新一代智慧型 MCU 加速推動工業4.0

TONY HO, NOV 2017
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
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
Internet of Things: Our IoT Platform

- 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**

<table>
<thead>
<tr>
<th>Sensors</th>
<th>Discrete MCU</th>
<th>Discrete RF</th>
<th>Wireless SoC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industrial</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

- 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**

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<td><strong>Metering</strong></td>
<td>✓</td>
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</tr>
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</table>

- 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
- Advanced security
- 10+ yr battery

### Solutions

<table>
<thead>
<tr>
<th>Sensors</th>
<th>Discrete MCU</th>
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- 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

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- 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

Solutions

<table>
<thead>
<tr>
<th>Wearables</th>
<th>Sensors</th>
<th>Discrete MCU</th>
<th>Wireless Modules</th>
<th>Wireless SoC</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
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- 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

Medical

Solutions

<table>
<thead>
<tr>
<th>Medical</th>
<th>Sensors</th>
<th>Discrete MCU</th>
<th>Wireless Modules</th>
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</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

- 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

<table>
<thead>
<tr>
<th><strong>Multi-facet Systems</strong></th>
<th><strong>Low Power Budgets</strong></th>
<th><strong>Demanding UX</strong></th>
<th><strong>Limited Resources</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Large on-chip memory</td>
<td>- Autonomous functionality in deep sleep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- High integration</td>
<td>- Low sleep currents, fast wakeup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Unique peripheral capabilities</td>
<td>- Unique capabilities like PRS, LESENSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Micrium RTOS</td>
<td>- Patented CSEN technology</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>- Large on-chip RAM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Quad-SPI and EBI interfaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- GFX software</td>
<td></td>
<td></td>
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- Simplicity Studio
- Wireless stacks and network debug tools
- Configurators, AEM, Probe, System View...
## Unique to GG11 MCU and Silicon Labs

### Outdoor Sensors
- Autonomous peripherals
- Probe debugging tool
- 10/100 Ethernet
- Energy Profiler
- Backup power

### Industrial Sensors
- Deep Sleep functionality
- Professional RTOS
- QSPI
- LE Segment LCD
- Linked DMA

### Building Automation
- Easy to add wireless
- 144 GPIO
- LESENSE + PRS
- Low active current
- Ultra fast wakeup

### Smart Energy
- Easy to add wireless
- Long range, mesh, BLE, and Wi-Fi
- TRNG
- Crypto Acceleration
- Easy to use STK
- Cryo Timer

### Wearables / Health
- Robust networking SW
- Dual CAN
- SAR CSEN

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**Silicon Labs Confidential**
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

- 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
- RAM Memory
- LDMA Controller
- Debug Interface
- ETM

### Clock Management
- High Freq Crystal Osc
- PLL
- Ultra Low Freq RC Osc
- Low Freq Crystal Osc

### Energy Management
- Voltage Regulator
- USB Osc
- DC-DC Converter
- Power-on Reset
- Backup Domain

### Security
- Crypto AES, ECC, SHA, TRNG
- CRC32
- Security Mgmt Unit

### Feature available down to Energy Mode
- EM0 Run
- EM1 Sleep
- EM2 Deep Sleep
- EM3 Stop
- EM4H Hibernate
- EM4S Shutoff

### Serial Interfaces
- USART and UART
- Octal-SPI
- 10/100 Enet MAC
- SO/MMC SDIO
- CAN
- LE USB xtal-free
- LE UART

### I/O Ports
- EBI + pixel-alpha
- External Interrupt
- Pin Reset
- GPIO
- GPIO Wake-up
- TFT Driver

### Timers and Triggers
- Timer/Counter
- Low Energy Timer
- Pulse Counter
- Calendar
- Cryotimer

### Analog Modules
- LE LCD Controller
- ADC
- DAC
- Operational Amplifier
- Analog Comparator
- Current DAC
- Capacitive Sensing

---

**Easy to reduce power in your application with AEM and Energy Mode examples in Simplicity Studio**
Giant Gecko Series 1 – Highlights

**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**
Giant Gecko Series 1 – Highlights

Process, Control

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

CPU and Memory

- ARM Cortex-M4 FPU
- MPU
- Flash Program Memory
- ETM
- RAM Memory
- LDMA Controller
- External Interrupt
- GPIO (5V Tol)
- Reset
- GPIO Wake-up
- Wake
- Timers and Triggers
  - Timer/Counter
  - Low Energy Sensor IF
  - Real Time Counter
  - Pulse Counter
  - 2x Watchdog Timer
  - Calendar RTC
  - Cryotimer

Serial Interfaces

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

I/O Ports

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

Analog Modules

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

Configurable network of peripherals
Giant Gecko Series 1 – Highlights

Safe and Secure

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

CPU and Memory

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

Secure data processing and storage with MPU, SMU, and security keys

- Transmit/Receive secure data with built-in HW accelerators
- Dual watchdogs for safety
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

Octal/Quad-SPI Controller

SDIO/SD/MMC

Dual-CAN

LE Segment LCD Driver

- **10/100 Ethernet**
  - HFXO
  - MAC
  - PHY

- **Octal/Quad-SPI Controller**
  - MCU
  - Octal SPI
  - QSPI / Octal SPI Memory

- **SDIO/SD/MMC**
  - MCU
  - SDIO
  - SDIO Card Connector

- **Dual-CAN**
  - MCU
  - CAN
  - CAN
  - PHY
  - Sensor

- **LE Segment LCD Driver**
  - Reduce display power consumption
  - NEW Low Energy segment driver
Simple, Flexible Solutions

Wireless SoC
- Highest integration (32-bit wireless)

MCU + Module
- Simplest wireless design (32-bit wireless)

MCU + XCVR/NCP
- Highest design flexibility (8 / 32-bit wireless)

Standalone MCU
- Highest MCU integration (32-bit wired)

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

<table>
<thead>
<tr>
<th>Gecko Type</th>
<th>Features</th>
<th>Flash</th>
<th>Power</th>
<th>Frequency</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mighty Gecko</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>256 - 1024 kB</td>
<td>Up to 19.5 dBm</td>
<td>Sub-GHz + 2.4 GHz</td>
<td>QFN32, QFN48, WLCSP40</td>
</tr>
<tr>
<td>Blue Gecko</td>
<td>✓ ✓ ✓</td>
<td>128-1024 kB</td>
<td>Up to 19.5 dBm</td>
<td>Sub-GHz + 2.4 GHz</td>
<td>SIP, QFN32, QFN48, WLCSP40</td>
</tr>
<tr>
<td>Flex Gecko</td>
<td>✓ ✓ ✓</td>
<td>32-1024 kB</td>
<td>Up to 19.5 dBm</td>
<td>Sub-GHz + 2.4 GHz</td>
<td>QFN32, QFN48</td>
</tr>
<tr>
<td>Gecko MCUs</td>
<td>✓ ✓ ✓ ✓ ✓</td>
<td>4–2048 kB</td>
<td>USB, Ethernet, CAN</td>
<td>QFP, QFN, BGA, CSP</td>
<td>24 – 192 pins</td>
</tr>
</tbody>
</table>
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

- 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

<table>
<thead>
<tr>
<th>Application</th>
<th>Wireless Stacks</th>
<th>Mighty Gecko SoC</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Zigbee</td>
<td>RAIL</td>
</tr>
<tr>
<td></td>
<td>Bluetooth</td>
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</tr>
<tr>
<td></td>
<td>Micrium OS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radio Scheduler</td>
<td></td>
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</table>
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

PRS - Peripheral Reflex System

**Reflex Producers**
- ACMP
- ADC
- DAC
- GPIO
- RTC
- BURTC
- TIMER
- LETIMER
- LESENSE
- UART
- USART
- USB
- VCMP

**Reflex Consumers**
- ADC
- DAC
- TIMER
- LESENSE
- UART
- USART
- USB
- PCNT

**ARM Cortex-M Processor**

**Peripheral Reflex System**
- Channel 1
- Channel 2
- Channel n
LESENSE - Low Energy Sensor Interface

- 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

Lowest power, autonomous sensing
Resistive, inductive, capacitive
Configurable and scalable
LESENSE - Low Energy Sensor Interface

Analog events
Capacitive, inductive or resistive sensors

Generic MCU
Wake-up periodically to detect the events
LESENSE - Low Energy Sensor Interface

**Analog events**
Capacitive, inductive or resistive sensors

**Generic MCU**
Wake-up periodically to detect the events

**Gecko MCU**
Wake-up only on the events
LESENSE - Low Energy Sensor Interface

Analog events
Capacitive, inductive or resistive sensors

Generic MCU
Wake-up periodically to detect the events

Gecko MCU
Wake-up only on the events

Gecko MCU
Conditional wake-up (e.g. on every 2nd event)
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

Inductive Measurement
• Tank circuit sensor
• Measure rate of decay in inductor oscillation
• Total current down to 1.5 µA

Dedicated Capacitive Touch
• Robust SAR-based operation
• Up to 64 inputs
Why Capacitive Touch (CSEN)?

<table>
<thead>
<tr>
<th>ADVANCED TECHNOLOGY</th>
<th>SIMPLE TOOLS</th>
<th>YOUR FINAL PRODUCT</th>
</tr>
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<tbody>
<tr>
<td><strong>NEW</strong> SAR-based Cap Sensing</td>
<td>Easy to Configure</td>
<td>Great Product UX</td>
</tr>
<tr>
<td>▪ More robust</td>
<td>Easy to Test</td>
<td>▪ Touch buttons / surfaces</td>
</tr>
<tr>
<td>▪ Higher noise and Voffset immunity</td>
<td>▪ Capacitive Sense Profiler</td>
<td>▪ Single-touch displays</td>
</tr>
<tr>
<td>▪ Enhanced touch resolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Ultra-low power</td>
<td></td>
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The Fast, Easy Way to Add Capacitive Touch Sensing

The Fast, Easy Way to Add Capacitive Touch Sensing

Your Final Product

Great Product UX

Touch buttons / surfaces

Single-touch displays

Easy to Configure

Easy to Test

Capacitive Sense Profiler
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

- 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

- 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

RTC or Calendar Mode
Operates down to EM4 and backup mode
LETIMER - Low Energy Timer

- 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

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

---

Flexible output generation
Available down to EM3
CRYOTIMER – Ultra Low Energy Timer/Counter

- CRYOTIMER Overview
  - Available in all energy modes, down to EM4S
  - 32-bit counter
  - $1 \times 2^N$ 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

Lowest Power Timer
Available in all energy modes
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**

- **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

---

10x faster than SW
Asymmetric and symmetric
Use through mbedTLS

$G@]%5| \rightarrow$ CRYPTO \rightarrow Hello!

Hello!
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
Focusing on your Development Experience

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

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

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

**uC/Probe Target Comms Module**

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

Visually instrument and test your embedded system

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

Easy and Fast Device and Peripheral Configuration

Simplify GG11 configuration:
- Up to 192 pins
- 144 GPIO
- 21x timers/counters
- 18x serial ports
- 5x clocks
Micrium OS (RTOS, Stacks and Middleware)

If your MCU has these peripherals
You’ll need middleware
We’ve got you covered with Micrium OS
## Integrated Starter Kits

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

**Features:**
- **J-Link Debug Interface**
- **32Mb QSPI Flash Memory**
- **Pixel Memory LCD 8-color RGB**
- **Battery Power Option**
- **Mode Control, Input Power and AEM**
- **Cap Touch Slider**
- **Breakout Pins**
- **RGB LEDs**
- **Push Buttons**
- **Power (Out) and Virtual Comm port**
- **J25 Ethernet Jack (Energy-Efficient Ethernet)**
- **Target Debug Connector**
- **I2S Microphone**
- **Relative Humidity Sensor**
- **20-pin Exp Header**
- **Magnetic Hall Effect Sensor**
- **Coil for (LC) LESENSE**
- **I2S Microphone**

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**Unique Features**:
- Backup super cap
- 10/100 Ethernet SD card slot
- 2x Stereo Mic Backup super cap

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Get Started with Giant Gecko Today!

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
Thank you!