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Summary

- 6+ years software development experience in designing and implementing highly scalable, fully distributed, multi-threaded, and robust wireless networked embedded systems
- 2 years web development experience using the Linux, Apache, MySQL, and PHP (LAMP) stack or Windows, IIS, SQL Server, and ASP

Education

- 2008–2014 **Wayne State University**, *Ph. D. in Computer Science*, GPA 3.93/4.0.
2004–2008 **Wuhan University, China**, *B. S. in Computer Science*, GPA 3.60/4.0.

Patent

H. Zhang, X. Liu, C. Li, “PRK-Based Scheduling for Predictable Link Reliability”, U.S. Provisional Application #61/788,445, International Application #PCT/US2014/27055

Technical Skills

Languages: proficient in C/C++, TinyOS/nesc (an embedded C), shell script, and Matlab; prior experience in Python, Java, Makefile, C#, Objective-C, PHP, ASP, Javascript, and HTML

Operating Systems: Linux, Mac OS X, and Windows

Databases: MySQL and MS SQL Server

Protocols: TCP/IP, UDP, HTTP, OSPF, 802.11, and 802.15.4

Network Simulators: TOSSIM and ns-2

Source Control: git

Experience

4/12 – 4/14 **Research Assistant**, *Wayne State University*, Michigan.

The patent-pending Physical-Ratio-K based Scheduling Protocol (PRKS) is the first-ever practical distributed scheduling algorithm to ensure reliability of wireless communication while maximizing throughput.

- Implemented, single-handedly, PRKS, its two variants, and four state-of-the-art protocols from scratch, on sensors with merely *10kB* RAM using TinyOS. The source code (**~58,000** lines) is available at <https://github.com/xhliu/prks>.
- Drove and refined the theoretical closed-loop controller using measurement data
- Designed the architecture of PRKS: split code into reusable encapsulated components, grouped components with coupled functionalities, and organized groups in a tree hierarchy.
- Debugged, *without gdb*, and deployed these complex distributed protocols in two real-world multi-hop dynamic testbeds of 127+ sensors and fixed non-repeatable and timing-dependent bugs caused by race conditions and inconsistent distributed states.
- Increased link reliability from as low as 0% in the state of the art to 95% in PRKS.

9/09 – 3/12 **Research Assistant**, *Wayne State University*, Michigan.

Multi-Timescale Adaptation (MTA) Routing Protocol is the best distributed routing algorithm for delivering probabilistic real-time traffic.

- Implemented, independently, MTA, its seven variants, and four other protocols from the ground up in TinyOS. Code (**~16,000** lines) is at <https://github.com/xhliu/mta>.
- Modified TinyOS kernels systematically to make code run concurrently and enable real-time computing, including radio communication stack, time synchronization, and resource arbitration.
- Increased deadline success ratio by 89% and reduced transmission cost by a factor of 9.7, shown in two testbeds of 127+ nodes.

- 12/07 – 3/08 **Software Engineer Intern**, *Wicresoft Company*, Shanghai, China.
Microsoft Forefront Security (MFS) is a business anti-virus software product that can be controlled over the network.
- Automated tests using MS-DOS scripting by partnering with the development team.
 - Launched unit and end-to-end tests of MFS on remote machines with different Windows families, CPU architectures, and languages; investigated test failures and performed root-cause analysis.
 - Found bugs and filed detailed and high-quality error reports in the bug tracking database; tracked them and verified they were fixed.
- 2/09 – 5/09 **Technical Team Member**, *LifeCode Health*, Michigan.
LifeCode is a remote health monitoring system to compete in Microsoft Imagine Cup.
- Built a Windows mobile phone application in C# to receive and display real-time heartbeat rates collected by wearable sensors and transmitted to the phone via Bluetooth.
- 11/08 – 5/09 **System Administrator**, *Wayne State University*, Michigan.
Students in lab course CSC1000 report machine breakdowns by filing tickets in a web-based system.
- Designed database schema and implemented the ticketing system using the LAMP stack, enabling users to insert, update, delete, search, and dump tickets online.
- 9/06 – 11/07 **Chief Development Officer**, *Trinity Studio*, Wuhan, China.
Trinity Studio is a studio I co-founded with three classmates, building websites for small businesses, government agencies, and universities.
- Designed and implemented database schema using SQL Server and Access.
 - Developed back end using ASP, IIS, and ODBC.

Open Source Community Participation

TinyOS is the de facto operating system for low-power wireless devices, such as those used in sensor networks and personal area networks. <http://www.tinyos.net>. Besides active discussions in the mailing list, I have reported several system-level bugs which have been incorporated into the latest distributions, including:

- Patch accepted: fixing bug to set default tx power in cc2420x, a radio communication stack for chip CC2420. <https://github.com/sallai/tinyos-main/commit/974ff870551d6fcc86f44e311dcbfd0fb71dbc94>
- Patch accepted: fixing bug in duplicate detection in CTP send queue, the default routing/collection protocol in TinyOS. <https://www.millennium.berkeley.edu/pipermail/tinyos-help/2010-March/045095.html>

Awards

- 2009 Microsoft Imagine Cup US Software Design Top 15 Finalist
- 2012 Outstanding Graduate Research Assistant (GRA) Award, Wayne State University
- 2005 National Scholarship, China

Selected Publications

Scheduling with Predictable Link Reliability for Wireless Networked Control. Hongwei Zhang, Xiaohui Liu, Chuan Li, Yu Chen, Xin Che, Feng Lin, Le Yi Wang, George Yin. In *IEEE/ACM International Symposium on Quality of Service (IWQoS)*, 2015.

Adaptive Instantiation of the Protocol Interference Model in Wireless Networked Sensing and Control. Hongwei Zhang, Xin Che, Xiaohui Liu, Xi Ju. In *ACM Transactions on Sensor Networks (ToSN)*, 2014.

Taming Uncertainties in Real-Time Routing for Wireless Networked Sensing and Control. Xiaohui Liu, Hongwei Zhang, Qiao Xiang, Xin Che, Xi Ju. In *IEEE Transactions on Smart Grid (TSG)*, 2013.

When In-Network Processing Meets Time: Complexity and Effects of Joint Optimization in Wireless Sensor Networks. Qiao Xiang, Jinhong Xu, Xiaohui Liu, Hongwei Zhang, Loren J. Rittle. In *IEEE Transactions on Mobile Computing (TMC)*, 2011.