Developments in intelligent buildings

Contributed by Andrew Mawson, July 2005

The concept of the 'intelligent building' is probably the best part of 20 years old. In practical terms, the technology is just beginning to catch up with the vision, made possible by three specific technologies.
My own company was formed from a major research exercise known as the Learning Building Research Programme. This brought together some of Europe's top technology and construction companies to paint the picture of the 'intelligent building' of the future.

Interestingly, at the time we had a vision but the technology lagged behind. Now, the technology is catching up with the vision. Many of the components needed to bring the vision to reality are becoming available - and cheap enough - for most companies to consider applying them. Perhaps we were just 15 years too soon!

In any case, there are three specific technologies that are making the vision possible.
Voice over IPThe intelligent building concept was formed around the notion of a single high-speed network over which voice, data and other information (security, building controls, telemetry etc.) would be carried. For years each had their own network, but now using Internet Protocols (IP) - the technology and rules that enable information to be communicated across the Internet) - a variety of systems can use the same single data network.

Voice over IP means in practice that voice traffic can use the Local Area Network (LAN) connection in the same way that a PC does. In effect, the PBX becomes just another server providing a service on the network. Two types of telephone devices exist: the first, what is called an 'IP Phone', is a normal handset that is connected to a LAN at the desk. The second is what is known as a 'soft phone'. A soft phone comes as a piece of software installed on a user's PC. Usually a headset or a microphone and speakers are used instead of a normal phone. Soft phone technology can also be installed on laptops, making it possible for calls to be directed to the individual over the LAN or via broadband at home. The beauty of it for a home-worker is that once the user has signed up for broadband the calls are, in effect, free.

In the office, the additional benefit is that the user can input their password or telephone number into the system and all calls are then routed to the desk at which the individual is working.

From a cost standpoint, it means that you don't have the cost of a second network that only handles voice traffic, nor the maintenance or cost of change, for example, recabling, changing patch panels and so on.

But why and when might it make sense to switch to a Voice over IP solution? Well, if you have a PBX and existing network you are happy with you might not bother; but if you are planning a new building it will be a cheaper and more appropriate option than the traditional PBX. If your PBX is coming up for replacement anyway, it makes sense to move to Voice over IP. If you want to introduce more flexible styles of working to maximise the use of the real estate your organisation has, and if your existing PBX won't give you the capability to 'pull' calls to your desk, Voice over IP may be a solution for you. Or, if your company is an amalgam of several companies through acquisition or merger, and you have several disparate PBX systems but you want users to be able to 'pull' their phone number to any phone in the estate, then again Voice over IP may be the solution.
Radio Frequency Identification (RFID)With RFID, a credit card-sized badge attached to an item or a person enables sensors in defined locations (e.g. a building or a warehouse) to track the exact location of the individual or the item in real time. There are two types of badge - passive and active.

Active badges are electrically charged, last 3-4 years and at regular intervals - say, every 1.5 seconds - send out a signal that is picked up by sensors placed in the building. Passive badges rely on a transmitter in an area of a building sending out a signal to establish if there is a badge nearby and, if so, where it is.

Information from either is processed using a triangulation technique to establish the precise location of the card at that moment. This information is stored in a database and processed in real time or in slow time depending upon the application the cards are used for. At present this technology is being used extensively in logistics to track the movement of parcels and items in the retail sector.

For example, an organisation like DHL might use RFID to track parcels from the time of posting, through the vehicles, in the air and on through warehousing and ultimately delivery to the customer anywhere in the world. It enables the true location of the item to be tracked across the globe.

At AWA, we have been examining the application of this technology within an FM context. We think there are some exciting possibilities, the first being in the management of space.

In today's competitive yet chaotic world, people work in a variety of ways and locations. People responsible for space are in the business of maximising the users' opportunity to work effectively, whilst enabling the space to be used as efficiently as possible. Information about the true use of space is the challenge. Today, organisations have to use snapshots of the workplace to establish its utilisation, involving people going round the building perhaps once an hour observing the use of

each workstation, meeting room etc.

Whilst helpful, this has three weaknesses. The first is that we are only sampling; in other words, we might observe a workstation in use for a few seconds in each hour, so there is a limit to the accuracy of information and we are unable to really understand patterns of use. In the absence of anything else, this is a satisfactory approach. With RFID, however, you are able to get a constant stream of information giving absolute accuracy, confidence and the ability to understand patterns.

The second problem is that whilst we might say that through observation an individual is not physically at their desk, we may not have much of a clue where they actually are. With RFID technology, we can quickly gain an understanding of this. A third problem is of course that capturing this sort of information using people undertaking observations is expensive and, as a consequence, will usually only be undertaken as a one-off.

So what can we do with this data? We can answer a variety of key questions, for instance: How well are our workstations, meeting rooms and social spaces being used? When people are not at their desks, where are they? Who really needs to be closely located with whom? In summary, we can begin to understand patterns of use in ways that with other techniques are almost impossible.

From a life safety standpoint, if there is a fire in a building we can establish not only who is still in the building after evacuation, but we can also establish exactly where they are, enabling rescue services to focus their resources. For document management applications, files could be badged so that at any time we know where a file is. We think that RFID technology will be used for vending, access control, user authentication, capacity management and life safety, providing valuable information for free.

Wireless systems

The third intelligent building technology that we feel will make a significant difference to facilities managers is wireless systems. These can be used in a number of ways within organisations, but the most obvious application is to allow staff with laptops the freedom to roam the building without having to plug into the LAN each time they remain static in a specific place.

The building is in effect configured with a number of zones to enable seamless movement throughout. Currently, manufacturers claim that an access point can service a zone with a radius of 40m at 11Mb per second; however when you put walls, furniture and people in the way, that distance reduces significantly, so to make a whole building wireless needs a large number of access points.

The other point to bear in mind is that 11Mb per second may sound quite fast when you consider that BT's domestic broadband offering is now operating at a speed of 2Mb per second. But you have to remember that the 11Mb per second is being shared amongst the number of users in the zone in which they are located. So, if you have more than 15 users in a zone, you can expect the performance to be worse than the very basic broadband services operating at 512Kb per second.

But of course if you have a large building with the majority of staff with wireless-enabled laptops (most are these days) then you don't have to recable with every move - and if you design the space effectively to support a mobile workforce you can reduce the cost of churn from about £400 per move to effectively zero. For a building with 500 people with an average of one move per person a year, this could equate to a saving of as much as £200,000 per annum, not to mention a reduction in business disruption.

The security of wireless LANs is often cited as a reason for holding back on implementation by large risk-averse organisations. However, it should be noted that no LAN (wireless or otherwise) is entirely secure and the way wireless signals are encrypted and decrypted makes it difficult to 'listen in'. Nevertheless, manufacturers are responding to these concerns and in the next generation of wireless systems we expect to see advanced encryption technologies being deployed to overcome them.

Another interesting development is a hybrid of wireless and Voice over IP. If you think about it, when you have 'always on' wireless networks (in the same way as you have with broadband services), you could also consider Voice over IP over wireless LANs. This would mean that any roaming laptop user in the building could use their laptop as a telephone too. Intel and others are experimenting with this idea, letting you have one network for voice and data, wired or mobile.

So the technology is finally catching up to the vision of 15 years ago!

About the author
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