Part VII
System Co-Design

Co-Design Processes for Pervasive Systems

1.1 Summary

A systems-led design and innovation process typically requires a resolution of issues that overlap two or more domains of expertise. A simple example to provide, though perhaps less so to implement, is that between the hardware and software in embedded systems. A number of co-design processes have been, and continue to be, developed to answer this particular embedded systems challenge. In fact, co-design approaches can be applied between two associated areas of hardware (e.g. chip-package co-design) or software. As a result, most of us working or researching the areas of IT systems are at least notionally aware of a co-design process, or programme.

In fact, co-design is best presented as a philosophy that supports genuine collaboration and in particular a balanced process that moves beyond the relatively static approach of partners delivering know-how to each other and towards integrated co-innovation initiatives. It is not atypical for co-design to feature as a methodology when significant whole-systems issues, such as the challenges in power management or reliability, discussed previously in Part VI, are defined as being performance requirements for an application.

This part investigates co-design from two perspectives. Chapter 12 investigates co-design largely from the perspective of hardware systems and their use as infrastructure in building smart objects. The particular example provided by the concept of Augmented Materials, as discussed in Chapter 2, provides a framework for this discussion. Chapter 13 broadens this to an extent by analyzing the area of co-design for pervasive systems and arguing that this should focus upon context awareness and creating the ability to integrate information derived from a wide number of different sources.

1.2 Relevance to Microsystems

The application of co-design to optimise technology platforms that integrate MEMS sensing devices with their associated control and calibration circuitry represent an immediate example of the relevance of these methodologies to Microsystems.
Furthermore, it should be anticipated that the co-design ‘interfaces’ between hardware and software implementations of particular Ambient Intelligence applications may well be relatively deep, allowing for clearly defined flexibilities and constraints within the infrastructure. This may well affect the nature of the Microsystems devices themselves and will certainly influence the nature of the subsystems within which they are integrated.

1.3 Recommended References

As co-design is broadly used phrase, there are references to it within many different research domains. One area, which is well established, is that of hardware-software co-design for embedded systems and in particular the tools that have been developed to support this process. Two relevant references are provided that introduce this area of research in more detail. A number of other research programmes have also served to illustrate the nature of co-design approaches in the domains of Ambient Intelligence and Pervasive Computing. Of these, two that are of particular interest are the projects framed within the European Commission’s Disappearing Computer Initiative and the Grand Challenge that is the ‘Smart Dust’ concept.

3. The Disappearing Computer initiative: http://www.disappearing-computer.net/
5. The Smart Dust Project: http://robotics.eecs.berkeley.edu/~pister/SmartDust/