Home Energy Gateway

DFAE Training – Dec 2010

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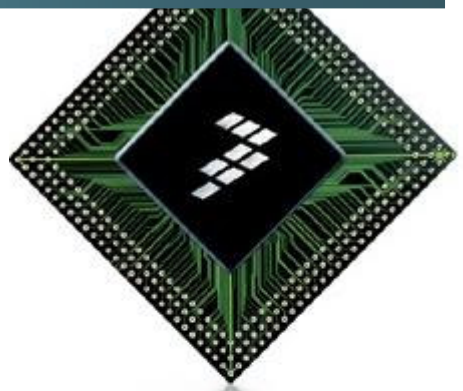
Agenda

- The need for more visibility and control
- The ‘Home Energy Gateway’ in the HAN
- Freescale HEG Reference design : overview
- Freescale HEG Reference design : hardware
- Freescale HEG Reference design : software
- Freescale HEG : Schedule, Partners & Business Model



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The need for an “Energy Gateway”

- Climate change, grid reliability and political will, boost smart grid technologies and projects.
- Deployment of advanced metering systems, of demand response and other utility control systems, deployment of home/building area networks and grid integration of distributed generation and storage systems are speeding up all around the world.
- To address this fast growing market, Freescale and partners have teamed up on an “Energy Gateway” platform aimed at :
    1. helping utilities better communicate with customers and industrials and thus improve peak demand
    2. helping customers and industrials make smarter decisions about power usage

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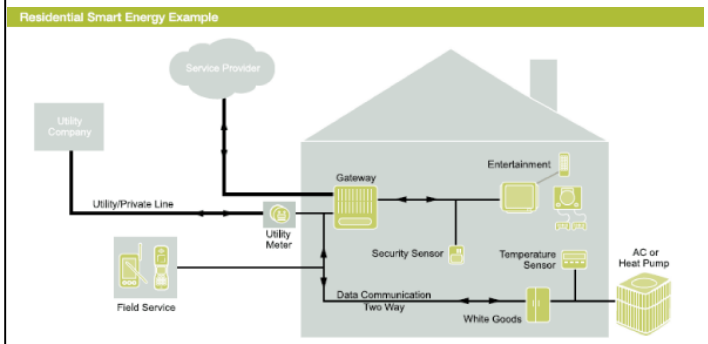
The “Energy Gateway” platform

- The “Energy Gateway” platform can help consumers, industrials and utilities bring energy into balance and reduce overall power consumption by :
  1. Raising energy consumption awareness
  2. Time shifting energy usage based on time-of-use tariffs
  3. Deploying demand-response energy schemes
- The “Energy Gateway” platform provides a set of applications enabling reliable and secure wireless enabled Home Area Network (HAN).
- The information captured and displayed by the “Energy Gateway” platform can be accessed through rich user interface running on a local display or over the Internet on smart mobile devices or web portals



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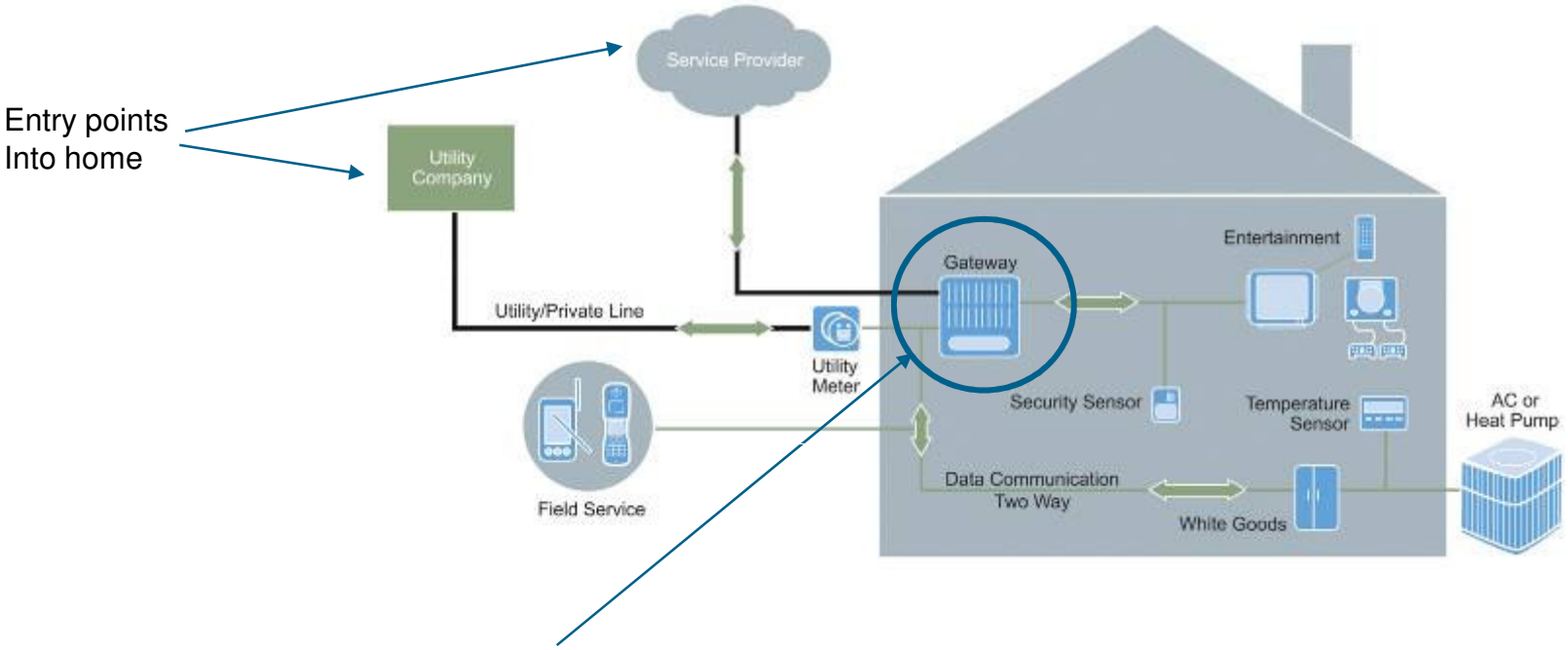
Home Energy Gateway – Gate for Smart Energy Management



- The Home Energy Gateway
  - Collects power consumption data from various sources
  - Controls activation/deactivation of HAN appliances
  - Generates dashboards to provide feedback about power usage
  - Provides control menus to control appliances and other Home Automation devices
  - Provides a ubiquitous link to the WAN for remote control/readout

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Market status : need more visibility and control

Energy peaks are putting the grid at stress and need to be managed / anticipated
New tools and devices need to be deployed and comprehended to make it happen

UTILITY : peak management through

- Demand management
1. Availability of peak load management data
2. Demand response integration in the home (real time messages)

- Micro generation management
1. Measurement of micro generation
2. Micro generation optimization based on energy price and household conditions

- Electrical vehicle management
1. PHEV charging optimization
2. Control of storage feed to the grid

CUSTOMER : ready to adopt peak management tools & devices because

- Becoming “Green” conscious
1. Energy alerts and energy saving tips are good for both the planet and the wallet
2. Need per appliance, real time/historical energy usage data to adapt consumption behavior

- Want more control
1. Need reliable energy (more and more electronic devices in the home)
2. Need smart appliances
3. Need monitoring/control platform

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Home Area Networking Market

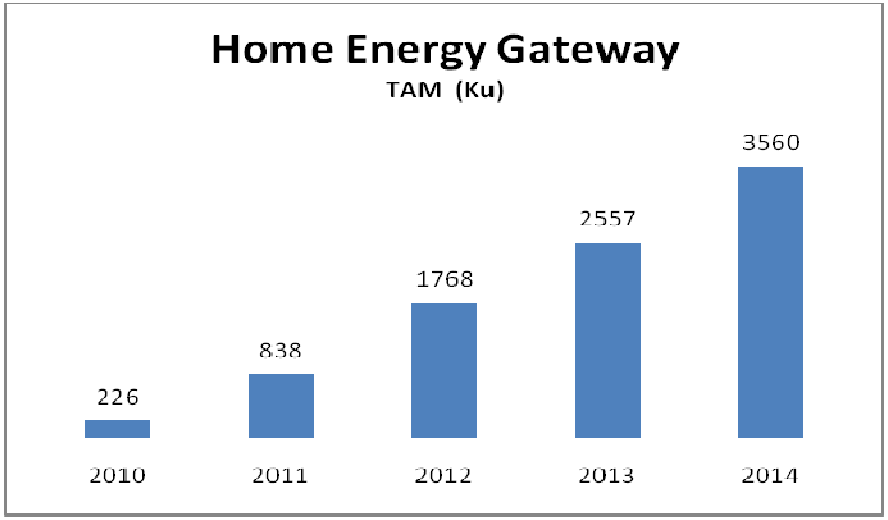
Market Forecast

►SAM 2013 : 96M$ /// CAGR 2010-2013 >100% (HEG, Smart Appliances, Thermostats, IHD, Lighting/Monitoring Hubs and Devices)

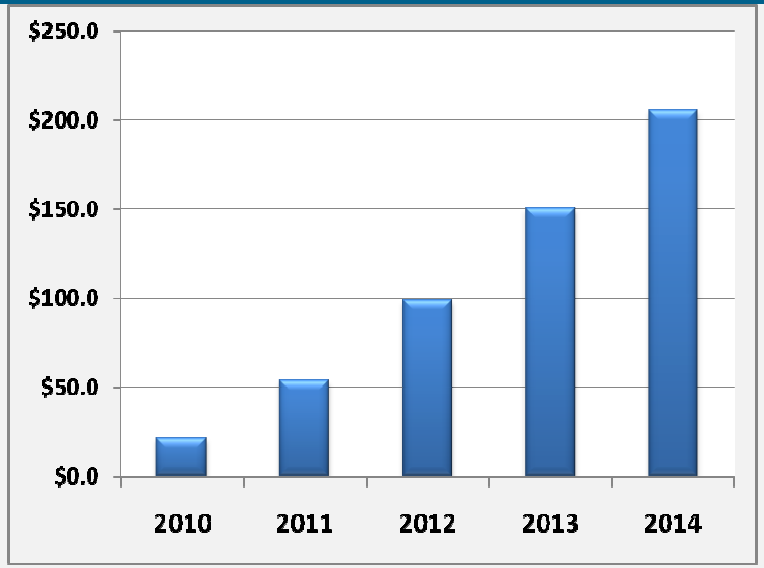
►HAN market growth is driven by multiple stimulus plans from government for deployment of smart grid.

►Installed base of smart home networks will increase dramatically in the period 2009-2014, from 1.5 million (2009) to 14.7 million (2014) – IMS Research

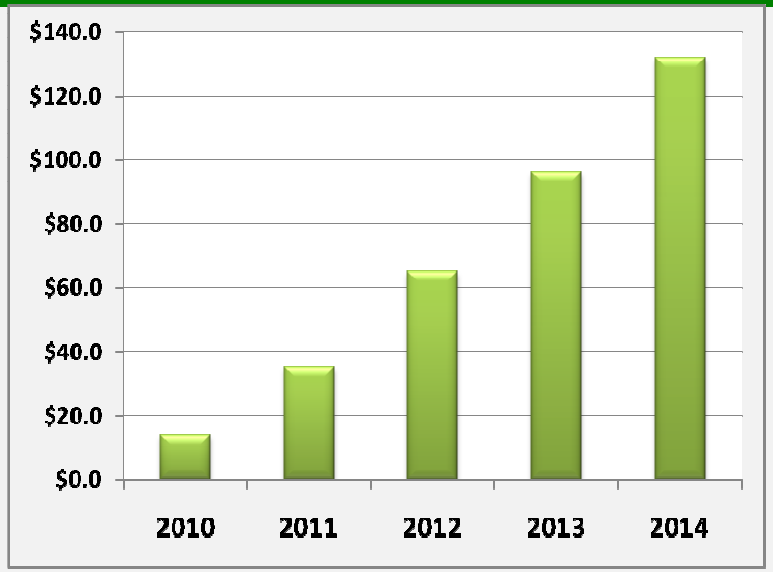
►105Mu of Smart Meters with HAN Connectivity are forecast to be installed during the 2010-2014 period



Total Available Market (M$)



Serviceable Market (M$)



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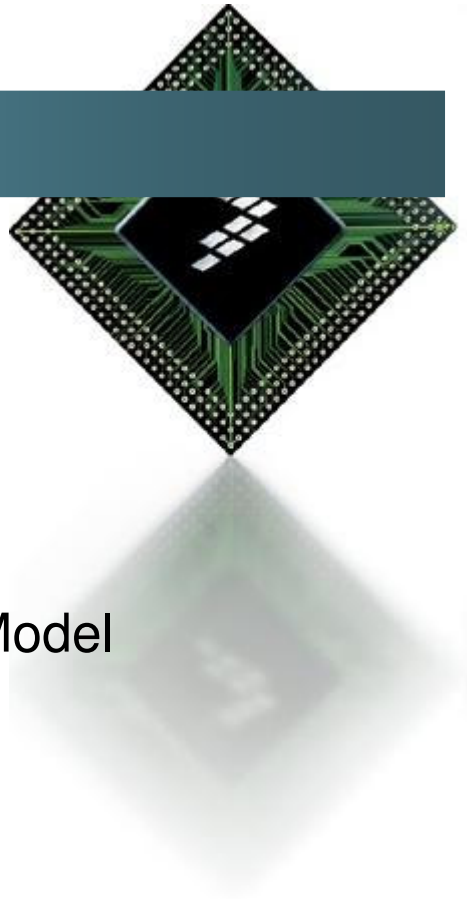

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Home Energy Gateway in the Home Area Network

Service Provider

Energy Saving Services

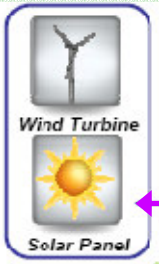
Consumer

Remote Control & Monitor

RF4CE
WIFI
IR

WIFI

WIFI
ethernet
PLM



RS-485
ethernet

Home Energy Gateway

WIFI
ethernet
PLM

Residential Gateway

Internet

Proprietary
868MHz RF

Zigbee SE/HA
PLM

Zigbee SE
MBUS-RF/wired MBus

PLM

Utility

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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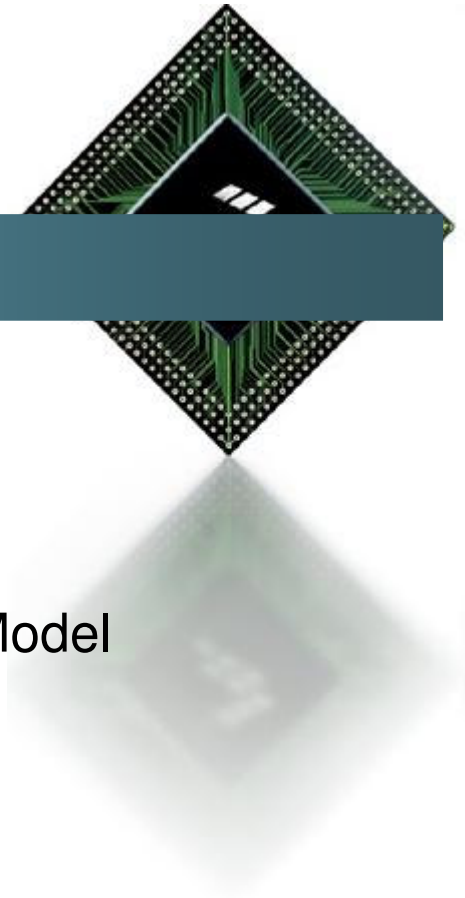

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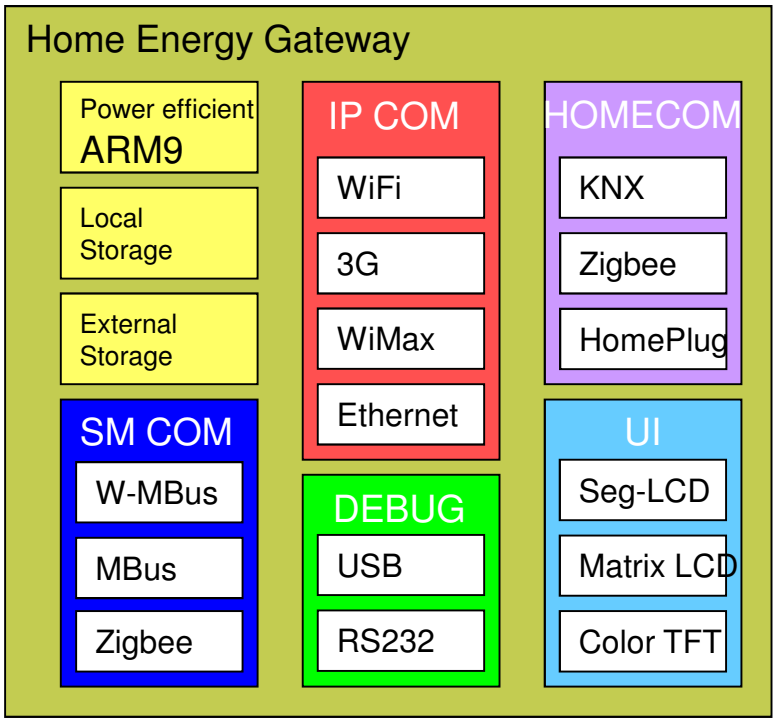
Freescale's Home Energy Gateway

- Flexible technology platform (form factor) to allow for fast customer developments and fast product introduction (time-to-market)
- Based on a powerful and low-power Freescale ARM9 SoC with extensive controller integration for lowest possible BOM
- Future proof SoC to capitalize developments on (scalable in terms of features and performances and part of Freescale's longevity program)
- Pre-validated communication stacks and example code to alleviate customer developments
- Straight forward upgrade path to accommodate evolving HAN connectivity requirements (running a rich OS)
- Growing ecosystem of linux and WinCE partners



The Home Energy Gateway is a scalable platform made out of two major parts :

- A cost optimized main PCB board comprising of a common baseline of peripherals addressing main stream home energy gateway requirements

- A set of extension cards addressing non-main stream requirements

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i.MX security features for energy gateways

- To address security, safety and privacy concerns, energy gateway manufacturers need to make sure :
  - *signals leaving the house can not be eavesdropped*
  - *device boots on authenticated (signed) firmware*
  - *devices can support security protocols (incl. web security protocols)*
- Those requirements can easily be supported on Freescale i.MX ARM9-based systems thanks to :
  - *dedicated hardware support for AES128-based authenticated boot and signed/authenticated firmware*
  - *dedicated hardware acceleration for AES, 3DES, SHA, MD5, … encryption/decryption/hash algorithms*
  - *secure off-chip storage mechanisms*

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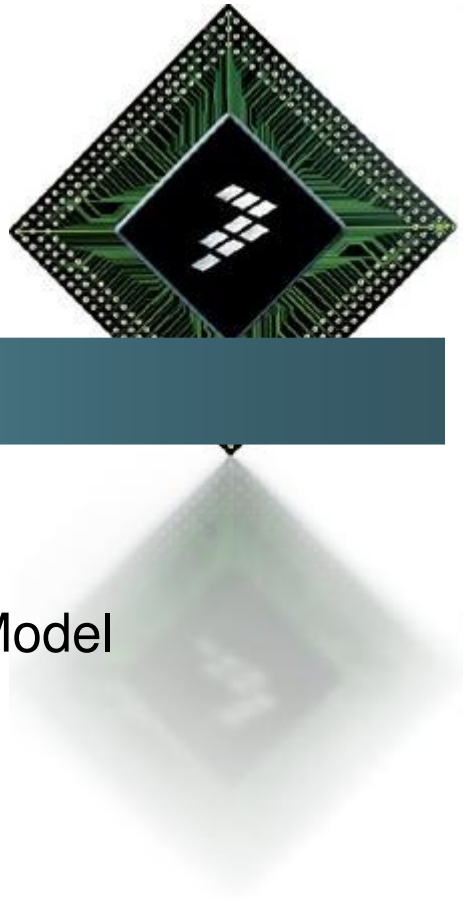

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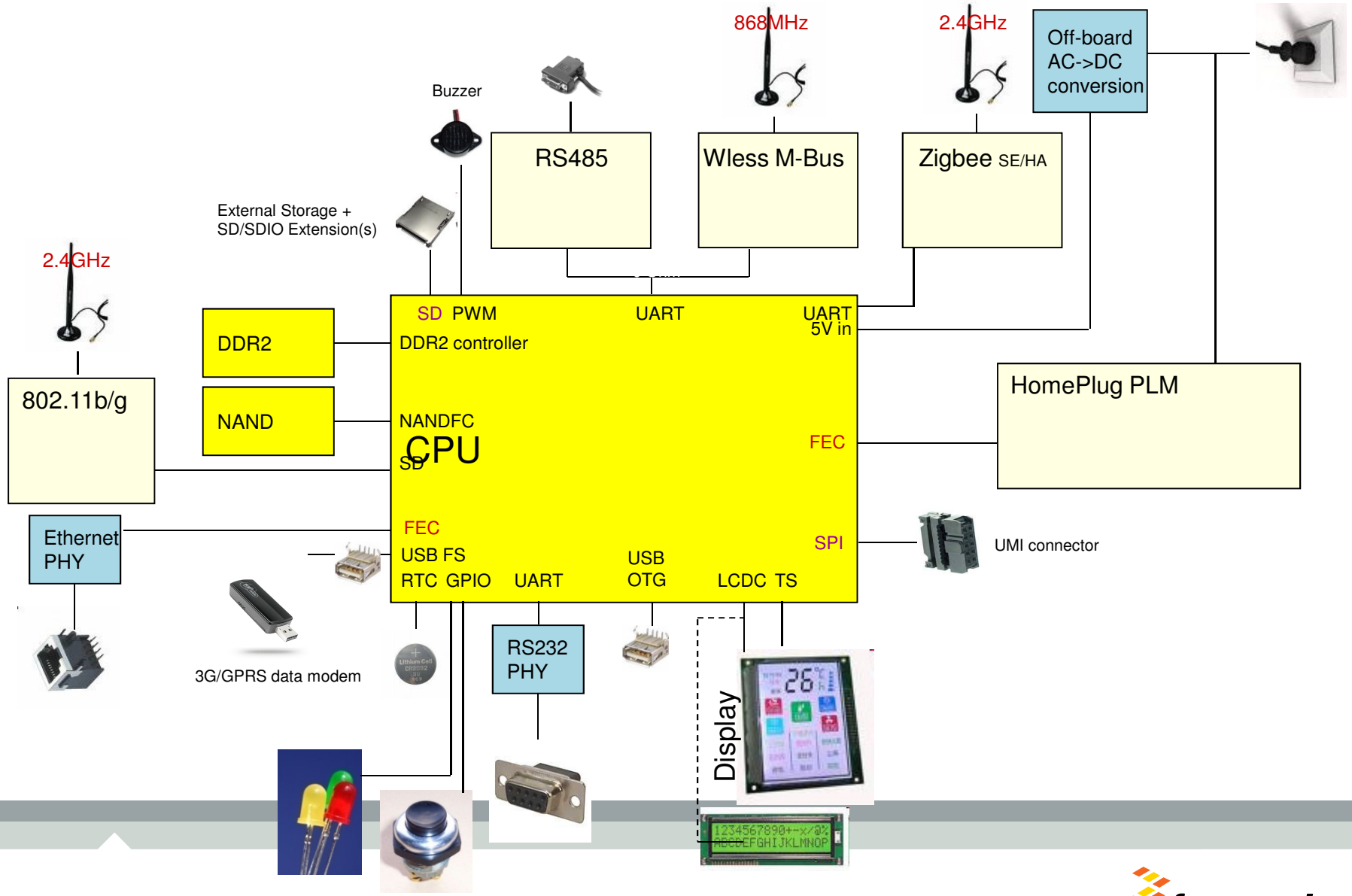
Home Energy Gateway : platform block diagram



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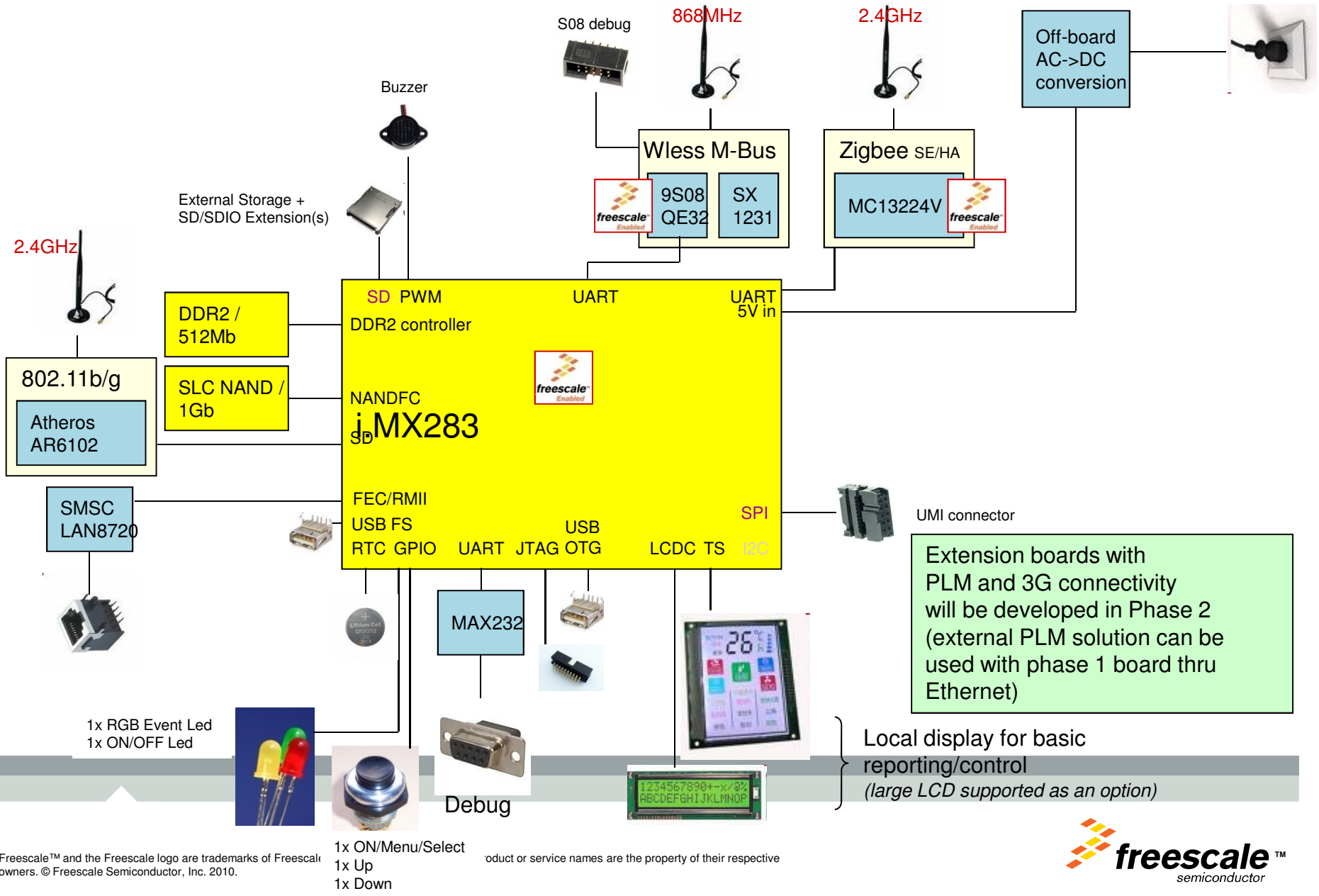
Home Energy Gateway : main PCB (Phase1)



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Home Energy Gateway : main PCB (Phase2)

- **Wireless M-Bus stack**
- **Homeplug Green PHY**
- **3G / GPRS data modem**
- **U-Snap**
- **….**

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ARM9 reference design to jump-start “Energy Gateway” designs

- ARM9-based Energy Gateway reference design (1xethernet, 1xWLAN, 1xZigbee, 1x MBus-RF, 1xRS232)
- Compact form factor (3.29” x 2.98” in headless mode)
- Based on a powerful and low-power Freescale ARM926 SoC with extensive controller integration for lowest possible BOM (<<$50 FOB)
- Powerful SoC capable of running a web server and web cryptography protocols
- Future proof Freescale SoC to capitalize developments on (scalable in terms of features and performances and part of Freescale’s longevity program + industrial qual)
- Pre-validated communication stacks and example code to alleviate customer developments
- Straight forward upgrade path to accommodate evolving HAN connectivity requirements (running rich OS like Linux and Windows Embedded Compact 7)

Freescale’s “Energy Gateway” reference design

“Energy Gateway” motherboard

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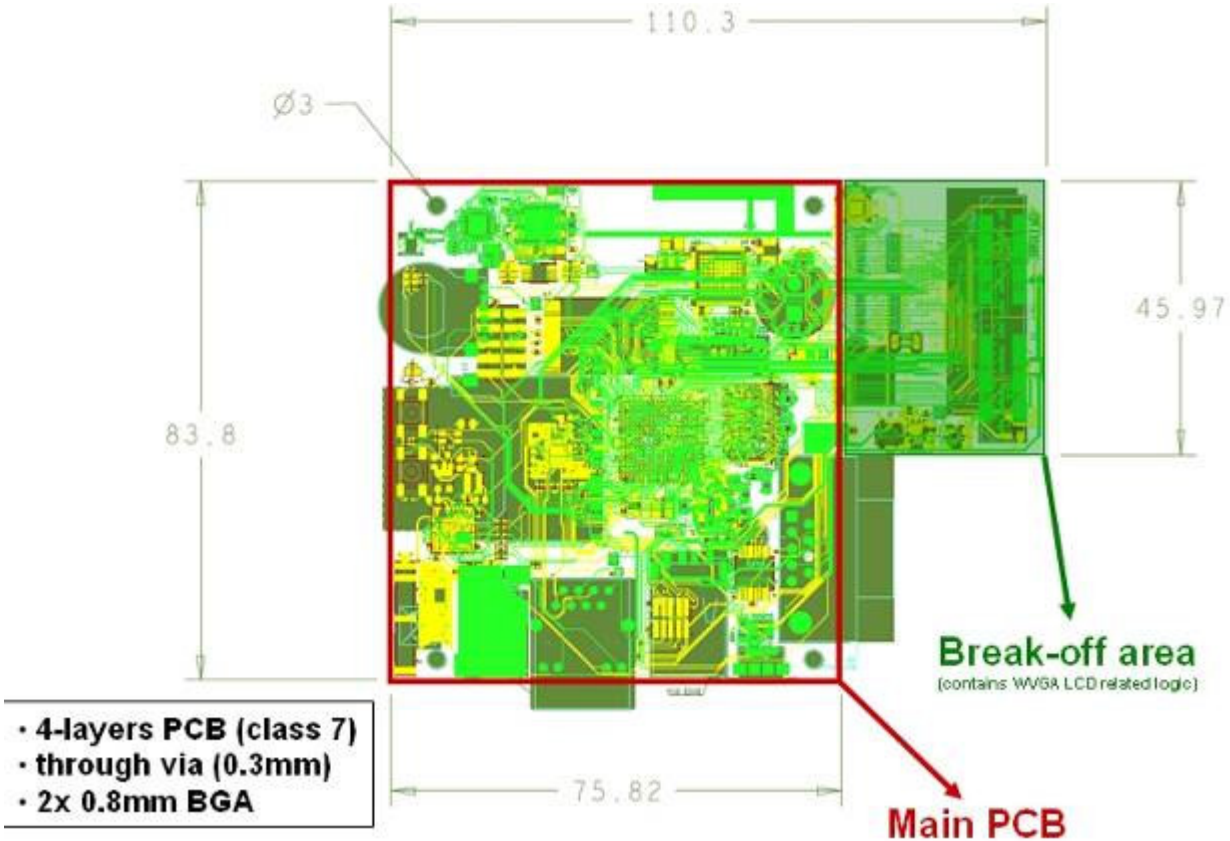
HEG Phase 1 Pictures



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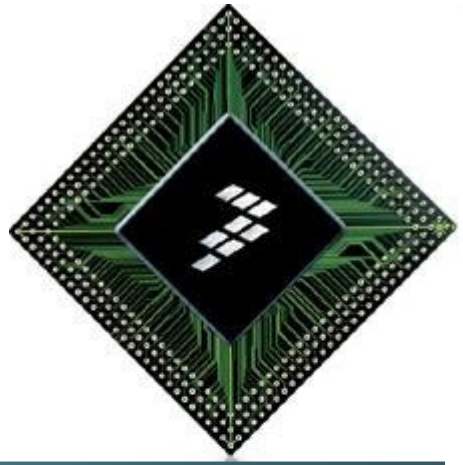

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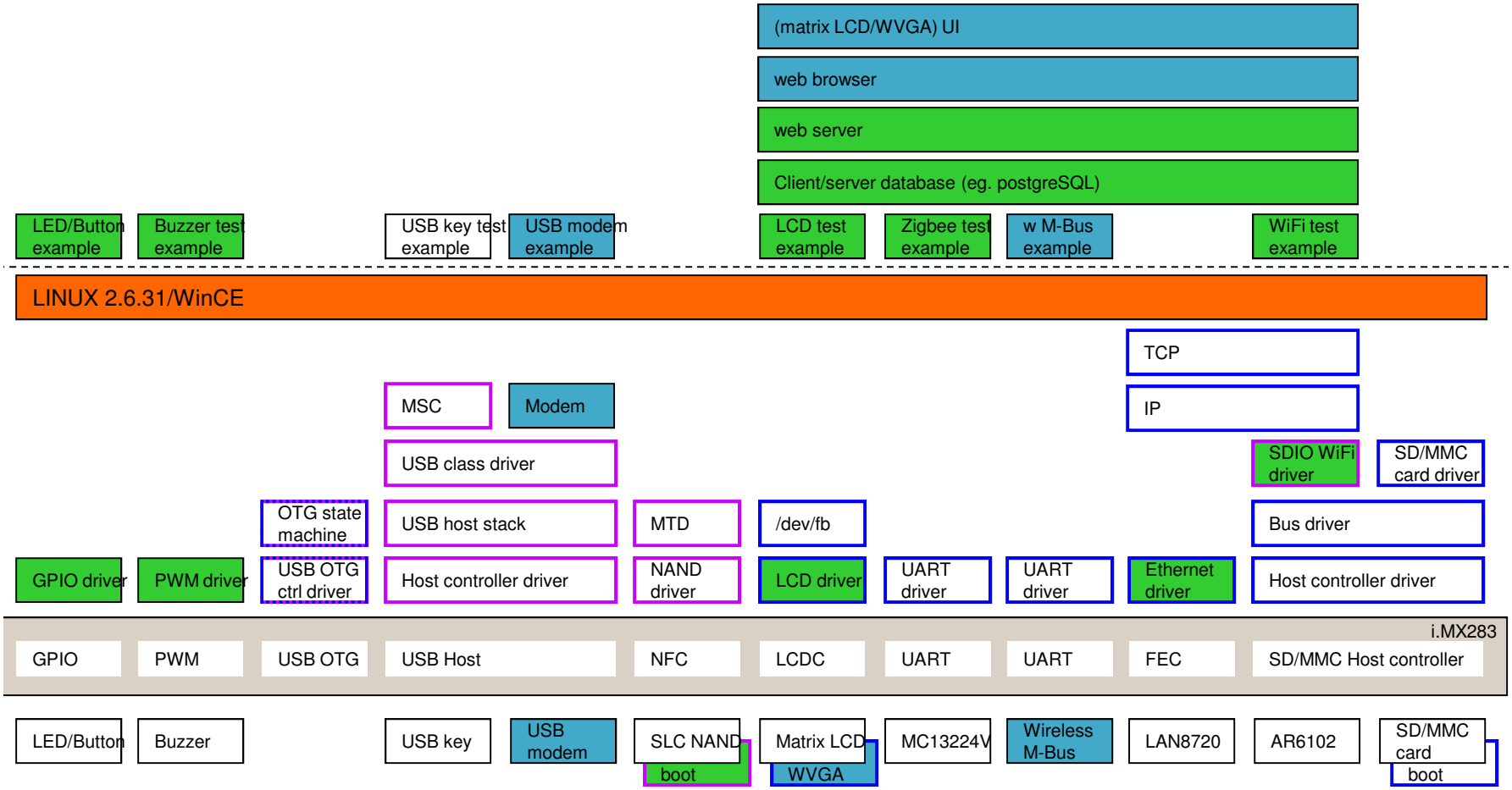
Freescale SW deliverables



Phase 1 : reuse from i.MX28x EVK BSP

Phase 1 : HEG adaptation/development

Phase 2

Additional value add software available at various 3rd parties

Note :
BSP will be delivered in source form and on an as-is basis

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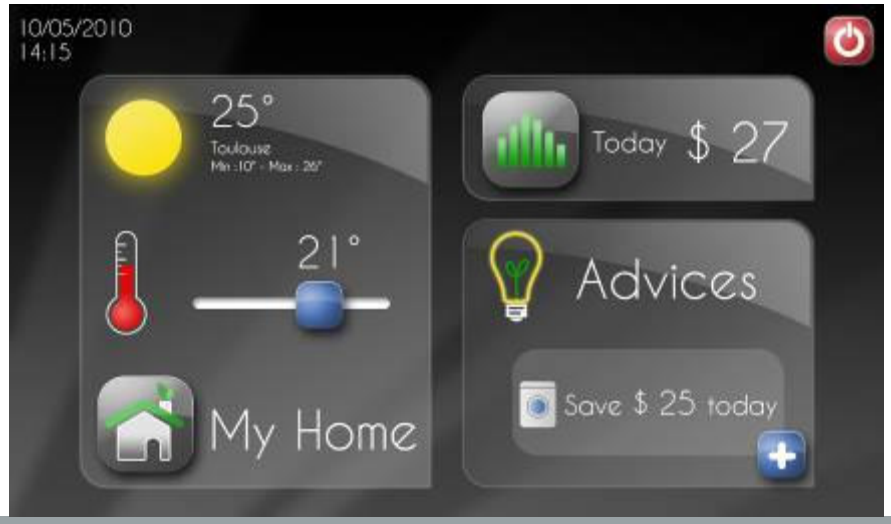
Ecosystem Software

Flash-lite IHD on i.MX25/QNX



Silverlight IHD on i.MX51/WinCE7

Linux and WinCE partners are developing frameworks to help customers reduce their time-to market

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Home Energy Gateway (HEG) Demo Set-Up

QNX SOFTWARE SYSTEMS

i.MX25, Neutrino/Aviage

freescale Enabled

i.MX51, WinCE7/Silverlight

AllGo embedded

i.MX233, Linux/Qt

In Home Displays

Wi Fi

Smart Meter

freescale Enabled

Zigbee SE 1.0

freescale Enabled

HEG

freescale Enabled

Zigbee HA

freescale Enabled

Smart Appliances

freescale Enabled

MCU: Freescale MCF51EM256 ColdFire
Zigbee SE1.0: MC13224V

MPU: i.MX28, Linux / Windows Compact 7

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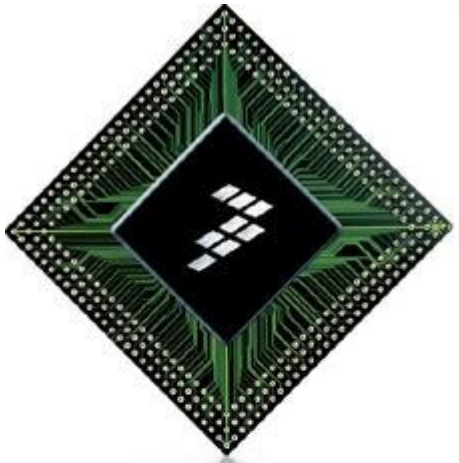

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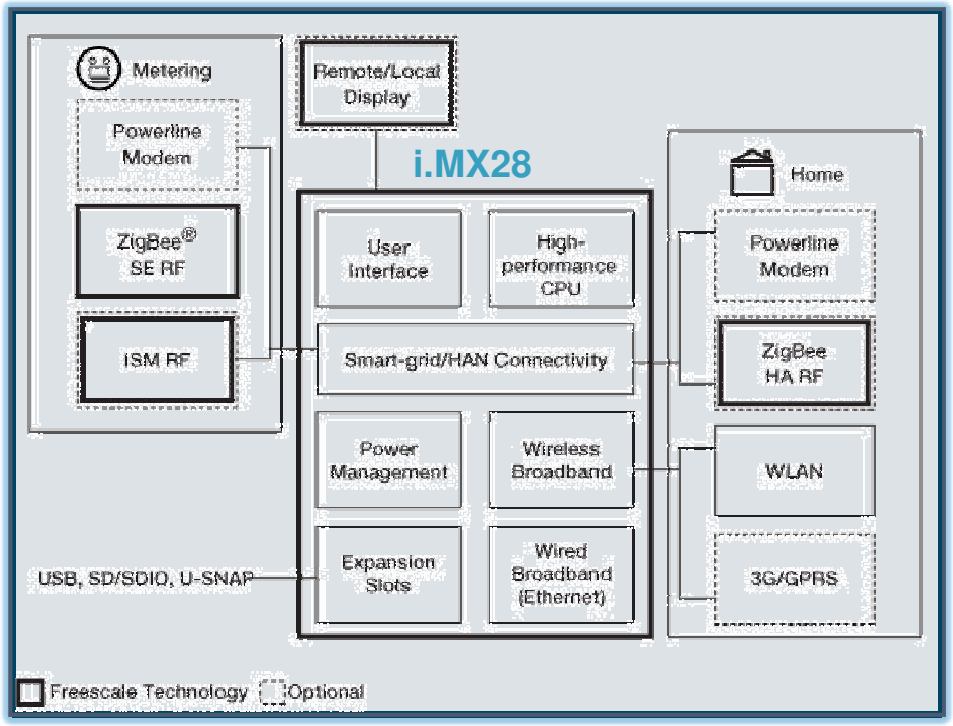
Applications: i.MX28 Home Energy Gateway Reference Platform

- The Home Energy Gateway
  - Acts as a central hub bridging data and electricity networks: it links Smart Meters, Smart Appliances and Smart Devices in the Home Area Network (HAN)
  - Collects power usage data from various sources
  - Controls appliances in HAN
  - Generates dashboards for feedback on power usage
  - Provides menus to control appliances, home automation devices
  - Provides a ubiquitous link to the WAN for remote control/readout

- Freescale's Reference Platform
  - Flexible and scalable form-factor platform for quick time-to-market
  - Based on a powerful and low-power i.MX28 with extensive controller integration for lowest possible BOM
  - Announcement on Sept 22 with schematics, design files and BSPs available from Freescale
  - Partnering with Adeneo to provide manufacturing and BSP support – Availability in November 2010



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HEG ecosystem

	T&C TBD w/ partners		Terms and conditions TBD w/ partners			
remote User I/F (running on IHD - connected through WiFi to HEG)	running on i.MX25	running on i.MX51	TBD	running on i.MX233 or i.MX37	running on i.MX51	running on i.MX25
Availability	*NOW!*	*FTF China '10*	*Metering Vienna?*	*FTF India '10*	*FTF China '10*	*NOW!*

	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		
Availability	*N/A*	*N/A*	*N/A*	*N/A*	*Electronica '10*	*end 2010*
Application	basic demo	basic demo	OSGi-based		MIC Torino	
Availability	*August 16, 2010*	*August 16, 2010*	*Metering Vienna?*	*FTF India '10*	*FTF China '10*	*NOW! (i.MX25 reuse)*
Engine	N/A	N/A			Silverlight	Flash-lite
Availability	*N/A*	*N/A*	*August 16, 2010*	*FTF India '10*	*August 16, 2010*	*NOW! (i.MX25 reuse)*
OS		Windows Embedded			Windows Embedded	Neutrino
Availability	*August 16, 2010*	*August 16, 2010*	*August 16, 2010*	*August 16, 2010*	*August 16, 2010*	*end 2010*
Hardware	i.MX283					
Availability	*August 16, 2010*					

OS Support	deneo Embedded
HW Manufacturing	deneo Embedded

	Planning
	Executing
	Done

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

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HEG – Proposed Support Business Model

- The HEG is a reference design aimed at promoting Freescale technologies for the smart-grid
- Freescale is willing to help customers jump start their own developments around i.MX and, therefore, is ready to grant access to all HEG manufacturing files and BSPs (on an as-is basis)
- HEG Reference Design is a promotion and demonstration vehicle. Freescale does not sell directly HEG reference design kit to customers, but can loan few of them for a one month duration to selected customers depending on business opportunities. Beyond one month, HEG hardware could be sold at $600 per unit with a 6 weeks manufacturing cycle time
- Software support and BSP optimization can be contracted to selected Partners

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HEG – Proposed Support Business Model

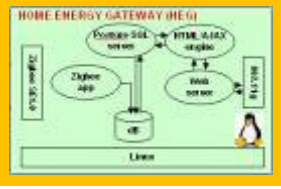
FOR FREE ($0)

HARDWARE

Hardware schematics	☑
Gerber files	☑
OrCAD files	☑
BOM list	☑
Loan (1 month) of HEG i.MX28 based HW	☑

SOFTWARE

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



Demo code owned by FSL

SUBJECT TO FEES ($$)

- Zigbee MC13224 evaluation kit
- i.MX287 evaluation kit

- Software support
- BSP optimization
- 3rd party demo access

HEG selected Partners