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**KNX STACK FOR SMART BUILDING
AUTOMATION**

Based on XMC™ Microcontrollers

Delivering intelligence and innovation for home and building automation

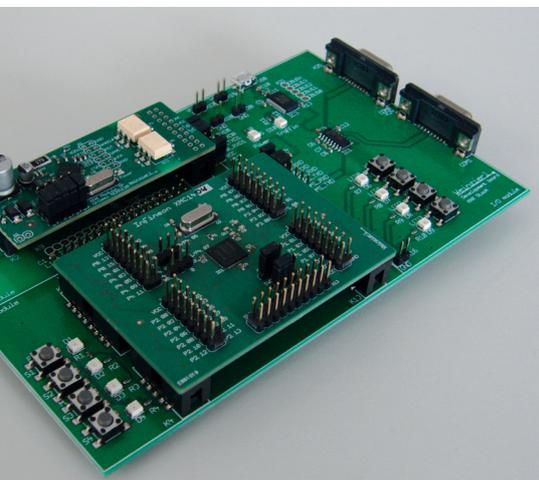
INTEGRATED KNX STACK SOLUTION REDUCES TIME TO MARKET

Smart homes and factories are growing rapidly and form the essential backbone of the smart cities of the future. In order for effective communication to exist, standardization is required. KNX has evolved to become a leading solution in this field and is an approved European (EN), International (ISO) and Chinese standard.

As more organizations enter this market, designers are challenged to deliver KNX-based solutions to the market quickly, leading to a steep learning curve. In this technical article Infineon Technologies and Avnet Silica will describe the benefits of the KNX standard. They will also consider some of the latest tools to reach the market that significantly ease the challenge for designers.

HOME AND BUILDING AUTOMATION OVERVIEW

Home and building automation allows people to access and control multiple devices via a mobile device anywhere in the world. Until fairly recently, this type of automation was only found in larger commercial buildings and high-end homes, but is now becoming more mainstream with multiple manufacturers releasing suites of products.



Home and Building automation is inextricably linked with the Internet of Things (IoT) where previously stand-alone devices now have an IP address and can be accessed and controlled remotely. Security is one area of focus with alarm systems, doors, windows, locks, smoke detectors and other sensors becoming linked. Automation also brings energy efficiency allowing remote control of thermostats, heating systems, lights and electrical outlets. Automation means that events can be programmed and scheduled for all connected devices.

This can be used to control things when the building is unoccupied, but can also automate repetitive tasks making the lives of the building occupants easier. As well as time-related commands, automation allows one event to trigger another non-scheduled event, such as

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turning on the heating if temperature drops below a certain level or turning on lights in the event of a person being detected approaching the house. With the location capabilities of modern mobile devices, intelligent buildings can detect the occupants returning and manage the heating to reach the optimum temperature just as they reach home, providing a comfortable home and managing energy usage.

It should come as no surprise that the number of connected 'things' is booming. Many estimates, including a recent report by market research firm IHS, indicate that there will be 50 billion connected devices by 2025. This represents several devices for each person on the planet, and estimates predict that building and home automation will represent a significant part of this.

HOME AND BUILDING AUTOMATION STANDARDS

In order to interoperate, devices need a system that allows them to communicate with a common language. While several such standards exist including EnOcean, Thread, LonWorks and BACnet, KNX is emerging as a leader in terms of functionality and number of installations.

Development of the KNX standard started some time ago and it has now matured into a manufacturer and application independent standard. KNX has been approved as an International Standard (ISO/IEC 14543-3) as well as a European standard (CENELEC EN 50090 and CEN EN 13321-1), Chinese standard (GB/T 20965) and an ANSI/ASHRAE standard (ANSI/ASHRAE 135), thereby ensuring compatibility between KNX devices from different manufacturers.

Several millions of successful KNX installations can be found throughout Europe, Asia and the Americas - demonstrating the popularity of the KNX approach. Over 370 KNX member companies worldwide offer more than 7,000 KNX certified product groups from different application domains.

Wherever it is deployed, KNX brings significant benefits to architects, designers, and contractors and, most importantly, to building owners and occupants.

With KNX, lighting and heating are only switched on when needed. This can be based on time profiles and/or presence or proximity detection, thus saving energy and money. Light levels can be automated in relation to the intensity of ambient light, thus maintaining a specified minimum brightness level in key building areas that are occupied, thereby reducing energy consumption (only those light sources where people are remain switched on).

By interlinking all devices with a single bus, KNX considerably reduces design

and installation time and cost. Unique manufacturer independent software allows the design and configuration of installations containing KNX certified products. As the tool is manufacturer and application independent, system integrators can combine any KNX-certified products with various communication media (twisted pair, radio frequency, power line or IP/Ethernet) into a single installation.

With the open architecture, KNX installations can easily adapt to new applications and are simple to extend. New components can be connected to the existing bus installation bringing new features and capabilities, or simply extending coverage further through the building.

CHALLENGES DEVELOPING KNX PRODUCTS

While it is theoretically possible to purchase a copy of the relevant standard and develop a KNX system from first principles, this is not a recommended approach. As with many emerging markets, time-to-market is critical in home and building automation; manufacturers need to deliver products to market rapidly to capture market share.

Bringing a KNX product to market involves several steps for designers. Depending on the desired functionality and configuration an adequate profile has to be selected. The next step is to develop the necessary hardware and software and select the transmission medium. The code then needs to be translated into a format that can be read by the ETS™ software package. The package needs to be checked for conformity to the KNX standard and submitted to KNX for registration and certification, allowing the product to be marketed with the essential KNX trademark.

Fortunately, leading manufacturers and distribution channels have

recognised the challenges associated with developing KNX systems and have developed hardware and software tools that allow designers to develop products rapidly and with confidence.

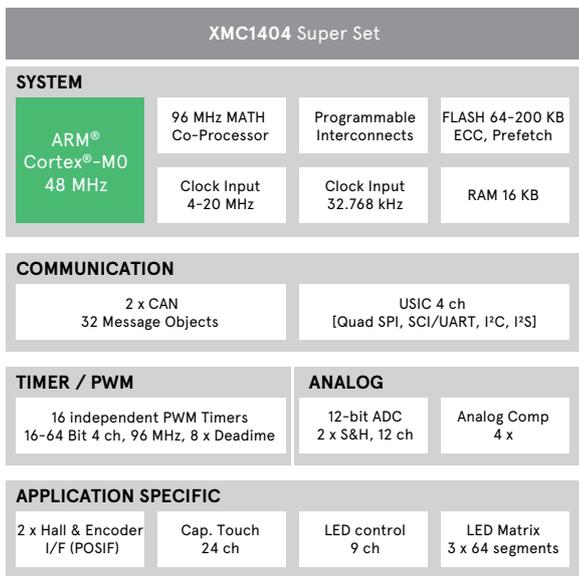
INTEGRATED SOLUTION: INFINEON XMC™ MICROPROCESSOR AND KNX DEMO BOARD

Avnet Silica, in conjunction with Infineon and Weinzierl have developed a new KNX stack NGS that offers a fully KNX-certified platform to develop bus devices in a very effective manner. When compared to legacy solutions the tool radically reduces development time, especially for complex applications.

The demo board includes all of the hardware required to create a KNX-approved solution. The base board is powered by a USB interface and features two COM ports. There are several push buttons and LED indicators that are invaluable in exercising and debugging designs. A range of jumpers enables the use of different IO lines from the microcontroller for various functions. Sockets are provided to insert KNX UART boards, depending on the media selected for the application.

The base board also includes the ability to connect a microcontroller board that will implement the bus communication (KNX protocol) as well as performing tasks required by the application. The preferred microcontroller is the XMC™ series from Infineon Technologies, specifically the XMC1404.

The XMC1404 is the most fully-featured solution in the XMC1400 series. This 'super set' device is based upon the popular 48MHz ARM® Cortex®-M0 core and is noted for its tailored features and broad scalability.



language and other software tools. It is compatible with the KNX ETS tool that allows configuration in 'system mode'. A full schematic circuit diagram is included with the full package.

Designers can select the best media for their application as the development system supports twisted pair, radio frequency (RF) and Ethernet as transmission media.

The KNX Stack NGS provides a model driven approach via the kScript scripting tool for application development. Using an application description in Python syntax, kScript generates the database entry for ETS software as well as the configuration and header files for the KNX stack. The fully integrated workflow reduces development time and eases change management. For efficient debugging, the TraceMon tool is included in the package.

SUMMARY

The home and building market is growing rapidly in terms of its size and sophistication. To be successful in this market, companies need to deliver KNX-compliant solutions to market quickly.

While this can be a significant learning curve, KNX approved development tools such as the KNX stack NGS from Avnet Silica, underpinned by the flexible XMC1404 microprocessor from Infineon Technologies, are invaluable in reducing the development complexity and time taken.

The advanced microcontroller solution includes an advanced 96MHz math co-processor and up to 200kB of ECC Flash memory as well as 16kB of RAM. The 4-channel USIC supports multiple protocols including SPI, SCI/UART, I²C and I²S.

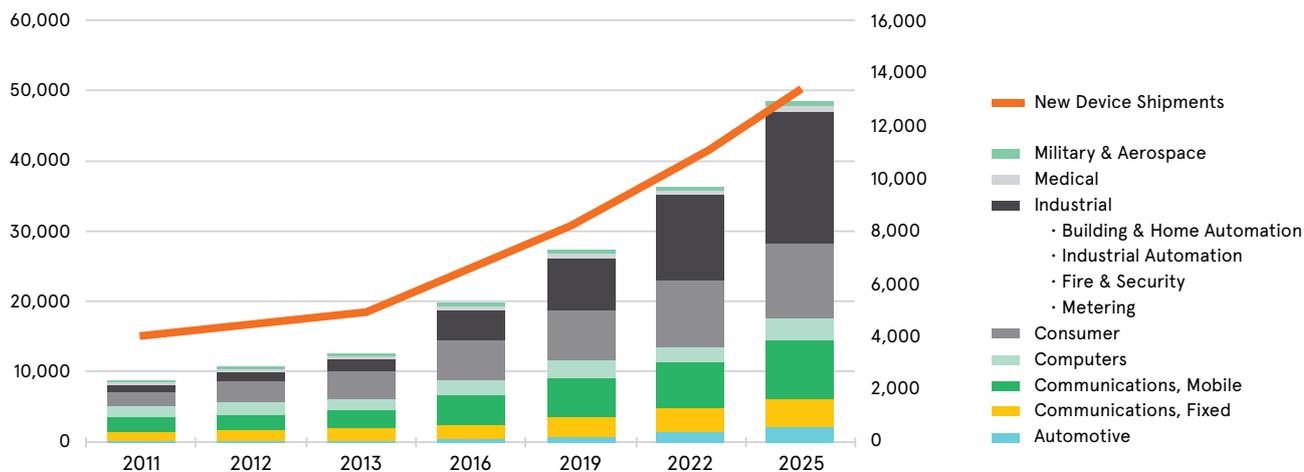
Four analog comparators and a 12-bit ADC with dual sample-and-hold are also included in the MCU, providing useful sensing features in home and building automation applications that are based upon analog sensors.

The KNX stack development system includes source code in the 'C'

The included firmware is a very lean system that is ideal for KNX bus devices. It includes the communication stack and a complete implementation of the standardized device model, known as System B.

All KNX resources including memory or properties are fully emulated by the firmware, ensuring that compatibility to the ETS software tool is achieved without any restrictions. The included source code is modular and comes with detailed documentation. Application development is based on an easy to use KNX API.

Connected Devices (M)



Source: IHS - Internet Connected Devices



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