

The image features a background of a blue-toned circuit board with glowing orange and yellow points of light. A grid of small white plus signs is overlaid on the entire scene. The ARM logo is positioned on the left side.

arm

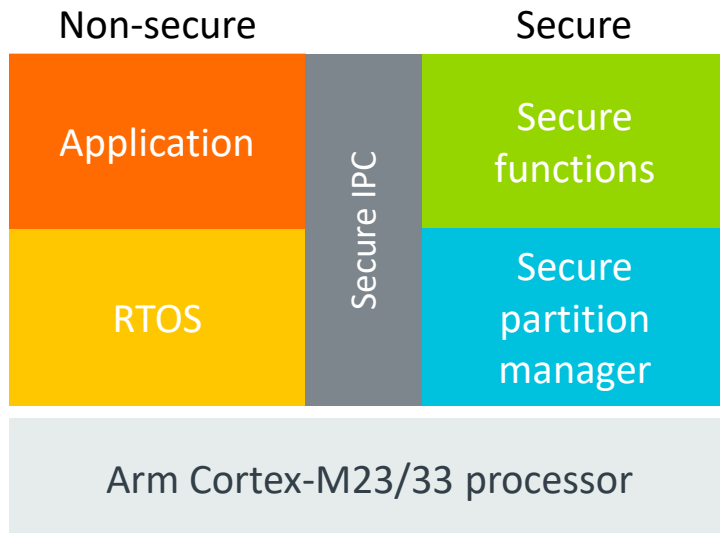
Secure, Optimized Software

For battery-powered applications

Solutions for IoT end-node software development challenges

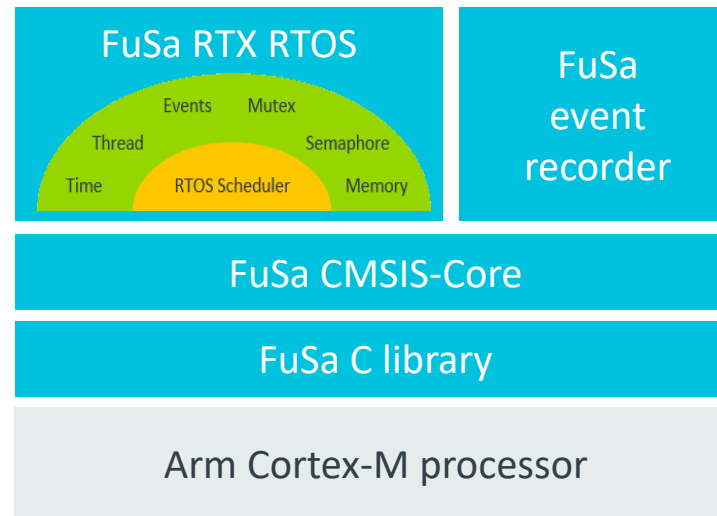
Security

TF-M: Trusted firmware implements Arm PSA for Armv8-M



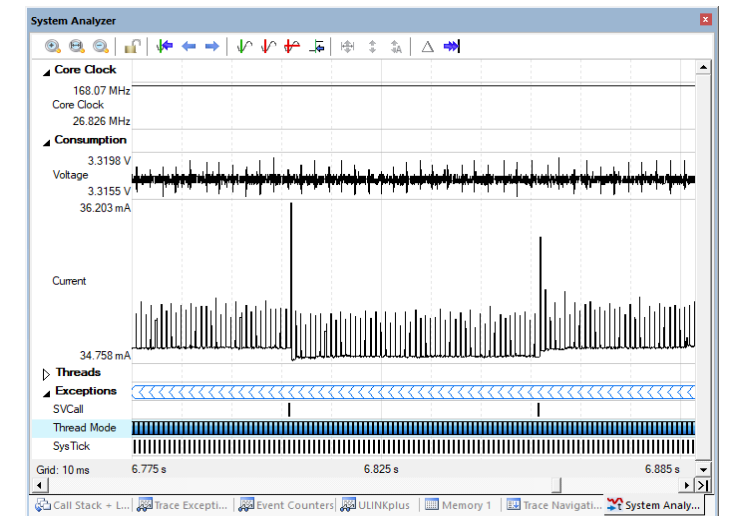
Safety

FuSA RTS: Run-time system certified for functional safety

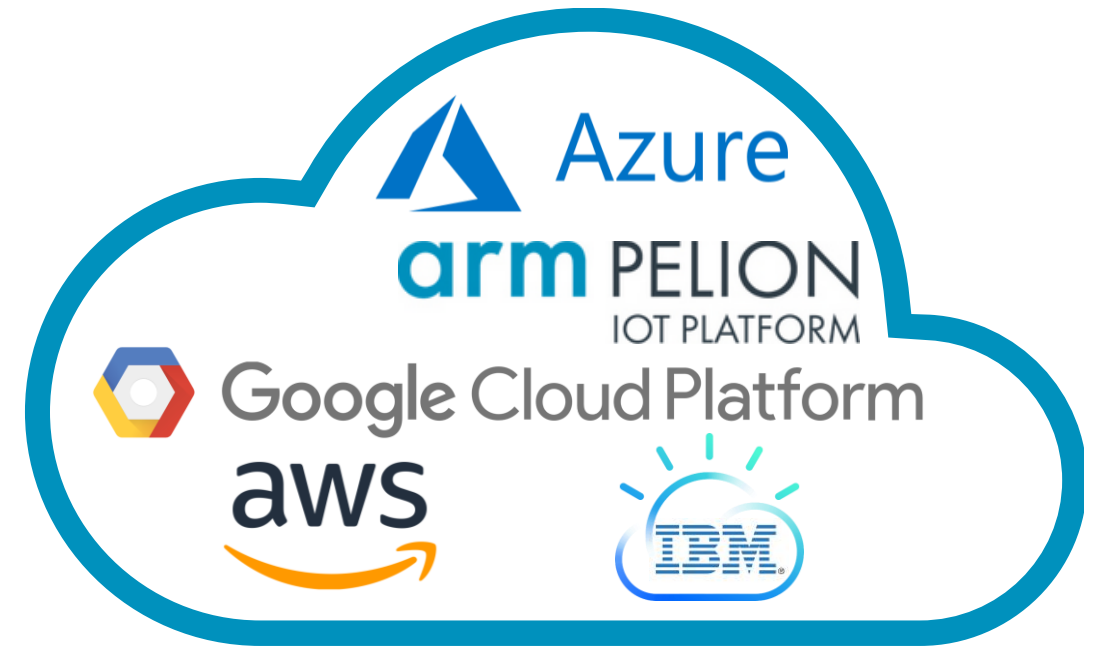
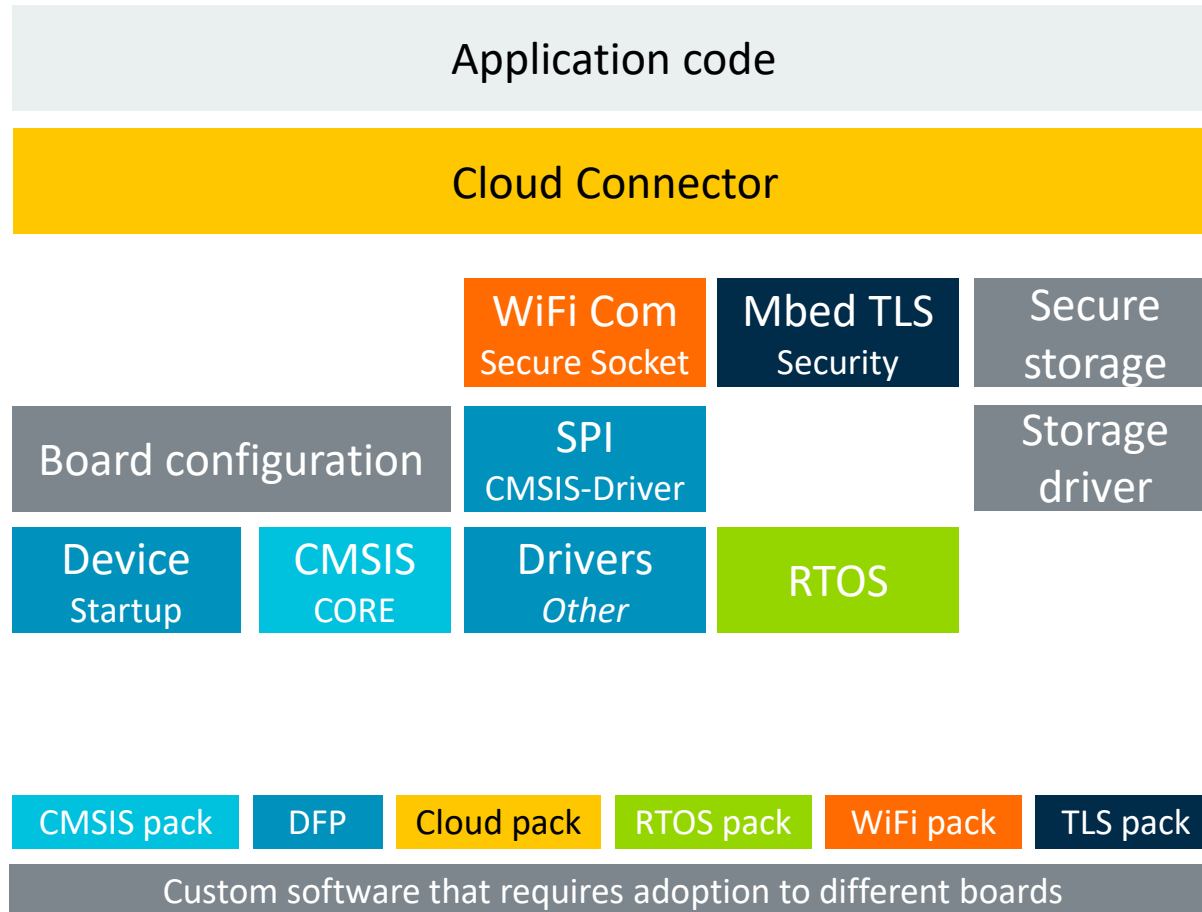


Power consumption

ULINKplus: Debug & power analysis synchronized with program events

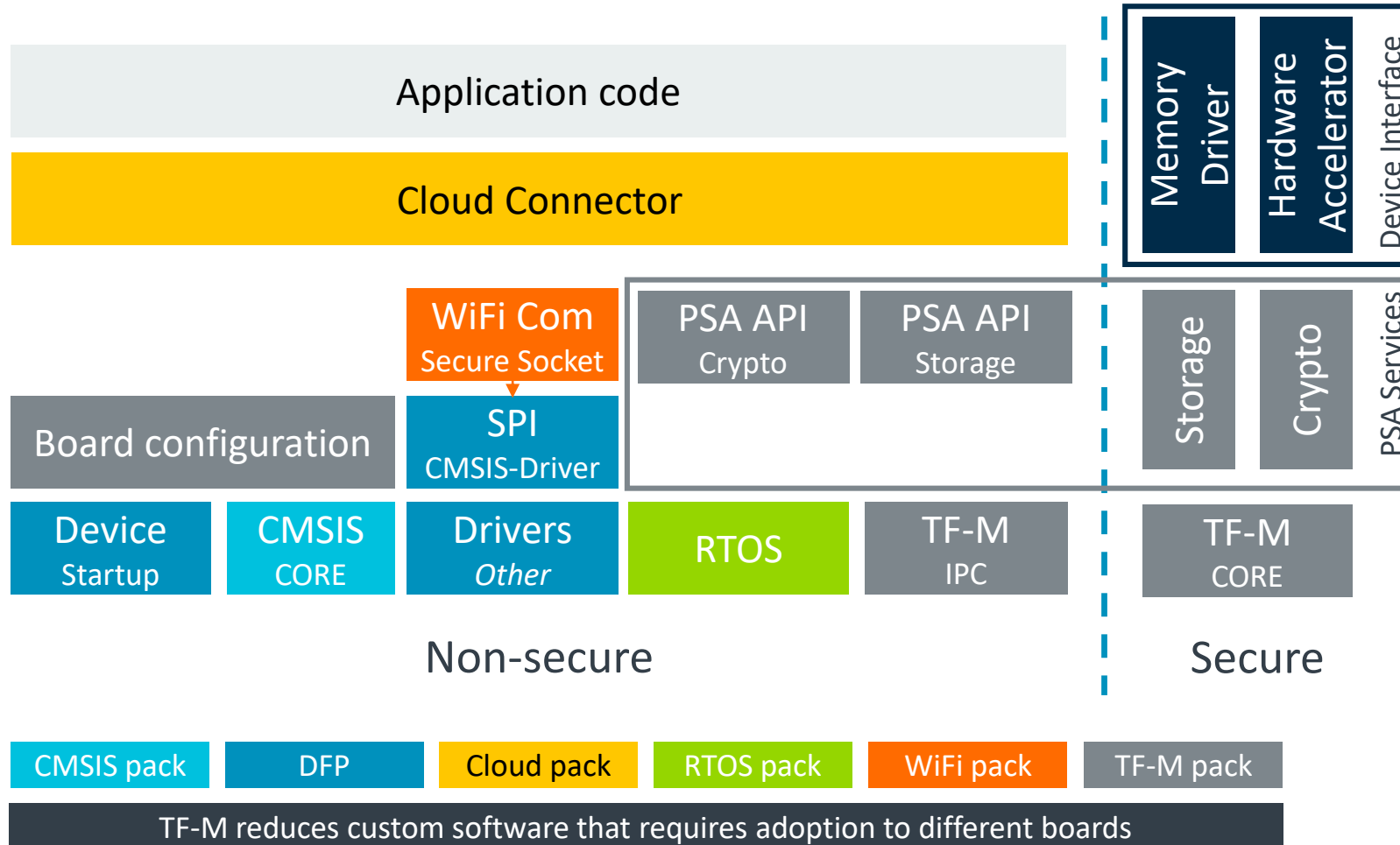


Cloud connectivity stack on Cortex-M4 (no PSA/TF-M)



www.keil.com/iot

Cloud connectivity stack on Cortex-M33 with PSA/TF-M

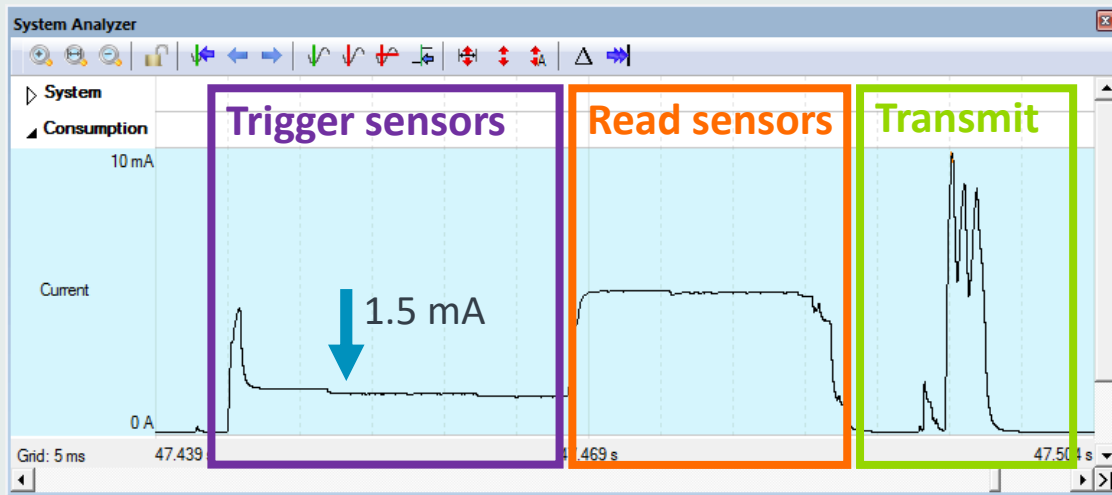


- Adds security for low-cost IoT devices
- Uses TrustZone to protect sensitive assets (credentials, keys, and firmware)
- Enables crypto services
- Software building blocks adopted to devices
- Trusted Firmware for Cortex-M (TF-M) is open-source:

www.trustedfirmware.org

Power use: analyzing and optimizing IoT sensor interface

original



Problems identified using ULINKplus:

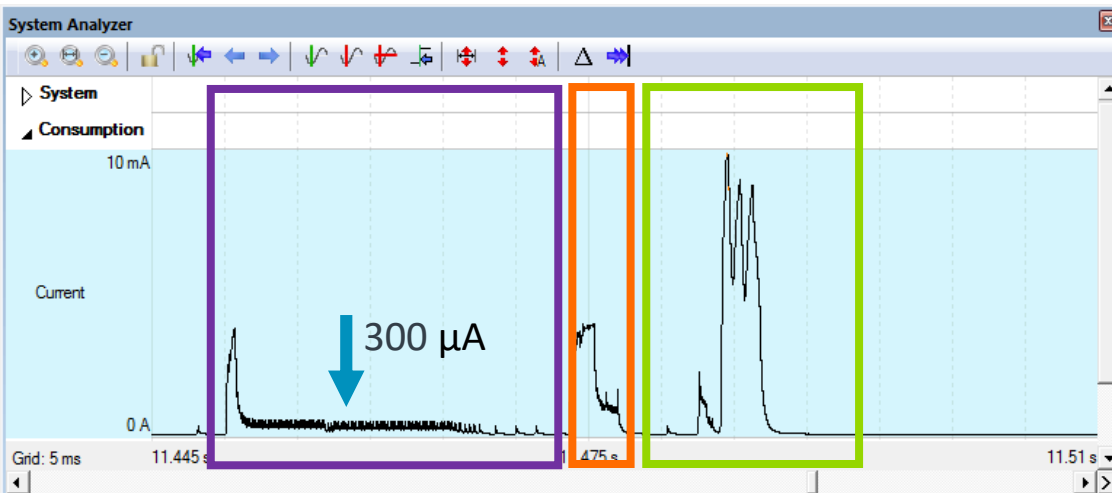
Trigger sensors for measurement

- Current: 300 μ A expected, 1.5 mA measured
- Caused by additional I²C command

Read sensors in polling mode

- Read time: 3 ms expected, 19 ms measured
- Caused by polling and additional I²C command

optimized



Results after optimization

- Triggering sensors works with lower current
- Read sensors is faster (less MCU activity)

Overall 75% less energy consumed

Analysis for software components

Check run-time status and dynamic software behavior

- Status information
- Dynamic operation with timing
- For every Arm Cortex-M
- Preconfigured for MDK-Middleware, Keil RTX5, and FreeRTOS
- Easy to add to custom components

The image shows two windows from a software development environment. The 'Event Recorder' window displays a table of system events, and the 'Network' window shows network configuration details.

Event	Time (sec)	Component	Event Property	Value
14075	97.46256332	RTX Mutex	MutexReleased	mutex_id=0x
14076	97.46256853	RTX Thread	ThreadYield	
14077	97.46257538	RTX Thread	ThreadGetId	thread_id=0x
14078	97.46257933	RTX Thread	ThreadFlagsClear	flags=0x0000
14079	97.46258447	RTX Thread	ThreadFlagsClearDone	thread_flags=
14080	97.46258889	RTX Mutex	MutexAcquire	mutex_id=0x
14081	97.46259368	RTX Mutex	MutexAcquired	mutex_id=0x
14082	97.46260796	RTX Mutex	MutexRelease	mutex_id=0x
14083	97.46261275	RTX Mutex	MutexReleased	mutex_id=0x
14084	97.46261827	RTX Thread	ThreadFlagsWait	flags=0x0000
14085	97.46262602	RTX Thread	ThreadFlagsWaitPending	flags=0x0000
14086	97.46263251	RTX Thread	ThreadBlocked	thread_id=0x
14087	97.46263746	RTX Thread	ThreadSwitched	thread_id=0x
14088	97.48683847	RTX Thread	ThreadFlagsWaitTimeout	
14089	97.48684232	RTX Thread	ThreadUnblocked	thread_id=0x20002BC8, ret_val=0xErrorTim
14090	97.48684811	RTX Thread	ThreadPreempted	thread_id=0x20002AFC
14091	97.48685229	RTX Thread	ThreadSwitched	thread_id=0x20002BC8
14092	97.48685796	RTX Semaphore	SemaphoreAcquire	semaphore_id=0x20002AEC, timeout=-1
14093	97.48686304	RTX Semaphore	SemaphoreAcquired	semaphore_id=0x20002AEC
14094	97.48686820	RTX Semaphore	SemaphoreGetCount	semaphore_id=0x20002AEC, count=0
14095	97.48687344	RTX Semaphore	SemaphoreRelease	semaphore_id=0x20002AEC
14096	97.48687858	RTX Semaphore	SemaphoreReleased	semaphore_id=0x20002AEC
14097	97.48688303	RTX Thread	ThreadFlagsWait	flags=0x00000001, options=0x00000001, tin
14098	97.48689077	RTX Thread	ThreadFlagsWaitPending	flags=0x00000001, options=0x00000001, tin
14099	97.48689726	RTX Thread	ThreadBlocked	thread_id=0x20002BC8, timeout=25
14100	97.48690219	RTX Thread	ThreadSwitched	thread_id=0x20002AFC
14101	97.49083840	RTX MsgQueue	MessageQueuePut	mq_id=0x20002A30, msg_ptr=0x200033B8,
14102	97.49084557	RTX Memory	MemoryBlockAlloc	mp_info=0x20002A3C, block=0x20002A64
14103	97.49085126	RTX MsgQueue	MessageQueueInsertPending	mq_id=0x20002A30, msg_ptr=0x200033B8

The 'Network' window shows the following configuration details:

- Library Version: IPv4/IPv6 Release
- ETH interface: Link-Up
- MAC address: 1E-30-...
- IPv4 settings:
 - IP address: 10.
 - Network mask: 255.255.255.0
 - Default gateway: 10.
 - Primary DNS server: 10.
 - Secondary DNS server: 10.
- IPv6 settings: (Expanded)
- UDP sockets: Used: 4, Available: 6
- TCP sockets: Used: 1, Available: 6
- Socket 1:
 - Local Port: Established
 - Local Port: 49152
 - Callback Function: bsd_cb_tcp
 - Options: Keep-alive: Off, Flow-ctrl: Off, Delay-ACK: Off
 - Address (IP4): 18.
 - Port: 8883
 - Timeout: 116 sec