

**USE OF OBJECTS AND AGENTS AT SYMBIAN  
(Abstract)**

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**Rapporteur:** Dr I Welch



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The Series 3 palmtop computer, launched by Psion in 1990, contained a ROM (initially only 384k) that was crammed full of objects. These objects allowed a highly significant amount of re-use of system libraries by the applications on the device, keeping the overall ROM requirements much lower than could be achieved by non-OO approaches. At the same time, the OO approach allowed the system architects to keep control of the complexity of the software in the device.

However, this was not an OO system written in C++. Psion's system architects (including the author of this talk) rejected C++ at the time, and hand-crafted a system that was much closer in spirit to the "Objective C" of Brad Cox. This system included a "category translator" as well as helper functions implemented in assembler, with most of the functionality being supplied in C. Special features coped with the "moving memory" that could take place, inside an interrupt, as the operating system juggled the memory segments on the device to optimise usage.

From 1994, the same team created a brand new software system, suitable for 32-bit hardware (whereas the Series 3 was a 16-bit device). This time, C++ was adopted, but with many caveats. For example, there are restrictions on inheritance, exception handling, default constructors, templates, and operator overloading. The result is now known as "EPOC" (or "the Symbian software platform"), and appears in the Ericsson R380 smartphone, and the Psion Series 5 and Series 7 computers. It will shortly also appear in devices from Nokia, Motorola, Panasonic, Sony, and others.

Part of this story has already been told in the opening chapters of "Professional Symbian Programming" (PSP), by Martin Tasker et al (Wrox Press, 2000). It is a story of the creation of two rich-featured OO systems that were nevertheless also compact, efficient, highly robust, and (as a result) marketplace successes. As PSP notes (p26), referring to the 32-bit version, "In three years, we had produced from scratch a practical operating system in C++, spanning the entire realm from hardware to a full application suite. EPOC is still the only system in the world to have achieved this."

This talk specifically describes the choices made by the software teams at first Psion and then Symbian, regarding the use of objects and agents. Some useful background reading can be found at <http://www.symbian.com/technology/papers/papers.html>.

## DISCUSSION

### Lecture One

**Rapporteur:** Dr I Welch

Mr Wood commented that one advantage of moving from dumb terminals to PCs was that users were no longer dependent on network connectivity. Professor Randell made the point that PCs brought with them increased cost of ownership and complexity. Mr Wood replied that this was a good point - it isn't a simple situation of advantage/disadvantage as people's relationship with their PCs is complex. Users typically have a fierce love/hate relationship with their PC - happy a lot of the time, loathing the machines when things don't work the way they expect.

Mr Watson asked to what extent would user interface variation impact the user experience? In the PC market, the argument is that the consistent (Windows) interface means that users can move from one machine to another with relative ease. This partially explained the popularity of PCs. Is this a problem for mobile devices? Do users perceive the same application as different because it has a different interface on different machines? Mr Watson followed this up with the question whether there had been any studies by Symbian or others of this particular issue?

Mr Wood replied that Symbian had talked to a lot of usability groups. The feeling is that even though there are different interfaces user's still have the same perceptual models and can quickly adapt to the different interfaces to the same application.

Mr Peine asked why was there a need for a custom operating system, why not use something like embedded Linux? Mr Wood replied that if they had started today then they would have looked at Linux, but in 1987 there was nothing equivalent.

Dr Lange made the point that the trend in the PC world is for permanent connectivity. The trend is for servers talking to clients. Why don't portable devices just act as clients to servers, this would solve data fragmentation problems, i.e. some of the address book on one device and the rest of an address book on another device. Mr Wood agreed that connectivity was important but mobile devices need to be able to access data in situations where there is no connectivity, for example on a plane. Users should be able to choose what model they want depending on the circumstances.

Dr Waldo expressed some scepticism about the degree of reusability separating out interface from application gives. When devices change there will still be significant re-testing needed. In a number of cases a single line change can require the rerunning of all tests, and this is very time consuming. Mr Wood agreed that often even a single line change is bad but at least with a clean architecture it was easier to rerun testing and it is possible to test different parts of the architecture separately. In their experience this is a superior approach. Their experience with porting Monopoly from one machine to another was that it took only two days because of the separation between interface and application.

Professor Wand made the point that he was surprised there was no mention of voice input, this seemed a good way to get around the problem of the size of the devices. Via voice does a good job, any chance of using a similar system on a portable device? Are Symbian interested in this approach? Mr Wood said this was an omission - the problem was that different hardware developers have different ideas on how to integrate voice, there are cases where one can't use voice i.e. in meeting and want to send an e-mail. Professor Jones suggested that thin client approach could deal with this, voice support could be downloaded as required, or the processing could take place at the server side.

Mr Watson asked how much bandwidth will new devices have at their disposal in a good signal area? Mr Wood replied that due to changes in transmitter software bandwidth will increase ten times. Mr Watson asked if it was anticipated that applications will be downloaded over wireless links? Mr Wood said that smaller applications will come over the wireless link but bigger applications will be downloaded from PCs. This will be a big area but there are questions about security.

Professor Sloman asked if there had been much thought given to docking stations for mobile devices? Mr Wood said that many manufacturers are talking about this. The idea is to provide access to the phone, and provide plug-in keyboards etc.. Professor Sloman wonders if this convergence is premature, would an exploration of alternatives be a good idea. Why not malleable user interfaces to allow for different preferences, for people who hate mice, for people who hate commands. A programming language for reprogramming the user interface could support this approach. Mr Wood replied that Microsoft has tried this with Bob of which the paper-clip is remnant. It wasn't entirely successful and more work is required in this area.

Professor Randell made the comment that Mr Wood had earlier made a brief allusion to security. This seems to be a real problem that needed to be addressed. It was complicated by the relative responsibilities of the parties involved. If groups such as Symbian addressed such a problem this would be a very positive step. Mr Wood replied that he hadn't planned to address this fundamental problem in his talk although this afternoon he planned to talk about the robustness of mobile devices.

A participant made the point that although it is healthy to separate the user interface from the model it sometimes made design more complicated as it introduced more complicated interactions. Mr Wood agreed that this can be a problem and occasional change is disruptive but most of the time it is possible to get around this.

Professor Jones asked if the lack of uniformity in the interface was not a real problem. Already the lack of uniformity caused some disgruntlement. Mr Wood replied that maybe in the future it would be possible that some convergence took place. Professor Jones made the point that different manufacturers settling on a single standard might be of benefit to all of them. Mr Wood replied that internally this does go on. Mr Watson added that manufacturers like the fragmentation as it allowed them to distinguish their product from the competition. His experience with the Corba standardisation process had brought him to the conclusion that manufacturers are usually slow to adopt a single standard. Mr Wood made the point that the manufacturers are prepared to co-operate on core facilities i.e. WAP, Java but they also have their own firm ideas on other issues.

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Professor Sloman suggested that in any case different submarkets need a different interface, for example mobiles for kids vs. mobiles for business users.

Professor Randell suggested that in order to achieve compatibility of the user interface there were two possible approaches. Either strong power in the hands of single company or alternative standardisation by means of an implementation, when using the same code, whatever looks like on outside will be same. The idea is to use shared code not standards. Professor Jones commented that achieving a standardised user interface was more difficult than for a PC because the different mobile devices were so different physically from each other. Mr Watson agreed and suggested that it is complicated as well by the intensely personal nature of mobile devices.

A participant questioned the degree to which applications could be ported to different devices and still be the same application given the different resource profiles of each machine. Mr Wood agreed that this was a problem sometimes, for example an application expecting Bluetooth support must be rewritten in part for devices that didn't yet support this standard.

Professor Sloman asked if there was work being done on exploring how you can develop utilities for the devices that could easily be combined by users to do more complex tasks. One of the problems is that different utilities make different assumptions about the environment, and it was necessary to find some representation of the environmental assumptions say as profiles. Mr Wood replied that the architecture he had shown was by necessity a simplified presentation and there are in fact more interactions and modules than shown. It is a complex task to capture profiles of assumptions. However, Symbian had developed some modules that encapsulate profiles. Professor Sloman commented that this seemed a good way forward and that analysis of possible interactions will be even more important in the future. Mr Killian asked if from the Symbian point view was Java a proprietary language? Mr Wood replied that his perception was that it was non-proprietary, especially in comparison with OPL. Part of the idea of adopting C++ or Java was the need to appeal to people who already programmed in an existing language.

Dr Elmore made the observation that there seemed to be two camps - "mobile phone plus" with some sexy interfaces, and PC with a speech interface and telephony capabilities. How does this impact on Symbian's approach? Mr Wood agreed that there were two camps. He found that EPOC is a shared standard that can support both. Some organisations are producing both versions not just one of the two.

Mr Watson asked if Symbian is a Java licensee then how does this square with being non-proprietary. Mr Wood made the point that although Java is a licensed technology there was a lot of scope for input into its development.

**Lecture Two**

Professor Jones asked what direction were Symbian going with Java? Mr Wood replied that the JavaPhone API is being implemented for Psion Series 6 and the Java Virtual Machine was already present in the Series 5mx.

There was some discussion about why threads were not used by Symbian. Mr Wood replied that threads were still used but there was an abstraction provided to make use of them in a safe manner.

