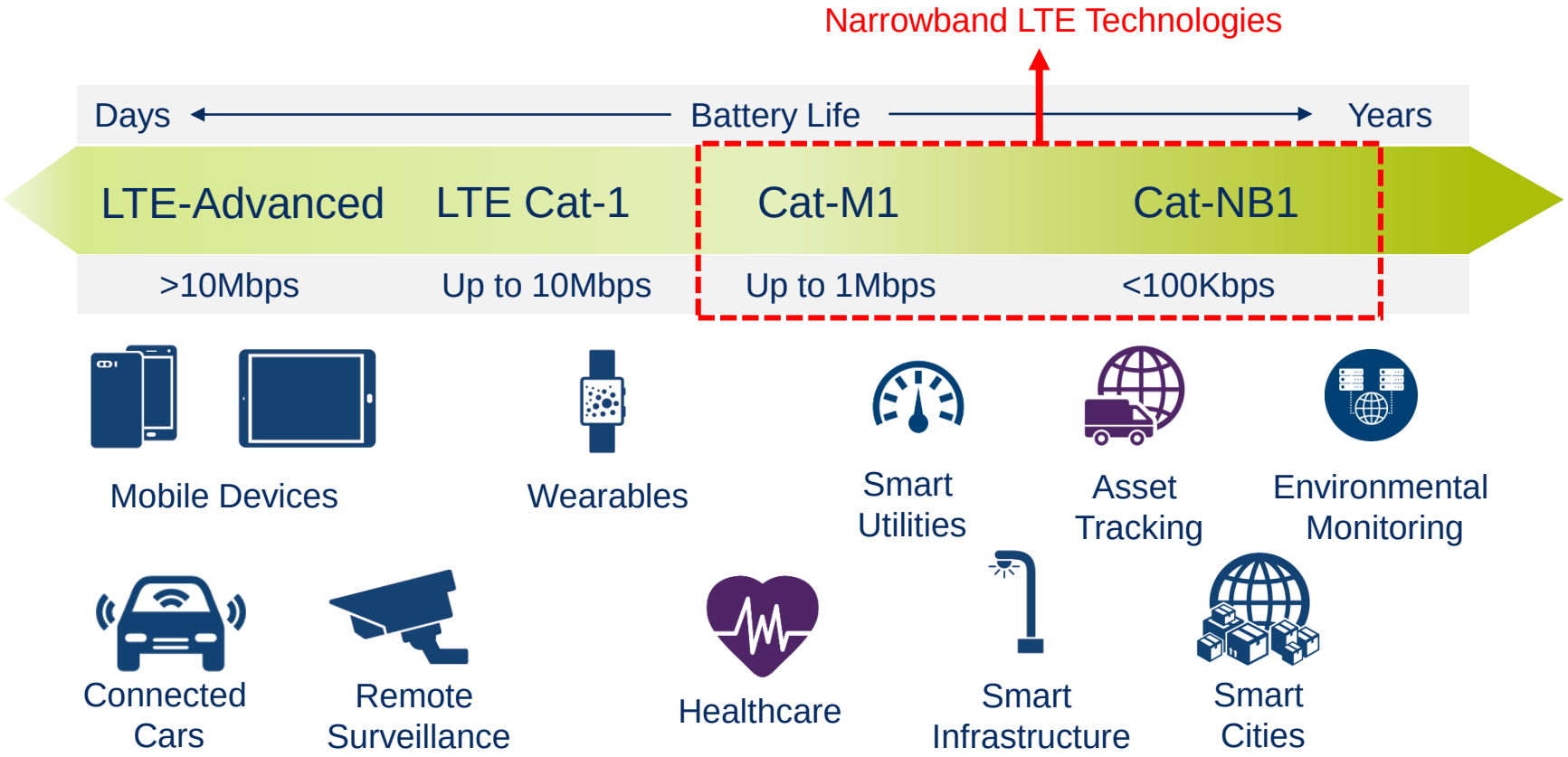
CEVA-X1 Lightweight Multi-Purpose Processor for IoT

www.ceva-dsp.com

Cellular IoT for The Massive Internet of Things



Introducing the CEVA-X1

Lightweight, multi-purpose, single-core processor for cellular IoT

- Derived from the NEW CEVA-X Architecture Framework
- Extended Instruction Set Architecture (ISA) combining DSP+CPU processing
  - Eliminates need for separate CPU
- Addresses severe size, power and cost limitations for cellular IoT devices
- Comes with dedicated Cat-NB1 instructions to vastly improve performance

DSP+CPU

30% Reduced Power*

Multi Mode

*For Cat-NB1 when using dedicated instructions

Introducing the CEVA-X1 (cont'd)

Also serves as processing hub for other closely-related IoT technologies

Connectivity
Short and long range wireless

Positioning
GNSS and indoor positioning

Sensing
Sensor-fusion using motion, sound and ambient sensing

Voice
IoT related voice activation and narrowband voice communication

The Three Pillars of CEVA-X1

1 Powerful DSP Processing

- 4-way VLIW Architecture
- 32-bit SIMD operations
- 64-bit memory bandwidth
- 2x 16x16 or 1x 32x32 MAC
- IEEE Single-Precision Floating Point

2 Efficient Controller Capabilities

- CoreMark/MHz: 3.3
  - On par with ARM Cortex-M4
- Compact code size
- Full RTOS support
- Ultra-fast context switch
- Comprehensive Control code ISA:
  - Zero latency
  - Byte support
- Dynamic and static branch prediction

3 Advanced System Control

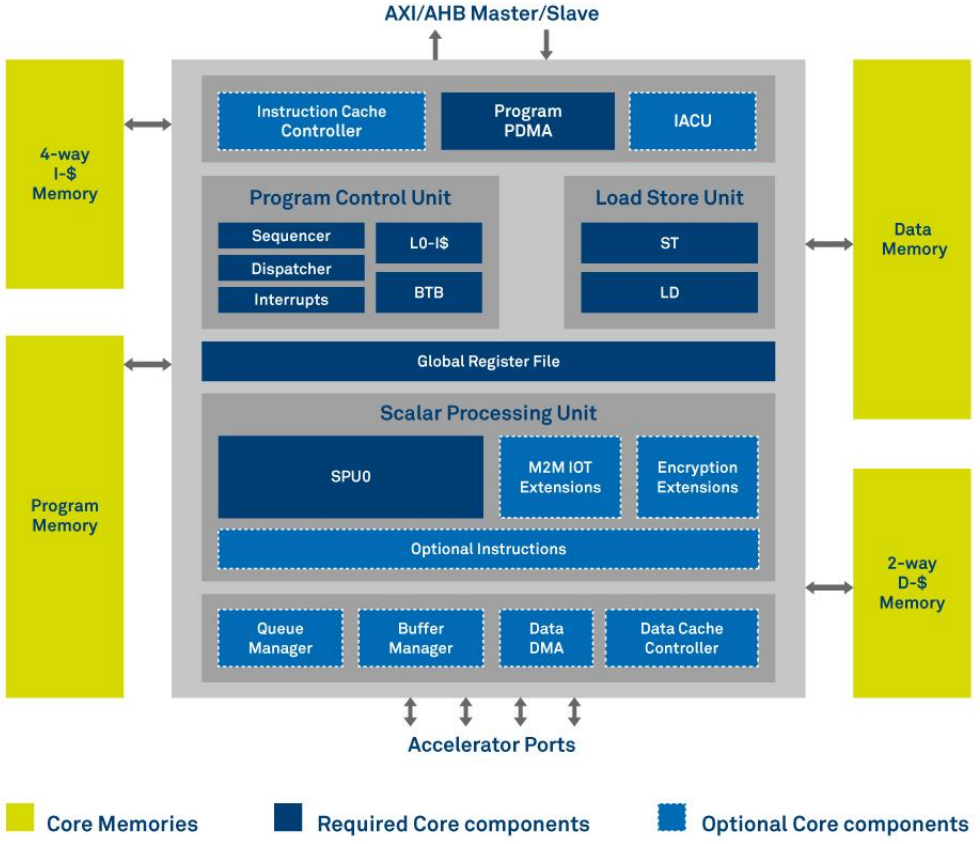
- CEVA Connect
  - Offload the processor with control and data plane hardware
  - Automatic data traffic management
    - for data flow between PHY and HWA
  - Dedicated interfaces to connect multiple HW accelerators
- Supports both AHB and AXI interconnect

CEVA X1

Effectively combines strong and native DSP capabilities with advanced real-time Controller attributes

CEVA-X1 Architecture Diagram

Features	Configurations
Pipeline	10 stage
VLIW	4 way
SIMD [bit]	32
Scalar Units	1
MAC [16x16-bit]	2
MAC [32x32-bit]	1
Data Memory width [bit]	64 LD + 64 ST
SP Floating-Point	Optional
Dynamic Branch Prediction	Optional
Data Cache	Optional
Instruction Cache	Optional
CEVA-Connect	Optional



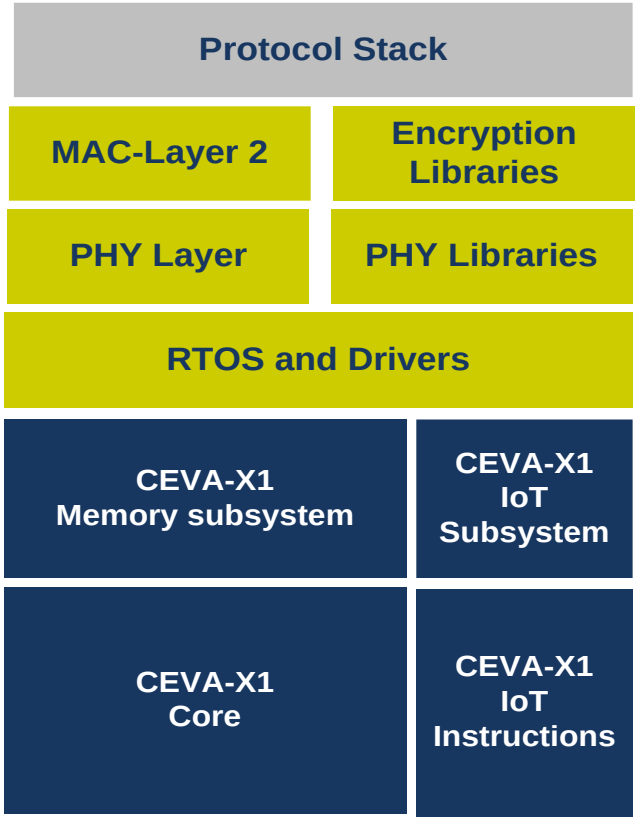
Dedicated Cat-NB1 Instructions

- Detailed analysis of the Cat-NB1 standard and profiling of Baseband and Layer 2 (MAC, PDCP, RLC) on CEVA-X1
- Low data-rate cellular IoT standards are better addressed with dedicated instructions rather than HW accelerators external to the core
  - Baseband: Viterbi, Turbo encoder
  - Layer 2: Encryption
- CEVA-X1 Power Savings Unit (PSU) supports LTE Cat-M1 and Cat-NB1 PSM and eDRX modes to reduce power consumption further during idle and sleep time

Reduces the power consumption of the Cat-NB1 modem, excluding RF, by a further 30%.

CEVA-X1 HW and SW Components

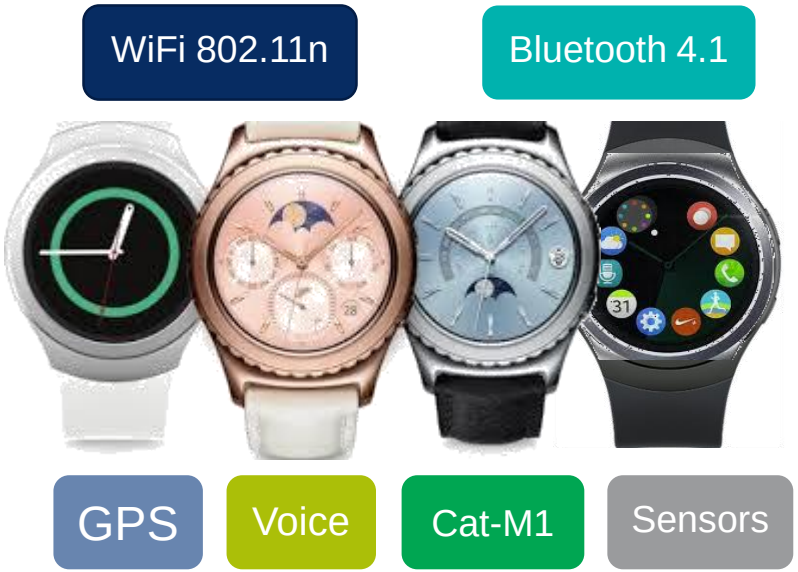
- SW components
  - RTOS and Drivers
  - Cat-NB1 and Cat-M1 PHY Libraries
  - Encryption Libraries
  - MACs & Protocol Stacks
    - From CEVA & Partners
- HW components
  - Cat-M1 and Cat-NB1 instructions
    - Baseband and Encryption
  - IoT subsystem
    - Standard specific HW accelerators
      - e.g. Cat-M1 Turbo decoder
    - Peripherals and interfaces



Smart Watch Multi-mode Use Case

Wearalone Smartwatch

- Samsung Gear S3
  - Your Smartphone is no longer necessary!



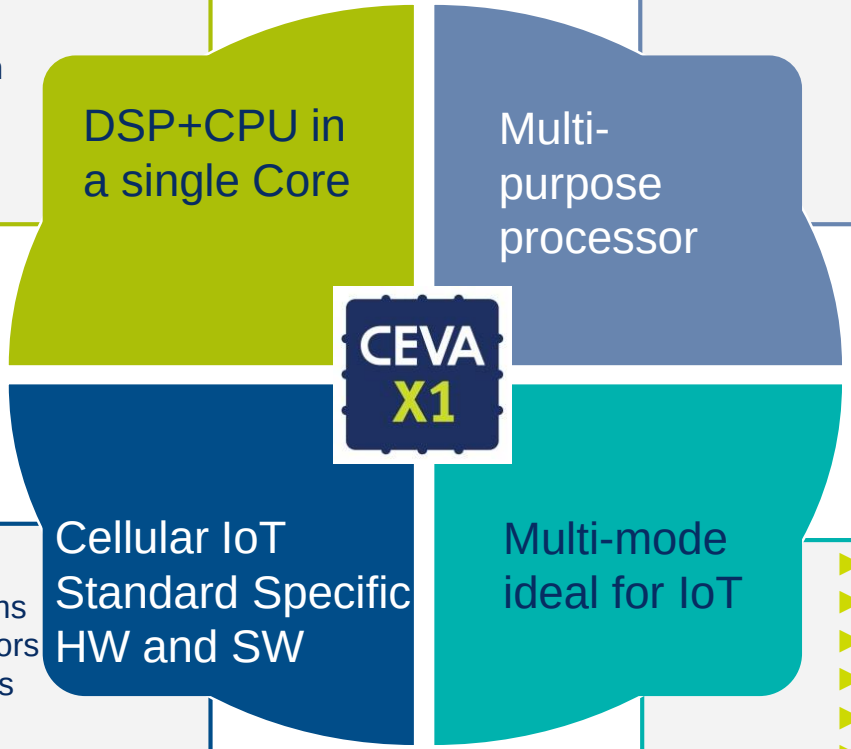
Multi-mode Use Case

- True concurrent multi-mode is required for
  - Communication: LTE Cat-M1, Wi-Fi, BLE
    - Only one will run at a given time
  - IoT: GNSS, Sensors, Voice codec & trigger
    - May all run at the same time
  - Cat-M1 and GNSS don't have to run at the same time
    - They are often idle and can time share Processor workload

A single CEVA-X1 can handle all above workloads concurrently, running everything in software

CEVA-X1 Putting it all together

- Coremark/MHz: 3.3
- Dynamic Branch Prediction
- Full RTOS Support
- Ultra Fast Context Switch



- Smart Home
- Asset Trackers
- Smart City, Smart Plants
- Smart Farming
- Wearables, eHealth

- Standard Specific Instructions
- Standard Specific Accelerators
- Optimized SW PHY Libraries
- MACs and Protocol stacks

- Wi-Fi, Bluetooth, BLE
- Zigbee / Thread
- GNSS: GPS, Beidou, Glonass
- Indoor positioning: beacons
- Sensors
- Vocoder, voice activation