



The third wireless revolution – sensor networks

If you ever had the foresight in 1970 to wonder along what sequence of events wireless technologies would start penetrating society, you probably would not have started first with high quality voice networks, then followed with high speed data-networks and finally ended with low data rate, low duty cycle simple sense and control networks. Most likely you would have suggested a sequence the other way around: let's start "slow and easy" with sense and control networks (sending temperature information every 5 minutes and control our heaters or air conditioners); then you may have guessed that this would have been followed by more complex data networks, as a higher speed next generation data network, and finally the wireless revolution would have been completed with the most complex voice networks with its high demands on low latency and high quality.

Not so. The first revolution was about wireless voice networks, in two steps: in-house and then outdoors (DECT/GSM). The second revolution was about wireless high speed data (Wi-Fi) in every laptop, you can't buy them without it anymore. And finally, the third wave with sense and control networks (ZigBee)?

Actually: remote controls for our televisions have been around for a while, our remote keys for our cars, for our garage door openers. But that never grew out of the stage of the wireless extension of a push button... Something feels wrong with this picture, what are we missing?

As usual the devil is in the details and going back to the 70-ies, it seemed that we missed an essential point, the usage model. And interestingly, only very recently we have started to pick up on this. The difference between voice and data networks on one side and sense and control networks on the other side is how to use these. We are used to live with handling a phone or a laptop and make sure that the batteries are charged – actually we have learnt it the hard way ("Where can I find an outlet?" Or worse: "I forgot my adaptor"). But with sense and control networks we need a "use and forget" model, that is, we do not want to be bothered with making sure that we have to regularly charge our remote control(s) or our car key(s)... and here is where trouble starts.

Let take our "house of the future"... remote controls for switching on/off lights; temperature sensors; motion sensors (whether someone is in the room) for comfort or security, etc. Without having to be too creative we can easily calculate 50 sensors (actually a not too sophisticated car has already 50 sensors today). Well... let's assume a battery life of 1 year per sensor. This means that we have on average to change a battery every week. And worse: to find out which battery we have to change, we will have every week at least one sensor down. OK, battery life will increase, but so will the number of sensors.

But there is more, and everyone who has a wireless switch in his house for a lamp will recognize this. In the past if a lamp does not work, well... change the bulb. But with a wireless switch this game has changed. If a lamp does not work, what is the problem: is the bulb broken, or is the battery of the switch empty?





All of a sudden “changing a bulb” has become a “diagnostics problem”, with different possible outcomes: the lamp is broken, the battery is empty (,or both!?). All of a sudden something as simple as “changing a light bulb” is not anymore what it has been. So, after all there is a simple explanation that the acceptance of sense and control networks is lagging compared to their sophisticated cousins in voice and data and this has nothing to do with the network sophistication, it is purely about the usage model: ease of installation/maintenance (and: “fix and forget”).

With the arrival of standards for sense and control networks, as well as with the increased possibilities for energy harvesting out of the environment (solar cells, motion energy), all the focus is going towards making these networks low maintenance, or better: total maintenance-free – and this will become the time of arrival of the third wireless wave, that originally was considered to be the most simple one.

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