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Industrial Network Protocols for Building Control

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Contents

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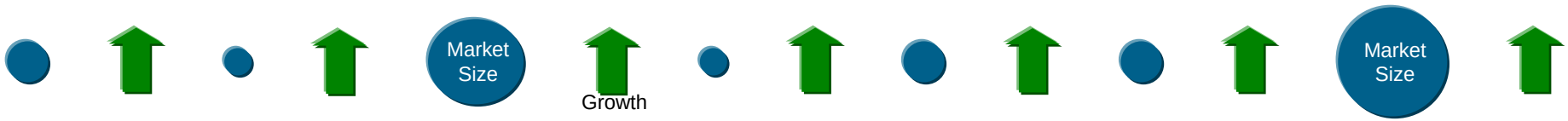
- Where to find out more

- **Lighting**
- **Smart metering**
- **Heating and air conditioning**
- **Wireless sensors for portable systems**
- **Human interfacing**
- **Large building control backbone**
- **Video surveillance**

Segmenting the Building Control Market

Building Control

Fire & Alarm Systems	Access Control	Video Surveillance	Building Automation	Utility Meters	HVAC	Lighting Control
Fire Detection	Garage Door Openers	IP Camera	Elevators & Escalators	Utility Meters	Boilers & Furnaces	Electronic Ballast
Fire Annunciation	Residential Access Control	IP Video Equipment	Time & Attendance	Utility Meters Communication Modules	Circulation Pumps	Emergency Lighting
Fire Alarm Control Panel	Commercial Access Control	IP Camera Control	Sanitation Control	Utility Load Control	Compressors	Lighting Control
Fire Alarm Notification	Electronic locks	IP Video Monitor	Blinds, Doors & Windows		Room Thermostats & Controls	Architectural Lighting
Intruder Detection		IP Camera Remote Control	Commercial Kitchen Equipment		Unitary Air Conditioners	Street Lighting
Intruder Notification		IP DVR	Warehouse Handling Equipment		Commercial Refrigeration	Traffic Light Control
Security Control Panel		Automated Surveillance Video Processing/Analytics	Networked Load, Lighting, HVAC, Security Control		Humidity Control	



Market and trends

Trends Driving Building Control Electronics Growth

▶Connectivity

- Wired and wireless networking is enabling improved control and new functionality
- Networking is driving the requirement for more processing throughput, more memory and the adoption of third party software (stacks, RTOSes)
- Connectivity will drive the requirement for more industry standards and interoperability

▶Security

- Networking introduces new threats and drives up system security requirements
- Increasing investment in software IP is driving need for more effective cloning protection
- General security concerns are driving growth in surveillance and access control applications
- Growth in video surveillance is driving the need for complex analytics and processing

▶Energy Efficiency

- Increasing energy costs are driving requirements for efficiency improvements through more sophisticated system wide control
- Ease of installation issues will drive requirements for battery operated equipment options
- Heat dissipation challenges in some installations will require low power consumption of control equipment

▶Ease of Use

- Networked equipment and more complex functionality require more sophisticated and easier to use user interfaces, leading to touch input with graphical and web based user interfaces
- Replacing analog intercom systems with Digital Voice (VoIP)
- “iPhone factor” and Nokia are driving up consumer expectations in home automation

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Challenges: Building “Automation” Standards...

1985 → 2010

1985

X-10™
CEBus©
LonWorks™
Smarthouse™
RS-232
RS-485

DIGITAL

2010

X-10™
CEBus©
Lonworks™
Smarthouse
Firewire
CAL/HPnP
Home RF
Bluetooth
LE Bluetooth
PRIME
ERDF G3
IOHome control
802.15.4g

enOcean
RS-485
LIN
UPnP
CAN
ModBus
DALI
OSGi
IRDA
M-Bus
DMX512
SOAP
IEC16334-5

HomePlug
ZigBee®
UWB
Ethernet
IPv4/6
6LoWPAN
WSDL
UDDI
U-SNAP
KNX
BACnet
HomeGate
Z-wave

OSI Model			
	Data unit	Layer	Function
Host layers	Data	Application	Communication language
		Presentation	Data representation/encryption
		Session	Inter-host communication
	Segments	Transport	End-to-end connections and reliability (TCP)
Media layers	Packets	Network	Path determination and logical addressing (IP)
	Frames	Data link	Physical addressing (MAC and LLC)
	Bits	Physical	Media, signal and binary transmission

Market Specific needs and optimization are driving the expansion in the number of Protocols
Inter-Operability is driving a trend towards Industry Standard Protocols

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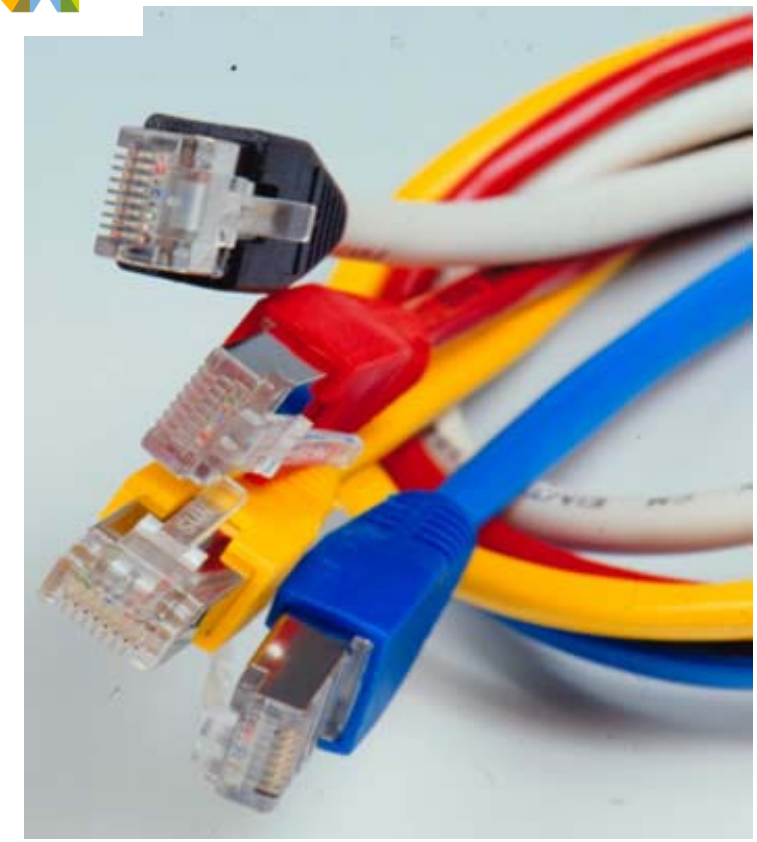


Applications and protocols

A tour through lighting, smart metering, heating and air conditioning, wireless sensors, human interfacing, large building control backbone and video surveillance

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Communication protocols are key to building control

Many applications have specific needs

Need	Example protocol
High data throughput	TCP/IP
Time synchronization across nodes	IEEE® 1588
Deterministic system	EtherCAT or CAN
Low power for longer battery life	ZigBee® or LE Bluetooth
Low latency	GPIO
Redundancy	CAN or redundant rink Ethernet
Low cost	UART
Easy of use	USB
Small memory footprint	UART/SCI
Cross board communication	SPI, IIC
Site wide communication	RS485
Single wire	LIN
One way communication	IrDA

Every application has a strong dependency on control or data

- Protocol choice often determines the most suitable controller product

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Building Control Connectivity Levels

Application Layer	BACnet, Modbus, NAFEM, DALI, VoIP, Smart Energy Profile, KNX, LonWorks		
	With the exception of BACnet, application layer protocols are not well established, with several standards competing for dominance in each application area		
Transport Data Link	WiFi, Bluetooth, 802.15.4/ZigBee®, Wireless HART, Z-Wave, Sub 1 Gb, EnOcean	Ethernet, USB, UART, SDIO, SPI, I^2C, SSI/I^2S, CAN	G.hn, HomePlug xx, HD-PLC, S-FSK, PRIME, OpenMeter, X-10
	Only WiFi is well established, other protocols are competing for acceptance	Wired protocols are well established in their application areas	No established standards, all are competing for acceptance
Physical Layers	Wireless	Wired	Powerline (wired)

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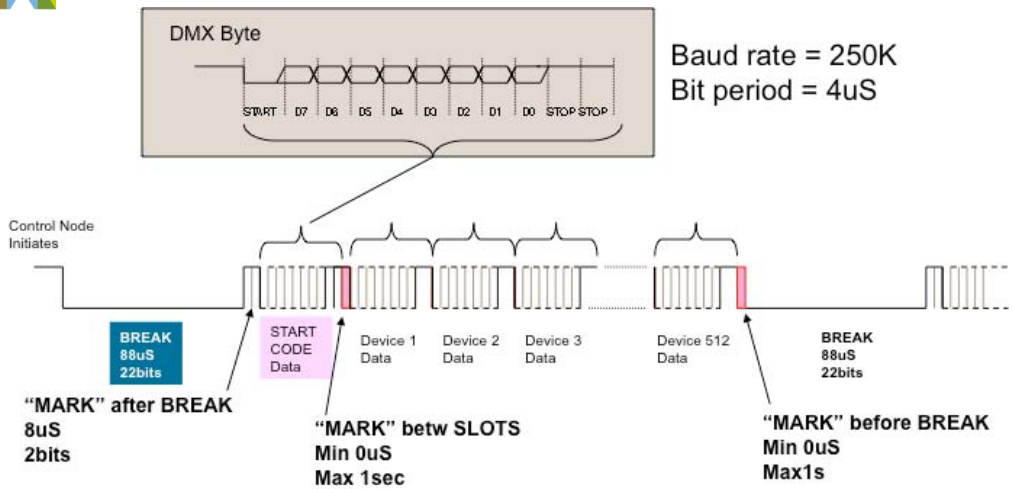
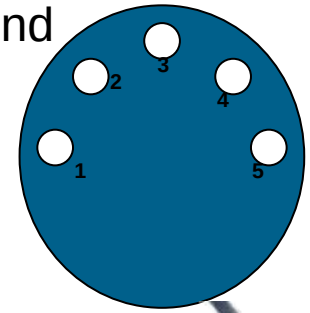
Lighting protocols have evolved significantly in the past 15 years

DMX512 - Introduction



1- 0V/Ground
2- D-
3- D+
4- opt D-
5- opt D+



- Developed by United States Institute for Theatre Technology, Inc. (USITT) in 1986
- DMX512-A is EIA-485 based standard Wired Communication Protocol used extensively in industrial lighting
  - Theatre stage lighting
  - Exhibition lighting
- Replaced ADB6.25 AVAB, CMX, Micro2, PMX protocols
- 3/5 wired protocol with 1 data signal constructed using two differential lines, common/ground and optional second set of data lines
- Half duplex communication running at bit rate 250 Kbaud
- Level shifted data from physical interface can be controlled via an 8-bit SCI/UART with second STOP bit insertion

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DMX 512 Bridge & HBLED RD

DMX512 Console

RS485

DMX512 Bridge Board

RF

HBLEDs RD Board

DMX512 – SMAC Bridge Board

- Featuring the 9S08GT60 MCU
- Supports DMX 512 serial protocol
- RS485 standard at 250 Kbps
- Using SMAC 4.1 to control the MC13192
- Currently supports four channels
- Code size 4018 Bytes
- RAM size 1448 Bytes

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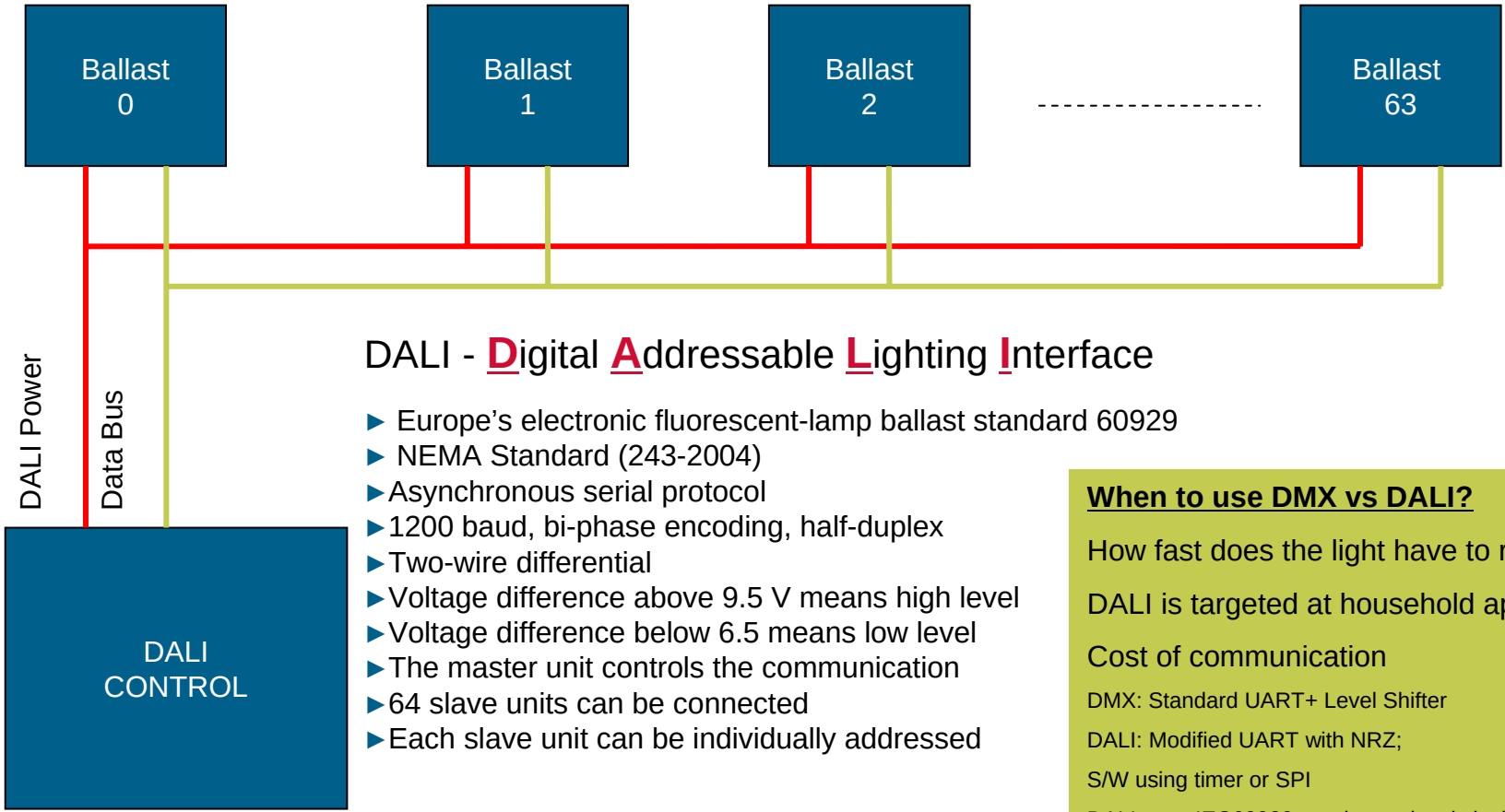
DALI Network Configuration



DALI - Digital Addressable Lighting Interface

- Europe's electronic fluorescent-lamp ballast standard 60929
- NEMA Standard (243-2004)
- Asynchronous serial protocol
- 1200 baud, bi-phase encoding, half-duplex
- Two-wire differential
- Voltage difference above 9.5 V means high level
- Voltage difference below 6.5 means low level
- The master unit controls the communication
- 64 slave units can be connected
- Each slave unit can be individually addressed

When to use DMX vs DALI?

How fast does the light have to react?

DALI is targeted at household applications

Cost of communication

DMX: Standard UART+ Level Shifter

DALI: Modified UART with NRZ;

S/W using timer or SPI

DALI spec IEC60929 requires galvanic isolation from mains – optical isolation

See: DRM004 - Digitally Addressable Lighting Interface (DALI) Unit Using the MC68HC908KX8 Designer Reference. (pdf on web)

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Lonworks CEA 709.1 Lontalk PLM protocol

Protocol Description

- Building Control protocol developed originally by Echelon Corporation and now defined in ANSI/CEA 709.1
- Used within the LonWorks platform for network communications – primarily within building control
- Defined to operate in a free topology network configuration with a twisted pair transceiver or work with a power-line transceiver
- 709.1 standard defines physical layer implementation and all ISO layers up to layer 7 (application layer)

Powerline Communication

- Dual Carrier Frequency operation using BPSK
- CENELEC Band A (Electricity Suppliers)
- 86 kHz Primary, 75 kHz Secondary
- CENELEC Band C (Consumer protocol)
- 132 kHz Primary, 115 kHz Secondary
- Max PLM bit rate 5400 baud

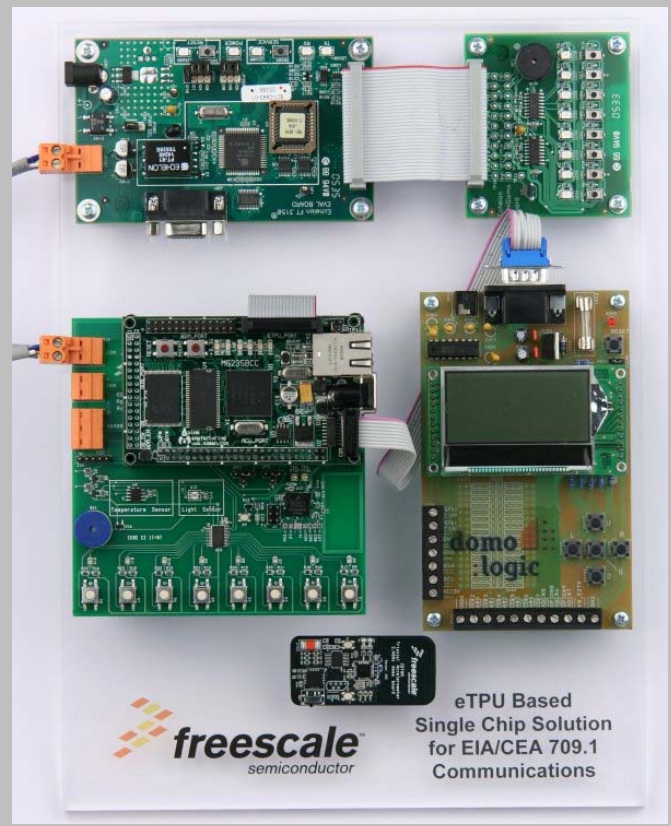
Twisted Pair Communication

- Maximum bit rate is 78kb/s
- Differential Manchester Encoding
- Stepped Sinusoid Wave shaping (patented)

- LonTalk is defined by the following standards
  - ANSI 709.1 - Control networking (US)
  - ISO/IEC 14908-1 - Communication protocol
  - ISO/IEC 14908-2 - Power line signalling technology
  - ISO/IEC 14908-3 - Twisted pair wire signalling technology
  - ISO/IEC 14908-4 - IP compatibility (tunnelling) technology

Freescale enablement

- MCF523x eTPU based solution combined with FFT-10A transceiver provides Layer 2 capability
- Domologic – 709.1 Stack – works in combination with Freescale MCF523x based Layer 2



Demo: http://roznov.ea.freescale.net/booking/index.asp?action=ShowDemoSup&IDS=40

KNX (Konnex)

Applications

- Industrial control and building control, home control
- The driving force behind KNX is KNX Association with more than 100 members, accounting for more than 80% of the home and building control devices sold in Europe
- KNX as the world's only open STANDARD for home and building control

Protocol description

- International Standard (ISO/IEC14543-3)
- European Standard (CENELEC EN50090 and CEN EN 13321-1 and 13321-2)
- Chinese Standard (GB/Z 20965)
- ANSI/ASHRAE Standard (ANSI/ASHRAE 135)

- KNX2 update of the KNX standard in final stages of development – due for release in 2010

- **Encompasses four hardware mediums**
  - Twisted Pair – UART based - legacy industrial control protocol
  - Powerline modem – 110kHz
  - Wireless (RF) - 868MHz FSK
  - Ethernet

- **Baud rate** = 10/100Mbit for Ethernet, 2400-9600 bits/sec for others

Hardware platform

- UART base for Twisted pair and powerline modem
- Powerline modem device
- 800-915 Mhz FSK transceiver (ECHO)
- Ethernet modem

FSL enablement

- Ethernet, UARTs and ECHO RF are key blocks on all MCUs
- Currently there are no KNX demos available from FSL – request in the queue for support

http://www.knx.org/knx-standard/introduction/

Protocol: M-BUS (Wireless, Wired and PLM)

Applications

- Metering AMR, heat allocators, gas, water and electricity meters
- Main adoption in Germany, Netherlands and potentially UK

Protocol description

- The M-Bus ("Meter-Bus") is a European standard for remote reading of heatmeters and it is also usable for all other types of consumption meters (gas, water, electricity) as well as sensors and actuators
- BS EN 1434-3:1997 - heat meters. Data exchange and interfaces
- IEC 870 – Datalink
- MBUS – Physical transceiver
- CENLEC TC294

Hardware platform - transceivers

- Typically connect via async serial, ie SCI/UART RS232
  - Wired
  - Wireless

Freescale enablement

- Currently no demos available – FSL supports the serial wired comms solution through any MCU with SCI and >16 KB Flash

Smart metering for smart homes

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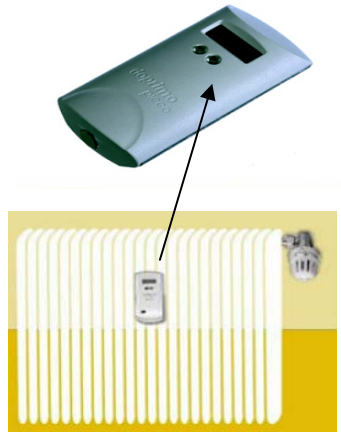
Metering Segmentation



Electricty

Communications with the utility company can be through a wide range of links

- Power line modem
- Sub 1 GHz RF
- GSM GPRS
- WiMAX

Gas

Communications with the utility company via electricity meter or via an energy gateway

- Sub 1 GHz RF
- ZigBee 2.4GHz

Water

Communications with the utility company via electricity meter or via an energy gateway

- Sub 1 GHz RF
- ZigBee 2.4GHz

Heat

Communications with the utility company via electricity meter or via an energy gateway

- Sub 1 GHz RF
- ZigBee 2.4GHz

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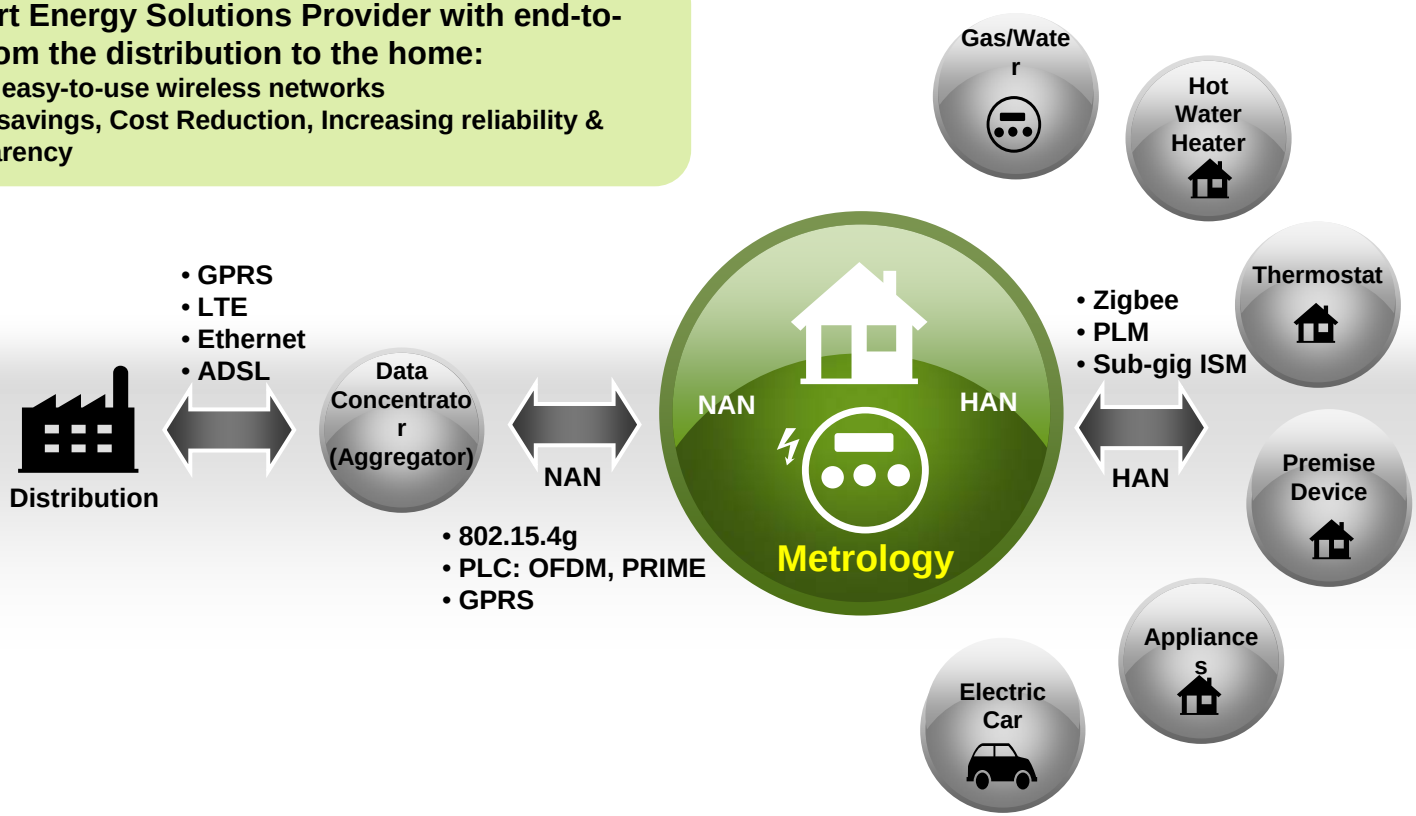
Freescale in Smart Energy

Complete Smart Energy Solutions Provider with end-to-end support from the distribution to the home:

- ► Secure, easy-to-use wireless networks
- ► Energy savings, Cost Reduction, Increasing reliability &
- ► transparency



Gateway: Send data collected from Neighbor Area Network (NAN) or Home Area Network (HAN) to utility

► Send data/commands from utility to NAN or HAN

NAN: Wireless or wired network to collect meter consumption information (AMR/AMI)

Metrology: Hardware that measures and controls flow of energy to/from building

HAN: Wireless or wired network used for load control and dynamic response by utilities

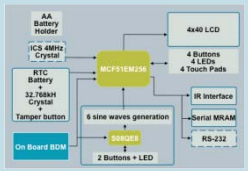
► Electric meter communicating with T-Stats, appliances, water heaters, pool pumps, electric hybrids, etc. (Load Control)

► Send pricing signals to consumers for smarter energy consumption (Demand Response)

Metering Demos & Reference Designs

3-Phase

Simulation Demo
MCF51EM256



1-Phase/3-Phase Meter
MCF51EM256
Integrated AFE

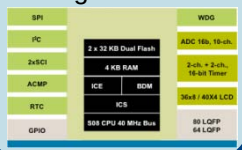
1-Phase

Low Cost Meter
9RS08KA8

Low Cost Meter
9S08LL/LG32

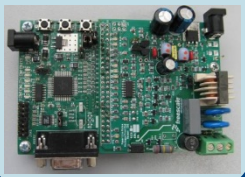
1-Phase Meter
MCF51EM256
Integrated AFE

Low Cost Meter
9S08LH64
Integrated AFE

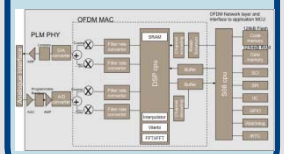


PLM

PLM
MC56F8025



OFDM PLM
MCF51EM256



All available Now

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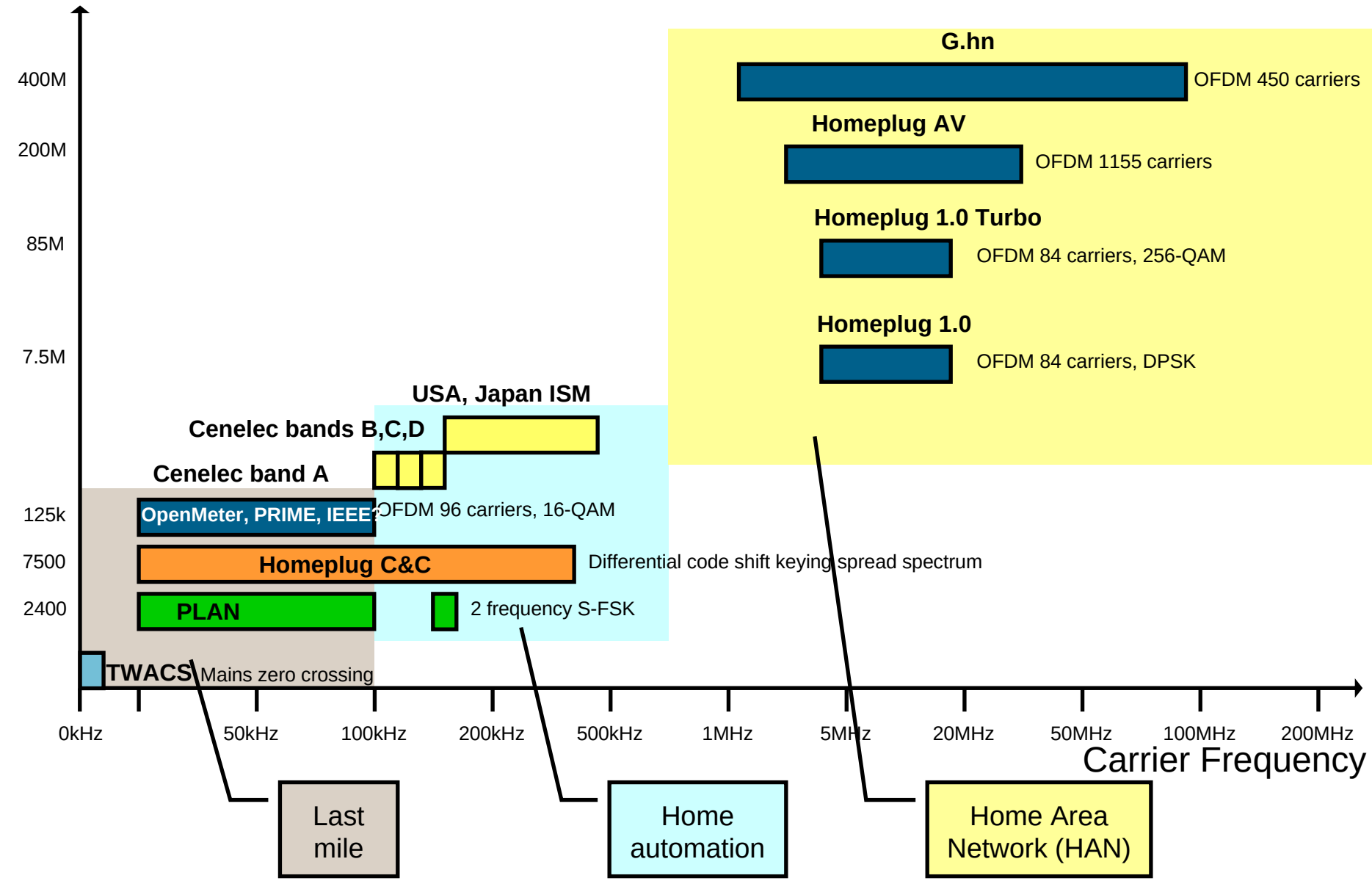
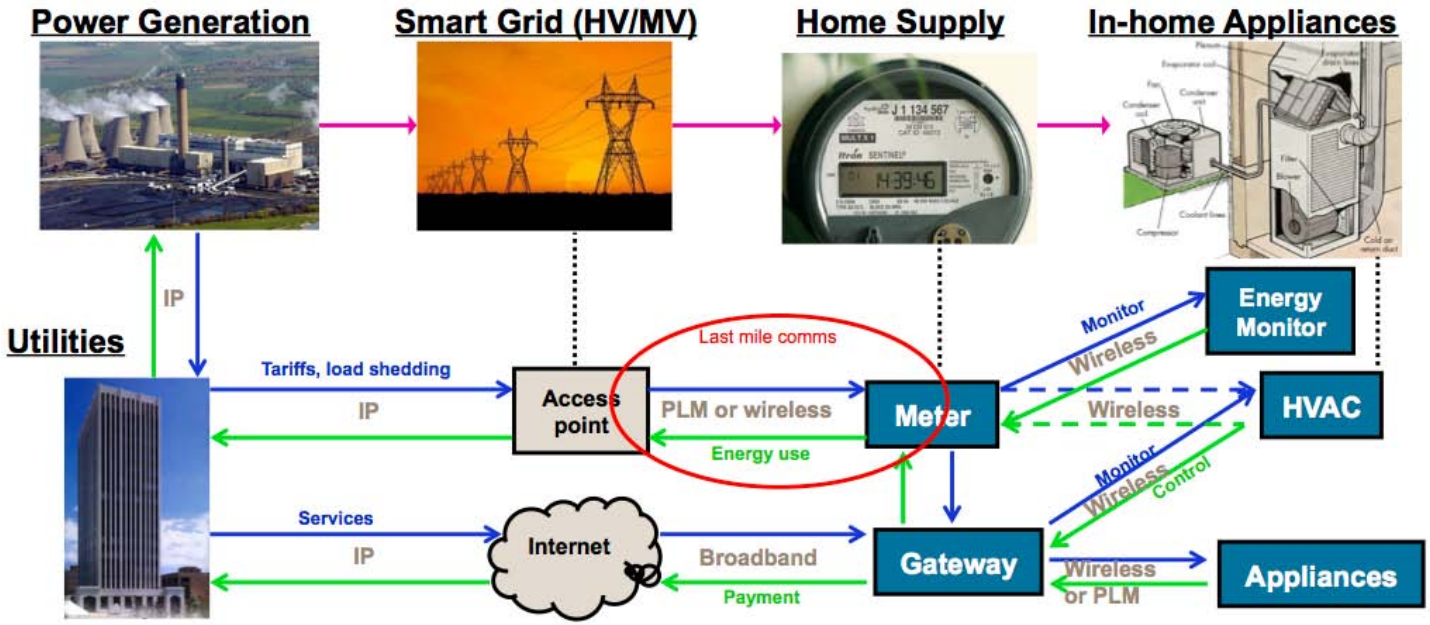
Power Line Communications Protocols - Summary

HomePlug C&C	Slow data rates with development increasing bandwidth in near term to 100kbps. Supported by Yitran. Being adopted for South Korea and Germany metering last mile
HomePlug Green Phy	Lower data rate subset of HomePlug AV for command and control applications
HomePlug AV	WiFi extender or ethernet extender in the home typically. Gathering popularity in US. GE adopting HP AV standard. FSL talking to external partners to offer solution in this space e.g. Intellon. FSL products have MII and TCP/IP stack support which works easily with an external transceiver.
G.hn	Ethernet replacement, FSL actively participating in standards meetings but no plans for products
ERDF G3	Requires power line modem with OFDM engine - deployed by EDF in France for smart meters
PRIME (PLM)	Requires power line modem with OFDM engine , trials ongoing in Spain
S-FSK (derivative of PLAN)	Current solution using DSC56F8025 Line Interface product development in concept stage S-FSK networking software support is in development
LonWorks	Working with partner Domologic on LonWorks solution based on ColdFire devices
KONNEX PL132 (PLM)	Currently Monitoring V2 standard and potential use of PLM in lighting and metering applications
MBUS (PLM)	Monitoring deployment of metering applications for last mile AMR in Germany and Netherlands. Some NPI activity required to provide support for all physical medium options
X-10	Protocol in decline, being phased out

Power Line modem frequency bands vs. bit rate



Smart Grid and AMR Concept and Components



Region	Utilities to access point	Access point to meter	Meter to appliances
Americas	**IP**	Wireless sub 1GHz Wireless Wimax	Wireless ZigBee PRO SE PLM (homeplug AV)
EMEA	**IP**	PLM (S-FSK/OFDM Cenelec A Band) or Broadband (ADSL)	Wireless M-Bus (868MHz) Wireless ZigBee PRO SE
A/P	**IP**	PLM (BPSK/S-FSK/OFDM) sub 500kHz	tbd

Big Players are investing NOW in Home Energy Management !

Google Power Meter

Intel

Microsoft with Microsoft® hohm™ beta

Nokia with "**There Corporation**" …

- Electrolux, Enel, Indesit and Telecom Italia have signed an agreement to test an innovative system in which "smart" appliances optimize home energy consumption
- Edelia (EDF), Sagemcom, Delta Dore currently running a pilot in Bretagne (France)
- … utility providers, industrial OEMs, service providers, telecom operators all are jumping on the boat to develop new products and services aiming to manage power consumption at home

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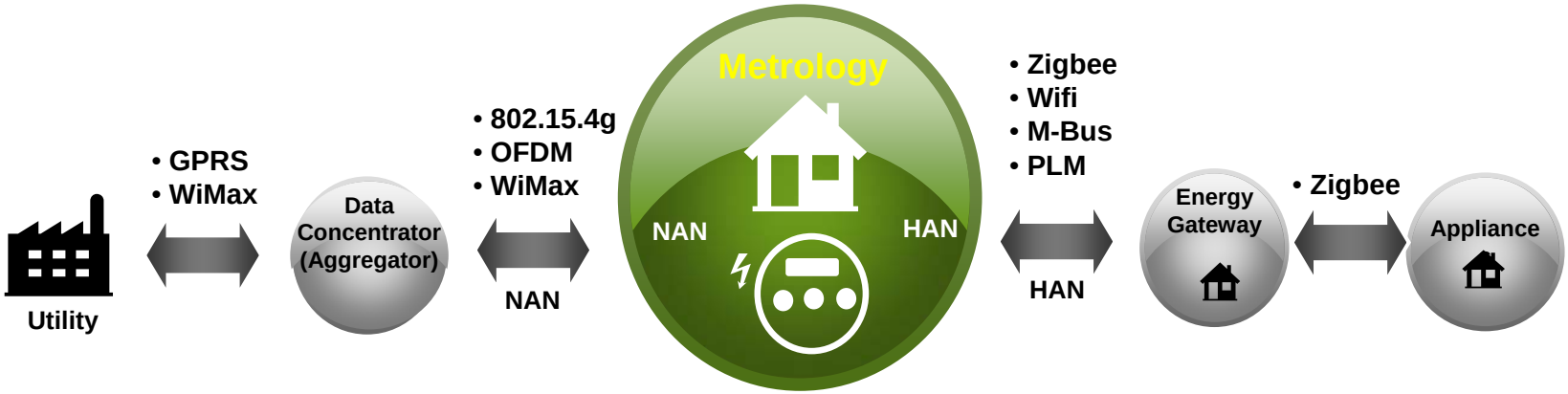
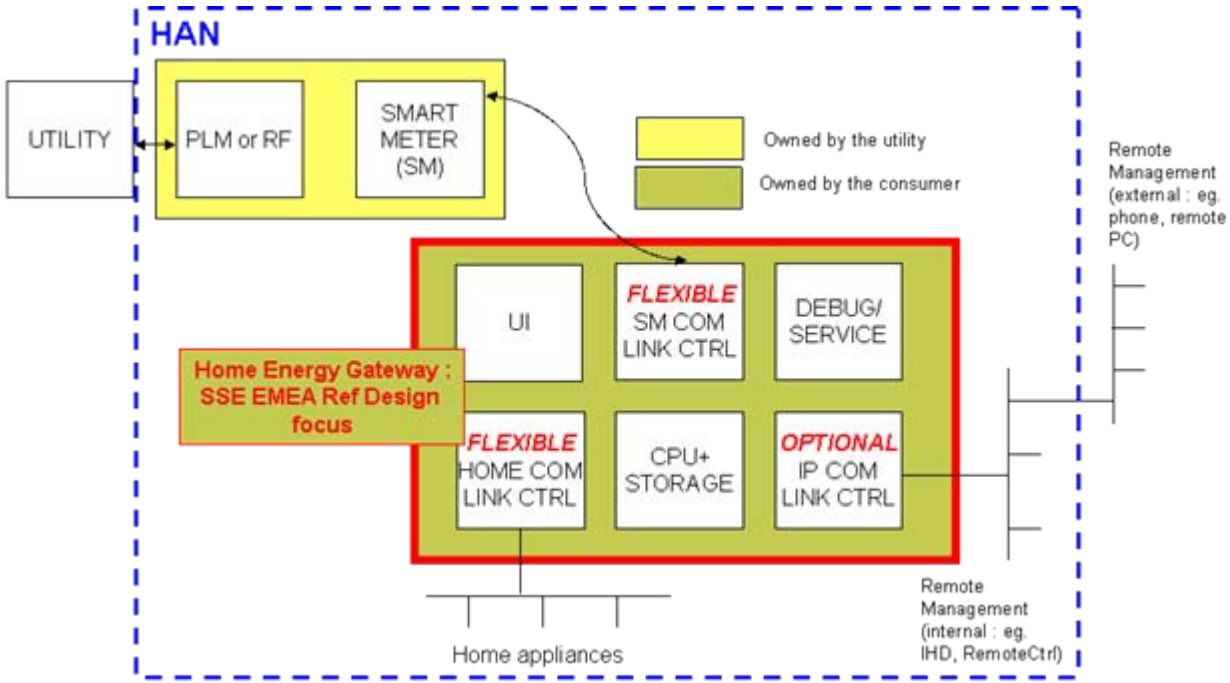
Home Energy Gateway in the HAN





NOTE: SM link and Home COM link need to be flexible as multiple standards compete for the same socket

Home Energy Gateway : the big picture

WIFI
IR
RF4CE

WIFI
ethernet
PLM

RS-485
ethernet

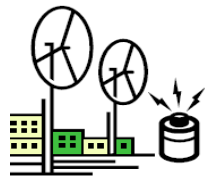
Home Energy Gateway

WIFI
ethernet
PLM

Residential Gateway

Internet

Utility Companies



Energy Saving Services

Monitor and alert

Proprietary
868MHz RF

ZigBee HA

PLC

GreenPHY

Zigbee SE/MBUS/KNX

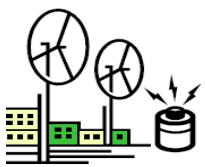
Wireless MBUS/KNX

Consumer

Remote Control &

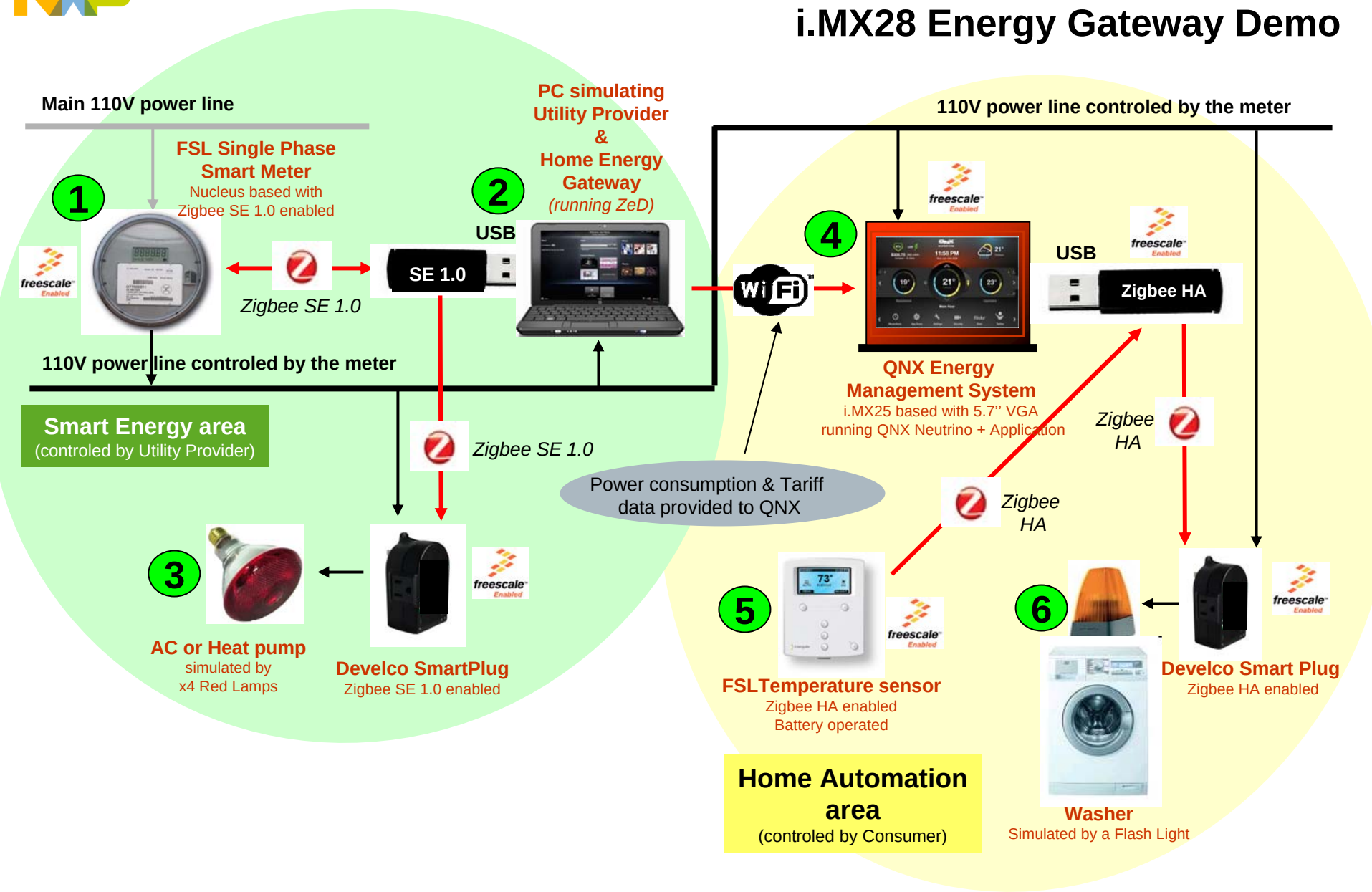
Monitor

Utility Companies



Note :
The market is quite fragmented when it comes to connectivity interfaces between home energy gateway, appliances and meters.
Freescale's Home Energy Gateway addresses this by using a modular platform approach.

i.MX28 Energy Gateway Demo



Home Energy Gateway: User interface examples

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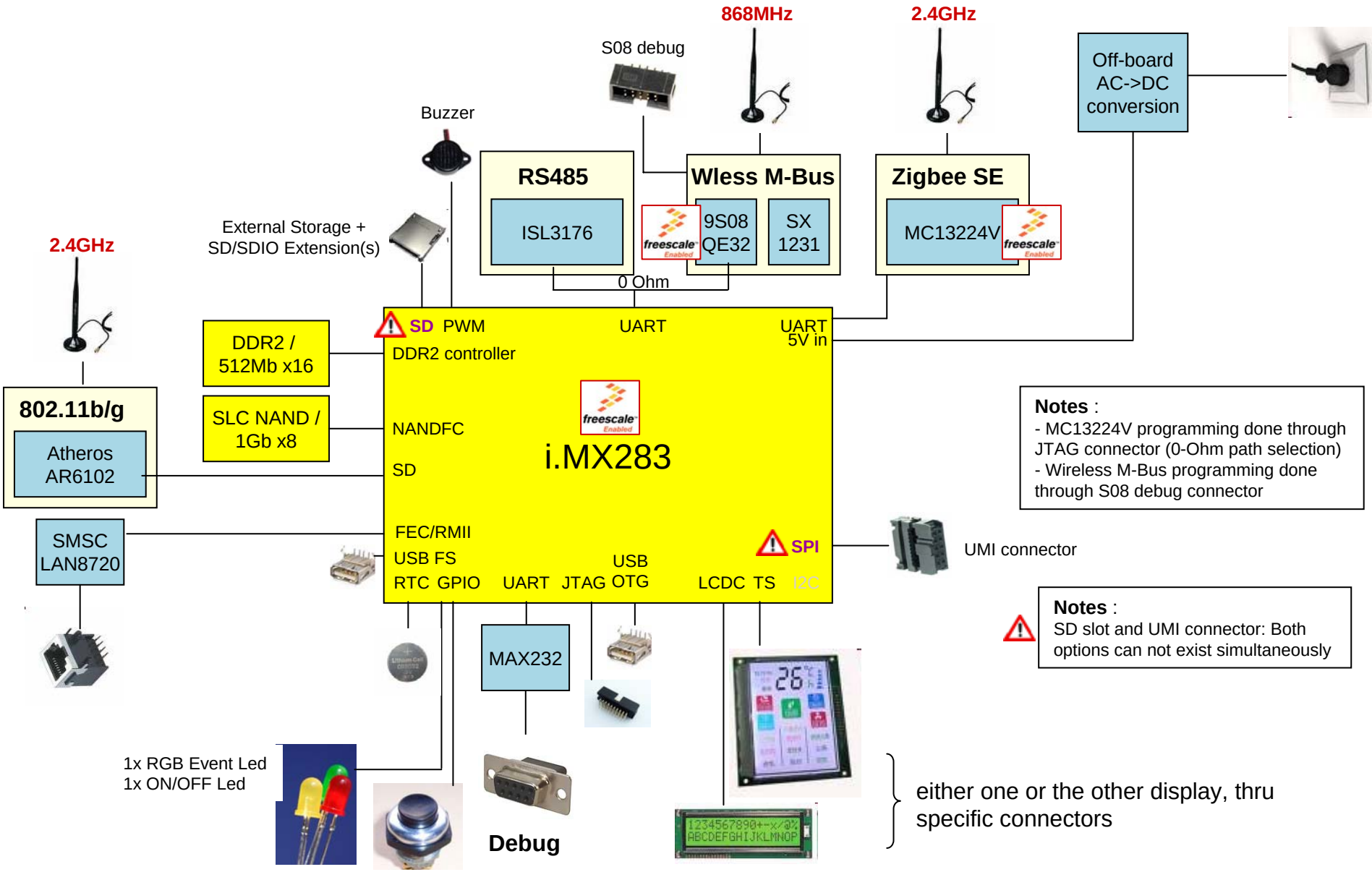
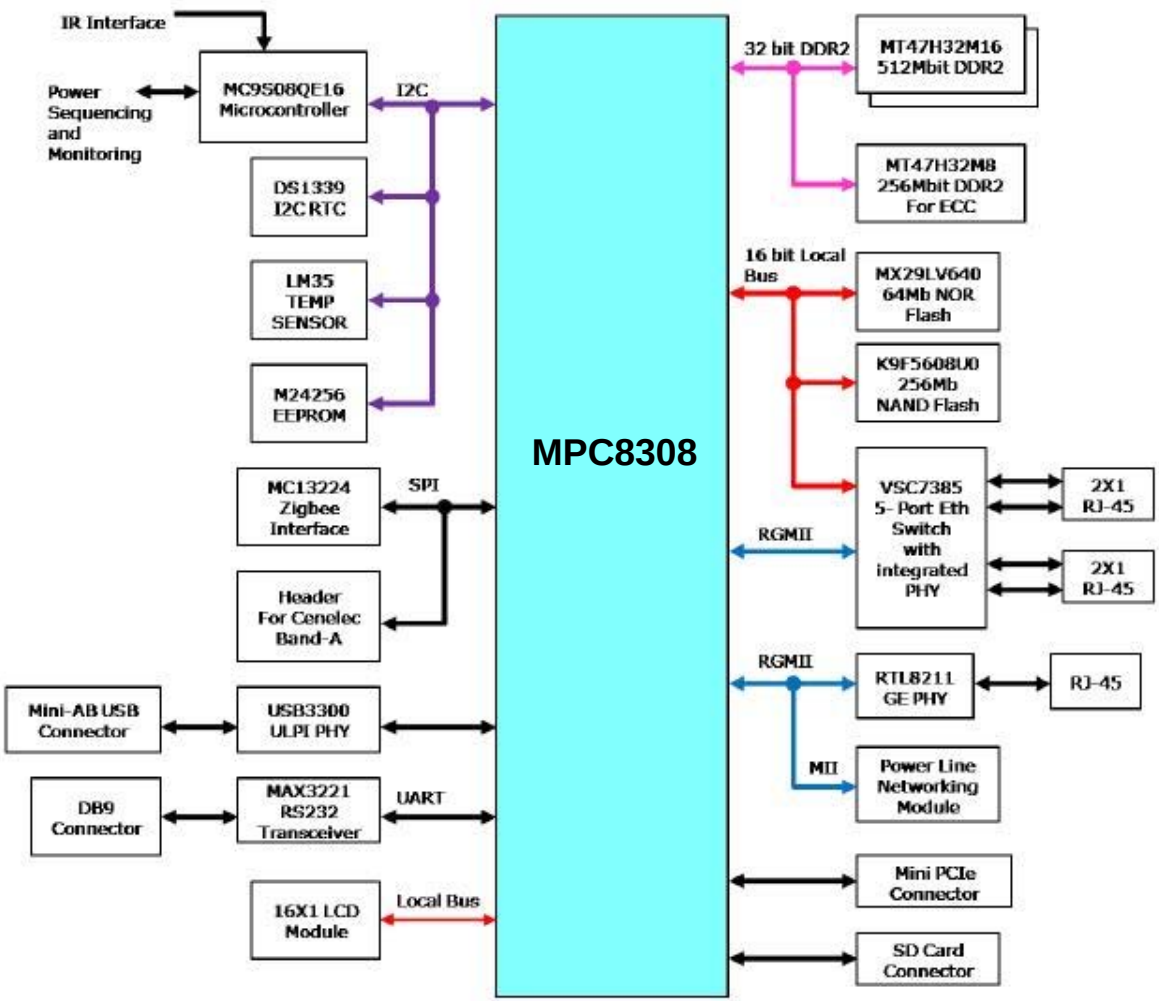
Home Energy Gateway: main PCB (Phase1)



Smart Energy Metering Gateway



Provided by:

GDA Technologies, Inc.
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Available for demo

i.MX25 is also an excellent candidate for this application and has a similar set of peripherals plus security features

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P-LAN S-FSK PLM

Protocol description

- 2400 baud S-FSK modulation within the Cenelec A band (9-90kHz)
- Use of FEC is not defined by the protocol and can result in non standard implementations

Hardware platform

- DSC (56F8023) running at 32MHz can manage this protocol up to 85kHz carriers.
- Ideally have a 6+ bit DAC and DMA for transmit to reduce external smoothing.
- Line interface needs up to 20V drivers and is likely to be discrete or SMOS

Key protocol promoters

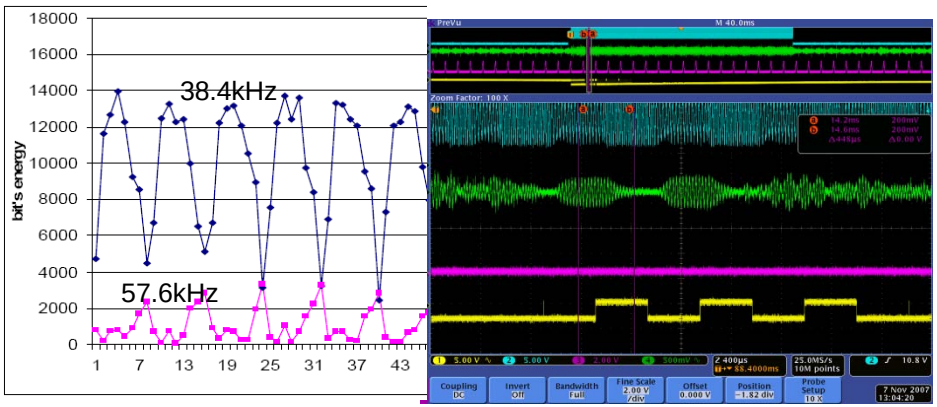
- ERDF using the type of protocol for AMR trials in France

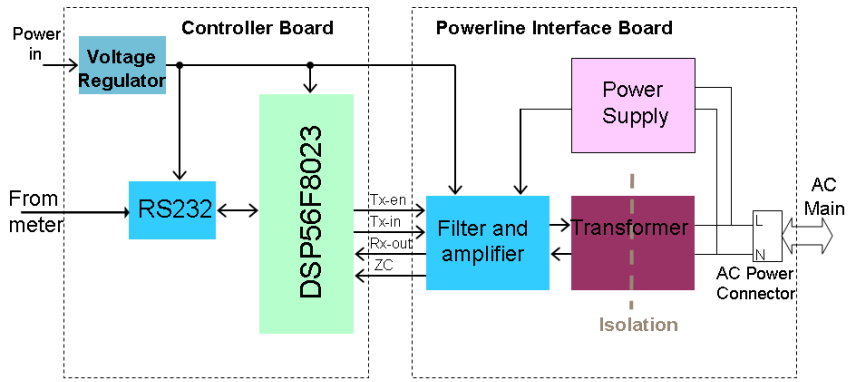
Applications

- AMR for power meters

FSL enablement

- MC56F8025 based PLAN PLM demo





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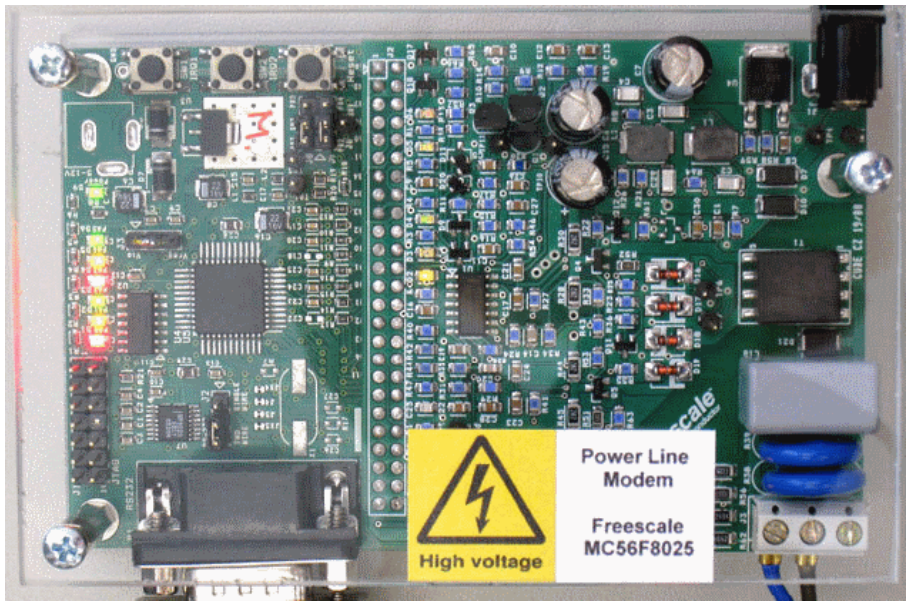
S-FSK Power Line Modem Evaluation Kit and Demo

- This demo serves as PLM evaluation kit – one client (master) and server (slave) on the other side. **MODEM TEST SUITE** is used to evaluate modems behavior. See **USER MANUAL** with demo usage description



- The Spread FSK (S-FSK) Power Line Modem Reference Design provides a complete solution for the communication over the power lines. A software-based solution is running on a Freescale's cost-effective 16-bit Digital Signal Controller DSC56F8023 which is tied to a simple analog front end interface

http://roznov.ea.freescale.net/booking/index.asp?action=ShowDemoSup&IDS=69

http://roznov.ea.freescale.net/booking/index.asp?action=ShowDemoSup&IDS=68

Protocol: PRIME (PLM)

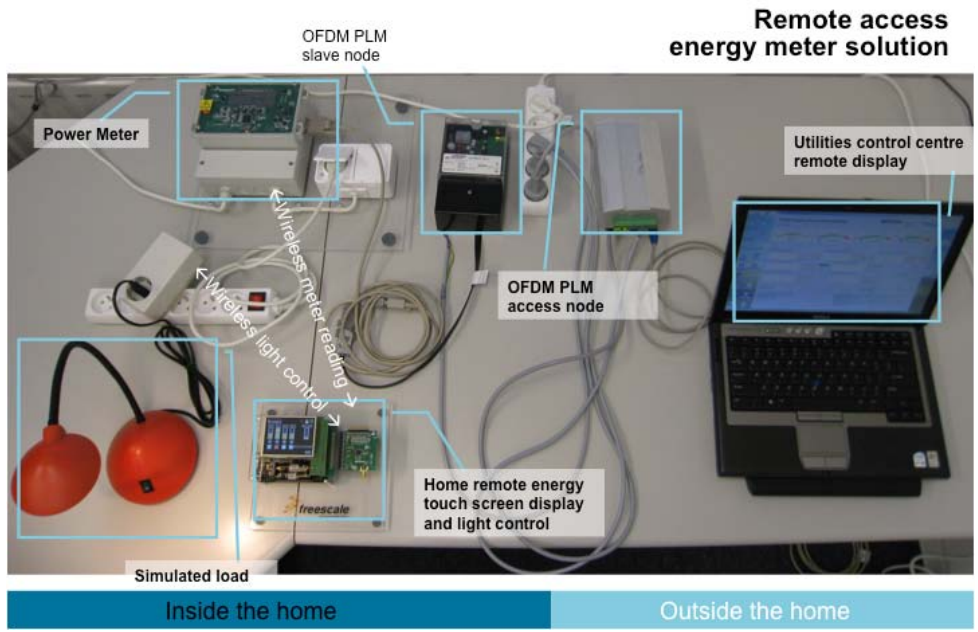
Applications
- Metering AMR, Street lighting
- Potential for in home communications but may be too slow comms speed in which case Homeplug may be better suited to home automation where data rates are ofetn needed.

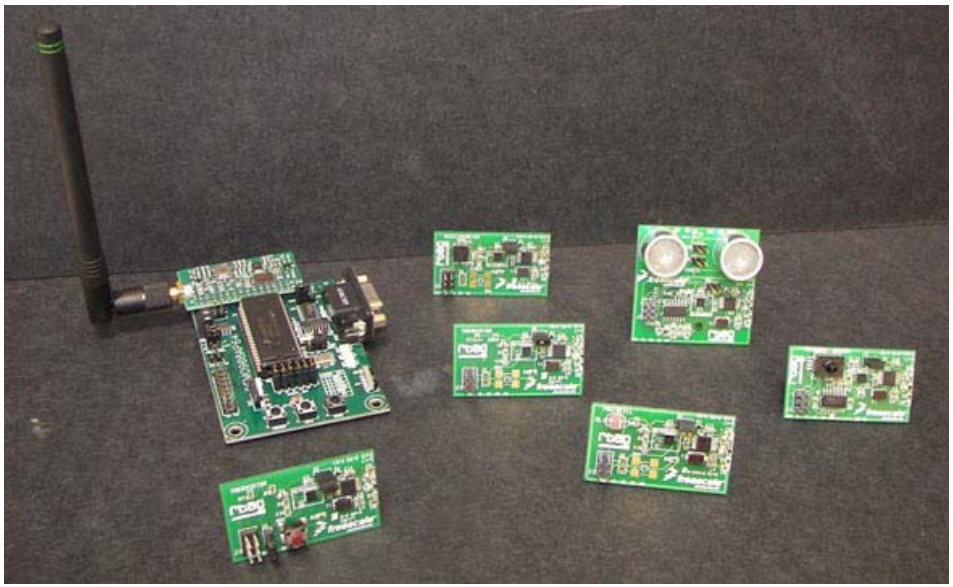
Protocol description
- OFDM Power Line modem for CENELEC band A Utilities use for AMR
- Communications up to 120kb/s in CENELC ban A
- MAC & PHY characteristics currently defined by PRIME
- ALL other protocol details are the subject of the PRIME2 project and are not currently available, these include OSI mapping, Data flow, Software flow, networking layers and application layers

Hardware platform
- Requires dedicated DSP hardware and AFE (ADC/DAC/PGA coupler interface)
- Typically requires hardware acceleration to aid OFDM communications
- PLM modem typically operates as master and communicates with SCI or SPI so no special MCU requirements hardware wise, software oh host TBD (PRIME2)

Key protocol promoters
- Iberdrola
- PRIME consortium
- OpenMeter alliance

FSL enablement
- PRIME2 stack planned for 2010
- Smart home demo using PLC solution from partner arivus /iAd available for larger customers and trade events





Wireless and Sensors for Building Control

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ZigBee®, 802.15.4, SMAC

Protocol description

- Mesh network, mostly on 2.4 GHz band
- The radios use direct-sequence spread spectrum coding, which is managed by the digital stream into the modulator
- BPSK is used in the 868 and 915 MHz bands
- Orthogonal QPSK that transmits two bits per symbol is used in the 2.4 GHz band
- The raw, over-the-air data rate is 250 kbit/s per channel in the 2.4 GHz band, 40 kbit/s per channel in the 915 MHz band, and 20 kbit/s in the 868 MHz band
- Transmission range is typically between 10 and 75 meters (up to 1500 meters for ZigBee PRO), although it is heavily dependent on the particular environment
- The maximum output power of the radios is generally 0 dBm (1 mW)

Hardware platform

- Dedicated RF stage required
- MCU provides MAC and network layer
- S08 and i.MX (ARM7 core) solutions available from Freescale

Applications

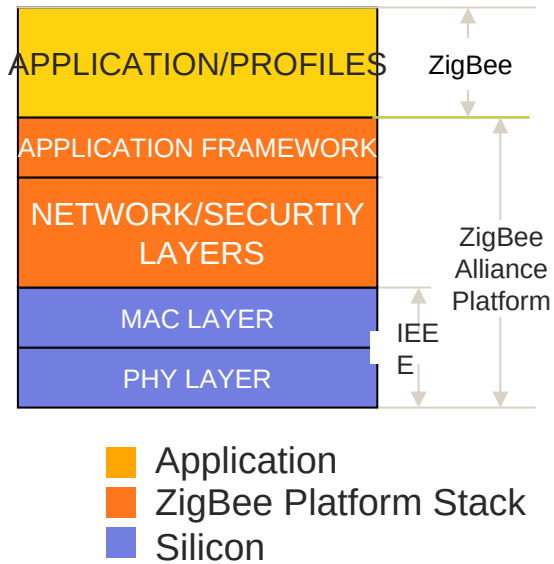
- Commercial building automation and control
- Home automation and control
- Utility/plant management
- Institution and home patient monitoring

Key protocol promoters

- ZigBee® alliance

Freescale enablement

- Silicon available today – latest is MC13224
- BeeStack, ZigBee PRO, RF4CE available today for i.MX and S08
- BUT no simple way to run on ColdFire® – need a refined interface without clock dependencies



http://www.zigbee.org/

WirelessHART

Protocol description

- Wireless mesh network protocol based on 802.15.4
- Standard published in September 2007
- Extends HART protocol to provide wireless capability
- Now managed by WiTECK Consortium of which Freescale is a founding member

Application requirements

- Battery Powered Sensor Nodes. 2-3 year battery life is a hard requirement. For Process and Industrial Automation sensor networks, TDMA is required for deterministic timing (ZigBee is CDMA). Channel Hopping and Mesh are required for Process Automation markets (WirelessHART and ISA100). - radio transceiver most likely IEEE 802.15.4. Extreme Low Power 16/32 bit MCU + transceiver. TI-MSP430 + CC2520 radio is benchmark.
- Best play we have today is the MC1322x PiP due to 18mA receive current and 30mA transmit current is at least acceptable. Benchmark is DUST Networks SoC has 7mA receive current and 15mA transmit current.
- A FCC, CE certified radio module seems to be a key enablement piece.
- Nivis is developing a radio module with TCXO integrated.
- 16K minimum RAM required to manage WirelessHART stack
- For battery applications < 20mA receive power (vs DUST at 7mA), < 30mA transmit power w/o PA (vs DUST at 15mA)
- High accuracy 32 KHz frequency source needed (+/-5ppm over -40-+85 deg C) Currently this technology can only be found in a couple of parts, i.e. Epson-ToyoCom RX-4801-JE/SA, Dallas Semiconductor (Maxim) DS3234
- 10dB Output Power
- Application processor should be extreme low power 16- or 32-bit. MCF51QE128 is our best play at this point.
- Ongoing discussions with Softing GmbH who are developing WirelessHART based Gateway – next meeting mid February

Key protocol promoters

- WITEK consortium
- Freescale is a founding member

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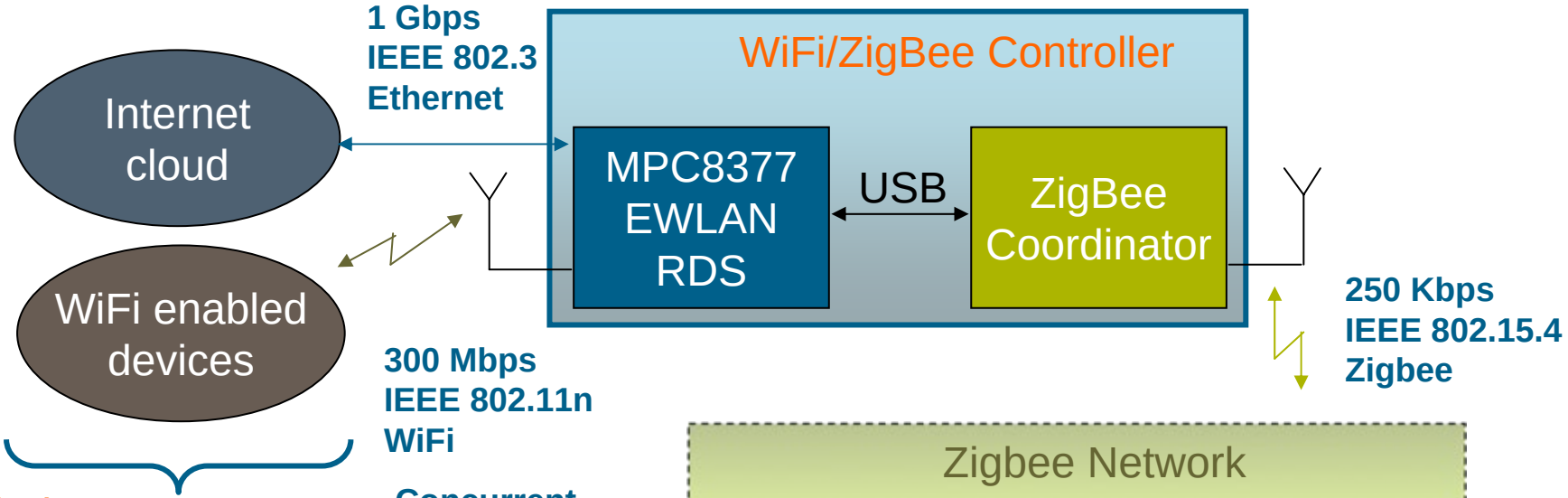
Wireless Remote Monitoring and Control with ZigBee®

Wireless service provider access



Wireless
Intra- premise access

Wireless (802.11n WiFi and 3G) connectivity for remote monitoring and control

Remote ZigBee sensors – Industrial and medical, building automation (e.g. Smart Metering)

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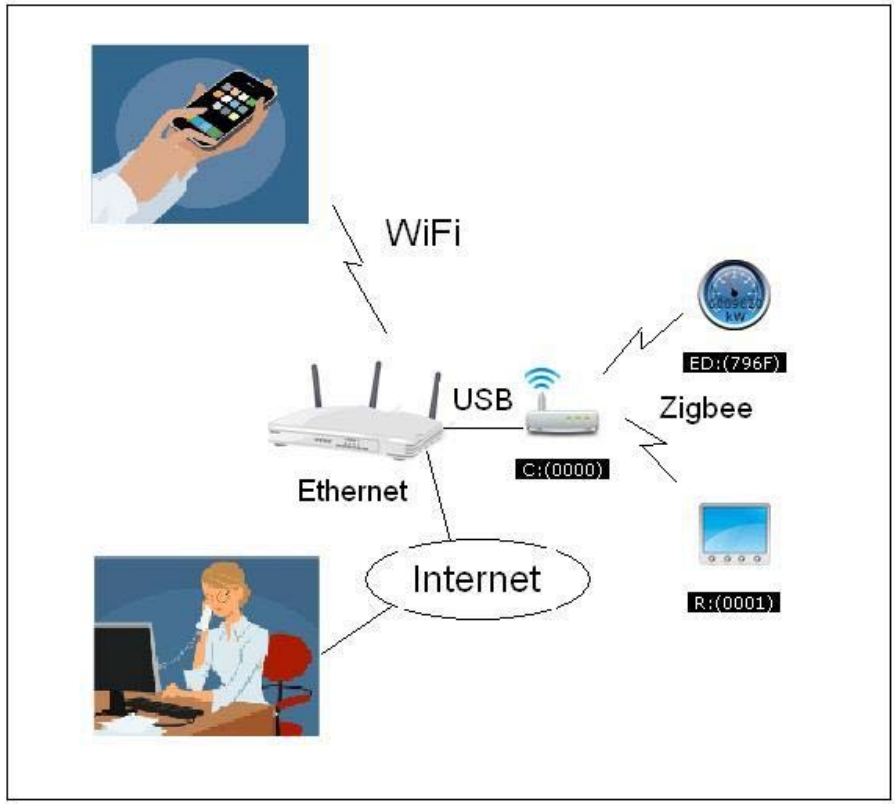
Wireless Remote Monitoring and Control with ZigBee®

freescale semiconductor **ZigBee® Remote Demo**

Wireless intra- premise access

Wireless (802.11n WiFi & 3G) connectivity for remote monitoring and control



Gas meter

Electric meter

Water meter

Wireless service provider access

Other ZigBee® sensors (Temp, Pressure, Humidity etc)

Remote ZigBee sensors – industrial and medical, building automation (e.g. Smart Metering)

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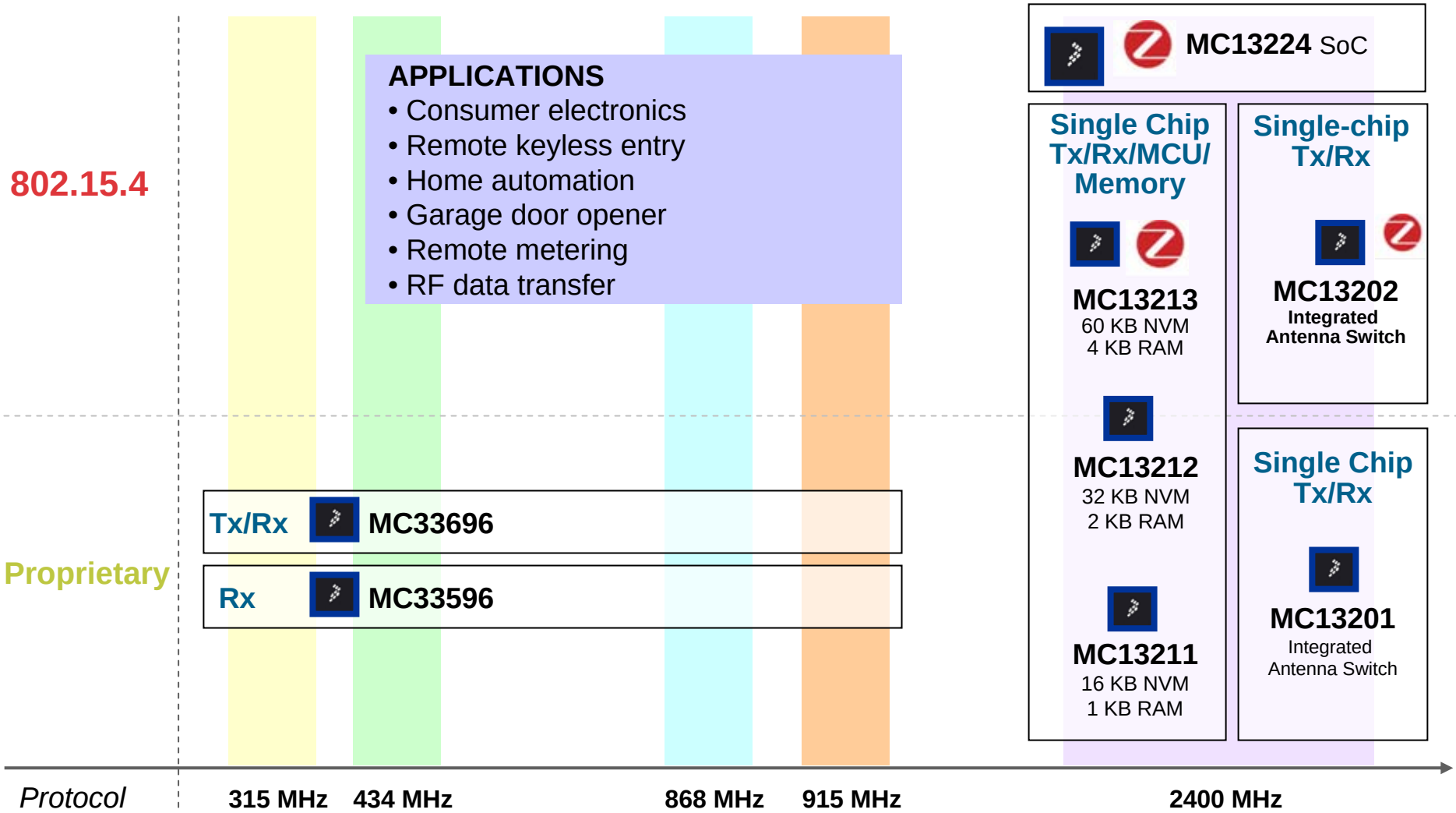
Wireless Connectivity Solutions Portfolio



ZigBee™-certified

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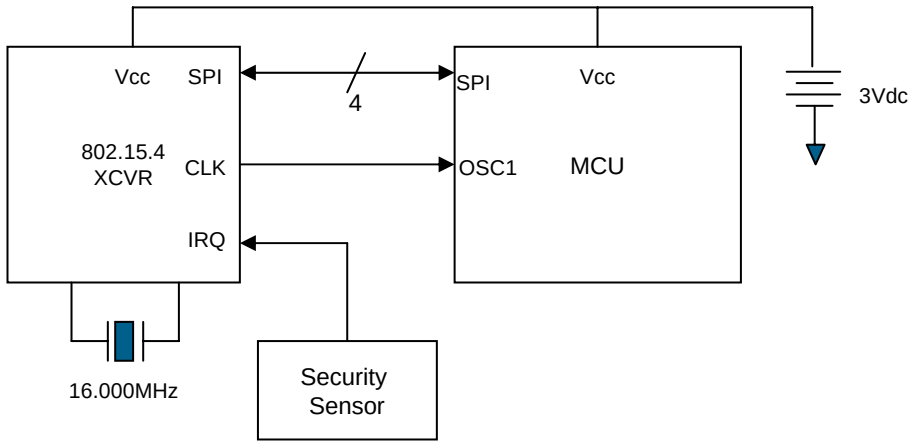
Peel-n'-Stick Security Sensors



- Battery Operation
  - 2 AA Alkaline 1600mAh
- 802.15.4/ZigBee® Mode
  - Non-beacon network environment
- Sensor process
  - RC oscillator waking up MCU and doing network check-in at some interval
    - Many security systems have between ~10 second and ~15 minute requirement
  - On a sensor event, device immediately awakens and reports in to network

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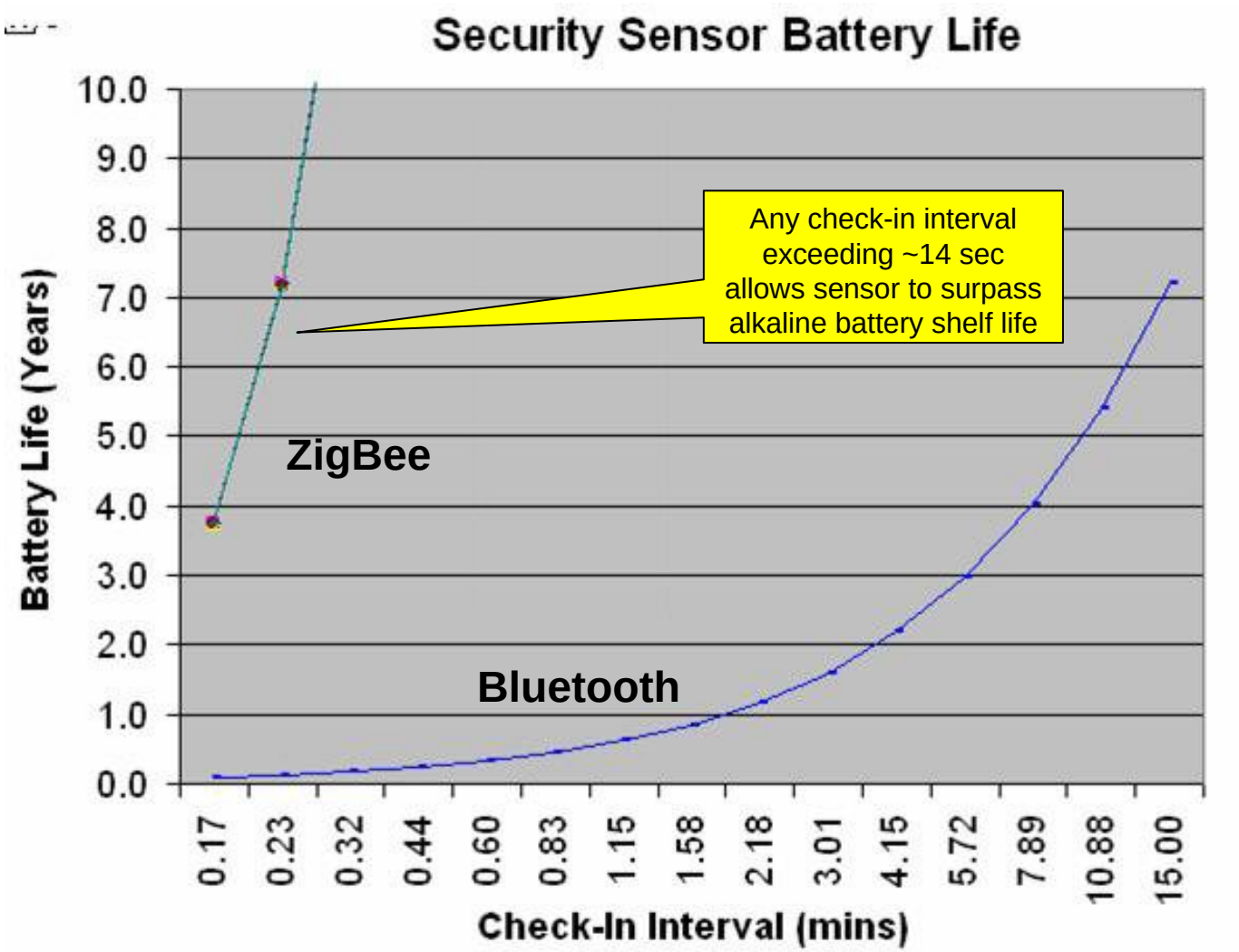
ZigBee® Security Sensor Lifetime



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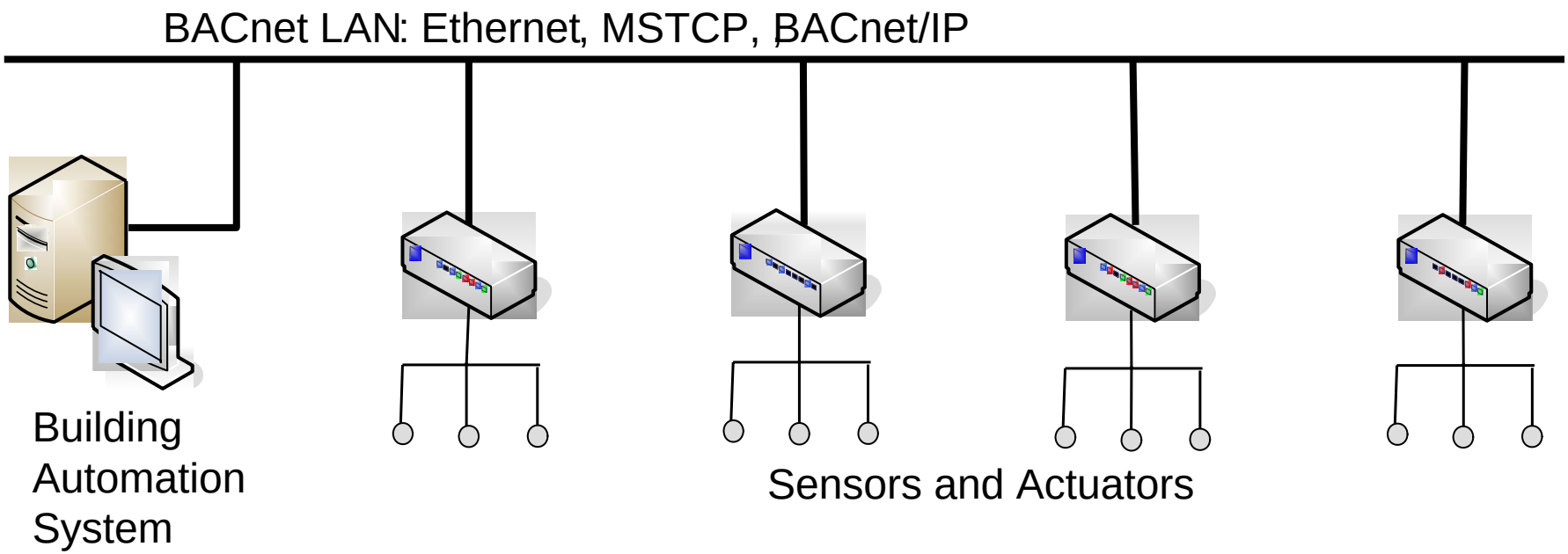
BACnet

- Mechanism to interconnect Building Automation Systems
- Various forms on various physical layers
- Ethernet TCP Version (BACnet IP)
- Networking backbone to link services and system components



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Industrial Digital Voice (VoIP)

Digital Voice Applications:

- Intercom Systems
- Public Address Systems
- ATAs, IP Phones

Factory Automation
Remote Monitoring
Manufacturing Equipment Support
Operator Panels

HVAC & Building Control
Access Control Intercom
PA Systems
Monitoring Systems
Remote Signal Monitoring
Remote Sensor Monitoring
Train PA Systems

Point of Sale
Card Payment Terminals
Automatic Teller Machines
Vending Machines
Ticket Vending Machines
Gas Pumps
Remote Customer Support
Restaurant order systems

Medical Instrumentation
Home Patient Monitoring
Patient Monitoring
Remote Signal Monitoring
Patient Intercom System
OR Voice Recorder Systems
Remote Physician Systems
Equipment Support

Fire/Security
Fire Alarm PA
Fire Alarm Control Panels
CCTV Cameras & Audio Monitoring
Intruder Alarm Control Panels
Intruder Alarm Audio Monitoring
Access Control Intercom
Emergency Phones
Site Wide Cordless Phones

Complete Hardware, Software, and Support Solutions – No NRE, Royalty included in product price:

- Voice only End Point – 32-bit MCUs
- Application with Voice functions – MCF53281, MCF53721, MCF53016, MCF53017, MPC83xx, MPC8536 P1020, P1022
- Asterix SIP Server – MCF5445x, MCF5441x

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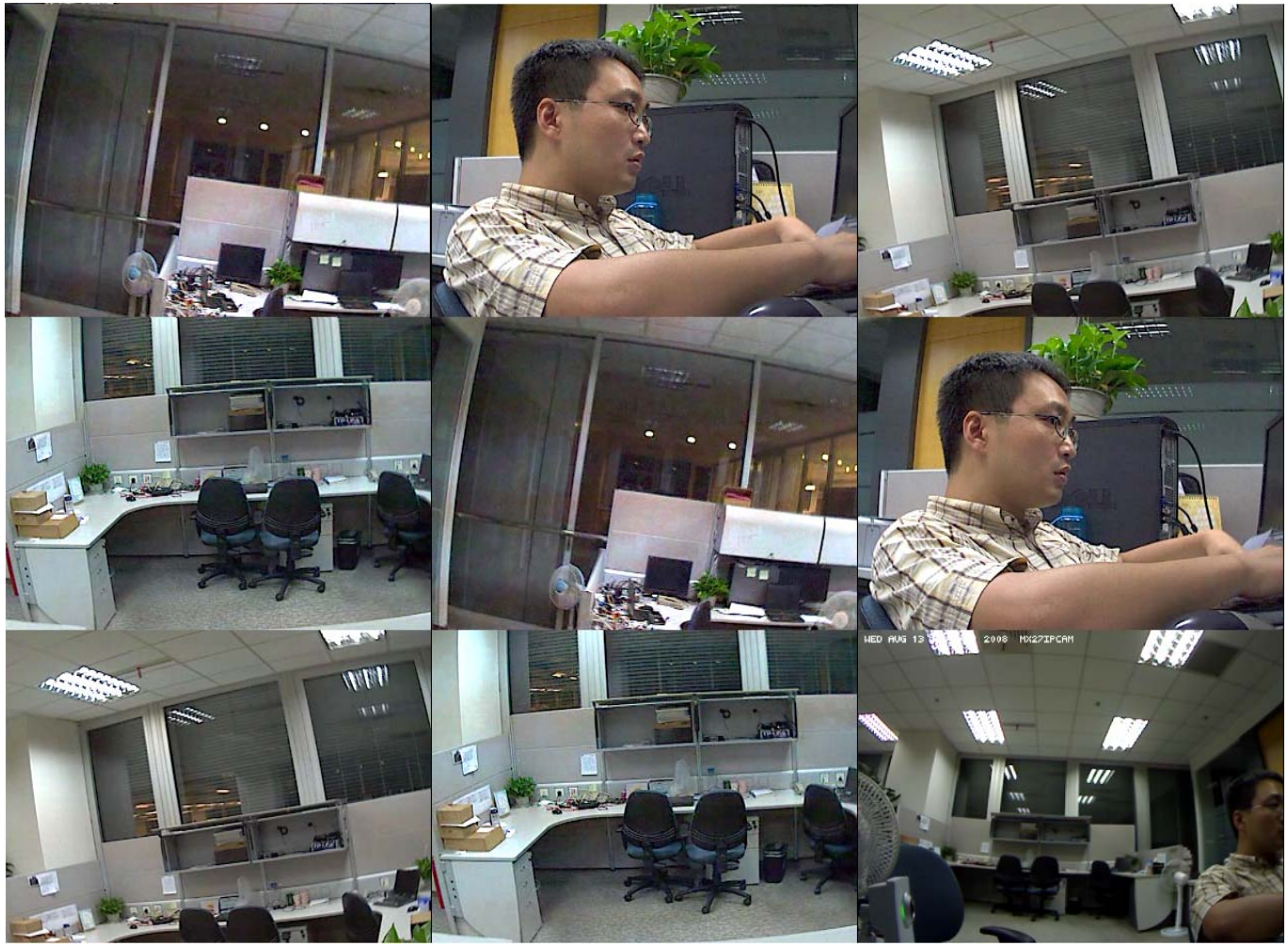

Video Surveillance and Security

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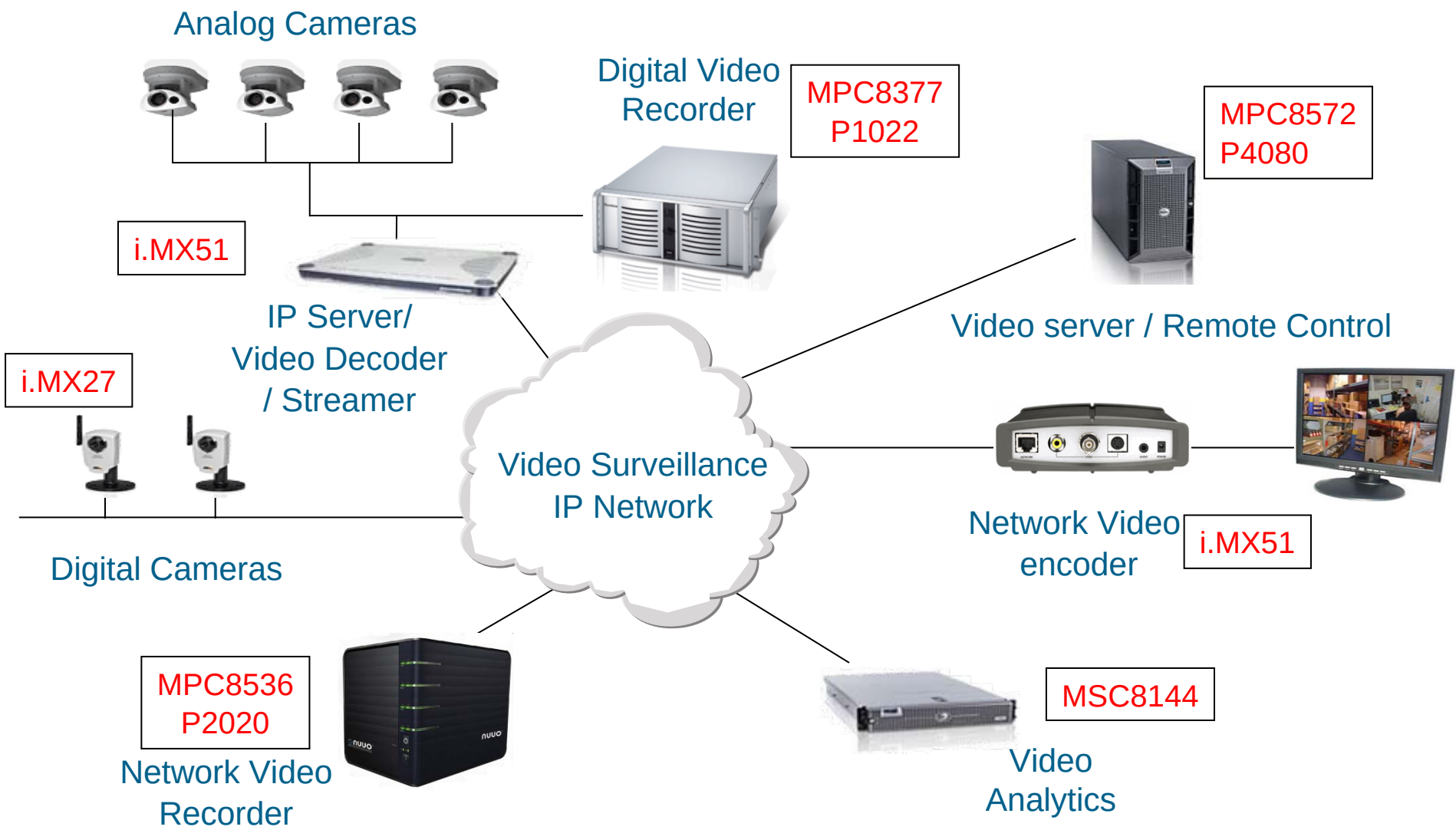
Video Surveillance System OVERVIEW



i.MX27 IP Camera

- IP Camera Kit includes:
  - Form-factor IP camera with enclosure, tripod
  - IP-CAM Developer's CD:
    - Hardware and software reference manual
    - Design files (Gerber) and schematics
    - BOM for CPU board and imager board
  - Freescale Linux BSP with integrated drivers (sensor), middleware and applications
  - FCC and CE compliant
  - Royalty-free reference design
  - Available for order (MCIMX27IPCAM) $1995

- **Software Features**
  - Integrated Web Server for all user configurable parameters
  - Multiple User Configurable Video Parameters
    - Compression format: H.264, H.263, MPEG-4 Part 2
    - Resolution: SQIF, QCIF, CIF, QVGA, VGA, up to D1
    - Frame Rate: 5 - 30fps
  - Remote Video Viewing
    - PC - Standard browser IE over IP – wired, wireless
    - On Screen Display (OSD) date, time and location (configurable)
  - Network Connectivity
    - Interface: 10/100 Ethernet or 802.11b/g, Protocols: TCP/IP, UDP/IP, HTTP, tftp, telnet, dhcp
    - Serial (primarily for development – console, debugger etc.)
  - Motion Detection
    - Baseline implementation to detect motion in field of view
  - Remote firmware upgrade procedure

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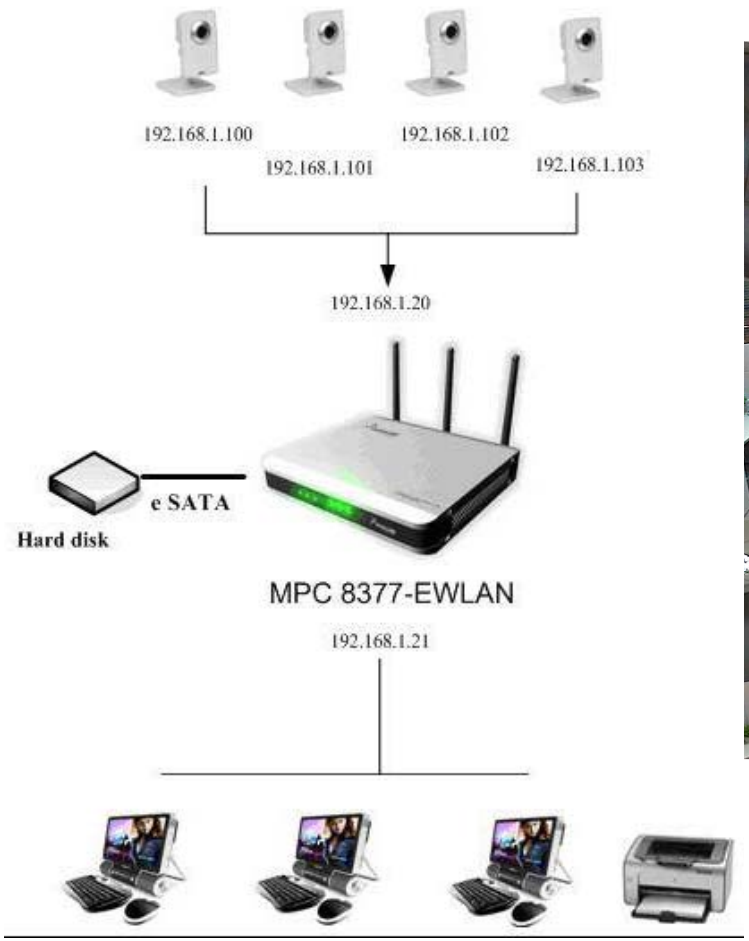
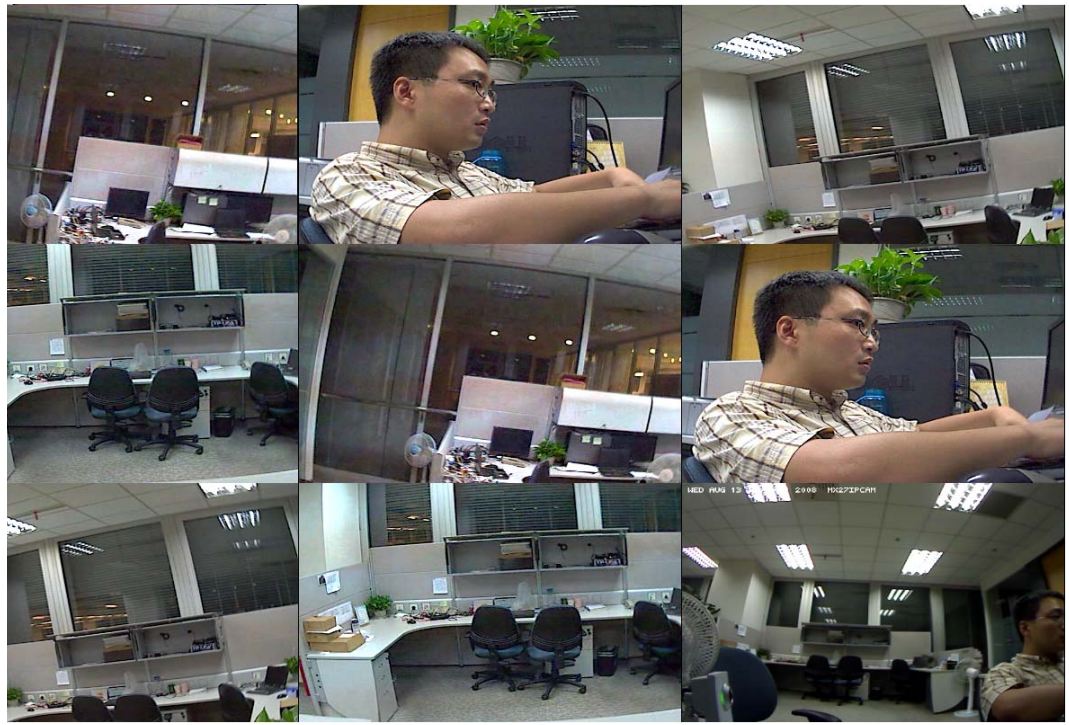
Video Surveillance: Network Video Recorder (NVR)

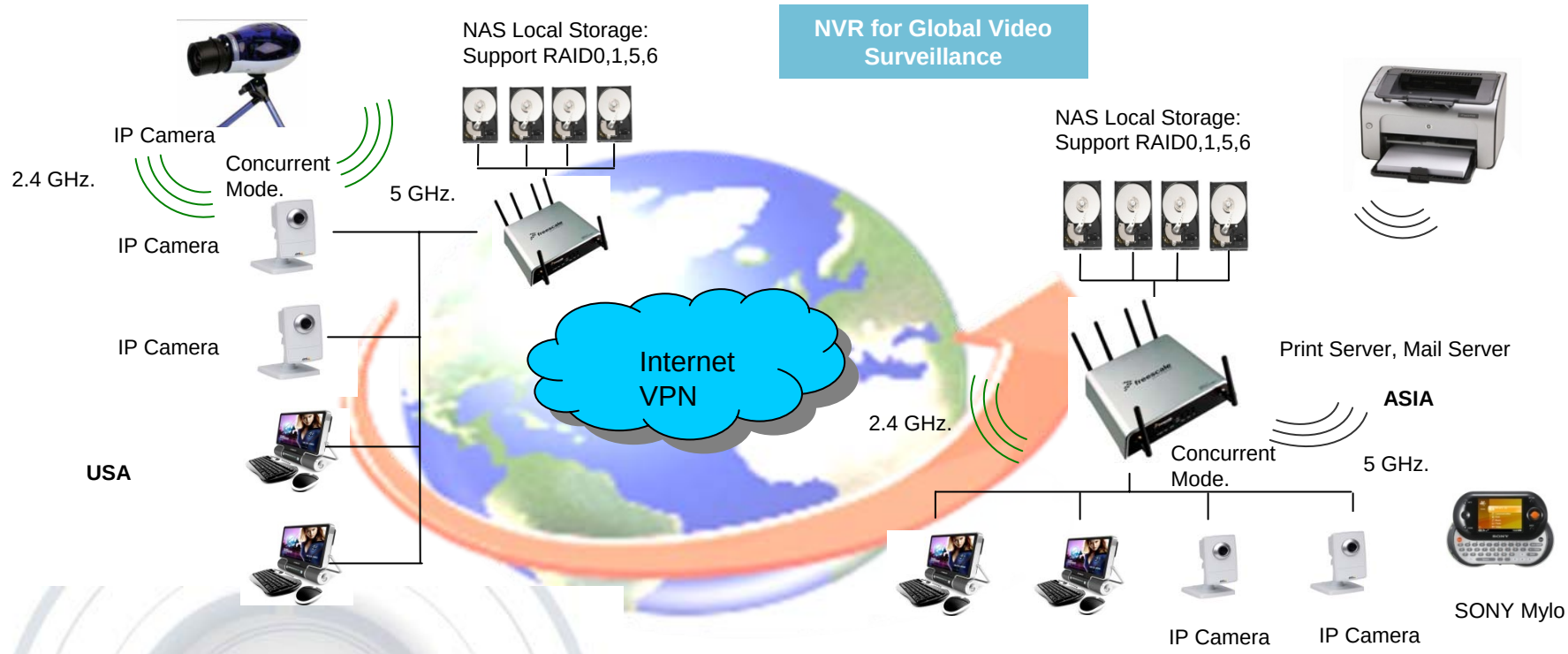




NVR Console: Matrix Mode

- Maximum support up to 15 channels simultaneously at 30 FPS D1(equivalent to 45 Mbps)
- Maximum support 120 channels for monitoring

Video Surveillance: Network Video Recorder (NVR)



- Reference Design Solution (RDS) platform for high performance NAS and NVR
- Enabled with optimized Linux® Open Source application for integrated network services
- Configuration management GUI
- Scalable from MPC831X to P20X0

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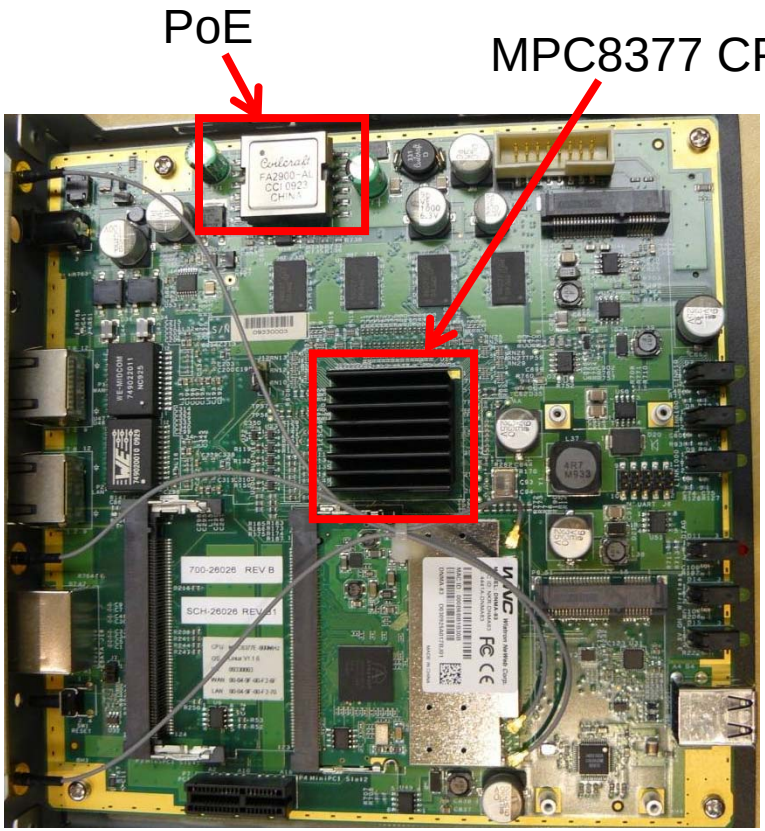
MPC8377EWLAN : Hardware Features



Orderable PN: MPC8377EWLANB
Price: $449.00

Hardware Features

- MPC8377E PowerQUICC® II Pro CPU
- 800 MHz core frequency
- 400 MHz DDR2 interface;
- **Memory subsystem:**
- 256 MB to 512 MB DDR2 SDRAM
- 32 MB to 64 MB NOR flash
- **Interfaces (Internal):**
- 2 x MiniPCI
- 2 x MiniPCI-Express
- 1 x PCI Express®
- RS232
- **Interfaces (External):**
- 2 x 10/100/1000 Base-T
- USB 2.0 Type A connector
- 2 x SATA II
- Power over Ethernet
- IEEE® 802.3af compliant 3 x 3 MIMO solution
- CE/FCC Class B certified
- Lead free (ROHS)
- 6-layer mini-ITX form factor PCB
- BOM Cost <$100 for 25Ku+/yr

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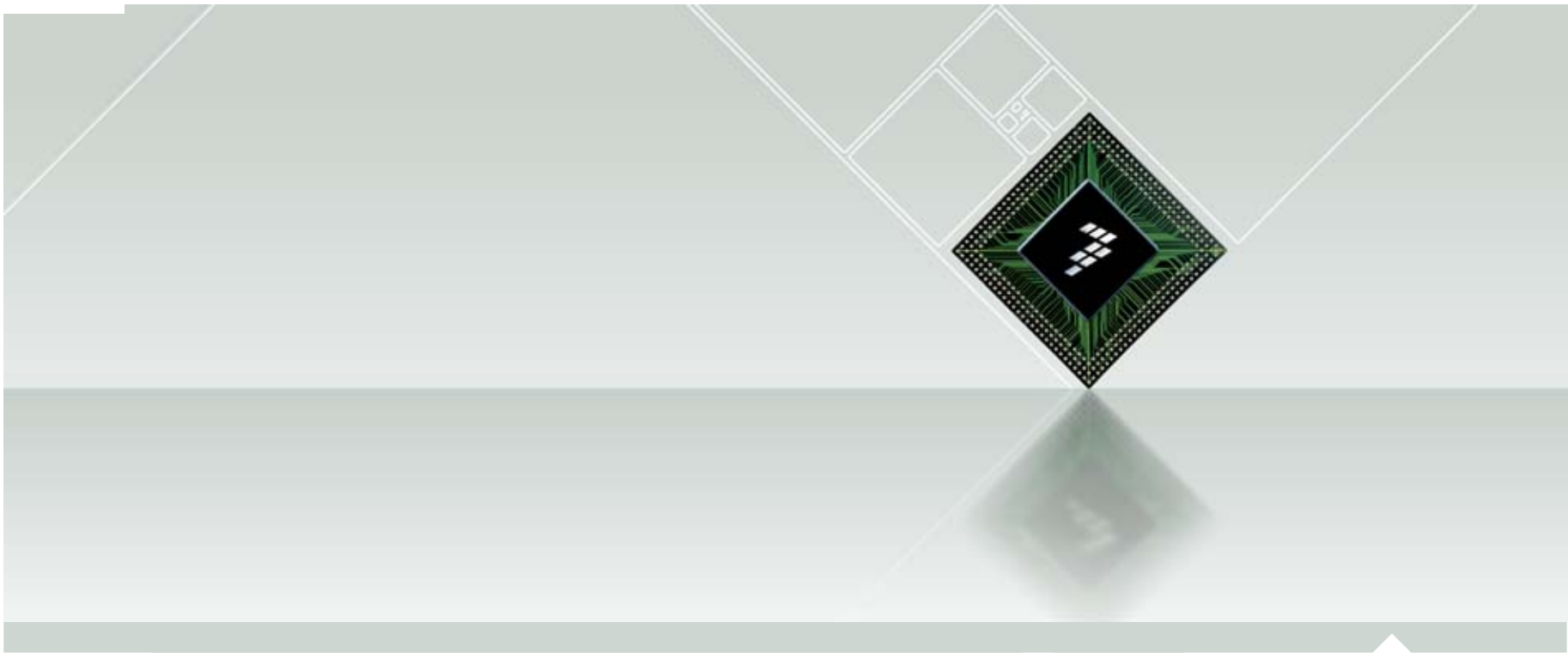

Enablement

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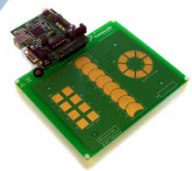
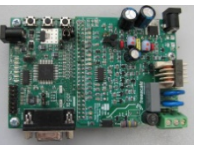
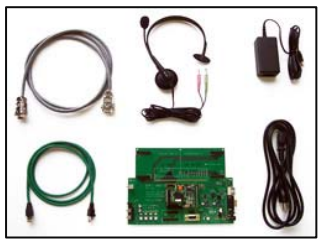
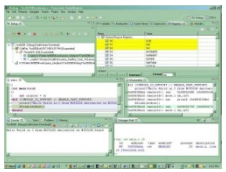
Building Control Key Enablement

Available:

- MQX RTOS and Protocol Stacks, free license for ColdFire products
- Linux, WinCE BSPs available from Freescale for i.MX ARM products at no charge
- Capacitive Touch sensing
- <$10 1-phase Electricity Meter Reference Design based on 9RS08KA8
- i.MX27 IP Camera reference design (www.freescale.com/imx27ipcam)
- Multimedia codecs library for audio, video and speech available royalty-free for i.MX portfofio (www.freescale.com/imxcodecs)
- Low cost Meter Reference Design based on 9S08LL32
- ZeroG WiFi (b/g) module with SPI interface
- Power Line Modem Reference Design
- 3-phase Electricity Meter simulation demo, using MCF51EM256 and 9S08QE8
- Digital Voice as part of Linux application solution and kit, with $0 NRE – MCF53281, MCF53721, MCF53016
- Digital Voice Asterix SIP server running on MCF5445x
- CodeWarrior 10.0 – Supports multiple architectures
- Tower evaluation and fast prototyping system
- 3-phase Electricity Meter production ready Reference Design based on MCF51EM256
- Residential Gateway reference design based on MPC8308
- Speaker independent Voice Control

Freescale MQX Software Solutions

Full- Featured and Powerful

Freescale owns

- Source code, rights to distribute and modify across the Freescale portfolio

Benefits

- Full production source code* with silicon
- Business-friendly licensing model that lets developers keep their source modifications
- Small, configurable footprint
- Integrated stacks (TCP/IP, USB, etc.)
- Customers focus on their application, not drivers, porting work, or integration work

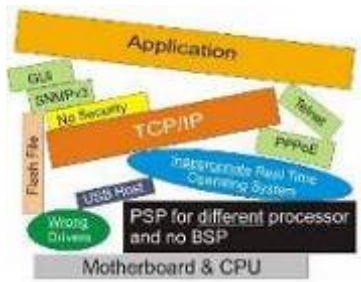
* Complimentary with selected ColdFire products. Subject to License Agreement

Selected e300 core processors supported: MPC837x (today) MPC8306/09 end 2010

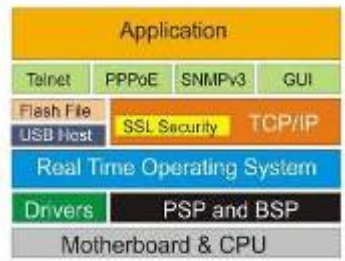
What is Freescale MQX?

- RTOS (Full priority-based, pre-emptive scheduler)
- Real-time TCP/IP Communication Suite (RTCS)
  - TCP/IP, FTP, Telnet, DHCP, SNMP etc..
- USB Host - HID, MASS, HUB
- USB Device - HID, MASS, CDC
- MS-DOS File System (MFS)
- BSP I/O Driver: CAN, UART etc…
- HTTP Web server

Past Customer Problem



The Solution



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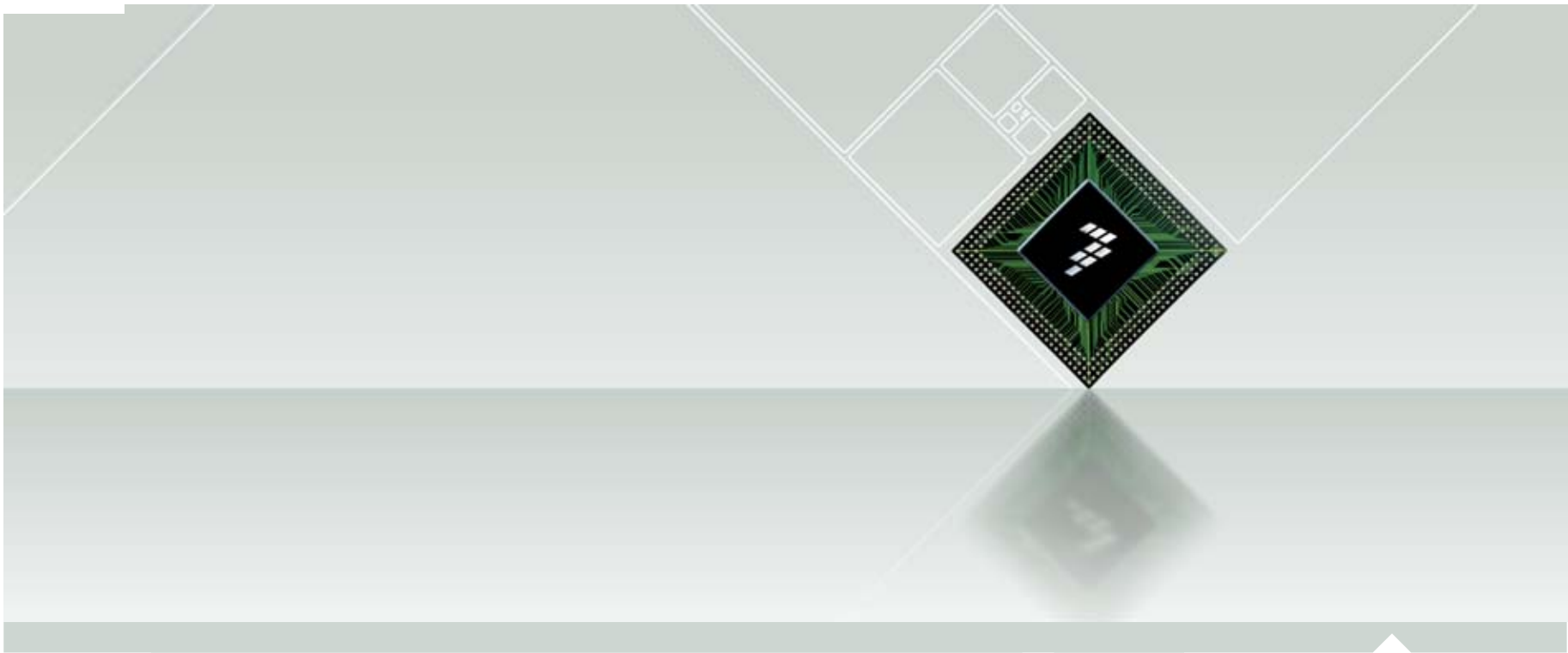

Freescale portfolio

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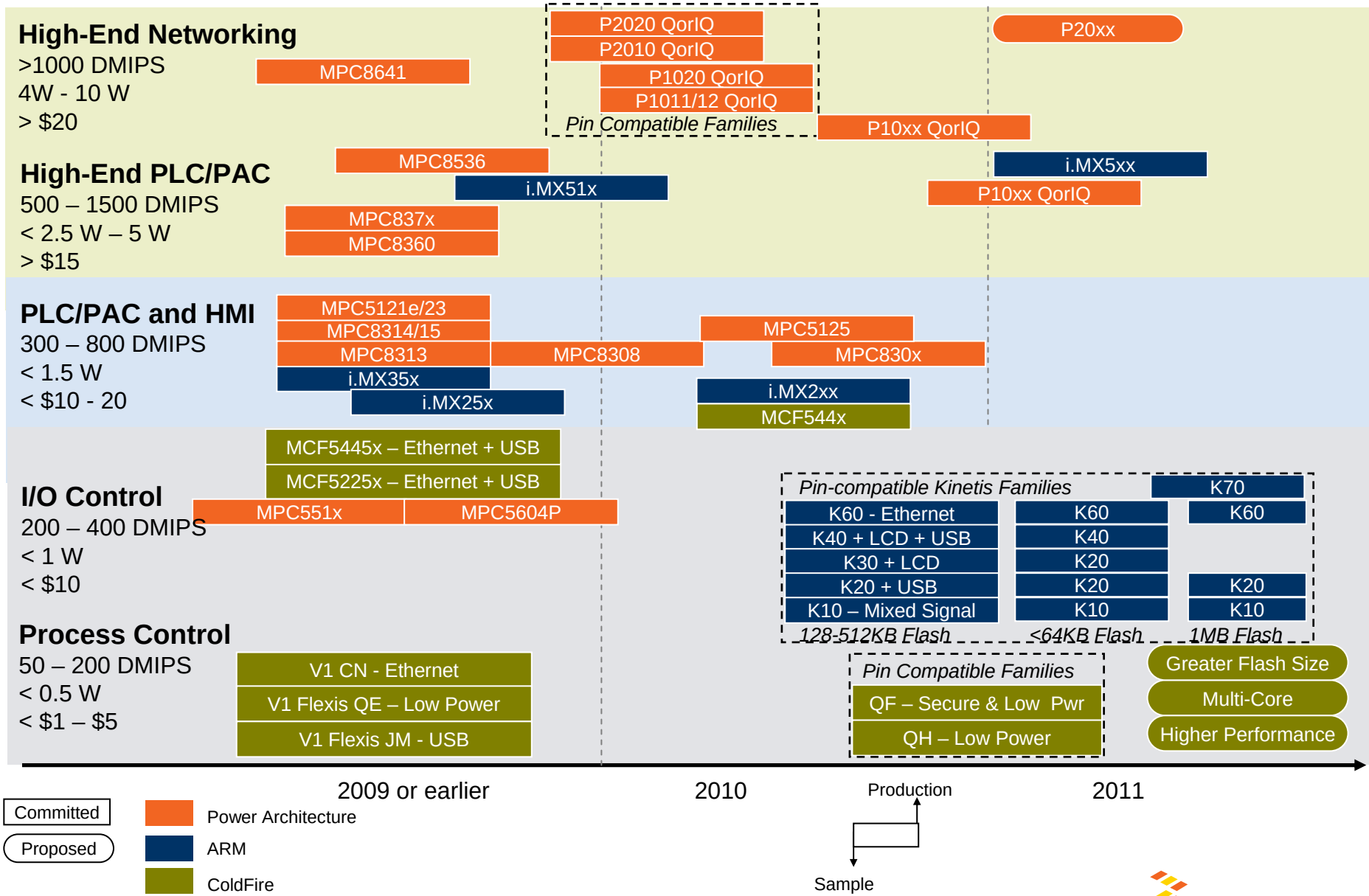
Processors for Industrial Control, Networking and HMI



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A Winning Smart Energy Portfolio

Measurement, Load control, demand response, real time monitoring to lower energy costs

Applications	Freescale Solutions
 Gateway Router, Data Concentrator, Switches	**Application processor:** PowerQuicc QorIQ i.MX **Microcontrollers:** **MCF51EM256** **MC9S08LH64** **MC9S08GW64** MC9S08LL Flexis QE, Flexis AC MC9S08MZ (China) MC9S08LG32 MC9RS08LA MC9RS08LE
 Electricity, Gas, Water, Heat Meters	MCF51EM256 MC9S08GW64 NEXT GEN MC9S08LH64
 Last Mile Connectivity/NAN	**Power Line Comms** RF Home Plug GreenPhy
 Meter,  Appliance,  Microgrids,  T-Stat,  **Premise Device**,  Electric Vehicle Home Area Network (HAN)	**Applications Processor:** MCF51MM, ColdFire, Digital Signal Controllers **RF:** MC1322x with Smart Energy Profile 2.0
Power Management Unit	MC13892, MC33730,MC34704
Sensors	Accelerometer: Tamper Detect MC33941, MPR03x (Proximity) MP3V5004, MPX12 (Pressure)

MPC83xx MPC85xx | i.MX25 | ColdFire | P2010 - 2020

Partnerships

ColdFire | ColdFire | NEXT GEN | NEXT GEN

MC1322x SE 2.0

MMA745xL | MMA736xL

Available Now → **2011-12**

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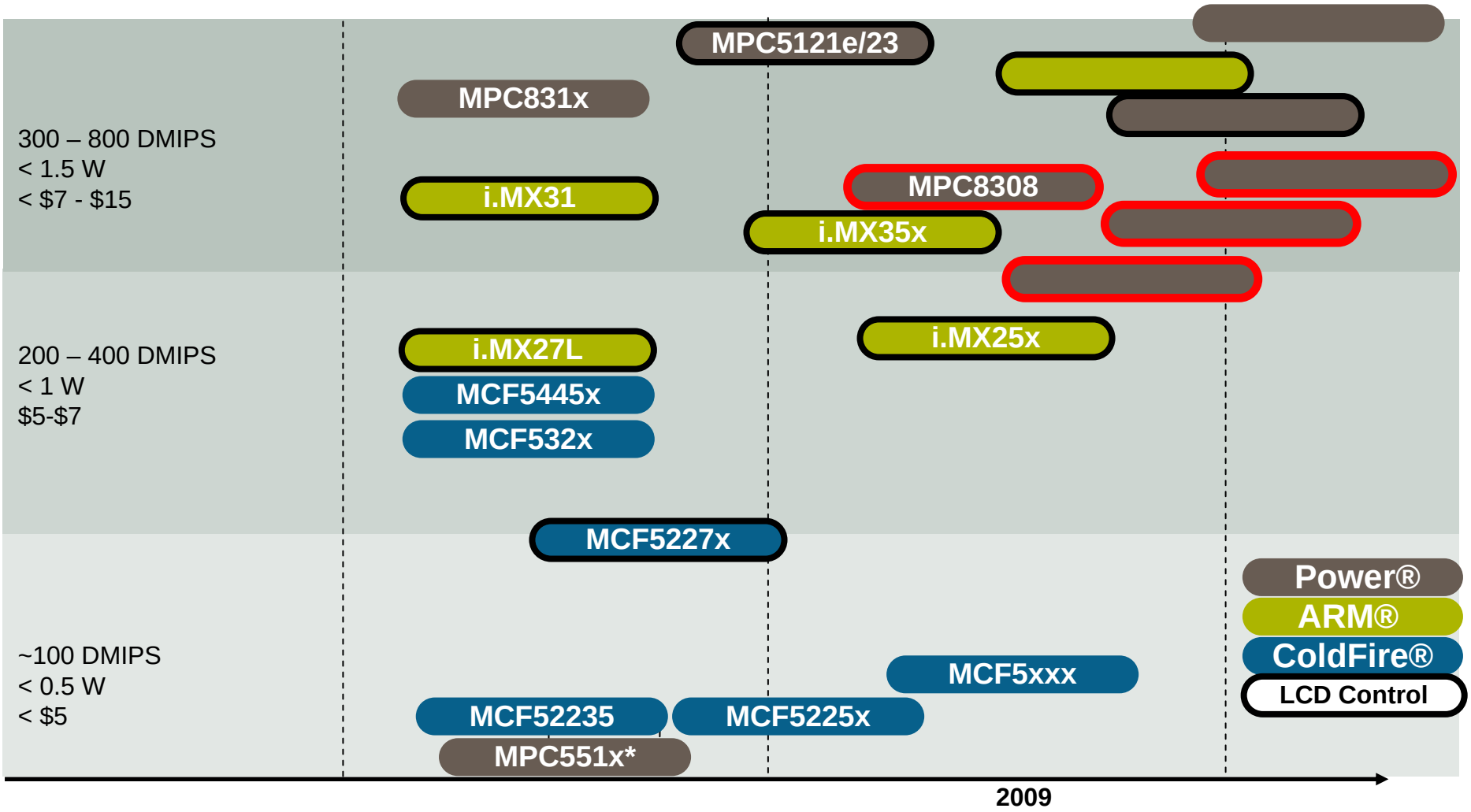
Low-End Embedded Networking



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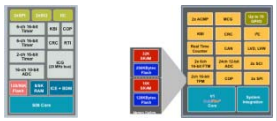
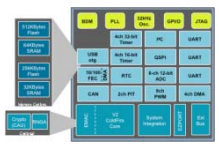
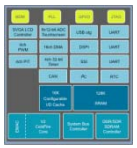
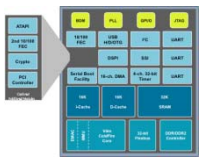
Building Control Key Freescale Products









Launched:

- VLP MCU 1.8V to 3.6V Continuum – 8-bit and 32-bit, 1 KB to 128KB Flash, 6 to 80 pins
- 5V MCU Continuum – 8-bit and 32-bit, 1 KB to 256KB Flash, 6 to 80 pins
- MCF56F8300 Family – DSCs for Motor Control and Energy Conversion, up to 512 KB Flash
- LCD Products – 8-bit to 32-bit MCUs and MPUs, 6x4 to 8x45 segments, to SVGA
- S08FL/SV16 – General Purpose 5V MCU with 16 KB Flash
- S08LG16/32 – LCD MCU with 16 or 32 KB Flash
- S08ACxxx/MCF51ACxxx – MCUs with Motor Control Timer, 8 KB to 256 KB Flash
- MCF51CN128 – MCU with Ethernet, 128 KB Flash, $2.99
- MCF5225x – MCU with Ethernet, USB, and up to 512K Flash
- MCF5227x – MPU with SVGA, Touchscreen, and USB
- MC56F800x – DSC with 32 MIPS, and up to 16 KB Flash
- MCF51EM128/256 – Metering MCU with 16-bit A/D metrology, 128/256 KB Flash, Security
- MCF5301x – MPU with 2x Ethernet, 2x USB, Audio
- MCF532x – MPU with SVGA, Ethernet, USB, CAN
- MCF5445x – MPU with MMU, 2x Ethernet, USB, PCI, Serial Boot
- i.MX25x – ARM9 MPU with Ethernet, LCD controller, A/D, CAN, Security
- i.MX35x – ARM11 MPU with Ethernet, OpenVG Graphics, LCD Controller, CAN
- i.MX51x – ARM Cortex A8 with Ethernet, dual LCD Controllers, Open VG and GL graphics, video encode/decode
- MPC8308 – e300 MPU with Ethernet IEEE1588, LCD controller, SDHC, USB 2.0, PCIe
- P1022 – dual e500 with Ethernet x2, LCD controller, SATA, PCIe x6 and Android support

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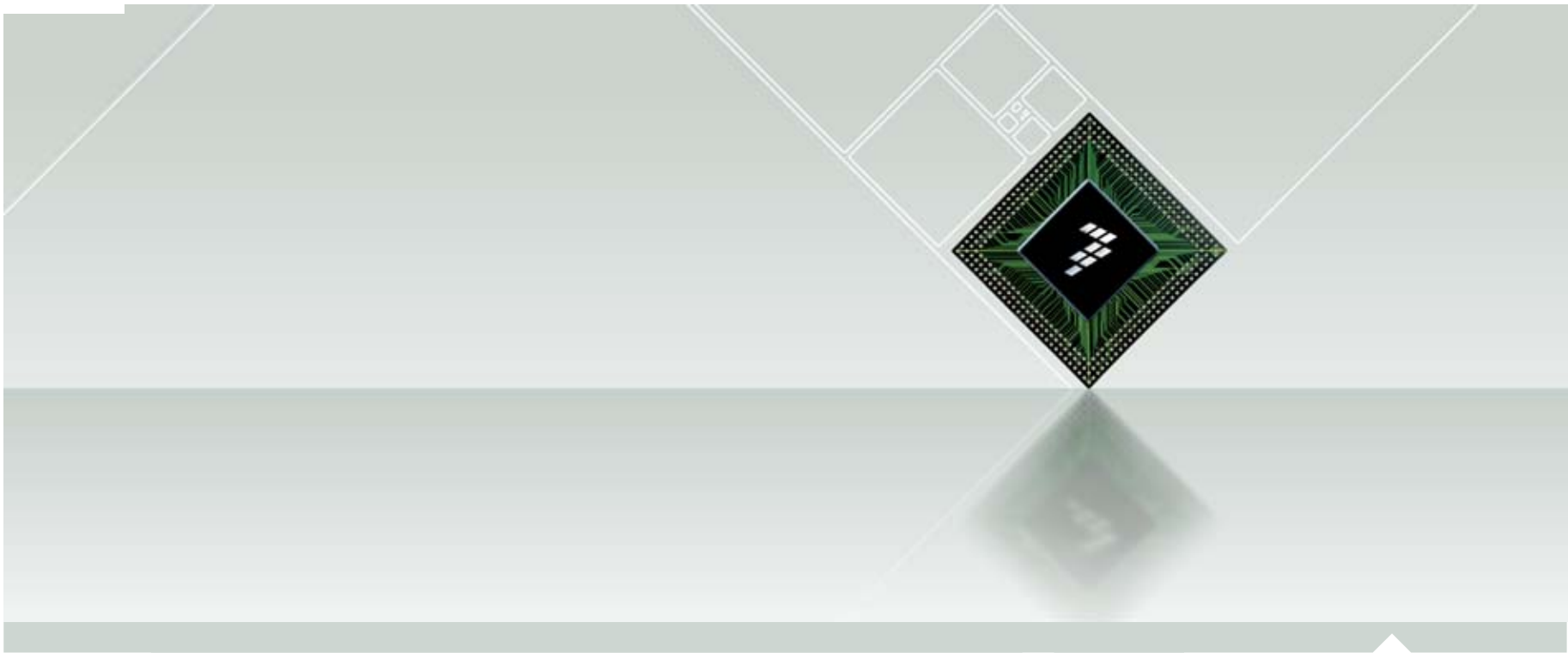
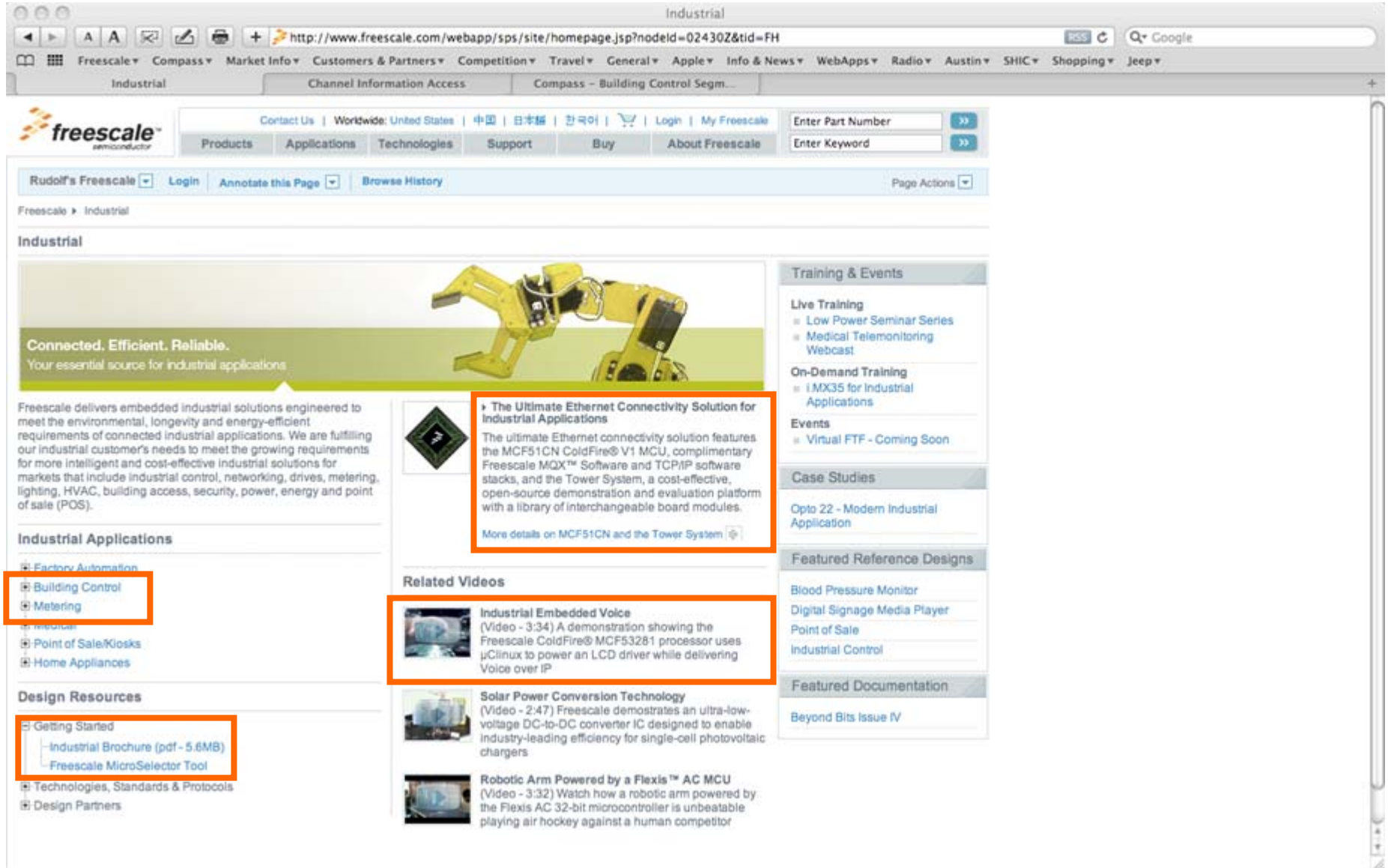


Where to find out more…

Freescale Web - Industrial



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