

Smart moves for smarter homes

Are today's communications protocols up to the job of enabling the domestic Internet of Things? Not everyone thinks so.

By John Walko.

A panel session scheduled to take place during next month's ITU Telecom meeting in Doha, will discuss 'The Internet of Things: A Force for Good or Evil?'. This should generate plenty of controversy, particularly when the talk focuses on one domain of the fragmented IoT concept – connecting 'things' via a mesh network. The idea is that thermostats, lighting, security systems and all kinds of home automation sensor will be able to find each other and communicate. As the panel will likely acknowledge, getting to that position will be no easy task.

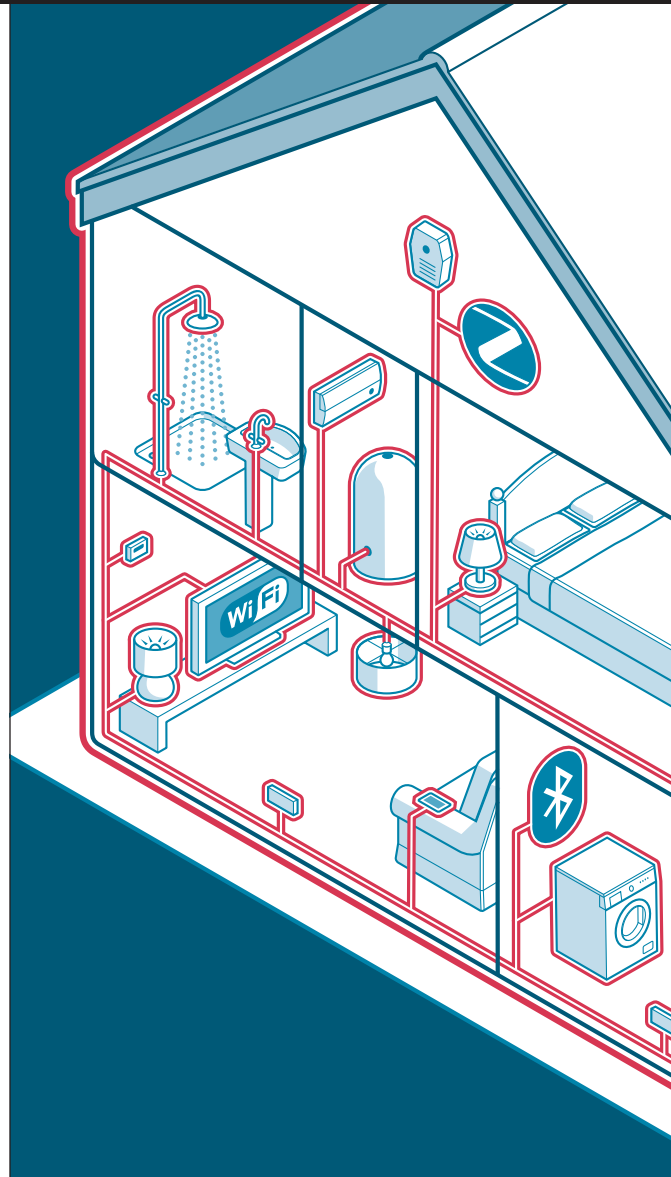
Today, there is no unified network or protocol that allows devices or 'things' to communicate amongst each other across multiple domains, never mind between these vertical application silos.

The home automation sector has seen frantic activity in the past few months, including strategic moves by some established players and attempts by key corporations and industry alliances to exert influence.

The 'new kid on the block' is the Thread Group, launched in July 2014 with the warning that existing protocols are just not good enough. It is proposing an implementation of a 6LoWPAN (low power wireless personal area networks) software stack based on IPv6 and includes IP routing.

Importantly, the Group notes that while other IEEE802.15.4 networking technologies are already available (a clear reference to ZigBee Pro), they generally lack interoperability, can't handle IPv6 communications, have relatively high power requirements and are predominantly 'hub and spoke' hierarchical models where if a hub fails, the entire network fails.

Thread will support a mesh network, using IEEE802.15.4 radios capable of handling up to 250 nodes

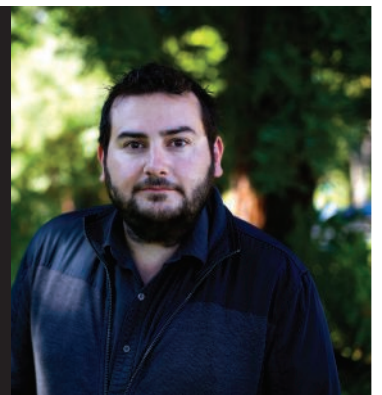


with 'banking class encryption' and authentication needed for all nodes. The Group stresses millions of IEEE802.15.4 enabled devices already on the market will be able to run Thread with a simple software upgrade – 'no new hardware required'.

The protocol operates at the UDP level and supports any IPv6 application layer. Thus Thread devices could be controlled by phones or tablets running iOS, Android or Windows, or by tablets using an IPv6 link, probably over Wi-Fi.

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Steve Hegenderfer

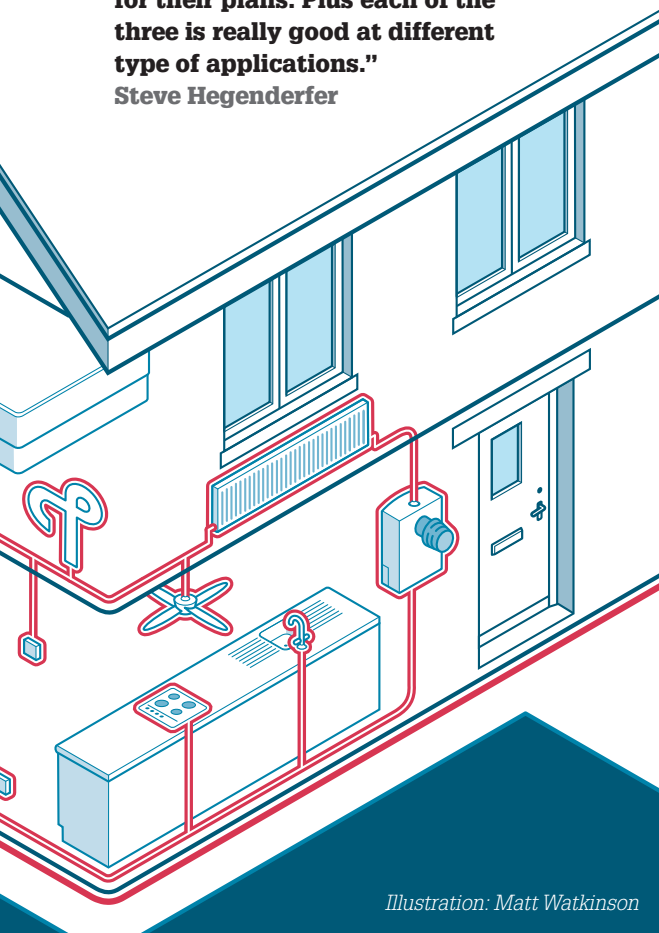


Illustration: Matt Watkinson

Driving force behind Thread

The main force behind Thread is Google, through its Nest Labs subsidiary (acquired last year for \$3.2 billion for its expertise in automated thermostats). Initial backers include ARM, Silicon Labs and Freescale on the silicon side, Samsung, and OEMs Yale Security and Big Ass Fans. A version of the Thread stack is already used in Nest's products.

Last month, at an event at Google headquarters that attracted more than 300 attendees, the group said it was opening up membership and that an initial version of the spec, including potential stacks, has already been tested at interoperability events. A rigorous certification programme should be in place by June 2015, with products on the market shortly thereafter.

Taking a leaf out of past efforts, such as Bluetooth, Thread compatible products will incorporate a logo testifying they have been certified and will work securely straight out of the box.

“We have been able to move at this pace because we are not reinventing the wheel – we are building a robust, self-healing mesh network protocol, but one based on some existing technologies. There was no protocol out there that completely met this industry initiative's exacting

requirements,” Chris Boross, president of the Thread Group and technical product marketing manager at Nest, told *New Electronics*. “I don't see Thread as a replacement for Wi-Fi or Bluetooth Smart,” he added. “I can see a scenario where devices have either of these as well as Thread – even Ethernet plus Thread. The sector needs to have a second network, a device-to-device mesh.”

Boross stressed the Thread effort should not be confused with the myriad of IoT networking allegiances and alliances taking shape of late, including the Qualcomm inspired AllSeen Alliance and the Intel led Open Interconnection Consortium. These, he notes, are predominantly higher level, application layer efforts that are tackling different, but equally important problems and bottlenecks. Thread will, of course, need to collaborate with these groups, which are keen to establish standards. “We are definitely not a standards body,” he added.

The networking protocol most likely to feel the heat from the Thread approach is ZigBee Pro. “Many companies, notably chip suppliers, are in both camps and have become aware of ZigBee's limitations,” claimed Nick Hunn, an independent consultant specialising in networking technologies and founder of Wifore. “While ZigBee Alliance members have had great traction in the smart meter sector, they have made almost no impact in mainstream home automation, despite the fact that they work in the same spectrum.”

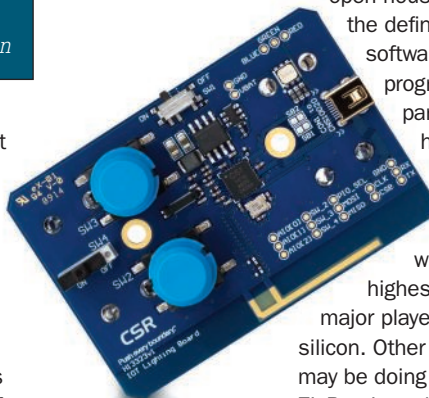
Leading definition role

Silicon Labs, for instance, revealed at the Thread Group's open house meeting that it has taken a leading role in the definition and development of the initiative's software stack, which is now a *de facto* ‘Thread beta programme for selected customers and ecosystem partners’. Almost 500 companies are said to have registered their interest in the beta programme, opening the door for developers and backers to see the platform at work.

This would indicate that Silicon Labs – which two years ago bought Ember, once the highest profile supplier of chips for ZigBee and still a major player – is prioritising development of Thread silicon. Other companies in both camps, as Boross implied, may be doing the same. Hunn was more forthright: “Perhaps ZigBee is no longer fit for purpose.”

Thread has implied that one outcome could be to convert both 6LoWPAN and ZigBee communities and thus consolidate these 802.15.4 based standards. As well as logical, this would bring some harmony to the fragmentation that started soon after ZigBee burst on to the scene. Thread's strategy, Hunn hints, may be to let engineers get on with finalising the protocol, fast track the spec as a *de facto* standard and simply submit it to the ZigBee Alliance for approval.

The target for chip developers is to create programmable platforms that will talk to multiple wireless technologies, including ZigBee, Bluetooth Low Energy (increasingly referred to as Bluetooth Smart) and sub GHz networks.



One of the boards found in CSR's CSRmesh development kit

The Bluetooth community will certainly have something to say on how this might pan out. Already, it is making tentative steps into the IoT and mesh networking scene, courtesy of companies such as CSR and US start up Zuli, which has developed a mesh technology in conjunction with its first product, the Smartplug. The Bluetooth Special Interest Group (SIG) has also started looking at mesh technology and longer range.

CSR – about to be acquired by Qualcomm – has recently released a development kit for its CSRmesh approach so engineers can start developing devices using the protocol.

Although proprietary, the technology sits on top of standard Bluetooth 4.0, so can be used with certified smartphones, tablets and nodes. “It addresses the two main reasons why home automation has not really taken off – too expensive and too complicated,” Rick Walker, IoT marketing manager at CSR told *New Electronics*.

Crucially, says Walker, CSRmesh offers ‘direct internet communication and control without the need of a cumbersome router or hub – and it is capable of connecting up to 64,000 things’. “The bottom line,” he says, “is that developers have demonstrated messages can be sent from one end of a multimode network, and acknowledgement received, with reliability and low latency.”

Initially, the company is targeting domestic smart lighting – and has signed up Samsung as lead supplier with its Bluetooth enabled LED bulbs. “Other big LED manufacturers are set to launch products working to CSRmesh and similar applications in the pipeline include air conditioning, heating, security and sensing.”

Walker revealed that CSR is about to launch other Bluetooth Smart enabled protocols suitable for home automation that will focus on controlling actuators and sensors. “We think Bluetooth Smart will have a significant new role in this space and are readying other verticals. We are aware of what other groups are proposing, but I am not convinced that simple home automation necessarily needs new IP related stacks – it is an overkill for most user cases, generally consumes too much power and is not necessarily the optimal use of airwaves.”

And he suggests ZigBee and Z-Wave (another home automation protocol with a reasonable user base, but



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which is essentially owned by Sigma Designs, and thus seen as not open) will ultimately disappear or be confined to particular niches. “Bluetooth and Wi-Fi will be the winners here.”

Thread, on the other hand, is likely to stay the course. “We heard rumours that companies were planning something like this, but the announcement did take us by surprise,” Walker admitted.

Like Boross, Walker sees the two mesh networking technologies coexisting, rather than competing. And he stressed that CSRmesh, like Thread’s protocol, was designed with security at the forefront. “Ours primarily prevents against eavesdroppers, man in the middle and replay attacks and is considered highly robust.”

Walker recently posted a detailed technical piece on the company’s blog area to highlight the level of security achieved, partly in response to recent revelations from London based Context Information Security concerning the ease with which a current generation of Internet connected LED light bulbs have been hacked and reveal the house owner’s Wi-Fi router password. The network involved used a mesh protocol based on 6LoWPAN linked to the router.

While evangelising the mesh protocol with several lead customers, Walker acknowledged the technology is, at this stage, proprietary. The company has donated the relevant codes to the Bluetooth SIG which, in September, set up a Smart Mesh Study Group. “The effort to get an official profile and a standard is likely to take between 12 to 18 months. It is the way this works, because all the competitor companies will have their own ideas.”

Knowing ‘it will just work’

Steve Hegenderfer, director of Development Programmes at the SIG, told *New Electronics*: “Having an SIG compliant mesh standard will be very important to Bluetooth and the IoT. The ability for an OEM to create a mesh compliant device and know that it will ‘just work’ with other OEM devices on the same mesh is what consumers want.”

However, he was keen to emphasise that other SIG members will be involved in crafting a standard ‘now that it is an official work item, including partners like Zuli and other Smart Home/Building OEMs’.

Commenting on the bigger picture, Hegenderfer suggested: “I don’t think it’s possible to have one standard to ‘rule them all’, as there are so many various use cases. Having said that, I think there are three technologies that will be used in more than 99% of all smart homes – Bluetooth, Wi-Fi and LTE/4G. There will always be a need for niche technologies, but that won’t be the norm.

“Bluetooth, Wi-Fi and cellular are so pervasive that it becomes a ‘no brainer’ for OEMs to use one of these three technologies for their plans – those technologies are already in people’s pockets. Plus each of the three is really good at different type of applications: Bluetooth, with low energy sensors; Wi-Fi, for high bandwidth apps; and cellular, to get to the cloud.”

As wireless expert Hunn put it: “The race has just started.”

A development kit will allow engineers to start exploring the potential of the CSRmesh protocol

