EOSS EMBEDDED OPEN SOURCE SUMMIT

9 Years in the Making, the Story of Zephyr, Starting with Commit Nr. 1

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Zephyr® Project
Developer Summit 2023

Introduction

- The Zephyr Project was started by Intel in 2014 and publicly launched as a Linux Foundation project in 2016, with Synopsys, NXP, and Wind River.
- *Primary goals of the Zephyr Project*:
  - Adoption by silicon vendors and the embedded community while, embracing the open-source and open eco-system vision of founding members.
  - The creation of a unified and a sustainable open eco-system while providing value to firmware developers running on different ISAs and using different OS environments.
- Goals have been achieved with majority of silicon vendors adopting Zephyr, products launched with Zephyr, and an ever increasing and vibrant community.
- The Zephyr Project was ranked among the top "Critical Open-Source Projects" list by Google.

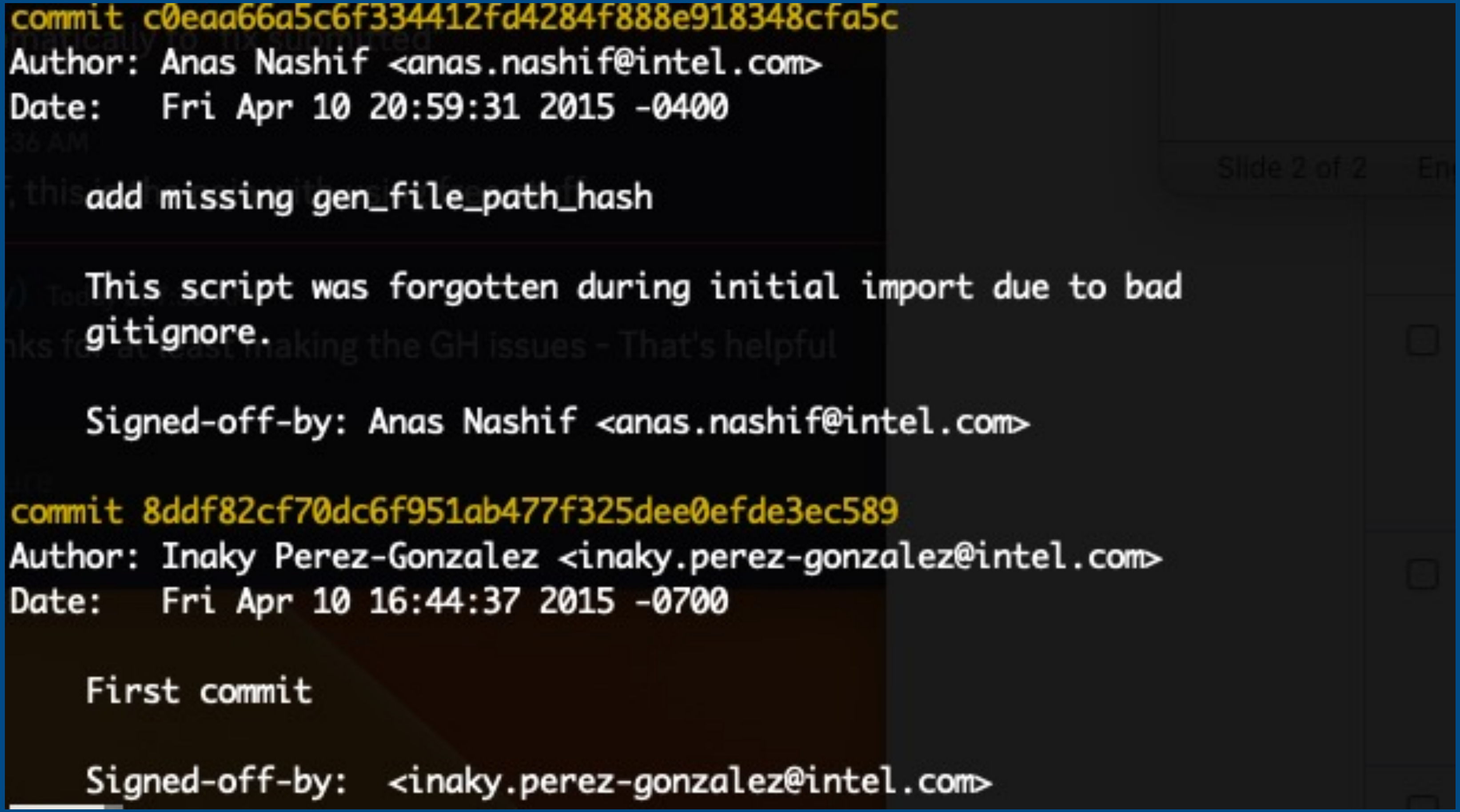
The Zephyr Project in Numbers*

Project Started	Project Went Public	Contributors	Commits	Architectures (ISA)	Targets and Platforms
2014	2016	1,647	> 80k	13	> 500

Releases	LTS Releases	Lines of Code (C)	Open Issues	Closed Issues	Pull Requests
40	2	> 1Mio	376	11,217	> 40k

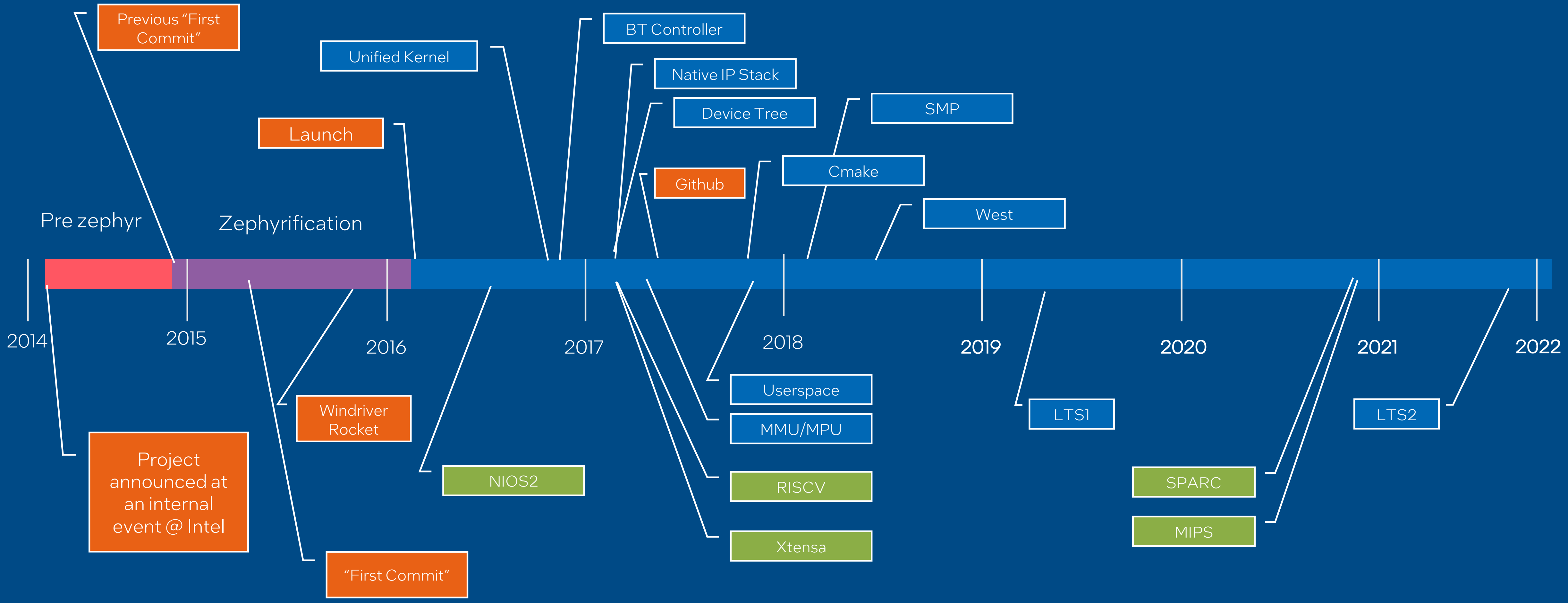
* as of 06/2023

First Commit?



```
commit c0eaa66a5c6f334412fd4284f888e918348cfa5c
Author: Anas Nashif <anas.nashif@intel.com>
Date:   Fri Apr 10 20:59:31 2015 -0400

    add missing gen_file_path_hash

    This script was forgotten during initial import due to bad
    gitignore.

    Signed-off-by: Anas Nashif <anas.nashif@intel.com>

commit 8ddf82cf70dc6f951ab477f325dee0efde3ec589
Author: Inaky Perez-Gonzalez <inaky.perez-gonzalez@intel.com>
Date:   Fri Apr 10 16:44:37 2015 -0700

    First commit

    Signed-off-by:  <inaky.perez-gonzalez@intel.com>
```

How we got here..



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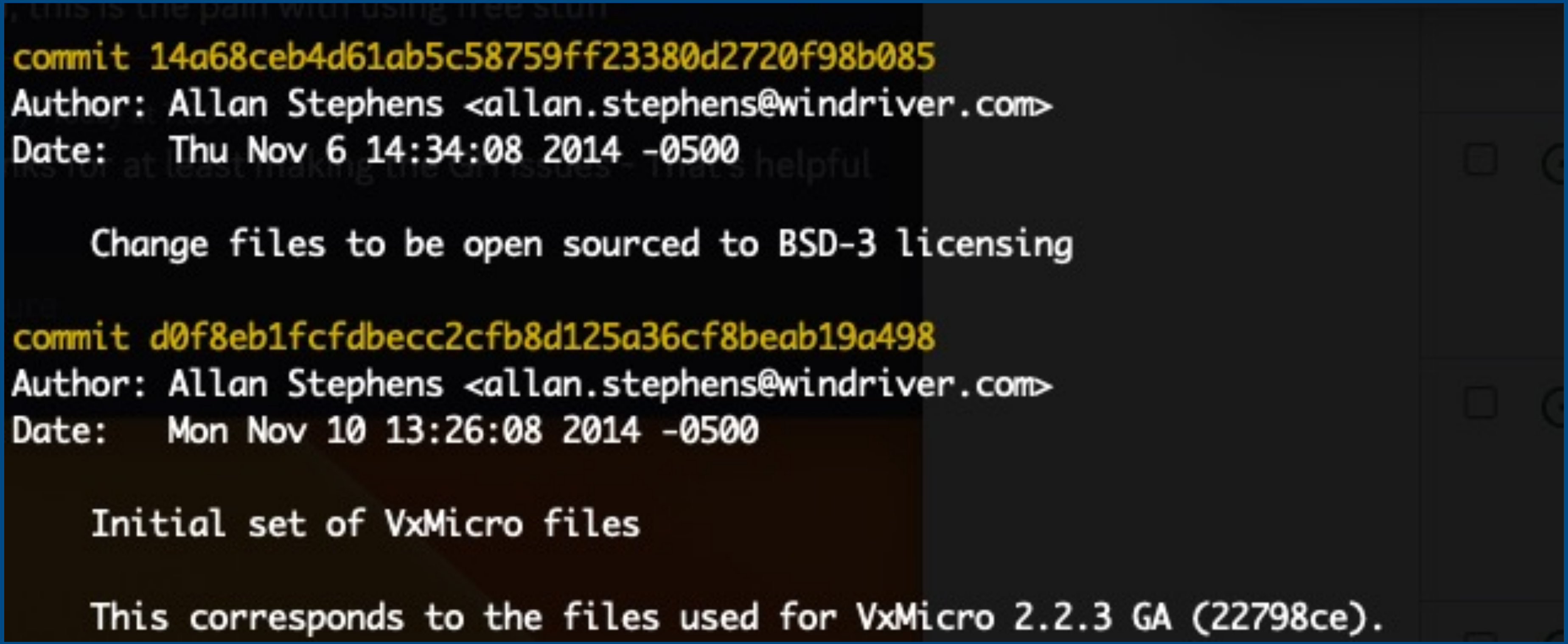
we go further back...

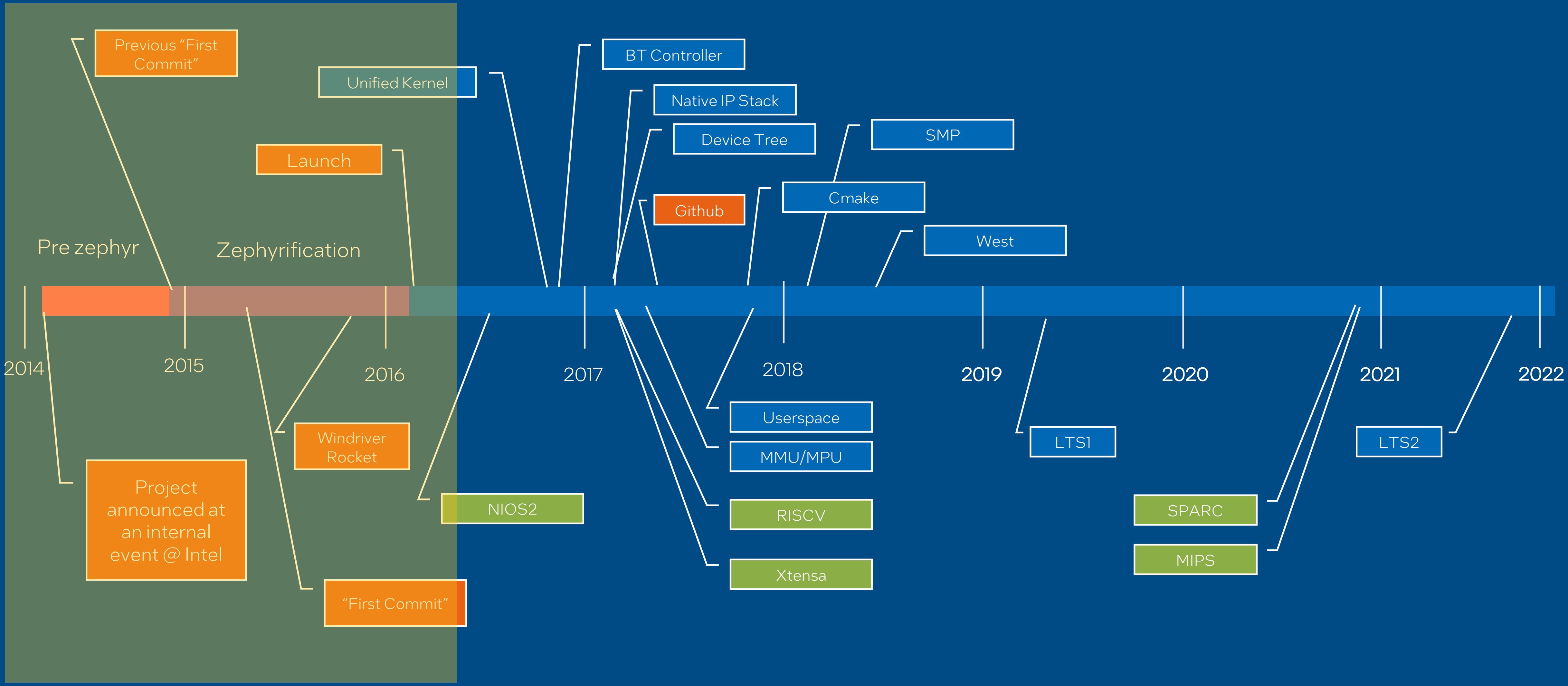


```
commit 14a68ceb4d61ab5c58759ff23380d2720f98b085
Author: Allan Stephens <allan.stephens@windriver.com>
Date:   Thu Nov 6 14:34:08 2014 -0500

    Change files to be open sourced to BSD-3 licensing

commit d0f8eb1fcfdbecc2cfb8d125a36cf8beab19a498
Author: Allan Stephens <allan.stephens@windriver.com>
Date:   Mon Nov 10 13:26:08 2014 -0500

    Initial set of VxMicro files

    This corresponds to the files used for VxMicro 2.2.3 GA (22798ce).
```

Wind River Rocket

- Commercial version of Zephyr launched by Wind River November 2015
- A lock-step downstream version of Zephyr, takes care of the OS configuration and hardware integration with Wind River Helix App Cloud for a streamlined development experience.

The Early Days of Zephyr



Progress towards open-sourcing and Launch

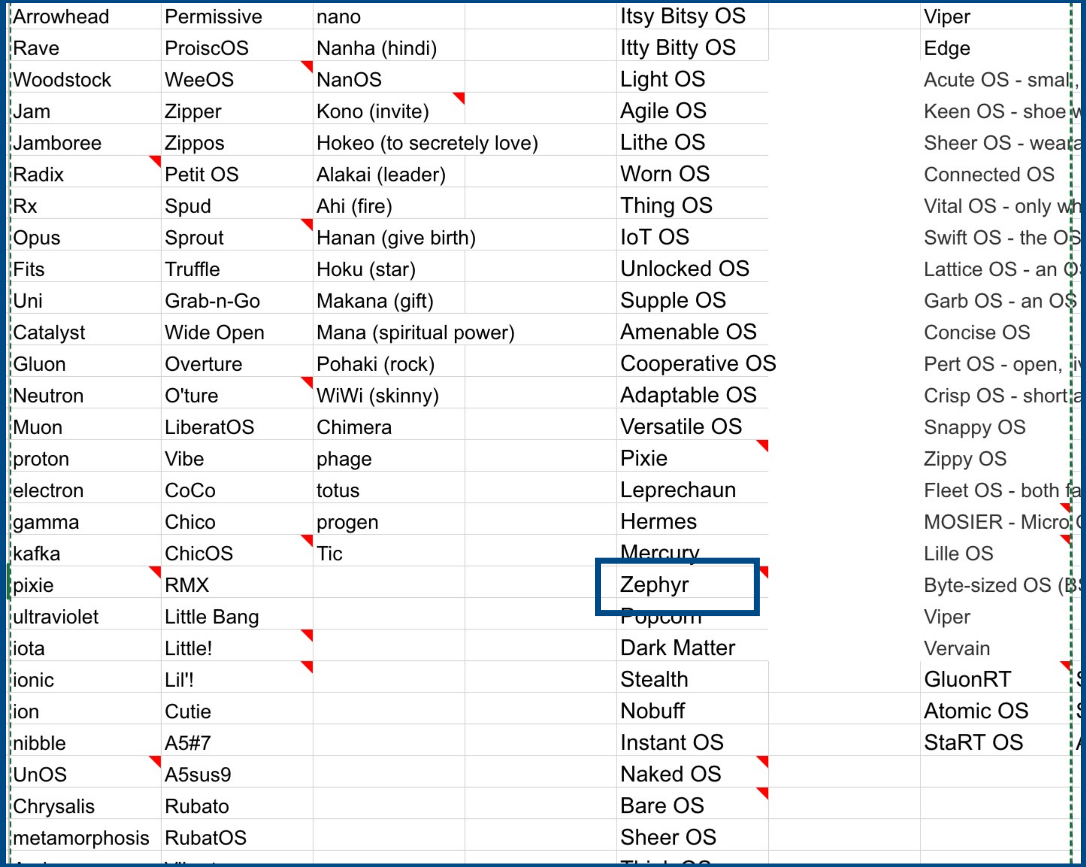
- By the release in 2016 (v1.0.0), we were at approx. 7000 commits
- First Commit in current Zephyr tree was 2200 commits in (Squashed into 1 single commit)
- What happened exactly before the release?
  - General Cleanup
  - Readying for open-source
  - Build System Overhaul
    - Kconfig
    - Kbuild
  - Device Model
  - De-feature: Remove unwanted features
  - Add support for launch hardware, implement first APIs and drivers
- Figure out name and license…

License Considerations

- Apache 2 license was NOT the first choice
- Zephyr was originally BSD licensed
- Potential project partners requested other licenses

Finally released publicly as an Apache 2 licensed project

Many choices for a project name…



Arrowhead	Permissive	nano		Itsy Bitsy OS		Viper
Rave	ProiscOS	Nanha (hindi)		Itty Bitty OS		Edge
Woodstock	WeeOS	NanOS		Light OS		Acute OS - smal
Jam	Zipper	Kono (invite)		Agile OS		Keen OS - shoe w
Jamboree	Zippos	Hokeo (to secretely love)		Lithe OS		Sheer OS - weara
Radix	Petit OS	Alakai (leader)		Worn OS		Connected OS
Rx	Spud	Ahi (fire)		Thing OS		Vital OS - only wh
Opus	Sprout	Hanan (give birth)		IoT OS		Swift OS - the OS
Fits	Truffle	Hoku (star)		Unlocked OS		Lattice OS - an O
Uni	Grab-n-Go	Makana (gift)		Supple OS		Garb OS - an OS
Catalyst	Wide Open	Mana (spiritual power)		Amenable OS		Concise OS
Gluon	Overture	Pohaki (rock)		Cooperative OS		Pert OS - open, i
Neutron	O'ture	WiWi (skinny)		Adaptable OS		Crisp OS - short a
Muon	LiberatOS	Chimera		Versatile OS		Snappy OS
proton	Vibe	phage		Pixie		Zippy OS
electron	CoCo	totus		Leprechaun		Fleet OS - both fa
gamma	Chico	progen		Hermes		MOSIER - Micro C
kafka	ChicOS	Tic		Mercury		Lille OS
pixie	RMX			Zephyr		Byte-sized OS (BS
ultraviolet	Little Bang			Popcorn		Viper
iota	Little!			Dark Matter		Vervain
ionic	Lil'!			Stealth		GluonRT
ion	Cutie			Nobuff		Atomic OS
nibble	A5#7			Instant OS		StaRT OS
UnOS	A5sus9			Naked OS		
Chrysalis	Rubato			Bare OS		
metamorphosis	RubatOS			Sheer OS		

In hindsight, we should have picked another name…

ZEPHYR TOOL GROUP
zephyr
Zephyr
ZEPHYR HOMELOANS
ZEPHYR Air Purifiers
ZEPHYR
ZEPHYR HEALTH
ZEPHYR PRODUCTS, INC
Weld·Fab·Finish
ZEPHYR Real-Time Test Management
Zephyr
ZEPHYR
ZEPHYR ADVENTURES
ZEPHYR
ZEPHYR Hôtels
ZEPHYR BOUTIQUE
ST. MARY CATHOLIC ZEPHYRS
ZEPHYR Yachting

Board Support at Launch in February 2016

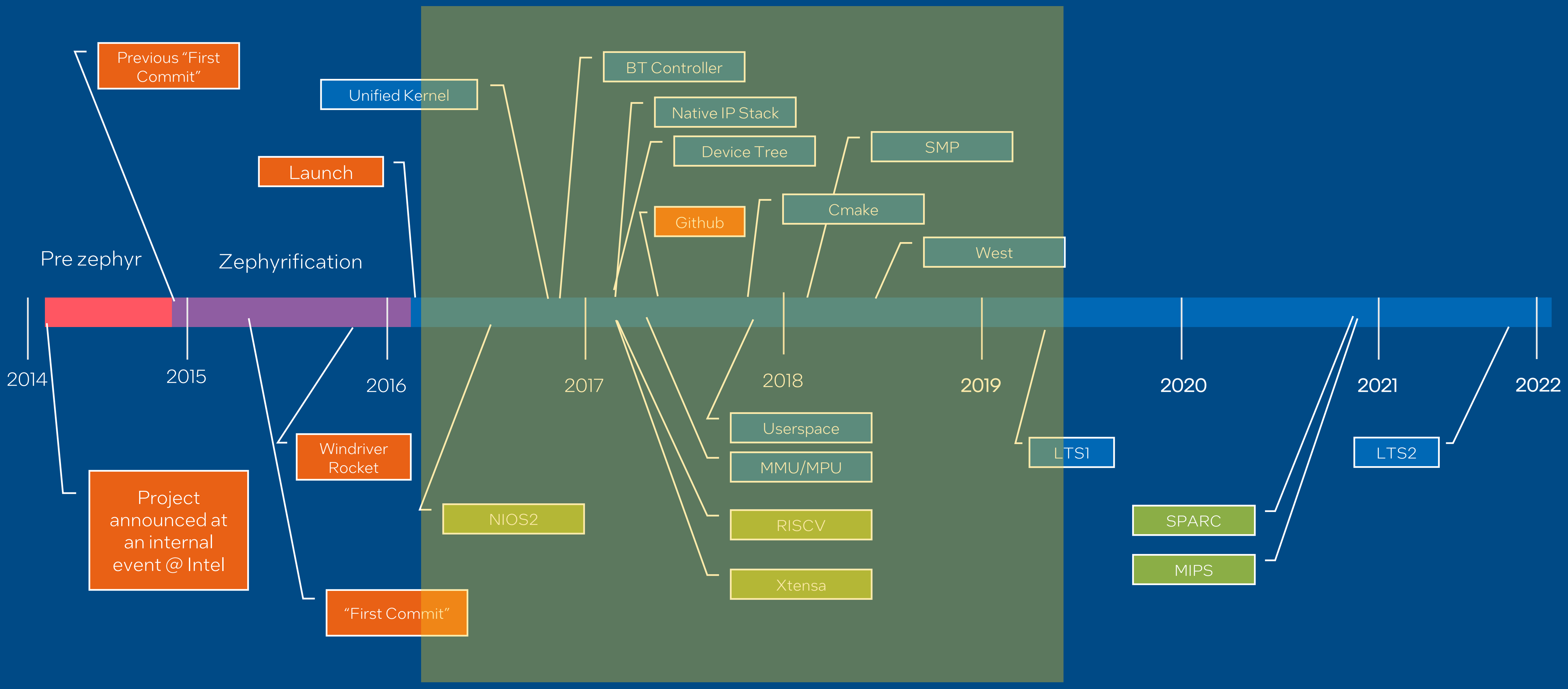
Arduino 101

FRDM-K64f

Arduino Due

Intel Galileo

Developing and RTOS for EVERYONE



Pre zephyr

Zephyrification

2014

Previous "First Commit"

Project announced at an internal event @ Intel

2015

"First Commit"

Windriver Rocket

2016

Launch

Unified Kernel

NIOS2

BT Controller

2017

Native IP Stack

Device Tree

Github

Userspace

MMU/MPU

RISCV

Xtensa

2018

Cmake

SMP

West

2019

LTS1

2020

SPARC

MIPS

2021

LTS2

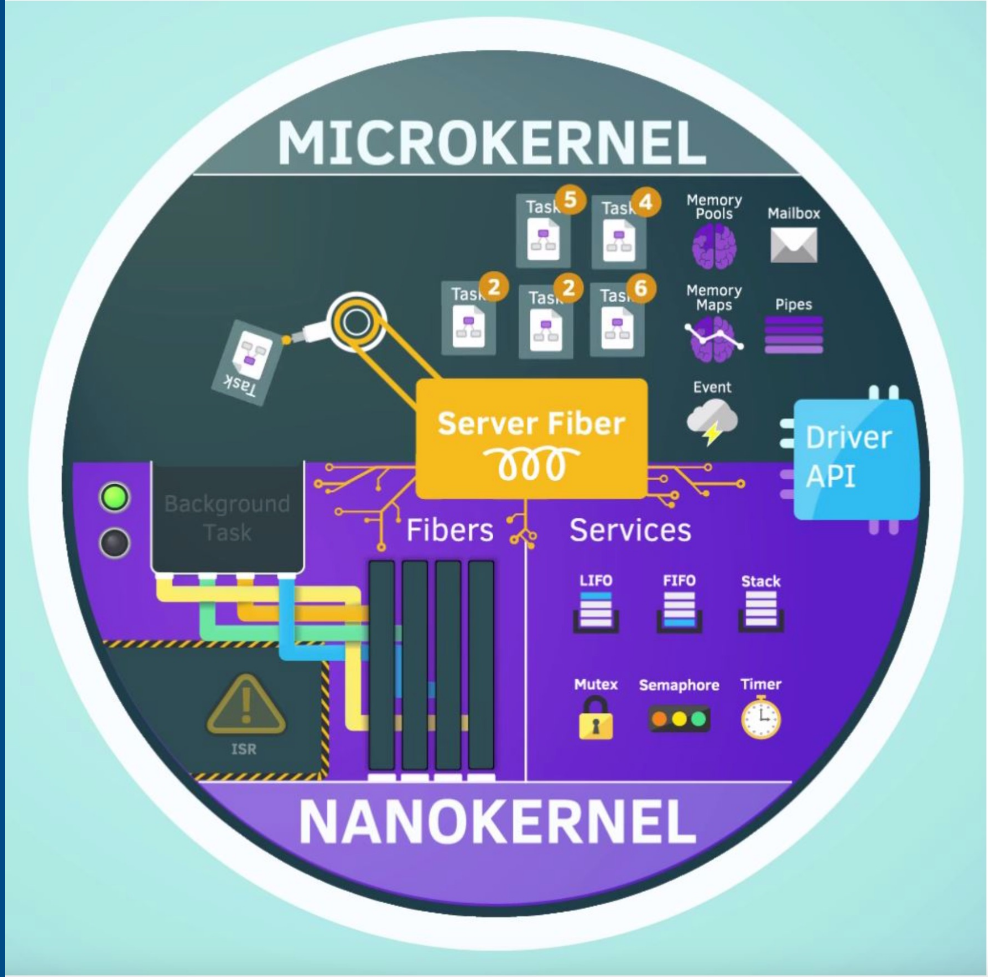
2022

Major Transitions and Transformation of the project

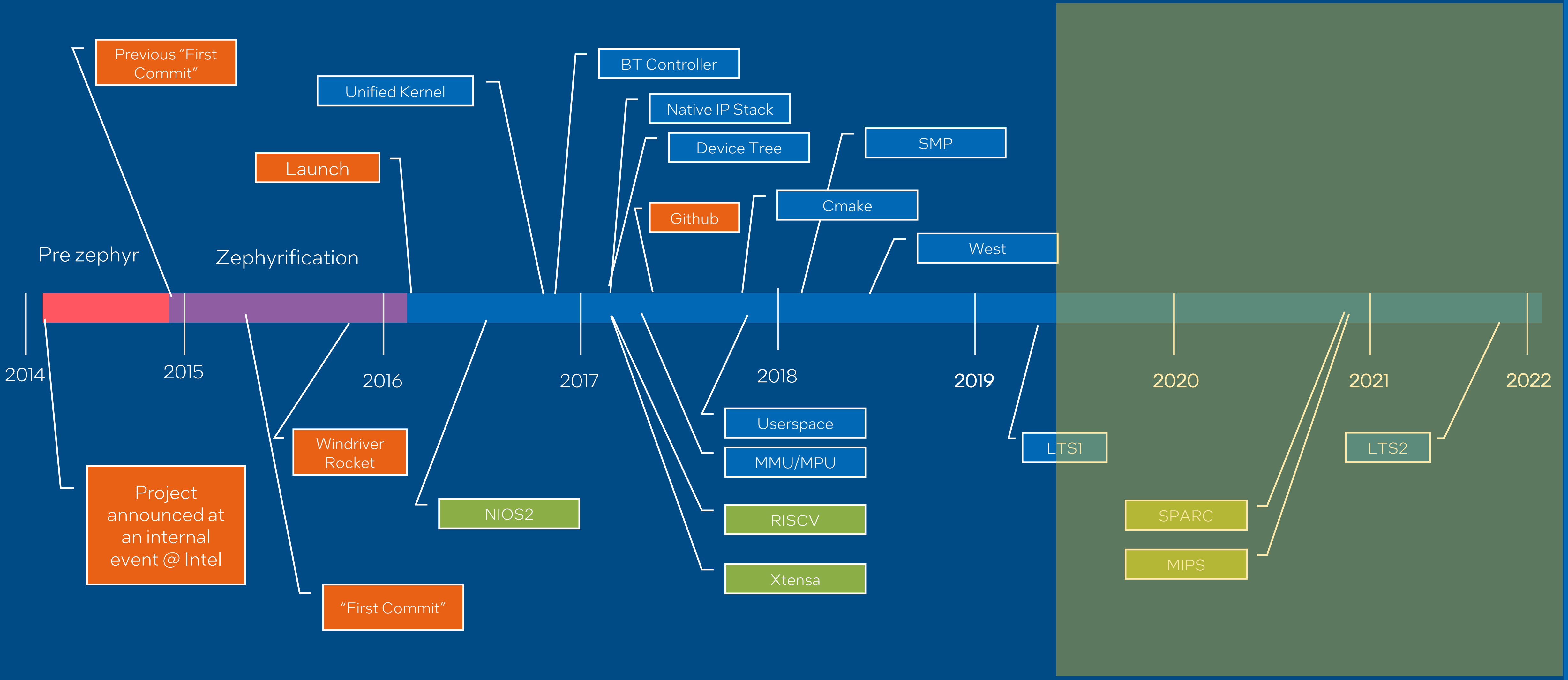
- Build System
  - Initially Custom (Makefile based)
  - Then Kbuild for a while
  - And finally, Cmake
- Networking: Contiki stack to Native implementation
- Kernel: Move from Nano and Micros kernels to the Unified Kernel
- Review System:
  - Move from Gerrit to Github
- Continuous Integration:
  - Move from Shippable to Github Actions

Moving from dual-kernel model to the Unified Kernel

- Problems with dual-kernel model:
  - Non-intuitive nature of the nanokernel/microkernel split
  - Double-context switch affecting kernel performance (speed and footprint)
  - Duplication of object types between the nanokernel and microkernel
  - System initialization running in the idle task
- The unified kernel…
  - made the nanokernel 'pre-emptible thread' aware
  - unified fibers and tasks as one type of threads by dropping the Microkernel server
  - allowed cooperative threads to operate on all types of objects
  - clarified duplicated object types
  - created a new, more streamlined API, without any loss of functionality



Adoption, Products and a self-sustaining Eco System



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Where we started....

Arduino 101

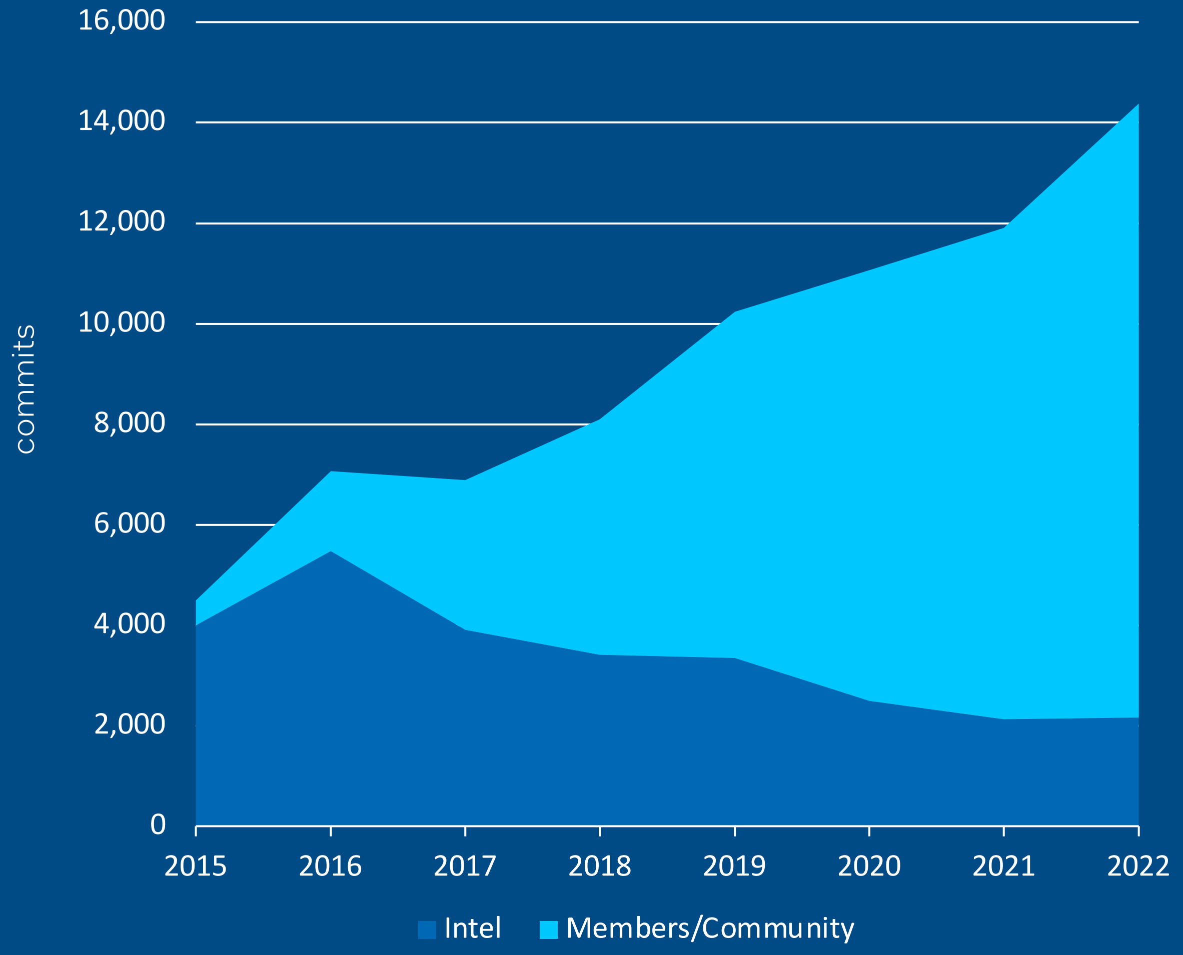
FRDM-K64f

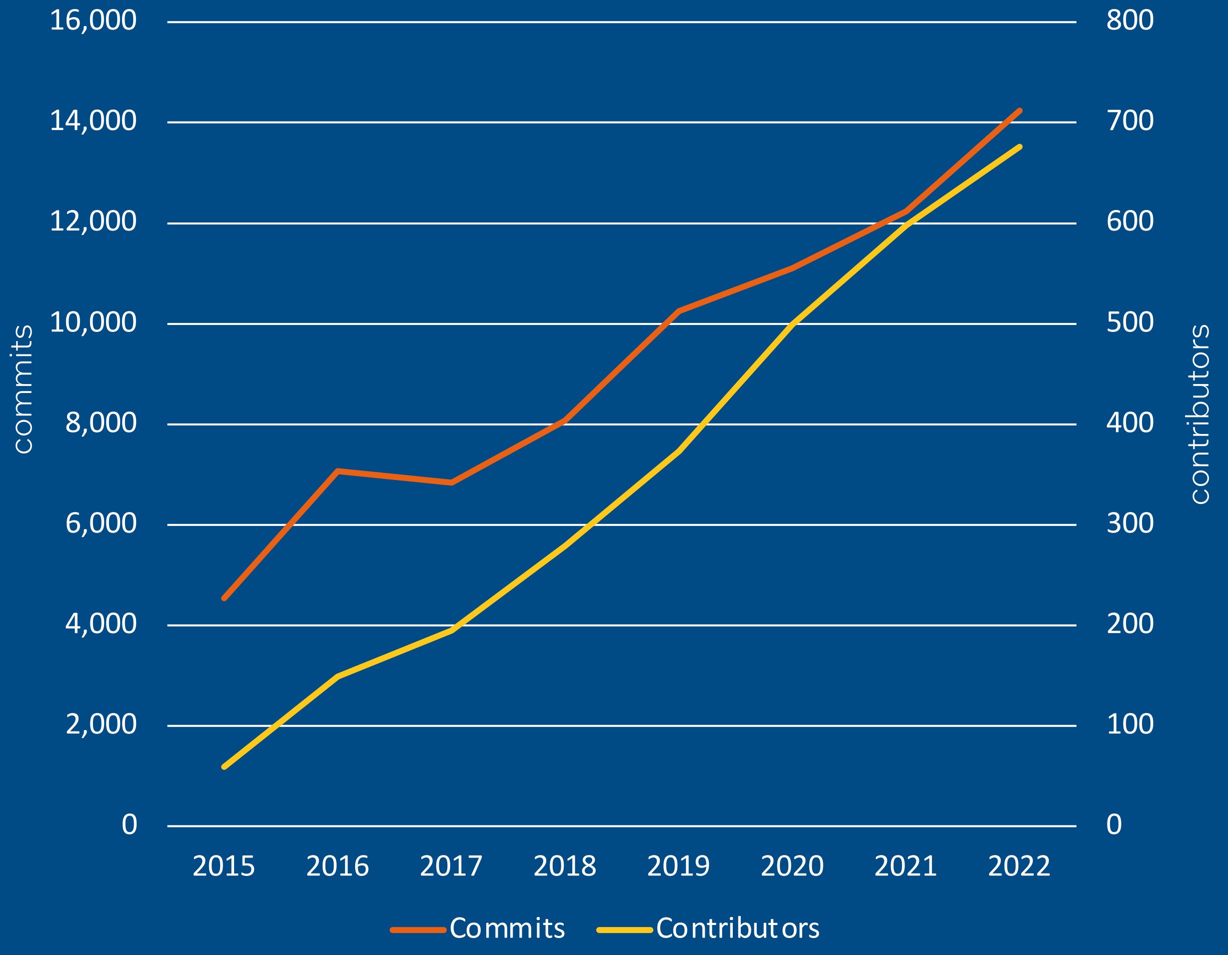
Arduino Due

Intel Galileo

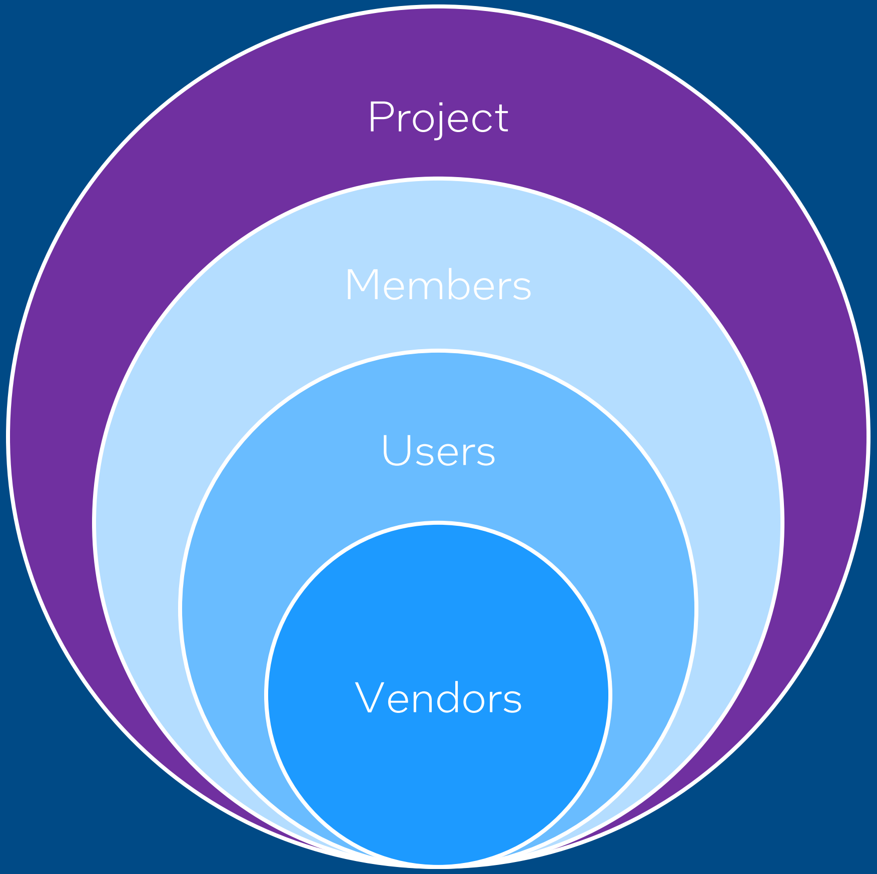
And now...

Healthy Eco System and Community Growth





Evolving and Self-Sustaining Open Eco-System



Getting Things Done

- By those who need a feature:
  - Adding support for own hardware and platforms.
  - Implement generic and cross platform features.
- By collaborating on major features:
  - Collaboration is the most efficient path to get features done.
  - Most code development is based on collaboration.
- By contracting 3rd parties or other project members to implement a feature:
  - In cases where someone does not have the resource, contracting is the best option.
- Or by asking a vendor for a new feature or for Zephyr support:
  - Users asking tool vendors to support Zephyr
  - Users asking for support commercial compilers, etc.

Looking Forward

- Maintain project health and scale up to support growing userbase, contributors and members
- Focus on user and developer experience
  - Ease migration between releases
  - Maintain a stable and a rich API
- Continue to aggressively pursue project safety and security goals
- Encourage and enable more users and products to use LTS
- Focus on and Release third LTS in 2024

Thank You

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