The future of personal devices

An essay on the future of PCs and mobile computing/communications devices, showing why and how next generation user interfaces will be based on the principles of Human Interaction Management.

INTRODUCTION - EVERY MAN HIS OWN MECHANIC 1
ONE STEP FORWARD, TWO STEPS BACK 2
PROCESSES ARE NOT PROGRAMS 3
IMPROVING THE PERSONAL COMPUTING AND COMMUNICATIONS EXPERIENCE 5
THE BENEFITS OF A PROCESS APPROACH 7
THE POWER OF HUMAN INTERACTION MANAGEMENT 9
THE NEXT GENERATION OF OPERATING SOFTWARE 10
SERVING UP PROCESS 11
CONCLUSION - MAKING THE MOST OF A VIRTUAL WORLD 12

Introduction - Every Man His Own Mechanic

When my wife and I bought our first house, my father-in-law gave me, not entirely as a joke, a collection of books that originally belonged to his own father. Some had been first published in the late nineteenth century, and were enormously popular in their day, running into many editions and in print for decades. With titles such as “Every Man His Own Mechanic”, these books showed you not only how to repair everything in and around your home, but how to construct for yourself anything you might conceivably need. A washing machine, for instance. At the time, the white goods industry did not exist - if you wanted mechanized help in the household, for most people the only option was to buy a motor and the necessary parts, then put them together as appropriate for their needs.

This seems faintly ridiculous to us today. The idea of building your own washing machine is so far removed from everyday reality in the twenty-first century that one cannot imagine it being done by anyone, wherever they live or however little money they have. This is not because people are in general so much more prosperous (some are, some aren’t). It is because the technology industry no longer sells motors to the general public. It sells things built using motors – cars, washing machines, dishwashers, computers, electric toothbrushes. You can buy a replacement fan for your PC and install it yourself, but most people don’t – they get it repaired by someone who has the necessary skills and equipment. Cars are no longer serviceable by the amateur. And if your electric toothbrush stops working, you chuck it away and get a new one.

The engineering industry has become invisible to the domestic consumer, in a way, and this is not just because components are sold pre-assembled. More than that, it is because of the cleverness with which they are assembled. Although a washing machine may boast high revs per minute or low power consumption, for most people these low-level

technical issues are secondary to (or absorbed into) questions of usage. Some consumers may only ask basic questions, such as how effectively a washing machine will clean their clothes, or how much it costs to run. But many will also look to see what "intelligent" features are offered – how well the machine helps to remove effort from a particular PROCESS, that of "clothing the household". Washing machines and tumble dryers are not yet expected to proactively replace worn out or unfashionable clothes, but they are expected to take as much as responsibility as possible for the rest of the clothing process, the cleaning part, by carrying out appropriate sequences of actions on behalf of the householders.

Function has become subordinate to process, and rightly so, since in the end it does not matter how fast the drum spins if the clothes are washed effectively. Let the engineers worry about such issues, and free up the consumer to get on with their life. Spending your spare time building machines out of their component parts should be an activity for the enthusiast, not a necessity imposed by market conditions. How far we have come since "Every Man His Own Mechanic".

One step forward, two steps back

It would be nice to think so. However, although no-one these days builds their own washing machine, most people spend at least as much time on maintenance activities as their great grandfathers. They just don't do it in their shed or out in the garden. They do it hunched in front of a computer, or bent over a mobile device, staring at a screen, trying to install and configure a multitude of software applications for work and leisure – email programs, word processors, music players, Web browsers, search tools, accounting suites, games, spreadsheets, image editors, video editors, project management tools, … the list depends on your individual needs. And since many of these pieces of software need to work together, and are subject to continual upgrades, the job is complex and never-ending. There is probably more amateur construction, installation and servicing these days than in the heyday of the Victorian handyman.

When it comes to personal computing or communications devices, function still rules. Process is not yet even a contender. You cannot buy a device capable of understanding how you personally work, or how you personally play. You can only buy the components, as separate pieces of hardware and software, and assemble them yourself, into something that supports a rudimentary form of the processes you require. It is like the first days of household appliances. An early washing machine was capable of jiggling your clothes about in hot soapy water but not of spinning them dry – the user was responsible for carrying out each activity in turn, using separate machines for each step. A major step forward was taken when machines combined the two activities. Then they learnt to do them in sequence, and modern machines now offer a range of preconfigured washing processes – they "know" what is involved in washing different types of clothing, and can not only do it unaided but do it at a convenient time for the user via automatic timer mechanisms. The modern white goods industry continually envisages further process advances – the fabled fridge that restocks automatically via the Internet cannot be too far away now.

So, how far away from this process nirvana are we with personal computing and communications devices? The enterprise Business Process Management (BPM) industry is going from strength to strength, with latest estimates of the market size as between $4 and $6 billion U.S. dollars in 2005 (www.bpm.com/FeaturePrint.asp?FeatureId=155). Yet little process enablement is filtering down to the desktop, and hardly any to the mobile device. When you set up your PC, PDA or smart phone, you do it function by function - any process context is held in your head alone. We should be downloading processes that auto-install, not downloading the constituent programs one by one, fiddling around to install them, then running them one after another as required. And data is yet another issue – how much time do you spend synchronizing data between machines, backing it up, or sending it to other people? All this should be done for us, since the technology is simple and available. So why isn't it done for us?

As BPM pioneer Peter Fingar writes, in "The Coming IT Flip-Flop":

> *Most of today's BPM solutions can take care of 80% of the routine, predetermined system-to-system scenarios with predefined workflow and inter-application transaction management. Such capabilities are needed to help a company put its "house in order" with application integration. But they don't directly support the way people actually accomplish their work. … What's needed is dedicated support for dynamic human-to-human interactions - that cannot be preordained or preprogrammed they way system-to-system interactions are. Further, it's the human-driven business processes that are the very heart of business process management.*

Such human-to-human interactions are what we seek to support when we toil away installing, configuring and updating software. Mobile devices in particular are designed to facilitate human-to-human interaction, from the humble telephone conversation through to contact management, email and Web service interfaces. Yet the devices possess no process context, since software manufacturers don't know how to give it to them.

Processes are not programs

This is because the notion of "process" entertained by most software developers is pretty close to their notion of "program" – if they see a difference at all, it is that a process can be configured largely using diagrams rather than text. Even then, the diagrams they use to build processes are pretty much the same as those used to build conventional programs. It may be possible to construct some industrial processes in this way: the mechanized, routinized, regulated kind, such as order-to-cash or supply chain. Even some superficially flexible and adaptive processes such as insurance claim management can be put under process control via these means, at least in some cases. But this is just the tip of the iceberg - most "processes" holding our world together are of a different kind, and not at all amenable to the same treatment.

We might call this second kind of process "human-driven". Processes based on human interaction do not look anything like programs. Even forgetting leisure for the moment and focusing on work, how about Product Lifecycle Management? IT Outsourcing? Complex Sales? Marketing? Company growth, merger, or divestment? Health care? Human resources? And this is to say nothing of processes that are not specifically commercial but are nevertheless at the root of our society: political/social negotiation, disaster prevention/management, crime solving, epidemic control, government policy implementation, running an election campaign, military action, and so on. Perhaps if we dealt with such processes more efficiently with the aid of IT the world would be a better place to live in.

The trouble is that you cannot use the same techniques to handle such human-driven processes that you can with mechanistic ones. Human-driven processes tend to be far more involved than mechanistic processes, for a start. There is a travel agent example described in the report of the Process Modelling Group from June 2005 (http://tinyurl.com/83huc) that illustrates the complexity typical of most real-world sales processes. To quote from the commentary on the travel agency process used as an example (itself a third generation attempt):

> *[This process description] takes the Travel Agency closer to real life - but still not close enough. It does not deal with information provision to the Customer, exception situations, the interaction between different bookings, successive refinement of bookings, payment options/problems, and so on. All these issues and more are a normal part of such processes - even when mechanized, say by a Web site.*
>
> *Moreover, if we consider a human Travel Agent, the process becomes even more complex, since we are then in the domain of "human-driven processes", where the activities may go off in unforeseen directions. Consider a very normal situation: an agent who books business trips on behalf of a large company. All sorts of additional process issues arise, since if the agent wishes to prove their value and retain the company's business, they must effectively embed themselves into the internal business processes of the company concerned, taking note of considerations which differ from trip to trip and even making proactive suggestions based on their knowledge of the company's working practices.*

It is hard to bend mechanistic process tools to fit such processes. And even if you try, all you end up with is a maintenance nightmare. Human-driven processes change constantly – humans are innately flexible, adaptive and innovative and hence so are our processes. It is necessary to approach the process problem with this in mind from the start, and apply not only appropriate techniques for creating human-driven processes but also appropriate techniques for managing them.

To handle human-driven processes properly, you need a lot more than a set of software tools. This is not purely an IT problem, unfortunately - it would be much simpler to solve if it were. The only way forward is via a dedicated approach to human-driven process

support, founded on a complete theory of human collaboration. Quoting Peter Fingar again:

> *To harness the Net for business innovation and transformation, we can no longer rely on incremental upgrades to legacy process support tools. Breakthrough thinking and new systems will be needed to provide the freedom that workers need so that they are helped, and not hindered, by the system. That new way of thinking is Human Interaction Management, and the technology needed to harness the Net for helping people work better in the wired, flat world of global business is a new category of business technology, the Human Interaction Management System.*

You can find out more about the principles of Human Interaction Management (aka HIM), and how to support these principles with computer technology, at www.human-interaction-management.info. For now, we will ask simply: how can Human Interaction Management enhance the personal computing and communications experience?

Improving the personal computing and communications experience

The most natural approach to supporting personal interactions, activities and resources (whether for work or leisure) is to divide them up according to the different *Roles* they correspond to. For example, a recent suggestion made on the Oxford University Next Generation Mobile Applications Panel was to enable mobile devices with software that can play Roles such as the following:

1. *Butler*, your head servant for daily chores
2. *Herald*, to announce your arrival or actions
3. *Copilot*, to help you navigate by interpreting maps and location
4. *Shopping assistant*, bringing you relevant addresses, recommendations and coupons
5. *Librarian or research assistant*, bringing you the right information
6. *Opponent or buddy,* to challenge you or to help you play
7. *Matchmaker or host*, helping you meet the right people at parties or conferences
8. *News anchor*, keeping you current on what you need to know
9. *Record keeper or logger*, keeping track of your activities
10. *Lifesaver*, helping you in case of emergencies
11. *DJ or entertainer*, playing your music and distracting you
12. *Usher*, streaming your movies
13. *Personal trainer*, helping you work out
14. *Secretary*, reminding you of your appointments
15. *Photographer*, helping you capture special moments
16. *Postman*, delivering your messages
17. *Operator*, helping you call and communicate
18. *Dog*, your loyal agent that fetches what you need and that keeps you company (and which you take care of and feed, ie.recharge)

19. *Beacon or marker*, to signal or broadcast your presence, location, speed and/or direction
20. *Wallet*, storing your important id numbers and helping you pay for stuff

However, these "Roles" are coarse-grained, generic, and unstructured, to the point that they do not actually represent process participation at all. Consider message collection and delivery, for instance (the **Postman** Role above). A person shouldn't have to wade through all their messages at once, since the messages may all concern quite different matters. Rather, the person should be responding to particular messages, no matter how received (email, SMS, fax, chat, whatever), each *in the context of a particular process*.

Quite apart from the time management benefits this brings, many people are now swamped by communications every day. Take email, for instance. Even excluding spam, many office workers receive hundreds of emails each day, partly as a result of the group postings common inside organizations. It is not sensible to bundle all these together as part of the "messaging activity".

Messages of all kinds should be divided up according to the various work and personal processes they belong to, prioritized accordingly, and presented to the user in a process context – somewhat like the way you can use folders and message filters with email, but more sophisticated. For one thing, you should see all messages, whether received by email or any other means, when you open up a process. For another, in order to deal with the messages properly, you need supporting information associated with the process (most of which will *not* be included as attachments), so this should be presented side-by-side with the message itself.

Old "groupware" systems like Notes, and modern ones like Groove, let you do something like this, but in a primitive way. It is primitive since these systems fall down when it comes to *structuring* the process. There are basic means in such systems by which a "process designer" can incorporate such useful features as routing rules and exception conditions. However, the features are not only hard to set up but hard-wired and inflexible - they do not permit process users to change the structure of the process as they go along. However, this is exactly what is required! Much of the work in a human-driven process is about deciding "what to do next" - in other words, it is about redesigning the process on-the-fly. Notes and Groove et al effectively require the users to keep the process in their heads – and this is not the best place if you want to manage it properly.

An interface based on Human Interaction Management for the next generation of personal computing and communications devices permits such ongoing process redesign, and provides natural support for process management, while concealing the low-level applications with which we all grapple at the moment. Such an interface leverages the computing power it has access to, rather than hindering and confusing the user with it.

Returning to the analogy that opened this discussion, mobile devices and PCs are getting close to the stage that washing machines reached when you could buy an appliance that

"knew" you would need both to wash and to spin-dry your clothes. But this is just scratching the surface. A computing device is capable of so much more - capable of becoming an "agent", if you like, that acts intelligently on your behalf to facilitate the processes in which you engage, both work-related and personal.

To do this, the software pre-installed on a PC or smartphone must offer more than a range of functions, even if these functions are dressed up as "Roles". The software must have some understanding of what **sort** of processes humans engage in, and **how** they can be supported. This is what Human Interaction Management provides.

There is growing recognition in the enterprise IT world that Human Interaction Management may be the latest Next Big Thing (for example, bptrends.com described it as a key component of "the overarching framework for 21st century business technology"). But the ideas are just as applicable to personal devices as to the big iron systems that underpin corporations. If not more. After all, what is a mobile phone for, if not interaction? Leveraging hardware functions properly will bring massive benefits to both vendor and purchaser.

The benefits of a process approach

In a world of globalized and extreme competition, there is a strong commercial argument for such an approach to personal computing and communications devices. For example, a natural application for mobile devices is to capitalize on consumer behaviour and desire, ideally for the benefit of both vendor and purchaser. However, this can only be achieved fully via a deep level of integration - not just providing relevant **information** in a timely manner, but enabling the vendor to participate in the consumer's **processes**.

Both the information approach and the process approach are deeply personalized, and adapt over time, but the first approach is weak compared to the second. From a user's point of view, would you rather have constant access to a search engine (the information approach), or have a personal assistant who accesses a search engine when necessary, among a thousand other tasks, while concealing the details from you (the process approach)? From a supplier's point of view, the process approach offers a chance to gain – and retain – a place in Pine and Gilmore's "Experience Economy".

Pine and Gilmore suggest that forward-thinking companies need to "use experiences as the basis for a fifth economic offering: transformations, where businesses guide their customers to achieve their aspirations". But "Guiding customers to achieve their aspirations" is about more than gaining their attention via a congenial trading environment. It is about more, even, than mining supermarket loyalty card data for trends that suggest cross-selling opportunities, or projecting a customer's future demand for an item based on purchases of the item they have made in the past. It's about *engaging with the customer's long-term processes*.

Consider the Western domestic market, for instance—in which people often have more disposable income than time available to spend it. There is a resulting movement toward

what might be termed *personal buying services*—suppliers that get to know a customer's lifestyle habits, and proactively suggest the products that they require. Wine dealers, art dealers, dressmakers, booksellers and bankers have traditionally served a moneyed class in this way. In the twenty-first century, diversified companies such as Virgin, Amazon and lastminute.com aim to return to such a model, and hope to use the Internet to implement it. They build on their knowledge of each individual customer's previous purchases to push products of various different kinds forward, rather than waiting for the customers to come to them.

However, such companies still have no way of *binding the customer into a shared process*. For example, you may fly with Virgin for years without anything preventing you switching to other carriers whenever you feel like it—in general, buying via an Internet full of search and price comparison engines just encourages *fickleness* on the customer's part. How can a supplier gain *loyalty* from you—the same kind of loyalty that your personal accountant gets without even needing to try very hard?

The reason one stays loyal to a personal accountant is because the more you deal with them, the more they know about *the way you live your life*—and as their depth of knowledge increases, the harder it would be to transfer it to someone else. Every interaction you have with an accountant embeds him or her further into your personal processes. From the supplier's point of view at least, it is a virtuous circle. How can we extend this principle to the corporate world, and allow suppliers to recreate this kind of engagement with their customers' individual processes?

The answer is not to be found in implementing and automating a networked supply chain. However valuable such efforts are, their aim is simply to improve the mechanistic efficiency with which you operate—to deal better with machines, not with humans. In order to *engage with your customers*—to win their loyalty by binding together your processes and their own—you need to integrate the goals and responsibilities of the humans in their organization with those of the humans in your own. To do this, you need support for Human Interaction Management.

Human Interaction Management allows you to become a fundamental part of the processes by which your customers go about their work—participating on an ongoing basis in their deliberations, negotiations, re-organizations, expansions, evaluations, and so on. The product deliveries that you make, and the payments that you take, are external manifestations of a fundamental integration with the needs of the customer. Such integration isn't just about allowing the customer to specify exactly what they want on a case-by-case basis—it is proactive as much as reactive, and tied intimately into the human-centered processes for which the products will be used.

It is conventional business wisdom that the most profitable business comes from existing customers. In the twenty-first century, where customers are bewildered by choice and seek *understanding* from a supplier as well as low price and efficient delivery, this may be almost the *only* business. Customers will find a supplier that they trust, engage with them, and stick with them. Anyone can compete in this heady new world—but you need Human Interaction Management in order to do so.

Let's look at an example.

The power of Human Interaction Management

Human Interaction Management shows that personal computing and communications devices are quite capable of understanding:

- What you are attempting to achieve in a particular process
- How you intend to do it
- Who you will interact with along the way
- The constraints you are working under
- The resources you have
- The additional resources you will need
- And so on

This is valuable whether the processes in question are work-related or personal. In both cases, this kind of support is becoming more and necessary in order to make a complex and ever-changing world easier for people to deal with! There is much talk of information overload these days. But what of "process overload"? Many people struggle to do too many *types of thing* during the day, and receive little or no computing support.

Such support is necessary since each “type of thing”, each process, is so complex. Consider a process that represents a marketing programme, for instance (itself just one part of what is often called Product Lifecycle Management, or PLM). PR people will be dependent in many ways on the activities of advertising agents and graphic designers, and these activities are in turn dependent on the client's aims for the product/service. Considering the aims further, the situation gets even more involved, since there are dependencies in all directions between marketeers, designers, engineers, sponsors ...

Such processes are complex - but they *can* be structured. The generic underlying principles of Human Interaction Management result in simple practical techniques both for describing and (just as importantly) for **managing** human work activities. These techniques allow for the continual change that is a feature of such processes - since humans are always deciding what to do next and how, which is the same thing as saying they are "redesigning the process on-the-fly". Hence human-driven processes cannot be pre-set, but must be allowed to change, and this change must be made subject to management controls.

Process definition and management is vital if processes are to be made more efficient for the stakeholders. And there is an even deeper commercial issue, in that the world is becoming so ultra-competitive that the only way for suppliers to keep their customers is to "get inside" their customer's processes - otherwise you're only a Google search away from someone cheaper.

PCs and mobile devices are quite capable of helping out. So let's use them to the max: **embed the principles underlying of human collaboration into their operating software**, and hide the messy details of the functions they provide behind a higher level user interface - a user interface that knows what you are "up to" and helps you achieve it.

The next generation of operating software

What is required in order to do provide a more sophisticated user interface, a user interface based on process, in personal computing and communications devices?

A level of software higher than current operating systems. A level of software that leverages the principles underlying human collaboration: the principles of Human Interaction Management.

A modern computing device is quite able **technically** to conceal the tedious details of human collaboration, by:

- Using a protocol such as SMS or email to transmit messages
- Locating a file on the Internet
- Checking whether or not a document is complete
- Prompting the user to provide information when necessary
- Providing authentication details to other systems
- etc

But the technical ability to do such tasks is useless unless they are done as part of a useful work **process** - whether that process is to create a design, open a new office, arrange a sale, merge two companies, solve a crime, organize a football match, or anything else that is based on human interaction. If mobile devices are to act as their users' "personal assistants", and facilitate the carrying out of such processes, the operating software must have an appropriate concept of process built in at a fundamental level.

Personal computing and communications devices need operating software that is "process-oriented" rather than "function-oriented". In particular, process-awareness means understanding not just the user's preferences and contacts, but their various *goals* and *responsibilities*, and how they intend to deal with them.

Human Interaction Management is related to workflow, in the sense of supporting and automating human work activities, but more sophisticated - allowing for **managed process change** during the life of the process, in particular. The theory includes a simple concept, known as **separation of control**, which provides a 4 layer model describing the engagement of individuals in processes (as strategist, executive, manager or worker). This is not yet more management waffle, but a practical method, complete with mathematical underpinning and automatic translation into software support. As illustrated above in the marketing programme example, a lot of what humans do when they work together is "decide what to do next and how". Since such decisions are personal, they should be facilitated by our personal devices – especially mobile devices, which are always with you, always on, and were designed from the start to support human interactions – and *process management must be facilitated along with process enactment*.

Serving up process

We have seen how process support software can and will move to personal devices – and claim that the market for Business Process Management (BPM) on such devices will become at least as significant, if not more, than the market for process support on traditional big-iron enterprise servers. This is not to say that servers will become redundant. In fact, they will acquire a very simple and very useful purpose – as process repositories.

To see this, let's step back, and ask a question that is harder than it seems: what will a future personal computing/communications device look like?

The question is hard for a simple reason: there is no answer.

In most sci-fi visions of the future, the characters carry about a portable device (or have it embedded into them) that lets them run programs and talk to other computer systems (for example the systems that run their particular ecosphere or ship). But if they lose their device, leave it behind, or get it deactivated, they can *still* connect, in order to carry out computing activities. They just need a convenient "point of presence" – which is typically almost any other machine they come across. In most visions of the future, the characters interact with the virtual world they inhabit by a wide and nondescript variety of means.

We can rephrase this as follows. You possess a digital identity by virtue of belonging to a society or owning property (or even many identities) – and this is the important idea, since in principle, such an identity is all you need to interact with the computing fabric around you, whether it is via a portable device, an Internet cafe or a machine on your own network.

As a result, the form and specification of hardware devices is on the way to becoming irrelevant, compared to the software they run. Some DVD players are now cheaper than a single DVD - so how long before they are given away with the discs? As phones are currently, with a contract - the physical item is nothing more than a disposable accessory to the virtual item, an accessory that you may well change during the life of the contract.

As discussed above, the next breakthrough in mobile devices will not come from faster chips, better screens or larger disk sizes – it will come from the subordination of function to process. And your ability to participate in processes depends fundamentally on **access to your online identity**.

Hardware turns into junk after a surprisingly short time – last year's must-have gadget is this year's landfill. What has staying power is your virtual presence, and what that entitles you to. The successful hardware devices of the future will be those that support a concept of identity, and provide as wide a range of software support as possible for what that identity entitles you to - without locking you in to a proprietary means of access that only inhibits your use of the virtual world.

Whether you own one or many of these devices doesn't really matter. What does matter, is where your identity, your virtual presence, will "live" – on what system(s) it will be hosted.

Typically one would expect to store one's identity on some kind of server, owned perhaps by your government or your employer - or you may pay a trusted body to host it for you. In fact, the most likely scenario is that your identity will be federated amongst various such servers – with different Roles stored in different places – though this may be transparent to the user. Your virtual world will consist of different streams of activity, corresponding to Roles in different processes, each with its own interaction and resources. Your mobile devices will simply act as interchangeable and disposable portals to this virtual world: accessing the current "state" of one of your processes, changing that state as they move the process onwards, and returning the new process state to a server somewhere for secure online storage.

In a dramatic reversal of the current approach to process support, it doesn't matter what server is used, where it is, or who it belongs to – it may even be different each time the process is used. The current move away from thin client Web applications and towards a richer user experience is symptomatic of a longer-term move: away from server-based computing and towards the personal computing/communications device. The future of computing is personal. In every way.

Conclusion - making the most of a virtual world

In a networked and process-enabled future, the issue facing ordinary people will change from "how best to make use of technology" to "how best to make use of processes". Or, how can you **manage** your personal participation in processes?

Human Interaction Management provides the answer. The principle of separation of control can be regarded as a mirror-image of project management – a mirror image appropriate as we finally say goodbye to the Industrial Age. Centralized management techniques based on command-and-control are giving way in all areas of industry to decentralized approaches based on negotiation between parties. In a future populated by Handy's "portfolio people", and enabled by the Internet, industry is driven from the perspective of the worker, not the perspective of the management.

Such a future cannot be made practical in terms of money and time without establishing the necessary **process controls** – controls that reassure investor, sponsor, manager and worker alike. Human Interaction Management provides a framework in which such controls are guaranteed, and can be enabled with little or no effort on the users' part – they are simply part of the computing fabric.

The next generation of personal computing and communications devices will allow users access to their information resources, support their interactions with others, and enable their activities *within a process context*. Such devices will incorporate innate mechanisms for *measuring and managing the processes they support* – mechanisms that are easy to use since they are transparent; just part of the computing fabric. The devices will all look different. But they will all run similar software – software that implements the principles of Human Interaction Management.