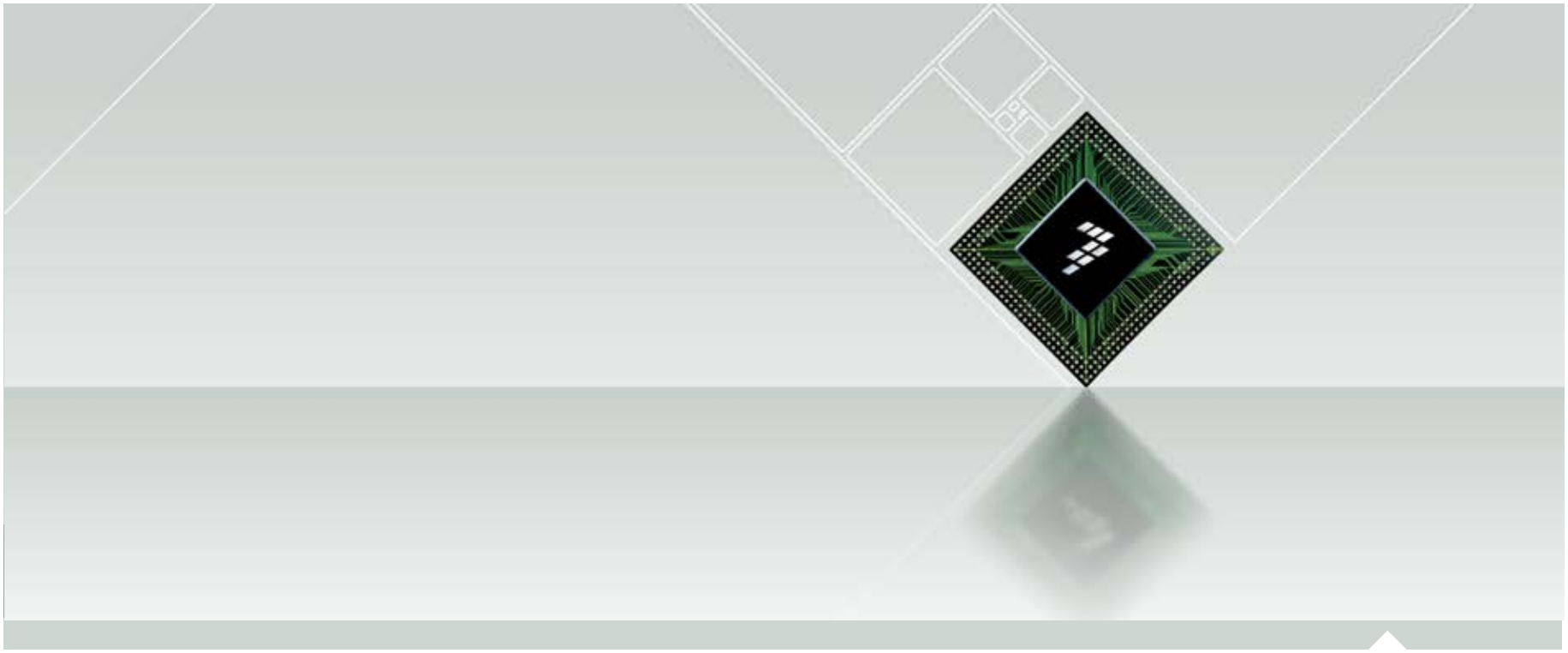


June, 2011

ZigBee™ Enabled Options for Smart Energy Industrial and Building Control

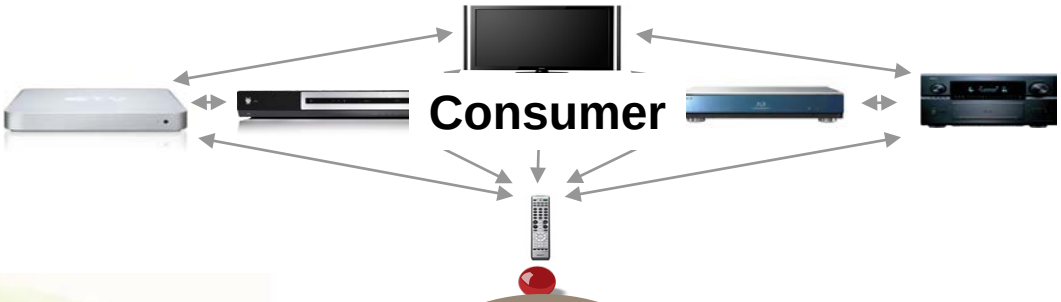
Peter Ligertwood
Technical Marketer

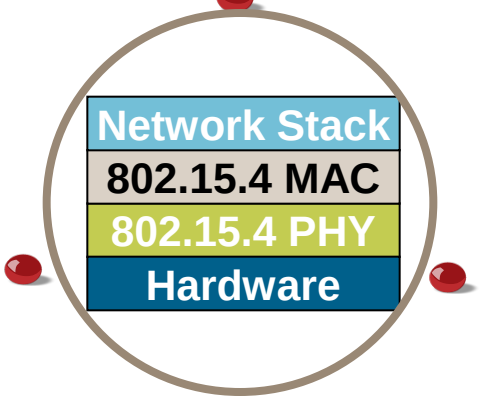
freescale™ semiconductor

Agenda

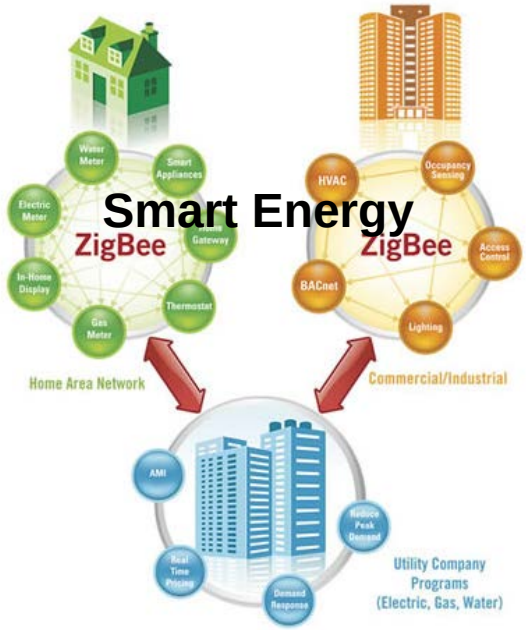
- Introduction
- ZigBee Smart Energy Overview
- Home Area Network Applications
- Energy Management Reference Designs
- Freescale 802.15.4 Solutions Overview
- Summary

Freescale ZigBee Wireless Connectivity





- **FSL Leadership**
  - #1 market share in 2007-2010
  - ZigBee Leader
    - ZigBee Promoter
    - Led effort in RF4CE specification
    - Active participation in
    - Continua Health Alliance



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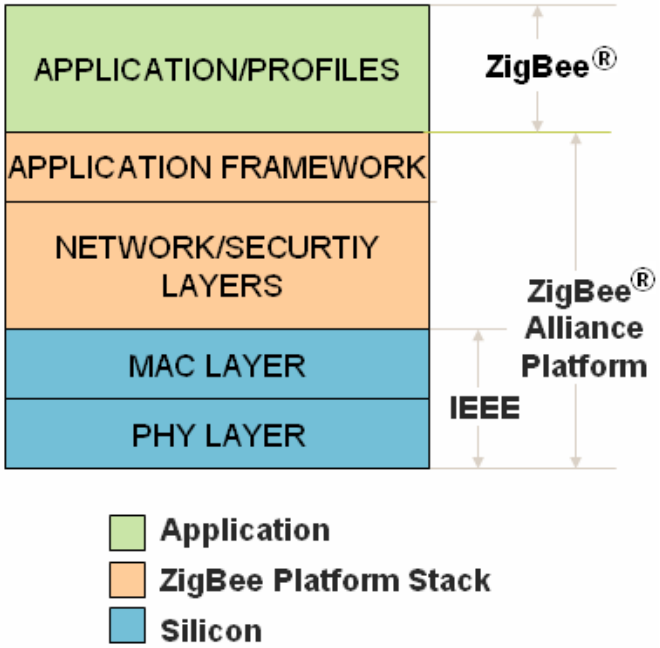
ZigBee Overview

- A global protocol developed and supported by companies around the globe
  - Based on 802.15.4
  - Creates specifications for wireless sensing and control
    - ZigBee 2007 (HA, SE 1.x, BA, HC)
    - ZigBee RF4CE (RC, HID*)
    - ZigBee IP (SE, 2.x)
  - Defines certification and compliance testing
  - Provides branding, market development and user education



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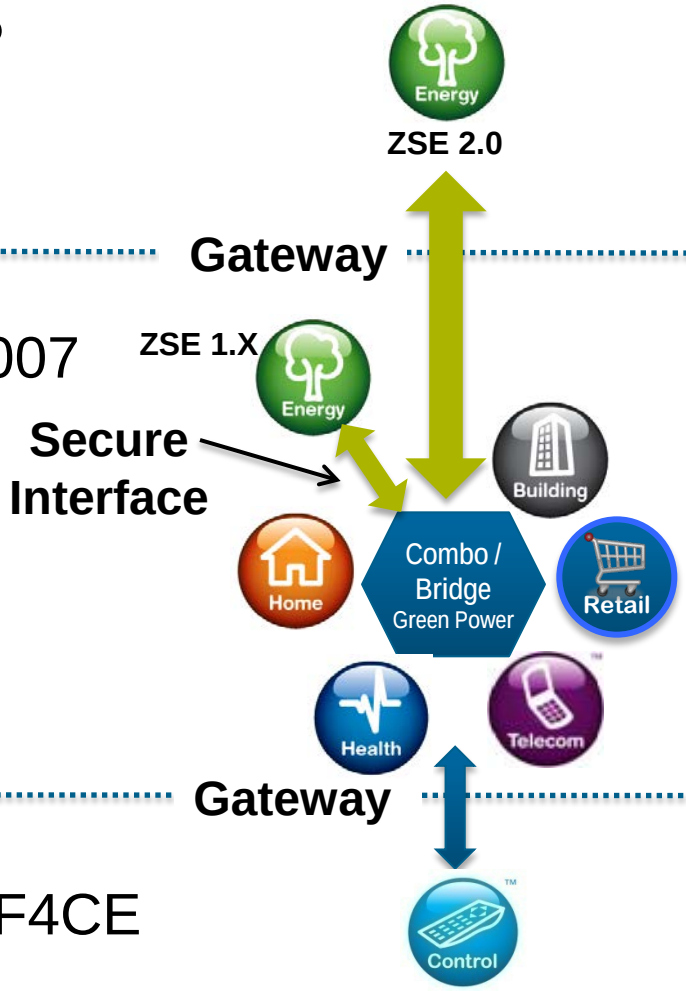
ZigBee Stack Profile Interaction

- ZigBee IP
- ZigBee 2007
- ZigBee RF4CE



Combo
- Device certified for all supported profiles
- Usually in same device

Gateway
- Network translation between ZigBee IP, ZigBee 2007 and ZigBee RF4CE
- Typically requires multiple radios
- Example Energy Management System (EMS)

No over the air compatibility between ZigBee RF4CE, ZigBee 2007 and ZigBee IP

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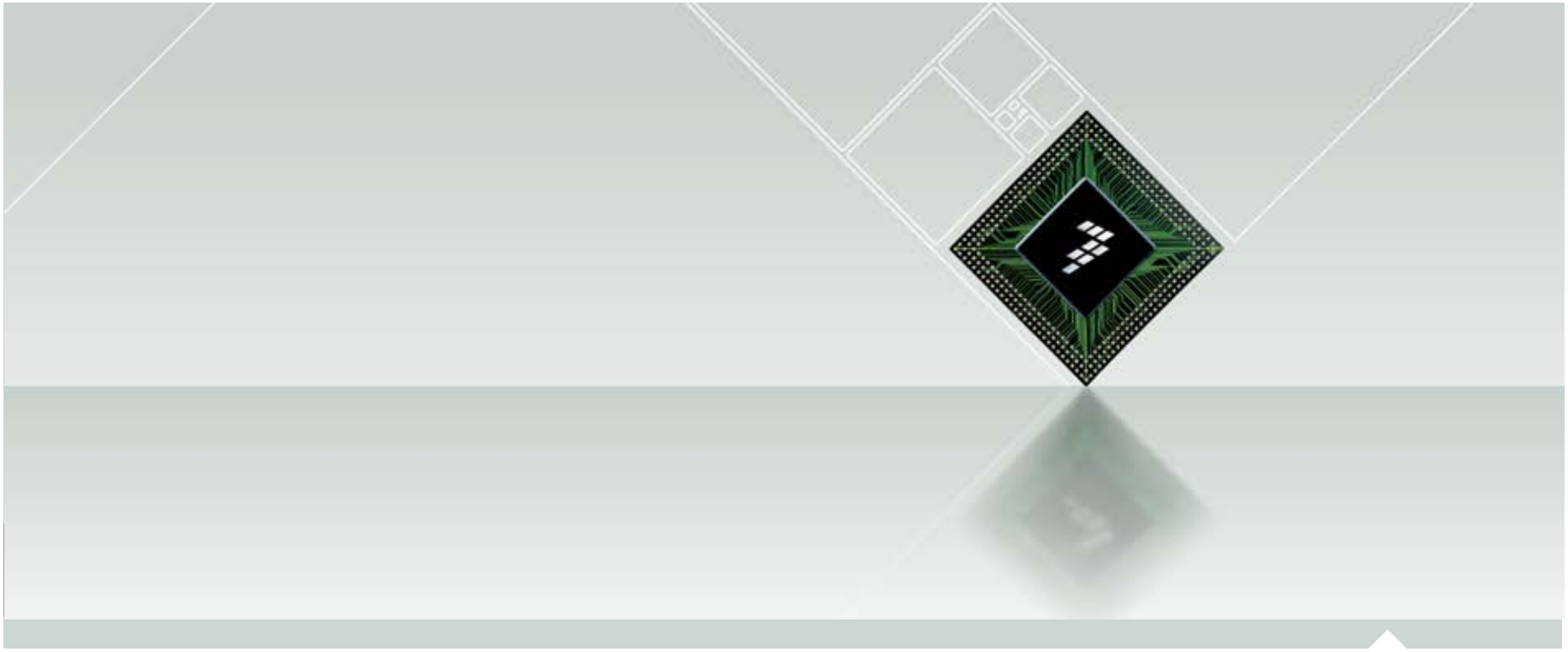

Smart Energy

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Growing Market for ZigBee Smart Energy

- Energy management and efficiency solutions can bridge the gap between the power grid today and the Smart Grid of tomorrow
  - Households with digital tools controlling temperature and price preferences saved on average 10% on utility bills
- Market is starting with large scale rollouts
  - Technology is available today, deployments are happening now
    - Over 10 million ZigBee enabled meters deployed through 2010
- Over 40 million ZigBee electric meters being deployed by utility over 11 utility companies
  - Pike Research predicts approximately 85 million ZigBee enabled meters installed through 2015
- Stimulus funds are driving early adoption
  - 3.4 billion in stimulus funds awarded for the Smart Grid in the US
- Major companies launching products
  - GE, LG have launched ZigBee enabled appliances
  - Cisco, Intel and Control4 have launched Home Energy Management systems
  - Google Power Meters & Microsoft Hohm

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Why will it take off ?

Consumers

- Desire for monitoring/controlling
- Remote access to home

Growing Energy Prices

- Reduce home energy consumption
- Smart consumption

Service Providers

- Innovative services around energy management and home security
- Utilities to take control over energy usage

Technology Enablers

- Commoditization of LAN/WLAN networks
- Maturity of low power technologies (ZigBee®, Z-Wave, etc.)

Standardization Bodies

- Individual protocol alliances (ZigBee, Z-Wave, HomePlug, etc.)
- Application-oriented alliances:
  - OpenHAN from UtilityAMI
  - CECED for Appliances

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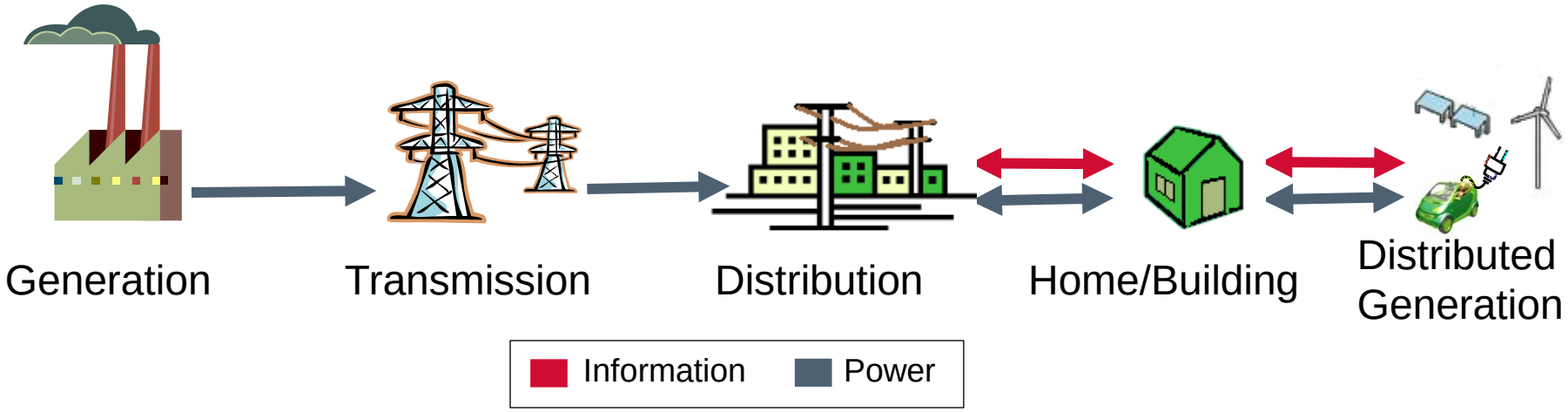
What is the Smart Grid



Smart Grid consist of end-to-end, bi-directional flow of energy and communication capabilities from generation to consumption to:

- Improve power reliability and quality
- Increase resiliency of the grid
- Increase capacity through optimized generation efficiency
- Allow easier use of renewable energy and distributed generation
- Reduce consumption on a per user basis
- Increase consumer choice

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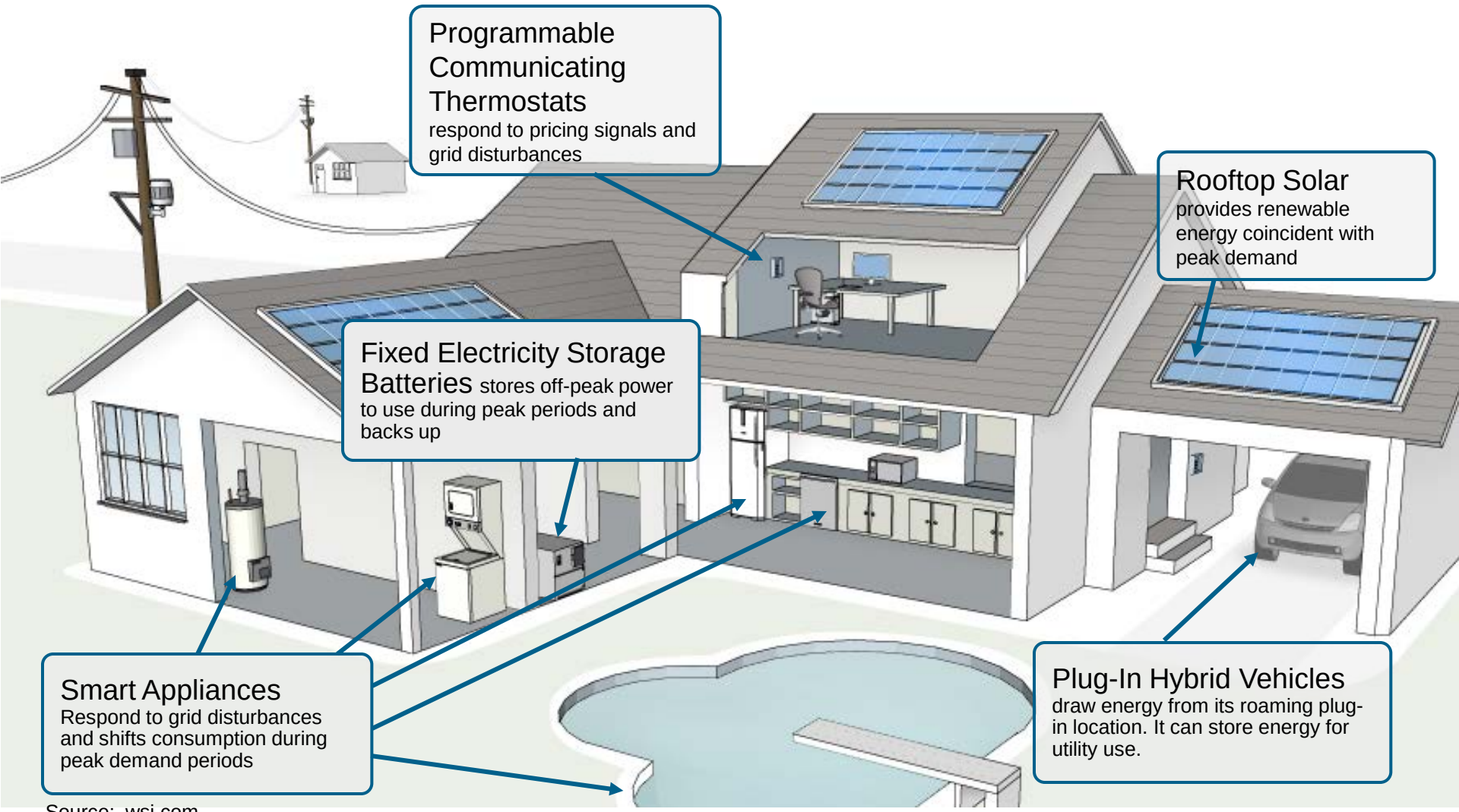
Where does ZigBee Fit Into the Smart Grid



Source: wsj.com

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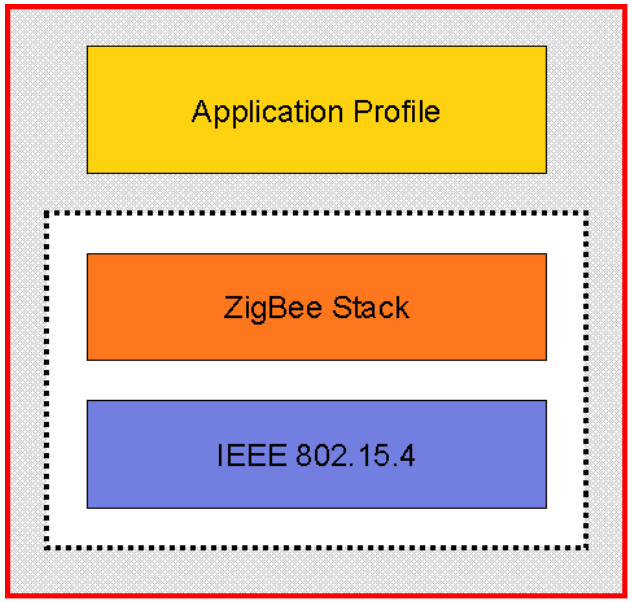
Smart Energy 2.0 Devices

- Devices defined by the SE 2.0 application profile:
  - In-home display
  - Smart thermostat
  - Load control
  - Meter
  - Smart Appliance
  - Range Extender
  - Energy Service Interface
  - Pre-Payment Terminal
  - **Premise Energy Management System**
  - **Plug-In Electric Vehicle**
  - **Inverter**



SE 2.0 Spec complete Sept 2011
Freescale will be Golden Unit

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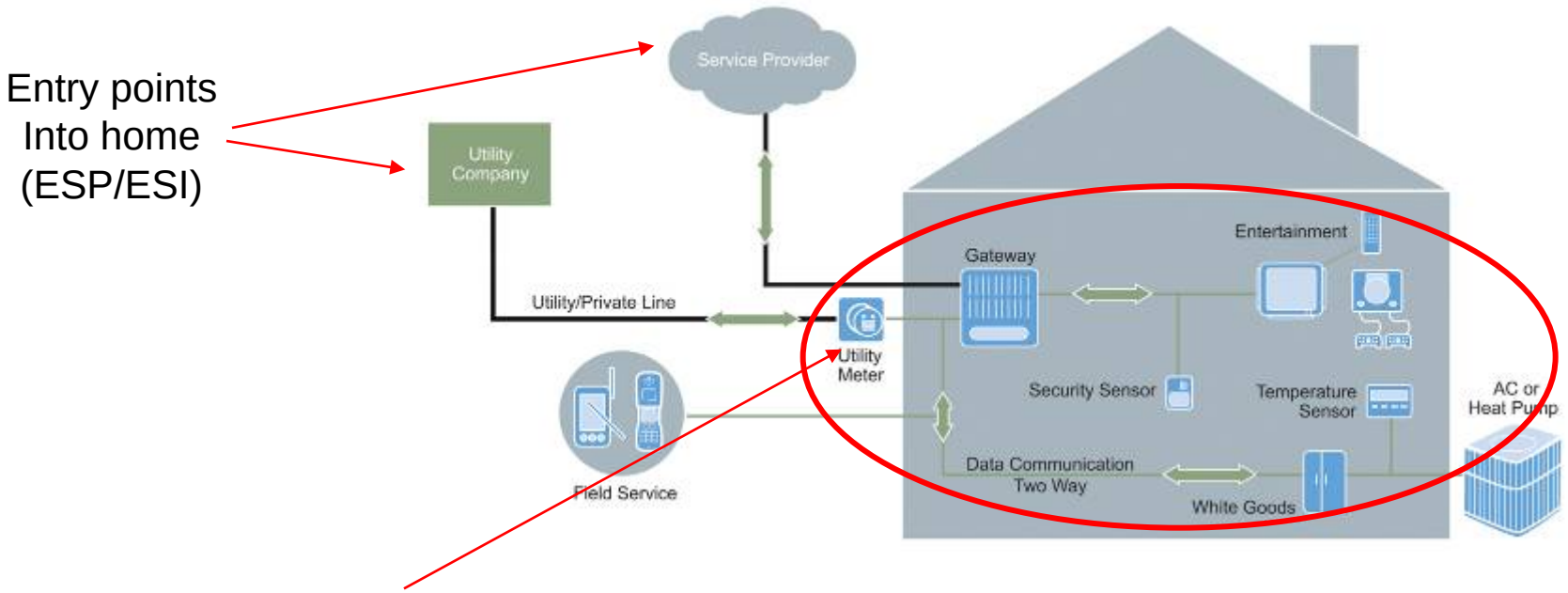
Smart Energy Application Profile Example



- ZigBee Smart Energy Application Profile addresses communication from the meter to the HAN (Home Area Network) for purposes of load control and demand response
  - Load control allows the ability for the utility to turn off loads for short periods of time in the customer premise during peak loads
  - Demand Response is the ability for utilities to communicate with a home to inform of changing utility rates during peak times, etc. The user will then have the option of taking voluntary actions to reduce their personal consumption.

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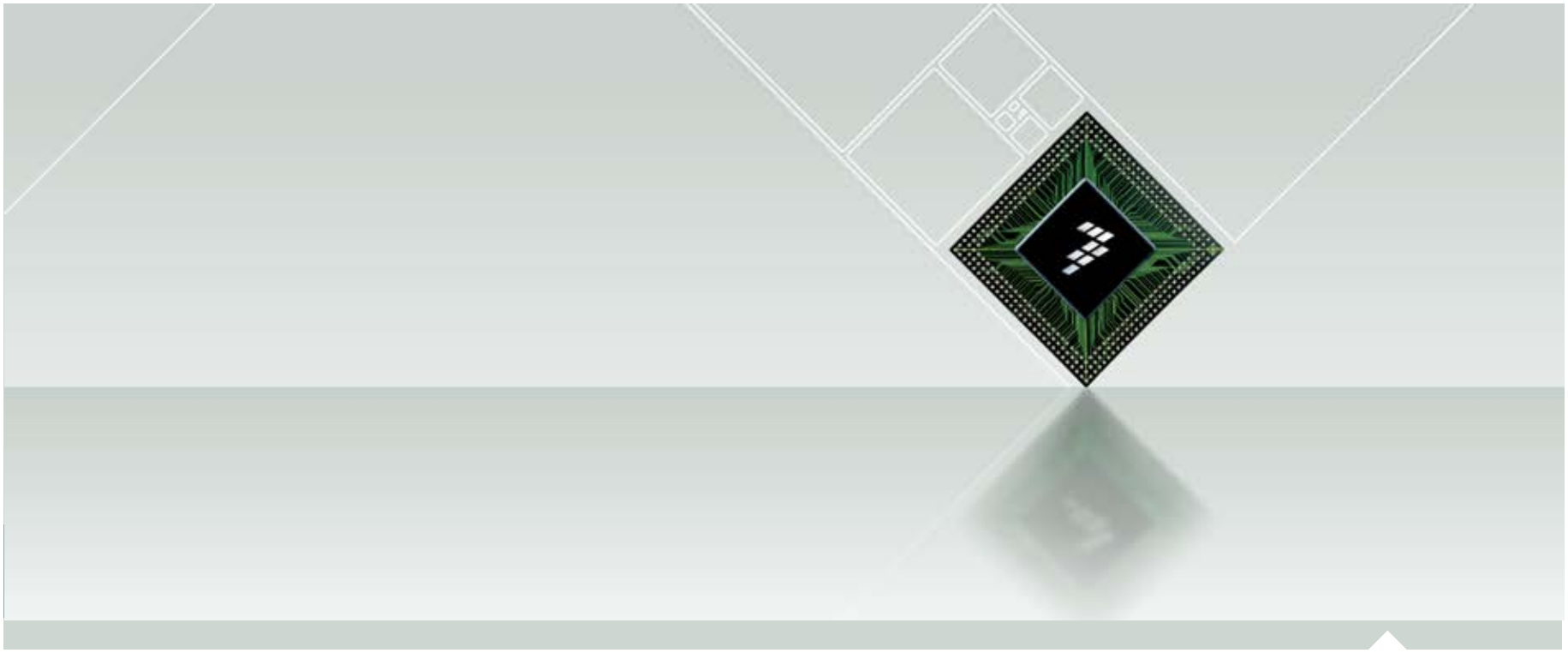

Home Area Network Applications

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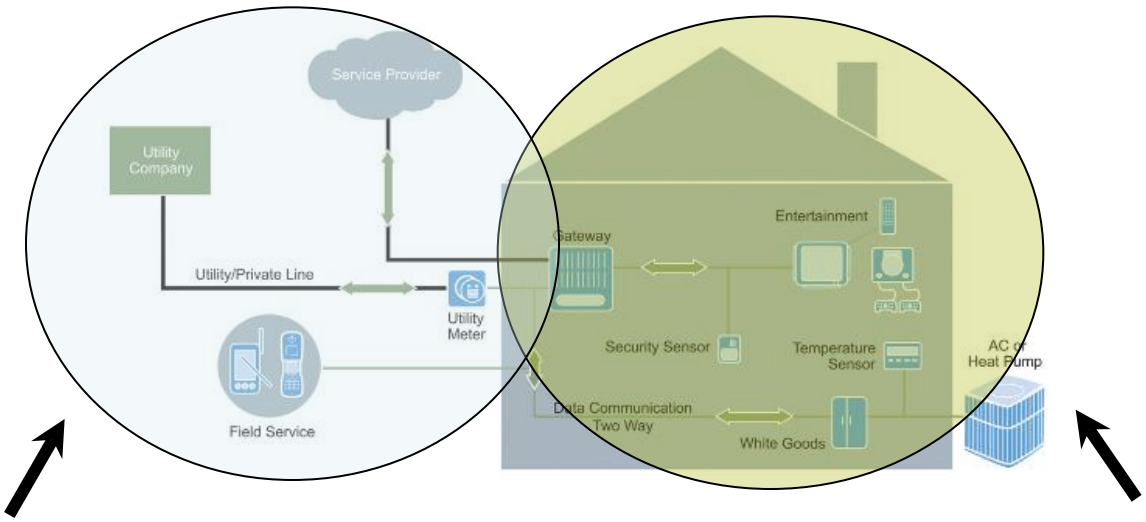
The Challenge of HAN



- **Connect the entire house/building** network to the 'external world' for remote monitoring and control
  - For consumer: Remote control and monitoring of smart objects (HVAC, lighting, alarm systems)
  - For service providers: Remote metering for utility companies, security monitoring for surveillance companies

&

- **Connect objects** inside houses/buildings to offer smart interoperability features.
  - Example: PIR sensors connecting to HVAC system and lighting system to turn off heating when windows are open, or turn OFF lights when no presence is detected

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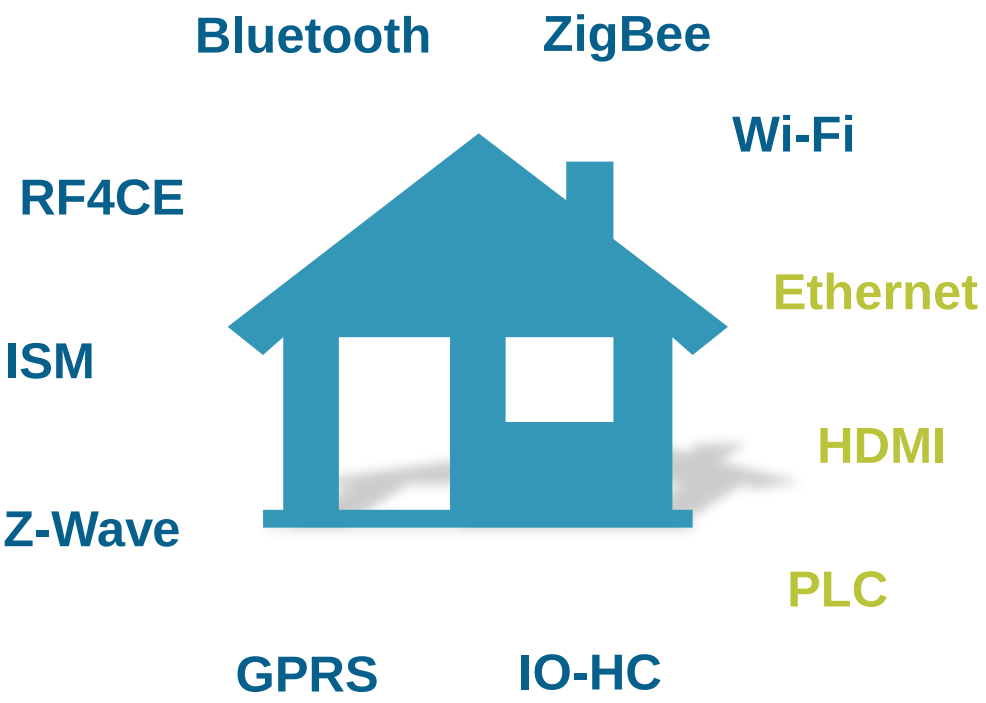
HAN – It is all about Connectivity

- **Home area network is a combination of various specialized networking technologies**
- **Challenge is to interconnect different technologies to offer smart services for**
  - **Comfort**
  - **Automation**
  - **Security**
  - **Energy management**



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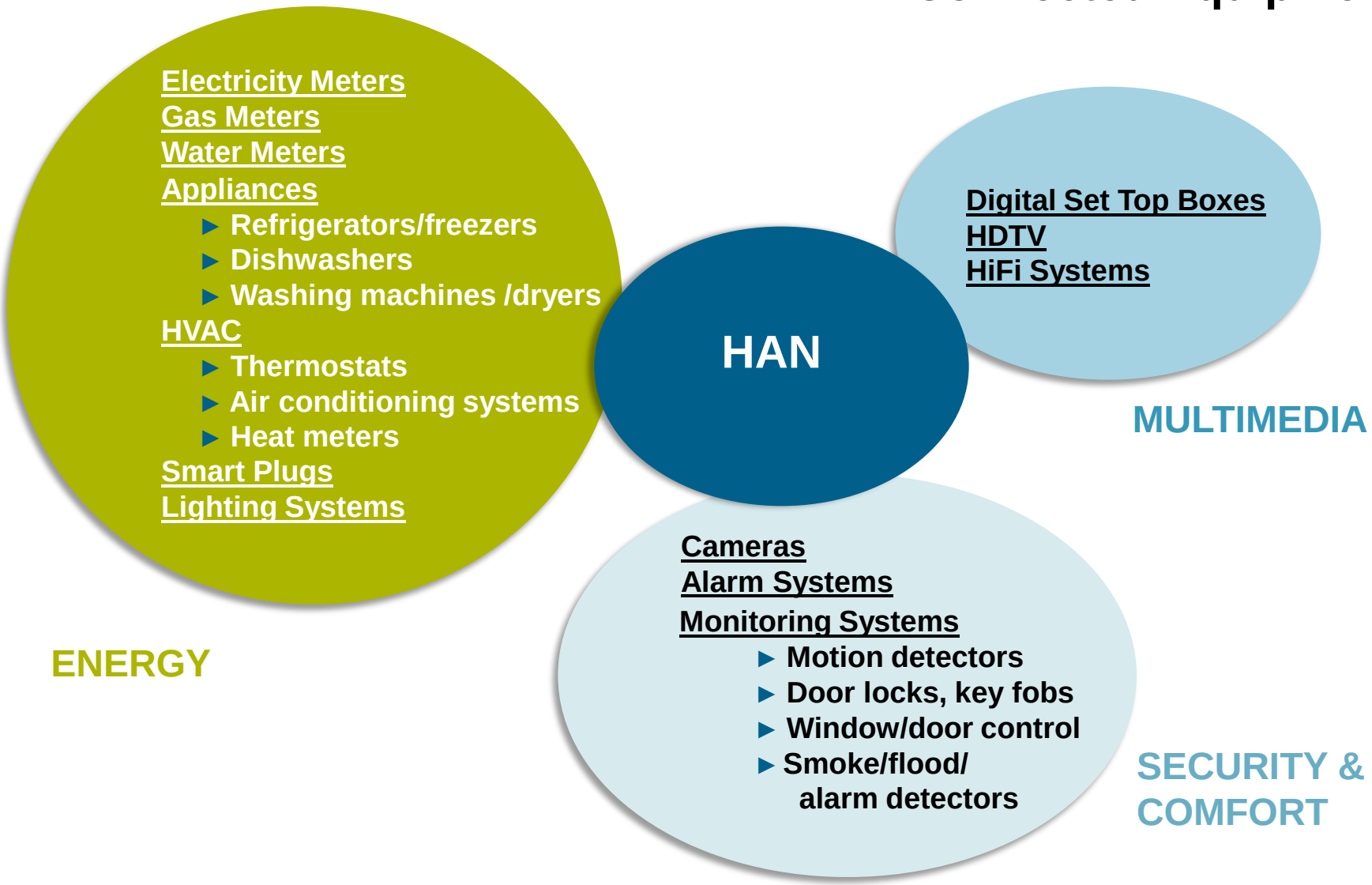
Connected Equipments



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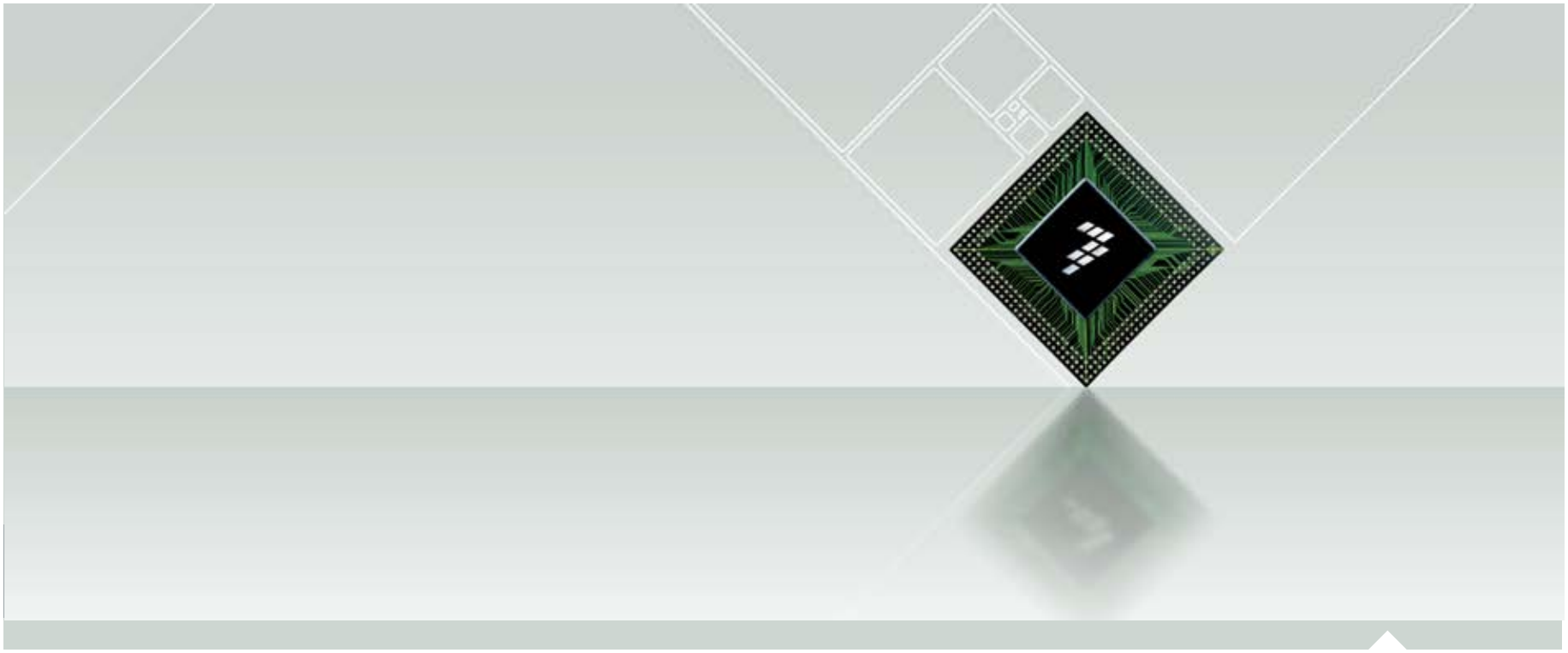

Energy Management Reference Designs

- In-Home Display
- Energy Gateways

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Home Energy Management (HEM) is a hot topic for several good reasons:

1. In a time of increasing energy bills and shrinking income, consumers want to reduce the amount they spend each month on electricity;

2. Utilities need to switch from a model of getting people to consume more to consuming less (for capital cost and regulatory reasons); and

3. Societies around the world need to put the brakes on unsustainably escalating use of fossil fuels, much of which go to generating electricity.

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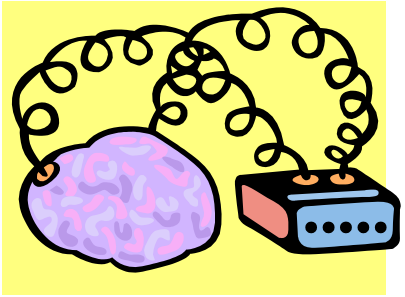
We are entering the “post-PC” era that will be defined by machine-to-machine communications (M2M) without user intervention.

….. for example, a clothes dryer can autonomously determine when the cheapest time is to run and start itself ☺



In the next 5-10 years virtually any device over $20 will be connected to a network of some sort.

“In 2014, global revenues for energy-related HAN products and services could reach $3.3 billion”

On World report, 2010
- Pike Research, Dec 2009

In smart homes, almost all aspects of the living space (temperature, entertainment, lighting, communication) are connected to each other and the wider world, intelligent to one degree or another, and able to be queried and controlled by the home owner remotely.

“Driven by consumer demand and a strong push from electric utilities, there is a substantial market for HEM systems and energy information displays (EIDs), which is predicted to reach 28.1 million users worldwide by 2015.”

- Pike Research, Dec 2009”

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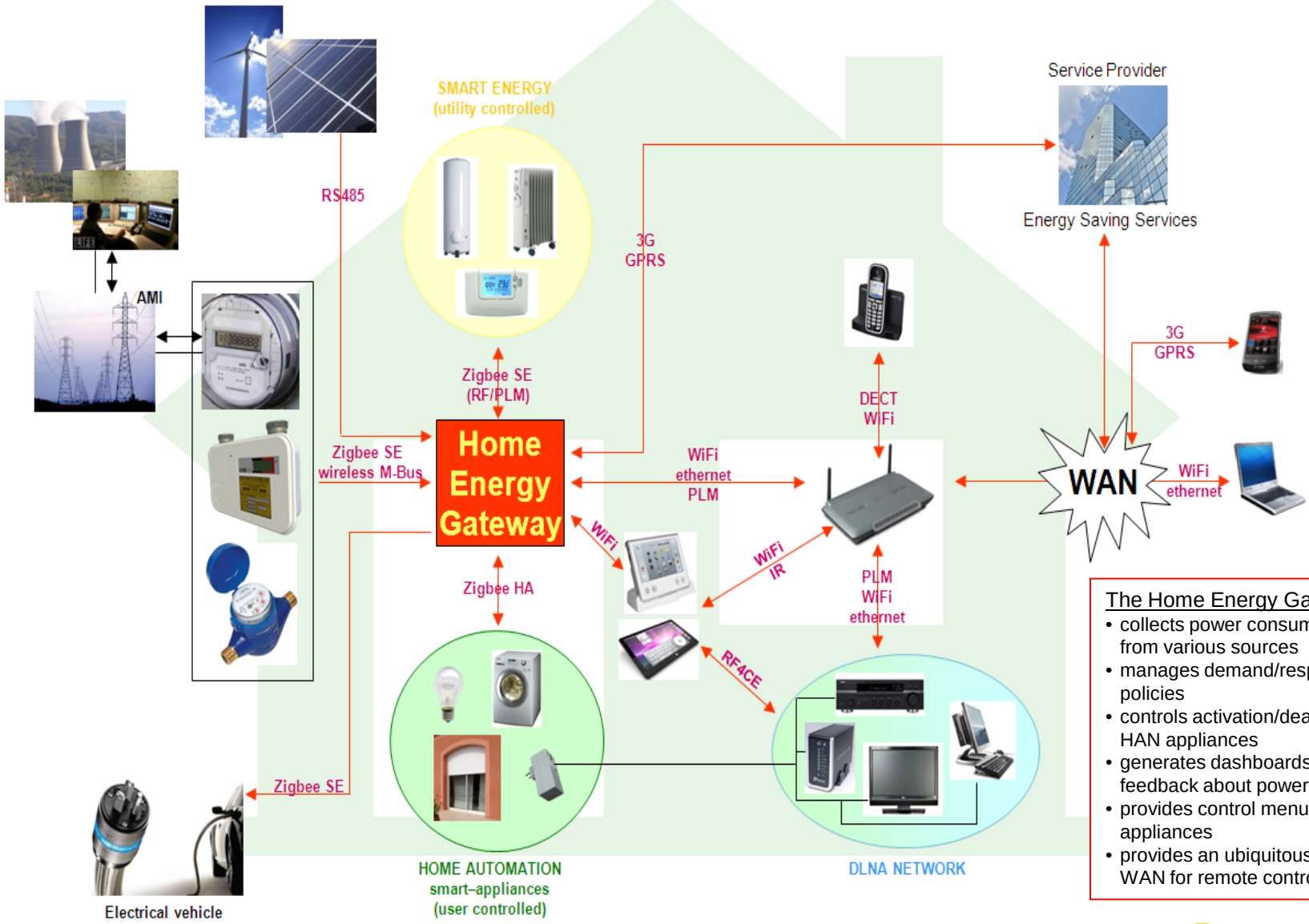
Home Energy Gateway in the Home Area Network



The Home Energy Gateway:

- collects power consumption data from various sources
- manages demand/response policies
- controls activation/deactivation of HAN appliances
- generates dashboards to provide feedback about power usage
- provides control menus to control appliances
- provides an ubiquitous link to the WAN for remote control/readout

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Freescale HEG Demo

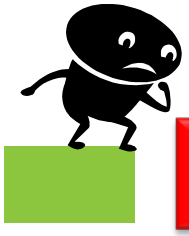
HEG available UIs

Flash-lite IHD on i.MX25/QNX

'Web' UI running on e.g. iPod / iPad

Silverlight IHD on i.MX51/Windows Embedded Compact 7

ProSyst (Linux) and Bewise (Windows) partners have developed frameworks helping customers to reduce their time-to-market ☺



No UI running on Android

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HEG Block Diagram

2.4GHz

DC/DC buck
MC34726

ZigBee SE radio
MC13224V

subGHz

2.4GHz

BOM < $40

2.4GHz

ISM-band radio
9SO8 QE32
SX 1231

ZigBee HA radio
MC13224V

Buzzer

0-Ohm

DC/DC buck
MC34726

DDR2

802.11 b/g
AR6102

NAND

PWM
DDR2
NANDFC
SDIO
FEC
USB
RTC GPIO UART
UART
USB OTG
LCDC TS
UART

i.MX283 CPU

Embedded PMIC 5V
Embedded security blocks
SSP OR
SD
UART
UART
SPI

Off-board AC->DC conversion

RS485 PHY

Expansion ports (UMI, U-SNAP, power-line, GPRS)

Ethernet PHY

RS232 PHY

DC/DC

Extension boards with PLM and 3G connectivity could be developed in a Phase 2

Freescale IC
Optional – use case dependent

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HEG Ecosystem

	Can be delivered for free ($0)		Terms and conditions TBD w/ partners		
remote User I/F (running on IHD - connected through WiFi to HEG)	QNX SOFTWARE SYSTEMS running on i.MX25	Bewise running on i.MX51	web enabled device (e.g. iPod touch)	AllGo embedded running on i.MX233	N/A
Availability	*NOW!*	*NOW!*	*NOW!*	*upon ctmr request*	*N/A*

	Can be delivered for free ($0)		Terms and conditions TBD w/ partners		
local User I/F (running on HEG)	N/A	N/A	N/A	N/A	QNX SOFTWARE SYSTEMS
Availability	*N/A*	*N/A*	*N/A*	*N/A*	*Q1 '11*
Application	freescale semiconductor basic demo	freescale semiconductor basic demo	ProSyst OSGi-based	AllGo embedded	QNX SOFTWARE SYSTEMS
Availability	*NOW!*	*NOW!*	*NOW!*	*upon ctmr request*	*Q1 '11*
Engine	N/A	Microsoft Silverlight	MicroDoc	Qt	Flash-lite
Availability	*N/A*	*NOW!*	*NOW!*	*upon ctmr request*	*Q1 '11*
OS		Windows Embedded			QNX SOFTWARE SYSTEMS Neutrino
Availability	*NOW!*	*NOW!*	*NOW!*	*upon ctmr request*	*Q1 '11*
Hardware	i.MX283				
Availability	*NOW!*				

OS Support	deneo Embedded
Availability	*Dec' 10*
HW Manufacturing	deneo Embedded
Availability	*Dec' 10*

Planning
Executing
Done

802.11 b/g	Atheros
Zigbee SE/HA	freescale semiconductor
Mbus-RF	freescale semiconductor SEMTECH

deneo Adetel Group

Windows Embedded

QNX SOFTWARE SYSTEMS

ProSyst

Bewise

MicroDoc

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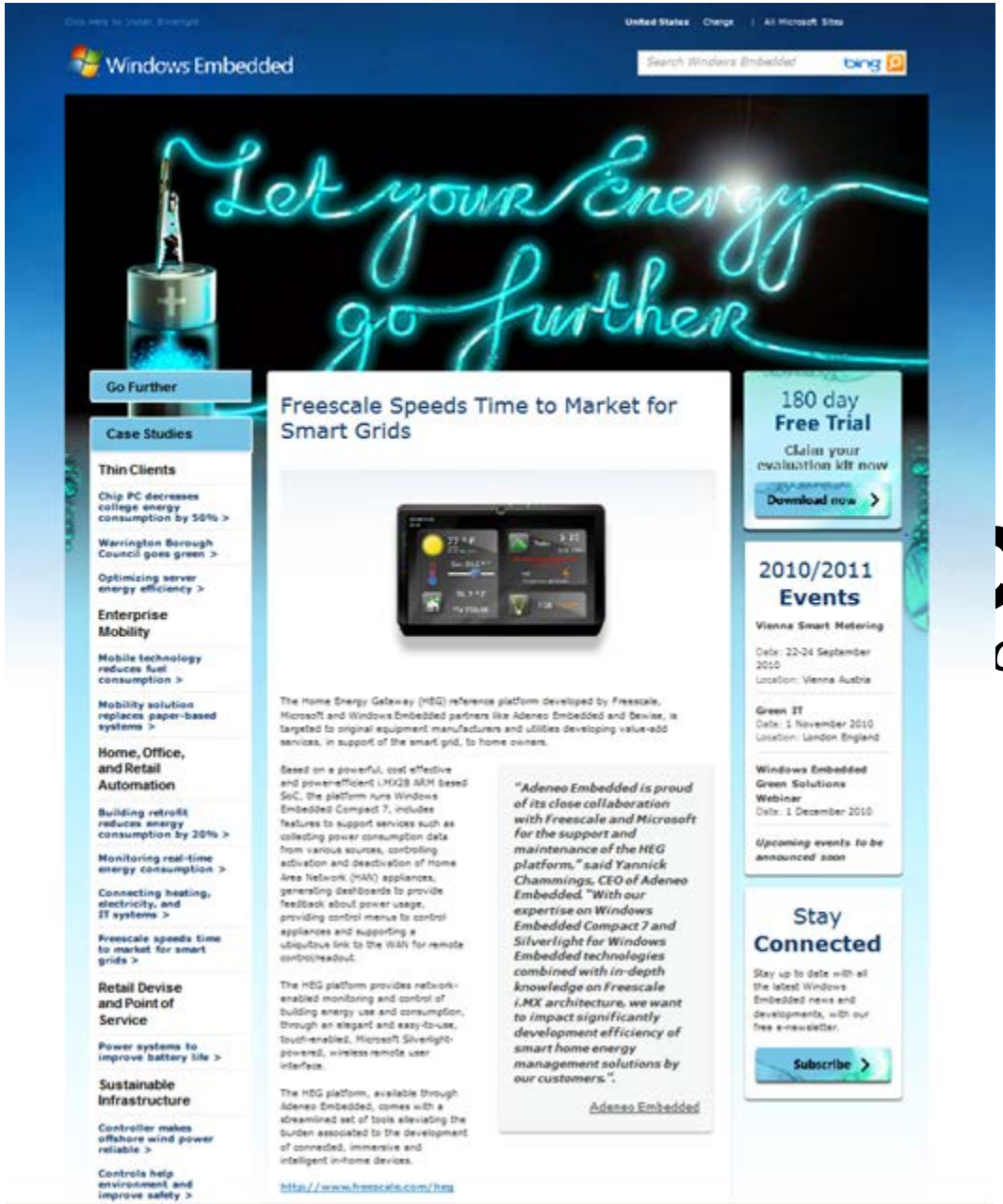
Freescale & Microsoft Partnership

Microsoft has selected the Freescale-based home energy gateway for their EMEA-sponsored Chelan (i.e. Windows Embedded Compact 7) demo tour ☺



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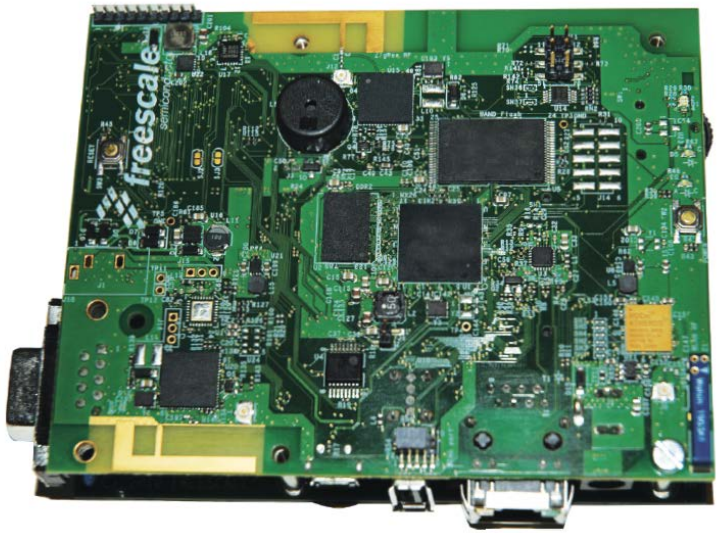
HEG Quick Start Guide

Quick Start Guide for HEG Reference Platform



Home Energy Gateway Reference Platform Quick Start Guide

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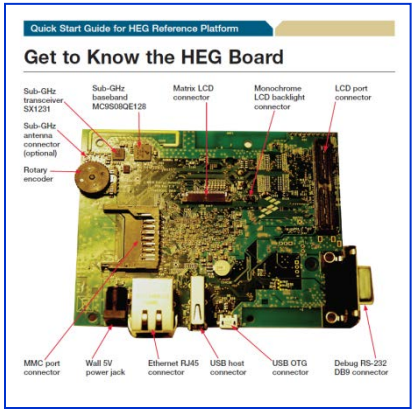

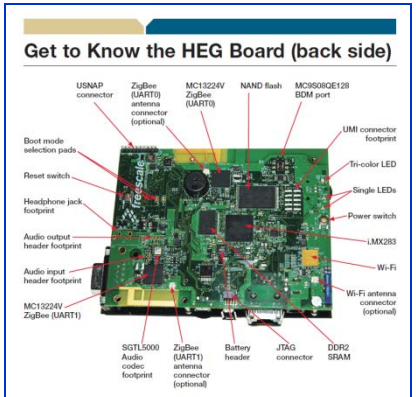

Quick Start Guide for HEG Reference Platform

HEG Adeneo Embedded Website Content

adeneo-embedded.com/heg

Type	Description		
HEG Documentation	• i.MX28 Windows Embedded Compact 7 BSP User Guide • HEG Linux Software User Guide • HEG Hardware User Guide • HEG Schematics, layout and Gerber files • HEG Windows Embedded Compact 7 demo tutorial • HEG Linux 2.6/Prosyst mBS OSGI/MicroDoc JVM demo tutorial • HEG Linux 2.6/QNX demo tutorial		
BSPs	**OS**	**Delivery**	**Comment**
	Windows Embedded Compact 7	Source Code	
	Linux	Source Code	• i.MX28 LTIB ver L2.6.35_10.12.01_ER • HEG Patch for LTIB ver10.05 • ZigBee firmware loader (KB_Load)
Software Demo	**Demo**	**HEG Application**	**Remote UI**
	Windows Embedded Compact 7	Delivered in Source Code with embedded Web server	Any Web Browsers (supporting Microsoft® Silverlight® plug-in)
	Linux–Linux 2.6/ Prosyst mBS OSGI/ MicroDoc JVM	Delivered in Binary Object with embedded Web server	Google Chrome™ browser, Firefox® or Safari Web® Browsers
	Linux–QNX	Delivered in Source Code	Running on i.MX25pdk delivered in Source Code

Table 3

QNX SOFTWARE SYSTEMS · ProSyst · MICRODOC · Windows Embedded

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http://www.adeneo-embedded.com/heg

Adeneo Embedded
EMBEDDING SUCCESS

My Adeneo Login

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Search... OK

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OVERVIEW

HOME ENERGY GATEWAY

PRODUCT QUICKSEARCH

> Choose your OS
all

> Choose your CPU Architecture
all

> Choose your product
all

OK

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Home Energy Gateway (HEG) "Smart Grid" Reference Platform

Adeneo Embedded has been selected by Freescale to support device makers starting their design with an i.MX28 HEG reference platform which can run either Linux 2.6 or Windows Embedded Compact 7 operating system.

freescale™ Alliance Member

Need more information, contact our team: heg@adeneo-embedded.com

Freescale i.MX28 HEG Reference Platform - SW Reference Solutions.pdf 1.16 MB

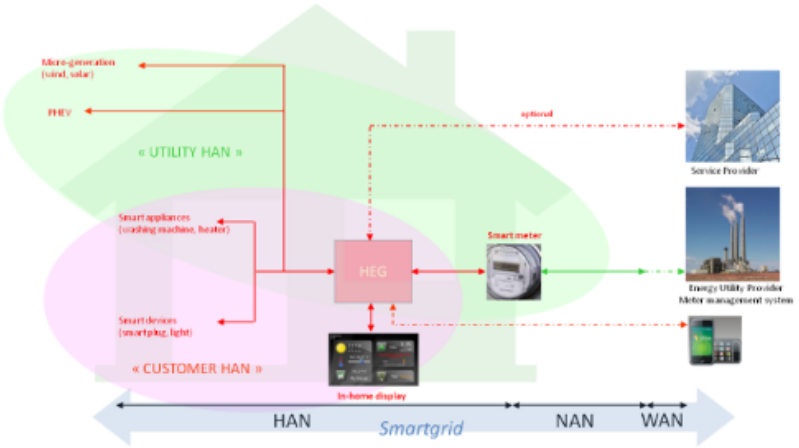
Overview | Features | Software Demos | Distribution & Services

The HEG offers features for collecting power consumption data over ZigBee networks from Home Area Network (HAN) appliances, controlling power activation, and communicating with utility networks, through an easy-to-use, touch-enabled wireless remote user interface.

The HEG platform supports services such as:

- Collecting power consumption data from various sources;
- Generating dashboards to provide feedback about power usage;
- Providing control menus to control appliances;
- Supporting a ubiquitous link to the WAN for remote control/readout;
- Controlling activation and deactivation of HAN appliances.

You can also find more details on the official Freescale HEG webpage: www.freescale.com/heg



HEG – Proposed Support Business Model

FOR FREE ($0)

HARDWARE

Hardware schematics	☑
Gerber files	☑
OrCAD files	☑
BOM list	☑
Loan of HEG i.MX28 based HW (one month depending on availability)	☑

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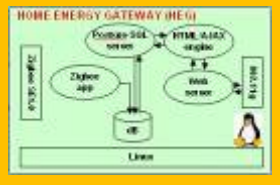
SOFTWARE

	2.6.31 HEG BSP (as-is basis)
Microsoft Windows CE	7.0 HEG BSP (as-is basis)



Demo code owned by FSL

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SUBJECT TO FEES ($$)

- ZigBee MC13224 eval kit
- i.MX287 evaluation kit

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- HEG eval kit ($650)
  - HEG board
  - Power supply
  - Cables

Adeneo Embedded

Third Parties

- Software support — Adeneo Embedded
- BSP optimization — Adeneo Embedded
- 3rd party software

ProSyst · QNX SOFTWARE SYSTEMS · AllGo embedded

Third Parties

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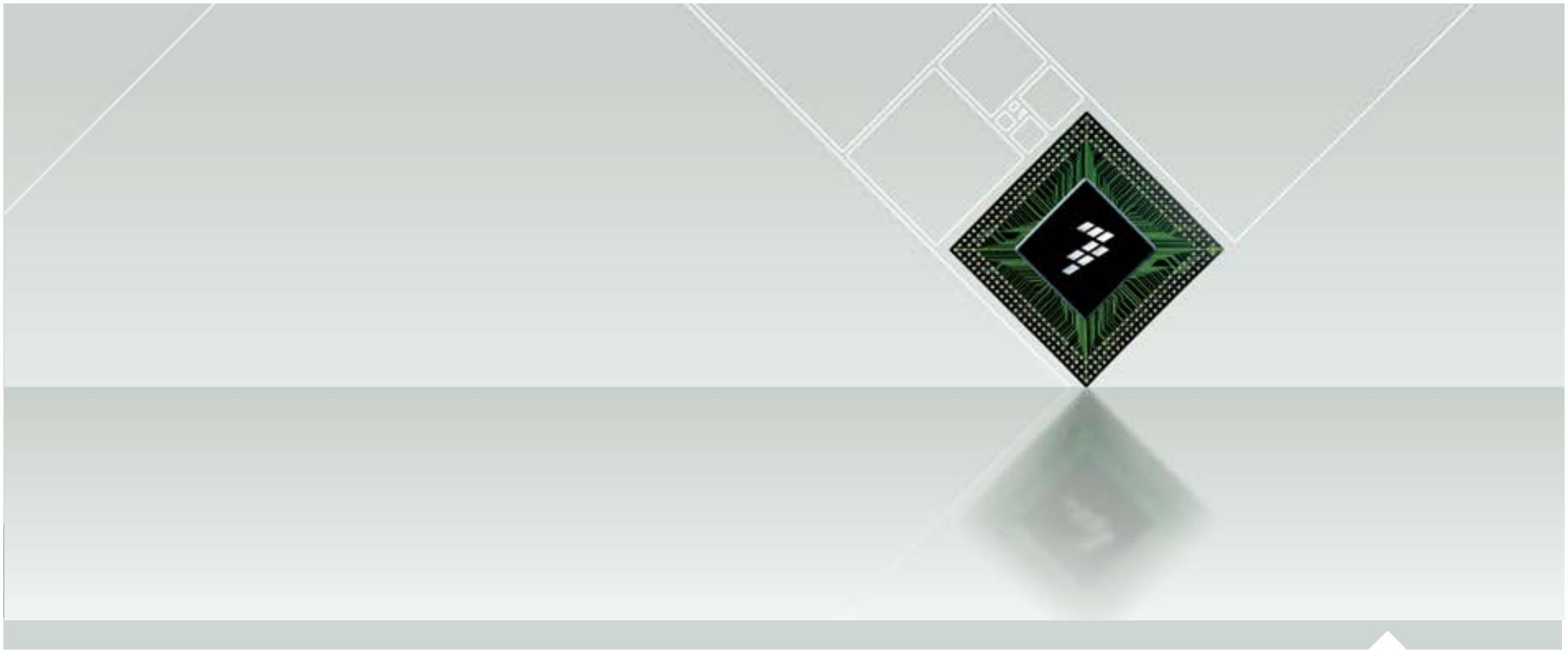

Freescale 802.15.4 Solutions Overview

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Freescale RF IC Roadmap

High Performance Platforms

MC13224
•PiP (Platform-in-Package)
•2.4 GHz RFIC + 32-bit ARM

MC13226
•2.4 GHz ZigBee ROM

Low Cost Platforms

MC1321x
•SiP (System-in-Package)
•2.4 GHz RFIC + 8-bit HCS08

MC13233
•2.4 GHz SoC
•8-bit HCS08
•82 KB Flash, 5 KB RAM

MC13234
•2.4 GHz SoC
•128 KB Flash, 8 KB RAM

MC13238
2.4 GHz SoC
• 128 KB Flash, 8 KB RAM and USB

RF Transceivers

MC1320x
•2.4 GHz RFIC

2007 Timeline 2012

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MC13233 System-on-Chip

MCU Features

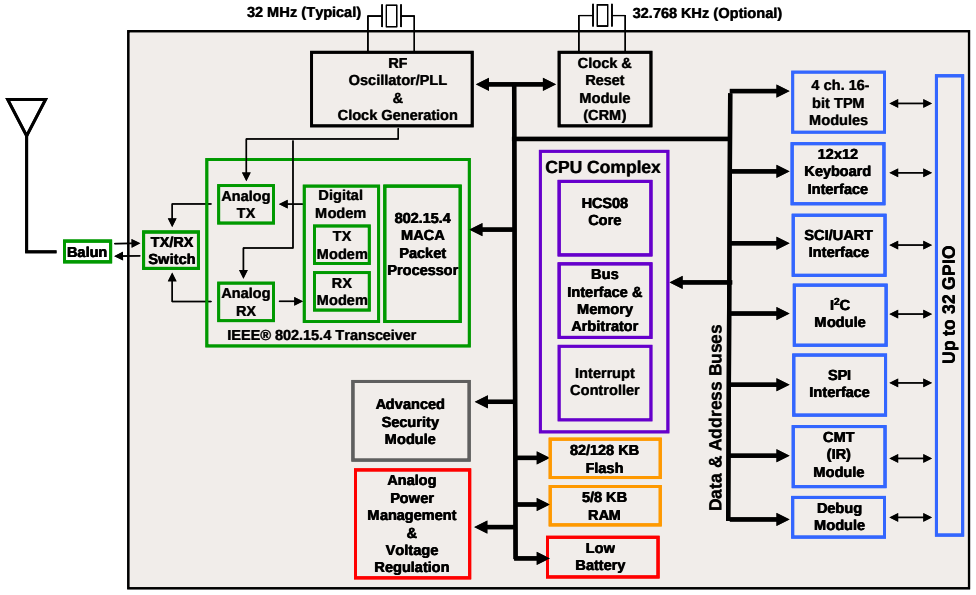
- Integrated HC9S08 8-bit up to 32MHz
- Up to 82 KB Flash and 5 KB RAM
- Peripherals: SCI, SPI, I2C, up to 12x12 KBI, carrier modulated timer (IR)
- Up to 32 General Purpose Input/Output ports (GPIO)

Radio Features

- Programmable Tx from -30 dBm to +2dBm
- RX sensitivity of -94 dBm
- <34 mA Rx & 27 mA Tx with radio and MCU
- 802.15.4 compliant 2.4 GHz RF transceiver
- Auto-trim feature for crystal accuracy
- Integrated Transmit/Receive switch

General Features

- Power supply range: 1.8V to 3.6V
- AES 128-bit hardware encryption/decryption
- 7 mm x 7 mm 48pin LGA
- Operating Temperature Range: -40°C to 85°C



Features	MC13233
Protocol Stack	SMAC IEEE © 802.15.4 SynkroRF ZigBee 2007 ZigBee RF4CE
Memory	82 KB Flash 5 KB RAM
2011 1K SRP	$2.99

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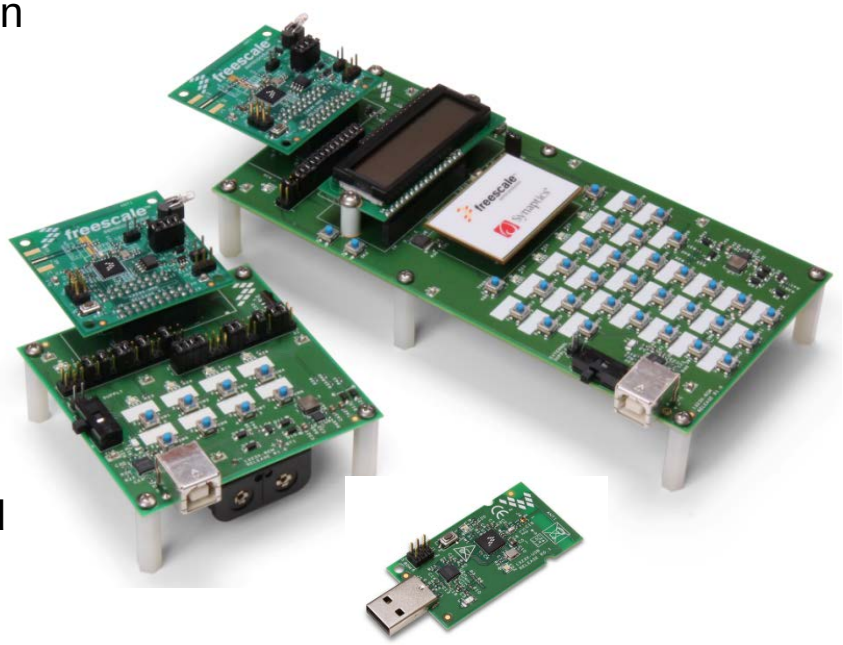
Development Tools and Support

▶See for yourself – Evaluate wireless networking in minutes

- Select the development kit that meets your design and budget objectives
  - 1323XUSB – $199
  - 1323XDSK and DSK-BDM – $199/$279
  - 1323XNSK, NSK-BDM, and NSK-SFTW – $449/$529/$999



▶Learn Quickly/Develop Rapidly– Right out of the box

- Development kits come with everything you need to jump start your design
  - Development boards for a variety of applications
  - BeeKit GUI with BeeStack (six protocol stacks from which to choose)
  - Out of the box applications
  - Sample code

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MC1323x End Product Benefits

- MC1323x provides a low cost platform for ZigBee
  - Ideal for RF4CE, ZigBee HC and HA applications where cost is critical
  - BlackBox application provides option for applications like Smart Energy that require more system and memory resources
- Based on HCS08QE 8-bit core
  - Uses same tools as Freescale S08 family
- Provides low stop current providing lowest power for applications where the device will be in sleep mode for long periods
  - For sleeping devices, stop current can become more important than transmit/receive

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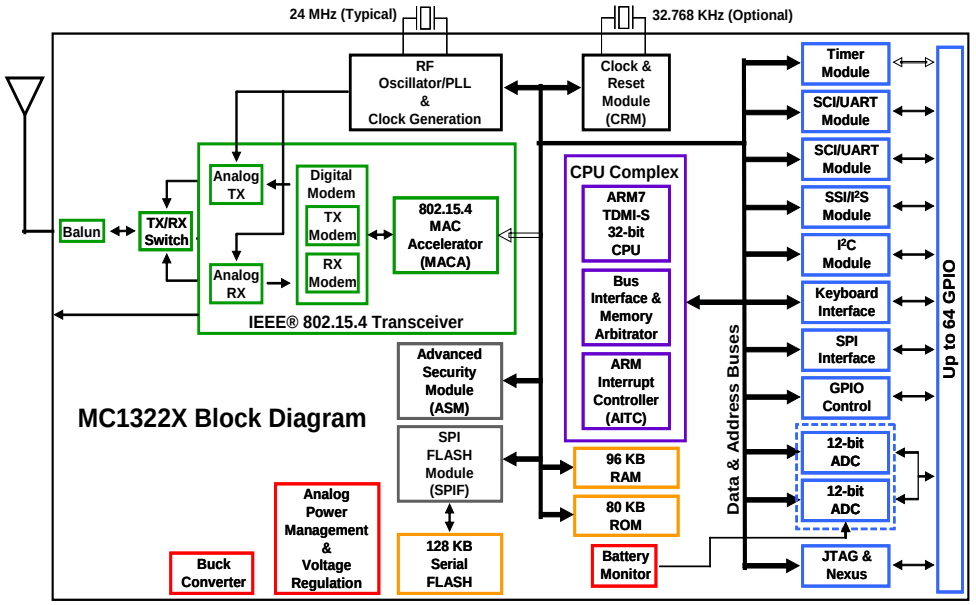
MC13224 Platform in a Package (PiP)

- Features
  - Integrated 2.4 GHz transceiver with 32-bit CPU
    - 802.15.4 Compliant transceiver
    - ARM7TDMI up to 26Mhz
  - Lowest power
    - 1.8 to 3.6 Operating Voltage
    - 22 mA Rx & 29 mA Tx with radio and MCU
  - ROM, Flash and RAM
    - 80K ROM, 128K Flash, 96K RAM
  - Improved RF performance
    - -96 dBm sensitivity (DCD mode)
    - -100 dBm (NCD mode, +3-4 mA current)
    - +4 dBm power output
  - Hardware accelerator reduces MCU overhead
    - MAC accelerator
    - AES 128-bit hardware encryption/decryption
  - Best in class peripherals
    - UART, SPI, KBI, 8 channel 12-bit ADC, 4x16-bit timer, I^2C, SSI (I2S), 64 GPIO
  - Unique platform in a package
    - RF matching in package
    - Requires power, crystal and 50 Ohm antenna
    - 9.5 mm x 9.5 mm 99-pin LGA
    - -40 to + 105 Operating Temp



Features	MC13224
Protocol Stack	SMAC IEEE © 802.15.4 SynkroRF ZigBee 2007 ZigBee RF4CE
Memory	128 KB Flash 96 KB RAM 80 KB ROM
2011 1K SRP	$4.28

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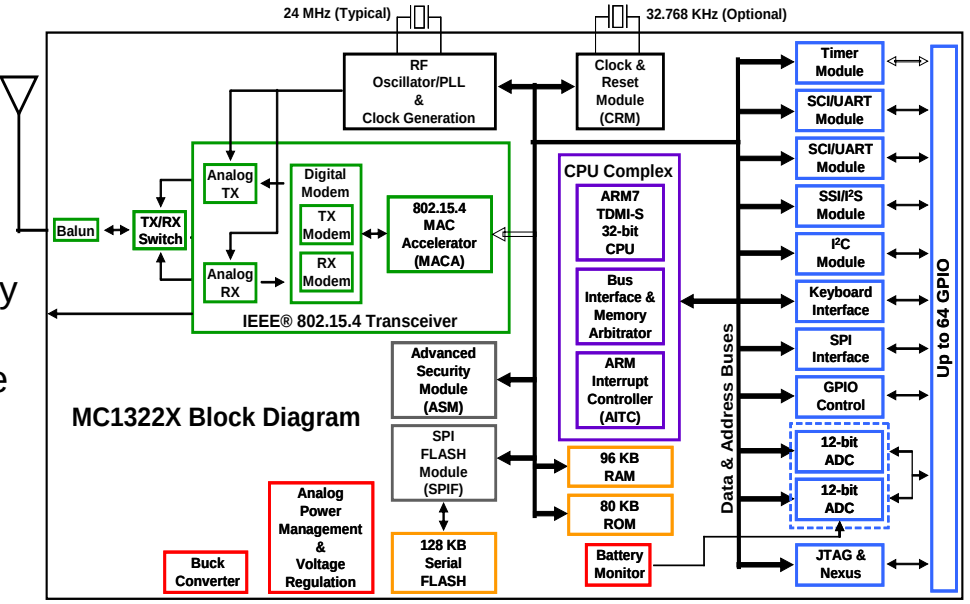
MC13226 Platform in a Package (PiP)

- Features
  - Pin-for-pin compatible with MC13224
  - New ROM image optimized for ZigBee PRO
    - Maximizes the amount of available RAM for application use
    - Streamlined IEEE MAC/PHY functionality to meet the ZigBee specification
    - MAC functionality is 802.15.4 compatible
    - Certain drivers present in the MC13224 ROM have been removed including the ADC, LCD_font, and SSI drivers
      - Drivers are still available as library functions, but now compile into the RAM space
    - Low Level Component (LLC) functionality has also been streamlined for the ZigBee specification
    - Combo Device support has been moved to ROM
  - Reduces RAM usage by about 20K
  - Optimized for ZigBee Pro
  - Easy codebase upgrade from MC13224



Features	MC13226
Protocol Stack	ZigBee ZigBee Pro ZigBee IP
Memory	128 KB Flash 96 KB RAM 80 KB ROM
2011 1K SRP	$4.28

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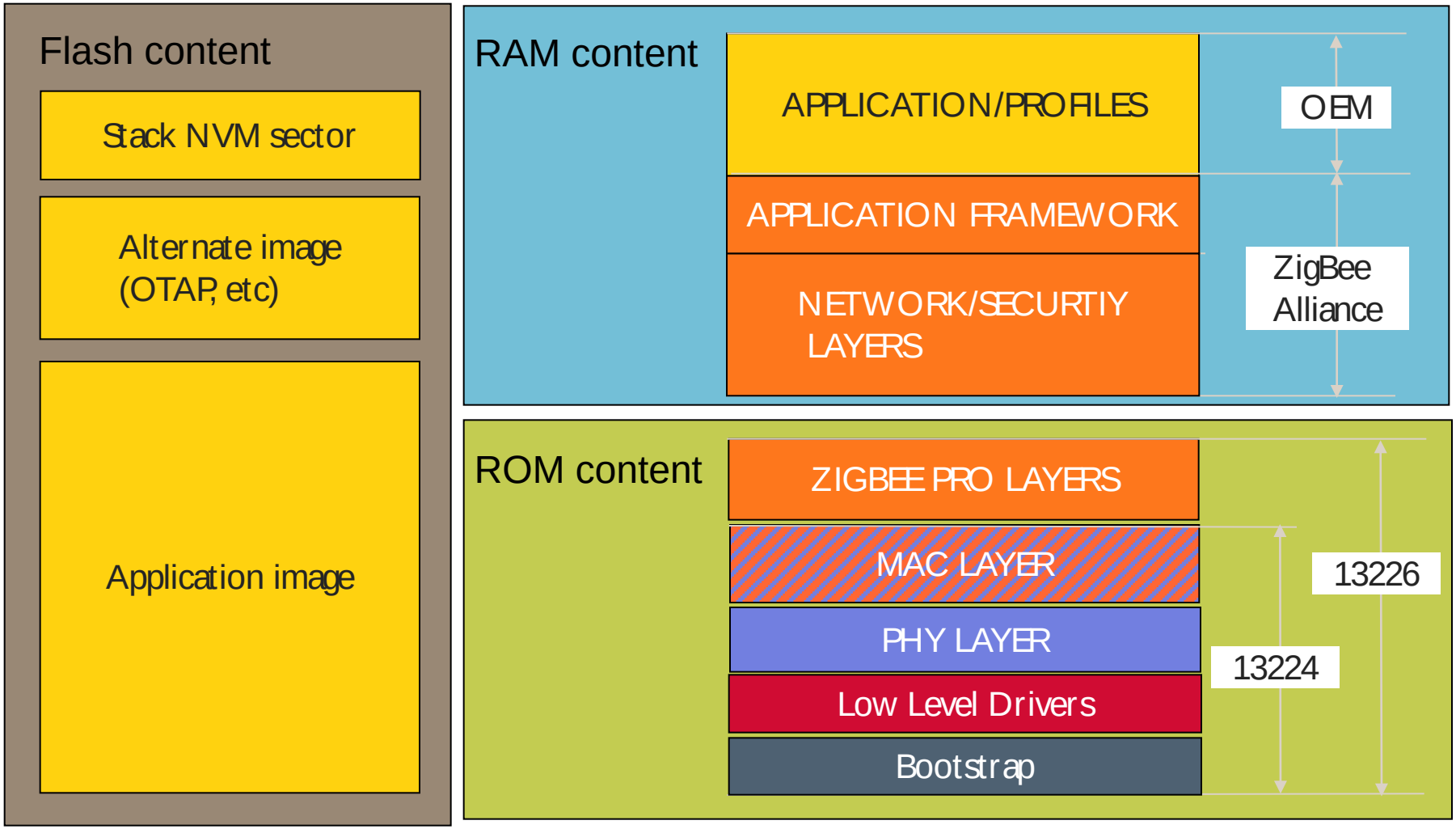
MC1322x Software Introduction – Flash, ROM, RAM content



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MC1322x End Product Benefits

- MC1322x is the ideal platform for ZigBee Smart Energy
  - Flexible memory configuration and necessary processing power for ZigBee Smart Energy
- Lower RX and TX power consumption lowers ZigBee power budget requirements
  - Ideal for battery-powered applications as well as main-powered applications where power budget is low
- Highly integrated package reduces design time and cost
  - Reduces design complexity through reduced integrated RF front end
  - Reduces total cost through lower component inventories, less board space, etc.

Freescale ZigBee Offering

- Robust and stable ZigBee stack
  - Designed for embedded processors
  - Buffer based memory system allows for a fast stack with no HEAP that can be fragmented
  - Extensive testing for interoperability including application profile certification testing
- Provides for memory optimization
  - Optimizes memory usage by only compiling features needed
  - Supports Combo device
    - Allows single device to support all devices types
- Freescale Supports ZigBee, ZigBee Pro and ZigBee IP*
  - ZigBee 2007 SP1 Golden Unit
  - ZigBee 2007 SP2 Compliant Platform
  - ZigBee IP – Planned Golden Unit
- Simplified Network Configuration reduces development time
  - BeeKit provides simplified and flexible network configuration
  - Provides Public Profiles and Sample Applications

ZigBee Family Comparison

	MC1320x	MC1321x	MC1323x	MC1322xV
Key Attributes	Standalone transceiver supports a number of MCUs Provides greatest flexibility of MCU choice	SynkroRF and RF4CE where customer require and ADC	Cost optimized solution for consumer devices and RF4CE	High performance device specifically targeted for Smart Energy and Health Care
Protocol Stack Support	ZigBee RF4CE ZigBee Health Care ZigBee Smart Energy	SynkroRF/RF4CE	RF4CE ZigBee Health Care (128K Version)	ZigBee RF4CE ZigBee Health Care ZigBee Smart Energy
Flash/RAM/ROM	-	Up to 60K Flash 4K RAM	82K/5K (MC13233) 128K/8K (MC13234)	128KB/96KB/80KB
Core	N/A	HCS08GT	HCS08QE	ARM7 TDMI-S
AES Encryption	Software	Software	Hardware	Hardware
Packet Processor	No	No	Yes	Yes
Power Consumption				
RX	37 mA	37 mA	33 mA CPU sleep	19 mA CPU idle
TX	30 mA	30 mA	26 mA CPU sleep	26 mA CPU idle
Sleep	<1 uA	<1 uA	<1 uA	1uA 8K RAM Retained 5uA 96K RAM Retained
Sensitivity	-92 dBm	-92 dBm	-94 dBm	-96 dBm, -99 dBM (NCD mode)
Output Power	+3	+3	+2	+4
ADC	N/A	10-bit 8 channel	None	12-bit 8 channel
External Components	14	13	13	1
Package	5x5 mm, 32-pin QFN	9 x 9 mm, 64-pin LGA	7x7 48-pin LGA	9.5x9.5 mm, 99-pin LGA
Silicon Cost 2011 SRP	$2.13 (MC13202)	$3.34 (MC13213)	$2.99 (MC13233)	$4.28
Total Solution Cost	$3.19	$4.11	$3.76	$4.62

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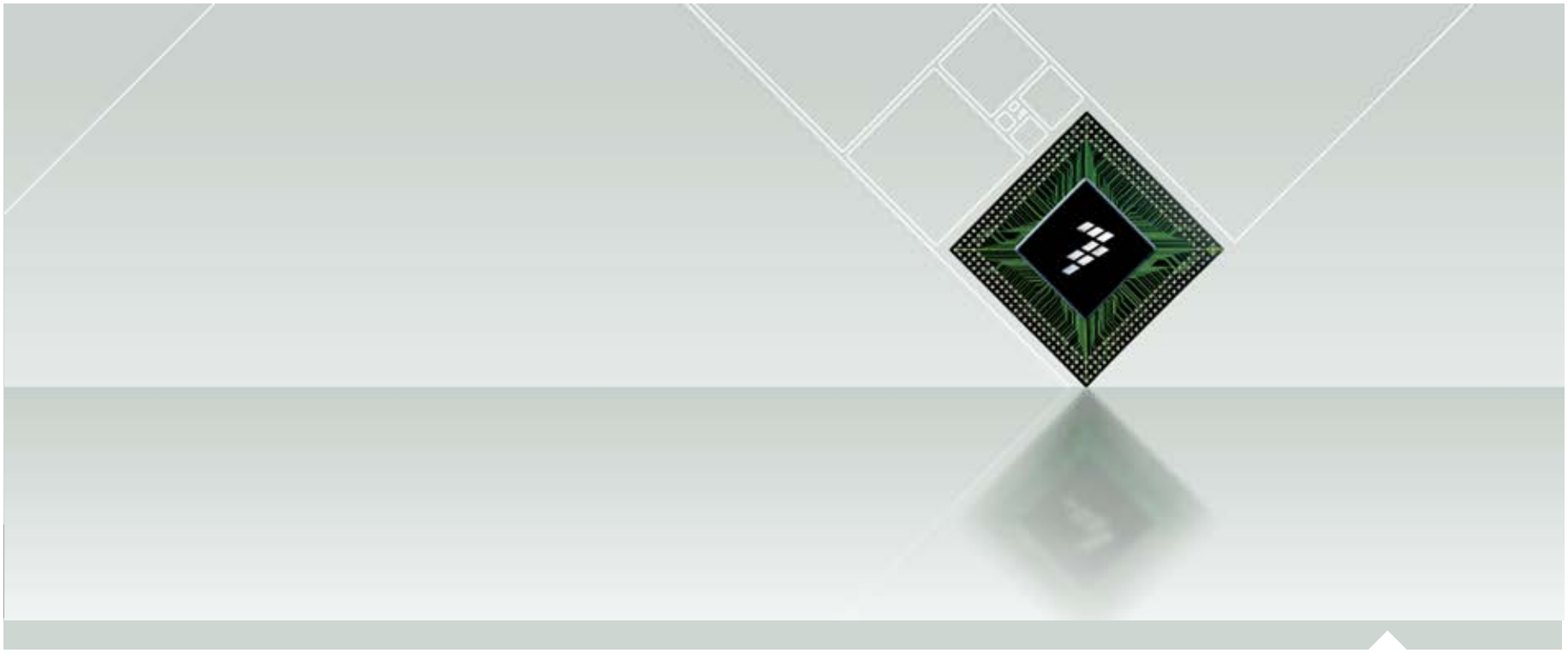

Software

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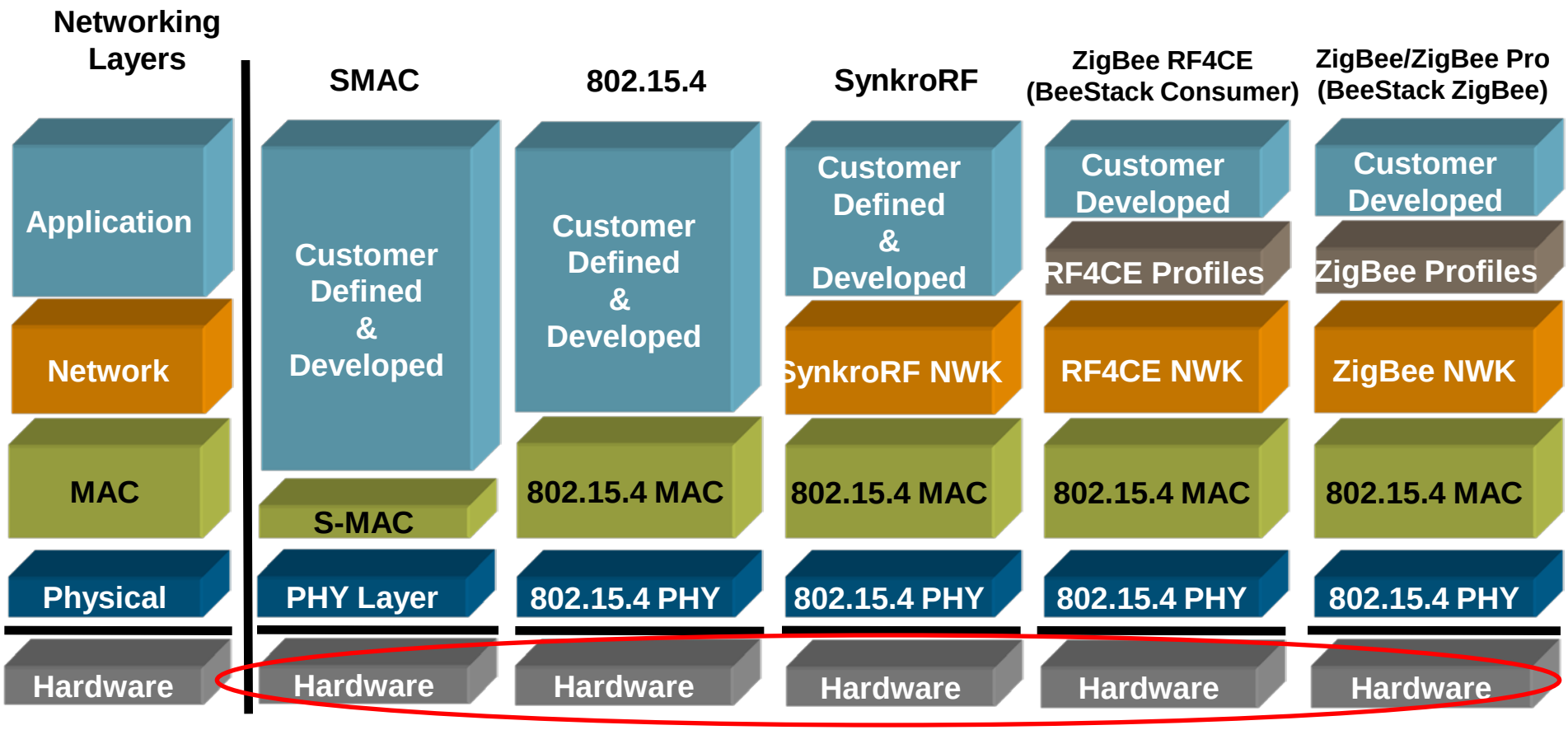
Freescale Multi-Offering Approach with 802.15.4



Memory-upgradeable and pin-compatible MCUs and RF ICs

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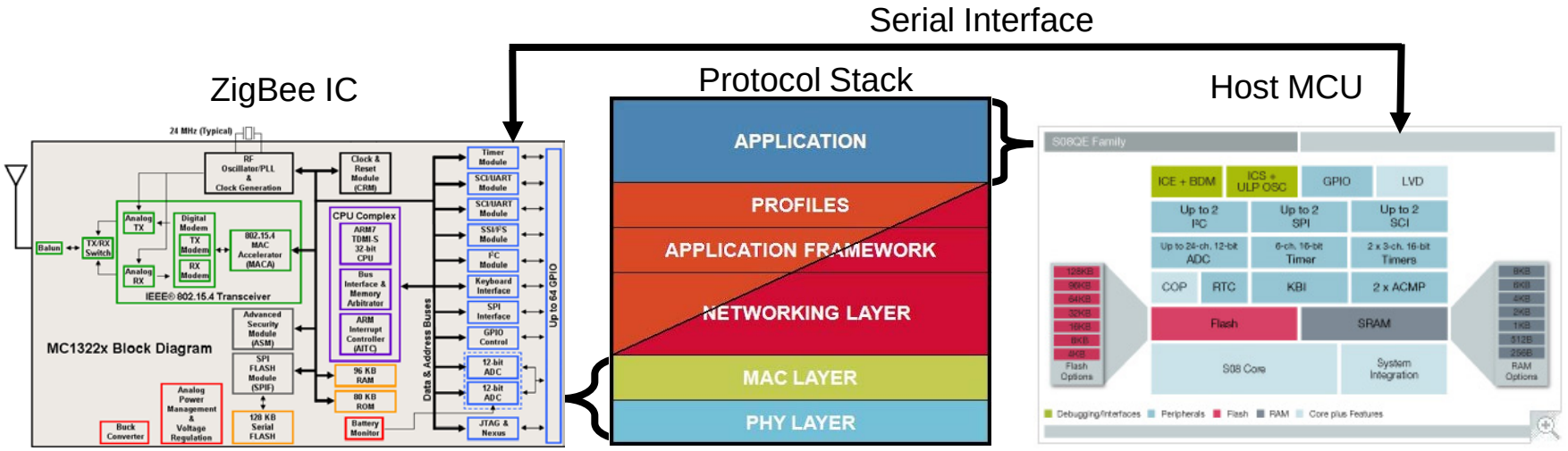
Freescale BlackBox Flexible Architecture Block Diagram



- ▶BlackBox provides protocol stack and host flexibility
  - Allows for upgrade path ZigBee stack grows
  - Provides for host MCU flexibility
- ▶ZigBee IC runs 802.15.4 MAC and portion on networking layer
  - Keeps 802.15.4 timing critical requirements on MC13224/MC13234
  - BlackBox application allows flexible memory split from Network to Application
- ▶Host MCU runs upper layers
  - Application Profile and device customer's application
- ▶UART, SPI and I2C connection from Host MCU to MC13224/MC13234 for communication

BlackBox provides protocol stack and MCU flexibility

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Freescale's BeeKit™

- BeeKit provides customers an exceptional development tool which offers a simplified implementation of Freescale 802.15.4 based technologies including SMAC, 802.15.4 MAC, SynkroRF, ZigBee RF4CE, ZigBee & ZigBee Pro
  - Features
    - Graphical user interface (GUI) for the creation, modification and updating of wireless networking implementations
    - Comprehensive code base of wireless networking libraries, application templates, and sample applications
    - Automated validation of configuration parameters
    - Generation of workspace files to be imported into an Integrated Development Environment (IDE) for continued development and debugging
    - Easily scalable to support new code bases and functionality
    - Complementary tool to CodeWarrior (CW) or IAR EWARM IDEs for MCU development
  - Benefits
    - Provides a cost effective wireless design solution
    - Reduces complexity of wireless implementation
    - Allows focus on MCU application software via complementary IDE
    - Eases start up time and reduces tool learning curve
    - Gets you to market fast
    - Backed by premiere design support

Freescale ZigBee Offering - Summary

- Robust and stable ZigBee stack
  - Designed for embedded processors
  - Buffer based memory system allows for a fast stack with no HEAP that can be fragmented
  - Extensive testing for interoperability including application profile certification testing
    - Compliant Platforms
    - ZigBee HA, SE, HC and RF4CE
    - Certified Product testing
    - Provides for memory optimization
  - Optimizes memory usage by only compiling features needed
  - Supports Combo device
  - Flexible partitioning provide upgrade path
- Freescale Supports ZigBee, ZigBee Pro and ZigBee IP*
  - ZigBee 2007 SP1 Golden Unit
  - ZigBee 2007 SP2 Compliant Platform
  - ZigBee IP – Planned Golden Unit
- Simplified Network Configuration reduces development time
  - BeeKit provides simplified and flexible network configuration
  - Provides Public Profiles and Sample Applications

Freescale provides comprehensive and flexible ZigBee Protocol Stacks

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