



In January 1999 we wrote a Technology Topic on Device Access Networks, 'Will the Pot call the Kettle Back? (1).

We suggested that the protocols needed to allow devices to discover one another and then have a meaningful conversation were insufficiently standardised to support widespread market adoption.

This was identified as a potential problem for Bluetooth enabled devices.

As with many prognostications we were partly right. Agreeing the Bluetooth procedures for device to device discovery and device to device communication proved to be a Herculean process and work is still ongoing in this area.

However substantial progress has been made over the past eight years. We thought it was time for a sequel - Will the Pot Call the Kettle Back? (2)

The original article focussed on device to device communications in the home.

In this month's Technology Topic we explore the positive cross over value opportunities between corporate, specialist and consumer machine to machine communication, the **M2M triple play proposition**.

A recent workshop run by Cambridge Wireless, highlighted the present rapid growth in corporate and specialist machine to machine communications.

The thesis is that there are ten microcontrollers for every human on the planet with the microcontroller population growing faster over time - a 60 billion unit target market.

Thus machine to machine represents a potentially high value high growth revenue opportunity.

The question to answer is whether the revenue opportunities are in the corporate, specialist or consumer domain.

Additionally we examine the role that technology may play in realising or not realising this value.

Corporate M2M

There is a wide choice of technology for machine to machine communication, indeed the breadth of choice has often proved more of a hindrance than an asset.

If faced with too many options people may choose not to choose.

For example an M2M application connecting vending machines to a central hub can be realised using VHF or UHF two way radio. Wood and Douglas are a typical vendor in this sector. Alternatively GPRS cellular radio can be used.

More localised connectivity can be provided using WiFi and/or Bluetooth and/or Zigbee

Machines have some advantages over people. They do not complain though their owners might. Many corporate M2M applications are static, vending machines being one example. They are also often installed in basements where radio coverage is poor. Thus the choice of radio technology may be dictated by propagation.

Many of the applications are low bandwidth exchanges of a few kilobytes or less and may or may not be time critical. If power drain is not an issue, devices can be continuously connected. More often it makes more sense for devices to be polled or to send data at pre assigned intervals or on an as required basis - a 'running out of chocolate' message for example.

One application that is apparently successful is a rodent trap that sends an SMS message when a visitor arrives.

A number of organisations provide bespoke solutions for corporate end to end customers. Vianet are an example in the UK and Aeris in the US.

Operators such as Orange are also proactive in developing this market.

Specialist M2M

Specialist M2M applications are different from corporate M2M in that the application spend would typically be justified on the basis of public safety or security. The most pervasive example presently would be CCTV surveillance and/or speed cameras or traffic monitoring devices. The bandwidth exchange for a PIR detector would be a few tens of kilobytes. A picture from a surveillance camera would typically be 40 or 50 kilobytes.

As with corporate M2M these exchanges may be event driven or periodic. Images used as evidence in court need to be digitally water marked and audit trailed to minimise the risk of being challenged.

Specialist M2M includes devices that are capable of working in extreme conditions including heat (-30 to +80 degrees), water and dust and capable of withstanding shock or continuous vibration.

Low cost cellular modems are not always suitable for these applications.

There are a number of vendors that service this market for example Kore Telematics in the US and TDC in the UK.

There is obvious overlap between corporate and specialist user markets and

commonalities in terms of need and requirement.

Consumer M2M

Consumer M2M applications are different from corporate and specialist M2M in that the application spend is justified on the basis of entertainment and/or personal convenience.

Getting a kettle to tell a teapot that it has reached boiling point might be entertaining but is not necessarily useful though might be in special circumstances, for example making life easier and safer for home owners with sight disability.

Similarly moving higher bandwidth data around the home offers undeniable potential both from a user experience perspective and in terms of delivering new consumer product differentiation opportunities.

Simple examples prevalent today would be the use of shared folders on a laptop and PC across a wireless router.

Several issues however need to be considered.

Device Discovery and Device coupling in Consumer M2M applications and the role of Near Field Communication

Our January 1999 Technology topic talked about the difficulties of device discovery and device coupling. Essentially the question revolves around how to manage device discovery and device coupling policy.

As you walk around a house, devices come into radio view and become available for service. Just because a device is available to use does not mean that you want to use it and the process of discovery and coupling takes time (bandwidth) and power.

This is not a decision process that can be safely left to a machine unless that machine has an understanding of the user and the context in which the device may or may not be enabled.

The answer may be to use Near Field Communication.

NFC devices are in every day use as travel cards. The 13 MHz transponder is touched on the turnstile at the tube station or pay button on the bus.

Nokia have developed a parallel enthusiasm for NFC in hand held cellular devices.

This would seem to make complete sense as a means for managing the device coupling process. If you want two devices to talk or multiple devices to talk, you physically introduce them to one another.

Bandwidth Considerations

The second thing to think about is the bandwidth of the exchange. This can be several gigabytes rather than the tens of kilobytes more commonly handled in corporate and specialist M2M applications.

This is not just an access bandwidth issue but a storage bandwidth issue. There is not much point in streaming a high definition television programme to a device with a few kilobytes of buffer bandwidth and /or limited video and audio playback capability.

So for example most of us would understand that there is not much point in coupling the VCR and the kettle unless of course it is a very exceptional kettle.

There are also possibly at least four types of exchange which need to be supported, best effort, streamed, interactive and conversational.

Best effort is for non time critical exchanges, opening the curtains perhaps.

Streamed is for moving video from device to device.

Interactive is for gaming and other interactive pursuits (keep an eye on the teapot and the kettle they might start placing bets against each other).

Conversational is for conversational devices - teddy bears that talk to each other and/or respond to a TV programme - hideous but here.

Within the WiFi 802.11 e QOS standards process these applications have been accommodated with the extended data channel access wireless media extension which supports background and best effort and video and voice bearers simultaneously on a 20 MHz time multiplexed channel aggregated into an eight level queue at the access point.

This is a world away from the original contention based medium access control that has been the basis for WiFi systems to date. In practice it will probably work reasonably well most of the time which remarkably enough seems to be acceptable to most consumers.

Similarly Bluetooth 2.0 EDR now supports three simultaneous traffic streams for voice, data and device control. One suggestion is that Bluetooth 3.0 will extend this parallel approach by supporting WiFi at 2.4 and 5 GHz and UWB from 5 to 10 GHz.

Bluetooth would then become by default a local area radio access management protocol rather than a specific physical layer standard .

Together with Zigbee this would seem to address most of the foreseeable local area machine to machine requirements.

Femtocells as an M2M hub?

An alternative is to consider the role that Femtocells might play in the corporate, specialist and consumer M2M proposition.

In corporate applications we have said that machines are sometimes positioned deep within a building. The loss from an outdoor cell into a building interior can be anything between a few dB to more than 40 dB.

In these situations a Femtocell or Femtocells can be installed to provide coverage.

Similarly specialist machine to machine applications may need to be supported underground and femtocells would again provide a coverage option.

In both cases the economics of such a solution would probably need to be amortised over a range of uses including voice, broadband data and M2M.

The exception may be safety critical M2M where the application may have sufficient value to cover capital and running costs for the installation.

Operators are generally positive about Femtocells because the real estate cost of hosting a base station is transferred to the building owner or occupier.

If the operator provides ADSL broadband as part of the package then the backhaul has been transformed from being a cost to a revenue item.

Some infrastructure vendors are less positive - 'an excuse for a bad network' being one vendor's view.

The positioning of Femtocells as a home hub is also less than clear.

The same benefits to the operator apparently apply. The real estate cost of hosting a base station is transferred to the consumer and if the operator supplies an ADSL line then backhaul becomes a revenue item.

However in the home as indeed in many office and public spaces, Femtocells are competing with Wi Fi which all though far from perfect does work and still has significant cost reduction and performance optimisation potential.

Rather than the single 5 MHz RF channel pair used in a Femtocell, WiFi uses 20 MHz or in some cases 40 MHz (two bonded 20 MHz channels) to deliver 54 M/bits/s or 100 M/bits/s.

The actual throughput rates are a fraction of this but still faster than a femtocell can manage which is presently 7.2 M/bits of peak data rate on the downlink and 1.46 M/bit/s on the uplink.

Although Femtocell throughput rates will increase overtime so will WiFi.

Today on a Femtocell supporting four parallel voice channels typical peak data is 384 k/bits/s. This may be enough for corporate or personal e mail but is not enough for broadband machine to machine communication in the home.

The range from a Femtocell may be better as the allowed transmit power is higher and receive sensitivity is higher due to the frequency duplex. It must however be questionable as to how many houses are large enough for this benefit to count.

Thus although Femtocells may have a role to play in machine to machine connectivity in some corporate and specialist applications it is harder to see the rationale for home hub applications. Arguably all Femtocells do is increase the user's energy bill.

Summary

M2M is a fast growth sector attracting the attention and support of a wide range of vendors and more recently a relatively broad cross section of operators offering bespoke solutions.

Traditional VHF and UHF radio modems can still be cost and performance effective in many applications. In order to compete, cellular based propositions need to be carefully costed, well deployed and well supported.

There are essentially three markets, corporate, specialist and consumer. There is substantial overlap between corporate and specialist applications and cross over opportunities between machine to machine and telemetry applications.

Consumer machine to machine is substantially different and inherently more bandwidth hungry.

Traditional difficulties associated with device discovery can potentially be resolved by using NFC technologies integrated into cellular phones and hand held communication devices.

This would seem to suggest that consumer M2M could be potentially serviced by low cost Femtocells offering cellular compatibility.

However the consumer M2M market is aggressively addressed by WiFi products that offer higher data rates than Femtocells at lower unit costs. WiFi products still have substantial cost optimisation and performance gain potential.

For these reasons it is hard to see how Femtocells can score in this sector unless substantial subsidies are applied. Device to device data rates may be disappointing and dual cellular WiFi access may need to be provisioned which would be unnecessarily complex and expensive.

Outdoor to indoor coverage can also be expected to improve as network densities increase over time.

Consumer M2M can be expected to include a wide variety of higher bandwidth applications for example video sharing and lower bandwidth exchanges including device to device telemetry and control.

Handset vendors promote the logic of using the cellular phone as a control point for these devices and applications.

This begs the question as to whose phone controls the house in multi phone households.

We will continue to open curtains by hand rather than by phone and talking teapots will remain as at most a niche product opportunity.

The case for cellular in consumer M2M remains unproven but corporate and

specialist applications will provide a more than adequate market opportunity.

Ends

M2M technologies represent just one area of present RTT research on the impact of technology and engineering change on spectral and corporate value.

If you would like more details of other study work presently under way or are interested in commissioning bespoke research or advice on technology, engineering, market or business issues then please contact;

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