SYSGO
EMBEDDING INNOVATIONS

Product Note

ELinOS 6.2

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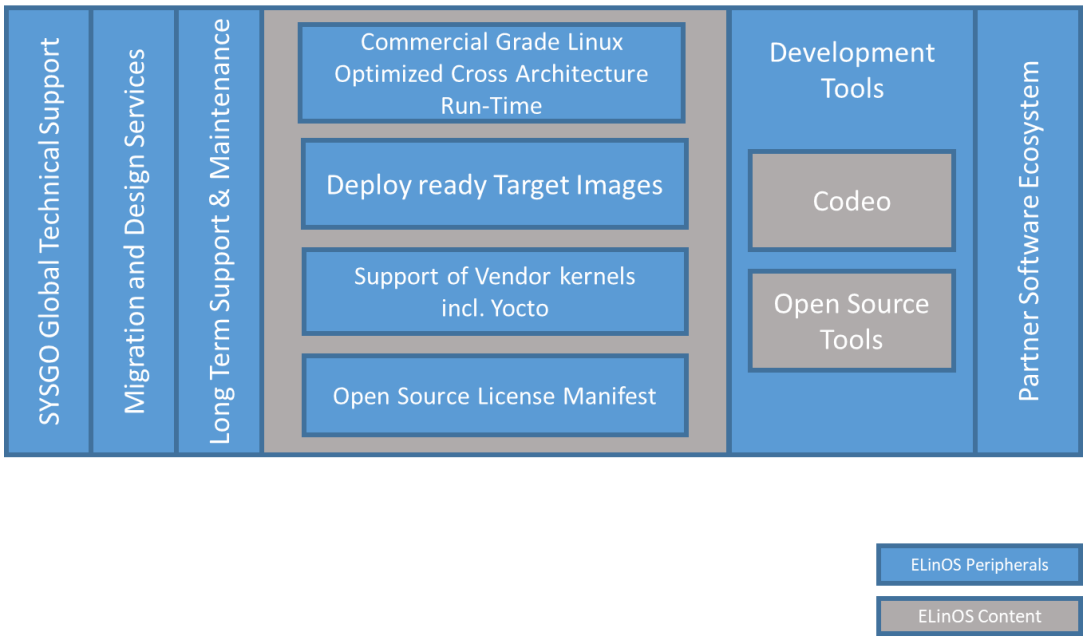
1. Introduction

No need any more to point out the benefits of Linux for embedded systems, including flexibility, broad range and hardware support. However some issues remain for embedded Linux developers who have to sort out the continuous proliferation of new components. ELinOS has been designed to allow developers and companies to save time and resources by helping them in focusing on their application, and only on it. Industrial strength and user- friendly interface goes along with the best selection of technology to meet customer needs, and with the comfort of world-class support.

ELinOS Version 6.2 contains tools and kernel support to develop applications for embedded systems based on this architecture. To cope with the large number of embedded platforms and I/O facilities available today, ELinOS uses a fairly recent kernel version. The development languages supported are C and C++.



ELinOS 6.2 Key Components

2. Key Users

ELinOS is an industrial grade Linux distribution running out of the box on SYSGO's PikeOS Hypervisor. The software can be used as foundation for safe and secure systems. The Key users are:

- **First-Time Embedded Linux Users**
  - Low entry barrier makes ELinOS especially suited for new users
  - Efficient build system with precompiled packages allows fast turn-around times during critical development stages
  - Scriptable build and deployment on target allows one-click build-and-test scenarios
- **Original Equipment Manufacturers**
  - Custom BSPs tailored for specific hardware product benefit OEMs customers and ease load on support teams
  - Super-compact root filesystems help reducing BOM cost and attack surface in security critical applications
  - SYSGO helps porting ELinOS to custom hardware and provides assistance during board bring-up
  - Integration of Linux Realtime (RT) patches expand ELinOS range of applications into the soft-realtime domain
- **PikeOS Users requiring a Linux Personality**

- When POSIX is not enough to support legacy applications.
- Broad range of hardware drivers available with “Direct-I/O” BSPs.
- “Secure-I/O” allows adding a fully compatible Linux runtime into safety-critical environments.

3. Most visible Use Cases

The supported use cases are manifold. An extract is listed below:

- Create an application on a stable and long supported COTS Linux distribution
- Run out-of-the-box as personality on SYSGO Hypervisor
- Support for security targeted developments by security patch updates
- Need for a customer project dedicated Linux kernel

4. Key Benefits of ELinOS

- Easy Access, Low Entry Barrier with quick Configure – Build – Deploy cycles
- Excellent Tooling Integration
  - Codeo Feature and Filesystem editors, LTTng-based tracing, GDB remote debugging, etc.
- Same distribution, toolchain, workflow no matter which board in use
- Built-in Real-time-Linux Support
- PikeOS Linux Personality
- PikeOS Hardware Virtualization support
- Quality-Controlled, with Professional Support
- Well-maintained upstream (Debian Stable) for packages
- All platforms under one umbrella

Feature	Customer benefit
Latest LTS kernel supported	Always up to date
New PowerPC 64bit	Supporting 64 Bit, helps sales in A&D
License Manifest	List all Packages and Open Source licenses used in a project
New generic platform BSP	Allows integration of Yocto Linux kernels
Aligned with Debian Distribution	Easier handling of package and security updates, but still needs SYSGO services
Package Update Automation	Easier and more frequent package updates
ELinOS Security Services	Notification about common vulnerabilities affecting ELinOS

ELinOS 6.2 Added Value

5. Supported BSPs

Qualified BSPs are available for almost every board made by SYSGO’s hardware partners. Support for SMP (Symmetric multi-processing) on multi-core platforms like x86, x86-64, PPC e500, PPC e500mc and ARM is included.

See also here: https://www.sysgo.com/products/board-support-packages/elinos-bsp-list/

6. Architecture Support

The following architectures are supported under ELinOS 6.2:

Architecture	ElinOS 6.1	6.2 Native	as PikeOS 4.2 perso
x86	✓	✓	✓
x86-64	✓	✓	✓
PPC e500	✓	✓	✓
PPC e500mc (QorIQ P2040 and above)	✓	✓	✓
PPC 60x (= PPC OEA)	✓	×	×
PPC e5500 (64bit)	×	✓	✓
ARM v5le	✓	×	×
ARM v7hf	✓	✓	✓
ARMv8 (64bit)	✓	✓	✓

ELinOS 6.2 Architecture Overview

7. Industrial Automation Support

Optional available drivers are

- CAN, CANOpen
- VME
- EtherCAT (upon request)
- Others

8. Supported Filesystems

The following filesystems are supported in ELinOS 6.2

- Ext2, Ext3, Ext4
- Btrfs
- UBIFS
- Flash-Friendly File System
- F2FS
- JFFS2 YAFFS2
- SquashFS
- ReiserFS
- FAT
- NTFS
- NFS v4.1
- Initramfs
- Others

9. IDE: CODEO (also with QEMU)

The Eclipse based IDE CODEO supports system architects with graphical configuration tools, provides all the components software engineers need to develop embedded applications and includes comprehensive little helpers to finish embedded projects in a time-saving and cost-efficient way:

- guided configuration
- remote debugging (down to the hardware instruction level)
- target monitoring
- remote application deployment
- and timing analyses

Of course, CODEO provides standard application development features such as compiler, assembler and linker. ELinOS also provides an IDE and command line environment. And it is possible to switch from IDE to CDK, when for example going to production.

CODEO offers Simulation Targets, a QEMU based hardware simulation. Simulation Targets for all available architectures can be managed and configured through graphical wizards, directly in the IDE. This enables a rapid software development, early testing and debugging even without a real target hardware on the table. Simulation Targets are available for all hardware architectures supported by ELinOS.

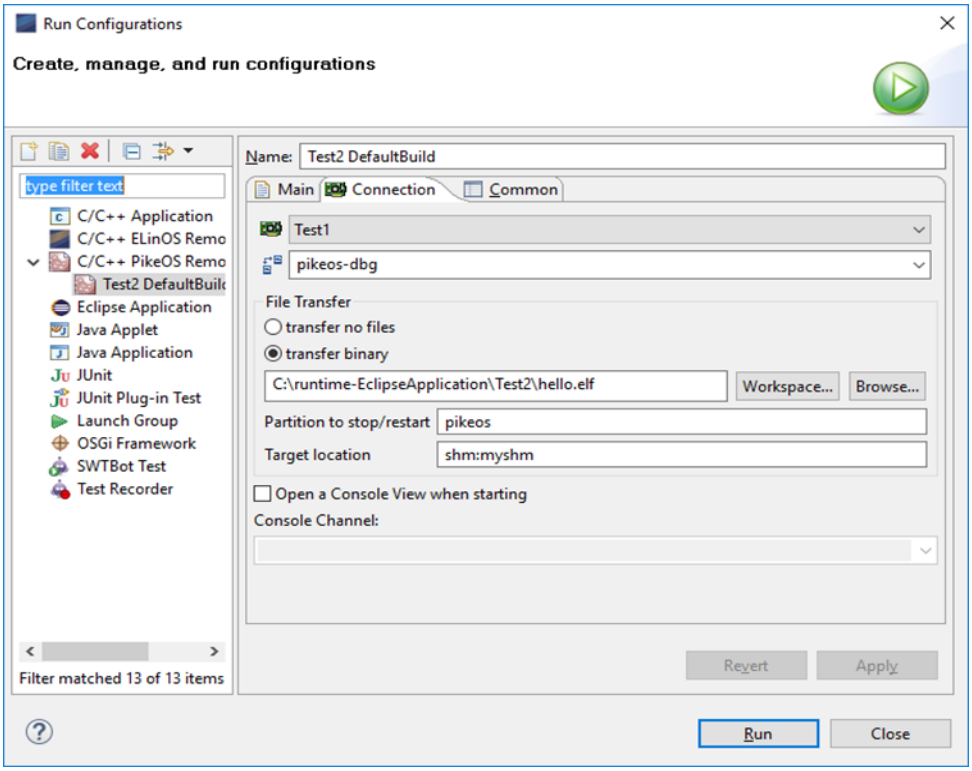
The ROM file editor allows an efficient management of files and system properties. Files can be added and removed directly to the ROM file system. Additionally it offers a dynamic preview of the final layout that updates automatically when changing related configuration that affects the ROM file system indirectly.

Several dedicated graphical editing views are supporting the system Integrator to always keep the overview on important aspects of the ELinOS system configuration with plug-ins for target analysis like system monitoring, tracing or debugging.

Projects can be easily defined with the help of reusable templates and distributed to the development groups. Customers can configure pre-defined components for their project and can also define and add other components during the development process.

The latest version is called CODEO 6.2 and has the following new highlights:

- Graphical enhancements and improvements in multicore scheduling
- Improved project configurator
- Re-deployment of applications
- Updated to Eclipse 4.6
- Toolchain Update with GCC 5.4



CODEO create and re-deploy applications

10.Host system environment for Linux

CODEO supports both 32 and 64-bit Linux distributions. For usage on 64-bit Linux distributions 32-bit compatibility libraries have to be installed.

11.Host system environment for Windows

CODEO can be used on the following variants of the Windows operating system:

- Windows 7 (32 and 64-bit)
- Windows 8 (32 and 64-bit)
- Windows 10 (32 and 64-bit)

12.Generic Platform BSP including Yocto Linux Kernel integration

Via the Generic Platform BSP customers can create systems with ELinOS standard features by configuration of the CDK (Cross Development Kit), defining the boot strategy and kernel source location. In this process CODEO is used as kernel configuration editor. This process also allows the support of all vendor specific kernel, for example from the Yocto project.

This is a quick way for customers to add a new “Native” or “HwVirt” platforms (if supported by the CDK). For the creation of P4Linux BSPs SYSGO professional services is able to support.

13.Core Tools used in ELinOS 6.2:

ELinOS is an integrated development environment for embedded systems running Linux. ELinOS offers various tools, supports adequate boot strategies, can be easily handled due to graphical interface and is available for the established embedded hardware. This enables seamless working from driver development up to application integration.

Development Tools:

- CODEO – Eclipse based integrated development environment for embedded systems including plug-ins for target analysis (system monitoring, tracing, debugging)
- Tool chain (incl. cross-compiler, linker, debugger)
- Linux kernel
- Pre-compiled target software and libraries
- Real-time extension (Patch PREEMPT_RT)
- Ready-made project templates, documentation

Following versions are used in ELinOS 6.2:

- QEMU 2.4
- GCC 6.3.0
- Glibc 2.24
- GDB 7.10
- LTTng 2.7
- Codeo 6.2

14.Product Features of ELinOS 6.2

- New Linux Kernel 4.9 LTS (Long Term Supported)
- Vendor patches for iMX6 “Sabre”, Xilinx and R-Car H3/M3 boards
- Standard and updated list of BSP with e.g. X86, ARM and QEMU
- New Architecture: PowerPC 64bit (PPC e5500 Platform)
- ELinOS Security Services
- License Manifest

15.ELinOS Demo Server

SYSGO offers a test environment in which customers can take the chance to test ELinOS in a real online session. This is done by connecting to a fully equipped workstation with a selected target board, using remote desktop technology. Customers can setup embedded Linux projects and create images which run and can be tested on a real target.

Learn more under: https://www.sysgo.com/services/support/elinos-demoserver/

16.Partner Ecosystem:

SYSGO is committed to establish the technological and business partnerships that will help its customers to achieve their goals. SYSGO is currently working with about 100 partners worldwide. A list of available partner that help to enhance the value, can be found here:

https://www.sysgo.com/partners/partner-directory/.

An excerpt of partners per category is mentioned below:

- Board Vendors: Curtiss-Wright Controls Embedded Computing, Kontron, MEN or ABACO
- Silicon Vendors: NXP, Renesas, TI, Xilinx, Infineon, NVidia or Intel
- Software Partners: CoreAVI, Aicas, AdaCore , Esterel, RTI, PrismTech, Datalight, Systerel, Imagination Technologies or RAPITA
- Tool partner: Lauterbach, Vector Software
- Supported Architectures: ARM, PPC, X86 (SPARC available on request)

17.SYSGO Customer Support

SYSGO provides support in all phases of the product life cycle. Our products and services are used since more than 25 years in embedded devices. Our online SYSGO Support Network is available for standard and certifiable products.

Standard products come with “standard support” that provide analysis of reproducible errors in and malfunctioning of software developed by SYSGO and provision of known error corrections, as well as support in preparing work-around solutions. Optional “premium support” offers additionally direct access to a dedicated support engineer and limited hours of consulting. Lastly “long term support” offers additionally a retaining ability to rebuild the selected frozen version, a limited number of consulting hours, a dedicated phone number and access to a wide data base of corrections, updates, demo programs and others.

Certified product versions profit from “product cert support” and “long term cert support” that includes safety and security bulletins that inform the customer of vulnerabilities or safety risks.

Customer support is reserved to customers owning a valid support-contract. For more information, please contact us under https://www.sysgo.com/company/contact/ .

18.SYSGO Professional Services:

SYSGO is certified according to ISO9001 and ISO27001. Our engineering processes are assessed according to SPICE Level 3 and our professional services organization support customers in the fields of:

- Training
- Consulting
- Certification Services

Experienced in aerospace, defense or automotive our specialists are available to help with implementing or adapting software architectures and processes. Services include guidance for software installation and orientation, architecture design, assistance with creating security- or safety-critical code, BSP

and driver migration and creation, software integration, legacy application and infrastructure migration, platform extensions, and process compliance.

For more information, please visit https://www.sysgo.com .

19.Available Documentation:

More detailed documentation is available in the SYSGO customer support area and can be provided under NDA. The documents are included in the product delivery and can be provided to customers for evaluation.

The available documents are:

- Release notes
- Installation manual
- User Manual
- Tutorials
- CODEO documentation
- Demonstrations

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