THE UNIVERSITY OF **CHICAGO** | **Department of Computer Science**

Distinguished Lecture Series

Mendel Rosenblum, Professor, Stanford University
Nanosecond-level Clock Synchronization in a Data Center

Computers connected by networks have long used protocols like Network Time Protocol (NTP) to adjust the clocks of the computers to show the same time of day. With machines connected by a high performance network in a data center, NTP can keep the clocks within a few hundred microseconds of each other, a clock skew that is fine for humans but not useful for distributed system software that can communicate between machines in a few tens of microseconds. In this talk I will describe the challenge of tightly synchronizing clocks in a data center and present Huygens, a new algorithm developed with my colleague Balaji Prabhakar's research group that can synchronize data center clocks within few 10s of nanoseconds. Like NTP, Huygens requires no special hardware and simply exchanges messages between machines but uses a number of techniques that exploit the high-performance networks in data centers. The techniques include sending many more probe messages and then using sophisticated machine learning techniques and global knowledge to compute the clock adjustment operations to keep the clock synchronized.

Mendel Rosenblum is a Cheriton Family Professor in the School of Engineering, Departments of Computer Science and Electrical Engineering at Stanford University where his research and teaching have focused on system software and distributed systems since 1992. In 1998 he helped transfer his research to industry by co-founding VMware. Mendel's work has numerous honors include receiving the ACM Software System Award (with several VMware colleagues), the ACM/SIGOPS Mark Weiser Award for innovation in operating system research, the IEEE Reynolds B. Johnson Information Storage Award (with John Ousterhout), the IEEE Computer Entrepreneur Award (with Diane Greene), and the ACM Doctoral Dissertation Award. He was the inaugural winner of the ACM Charles P. "Chuck" Thacker Breakthrough in Computing Award. He is a member of the National Academy of Engineering, the American Academy of Arts and Sciences, and ACM Fellow. Mendel has B.A. degree from the University of Virginia and M.S. and Ph.D. degrees from the University of California at Berkeley.

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Host: Kate Keahey