analysis from the Daily Parallel File System Snapshot** — *2016-present, Oak Ridge National Laboratory*

- Building an analysis framework using big data tools to analyze Spider II (Lustre PFS) daily snapshot data.
- Analyzing user behaviors and interactions through the observed file system activities.  
(Spark, SparkSQL, Parquet, Python, Lustre)

**Fast NVMe-Based Temporal Storage Framework for Data-Intensive Applications** — *2016-present, Oak Ridge National Laboratory, Virginia Tech*

- Designing a zero-copy, out-of-core framework to persist application in-memory objects.
- Implementing a user-space layer that directly manages NVMe devices and bypasses the kernel file system.
- Identifying a potential extension of the NVMe protocol for providing an object-based interface.  
(Linux, NVMe, NVMeDirect)

## DEVELOPMENT EXPERIENCES ON FILE & STORAGE SYSTEMS

**File System-Integrated Search and Discovery Services for High Performance Computing** — *2015-2016, Virginia Tech and Oak Ridge National Laboratory*

- Developed a file system-integrated metadata indexing framework that supports a user-defined tagging.
- Developed a command-line utility that allows to run interactive file search queries in SQL.
- Developed a computation offloading framework via a tagging-based file search, similar to 'find -exec'.

- Developed an automatic metadata extraction framework based on the tagging-based file search.  
(GlusterFS, SQLite, Linux)

**Analysis-Aware Storage System for High Performance Computing** — 2013-2015, Virginia Tech and Oak Ridge National Laboratory

- Developed an active storage target framework based on SCSI T10 OSD-2 specification.
- Enhanced OSD initiator driver and exofs in Linux Kernel to support the active processing.
- Designed and developed a FUSE file system that manages an array of active OSD devices.
- Developed a workflow manager within the file system to orchestrate scientific workflow tasks across an array of active OSD devices.
- Developed a provenance management framework with a light-weight database within the file system.  
(Linux Kernel, SCSI T10 OSD-2 Protocol, Linux TGT, FUSE, SQLite)

**Managing Multimedia Data for Content Servers with Hybrid Storage Architecture** — 2007-2009, Database Lab., Hanyang University

- Developed a content server log analyzer to analyze content popularity of a commercial media server.
- Developed a stripped-down file system based on ext2 for storage class memory devices, i.e., PRAM.  
(Linux Kernel, Windows Media Server)

**Design of a NAND Flash Memory-Based File System Supporting Transaction and Record Structure** — 2006-2008, Database Lab., Hanyang University

- Developed a framework to identify FTL mapping schemes of NAND flash memory-based storage devices.
- Developed a DBMS that directly manages a raw NAND flash memory chip for managing EPG (Electronic Program Guide) data in a set top box.
- Developed a buffer management policy in PostgreSQL for NAND flash memory-based storage devices.  
(Linux Kernel, Linux MTD, Wisconsin Storage System, ARM-based embedded board, PostgreSQL)

## OTHER DEVELOPMENT EXPERIENCES

**Shared-Memory Programming Framework for Processing-In-Memory Architecture** — 2015-2016, Oak Ridge National Laboratory

- Developed a high-level programming framework that facilitates the data analysis using PIM devices.
- Developed a runtime system that optimizes the data placement across an array of PIM devices.
- Developed a device driver that emulates PIM devices in a NUMA architecture.  
(NUMA, Pthread, Intel TBB, Linux Kernel)

**Pitapat Mobile, S. Korea: Senior Developer, Startup Member** — Jan-June 2011

- Developed a social marketing web application and a social quiz game for desktop and mobile devices.
- Integrated the application to the Facebook app platform using the Facebook API.  
(C#, Javascript, JQuery, HTML, PHP, SQL Server, MySQL, Amazon EC2)

**Metabuild co., S. Korea: Part-Time Programmer** — Dec 2008

- Developed a user-space module that delivers requested pixel data from the CMOS camera to the lane-recognition module in a self-driving vehicle.  
(Linux, C, ARM-based embedded board)

**Dept. of English Education, Hanyang University: Part-Time Programmer** — Feb 2010, Aug 2009

- Developed an online-survey web application including administrative tools.
- Developed a web application that visualizes interactions among educators.  
(Linux, PHP, HTML, Javascript, MySQL, GD, Apache)

**Construction of a Protein Function Database** — 2006-2008, Database Lab., Hanyang University

- Developed a GUI environment that verifies protein interaction graphs extracted from academic documents.  
(Windows, SQLServer, Delphi)

**Golfschool co., S. Korea: Programmer, Startup Member** — 2002-2003

- Developed and maintained a commercial website that serves online lectures and sells sporting goods.  
(Linux, Apache, PHP, MySQL, HTML, Javascript)

## WORK HISTORY

**Oak Ridge National Laboratory: Postmasters Research Assistant** — Mar 2015-present

**Oak Ridge National Laboratory: Summer Intern** — Jan-Aug 2013

**Virginia Tech: Research and Teaching Assistant** — Aug 2011-Dec 2013, Sep 2013-Feb 2015

**Pitapat Mobile, S. Korea: Senior Developer, Startup Member** — Jan-June 2011

**Dept. of English Education, Hanyang University, S. Korea: Part-Time Programmer** — Feb 2010, Aug 2009

**Metabuild co., S. Korea:** *Part-Time Programmer* — Dec 2008

**Golfschool co., S. Korea:** *Programmer, Startup Member* — 2002-2003

**Military Conscription in a Combat Police Force, S. Korea** — May 1999 - July 2001

## RESEARCH PUBLICATIONS

- **Hyogi Sim**, Youngjae Kim, Sudharshan S. Vazhkudai, Geoffroy R. Vallée, Seung-Hwan Lim, Ali R. Butt, *A Fast and Efficient Scientific Data Discovery Service* — currently under review
- **Hyogi Sim**, Youngjae Kim, Sudharshan S. Vazhkudai, Geoffroy R. Vallée, Seung-Hwan Lim, Ali R. Butt, *TagIt: An Integrated Search and Discovery Service for Extreme-Scale File Systems*, Poster in the 2016 USENIX Annual Technical Conference (ATC '16), Denver, CO, June 2016
- **Hyogi Sim**, Youngjae Kim, Sudharshan S. Vazhkudai, Devesh Tiwari, Ali Anwar, Ali R. Butt, Lavanya Ramakrishnan, *AnalyzeThis: An Analysis Workflow-Aware Storage System*, Proceedings of the 2015 ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis (SC '15), Austin, TX
- **Hyogi Sim**, Youngjae Kim, Sudharshan S. Vazhkudai, Devesh Tiwari, Ali Anwar, Ali R. Butt, Lavanya Ramakrishnan, *AnalyzeThis: An Analysis Workflow-Aware Storage System*, Poster in the 2015 USENIX Annual Technical Conference (ATC '15), Santa Clara, CA, July 2015
- **Hyogi Sim**, Hoyoung Jung, Sungmin Park, Sooyong Kang, Jaehyuk Cha, *Identifying the FTL Mapping Scheme for USB Flash Devices*, The 4th International Conference on Convergence Technology and Information Convergence, CTIC 2009, Oct. 12
- Sooyong Kang, Sungmin Park, Hoyoung Jung, **Hyogi Sim**, Jaehyuk Cha, *Performance Tradeoffs in Using NVRAM Write Buffer for Flash Memory-based Storage Devices*, IEEE Transactions on Computers, Vol. 58, Issue 6 (Jun. 2009) Pages 744-758
- Hoyoung Jung, **Hyogi Sim**, Sungmin Park, Sooyong Kang, Jaehyuk Cha, *LRU-WSR: Integration of LRU and Writes Sequence Reordering for Flash Memory*, IEEE Transactions on Consumer Electronics, Volume 54, Issue 3 (Aug. 2008)
- Sungmin Park, Hoyoung Jung, **Hyogi Sim**, Sooyong Kang, Jaehyuk Cha, *Using Non-Volatile RAM as a Write Buffer for NAND Flash Memory-based Storage Devices*, 2008 IEEE International Symposium on Modeling, Analysis & Simulation of Computer & Telecommunication Systems, MASCOTS 2008, Sept 8-10, Baltimore, MD
- Sungmin Park, Hoyoung Jung, **Hyogi Sim**, Sooyong Kang, Jaehyuk Cha, *Write Buffer-aware Address Mapping for NAND Flash Memory Devices*, 2008 IEEE International Symposium on Modeling, Analysis & Simulation of Computer & Telecommunication Systems, MASCOTS 2008, Sept 8-10, Baltimore, MD
- Hoyoung Jung, Kyunghoon Yoon, **Hyogi Sim**, Sungmin Park, Sooyong Kang, Jaehyuk Cha, *LIRS-WSR: Integration of LIRS and Write Sequence Reordering for Flash Memory*, The 2007 International Conference on Computational Science and Its Applications, ICCSA LNCS 2007, Aug. 29

## GRADUATE-LEVEL COURSES

**Virginia Tech:** Statistics in Research, Multiprocessor Programming, Research Method in CS, Advanced Parallel Computation, Advanced Topics in System and Network Security, Operating Systems, Software Refactoring

**Hanyang University:** Advanced Operating System, Computer Algorithms, Database System Implementation, Real-Time Systems, Cryptography, Database Tuning

## RECOGNITIONS

**Analysis Restaurant:** In November 2015, *DEIXIS online magazine* featured AnalyzeThis storage system as a monthly highlight, based on the SC '15 paper (<https://deixismagazine.org/2015/11/analysis-restaurant/>).

## AWARDS & SCHOLARSHIPS

**Virginia Tech:** Graduate Research Assistantship — Fall 2011, 2012, 2013, Spring 2012, 2014

**Hanyang University:** BK21 Scholarship — 2009, Academic Record Scholarship — 2005