Be Smart, Stay Smart –
Open Source for Long-living Products

Urs Gleim, Siemens AG, Corporate Technology
About Siemens

In a nutshell
• 171 years long history of innovations
• Currently around 380’000 employees
• About 83 Billion Euro revenue (2018)

Products and solutions for
• Power generation and distribution
• Industrial / building / rail automation
• Railway vehicles
• Medical technology
• Product life-cycle management software
• ...
Linux is widely used in our products

**Power Generation**
- PREEMPT-RT

**Rail Automation**
- Debian Linux

**Vehicle Control Systems**
- Safety-certified Linux

**Building Automation**
- Yocto Linux

**Industrial Automation**
- Public Yocto Layer

**CNC Controls**
- XENOMAI

**Industrial communication**
- KVM on ARM

**Medical Imaging**
- XENOMAI on “big iron”
More Software in Siemens Products – Focus on Differentiation

Differentiating
Why to buy the Siemens product

Commodity
Invisible for customers

Up to 2000
SIEMENS application
Proprietary operating system

2000–2015
SIEMENS application
Operating System

Today
SIEMENS application
Middleware
Communication
Domain-specific frameworks

HMI frameworks
Augmented reality platforms

Mobile
Enterprise IT interfaces

Device
App isolation
Data collection
Operating System
Monitoring
Virtualization

Cloud
IoT backend
Stream processing
Cloud frameworks

Today
Open Source Software Usage –
Many years of experience: technically, legally, strategically

Preconditions

Technical match

Licenses

Maturity

Quality

User Base

Community

Sustainability

Experts

Community backing

Influence
Software License Compliance – Continuous improvement of process and tooling… as Free Software

Component Analysis Tool

Software Catalogue

Central Open Source software team ensuring Siemens-wide strategy, governance, and guidance related to open source software: processes, trainings, tools, cross-division alignment.
Open Source Software Contributions – Upstream first

Community mainline

Siemens R&D

Products

Upstream first

- Avoid maintaining company-specific patch sets and adoptions
- Improve the open source project directly
- Benefit from communities' maintenance efforts and new features (e.g. for new hardware or other fixes)
- Improved quality due to immediate community reviews and tests
- Get support from core community experts

Examples: Xenomai, preempt-rt, KVM, ISAR, GitLab, …
Publishing Open Source projects – Driving standards, open product platforms, share efforts, ...

Examples: github.com/siemens (> 80 projects: Jailhouse, ROS#, kas, FOSSology, drace...), coaty.io
Increase relevant communities by engagement – Software Update example

**SWUpdate**
https://github.com/sbabic/swupdate

**SWUpdate / Suricatta**
https://sbabic.github.io/swupdate/suricatta.html

**Eclipse IoT hawkBit**
https://www.eclipse.org/hawkbit/

Versatile & flexible on-device framework doing the heavy lifting for software update on embedded systems, e.g., firmware, containers, applications, …

Extensible Framework within SWUpdate to connect it to remote (cloud) services orchestrating the updates

Domain-independent backend (cloud) framework for rolling out software updates to Edge/Controller/Gateway/… devices.

**Siemens contributions:** cloud backend integration framework “Suricatta”, x86/UEFI support, binary delta updates, systemd support, Lua scriptability support, FreeBSD support, …
Strategic Partnerships – Creating Communities

CIVIL INFRASTRUCTURE PLATFORM

https://cip-project.org
### “Hidden” Industrial IoT Systems

#### Transport
- Rail automation
- Vehicle control
- Automatic ticket gates

#### Energy
- Power Generation and Distribution
- Turbine Control

#### Industry
- Industry automation
- CNC milling control
- Industrial communication

#### Others
- Building automation
- Broadcasting
- Healthcare
Consumer IoT vs. Industrial IoT

**Consumer IoT**

End user interfaces and comfort features

- e.g. car

Single or few operator companies

End user

Permanent cloud connection required.
Quality and availability: Best effort
Low-cost / high volume

**Industrial (grade) IoT**

Digital backbone of connected systems

- e.g. traffic control

Backend eco-systems

Controlled network zone

Multiple users with different roles at different levels

Complex systems: local intelligence + centralized intelligence
24/7 operation even with no connection to backend.
Guaranteed latency, throughput, and responsiveness.
Smart Cities need a smart infrastructure
IoT technology to be applied to industrial systems
A Power Plant System:

25-60 years products life-cycle

Very reluctant to perform product updates and upgrades of hardware and base software platform.
Security

...for millions of devices
Leveraging IoT for industry – being aware of the whole products life cycle

Apply IoT concepts to industrial systems.

Ensure quality and longevity of products.

Keep millions of connected systems secure.

**Industrial gradeness**
- Reliability
- Functional Safety
- Real-time capabilities

**Sustainability**
- Product life-cycles of decades
- Backwards compatibility
- Standards

**Security**
- Security & vulnerability management
- Firmware updates
- Minimize risk of regressions
Strategic Partnerships –
Motivation & Context

We maintain different industrial flavors and versions of Linux

...in each division...

...for several products...

...for many years.

...without having business advantages from doing this.

And other companies do the same.

picture taken from Pinterest: https://www.pinterest.de/pin/554646510344033382/
Civil Infrastructure Platform (CIP) – Siemens is founding member “Crowd funding” hosted by The Linux Foundation

Provide a super long-term maintained industrial-grade embedded Linux platform.

http://collabprojects.linuxfoundation.org/  http://cip-project.org
Creating an “Open Source Base Layer”

Layered Linux distribution for industrial products, utilizing and influencing the relevant Open Source projects:

- **CIP Core packages** *(tens)*
- **CIP kernel** *(10+ years maintenance, based on LTS kernels)*
- **additional packages** *(hundreds)*
- company-specific middleware and applications

**Scope of a typical Linux distribution**

**CIP Civil Infrastructure Platform Project** ([https://www.cip-project.org/](https://www.cip-project.org/))  
**LTS Long Term Support**
CIP governance structure and projects

Governing Board (GB)

Technical Steering Committee (TSC)

1. SLTS kernel
2. Real-time
3. Testing
4. CIP Core
5. Security WG
6. Software update WG

- ✔ Industrial grade
- ✔ Sustainability
- ✔ Security

CIP projects and its scopes
The backbone of CIP are the member companies

Budget → Developers, maintainers

Optional: funding of selected projects

Open Source Projects (upstream work)

Contribution & usage / integration
Mapping CIP into the company

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- **CIP Core Packages (tens)**
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- **additional packages (hundreds)**

**BUs / Products**

- Siemens Divisions
- MO extensions
- EM extensions
- ...

**Siemens Corporate, Mentor**

- Firmware Update
- Security Hardening
- Container Runtime
- ...

- Kernel and Base Packages, SDK, QA
- hypervisor (optionally)

Up to 70% effort reduction achievable for OSS license clearing and vulnerability monitoring, kernel and package maintenance, application adaptation and testing for an individual product.

1. https://github.com/ilbers/isar

**OSS** Open Source Software  **QA** quality assurance  **SDK** software development kit
Summary –
Strategy consists of multiple pieces

Take a conscious “make, take, buy” decisions.

Influence OSS projects by working upstream first.

Engage in and steer OSS communities by contribution and partnering.

Develop sustainable technical roadmap incorporating business units and (in-house) vendors.

Drive cross-division collaboration copying OSS best practices.

We leverage the work of a distributor reducing clearing and maintenance efforts at better quality.

SWUpdate evolved to de-facto standard – with the help of Eclipse IoT.

International partnership established with big industry players to share efforts.

Shaping a harmonized Linux stack w/ business units and professional services and maintenance.

Inner Source community started, integration contributions by above mentioned parties and BUs.
Building smart infrastructure and industry products? Join us!

Create sustainable smart products with Open Source Software!
Ideas alone have little worth. The value of an invention lies in its practical implementation.

Werner von Siemens, 1865
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Further resources

To get the latest information, please contact:

- CIP Mailing list: cip-dev@lists.cip-project.org

Other resources

- Twitter: @cip_project
- CIP Web site: https://www.cip-project.org
- CIP news: https://www.cip-project.org/news/in-the-news
- CIP Wiki: https://wiki.linuxfoundation.org/civilinfrastructureplatform/
- CIP source code
  - CIP GitLab: https://gitlab.com/cip-project
  - CIP kernel: git://git.kernel.org/pub/scm/linux/kernel/git/cip/linux-cip.git