ZEPHYR PROJECT OVERVIEW

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Why RTOS Consolidation is Needed

• **High NRE** hindering mass adoption
• **Fragmentation** with large number of choices
• No single RTOS for IoT support **cross-platforms**
• OEMs and Devs need a solution they can **influence**
• Limited options where **safety & security** for connected, constrained devices are needed
• Roll your own demands high level of **maintenance**
Zephyr Project: beyond the kernel

• Neutral governance and active community participation
• Built with safety and security in mind
• Cross-architecture with growing developer tool support
• Complete, fully integrated, highly configurable, modular for flexibility, better than roll-your-own
• Product development ready
• Permissively licensed
Zephyr Project: Key Features

- 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 5.0) with both controller and host, BLE Mesh
- Native, Fully featured and optimized networking stack
- Cross architecture: ARC, ARM, Nios II, RISC-V, Tensilica, x86
- Permissively licensed – Apache 2.0
Zephyr Project: Architectures

February 2016

ARM
ARC Synopsys
Intel

arm
ARC Synopsys

Nios II Processor

RISC-V
Initial Platforms in 2016

ARC EM Starter Kit
Arduino* 101
Arduino Due
Intel® Quark™ D2000 CRB

2nd Generation Intel® Galileo
NXP FRDM-K64F
ST Nucleo F103RB
Sample of Board Support: today

82 BOARDS TODAY WITH MORE ON WAY...
Products Running Zephyr: today
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
Growing a Diverse Community!

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

Authors
- 2016/2: 80
- 2018/2: 354

Commits
- 2016/2: 2,806
- 2018/2: 23,324

Boards
- 2016/2: 4
- 2018/2: 82 in progress

LAST 90 days: 9 repositories, 94 authors, 1,572 commits

Organizations
- Intel
- Unknown
- Nordic Semiconductor
- Linaro
- Open Source Foundry
- Ocicon
- ICCS NTUA
- Bayfore
- The Apache Software Foundation
- Synopsys
- Google, Inc.
- NXP
- CLAGE
- Tencent
- Acer
- US National Security
- STMicroelectronics
- Sony
- Tuxera
- Yalse
- Google
- PHYTEC Messtechnik
Zephyr Project: Membership Momentum

February 2016

Platinum Members

February 2018

Silver Members

and others….
# Zephyr Roadmap 2018

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### Zephyr 1.11
- 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

### Zephyr 1.12
- QM level qualification
- AMP Support
- LLVM Support
- IDE Integration
- MIPS support
- Improved Logging Support
- Source Code modularisation: Support external modules, boards, SoCs
- Eco-System: Tracing, Profiling, debugging support through 3rd party tools

### Zephyr 1.13/2.0 (LTS)
- MISRA-C 2012: Kernel
- Precision Time Protocol (PTP) Support
- Time Sensitive Networking (TSN) Support
- 802.1Q - Virtual LANs

### Future
- Safety and Security Pre-Certification
- LoRa Support
- CanBUS, SocketCAN
- Paging Support
- Dynamic Module Loading
- Enhanced Sensor support (support HW FIFOs)

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

Zephyr Project

- Kernel / HAL
- OS Services
- Application Services

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
Sample of Developer Tools...

- MCUpresso: Software and Tools
- RENODE
- Synopsys DesignWare ARC Development Tools
Zephyr Project: Safety & Security Vision

Security and Global IoT
“... to maintain and address all security concerns in the sector, both software and hardware security chips should be used.” – Technavio, January 2017

Safety & Security

• Focus on addressing security needs of connected, resource constrained devices
• Work group focused on defining the safety & security strategy and development plans
• Membership marries HW & SW functional safety & security expertise and investment through open source development
• The goal of working group to develop a safety & security auditable version of the OS

Global internet of things security market is expected to grow at a CAGR of nearly 48% during the period 2017-2021 – Technavio, January 2017
Code Repositories

- Development
- Long Term Support "Stable"
- Auditable

- Community Contributions via DCO
- Releases
- Products
- Safety & Security Processes
- Products Ready to be Certified
- Audit Ready Documentation (PLATINUM MEMBERS ONLY)

Backports & Keeping Configurations in Sync
Zephyr OS: Readying Auditable

• 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 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.
Participation Information

Developer Participation Orientation:
  • https://www.zephyrproject.org/community/how-to-contribute
  • https://www.zephyrproject.org/doc/contribute/contribute_guidelines.html

TSC:
  • weekly on Wednesdays

Security Committee:
  • bi-weekly on Wednesdays (members only)

Governing Board:
  • monthly (members only)