



ZEPHYR PROJECT OVERVIEW

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RTOS Landscape 2018



OS options	First commit	Commits controlled by	Terms	License	Total Contributors	Total Commits	Commits in last month
AliOS-Things	2017/09	Alibaba	CLA	Apache-2.0	36	470	6
Contiki	2006/06	community		BSD-3-Clause	161	12,327	0
Contiki-NG	2006/06	community		BSD-3-Clause	175	14,116	61
FreeRTOS*	2004/07	Richard Barry	CLA	GPL-2.0 w/ FreeRTOS exception	3	2,441	0
Amazon-FreeRTOS	2017/11	Amazon	CLA	MIT	3	12	1
LiteOS	2016/09	Huawei	??	BSD-3-Clause	18	203	3
mbed OS	2013/02	ARM	CLA	Apache-2.0 or BSD-3-Clause	419	17,048	282
myNewt	2015/06	community		Apache-2.0	76	7,573	22
nuttX*	2007/?	Gregory Nutt		BSD-style?	244	36,531	184
RIOT	2010/09	community		LGPL-2.1	189	18,324	25
RT-Thread	2009/06	community		GPL-2.0	127	6,132	107
Tiny OS	2004/10	??		BSD-3-Clause	44	3,807	0
Tizen RT	2015/04	Samsung	??	Apache-2.0 or BSD-style?	94	4,535	12
Zephyr	2014/11	community	DCO	Apache-2.0	304	21,633	591

Zephyr in RTOS Landscape

#2

**Total
Contributors**

Rank	RTOS	#
1	mbed OS	419
2	Zephyr	304
3	nuttX	244

#2

**Total
Commits**

Rank	RTOS	#
1	nuttX	36,531
2	Zephyr	21,633
3	RIOT	183,24

#1

**Commits
(last 30 days)**

Rank	RTOS	#
1	Zephyr	591
2	mbed OS	282
3	nuttX	184

Zephyr in RTOS Landscape

#2

**Total
Contributors**

#2

**Total
Commits**

#1

**Commits
(last 30 days)**

Very Active, Growing Community!



Zephyr Project:

- **Open source** real time operating system
- **Vibrant Community** participation
- Built with **safety and security** in mind
- **Cross-architecture** with growing developer tool support
- **Vendor Neutral** governance
- **Permissively** licensed - Apache 2.0
- **Complete**, fully integrated, highly configurable, **modular** for **flexibility**, better than roll-your-own
- **Product** development ready with LTS
- **Certification** ready with Auditable

Open Source, RTOS, Connected, Embedded
Fits where Linux is too big

Zephyr OS

3rd Party Libraries

Application Services

OS Services

Kernel

HAL

Why Zephyr?



The Zephyr OS addresses broad set of embedded use cases across a broad set of platforms and architectures using a modular and configurable infrastructure. It addresses the need for RTOS consolidation.



Address Fragmentation

- No single RTOS addresses broad set of embedded use cases across a broad set of platforms and architectures
- Disjoint use cases have led to fragmentation in RTOS space
- Existing commercial solutions force roll your own solutions and duplication of software components



Modular Infrastructure

- **Modular and configurable infrastructure** allows creation of highly compact and optimal solutions for different products from a **common** origin
- **Reuse** allows NRE costs to be amortized across multiple products and solutions
- **Multi-architecture** support reduces platform switching costs and vendor lock-in concerns



Open-Source

- Roll your own is expensive & difficult to develop & maintain
- Permissively licensed corresponds to ease of adoption
- Corporate sponsorship assures long term commitment and longevity
- Community innovation has proven faster for progression and project development is a collaboration of industry experts



Feature Richness

- Need for a solution or semi-complete solution rather than just an ingredient.
- Lowers entry level barrier for new products and speeds up software delivery using existing feature and hardware support
- Encourages adherence to standards and promotes collaboration on complex features inside the organization
- Developers focus on the end-user facing interfaces instead of reinventing low-level interfaces

Reduce costs and improve efficiency through reuse

Zephyr Ecosystem



Zephyr OS

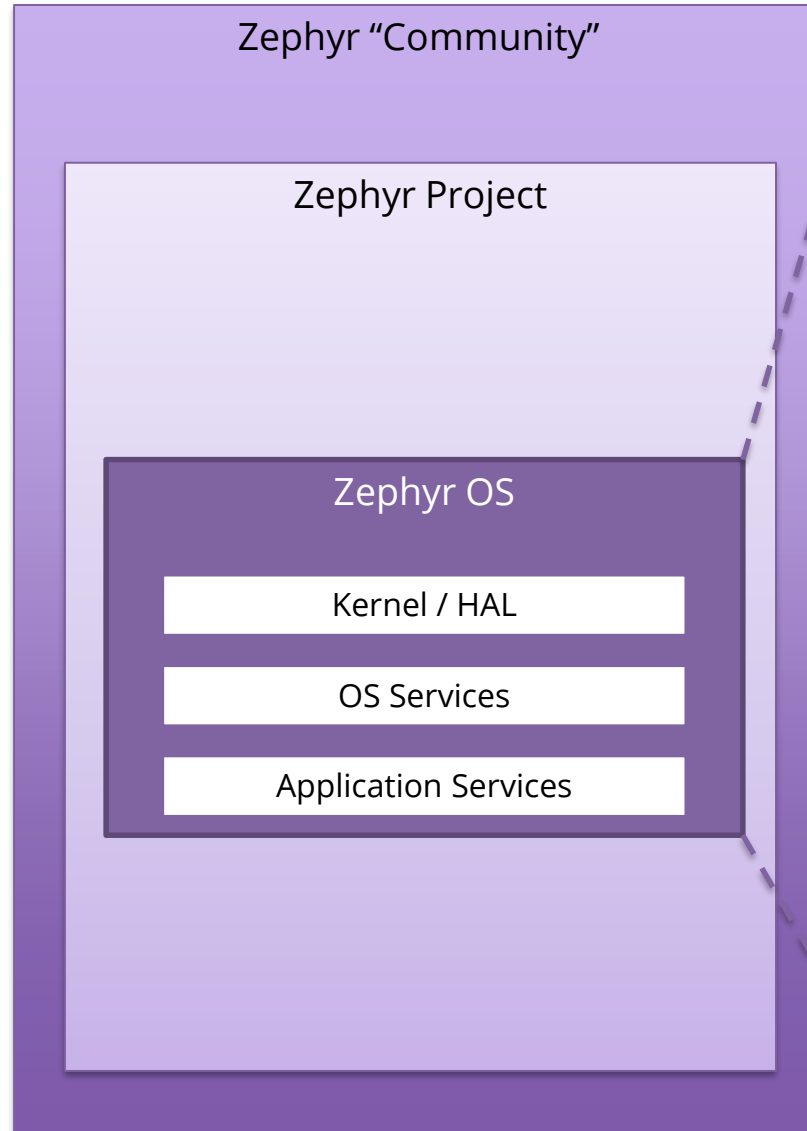
- The kernel and HAL
- OS Services such as IPC, Logging, file systems, crypto

Zephyr Project

- SDK, tools and development environment
- Additional middleware and features
- Device Management and Bootloader

Zephyr Community

- 3rd Party modules and libraries
- Support for Zephyr in 3rd party projects, for example: Jerryscript, Micropython, Iotivity, EdgeX



Kernel / HAL

- Scheduler
- Kernel objects and services
- low-level architecture and board support
- power management hooks and low level interfaces to hardware

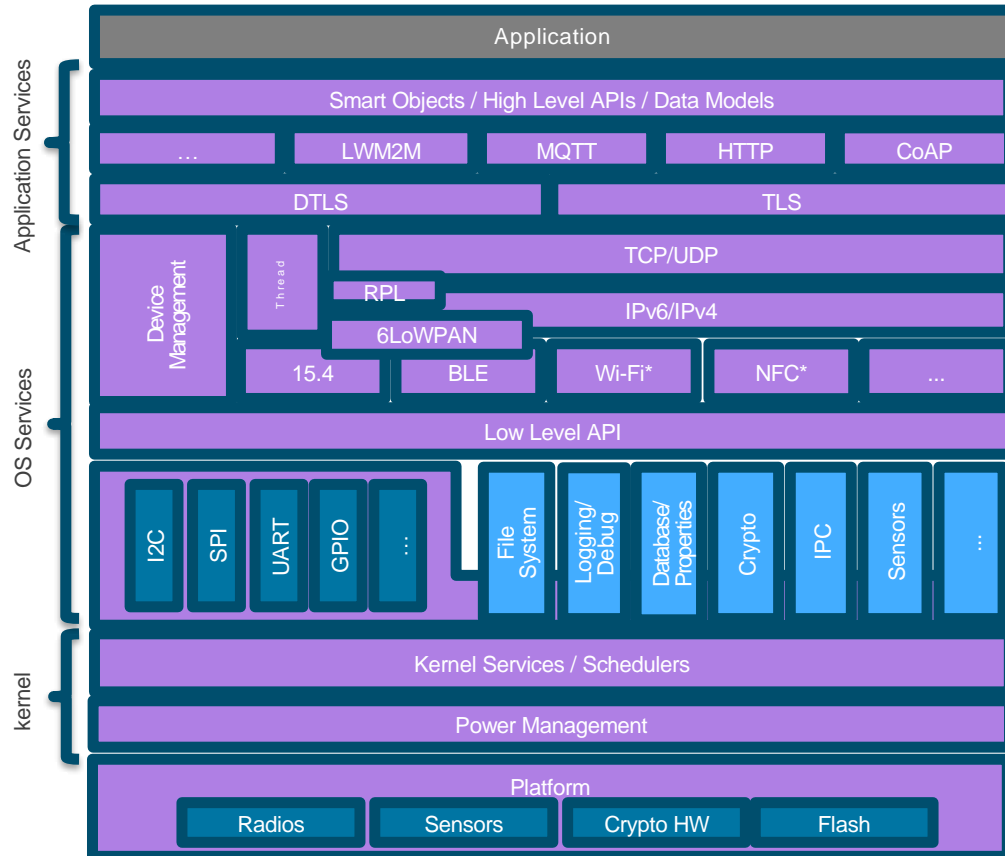
OS Services and Low level APIs

- Platform specific drivers
- Generic implementation of I/O APIs
- File systems, Logging, Debugging and IPC
- Cryptography Services
- Networking and Connectivity
- Device Management

Application Services

- High Level APIs
- Access to standardized data models
- High Level networking protocols

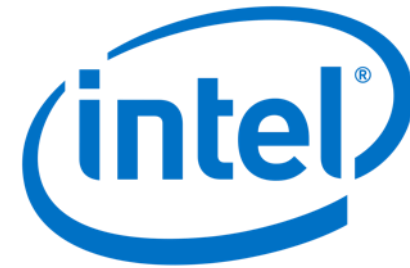
Architecture



- Highly Configurable, Highly Modular
- Cooperative and Pre-emptive Threading
- Memory and Resources are typically statically allocated
- Integrated device driver interface
- Memory Protection: Stack overflow protection, Kernel object and device driver permission tracking, Thread isolation
- Bluetooth® Low Energy (BLE 4.2, 5.0) with both controller and host, BLE Mesh
- Native, fully featured and optimized networking stack

Fully featured OS allows developers to focus on the application

Zephyr Hardware Architecture Families



Growing Diverse Community!

Repositories

- 2016/2: 5
- 2018/6: 15

Authors

- 2016/2: 80
- 2018/6: 401 (OS++)

Commits

- 2016/2: 2,806
- 2018/6: 25,356 (OS++)

Boards

- 2016/2: 4
- 2018/6: 96 in progress

1.12 release statistics:

- › 13 weeks cycle, with 2 weeks of merge window
- › 1,978 changes (patch commits)
- › 111 developers identified
- › 17 companies participated
- › 21 changes / day (.9/hour)

Zephyr Project: Membership Momentum

February 2016



SYNOPSYS®

June 2018

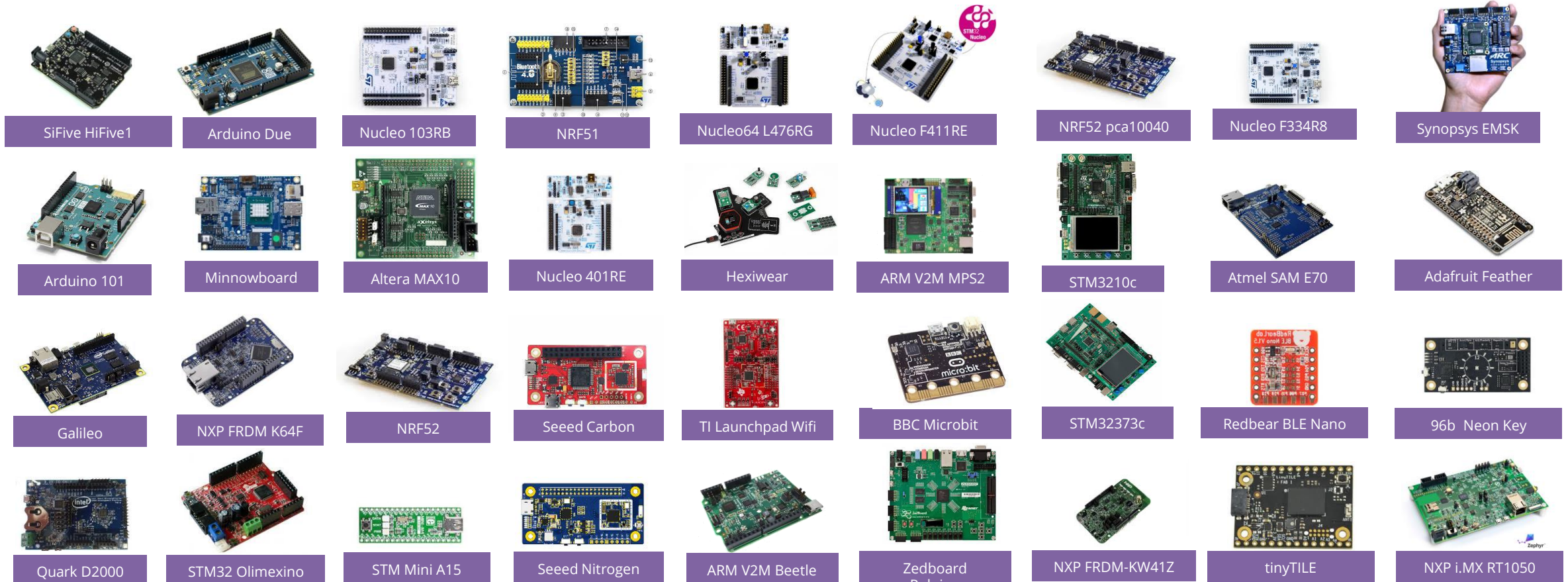


SYNOPSYS®



and others....

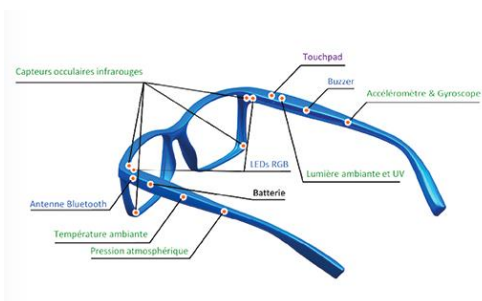
Sample of Board Support



96 BOARDS TODAY WITH MORE ON WAY...

<http://docs.zephyrproject.org/boards/boards.html>

Products Running Zephyr Today



Ellcie-Healthy Smart Connected Eyewear



ProGlove scanning gloves



Intellinium Safety Shoes



Rigado IoT Gateway



Grush Gaming Toothbrush



hereO Smartwatch



Blocks Modular Smartwatch



Antmicro Badge



GNARBOX 2.0 SSD

Developer Tools...



RENODE™

by:  antmicro
EMBEDDED SYSTEMS



Synopsys DesignWare
ARC Development Tools



Zephyr Roadmap 2018

2018												
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Zephyr Releases		◆ 1.11			◆ 1.12			◆ 1.13			◆ 1.14	

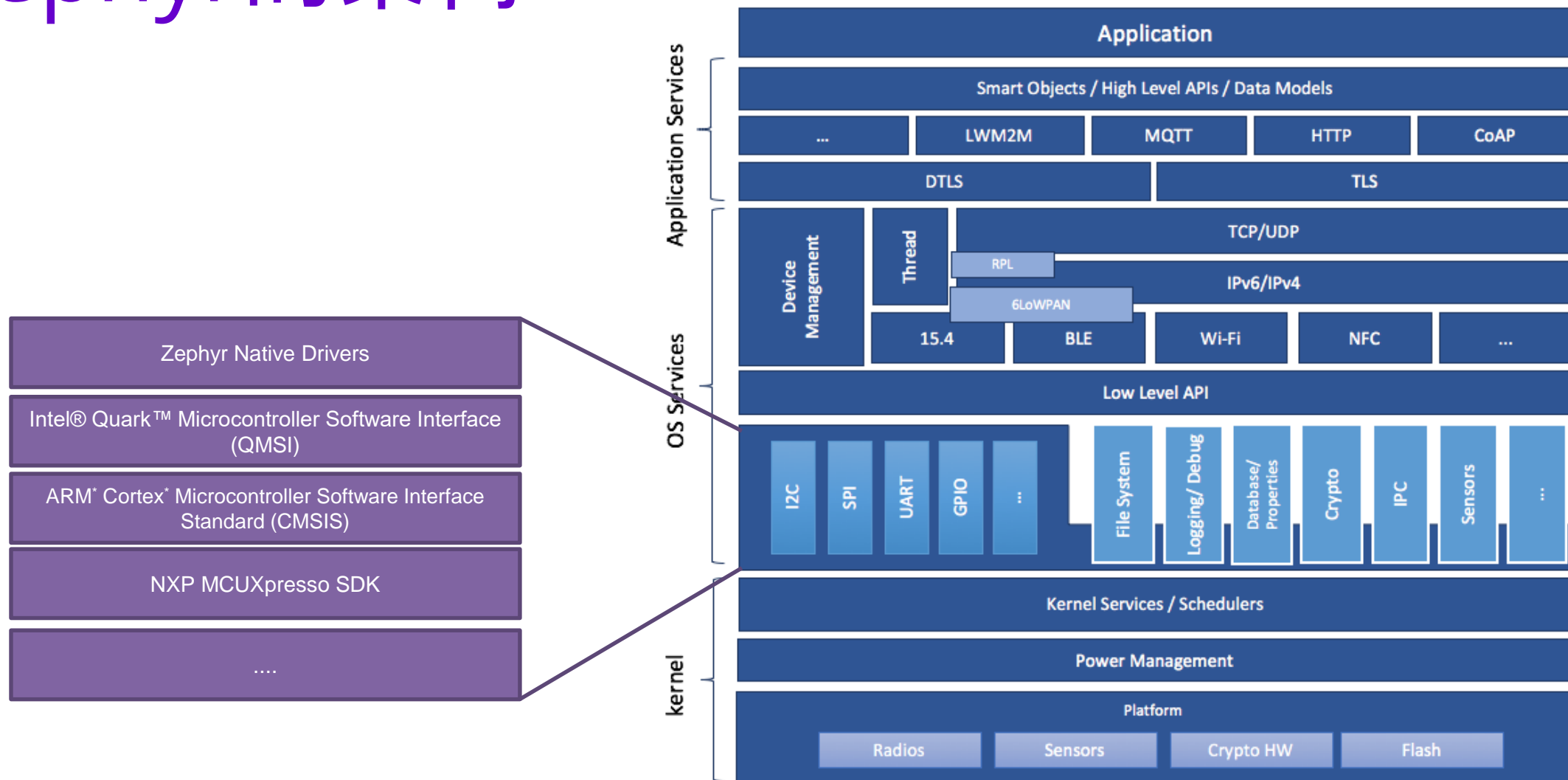
Zephyr 1.11	Zephyr 1.12	Zephyr 1.13 (LTS?)	Future
<ul style="list-style-type: none"> • OpenThread support • Native POSIX Port • POSIX API Layer (PSE52) • FOTA Updates (LWM2M, BLE) • SMP Support • Lightweight Flash Storage • Support the kernel (scheduler + objects) as a separate module 	<ul style="list-style-type: none"> • AMP Support • 802.1Q - Virtual LANs • Persistent Storage for BT • TAP net device support • SPI slave support • CanBUS support • Source Code modularisation: Support external modules, boards, SoCs • Command line meta-tool "west" • WIFI driver 	<ul style="list-style-type: none"> • QM level qualification • MISRA-C 2012: Kernel • LLVM Support • Precision Time Protocol (PTP) Support • Improved Logging Support • Eco-System: Tracing, Profiling, debugging support through 3rd party tools • Multiple Git Repos • Soft real-time tasklets • Advanced Power Mgmt. 	<ul style="list-style-type: none"> • Safety and Security Pre-Certification • Time Sensitive Networking (TSN) Support • TEE for ARMv8-M • LoRa Support • SocketCAN • Paging Support • Dynamic Module Loading support (support HW FIFOs) • MIPS

NOTE: Features aligned to releases are subject to change per guidance from the TSC

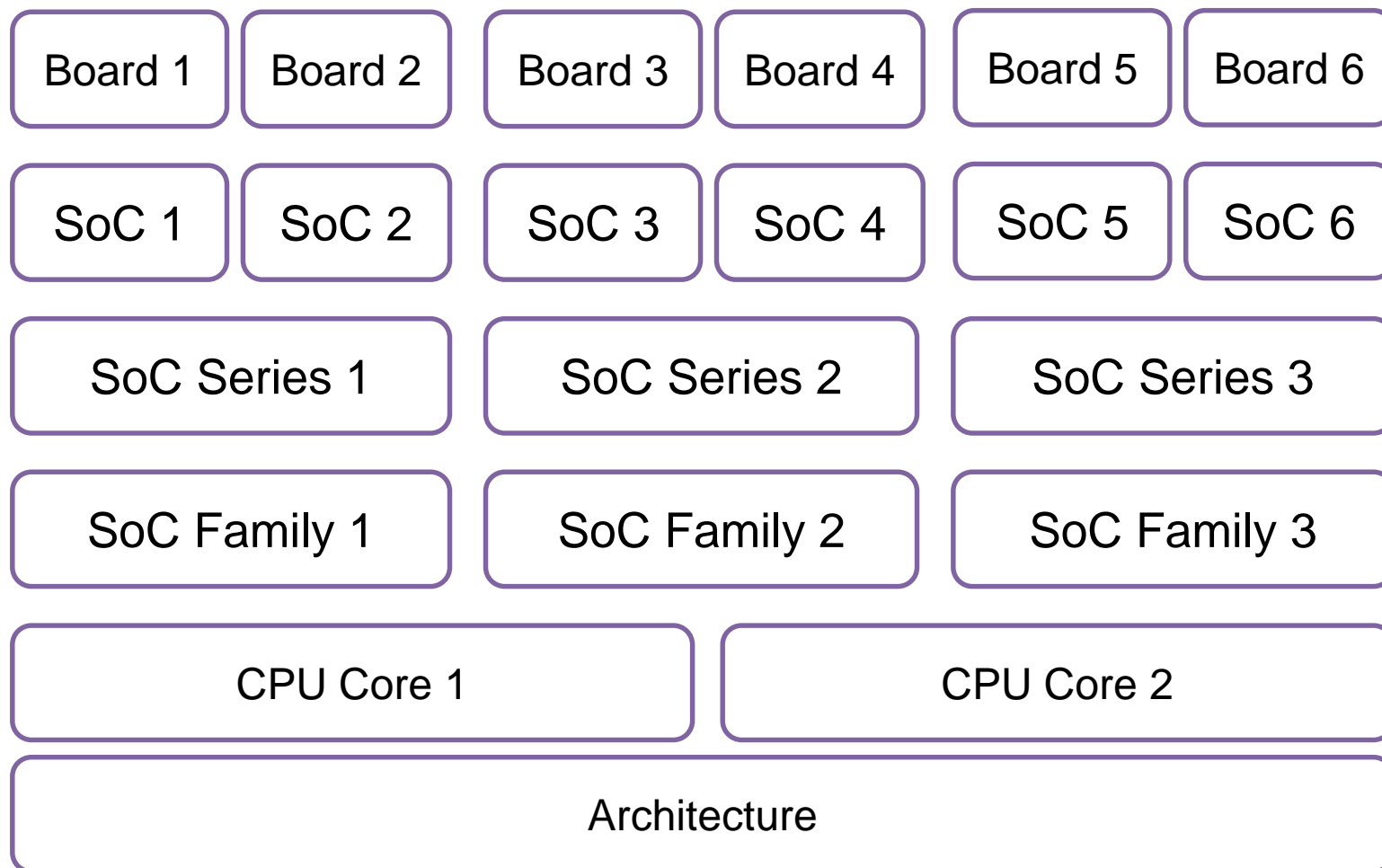
Zephyr

- 真正的开源软件（Linux Foundation），宽松自由的许可证（Apache 2.0）
- 针对MCU的OS，占用内存小（~2KB）
- 支持多种架构（x86/ARM/RISCV/ARC, etc）
- 社区支持
- LTS计划

Zephyr的架构



Zephyr硬件支持结构

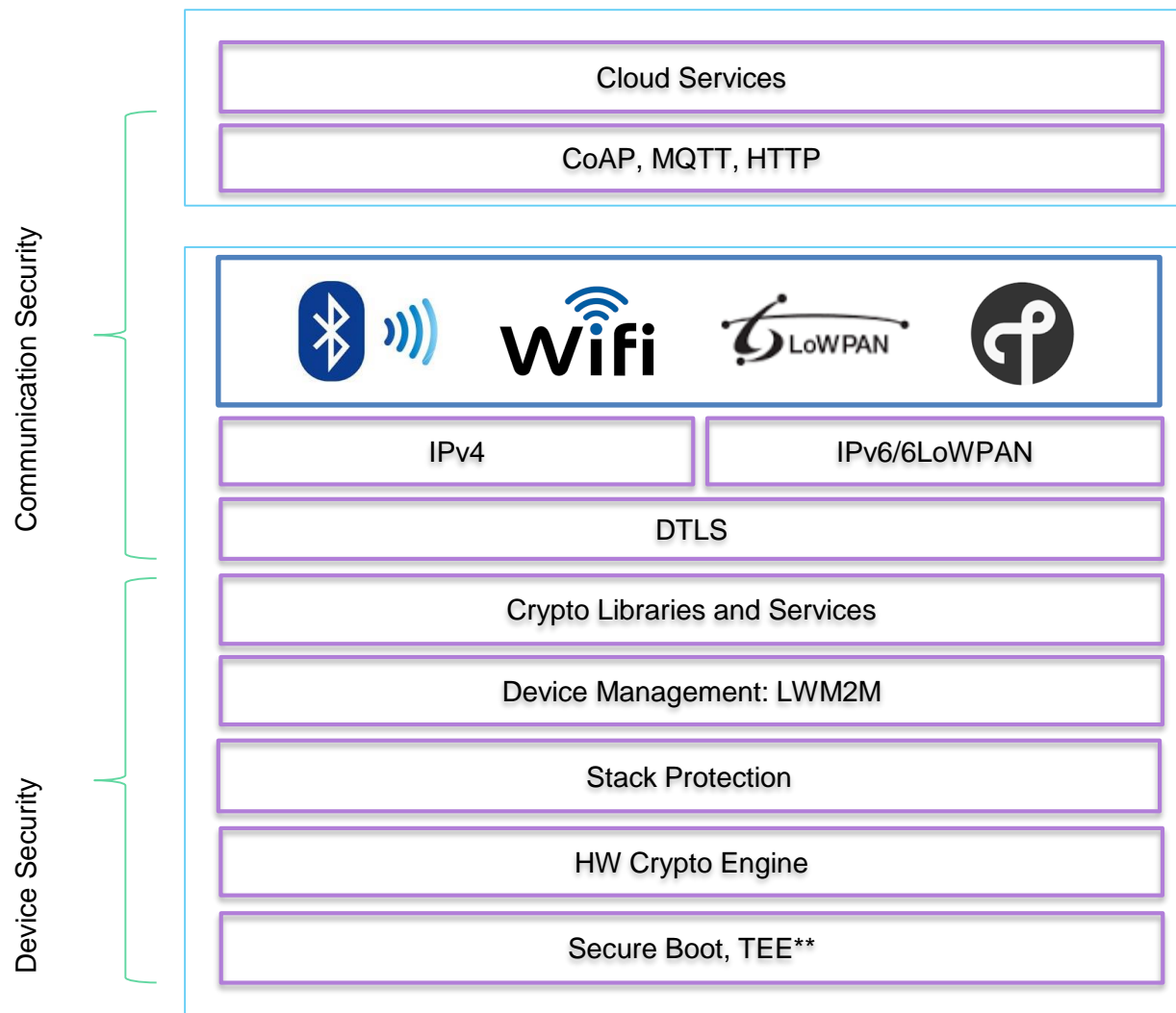


Zephyr的特性

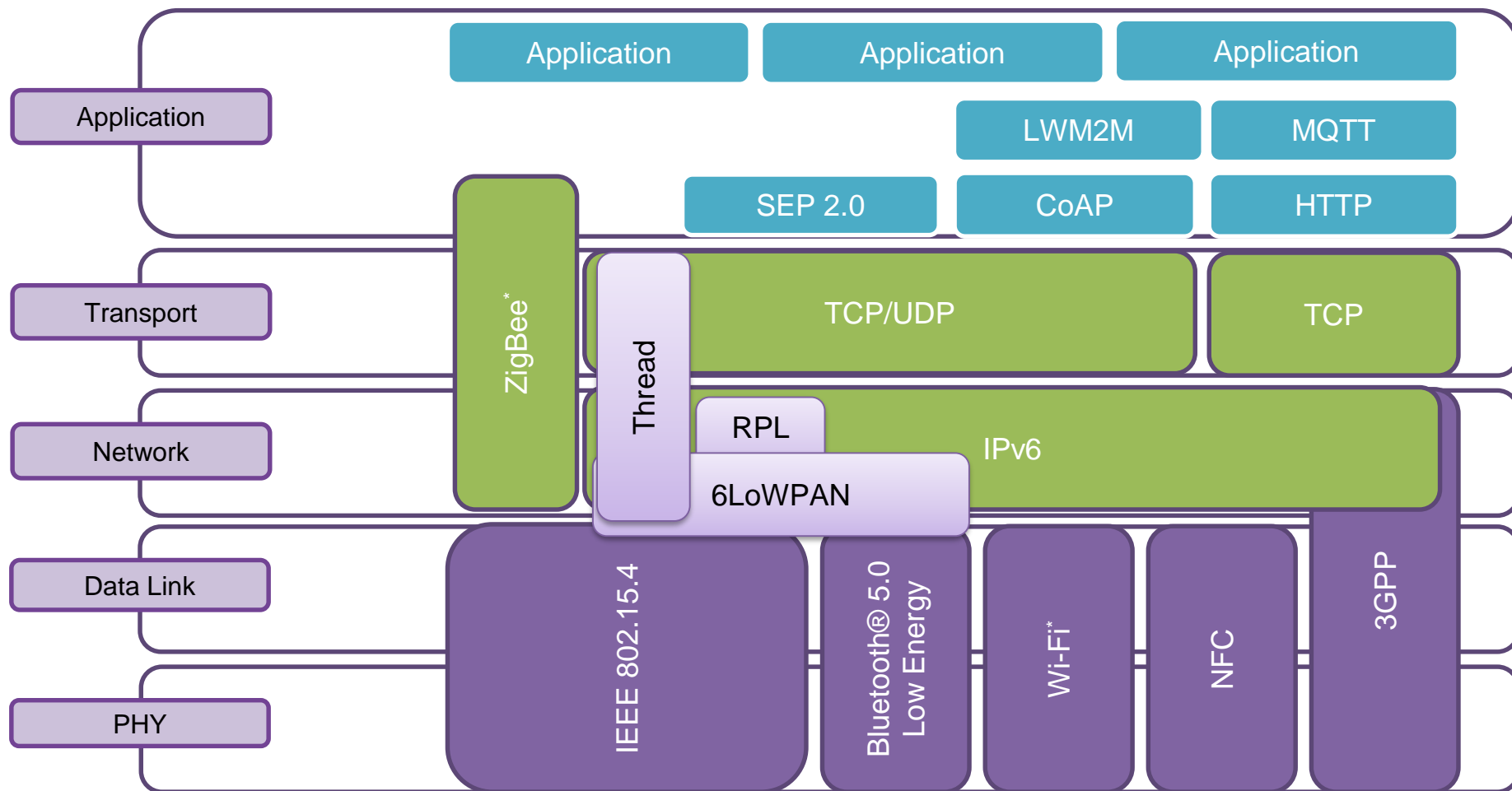
- 多线程支持
- 线程间同步/通信
 - Semaphore, mutex, alerts / Mailbox, pipe, message queue, FIFO, LIFO, stack
- 内存管理
 - Slab/Pool/Heap pool
- Tickless idle
- 模块化

Zephyr的安全性

- 无动态加载
- 内存保护
- 基于TinyCrypt2和mbedtls的加密库
- 提供了标准化的通信协议栈构建单元



Zephyr连接性



Zephyr Bluetooth

- Bluetooth 5.0 compliant (ESR10)
- BLE Mesh
- Bluetooth Low Energy Controller support (LE Link layer)
- Generic Access Profile with all possible LE roles
- GATT
- Pairing support
- IPSP/6LoWPAN for IPv6 connectivity over Bluetooth LE
- Basic Bluetooth BR/EDR (Classic) support
- Clean HCI driver abstraction
- Raw HCI interface to run Zephyr as a controller instead of a full Host stack
- Verified with multiple popular controllers
- Highly configurable

Zephyr Networking

- IPv6 (enabled by default)
- IPv4
- Dual stack support
- UDP/TCP
- BSD sockets API
- HTTP/MQTT/CoAP
- LWM2M/RPL/DNS
- Minimal copy network buffer management
- Virtual LAN support
- Network traffic classification

Zephyr开发

- 详细的文档
- 使用cmake构建工程（make/ninja）
- Kconfig, Linux内核配置工具
- 功能丰富Zephyr专门的SDK（powered by Yocto project）
- 多平台编译支持：Linux/Windows/MacOS
- 支持Docker容器

Zephyr & NXP

- i.MXRT
 - i.MXRT105x
- i.MX
 - i.MX7_m4
- Kinetis
 - K6x
 - KL2x
 - KW4x
- LPC
 - LPC54xxx

<http://www.nxp.com/zephyr>

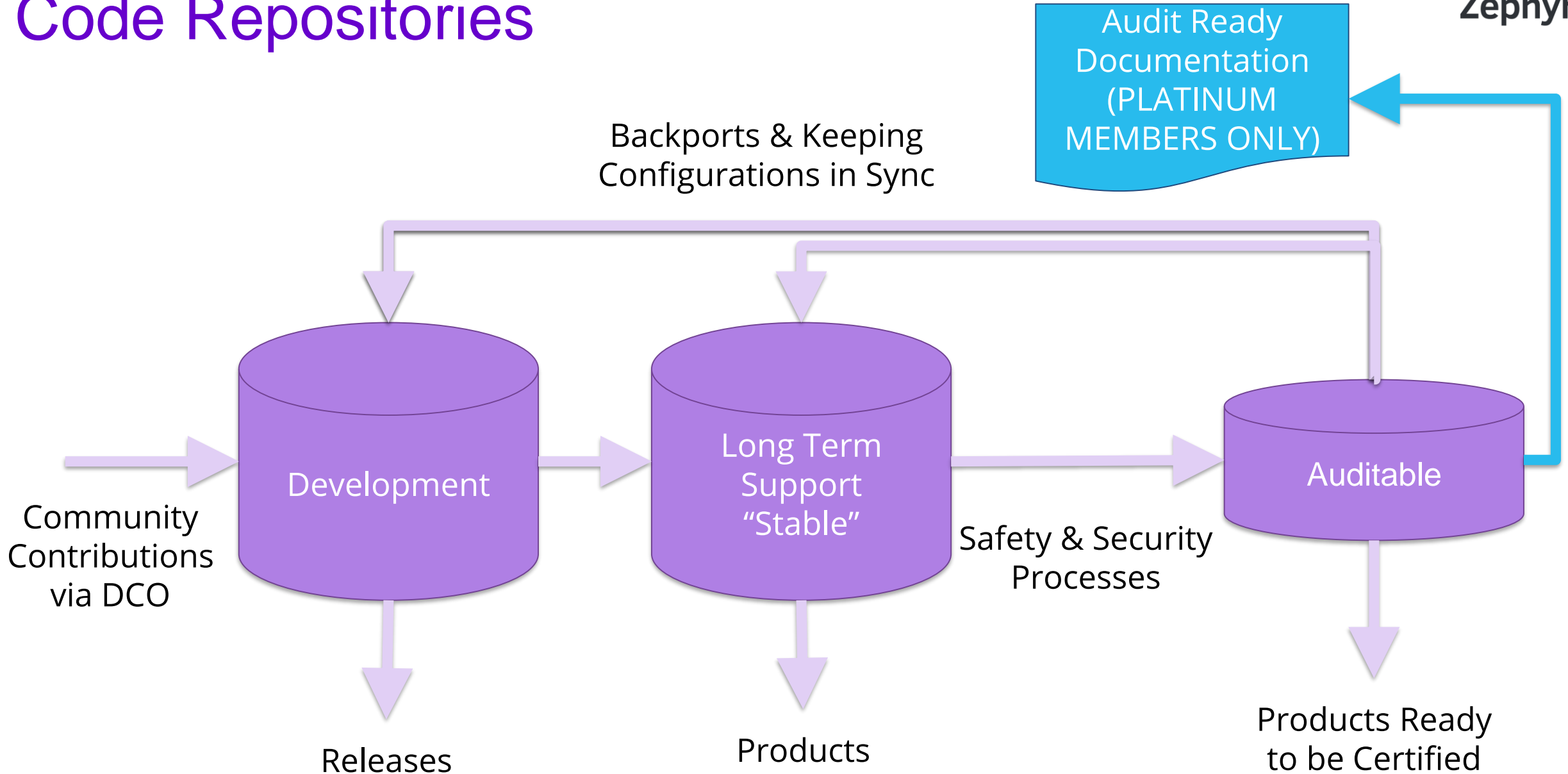


i.MXRT105x

Crossover Processor with Arm[®]
Cortex[®]-M7 core

- Highest performing Arm Cortex-M7
- 3020 CoreMark/1284 DMIPS @ 600 MHz
- Up to 512KB Tightly Coupled Memory (TCM)
- Industry's lowest dynamic power with an integrated DC-DC converter
- 2D graphics acceleration engine
- Parallel camera sensor interface
- LCD display controller (up to WXGA 1366x768)
- 3x I2S for high-performance, multichannel audio
- Extensive external memory interface options

Code Repositories



Zephyr OS: Auditable Code Base

- Initial and subsequent certification targets to be decided by Governing Board.
- An auditable code base will be established from a subset of Zephyr OS.
 - Code bases will be kept in sync from that point forward.
 - More rigorous processes (necessary for certification) will be applied before new features move into the auditable code base.

Processes to achieve selected certification to be determined by Security Working Group and coordinated with Technical Steering Committee.

Zephyr OS: Candidate Standards

Coding for Safety, Security, Portability and Reliability in Embedded Systems:

- [MISRA C:2012](#), with [Amendment 1](#), following [MISRA C Compliance:2016](#) guidance

Safety:

- [IEC 61508: 2010](#) (SIL 3 initially, eventually though like to get to SIL 4)
 - broadest for robotics and autonomous vehicle engineering companies. Reference for other standards in Robotics domain.
 - [Sampled Certifications derived from IEC 61508:](#) Medical: IEC 62304; Auto: ISO 26262; Railway: EN 50128

Security:

- [Common Criteria](#) (EAL4 but possibly higher)

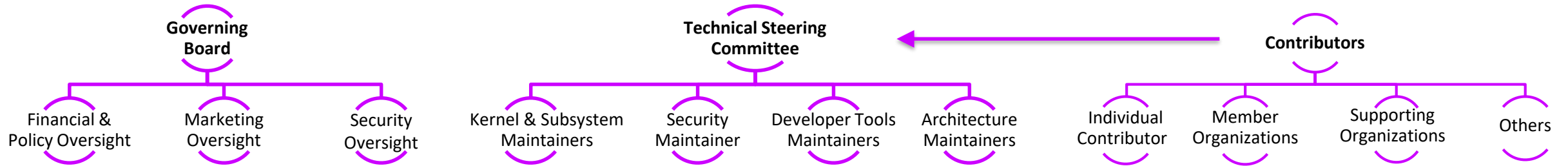
Others:

- Medical: FDA 510(K), ISO 14971, IEC 60601; Industrial: UL 1998, ??

Zephyr OS: Ready to Audit

- Established Security Working Group, meets bi-weekly.
- Secure Coding Practices have been [documented](#) for project.
- Zephyr Project [registered as a CVE Numbering Authority](#) with Mitre.
- Security Working Group has vulnerability response criteria publicly documented
 - addressed weakness determined by a researcher already.
- Passing Best Practices for projects as defined by CII
 - <https://bestpractices.coreinfrastructure.org/projects/74>
- Leveraging Automation to prevent regressions:
 - Weekly Coverity Scans to detect bad practices in imported code
 - MISRA scans being incorporated, to evolve to conformance and address issues.

Zephyr Project Governance



Goal: Separate business decisions from meritocracy, technical decisions

Governing Board

- Decides project goals
- Sets business, marketing and legal decisions
- Prioritizes investments and oversees budget
- Oversees marketing such as PR/AR, branding, others
- Identifies member requirements

Technical Steering Committee

- Serves as the highest technical decision body consisting of project maintainers and voting members
- Sets technical direction for the project
- Coordinates X-community collaboration
 - Sets up new projects
 - Coordinates releases
 - Enforces development processes
 - Moderates working groups
- Oversees relationships with other relevant projects

Community

- Code base open to all contributors, need not be a member to contribute.
- Path to committer and maintainer status through peer assessed merit of contributions and code reviews
- Ecosystem enablement

Want to help? :-)

Get Started:

- <https://www.zephyrproject.org/community/how-to-contribute>
- https://www.zephyrproject.org/doc/contribute/contribute_guidelines.html

Resource	Pointer
Website	http://www.zephyrproject.org/
Documentation	http://docs.zephyrproject.org/
Git Repository (Code)	https://github.com/zephyrproject-rtos/zephyr
Issues	https://github.com/zephyrproject-rtos/zephyr/issues
Mailing lists	https://lists.zephyrproject.org/mailman/listinfo

Wechat Groups QR code




ZephyrProject

Valid until 6/26 and will update upon joining group



Zephyr



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