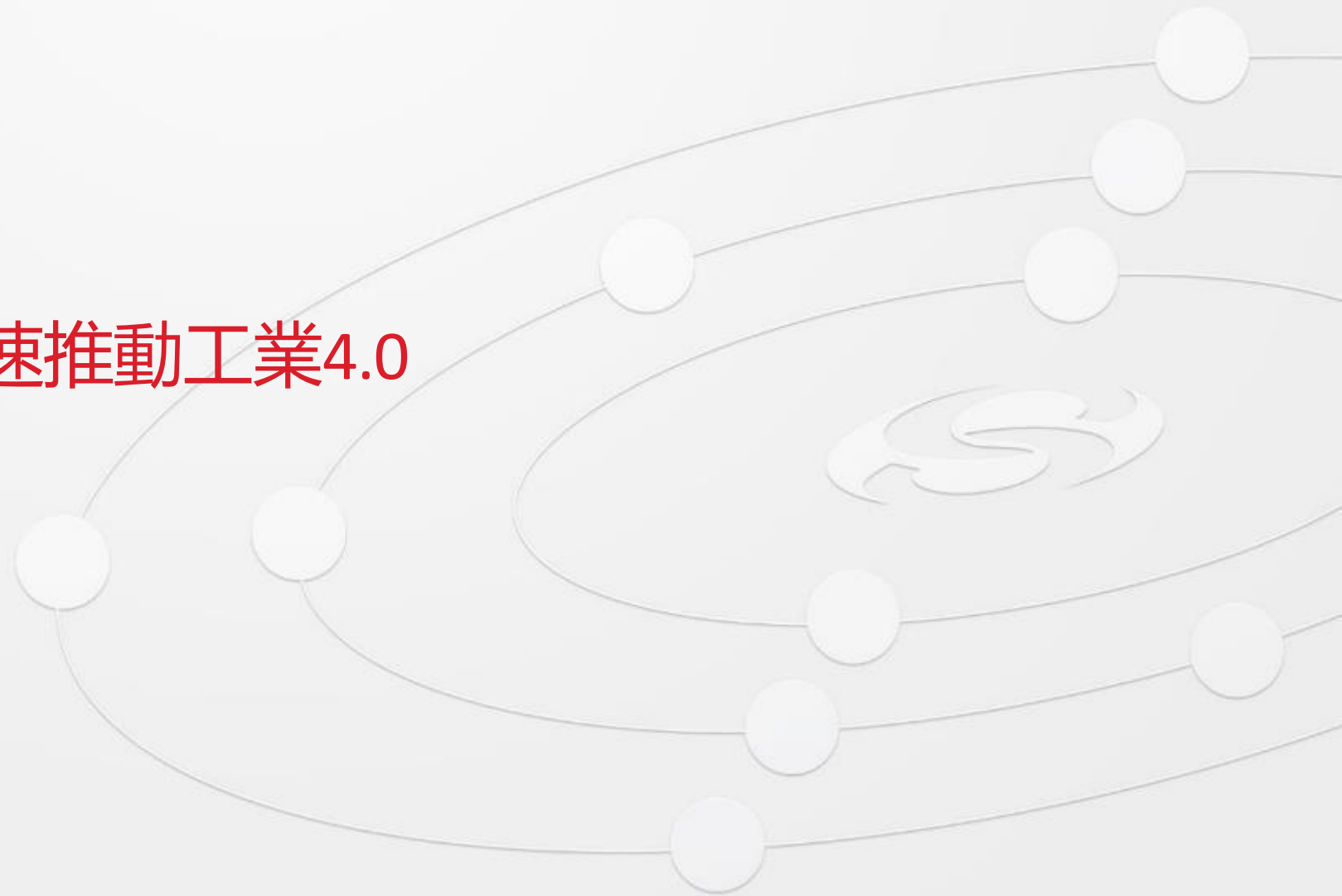# 新一代智慧型 MCU 加速推動工業4.0

TONY HO, NOV 2017

Silicon Labs

A track record of multiple industry firsts, transforming and disrupting large markets

- Core competencies in mixed-signal and RF CMOS silicon architectures, software, and systems

- Focus on high-quality, diversified markets

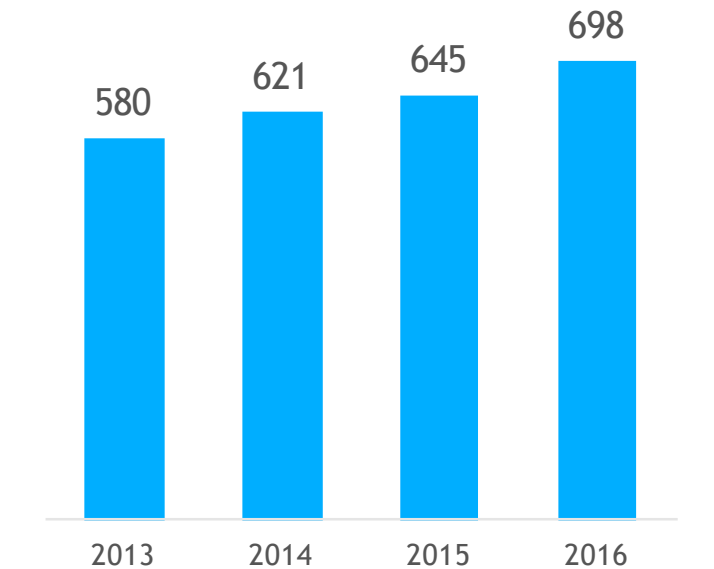- Increasingly positioned for sustainable growth

FOUNDED IN 1996

Nasdaq
LISTED SLAB

>30,000 CUSTOMERS

>1500 PATENTS

REVENUE ($M)

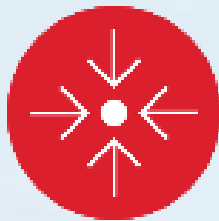| 2013	2014	2015	2016
580	621	645	698

GSA Global Semiconductor Alliance
2015 & 2016 MOST RESPECTED SEMICONDUCTOR COMPANY

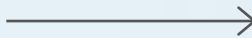# The Building Blocks for IoT Applications

Sense

Temperature, Humidity,
Ambient Light,
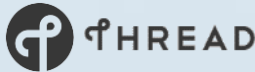Heart Rate, Magnetic

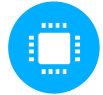**Compute**

32-bit, 8-bit, Xpress™

Connect

SoCs, Modules, TCVRs

Simplified IoT

WiFi®

Bluetooth®

ZigBee®

THREAD

Proprietary

Dev Tools, SW Stacks,
HW Reference Designs,
RTOS, Middleware

Simplicity Studio 4

Internet of Things: Our IoT Platform

- 8-bit, 32-bit MCU
- Wireless MCU
- Wireless modules
- Sensors
- Tools, stacks, RTOS, cloud

- Broad offering of low power, Cortex-based MCUs
- Bluetooth, BLE, 15.4, proprietary, Wi-Fi
- Infrared, proximity, humidity, heart rate, position sensors
- Software framework completes solution

Application Examples

Outdoor Sensors

Industrial Sensors

Building Automation

Smart Energy

Wearables / Health

Applications - Industrial

Outdoor Sensors

Long range wireless 10-20 yr battery Adv. security High I/O count

Solutions	Sensors	Discrete MCU	Discrete RF	Wireless SoC
Industrial	✓	✓	✓	✓

- Additional resources needed: Memory, LCD, CPU processing
- Ultra low active and deep sleep currents
- Enables long range wireless with Flex Gecko + RAIL
- SW solutions: Micrium RTOS, RAIL, AEM, uC/Probe

Smart Energy

MCU/SoC flexibility LE Analog and LESENSE Adv. security 10-20 yr battery

Solutions	Sensors	Discrete MCU	Discrete RF	Wireless SoC
Metering	✓	✓	✓	✓

- Similar to industrial sensors, plus…
  - Sense in deep sleep mode (LESENSE, ADC in EM3…)
  - Scalable device options
  - SoC options also

Applications - Home Automation

Smart Lock

Display drivers   Wireless module as NCP   Adv. security   10+ yr battery

Solutions	Sensors	Discrete MCU	Wireless Modules	Wireless SoC
Smart Lock	✓	✓	✓	✓

- Flexibility, simplicity of SoC or MCU+Module
    - BLE, Wi-Fi, mesh
- With MCU, more processing power, memory, features
- Integrated Captouch
- Ultra low power → LE Sense, LE ADC, LE segment driver, LDMA

Aesthetic Remotes

GFX display functionality   High I/O and interfaces   Capacitive touch   10+ yr battery

Solutions	Sensors	Discrete MCU	Wireless Modules	Wireless SoC
Remotes	✓	✓	✓	✓

- Similar to smart locks…
- +More resources needed for graphics!

Applications - Wearable Fitness & Medical

	High memory, High GPIO	Capacitive Touch	Silicon Labs sensor integration	Longer battery life

	LE Segment LCD	Micrium RTOS, drivers, file system	Capacitive touch	Longer battery life

Solutions	Sensors	Discrete MCU	Wireless Modules	Wireless SoC
Wearables	✓	✓	✓	✓

- High integration in single MCU
  - 144 GPIO, 2MB/512K memory, QSPI/EBI, USB, CSEN
- Easily pair with BLE / Wi-Fi modules and Silicon Labs sensors
- Ultra low power → Function in sleep
- Fast wakeup to Cortex M4, 72 MHz

Solutions	Sensors	Discrete MCU	Wireless Modules	Wireless SoC
Medical	✓	✓	✓	✓

- Low Energy segment LCD – save up to 40% power!
- Integrated CSEN for simple product UX design
- Scalable MCU and W-MCU portfolio
- Micrium RTOS
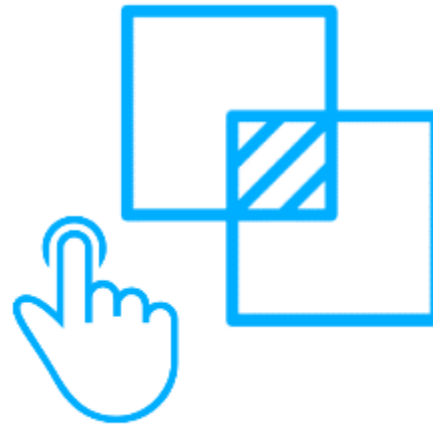- Easy to add BLE or Wi-Fi connectivity

Top Challenges

Multi-facet Systems

Low Power Budgets

Demanding UX

Limited Resources

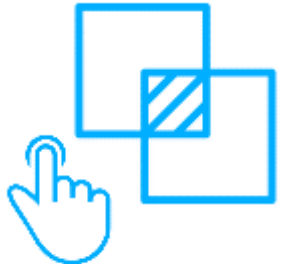# Giant Gecko GG11 MCU Offers Solutions

Multi-facet Systems

- Large on-chip memory
- High integration
- Unique peripheral capabilities
- Micrium RTOS

Low Power Budgets

- Autonomous functionality in deep sleep
- Low sleep currents, fast wakeup
- Unique capabilities like PRS, LESENSE

Demanding UX

- Patented CSEN technology
- Large on-chip RAM
- Quad-SPI and EBI interfaces
- GFX software

Limited Resources

- Simplicity Studio
- Wireless stacks and network debug tools
- Configurators, AEM, Probe, System View…

Unique to GG11 MCU and Silicon Labs

Outdoor Sensors

Industrial Sensors

Building Automation

Smart Energy

Wearables / Health

Large Flash / RAM   Deep Sleep functionality   Easy to add wireless➔   Long range, mesh, BLE, and Wi-Fi

Autonomous peripherals   Professional RTOS   144 GPIO   TRNG   Robust networking SW

Probe debugging tool   QSPI   USB 2.0   LESENSE + PRS   Crypto Acceleration   Dual CAN

10/100 Ethernet   Energy Profiler   LE Segment LCD   Easy to use STK   Cryo Timer   RTCC

Backup power   Linked DMA   Low active current   Ultra fast wakeup   SAR CSEN

Enhanced Graphic Displays

- Graphics applications without external memory
  - 512 KB on-chip SRAM for larger frame buffers and/or double-buffering
  - 2 MB flash for graphics assets and code

- Two options for connecting to display
  - High-speed SPI interface, with 36 MHz write speed
  - Parallel interface for maximum speed

- Hardware per-pixel alpha blending
  - New pixel formats, with alpha encoded
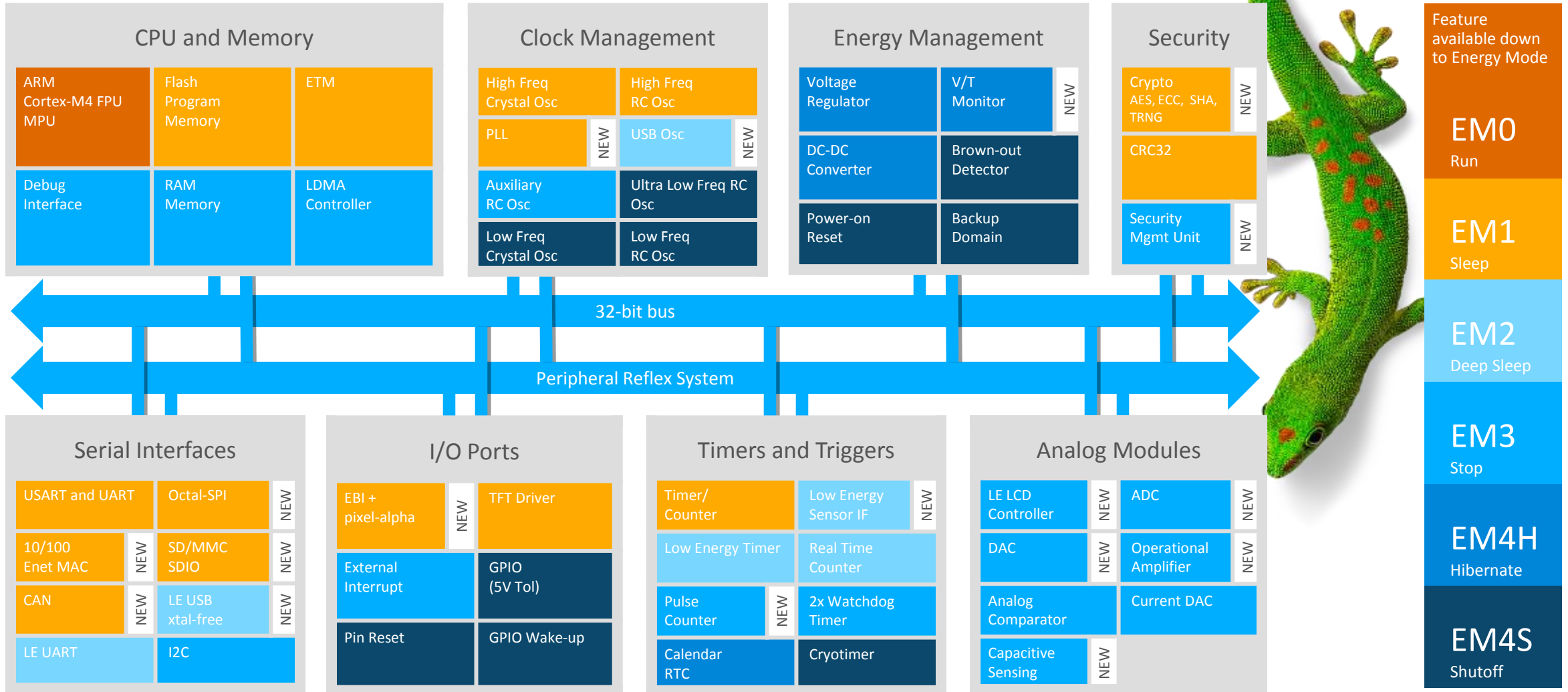 - Display beautiful fonts and graphics

- Working to include TouchGFX support
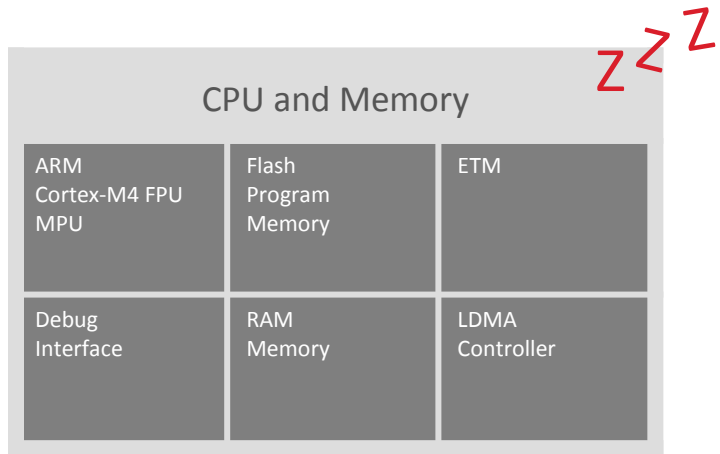
Giant Gecko GG11 MCU Overview

GIANT
ARM Cortex-M4

- **Processor and memory**
  - Cortex-M4 with FPU
  - Up to 72 MHz
  - 1024-2048 kB Flash, 384-512 kB RAM w/ECC

- **Power**
  - 77 µA/MHz
  - 1.6 µA deep sleep with retention/BOD/RTCC
  - 1.8–3.8 V single power supply
  - Unique autonomous sleep-mode capabilities

- **Packages**
  - QFN: 64 (9x9)
  - TQFP: 64 (10x10), 100 (14x14)
  - BGA: 112 (10x10), 120 (7x7), 152 (8x8), 192 (7x7)
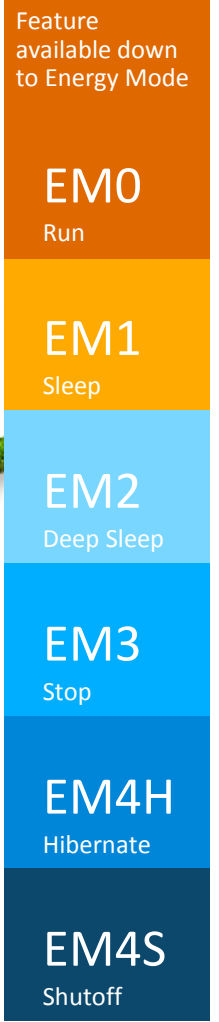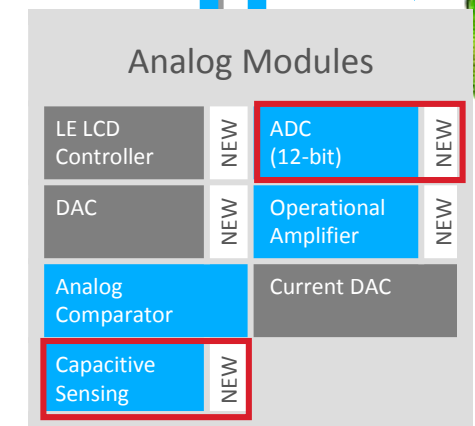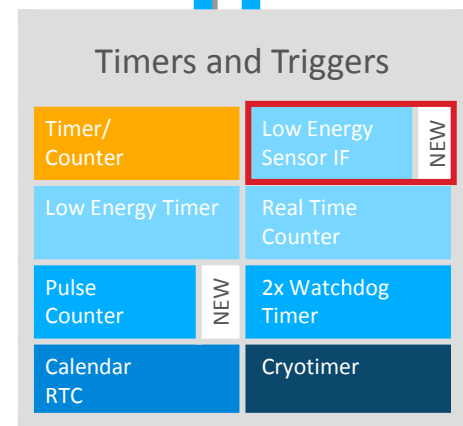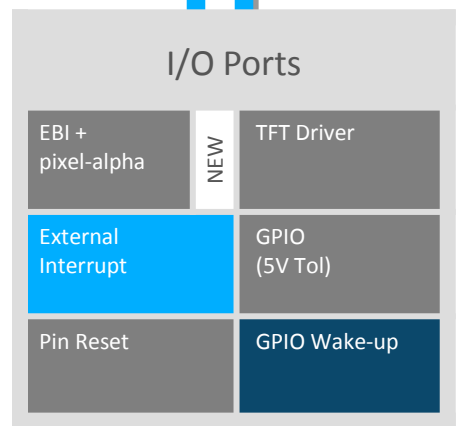
Giant Gecko Series 1 – GG11 Family

CPU and Memory

ARM Cortex-M4 FPU MPU	Flash Program Memory	ETM
Debug Interface	RAM Memory	LDMA Controller

Clock Management

High Freq Crystal Osc	High Freq RC Osc	
PLL	NEW	USB Osc	NEW
Auxiliary RC Osc	Ultra Low Freq RC Osc	
Low Freq Crystal Osc	Low Freq RC Osc	

Energy Management

Voltage Regulator	V/T Monitor	NEW
DC-DC Converter	Brown-out Detector	
Power-on Reset	Backup Domain	

Security

Crypto AES, ECC, SHA, TRNG	NEW
CRC32	
Security Mgmt Unit	NEW

32-bit bus

Peripheral Reflex System

Serial Interfaces

USART and UART	Octal-SPI	NEW
10/100 Enet MAC	NEW	SD/MMC SDIO	NEW
CAN	NEW	LE USB xtal-free	NEW
LE UART	I2C	

I/O Ports

EBI + pixel-alpha	NEW	TFT Driver
External Interrupt	GPIO (5V Tol)	
Pin Reset	GPIO Wake-up	

Timers and Triggers

Timer/ Counter	Low Energy Sensor IF	NEW
Low Energy Timer	Real Time Counter	
Pulse Counter	NEW	2x Watchdog Timer
Calendar RTC	Cryotimer	

Analog Modules

LE LCD Controller	NEW	ADC	NEW
DAC	NEW	Operational Amplifier	NEW
Analog Comparator		Current DAC	
Capacitive Sensing	NEW		

Feature available down to Energy Mode

- **EM0** Run
- **EM1** Sleep
- **EM2** Deep Sleep
- **EM3** Stop
- **EM4H** Hibernate
- **EM4S** Shutoff

Easy to reduce power in your application with AEM and Energy Mode examples in Simplicity Studio

CPU and Memory

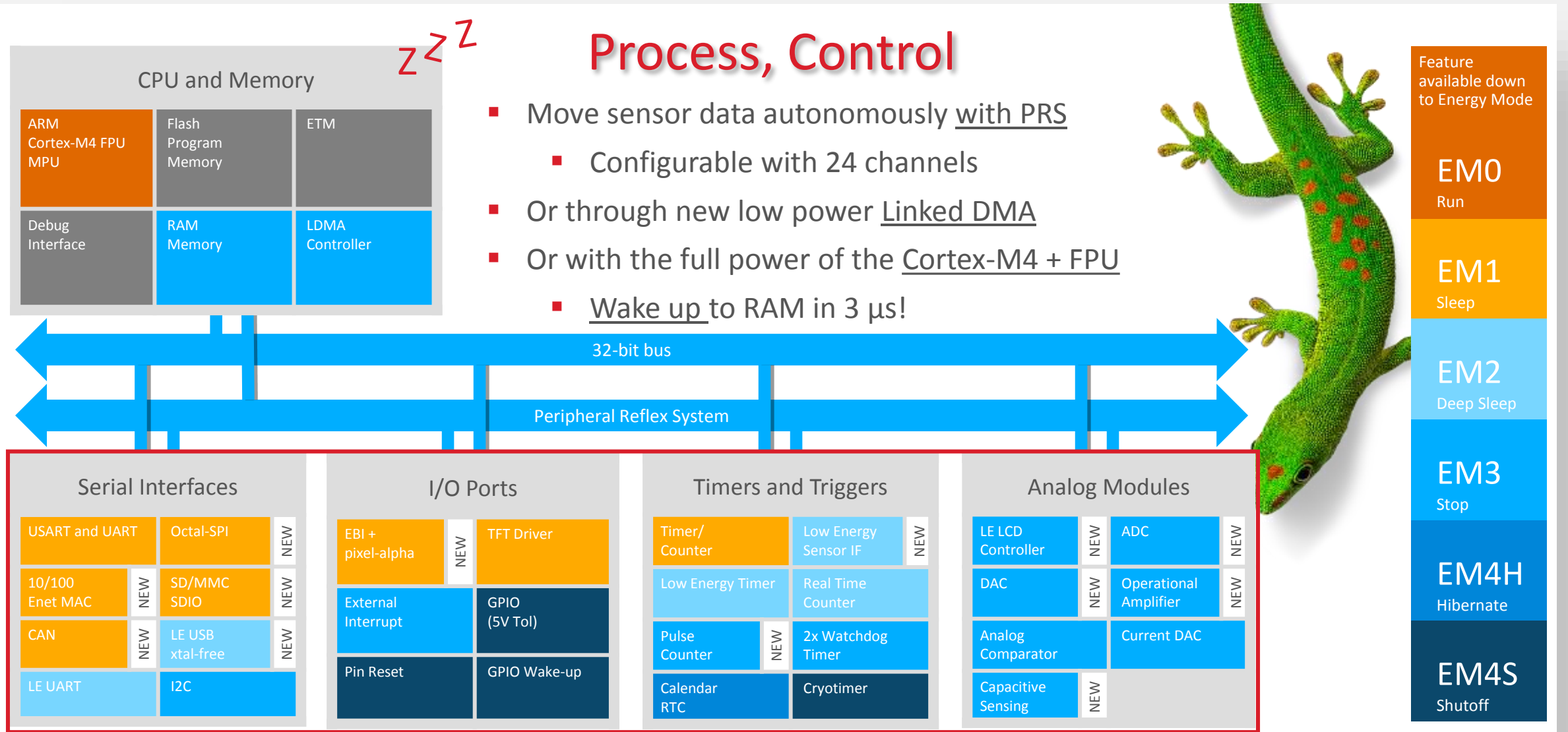|		
ARM Cortex-M4 FPU MPU	Flash Program Memory	ETM
Debug Interface	RAM Memory	LDMA Controller

Sense

- Use LE-Timers, external interrupts, or analog modules to trigger sensing
- Sense with LESENSE™, LE ADCs, ACMPs, Cap Sense interface, or SiLabs digital sensors (I2C)
- ...while the CPU is in deep sleep

32-bit bus

Peripheral Reflex System

Serial Interfaces

USART and UART	Octal-SPI	NEW
10/100 Enet MAC	SD/MMC SDIO	NEW
CAN	LE USB xtal-free	NEW
LE UART	I2C	

I/O Ports

EBI + pixel-alpha	TFT Driver	NEW
External Interrupt	GPIO (5V Tol)	
Pin Reset	GPIO Wake-up	

Timers and Triggers

Timer/Counter	Low Energy Sensor IF	NEW
Low Energy Timer	Real Time Counter	
Pulse Counter	2x Watchdog Timer	NEW
Calendar RTC	Cryotimer	

Analog Modules

LE LCD Controller	ADC (12-bit)	NEW
DAC	Operational Amplifier	NEW
Analog Comparator	Current DAC	
Capacitive Sensing		NEW

Feature available down to Energy Mode

EM0 Run
EM1 Sleep
EM2 Deep Sleep
EM3 Stop
EM4H Hibernate
EM4S Shutoff

Giant Gecko Series 1 – Highlights

Process, Control

- Move sensor data autonomously <u>with PRS</u>
  - Configurable with 24 channels
- Or through new low power <u>Linked DMA</u>
- Or with the full power of the <u>Cortex-M4 + FPU</u>
  - <u>Wake up</u> to RAM in 3 µs!

CPU and Memory

ARM Cortex-M4 FPU MPU	Flash Program Memory	ETM
Debug Interface	RAM Memory	LDMA Controller

32-bit bus

Peripheral Reflex System

Serial Interfaces

USART and UART	Octal-SPI NEW
10/100 Enet MAC NEW	SD/MMC SDIO NEW
CAN NEW	LE USB xtal-free NEW
LE UART	I2C

I/O Ports

EBI + pixel-alpha	NEW TFT Driver
External Interrupt	GPIO (5V Tol)
Pin Reset	GPIO Wake-up

Timers and Triggers

Timer/Counter	Low Energy Sensor IF NEW
Low Energy Timer	Real Time Counter
Pulse Counter NEW	2x Watchdog Timer
Calendar RTC	Cryotimer

Analog Modules

LE LCD Controller NEW	ADC NEW
DAC NEW	Operational Amplifier NEW
Analog Comparator	Current DAC
Capacitive Sensing NEW	

Configurable network of peripherals

Feature available down to Energy Mode

EM0	Run
EM1	Sleep
EM2	Deep Sleep
EM3	Stop
EM4H	Hibernate
EM4S	Shutoff

Giant Gecko Series 1 – Highlights

Safe and Secure

- Secure data processing and storage with <u>MPU, SMU</u>, and security <u>keys</u>
- Transmit/Receive secure data with built-in <u>HW accelerators</u>
- Dual <u>watchdogs</u> for safety
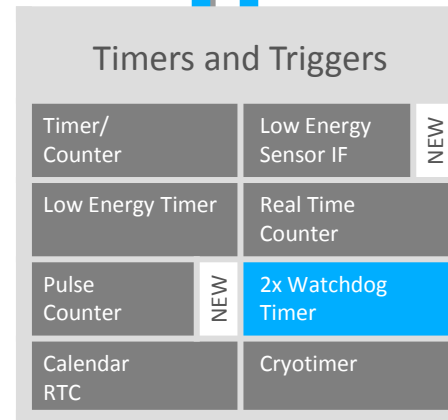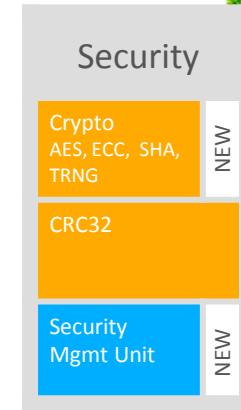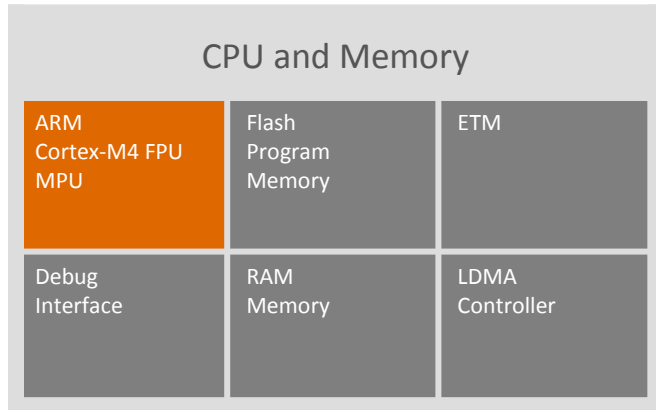
CPU and Memory

ARM Cortex-M4 FPU MPU	Flash Program Memory	ETM
Debug Interface	RAM Memory	LDMA Controller

Security

Crypto AES, ECC, SHA, TRNG	NEW
CRC32	
Security Mgmt Unit	NEW

32-bit bus

Peripheral Reflex System

Timers and Triggers

Timer/ Counter	Low Energy Sensor IF	NEW
Low Energy Timer	Real Time Counter	
Pulse Counter	NEW	2x Watchdog Timer
Calendar RTC	Cryotimer	

Feature available down to Energy Mode

EM0 Run
EM1 Sleep
EM2 Deep Sleep
EM3 Stop
EM4H Hibernate
EM4S Shutoff
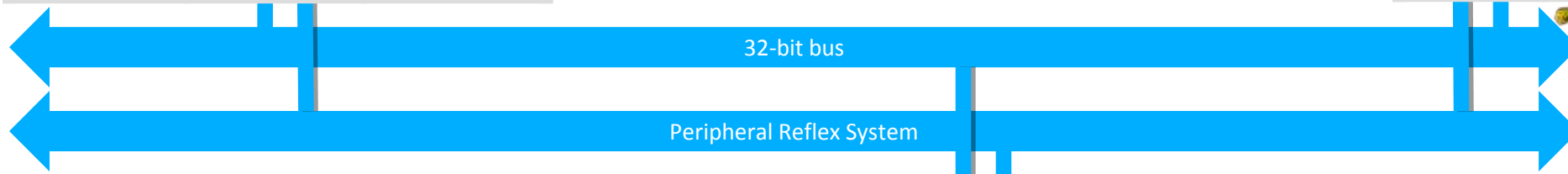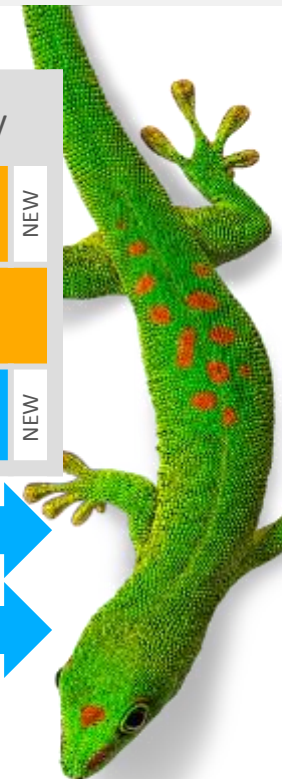
High Performance in a Low Energy Platform

Memory

- Large on-chip flash and RAM
  - Reduces / eliminates power-hungry off-chip accesses
  - Enables data-logging, and faster debugging
- CPU cache policy enables low-energy execution
- Quad-SPI interface
  - Supports direct/XIP accesses
- Octal-SPI
  - Delivers equivalent bandwidth at 50% clock speed, enabling more power-efficient I/O

Security

- State-of-the-art ciphers, in hardware
  - AES, SHA, ECC
- NIST-certified TRNG engine
- CRC engine
- Security Management Unit
  - Controls on-chip peripheral access privileges

Human Machine Interface

- Capacitive touch hardware interface
  - Simple – No need for complex software
  - Robust and accurate – more immune to environmental and system detractors (radiated noise, moisture, etc.)
- Display support
  - Hardware accelerated block transfers
  - Per-pixel alpha blending
  - Segment LCD controller supports full HW offload of common animation sequences

Communication Interfaces

- Ethernet MAC with 802.11az
  - Supports the latest Energy Efficient Ethernet PHYs
- USB Controller and PHY
  - Patented LE mode that saves idle energy
- Dual CAN bus
- SDIO interface
  - Connect to external Wi-Fi chipset

Giant Gecko S1 New Features

10/100 Ethernet

50 MHz

HFXO

AHBCLK 50 MHz

APBCLK 25 MHz

÷2

MAC

RMII

50 MHz REFCLK
TXDx
TX_EN
RXDx
CSR_DV
RX_ER

PHY

SDIO/SD/MMC

MCU

SDIO

CLK
CMD
DATA — 4
WP
CD

SDIO Card Connector
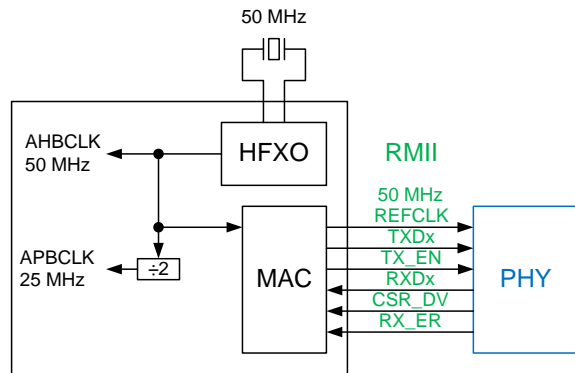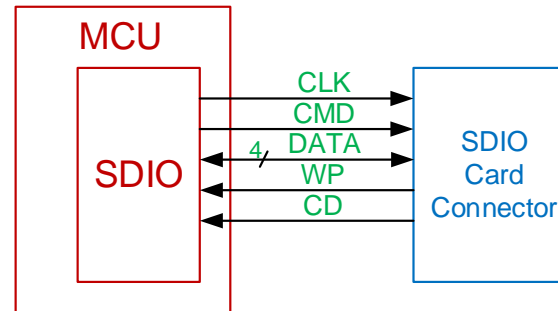
LE Segment LCD Driver

Octal/Quad-SPI Controller

MCU

Octal SPI

CS
SCLK
1-8 DQx
DQS

QSPI / Octal SPI Memory

Dual-CAN

MCU

CAN   CAN

PHY   PHY

Sensor Sensor   Sensor Sensor

SILICON LABS
EFM32 Giant Gecko 11

SEG[0:35 / 0:39]

COM[0:7 / 0:3]
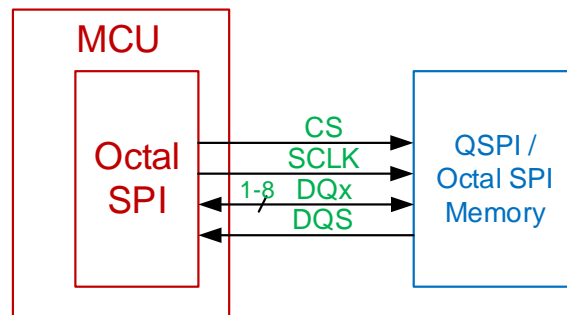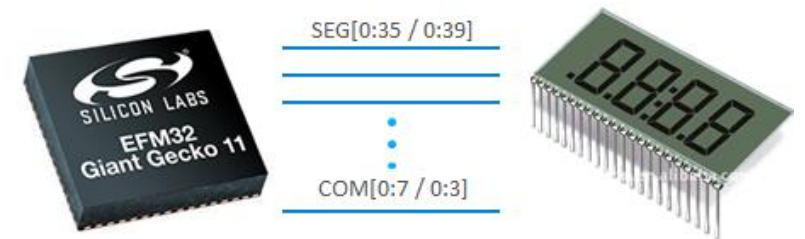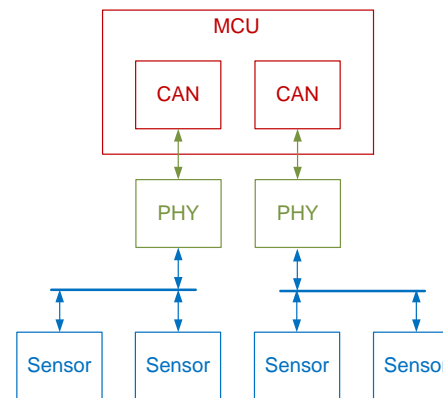
Reduce display power consumption

NEW Low Energy segment driver

Simple, Flexible Solutions

Wireless SoC

Highest integration
(32-bit wireless)

Cortex M3/M4

MCU + Module

Simplest wireless design
(32-bit wireless)

Cortex M0+/M3/M4

HW Scalability + SW Compatibility

MCU + XCVR/NCP

Highest design flexibility
(8 / 32-bit wireless)

Cortex M0+, 8051

Standalone MCU

WIRED

Highest MCU integration
(32-bit wired)

Cortex M0+/M3/M4

NEW: 2 MB Giant Gecko
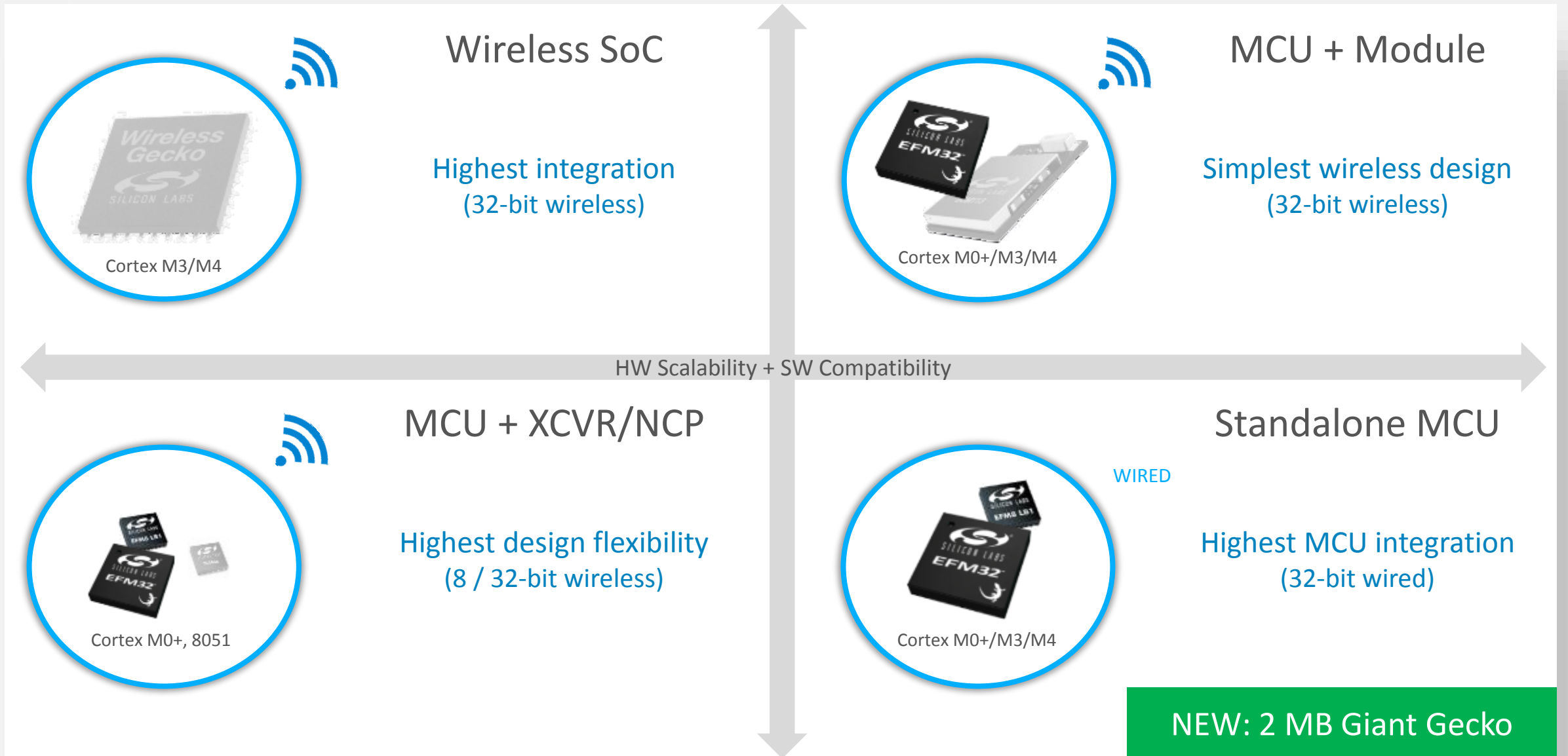
Gecko MCUs and W-MCUs

		THREAD	ZigBee	Bluetooth	Proprietary wireless	WIRED		■ SoC ■ Module
■ ■	**_Mighty Gecko_**	✓	✓	✓	✓	Basic		256 - 1024 kB Flash Up to 19.5 dBm Sub-GHz + 2.4 GHz QFN32, QFN48, WLCSP40
■ ■	**_Blue Gecko_**		✓	✓		Basic		128-1024 kB Flash Up to 19.5 dBm Sub-GHz + 2.4 GHz SIP, QFN32, QFN48, WLCSP40
■	**_Flex Gecko_**			✓		Basic		32-1024 kB Flash Up to 19.5 dBm Sub-GHz + 2.4 GHz QFN32, QFN48
■	**_Gecko MCUs_**					Advanced		4–2048 kB Flash USB, Ethernet, CAN QFP, QFN, BGA, CSP 24 – 192 pins

A Single Chip Solution to Integrate Multiple Protocols

- Provide Zigbee and Bluetooth LE functionality with a single radio

- Simplify device setup, operation, and maintenance with local smartphone control

- Deploy scalable indoor location-based service infrastructure in homes and buildings

- Improve over-the-air update performance with higher speed Bluetooth LE based downloads

- Reduce Wireless Sub-System BoM Cost by 40%

Dynamic Multiprotocol Scheduling from Silicon Labs
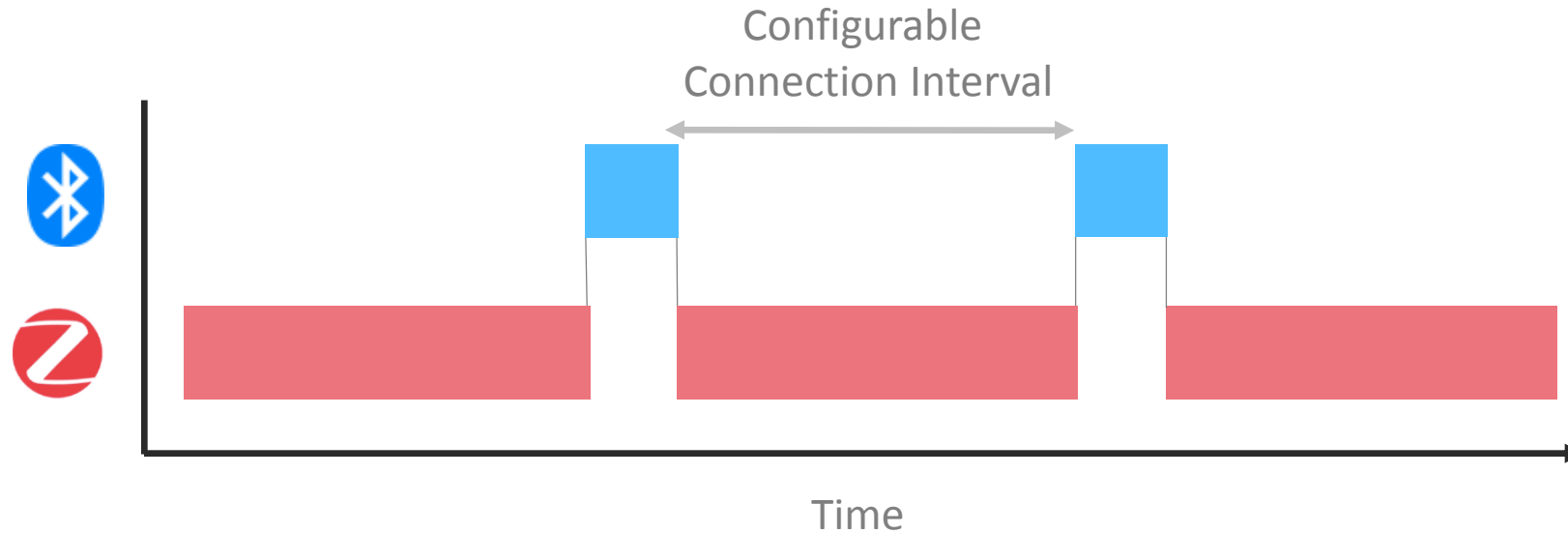
Time-slices Zigbee and Bluetooth communication on a single radio

Supports Zigbee routing, Bluetooth connections, and Bluetooth beaconing

Provides configurable connection intervals to match application requirements

Multiprotocol Design Enabled by Wireless SDKs and Micrium OS

Application

Wireless Stacks	
Zigbee	Bluetooth

Radio Scheduler	RAIL

Micrium OS

Mighty Gecko SoC
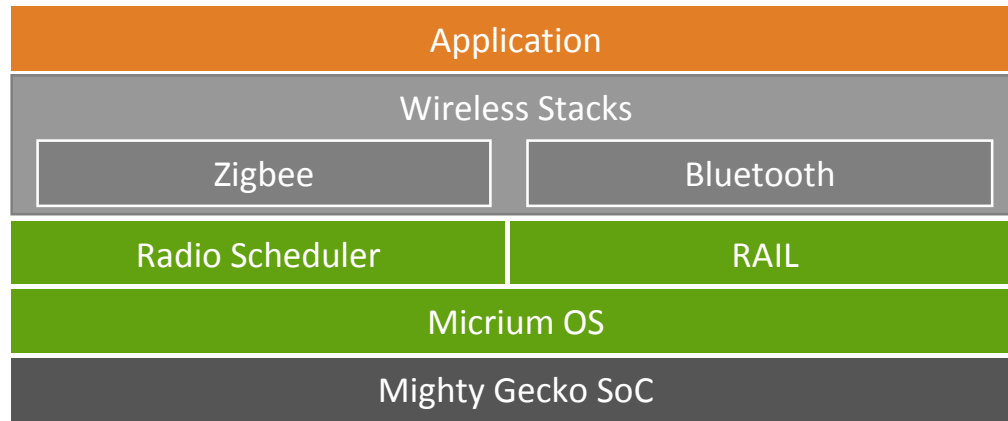
- Bluetooth and Zigbee stacks run on a common Silicon Labs Radio Interface Layer (RAIL)

- Micrium OS and the Radio Scheduler coordinate timing between Bluetooth and Zigbee stacks

- The Bluetooth connection interval is configurable to support many application needs

- Customer application development is independent from radio scheduling

What does "Ultra Low Power" mean?

Do more while sleeping

Extremely fast wakeup

Ultra low current

Running your System at "0 MIPS"

- Traditional application: CPU micro-manages peripherals
  - Reduces ability to sleep. Must wake up on every interaction
  - Limits scale of application. CPU can only do so many things at once
  - High energy consumption

- Autonomous sub-systems
  - Free up the CPU
  - Allow higher sleep duty-cycles
  - Enables ultra low power applications

- Specialized functionality
  - Chain standalone peripherals
  - LESENSE – Ultra low power analog sensors

Article available at: http://eecatalog.com/8bit/2017/04/19/running-your-embedded-system-at-0-mips/
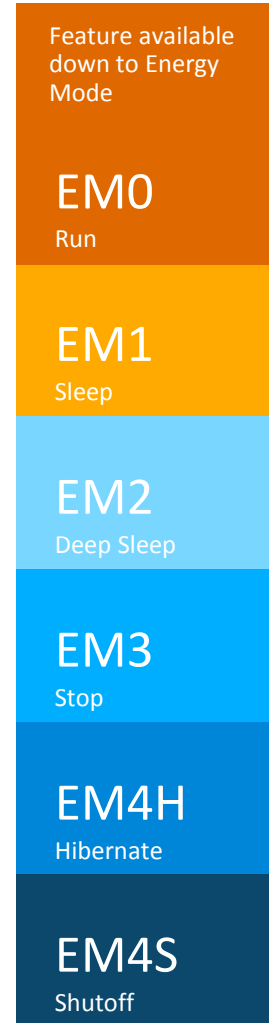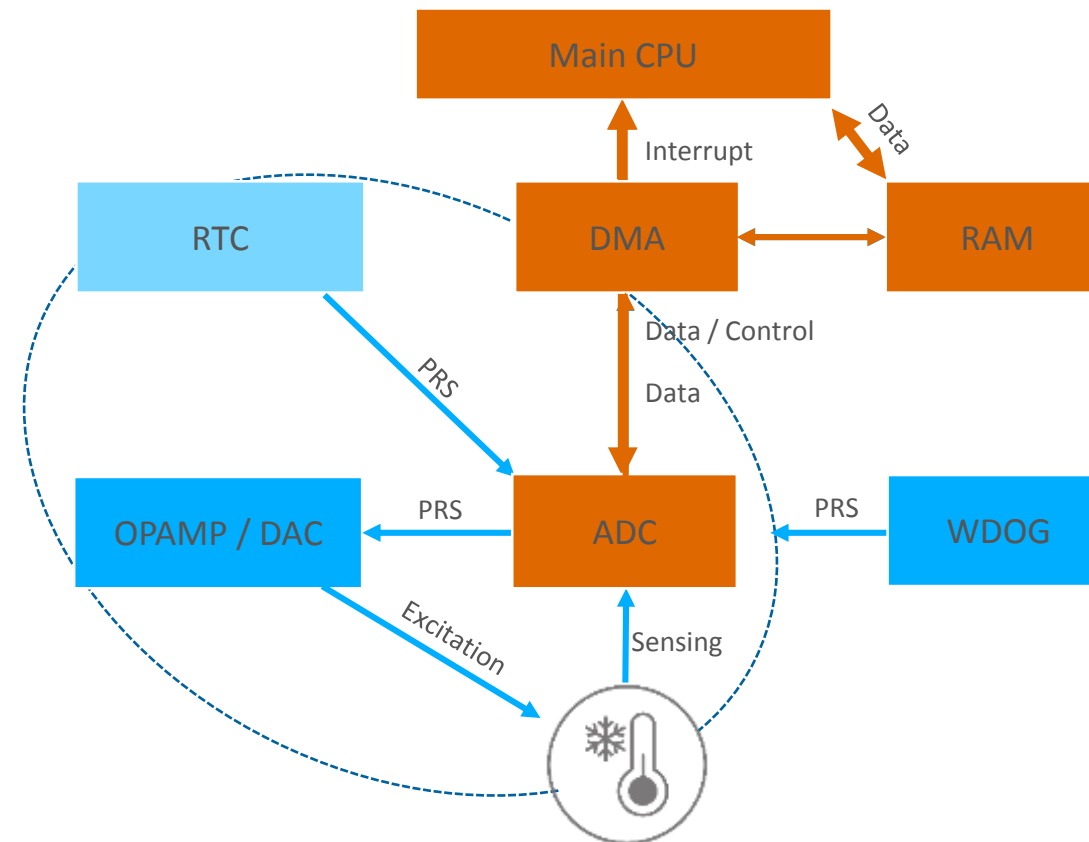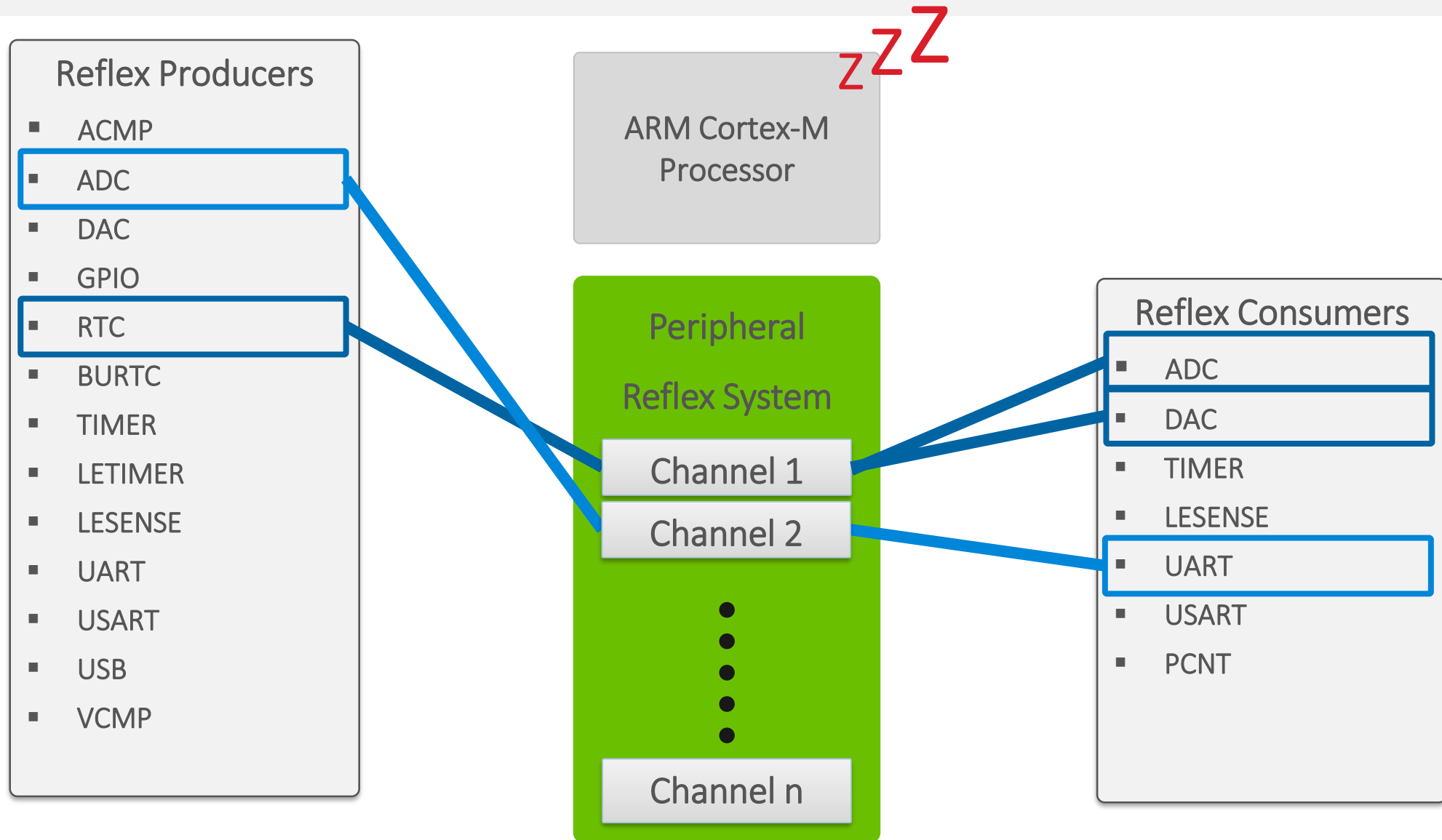
LESENSE - Low Energy Sensor Interface

Lowest power, autonomous sensing
Resistive, inductive, capacitive
Configurable and scalable

- Autonomous sensing in Deep Sleep
  - Excite and measure up to 16 sensors
  - Capacitive, inductive and resistive sensors
  - Performs action or sleeps, depending on values
  - Result buffer with 16 entries for low power calibration

- Programmable State Machine
  - 4 measurements can be fed to state machine
  - Automatically track system state E.g. for quadrature decoding and error detection
  - Can generate IRQs or PRS depending on states

- Leverages integrated MCU peripherals
  - ACMP or ADC used for measurement
  - DAC for reference generation
  - PCNT used for counting state machine events

- Operates down to EM2

Analog events
Capacitive, inductive or resistive sensors

Generic MCU
Wake-up periodically to detect the events

LESENSE
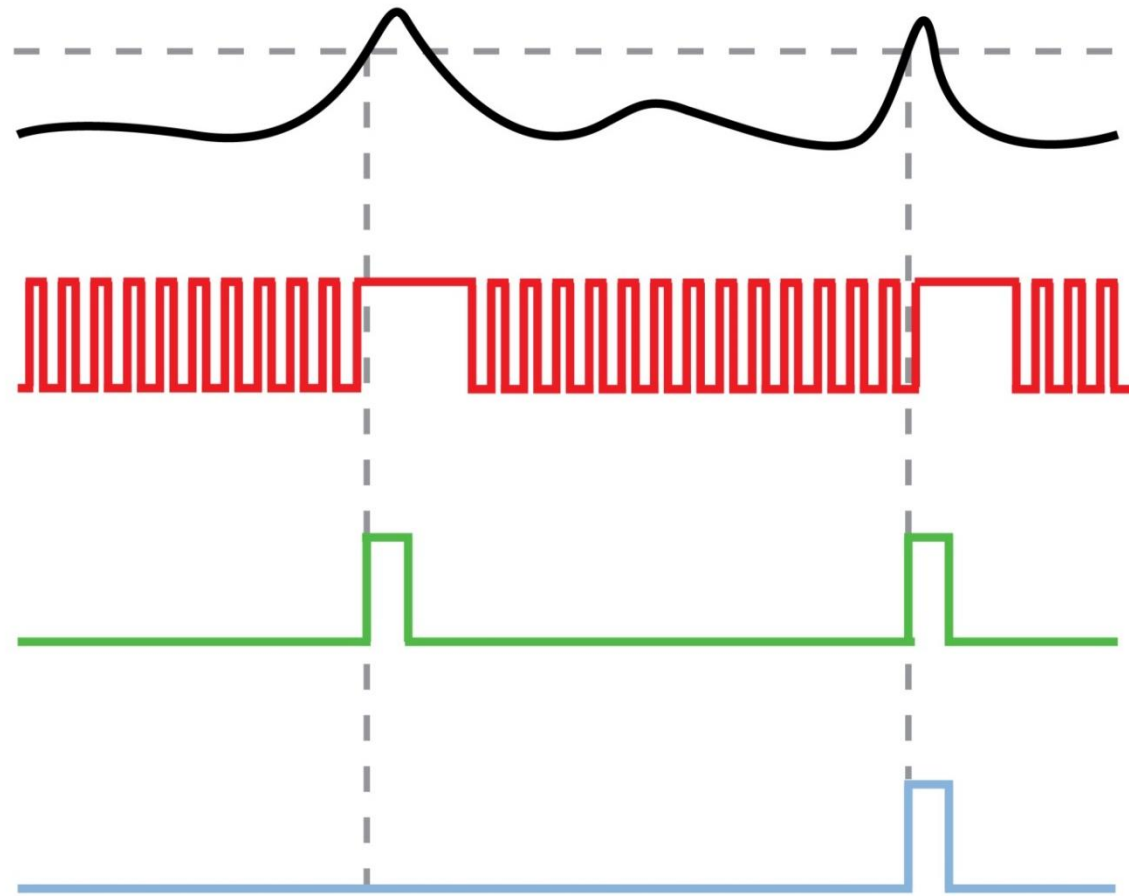
Resistive Measurement

- **Duty cycled power supply**

- **Total current down to 1.3 μA**
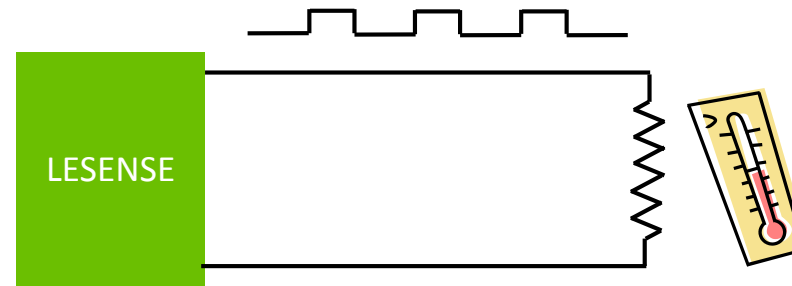
Capacitive Measurement

- **Relaxation Oscillator**

- **Total current down to 1.3 μA**
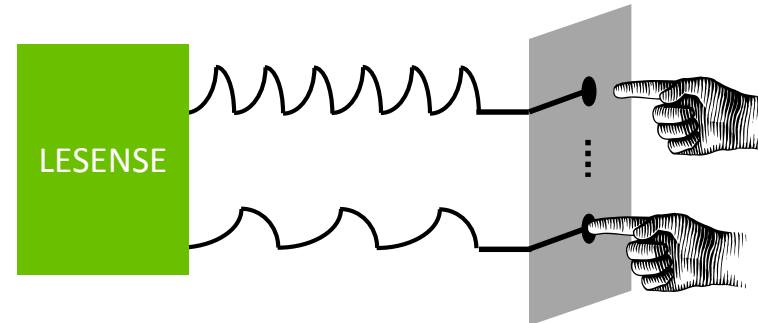
Inductive Measurement

- **Tank circuit sensor**

- **Measure rate of decay in inductor oscillation**

- **Total current down to 1.5 μA**
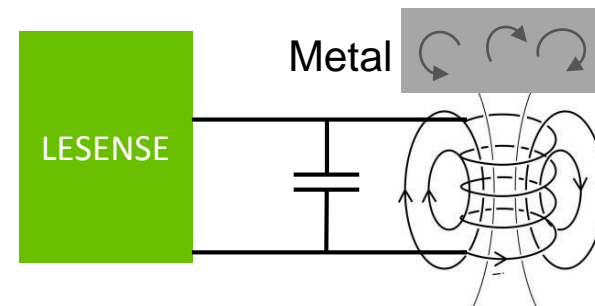
CSEN – Capacitive Touch

Resistive Measurement

• Duty cycled power supply

• Total current down to 1.3 µA

LESENSE
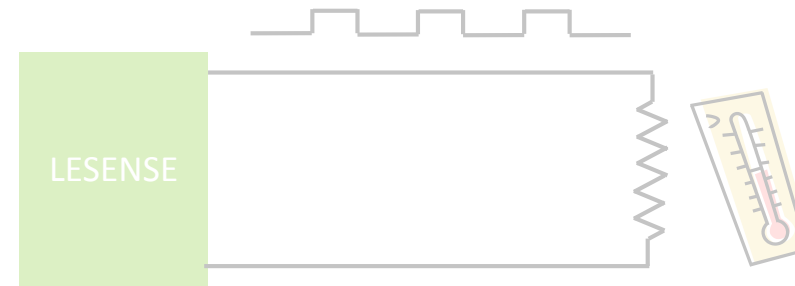
Dedicated Capacitive Touch

• **Robust SAR-based operation**

• **Up to 64 inputs**
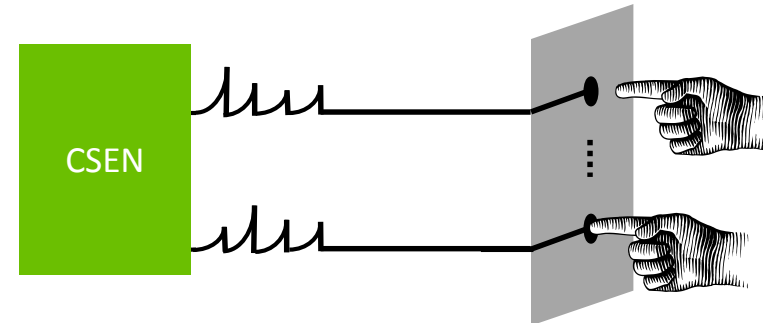
CSEN

Inductive Measurement

• Tank circuit sensor

• Measure rate of decay in inductor oscillation

• Total current down to 1.5 µA

LESENSE

Metal
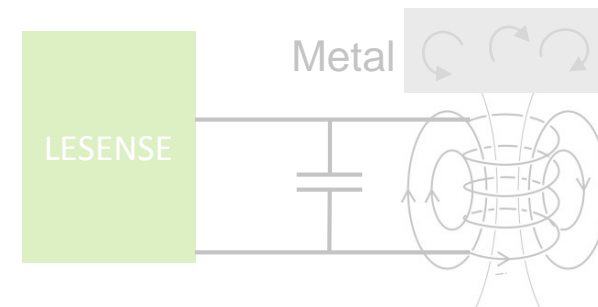
Why Capacitive Touch (CSEN)?

ADVANCED TECHNOLOGY	SIMPLE TOOLS	YOUR FINAL PRODUCT
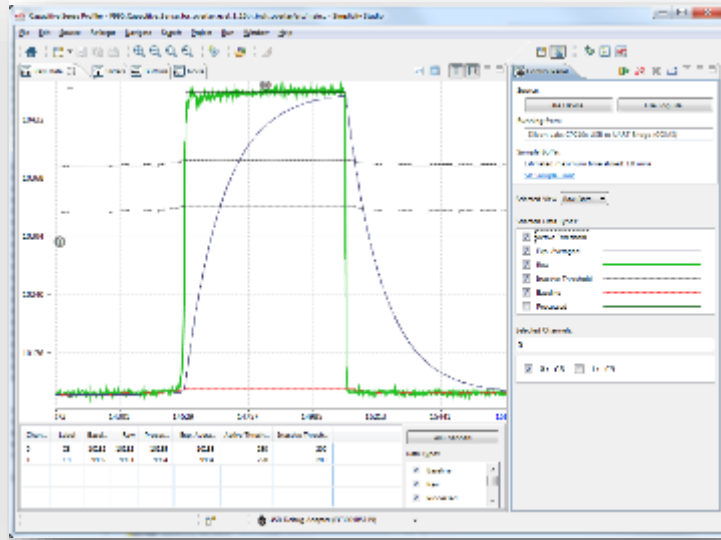
NEW SAR-based Cap Sensing

- More robust
- Higher noise and Voffset immunity
- Enhanced touch resolution
- Ultra-low power

Easy to Configure

Easy to Test

- Capacitive Sense Profiler

Great Product UX

- Touch buttons / surfaces
- Single-touch displays

CSEN Firmware and Software Support
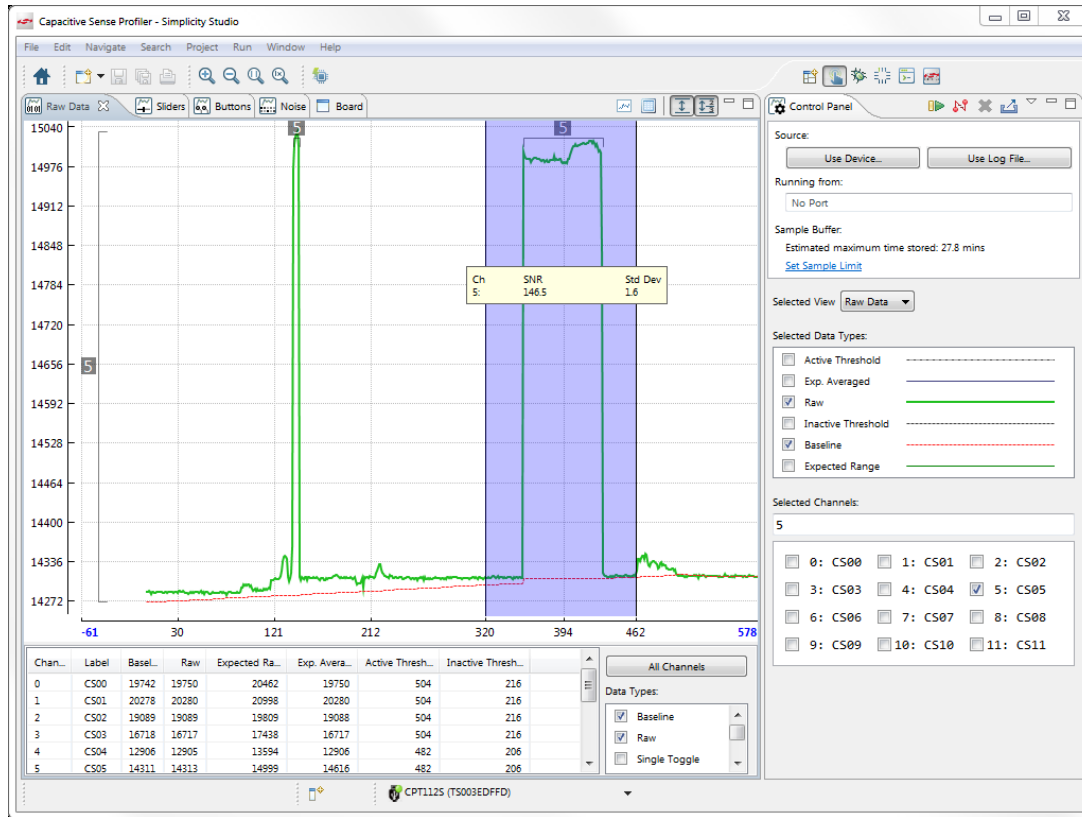
- Quick configuration in Simplicity Studio
- Configure 2 CSLIB files
  - Library includes all low-level sensing and processing routines

- Capacitive Sense Profiler
  - Visualizer for CSLIB data output
  - Simple interface
  - Real-time display of touch status and raw data
  - Enables logging of data stream

LEUART - Low Energy UART
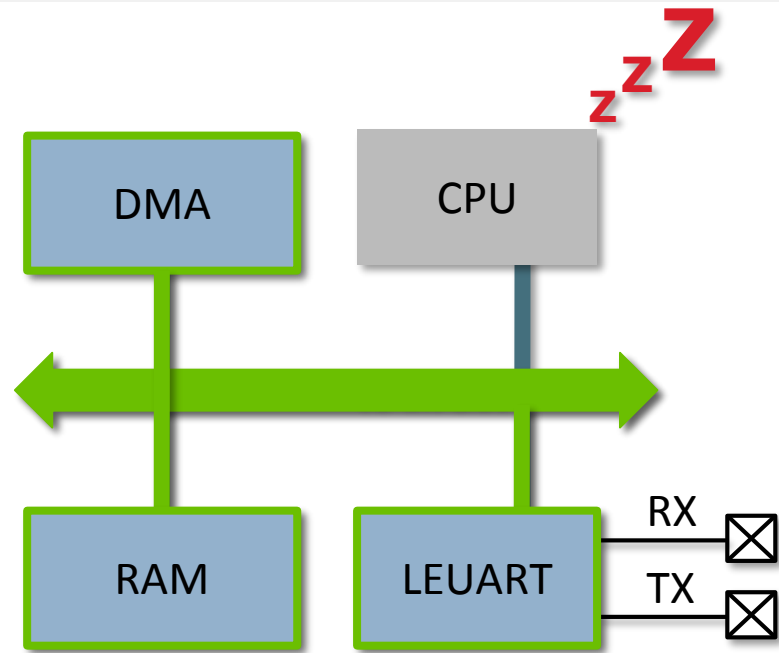
Optimized for low energy operation
Fractional baud rate generator
Autonomous operation in EM2

- Up to 2 LEUARTs
  - Optimized for low energy operation
  - Double buffered TX and RX
  - IrDA modulator

- Supported baud rates
  - 300 - 10922 baud/s from 32 kHz osc
  - Fractional clock divider to support e.g. 9600 baud/s
  - Up to 12 Mbaud/s using high frequency clock

- Autonomous operation down to EM2
  - Multi-processor mode allows ignoring non-address bytes
  - Start and signal frames automatically drive data reception
  - Full DMA support down to EM2

RTCC - Real Time Counter with Calendar
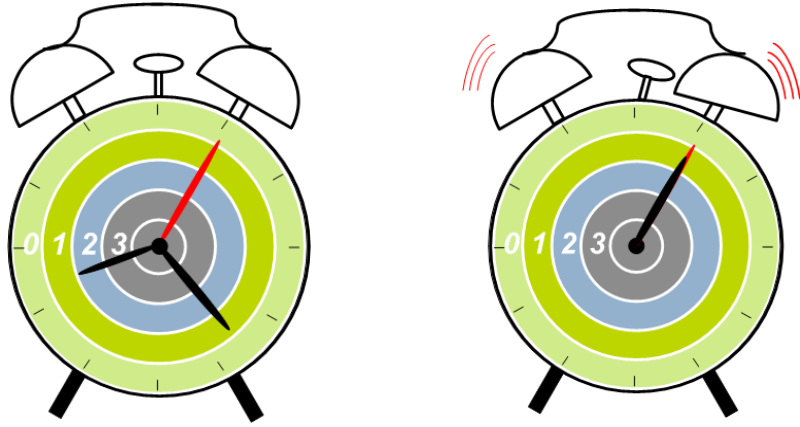
RTC or Calendar Mode

Operates down to EM4 and backup mode

- RTCC Overview
  - Runs in RTC Mode or Calendar Mode
  - 15-bit pre-counter
  - Runs down to EM4H and Backup mode
  - Includes 128 byte general purpose backup memory
  - 3 compare capture/alarm or input capture channels
  - Clocked from LFXO/LFRCO/ULFRCO

- RTC Mode
  - 32-bit counter value

- Calendar Mode
  - Day/Month/Year/Hour/Minute/Second
  - Second-fractions in pre-counter
  - Leap-year correction

LETIMER - Low Energy Timer

EFM32

RTC → LETIMER
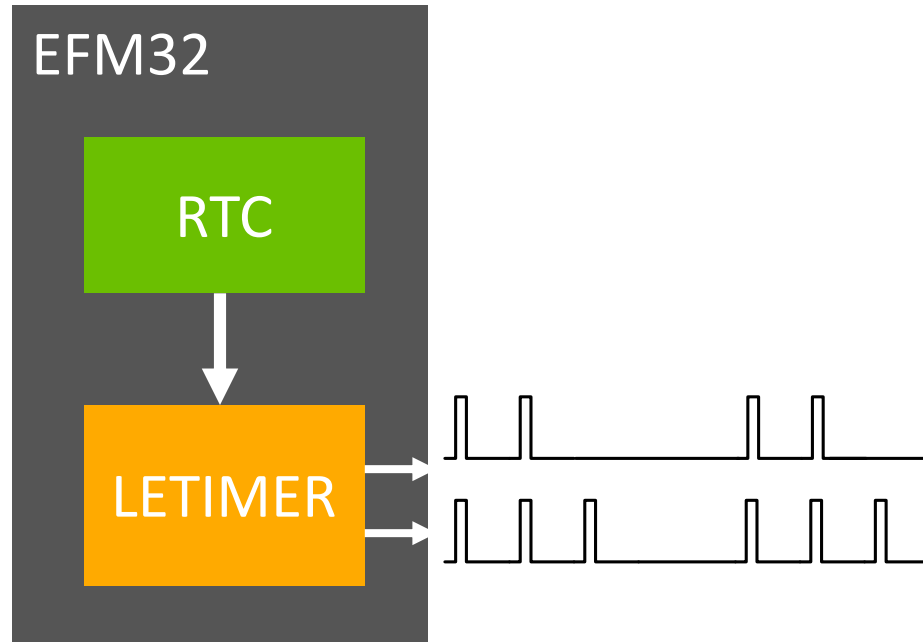
Flexible output generation
Available down to EM3

- 2 LETIMER peripherals
  - 16-bit down-counter
  - 8-bit buffered repeat
  - 2 compare values, or single buffered compare

- Flexible output generation
  - 2 output channels
  - toggle, pulse or PWM output
  - 3 PRS inputs: Start, stop and clear timer

- Usecases
  - Pulse-output for continuous communication of quantity
  - PWM generation down to EM3
  - Additional timer

CRYOTIMER – Ultra Low Energy Timer/Counter
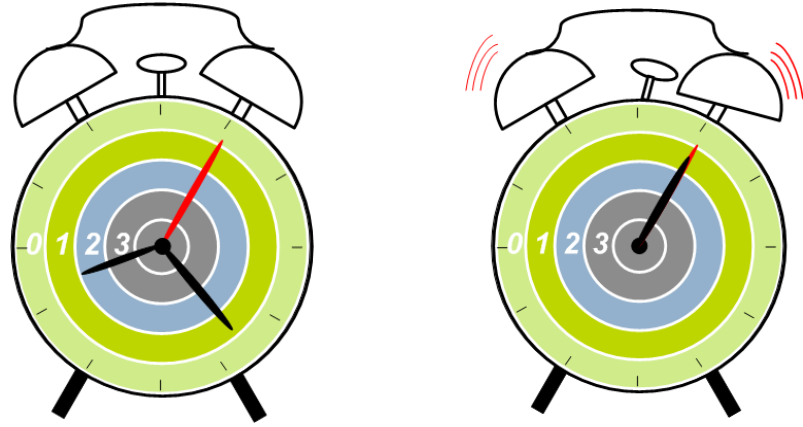
Lowest Power Timer
Available in all energy modes

- CRYOTIMER Overview
  - Available in all energy modes, down to EM4S
  - 32-bit counter
  - 1x 2^N comparator

- Clock sources
  - ULFRCO, LFRCO, LFXO available in all modes
  - Use ULFRCO for lowest energy
  - Prescale clock source up to 1/128
  - Maximum wakeup period: 194 days

Safety

- Memory ECC
  - Enabled for up to 256 kB RAM
  - Detect 1 and 2 bits errors per 32-bit word
  - Correct 1 bit per 32-bit word on read access
  - Can be used with DMA for continuous monitoring

- Dual WDOG
  - Independently configurable clock sources
  - Monitor using high-frequency or independent clock
  - Window and warning functionality
  - PRS monitoring

- Process separation with SMU
  - Augments MPU with bit-mask for peripheral access
  - Every peripheral can be marked as priv or non-priv

Hardware Accelerated CRYPTO

$G@%5| → CRYPTO → Hello!
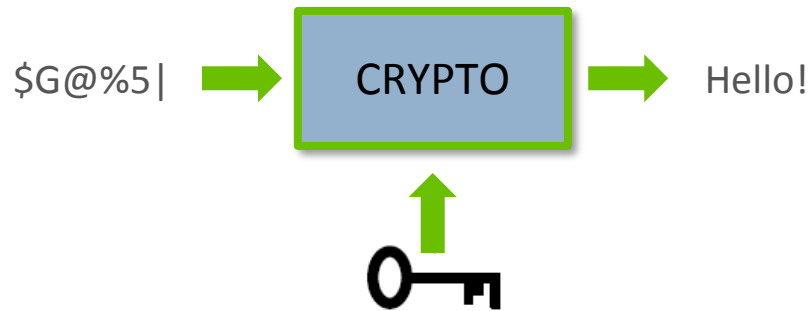
10x faster than SW

Asymmetric and symmetric

Use through mbedTLS

- Symmetric encryption
  - AES-128, AES-256
  - ECB, CBC, CFB, OFB, CTR, ..., CBC-MAC, GMAC, CCM, GCM, CCM*, ...
  - Zigbee (CCM*), WMBus (CTR / CBC), Bluetooth Smart (CCM), OTA, Production Prog, Secure Storage

- Asymmetric
  - Elliptic Curve Cryptography (ECC)
  - P-192, P-224, P-256, K-163, K-233, B-163, and B-233
  - Zigbee (Zigbee Smart Energy), BT Smart (LE Secure Connections), Thread, Signatures

- Secure Hashes
  - SHA-1, SHA-224 and SHA-256
  - Key buildingblock of e.g. HMAC, Zigbee, BT Smart, Thread, Data Integrity

Gecko Bootloader

- Secure Firmware Updates
  - Signed images to verify authenticity
  - Secure boot to verify firmware integrity
  - Encrypted images for code protection

- Flexible flash partitioning
  - Supports both internal or external flash (SPI)
  - Extensible to support other com. peripherals
  - Flash can be divided into multiple slots
    - e.g. EFR32xG12 with 4 x 256kB slots

- Multi-boot support for multi-protocol apps
  - 1st bootload Bluetooth for commissioning
  - Then bootload zigbee for mesh networking

- Field upgradeable

Running image

Bootloader

New Image
Signed / Encrypted

Counterfeit/Broken Image
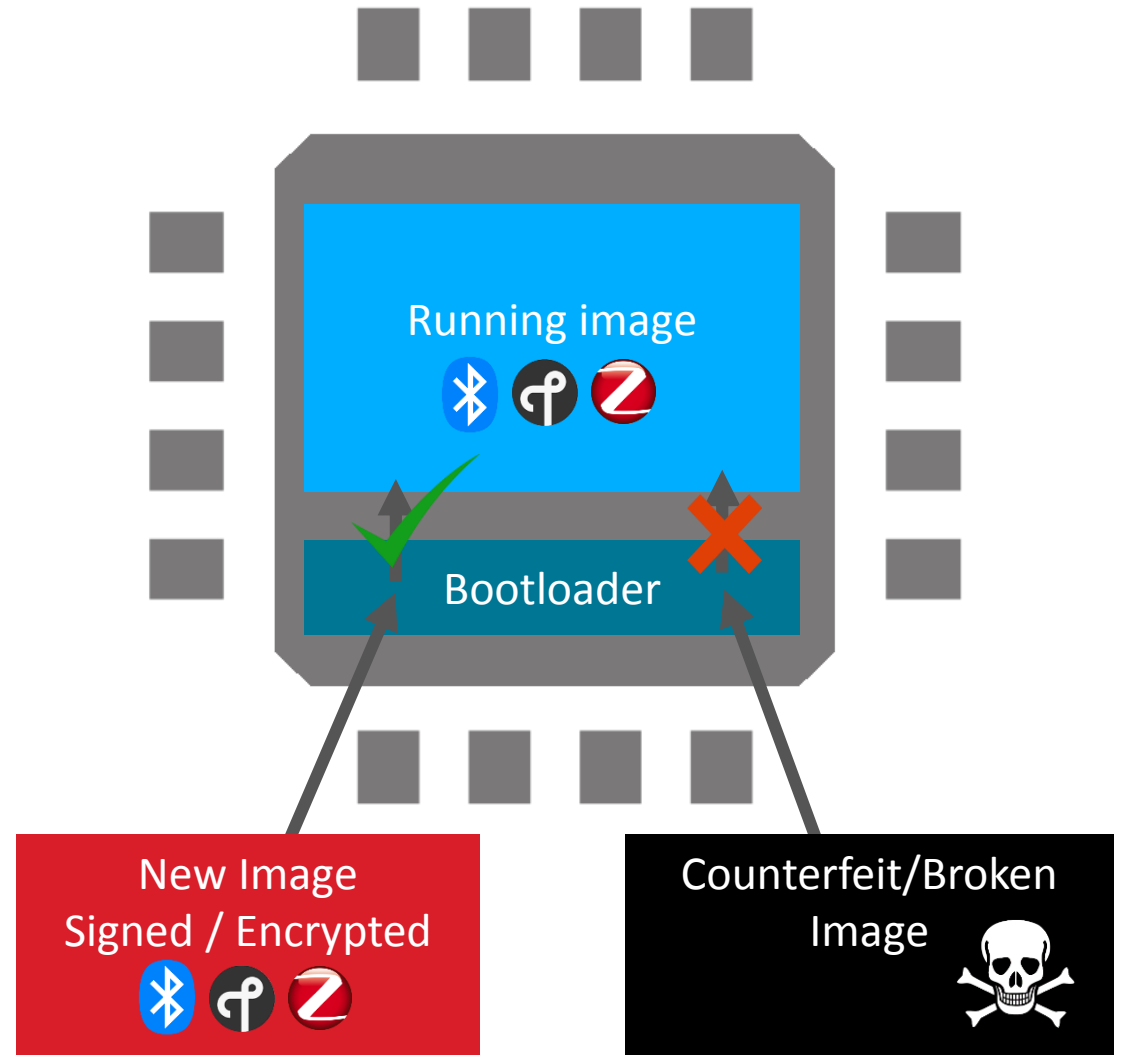
Focusing on your Development Experience

Jumpstart

- HW Configurator
- emLib
- RTOS
- Middleware drivers
- Reference code
- Compatibility with wireless

Full-featured OS and SDK
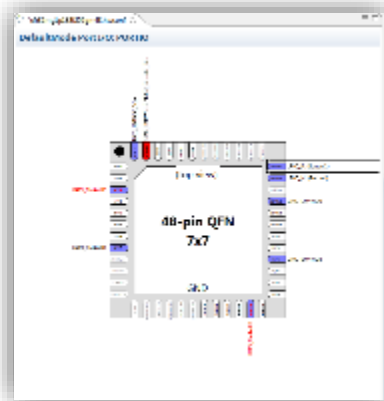
HW Configurator

Debug

- System View
- µC/Probe
- Debug over SWD or JTAG

µC/Probe

MCU Starter Kit

Configure and set up
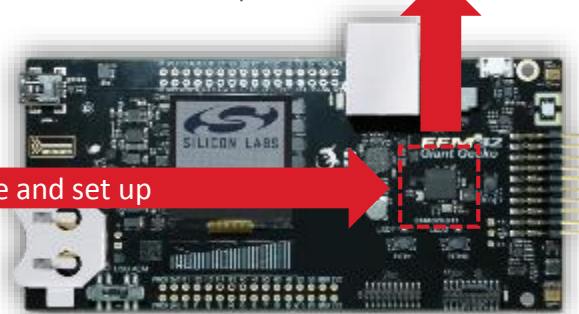
Optimize

- AEM (Energy Profiler)
- µC/Probe
- App Notes and design guides
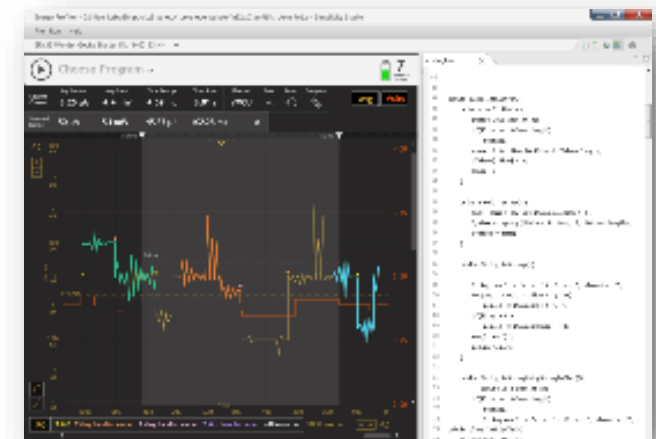
Advanced Energy Monitoring

Simplifying through Software

Maximum simplicity

Basic needs

Fully Featured Embedded OS

Connectivity Modules

Wireless Networking

Interface Drivers

Abstraction (emLib)

Reference Code

Integrated Hardware

Simplifying through Tools

Building the application
- Advanced Energy Profiler
- Configurator
- Integrated Starter Kits (STKs)

Adding connectivity
- Packet Trace
- BGScript
- RAIL, Connect™ stack
- AppBuilder

Embedded debugging
- Probe
- System View

Top 10 Concerns in Engineering Workplace

#1. Insufficient people to get job done

#3. Time-to-market pressures

#4. Insufficient funding

#6. Inability to adequately test the product

2016 Survey of Engineers, by Electronic Design

Simplicity Studio
Faster, Easier Software Development
Tools for the IoT

Simplicity Studio™

Wireless and MCU design made simple

- Common development environment for MCU and Wireless products

- Eclipse-based IDE with wireless stack support

- Complete Documentation

- Demos/Software Examples

- Advanced Tools
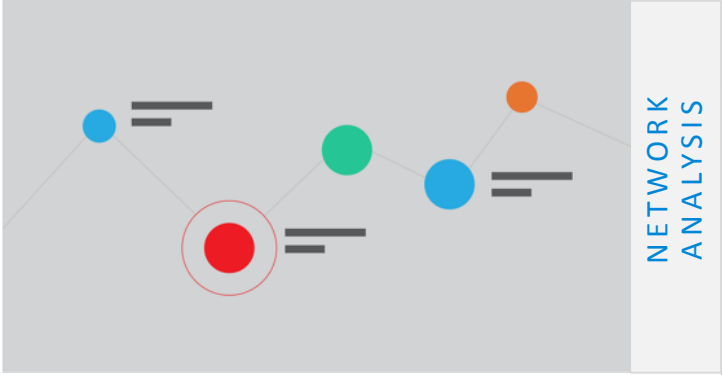 - Energy Profiler
  - Network Analyzer
  - AppBuilder
  - Hardware Configurator

Simplifying Multiprotocol Design
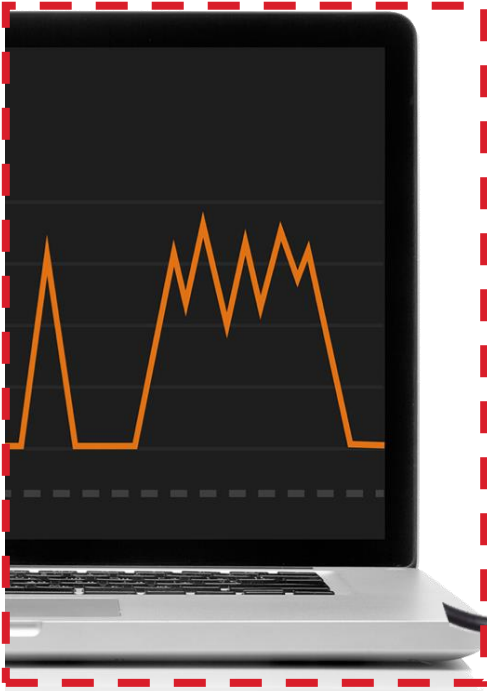
Simplicity Studio
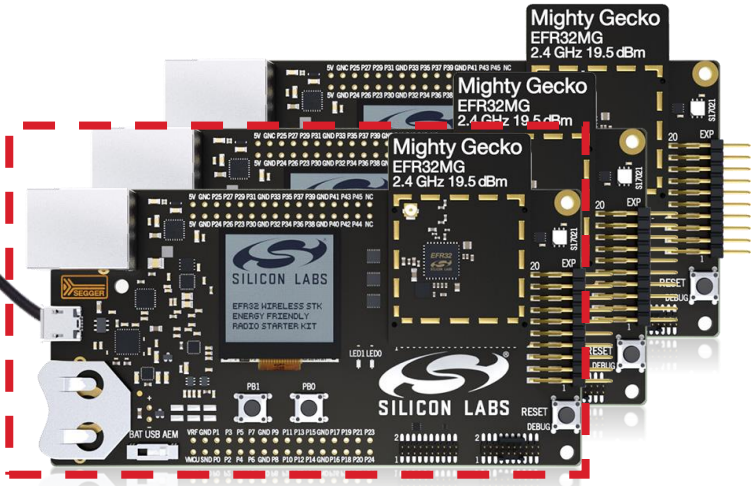
Starter Kit with
Radio Board

NETWORK ANALYSIS
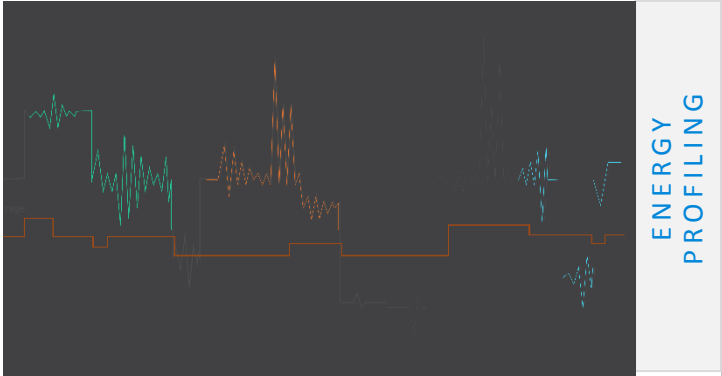
ENERGY PROFILING
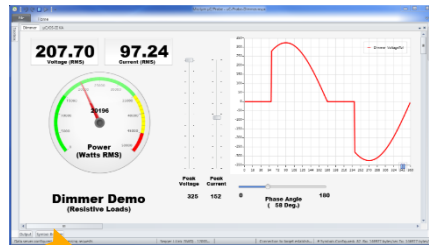
APPLICATION CONFIGURATION

uC/Probe

Windows PC
(Windows XP, 7, or 8)

uC/Probe

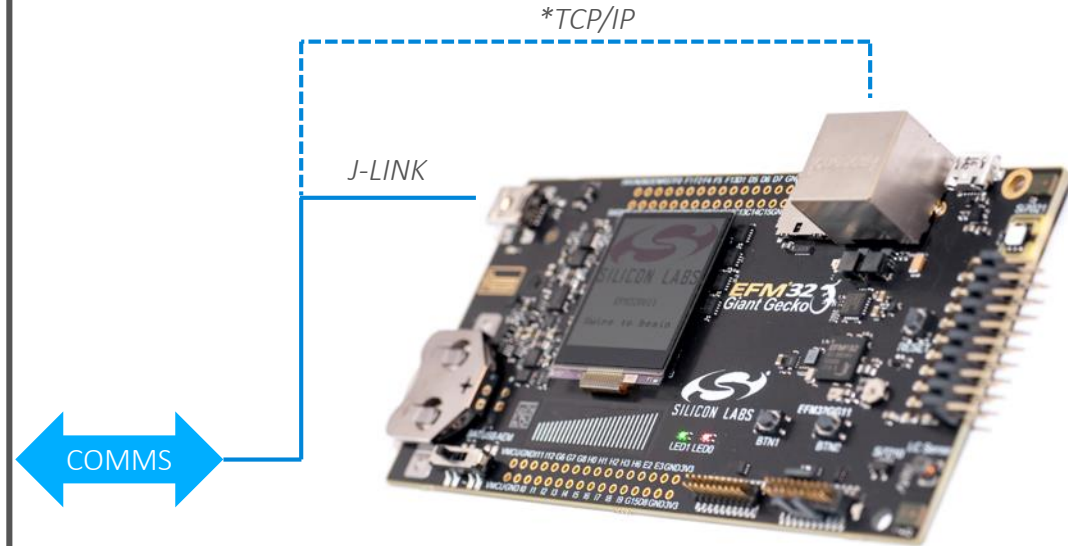uC/Probe Auto Updates and Licensing System

uC/Probe Data Client

- Main toolbar
- Toolbox
- Workspace/Project
- Symbol browser
- Workspace explorer

Dimmer Demo
(Resistive Loads)

uC/Probe Target Comms Module

ELF file, or symbol file required:
- Contains symbol names and addresses

Visually instrument and test your embedded system

TCP/IP

J-LINK

COMMS

No target code or kernel required!

System View – RTOS-based Trace Tool

- Captures RTOS events such as:
  - ISR enter/exit
  - Scheduling
  - Wait and Signals
  - Task statistics (Min, Max, Avg execution times, frequency, run count, etc.)

- Displays live data

- Traces can be saved for post-analysis

- FREE Windows-based tool

- Requires Segger **J-Link**
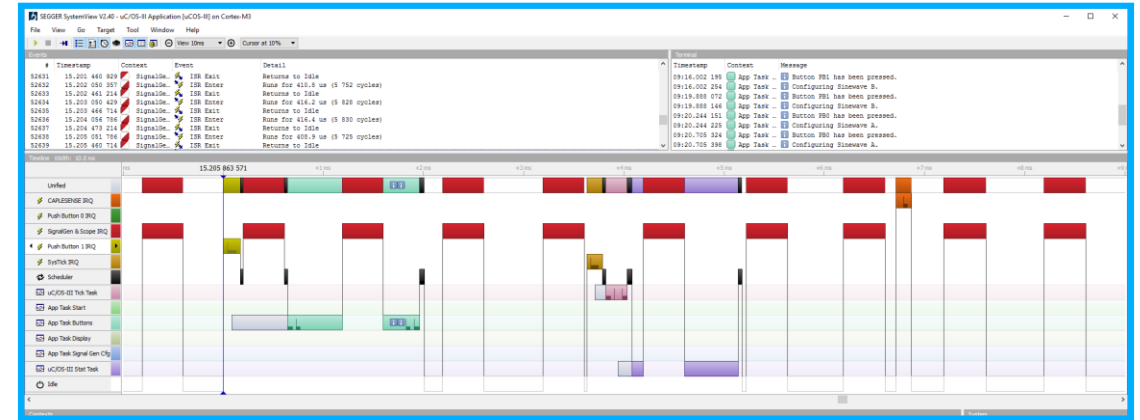
View, qualify your embedded system like never before

Energy Profiler
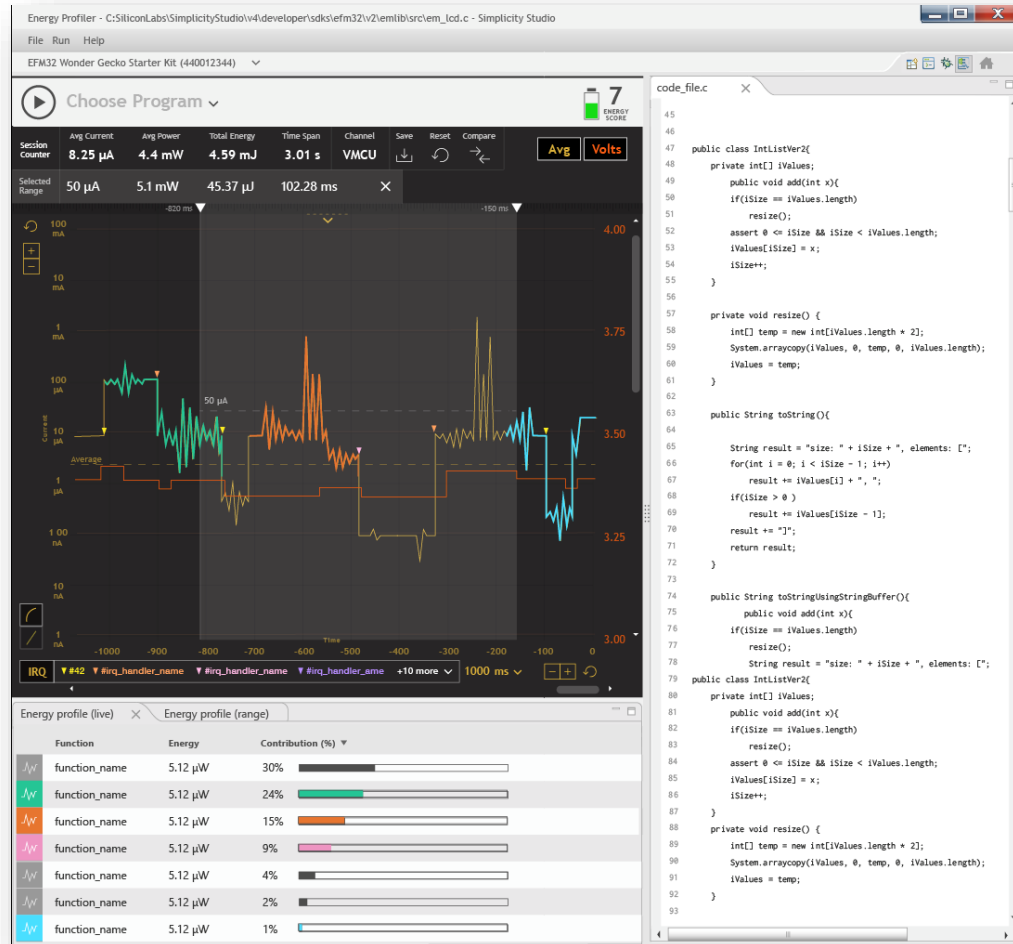
- Run-time visualizer for energy consumption

- Purpose
  - Improve battery life
  - Faster, simpler development and debugging

- Features
  - Energy vs. Code correlation
  - Available on all 32-bit Gecko Starter Kits
  - Examples in Simplicity Studio
  - Can be used with loads connected to STK's Vsupply

Advanced real-time energy profiling tools for optimization and debugging

Hardware Configurator
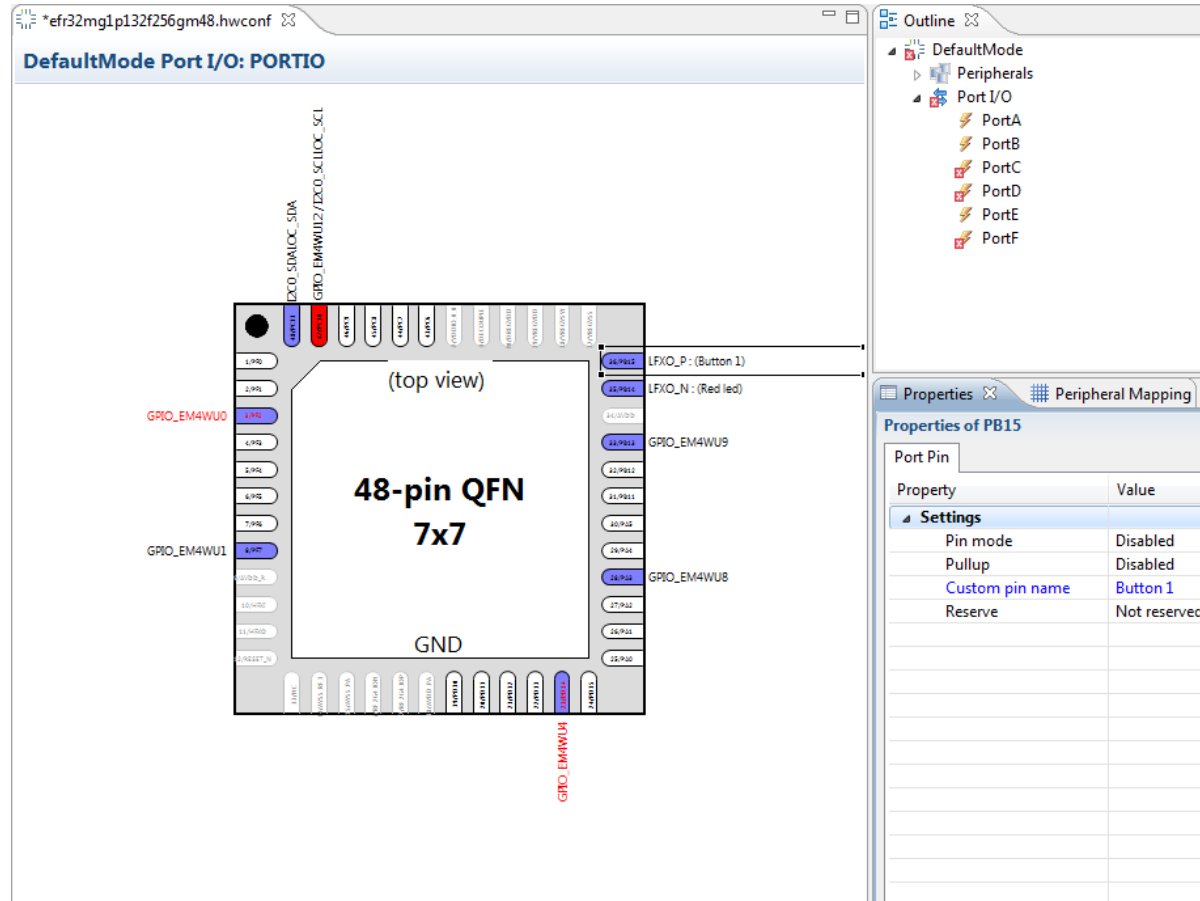
- **Graphical hardware configuration**
  - Clocks, DMA
  - I2C, SPI, UART
  - GPIO, etc.

- **Auto-generated C code for HW setup**
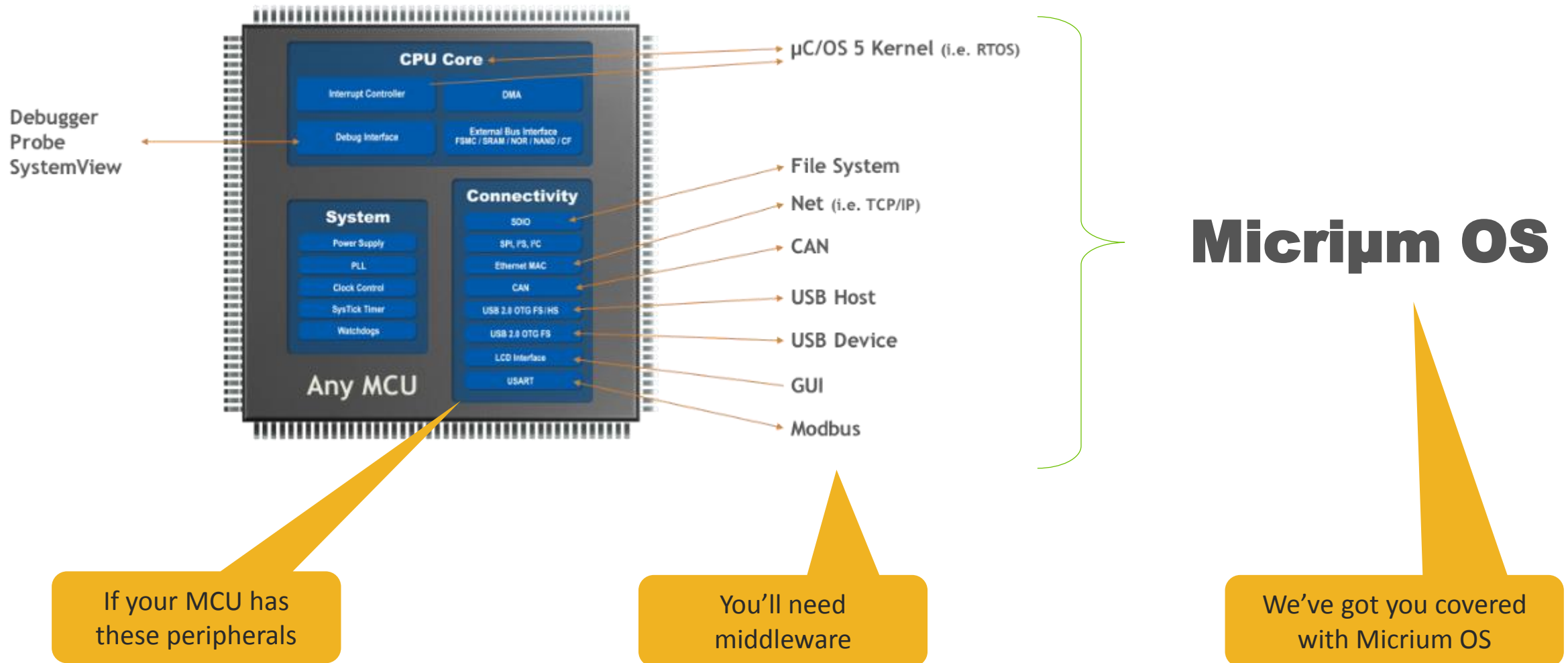
- **Support for GG11 in Q4**

Simplify GG11 configuration:
- Up to 192 pins
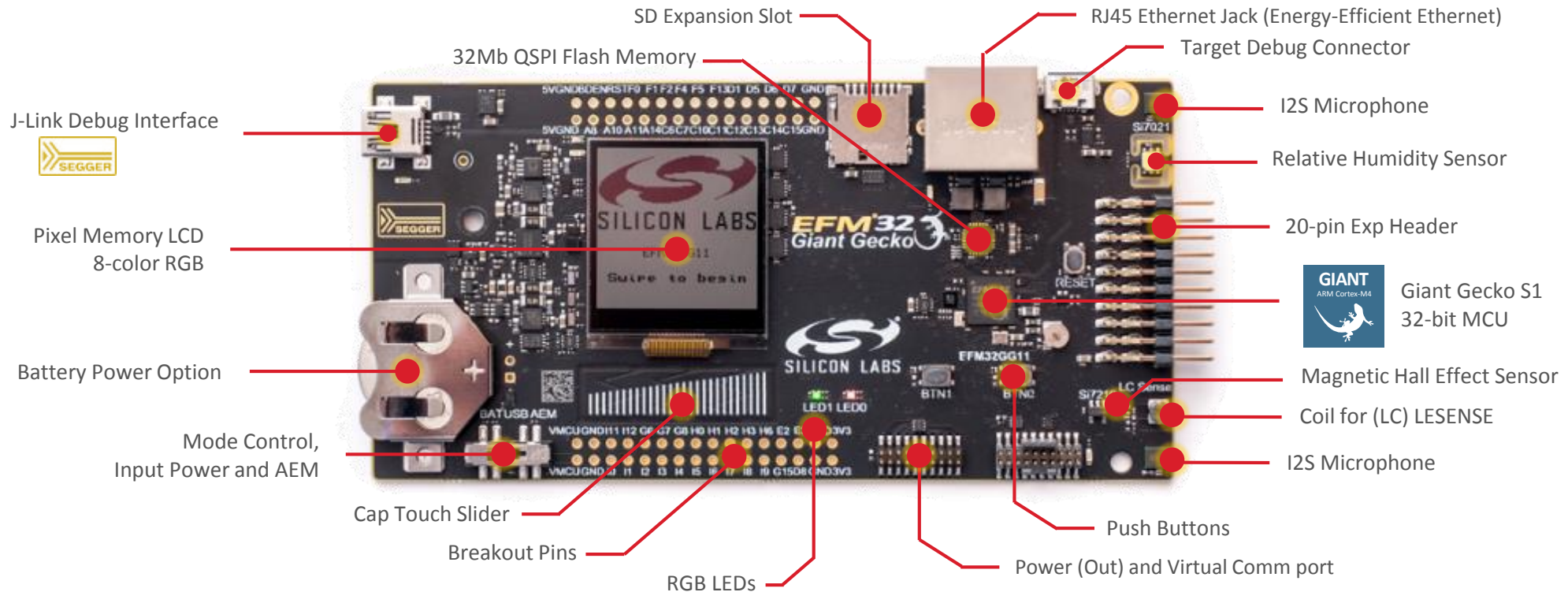- 144 GPIO
- 21x timers/counters
- 18x serial ports
- 5x clocks

Easy and Fast Device and Peripheral Configuration

Micrium OS (RTOS, Stacks and Middleware)

Integrated Starter Kits

Starter Kit (STK)	Part Number	Common EFM32 Starter Kit Features	Light Sensor	LC Sensors	User LEDs	Cap Touch	Extra Memory	LCD type	Unique Features	MSRP
Giant Gecko STK (S1)	SLSTK3701A	USB J-Link Debug 20-pin expansion header Temperature sensor Humidity sensor 2x push buttons Advanced Energy Monitor	-	✓	2x RGB	Slider	32 MB flash	Memory LCD (3-bit RGB)	10/100 Ethernet SD card slot 2x Stereo Mic Backup super cap	$99.99
Giant Gecko STK (S0)	EFM32GG-STK3700		✓	✓	2x YEL	Slider	32 MB flash	8x20 Segment	Backup super cap	$29.99

SD Expansion Slot
RJ45 Ethernet Jack (Energy-Efficient Ethernet)
32Mb QSPI Flash Memory
Target Debug Connector
J-Link Debug Interface
I2S Microphone
Relative Humidity Sensor
Pixel Memory LCD 8-color RGB
20-pin Exp Header
Giant Gecko S1 32-bit MCU
Battery Power Option
Magnetic Hall Effect Sensor
Coil for (LC) LESENSE
Mode Control, Input Power and AEM
I2S Microphone
Cap Touch Slider
Push Buttons
Breakout Pins
Power (Out) and Virtual Comm port
RGB LEDs

Get Started with Giant Gecko Today!

1. Visit: **www.silabs.com/products/mcu/32-bit/efm32-giant-gecko-s1**

2. Download the data sheet

3. Order a Starter Kit (STK)
   - SLSTK3701A

4. Launch kit demos provided in Simplicity Studio

5. Experience the benefits of GG11
   - Cortex M4, with 2MB/512KB
   - Ultra low power
   - High-speed interfaces
   - HMI / Capacitive touch
   - Up to 144 I/O

www.silabs.com/products/mcu/32-bit
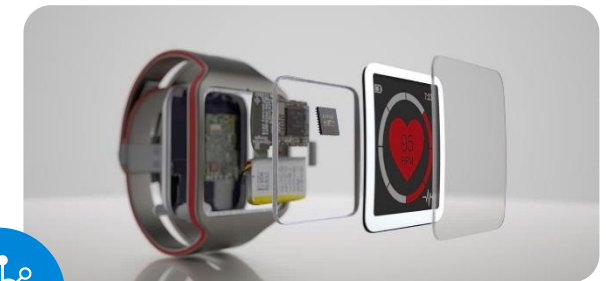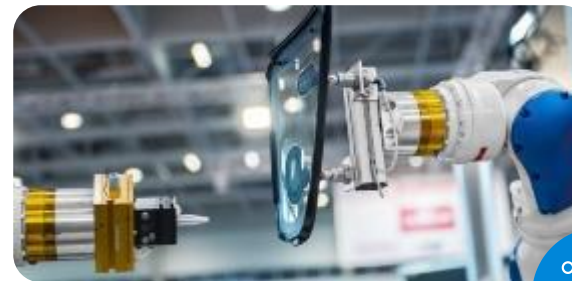
Thank you!

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