

# CC3120/CC3220 SimpleLink™ Wi-Fi® Overview

Aaron Lee – Texas Instruments

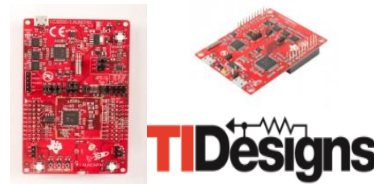
# Agenda

- Introduction to SimpleLink™ Wi-Fi® Solutions
- SimpleLink WiFi CC3220/CC3120
  - Low power
  - Security
  - Provisioning
  - HomeKit
  - Gen 1 to Gen 2 migration
  - Release schedule

# SimpleLink™ Wi-Fi® platform: Low-power embedded Wi-Fi

## Value Propositions

- **Wi-Fi and Internet connectivity on any system:** Wi-Fi and networking built-in
- **Easy to program:** Low barrier to entry - No Wi-Fi experience needed
- **Hardware design examples, 30+ software examples**
- **Low power design:** Wi-Fi connected for more than a year on two AA batteries



### Products

- **CC3100/CC3120: Wi-Fi Network Processor**
  - Connect any MCU to the Internet
- **CC3200/CC3220: MCU with Wi-Fi**
  - Integrated ARM Cortex-M4 MCU + Peripherals + Wi-Fi Network processor

### Features

- On-chip Internet & Wi-Fi security
- Flexible provisioning: AP mode, WPS, SmartConfig and more
- FCC/CE/ETSI/TELEC/SRRC certified modules
- SDK for development with IAR Workbench and Code Composer Studio

### Applications

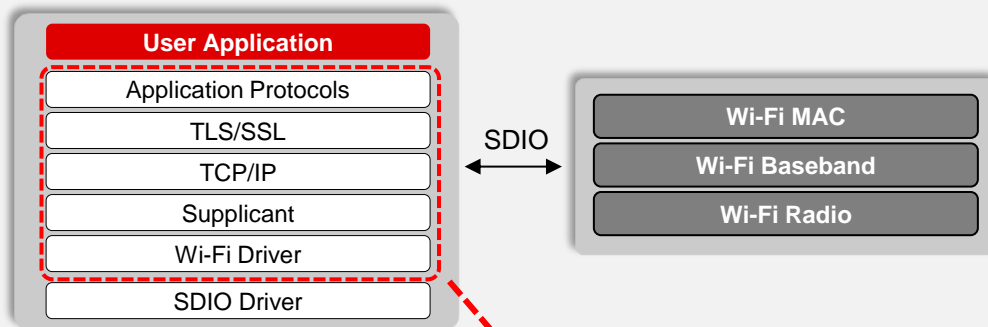
- Internet of Things (IoT)
- Home automation & appliance
- Safety and security
- Smart energy
- Industrial M2M communication
- Wireless audio streaming



# The SimpleLink™ Embedded Wi-Fi® Advantage

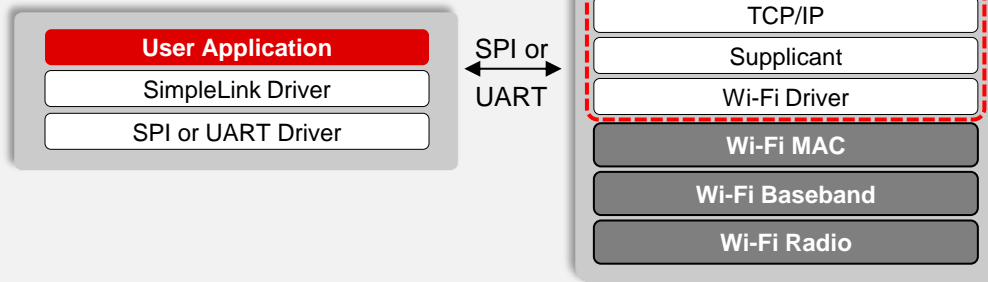
## Traditional Wi-Fi

- Designed for powerful microprocessors
- Ex: WiLink



## SimpleLink™ CC31xx/CC32xx

- Nearly all Wi-Fi and networking functions already handled by the Network Processor
- Use low capability MCU (7KB Flash & 700B RAM)
- **Less** expertise
- **Lower** system cost
- **Faster** time to market



# SimpleLink™ Wi-Fi® Gen2: R, S, SF

- SimpleLink Wi-Fi Gen2 major features:
  - Improved Power Optimizations
  - Enhanced system security features
  - Provisioning enhancements
  - HomeKit for iOS9 support
  - IPv6
  - 1MB on-chip flash memory variant available
- Revision will contain 4 new part numbers:

Product Number	Enhanced Features	Enhanced Security	Flash	RAM
CC3120R NMRGK	•			
CC3220R M2RGK (T / R)	•			256K
CC3220S M2RGK (T / R)	•	•		256K
CC3220SF 12RGK (T / R)	•	•	1M	256K

# Product Comparison: CC32XX

- **CC3200/CC3220:** MCU with Wi-Fi
  - Integrated ARM Cortex-M4 MCU + Peripherals + Wi-Fi Network processor

CC3200R	CC3200R Module	CC3220R	CC3220S	CC3220SF	CC3220S Module	CC3220SF Module
IPv4 Internet	IPv4 Internet	IPv4 + IPv6 Internet	IPv4 + IPv6 Internet	IPv4 + IPv6 Internet	IPv4 + IPv6 Internet	IPv4 + IPv6 Internet
				1 MB Internal Flash		1 MB Internal Flash
			Secure device	Secure device	Secure device	Secure device
	Necessary passives, crystals, etc. included				Necessary passives, crystals, etc. included	Necessary passives, crystals, etc. included
	FCC/IC/CE/T ELEC/SRRC certified				FCC/IC/CE/T ELEC/SRRC certified	FCC/IC/CE/T ELEC/SRRC certified

# Product Comparison: CC31XX

- **CC3100/CC3120:** Wi-Fi Network Processor
  - Connect any MCU to the Internet

CC3100R	CC3100R Module	CC3100R	CC3120R Module
IPv4 Internet	IPv4 Internet	IPv4 + IPv6 Internet	IPv4 + IPv6 Internet
	Necessary passives, crystals, etc. included		Necessary passives, crystals, etc. included
	FCC/IC/CE/T ELEC/SRRC certified		FCC/IC/CE/T ELEC/SRRC certified

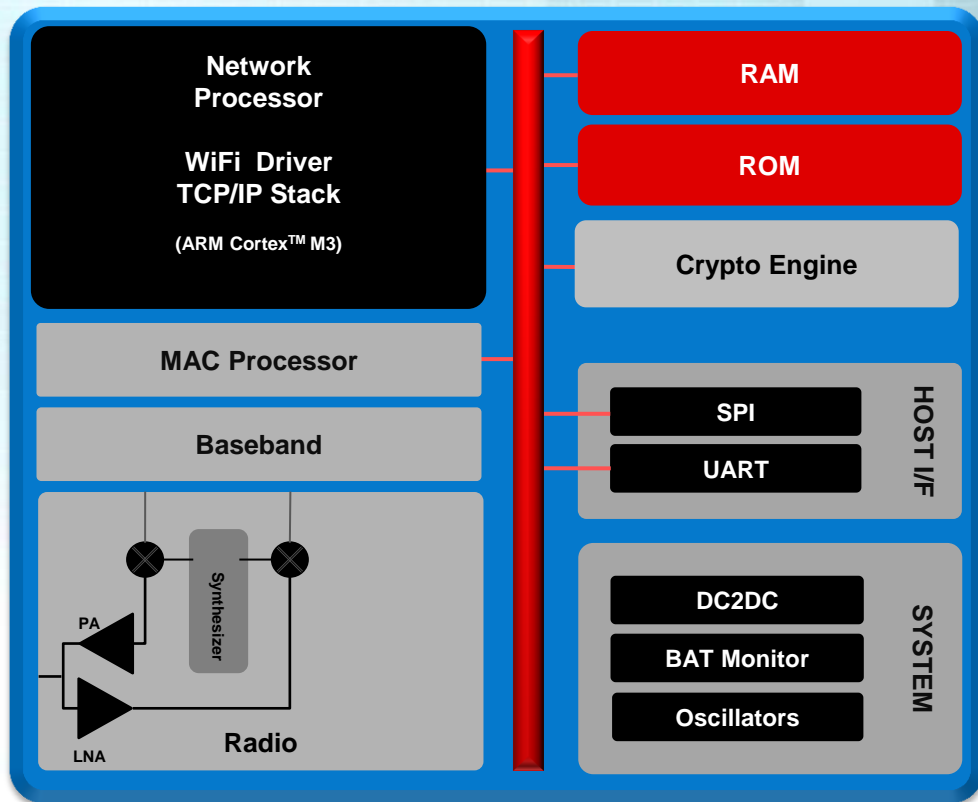
# Hardware Overview



	CC3100/CC3120	CC3200/CC3220	Modules
<b>SimpleLink Solution</b>	<ul style="list-style-type: none"> <li>• Wi-Fi® Network Processor</li> <li>• Customer Application runs on an external MCU</li> </ul>	<ul style="list-style-type: none"> <li>• Cortex M4 Applications processor + Wi-Fi® Network Processor</li> <li>• M4 Application stored on Serial Flash</li> </ul>	<ul style="list-style-type: none"> <li>• Modular certification for FCC, IC, CE, TELEC, SRRG</li> </ul>
<b>System Diagram</b>			
<b>Package</b>	<p>QFN (64) 9.0 mm x 9.0 mm</p>	<p>QFN (64) 9.0 mm x 9.0 mm</p>	<p>MOB (63) 20.5 mm x 17.5 mm</p>

# SimpleLink CC3100/CC3120 Wi-Fi® NWP overview

- **Best-in-class Wi-Fi core**
  - 802.11 b/g/n radio/baseband/MAC
  - Channels 1-13
- **Powerful Crypto engine**
  - Enables fast secured WLAN and Internet connections w/ 256 bit encryption
- **Built in Power Management**
  - Integrated DC2DC
  - Advanced low power modes
- **Integrated ARM® Cortex™-M3 MCU**
  - Dedicated to WLAN and TCP/IP stack
  - Offloads the host application processor
- **Host Interfaces**
  - Interfaces with 8/16/32 MCUs over a SPI or UART
  - SimpleLink driver has low memory footprint on host



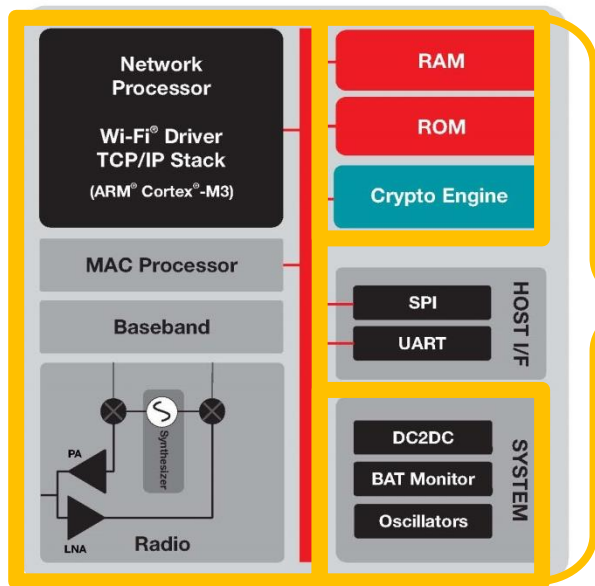
# SimpleLink Hardware

Two **pin compatible** products based on the same Wi-Fi network processor

## CC3100/CC3120 Internet on a chip

### Wi-Fi Network Processor

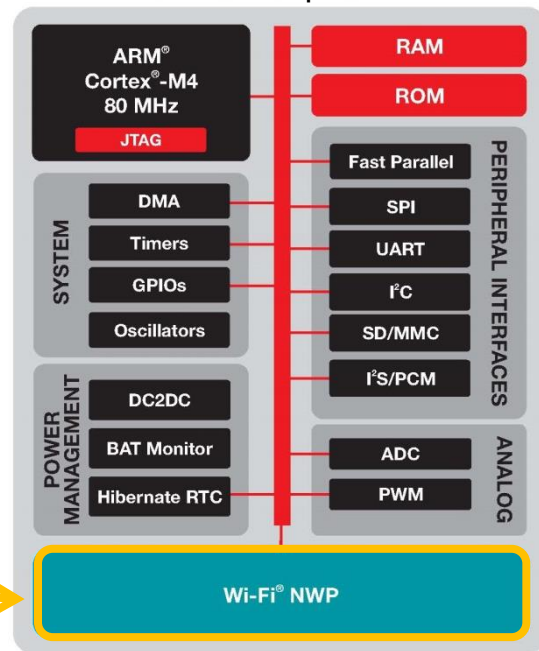
Embedded TCP/IP stack for systems using  
external low-cost MCU



## CC3200/CC3220 MCU + Internet

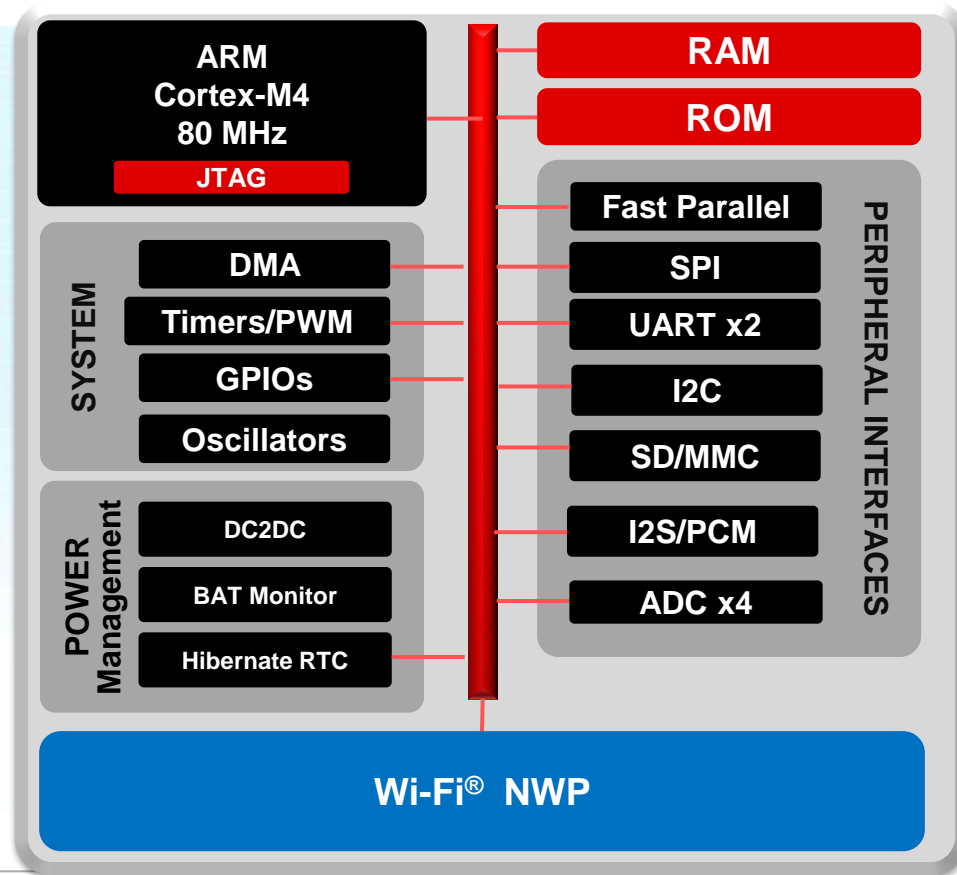
### Wireless MCU

80MHz ARM® Cortex™-M4 integrated  
+ Wi-Fi network processor



# SimpleLink CC3200/CC3220 Hardware Overview

- **ARM® Cortex™ M4 Core @ 80MHz**
- **Memory options**
  - RAM (up to 256KB)
  - 1MB internal flash for CC3220SF
  - Peripheral Drivers in ROM
- **Rich peripheral interfaces (32 I/O pins)**
  - SPI (20 MHz max), UART (5Mbps max),
  - MCASP (two I2S channels)
  - I2C, SDIO
  - 4-channel 12 bit ADC (0.5MSPS)
  - Parallel Interface
  - 4 PWM controls
  - Up to 27 GPIOs
  - Factory restore
- **Built in Power Management**
  - Integrated DC2DC
  - Advanced low power modes
  - Hibernate mode with RTC
- **Wi-Fi® Network Processor**



# SimpleLink Software

# Socket API

BSD Socket API	SimpleLink Socket API	Notes
accept()	sl_Accept()	
bind()	sl_Bind ()	
close()	sl_Close ()	
connect()	sl_Connect ()	
getbyhostaddr()		
getbyhostname()	sl_NetAppDnsGetHostByName()	
	sl_NetAppDnsGetHostByService()	
getsockopt()	sl_GetSockOpt ()	
listen()	sl_Listen ()	
poll()		Same functionality can be performed by select().
recv()	sl_Recv ()	
recvfrom()	sl_RecvFrom ()	
select()	sl_Select ()	
send()	sl_Send ()	
sendto()	sl_SendTo ()	
setsockopt()	sl_SetSockOpt ()	
socket()	sl_Socket ()	

# Simple Example

Send “Hello server” to www.google.com:

```
sl_Start(0,0,0);
```

```
SISockAddrIn_t  Addr;
```

```
unsigned int uiIP;
```

```
int iSockID;
```

```
SIParams_t secParams = {0};
```

```
secParams.Key = “password123”;
```

```
secParams.KeyLen = 11;
```

```
secParams.Type = SL_SEC_TYPE_WPA2;
```

```
sl_WlanConnect(“MyAPName”, 8, 0, &secParams, 0);
```

```
while(!IS_CONNECTED(g_ulStatus) || (!IS_IP_ACQUIRED(g_ulStatus))) sl_Task();
```

```
sl_NetAppDnsGetHostByName(“www.google.com”, 14, (unsigned long*)&uiIP, SL_AF_INET);
```

```
Addr.sin_family = SL_AF_INET;
```

```
Addr.sin_port = sl_Htons(80);
```

```
Addr.sin_addr.s_addr = sl_Htonl(uiIP);
```

```
iSockID = sl_Socket(SL_AF_INET,SL_SOCKET_STREAM, 0);
```

```
sl_Connect(iSockID, (SISockAddr_t *)&Addr, sizeof(SISockAddrIn_t));
```

```
sl_Send(iSockID, “Hello server.”, 14, 0 );
```

# SimpleLink™ CC3220/CC3120 enhanced features

Feature	Description	Comments	3220R 3120R	3220S	3220SF
<a href="#">Secure MCU</a>	Secured serial flash file system and bootloader support	<ul style="list-style-type: none"> <li>Data protection</li> <li>Clone protection</li> <li>Secure boot with code authentication</li> <li>Secure file delivery over the air</li> </ul>		✓	✓
Power consumption optimizations	Further power optimization for Always Connected (e.g. thermostat), Intermittently Connected (e.g. sensor) and Transceiver (e.g. RTLS tag) modes.	<ul style="list-style-type: none"> <li>AP pattern learning algorithm to optimize current consumption in connected mode</li> <li>Improvement for Intermittently Connected via DHCP renew</li> <li>Improved power consumption and timing in device initialization and WLAN connection</li> <li>One time calibration option to reduce overall system power consumption.</li> </ul>	✓	✓	✓
IPv6	Adding support for IPv6	Supporting IPv4/IPv6 mixed modes	✓	✓	✓
HomeKit certification	Additional IP and Security components for HomeKit certification	HomeKit supporting iOS 9 iCloud	✓	✓	✓
Provisioning enhancements	SmartConfig enhancements	SmartConfig now supports: <ul style="list-style-type: none"> <li>40Mhz channels</li> <li>MIMO networks</li> <li>Operation with AP mode</li> </ul>	✓	✓	✓



# SimpleLink™ CC3220/CC3120 enhanced features (2)

Feature	Description	Comments	3220R 3120R	3220S	3220SF
AP support of 4 stations	AP capabilities extension to support up to 4 STA connected concurrently		✓	✓	✓
WPA2 enterprise cert	Wi-Fi Alliance certification for enterprise environment		✓	✓	✓
16 sockets	Increased number of concurrent sockets		✓	✓	✓
6 secure sockets	Increased number of secure sockets		✓	✓	✓
Trigger Mode (Asynchronous Control API)	Improve power consumption: <ul style="list-style-type: none"> <li>- Async mechanism for long time operations</li> <li>- Enable host sleep in Non-OS systems</li> </ul>		✓	✓	✓
AT commands	AT commands I/F support by host add-on		✓	✓	✓
Enhanced Rx filtering	<ul style="list-style-type: none"> <li>- Fully Supporting WoWLAN</li> <li>- Host wake up trigger based filter setting</li> <li>- Generic filter setting operation</li> </ul>		✓	✓	✓
Over-the-air programming + Factory Default	<ul style="list-style-type: none"> <li>- Restore to Factory Default option</li> <li>- HW IO option for factory reset, no SW dependency</li> <li>- Robust system behavior</li> </ul>	Built-in OTA support	✓	✓	✓

# Low Power Optimization

# Optimizing for Power Consumption - Software

- MCU in some type of sleep mode for majority of time, wake up for communication
- SimpleLink device can enter multiple power modes/schemes

- Hibernate

- » 4.5  $\mu$ A
- » Only the RTC is running
- » Wakeup from timer or from GPIO
- » Must perform full re-initialization
- » Must reload RAM with code
- » Must reconnect Wi-Fi and sockets



- MCU LPDS/NWP off

- » 135  $\mu$ A
- » Wakeup from timer or GPIO
- » Must re-initialize NWP
- » Must reconnect Wi-Fi and sockets



- Idle Connected

- » 710  $\mu$ A to ~300  $\mu$ A
- » Wakeup from timer, GPIO, or network



# Low Energy Consumption for Battery Powered Devices

## – Choice of protocol

- Use lighter weight protocol whenever possible
- For secure sockets, avoid using ECDHE when possible
- Reduce number of packets sent/received

## – Use Long Sleep Interval feature

- Wake for some beacons
- Check if data buffered by AP
- Up to 2 sec interval
- Additional latency for async. data

## – Parallelism between NWP and MCU

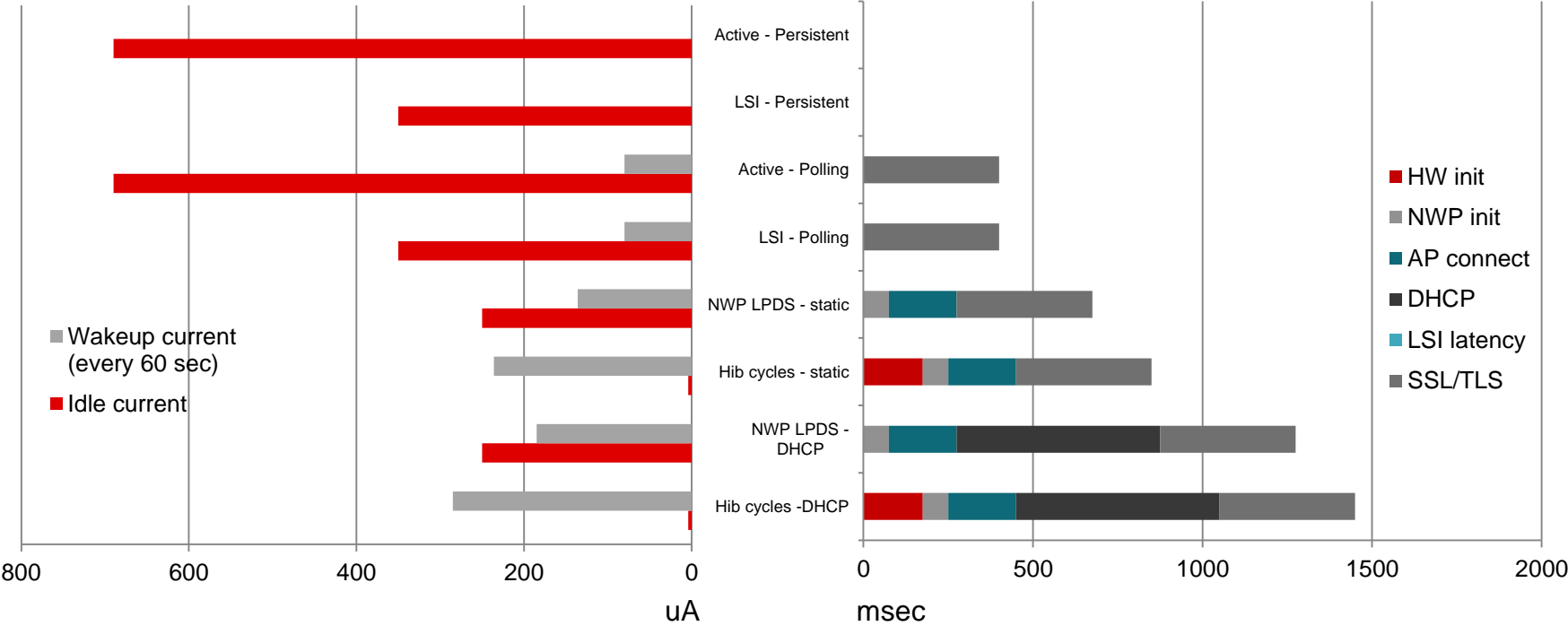
- `sl_Start()`
- Waiting for AP connection
- Waiting for DHCP

# Low Energy Consumption for Battery Powered Devices

Power consumption

vs

Latency



\*Example numbers only, based on Gen 1 observations. Do not use for system design

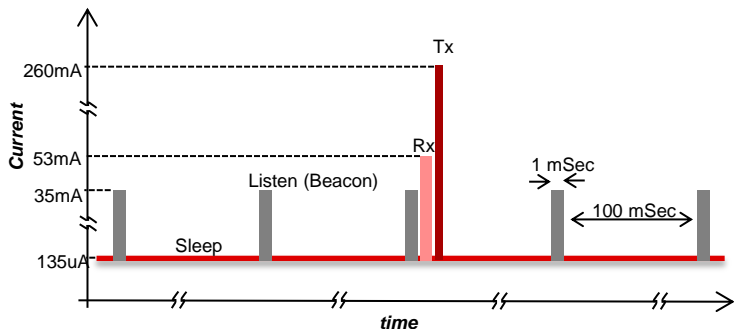
# Low Energy Consumption for Battery Powered Devices

- Stay connected to AP
- Use **Long Sleep Intervals**
- Optimizations:
  - Use persistent socket, accept data asynchronously

## Always Connected

Sleep cycle:

1. MCU wakeup from event
2. Communicate with peer, etc
3. Return to MCU sleep



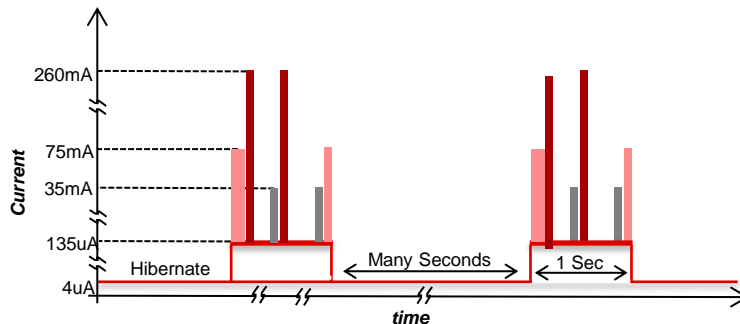
# Low Energy Consumption for Battery Powered Devices

- NWP in hibernate
- Device must reinitialize
- Use fast connect feature
- Optimizations
  - Static IP if possible
  - Poll peer with lightweight protocol

## Intermittently Connected

Hibernate cycle:

1. Device wakeup from event
2. Start SimpleLink NWP
3. Connect to access point
4. Communicate with peer, etc
5. Return to Hibernate

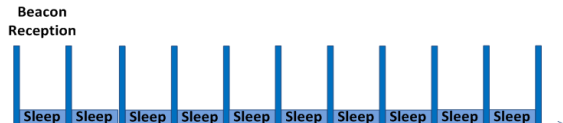


# SimpleLink™ CC3220/CC3120 improvements for low power

- Power management and extended battery life are primary focus areas for embedded low-power Wi-Fi devices.
  - CC3x20 Enhancements:
    - Robust and stable beacon listen mode Improved **idle connected applications** with a beacon listen current (~1mA) across at least **80% of APs more robust/stable**
    - **Faster AP reconnection**
    - **DHCP renew**: Improves the latency for intermittently connected profile and reduces the overall current by 25%.
    - **Optimized initialization** sequence, including one time calibration reduces current consumption for all applications - especially for **tag and sensor profiles**.

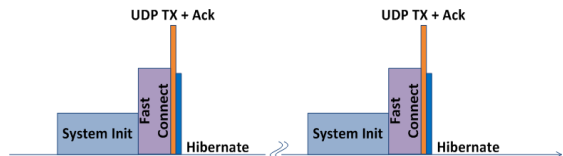


# SimpleLink™ CC3220/CC3120 improvements for low power: Test cases



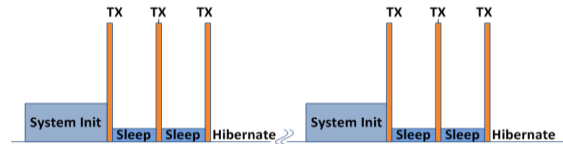
## Always Connected (e.g. thermostat):

Maintain connection to AP, listening to beacon every 1 sec



## Intermittently Connected (e.g. sensor):

Connect to AP/Server every 60 sec. Send packet, back to hibernate



## RTLS (e.g. asset tag):

Send 3 packets every 60 sec.

Gen. 1

Gen. 2

230uA  
(12 months  
@2700mAh)

230uA  
(12 months  
@2700mAh)

Increased  
robustness across  
APs

3100uC  
(3 years @2700mAh)

2500uC  
(4 years @2700mAh)

3150uC / cycle  
(3 years @2700mAh)

1850uC / cycle  
(5 years @2700mAh)

# SimpleLink™ CC3220/CC3120 Trigger Mode

- The trigger mode enables host application to be triggered by the SimpleLink device when network activity is detected, without using blocking mode or polling the socket.

- Polling:

```
while(status<0){  
    status=sl_Recv();  
    // other tasks  
    // sleep  
}
```

- Need to wake up frequently to check socket

- Blocking:

```
Thread 1:  
    status=sl_Recv();  
  
Thread 2:  
    // other tasks  
    // sleep
```

- Need multiple threads in RTOS environment

- Trigger mode:

```
void SimpleLinkSocketTriggerEventHandler() {  
    trigger=1;  
}  
...  
while(1){  
    if(trigger){  
        sl_Select();  
        status=sl_Recv();  
    }  
    // other tasks  
    // sleep  
}
```

# SimpleLink™ CC3220/CC3120 Trigger Mode

- Most useful for Non-OS battery powered applications
- The trigger mode will cause an event once one or more sockets become “ready”
- The event can occur while MCU is in sleep or not in sleep
- When the host wakes up, sl\_Select needs to be called in order to identify the network activity.
- All socket operations can be monitored in this way, which allows flexibility to implement many communication use cases.

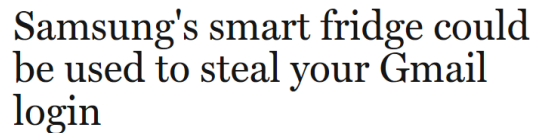
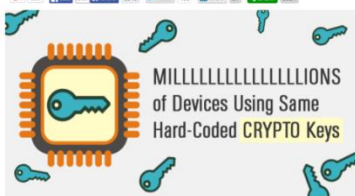
# SimpleLink™ CC3220/CC3120 Security Enhancements

# IoT today – a Vulnerable World



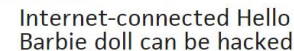
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## WEB OF INSECURITY: HACKED BABY MONITORS HIGHLIGHT PERILS OF INTERNET OF THINGS

BY CONOR GAFFEY ON 9/4/15 AT 11:33 AM



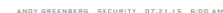
The iconic toy becomes a connected device, and promptly gets pegged for security issues.



BOSTON/SINGAPORE | BY JIM PHYLE AND JEREMY NAGSTAFF



MORE THAN 750,000 PHISHING AND SPAM EMAILS LAUNCHED FROM "THINGBOTS" INCLUDING TELEVISIONS, FRIDGE



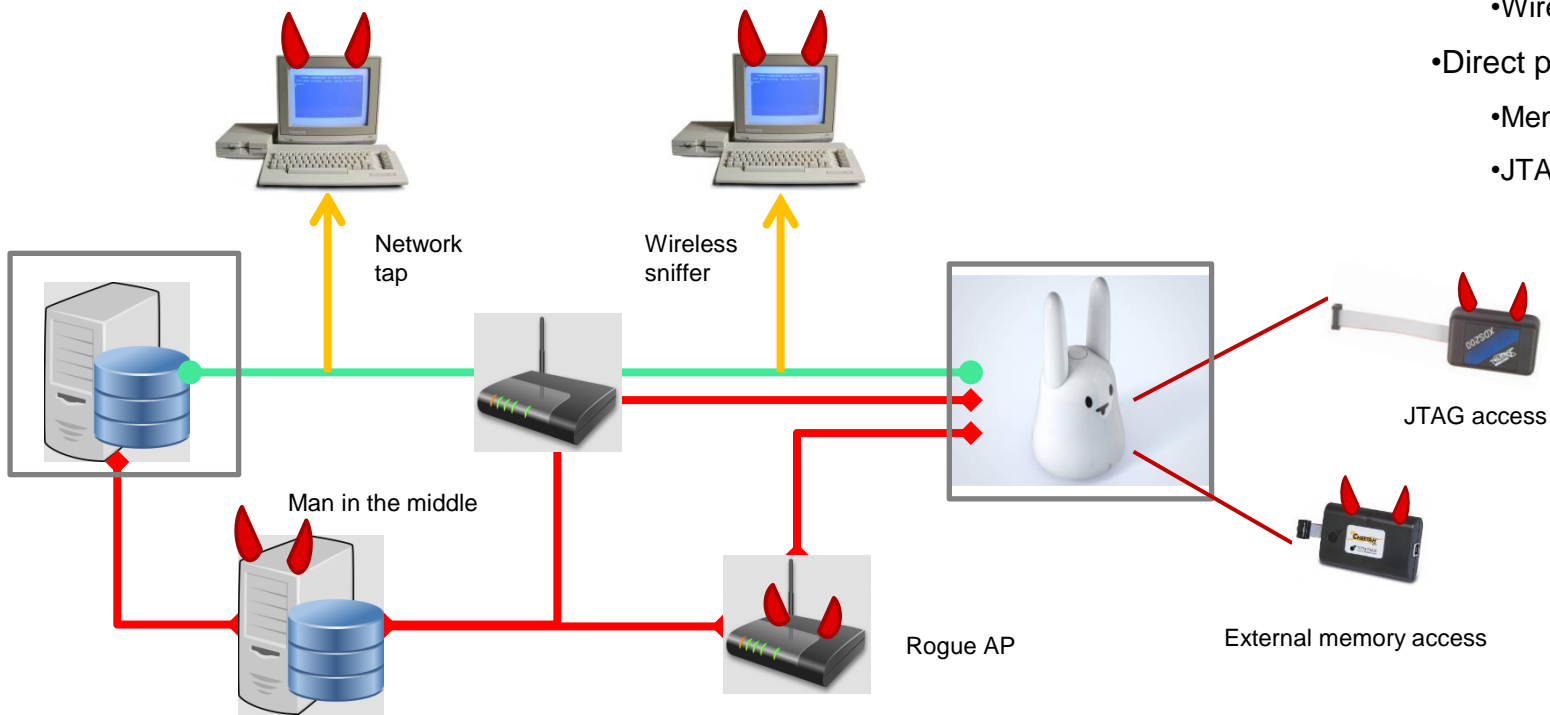
## HACKERS REMOTELY KILL A JEEP ON THE HIGHWAY—WITH ME IN IT



# Security Threats

Exposure points:

- Network access
  - Wired network
  - Wireless interface
- Direct physical access
  - Memory storage
  - JTAG

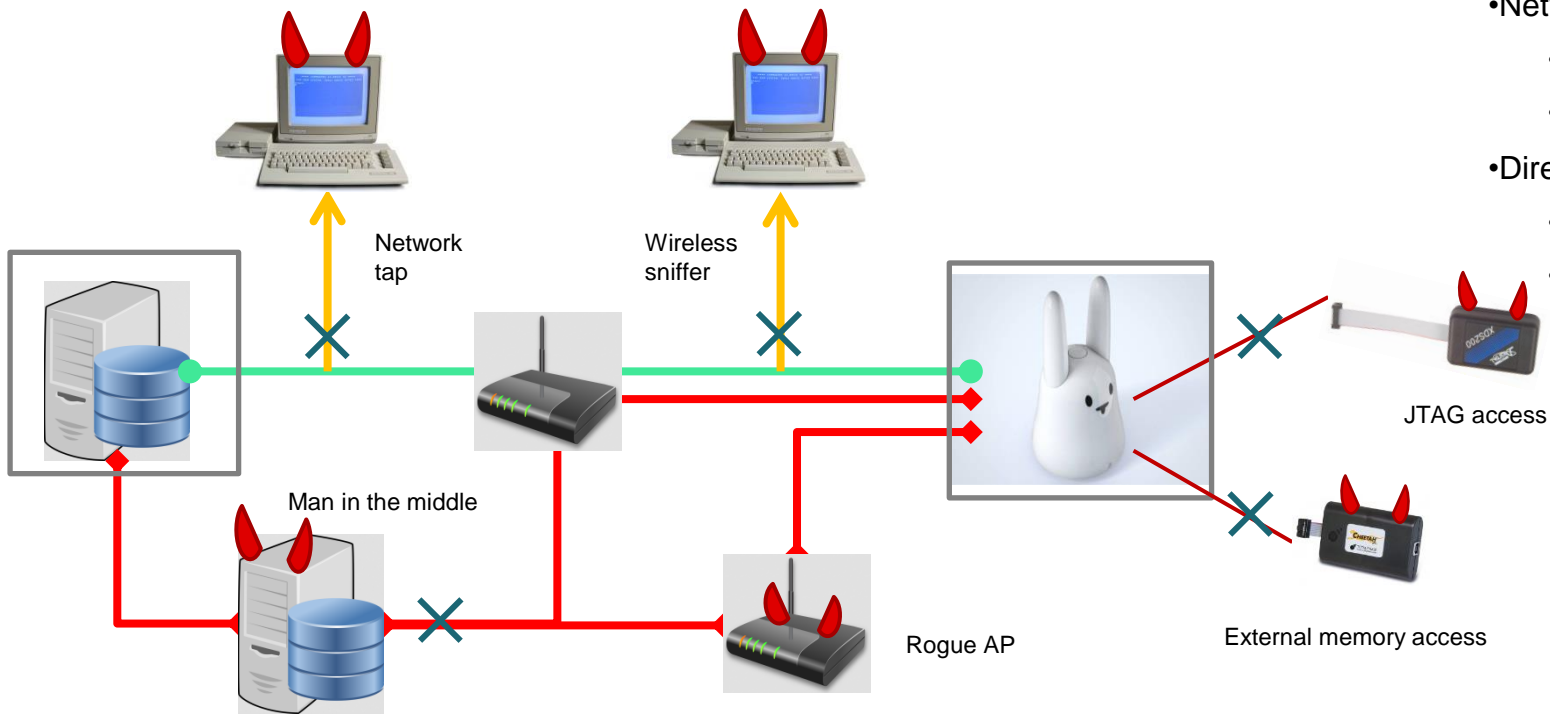


# SimpleLink™ CC3220/CC3120 Security Measures

SimpleLink™ CC3220/CC3120

## Security

- Network access
  - Secure sockets
  - Certificate verification
- Direct physical access
  - Encrypted file system
  - JTAG locked



# Built-in Wi-Fi and Internet Security

## On Chip Wi-Fi® security

- ☐ WPA2 Personal
- ☐ WPA2 Enterprise
- ☐ WPS2
- ☐ 802.1x
- ☐ EAP Fast
- ☐ EAP PEAPv0/1
- ☐ EAP PEAPv0 TLS
- ☐ EAP PEAPv1 TLS
- ☐ EAP TLS
- ☐ EAP TTLS TLS
- ☐ EAP TTLS MSCHAPv2



## On-Chip Internet security

- ☐ SSL 3.0
- ☐ TLS 1.2
- ☐ X.509
- ☐ DES3
- ☐ AES256
- ☐ MD5
- ☐ SHA2
- ☐ RSA
- ☐ ECC



**HW encryption engines establish  
TLS/SSL connection in ~200 mSec**



# SimpleLink™ CC3220/CC3120 - Networking Security Extension

- Add **SHA-2 384** based ciphers
- Add **Galois/Counter Mode (GCM)** based ciphers

## Gen1 Cipher Suites

- `SSL_RSA_WITH_RC4_128_SHA`
- `SSL_RSA_WITH_RC4_128_MD5`
- `TLS_RSA_WITH_AES_256_CBC_SHA`
- `TLS_DHE_RSA_WITH_AES_256_CBC_SHA`
- `TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA`
- `TLS_ECDHE_RSA_WITH_RC4_128_SHA`
- `TLS_RSA_WITH_AES_128_CBC_SHA256`
- `TLS_RSA_WITH_AES_256_CBC_SHA256`
- `TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256`
- `TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256`

## Gen2 Cipher Suites

- `SSL_RSA_WITH_RC4_128_SHA`
- `SSL_RSA_WITH_RC4_128_MD5`
- `TLS_RSA_WITH_AES_256_CBC_SHA`
- `TLS_DHE_RSA_WITH_AES_256_CBC_SHA`
- `TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA`
- `TLS_ECDHE_RSA_WITH_RC4_128_SHA`
- `TLS_RSA_WITH_AES_128_CBC_SHA256`
- `TLS_RSA_WITH_AES_256_CBC_SHA256`
- `TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256`
- `TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256`
- `TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA`
- `TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA`
- `TLS_RSA_WITH_AES_128_GCM_SHA256`
- `TLS_RSA_WITH_AES_256_GCM_SHA384`
- `TLS_DHE_RSA_WITH_AES_128_GCM_SHA256`
- `TLS_DHE_RSA_WITH_AES_256_GCM_SHA384`
- `TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256`
- `TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384`
- `TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256`
- `TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384`

**NEW**

# SimpleLink™ CC3220/CC3120 - Security Features



Feature	Description	R	S	SF
Secure socket	On-chip Wi-Fi security and TLS/SSL Internet security	✓	✓	✓
Socket upgrade to secure socket	Enable socket upgrade to secure socket on run time	✓	✓	✓
HTTPs - Secured http server	Integrated secured https server based on https 1.0	✓	✓	✓
Secured network information	Network passwords and certificates are encrypted	✓	✓	✓
Crypto accelerators	Application can access on-chip crypto engines	✓	✓	✓
Secure and authenticated Service Pack	Service Pack signed based on TI certificate	✓	✓	✓
Secured file system	Secured sFlash file system and boot-loader support		✓	✓
Code and data protection	User Application and data files are encrypted on sFlash		✓	✓
Code and data authentication	User Application and data files are authenticated with a public key certificate		✓	✓
Cloning protection	Application and data files are bound to specific device		✓	✓
Access control	Application and data files are protected against unauthorized access		✓	✓
Device locked	JTAG and debug ports are locked		✓	✓



# SimpleLink Gen. 2 Provisioning

# Most Flexible and Robust Provisioning

Provisioning Method	Access Point with HTTPS server	SmartConfig™	WPS
What's needed	Web browser	Android or iOS phone app	Push button on router
Networks supported	Any Network	Most networks	WPS enabled routers only
How many Steps	Multiple Steps	1 step	1 step (push button)
Number devices configured	Configure one device	configure multiple devices	Configure one device
Home network connection	Phone must disconnect from home network	phone stays connected to the home network	NA
Secure	Secure	Secure	Not secured

- Gen 2 improvements:
  - SmartConfig and Access Point operate simultaneously and based on user selection and configuration device capabilities
  - Access Point provisioning mode is now secured based on internal HTTPS server
  - More robust success/fail notification feedback to the user
  - Apple Wireless Accessory Configuration (WAC) support

# Provisioning Options

- **Access Point (AP)**
  - The un-provisioned Wi-Fi device temporarily operates as an AP
  - AP provisioning requires a smartphone or tablet to connect via Wi-Fi to the temporary AP
  - The user can use the smartphone to transmit the network information for the desired AP to the Wi-Fi device
- **Station Mode + SmartConfig (SC)**
  - SC is a TI proprietary provisioning method that uses a smartphone or tablet to broadcast network credentials to a TI Wi-Fi device
  - The SimpleLink Wi-Fi device operates as a station and scans for the SC data broadcasts
- **AP + SmartConfig (AP + SC)**
  - The SimpleLink Wi-Fi device is in AP role while simultaneously scanning for SC broadcasts
  - Users can either connect via AP or SC provisioning
- **AP + SmartConfig + External Configuration**
  - In this mode the device is in AP role
  - Users can either connect via AP, SC, or an external configuration method managed at the host level (such as WAC—an Apple MFi licensed technology)
- **Wireless Protected Setup (WPS)**
  - Certain APs that support WPS allow devices to connect for a brief time period at the push of a button—not very secure

# SmartConfig™ Improvements

Domain	Item	Gen1 Status	Gen2 Status
Device	MIMO Modulations	Not working when the device is transferring data with the AP in MIMO mode	✓
	SISO 40MHz connection	Not working when the device is transferring data with the AP in SISO 40MHz mode	✓
	Proprietary 256QAM modulations	Not working when the device is transferring data with the AP using non-standard proprietary modulation schemes. <ul style="list-style-type: none"> <li>• Devices - iPhone 4, Galaxy S4, LG2</li> <li>• AP: ~4-5 years back – Apple Airport extreme, Linksys E1000</li> </ul>	✓
Environment	<ul style="list-style-type: none"> <li>• mDNS</li> <li>• Congested AIR</li> <li>• Short packets</li> </ul>	<ul style="list-style-type: none"> <li>• Some APs do not support mDNS</li> <li>• May not work in a very congested environment</li> <li>• May not work if phone and AP transmit</li> </ul>	✓
	<ul style="list-style-type: none"> <li>• AP Restart</li> </ul>	<ul style="list-style-type: none"> <li>• Some AP recognize the SC transmission as an attack</li> </ul>	✓
Application	64B password not supported	The application is limiting the password to 32 Bytes – the device supports 64Bytes	✓
	OS Support	Only iOS and Android	

# Over the Air Programming

# Over the Air Updating - Overview

- Over the Air (OTA) programming allows for updating software via a network connection. This includes:
  - ❑ SimpleLink Service Pack
  - ❑ CC3200/CC3220 MCU application
  - ❑ Internet content (HTML, Java script)
  - ❑ Configuration files, etc.
- OTA is a critical feature needed by many end products, because it allows for:
  - ❑ In-the-field software upgrades
  - ❑ Bug fixes
  - ❑ Fast programming in assembly line
- We provide support for OTA
  - ❑ Necessary infrastructure for robust OTA
  - ❑ Code libraries and examples





# Over the Air Programming (OTA)

- CC3220/CC3120 has the ability to use “**bundles**” to automatically enable reliable OTA for multiple files
- Bundles enable changes to the content to a group of files
- Can accept or reject the changes for all the files in the group at once. This is important because of the possible dependencies between files
- The bundle is used by the OTA process which downloads a group of files and needs the ability to first test the files and then to accept or reject the downloaded content



(bundle)

# CC3220 OTA with Bundles

After a new bundle is downloaded, the bundles state is changed to "**STARTED**".

Upon reboot, the bundle state changes to "**PENDING\_COMMIT**". Reading the file in the bundle will show the new copies.

The Application must test the files for validity, and call API to either commit or rollback

After commit or reboot the bundle state changes to "**STOPPED**". If commit was successfully called, the new version of bundle of files will be active. Otherwise the old ones will remain active.



# HomeKit Support

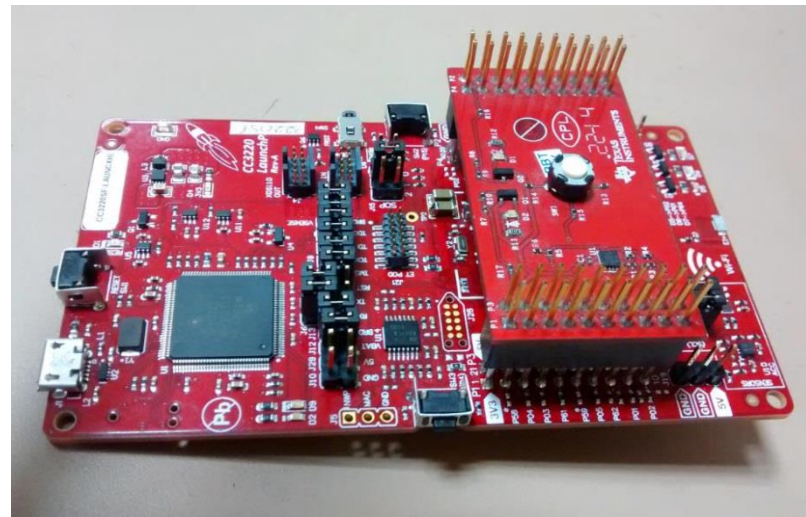
# HomeKit

- **HomeKit** is a framework for communicating with and controlling connected accessories in the home environment.
- It defines a ***HomeKit Accessory Protocol*** (HAP) over an IP network
- Controller (iOS device) and an accessory can communicate directly via the local network or the cloud
- We have developed a library for using the HAP, and has proven ability to pass HomeKit certification.



# HomeKit Development Support

- HomeKit library was developed for the CC3220
  - HomeKit library can technically run on the CC3220S/R but use of CC3220SF is recommended for almost all applications due to memory constraints
- Developer must be verified MFi licensee to receive our software
  - They must download through [mySecure Software](#)
- User Guide for Blink example
  - Control an LED on the Launchpad via mobile app
- Apple Authentication Coprocessor is required
  - Communicates with MCU via I2C interface
  - TI MFi Booster Pack is used to fulfill this requirement



# Uniflash/Image Creator

- Programming method based entirely on “gang image” creation
  - Entire contents of serial flash is flashed at once
  - An image is not the final contents of the serial flash
  - The SimpleLink device converts the image into the filesystem and files upon boot when it detects the presence of a gang image
  - MCU program, user files, etc.
  - Service pack
  - Default configurations
    - Country code
    - Device role (STA/AP/P2P)
    - TX power
- SPI programming more suitable for mass production than UART-based mechanism
  - SPI programmer connected directly to lines of serial flash
  - Provisions on board layout needed
  - Serial flash manufacturer may be able to pre-program devices
  - Faster process
  - Parallelism

# Image Creator

- Image Creator Tool is used to create gang images
- Image Creator Tool can also be used to flash gang image to device
  - Uses UART interface

The screenshot shows the 'General-> Settings' window of the Texas Instruments Image Creator. The left sidebar contains a navigation menu with sections: General (Settings), System Setting (Device, Role Settings, STAWi-Fi® Direct Device, AP/Wi-Fi® Direct GO, WLAN Settings, Network Settings, Network Applications), and Files (User Files, Service Pack, Certificate Store). The main area is titled 'General-> Settings' and contains three sections: 'Image Mode' with a dropdown set to 'Development' and a text field for 'Original Mac Address' containing '98:7b:f3:13:d2:cb'; 'Capacity' with a dropdown set to '2M BYTE' and a 'Check device size' button; and a bottom section with 'Secured Device' (False), 'Target Device' (Preproduction Device), 'Return To Factory Image SOP' (Enable), 'Return To Factory Configuration' (Defaults and Image), and a checked checkbox for 'Use device MAC Address' with an empty text field. On the right, there are buttons for 'Service Pack', 'Certificate', and 'Help', a 'Device status' section showing 'Connected: Off', and a 'Connect' button with three icons below it.

**TEXAS INSTRUMENTS**

**General-> Settings**

**General**

- Settings

**System Setting**

- Device
  - Radio Settings
- Role Settings
  - General Settings
  - STAWi-Fi® Direct Device
    - Network Settings
  - AP/Wi-Fi® Direct GO
    - WLAN Settings
    - Network Settings
  - Network Applications

**Files**

- User Files
- Service Pack
- Certificate Store

**Image Mode**

Development

Original Mac Address

98:7b:f3:13:d2:cb

**Capacity**

2M BYTE

Check device size

Secured Device

False

Target Device

Preproduction Device

Return To Factory Image SOP

Enable

Return To Factory Configuration

Defaults and Image

☒ Use device MAC Address

Service Pack Certificate Help

Device status

Connected: Off

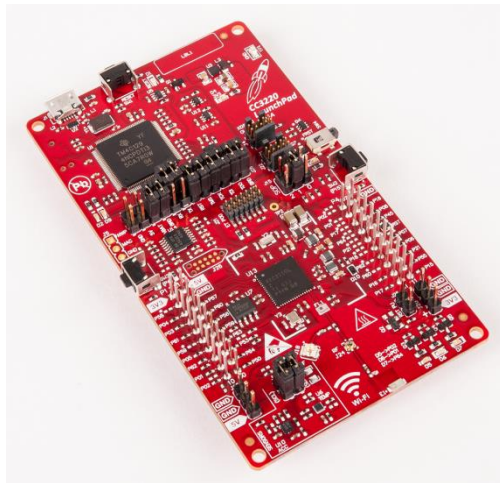
Connect

Icons: Save, Refresh, Share

# SimpleLink Gen. 2 Development Boards

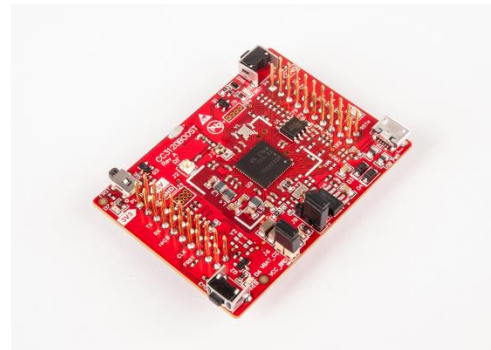
- CC3220 Launchpad

- Chip antenna
- 40-pin TI Launchpad standardized connectors
- 2 x GPIO Pushbuttons
- 3 x GPIO LEDs
- I2C Temperature sensor
- I2C 3-axis Accelerometer



- CC3120 Boosterpack

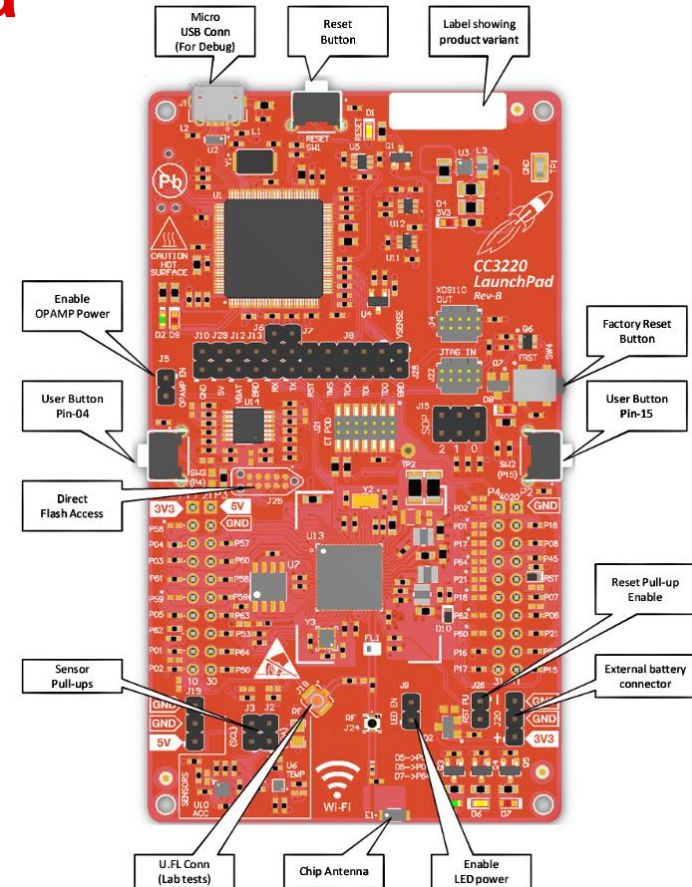
- Chip antenna
- 40-pin TI Launchpad standardized connectors





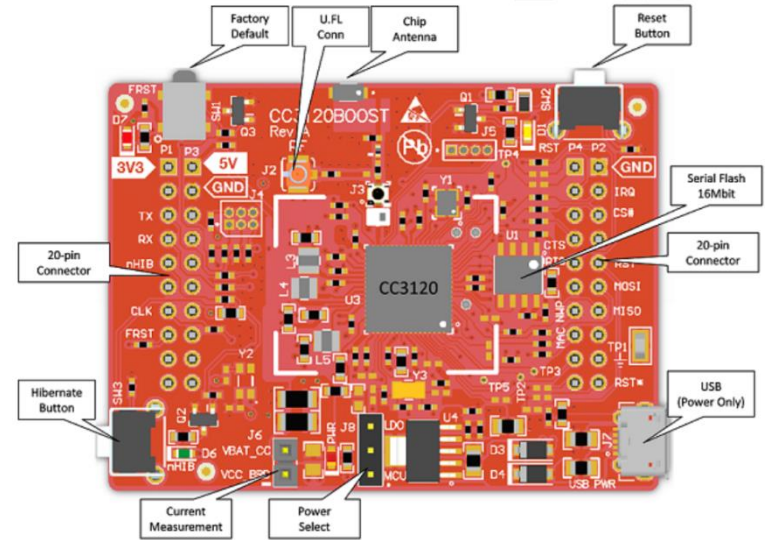
# SimpleLink CC3220 Launchpad

- 32 Mbit serial flash
- Header for direct serial flash programming through SPI
- Factory restore button
- XDS110-based JTAG emulation with serial port for flash programming
- U.FL connector for external antenna
- Jumper for measuring power consumption



# SimpleLink CC3120 Boosterpack

- 16 Mbit serial flash
- Factory restore button
- U.FL connector for external antenna
- Power from onboard LDO using USB or 3.3 V from MCU LaunchPad
- Jumper for measuring power consumption





- <http://www.ti.com/llds/ti/wireless-connectivity/wi-fi/simplelink-wi-fi-cc31xx-cc32xx/overview.page>