A LandMARC Success for Lancaster University: The Contribution of Mobile IPv6 Source Code to Microsoft® Windows® .NET Server and Windows CE .NET

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Lancaster University actively uses Microsoft Windows source code to support experimental aspects of its research. In early 2002 they achieved notable success by having LandMARC project source code adopted by two of Microsoft's product groups: the Windows .NET Server IPv6 group and the Windows CE .NET Core-OS group.

Background

The Department of Computer Science at Lancaster University is one of the leading centers for networking and distributed multimedia research in the United Kingdom. As with most others in the academic field, Lancaster researchers traditionally employed one of the Unix operating systems—typically NetBSD, FreeBSD, or Linux. However, some of the Ph.D. students at Lancaster started to experiment with the Windows source code as an alternative to the more established research platforms.

By early 1999, a Windows source-code thesis project had been submitted, and senior academics at Lancaster were convinced that the Windows source code offered their team an alternative research platform for experimental work. Lancaster decided to use Windows as the basis for their efforts, and approached the University Relations Team at Microsoft Research in Cambridge, England for support.

Started in October of 1999, the outcome of this venture was the Lancaster and Microsoft Active Research Collaboration (LandMARC) project (www.LandMARC.net). The most celebrated aspect of the LandMARC project was an implementation of Mobile IPv6 in the Windows operating system.

Mobile IPv6

One of the objectives of the LandMARC project was to provide an implementation of Mobile IPv6 on the Windows operating system for research purposes. Mobile IPv6 allows a mobile device to retain the use of an IPv6 address after moving from the "home" network for which that address is valid, so that applications wanting to contact the device at that address may do so directly, and so that network connections bound to the address survive movement of the mobile device.

The Internet Engineering Task Force (IETF) had been working on defining a next generation Internet Protocol, known as Internet Protocol Version 6 (IPv6). The starting point for the LandMARC development of Mobile IPv6 effort was the MSR 1.4 protocol stack for IPv6, developed and released in source form for research purposes on Windows NT® 4.0. The MSR 1.4 stack did not support Mobile IPv6 machines, and the work of extending the code to do so was initially undertaken by Lancaster University. The result was a working implementation of Mobile IPv6 for Windows 2000, which was released for research purposes from the Microsoft Research Web site in January 2001.

During one of the Lancaster team's several visits to Microsoft Corporate headquarters in Redmond, Washington, the Windows CE product group expressed interest in the Mobile IPv6 project. It was decided that the LandMARC project would be extended to include the Windows CE operating system. What followed was a stellar example of distributed teamwork among Lancaster, Cambridge, and Redmond. In early January

LANCASTER UNIVERSITY

Customer Profile

The Department of Computer Science at Lancaster University is a leading British computer science department with research interests that include distributed multimedia systems, mobile computing, software systems engineering, interactive systems and natural language processing.

Business Situation

As with most others in the academic field, Lancaster researchers traditionally employed one of the Unix operating systems—typically NetBSD, FreeBSD, or Linux. However, some of the Ph.D. students at Lancaster started to experiment with the Windows source code as an alternative to the more established research platforms.
Lancaster University was one of the first universities in Europe to receive a source license for the Windows CE operating system.

"We embarked upon this project because we thought that the people at Lancaster were good, and the results have fully justified this. In this case the outcome has surpassed anything that we might reasonably have expected, and we are very pleased that it has produced something genuinely useful."

Professor Roger Needham
CBE FRS, Managing Director,
Microsoft Research Cambridge

"The prospect of porting the Mobile IPv6 stack to Windows CE was particularly challenging. Thanks to the availability of source code and the excellent development and debugging environment provided with Windows CE, we were able to produce a prototype release in much less time than we had originally envisioned."

Dr. Nicholas Race
Lancaster University
Original Member of LandMARC Team

2002, the exercise was declared complete, and ownership of the active source code moved from Lancaster to Microsoft, in time for the next phase of Windows CE development. The Mobile IPv6 source code is now held in the source repositories for Windows .NET Server and Windows CE .NET.

"In late 2001, the project was completed successfully, and mobile IPv6 was demonstrated running on the Windows CE .NET operating system. At the time, Windows CE did not support IPv6, let alone mobile IPv6, so this was a significant accomplishment."

Glenn Davis
Microsoft Development Lead, WinCE Core-OS

Criteria for Success

From an academic perspective, the joint endeavor can be declared a success on the strengths of the number of papers published and the number of Ph.D. candidates who have used or now are using Windows source to obtain their degrees.

Microsoft invests heavily in research, maintaining five substantial research labs of its own in Redmond, Beijing, Silicon Valley, Bay Area, and Cambridge. The work is both theoretical and applied, and Microsoft, determined to support innovation, employs a dedicated, experienced staff to help put research teams and product groups in contact with each other and to facilitate the technology transfer of research ideas between groups. Phil Fawcett, an experienced Microsoft veteran of multiple product releases, is particularly responsible for the Windows Division, Digital Media Division, and the Cambridge Research Lab. Speaking to Microsoft researchers in Cambridge, he explained how people within the Microsoft development groups tend to view research: "They might ask you how many papers you've had published and they may or may not care. They might even ask you how many patents you've obtained; and they might care, but usually not much. What they really care about is this: the impact your technology and research will have or has had on any of the product lines and Microsoft customers."

"The benefits of access to the Microsoft Windows CE shared source became apparent fairly quickly to all of us. Having come to Windows development from Linux-based or application-level projects, we faced a significant learning curve. That curve was considerably softened by availability of the shared source to use as a resource of examples of good Windows programming practice and as a guide to the existing mechanisms in Windows that we needed to accomplish more complex tasks."

Tim Chart
Lancaster University, Ph.D. Student
Member of LandMARC Team

Conclusion

The Microsoft Research Source Licensing Program (MSRLP) authorizes faculty, staff, and students in the licensed institution to use, reproduce, and modify source code and related confidential information provided by Microsoft for educational purposes or sponsored government and commercial research. The LandMARC project clearly demonstrates the potential for rewarding technology transfer from academic research into business applications.

The success of the work at Lancaster University proves that talented university researchers can successfully utilize Windows source code—either defined by conventional academic criteria or as measured by the criteria that Microsoft applies to its own professional research groups. It also demonstrates that university researchers can establish a close rapport with research and development groups inside Microsoft, and that both sides can work conjointly in developing top-quality operating system code.

"It has been great to work with such an enthusiastic and supportive group as the CE team. I've been impressed, not just by the effort the CE group put in ensuring we had the right code and development tools, but also how open they have been to discussing problems and new ideas with Ph.D. students.
Working with Windows provides us with a far richer set of platforms and applications than working with just Unix and allows us to carry out far more realistic experiments particularly in the area of mobile systems."

Dr. Andrew Scott
Senior Lecturer, Lancaster University
Original Member of LandMARC Team

For More Information

Please visit http://www.mobileipv6.net for further details of the Mobile IPv6 Systems Research Lab (MSRL) project, http://www.research.microsoft.com for further details of the Microsoft Research University Programs, http://www.idms2001.org for further details on the Interactive Distributed Multimedia Systems 2001 conference, and http://www.microsoft.com/windows.netserver/technologies/ipv6/default.asp for further details on the Internet Protocol Version 6 (IPv6).

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Dr. Stewart Tansley
Microsoft Program Manager, IPv6