

# XIAOHUI LIU

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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

9/08 – 12/14 **Wayne State University**, *Ph. D. in Computer Science*, GPA 3.93/4.0.

9/04 – 7/08 **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.

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## 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>

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## 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

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## 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.