Open Source Leadership Summit 2019 – March 14, 2019 – Half Moon Bay, CA

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

Urs Gleim, Siemens AG, Corporate Technology

Siemens Corporate Technology

About Siemens

SIEMENS
Ingenuity for life

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
- ...

Gas and Power

Smart Infrastructure

Digital Industries

Mobility

SIEMENS Gamesa
RENEWABLE ENERGY

SIEMENS Healthineers

Linux is widely used in our products

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Power Generation

PREEMPT-RT

Rail Automation

Debian Linux

Vehicle Control Systems

Safety-certified Linux

Building Automation

Yocto Linux

Industrial Automation

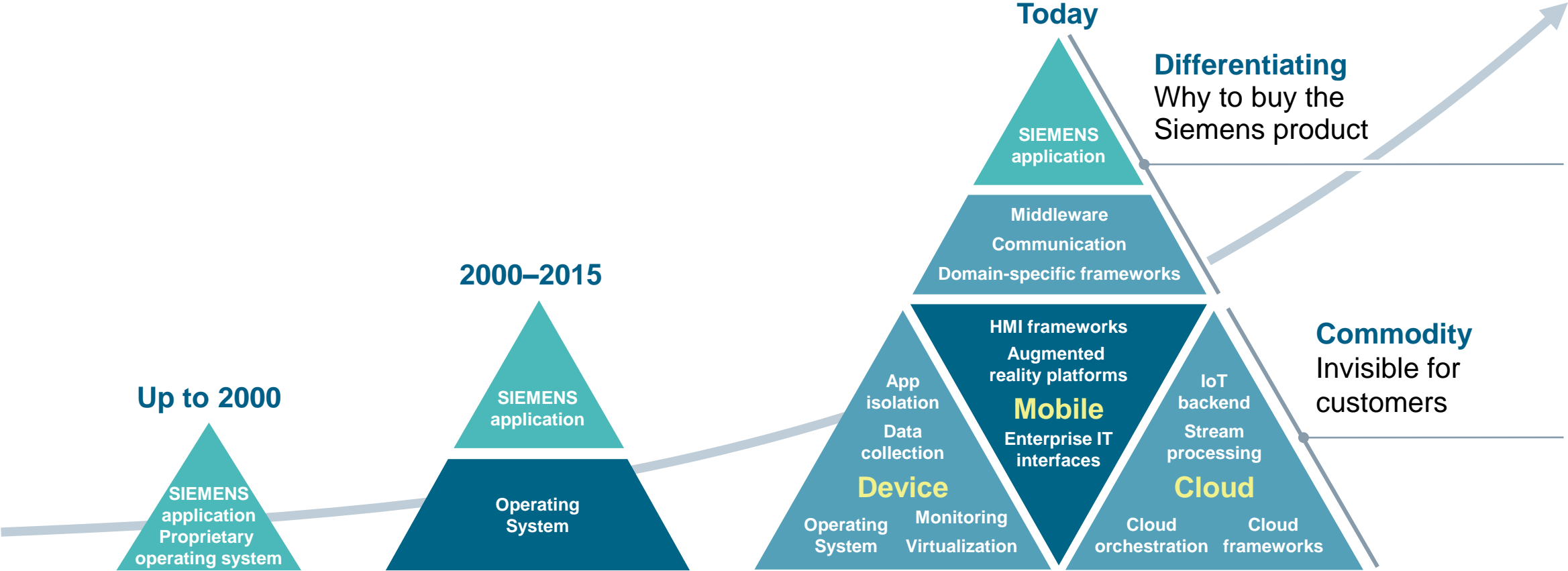Public Yocto Layer

CNC Controls

XENOMAI

Industrial communication

KVM on ARM

Medical Imaging

XENOMAI on "big iron"

PREEMPT-RT / XENOMAI Real-time Linux flavors   **Debian** Linux Distribution   **KVM** Hypervisor based on Linux   **Yocto** Build system for embedded Linux distributions

More Software in Siemens Products – Focus on Differentiation

Today

Differentiating
Why to buy the Siemens product

SIEMENS application

Middleware
Communication
Domain-specific frameworks

Commodity
Invisible for customers

HMI frameworks
Augmented reality platforms

App isolation
Data collection

IoT backend
Stream processing

Mobile

Enterprise IT interfaces

Device

Operating System   **Monitoring**
Virtualization

Cloud

Cloud orchestration   **Cloud frameworks**

2000–2015

SIEMENS application

Operating System

Up to 2000

SIEMENS application Proprietary operating system

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

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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

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**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
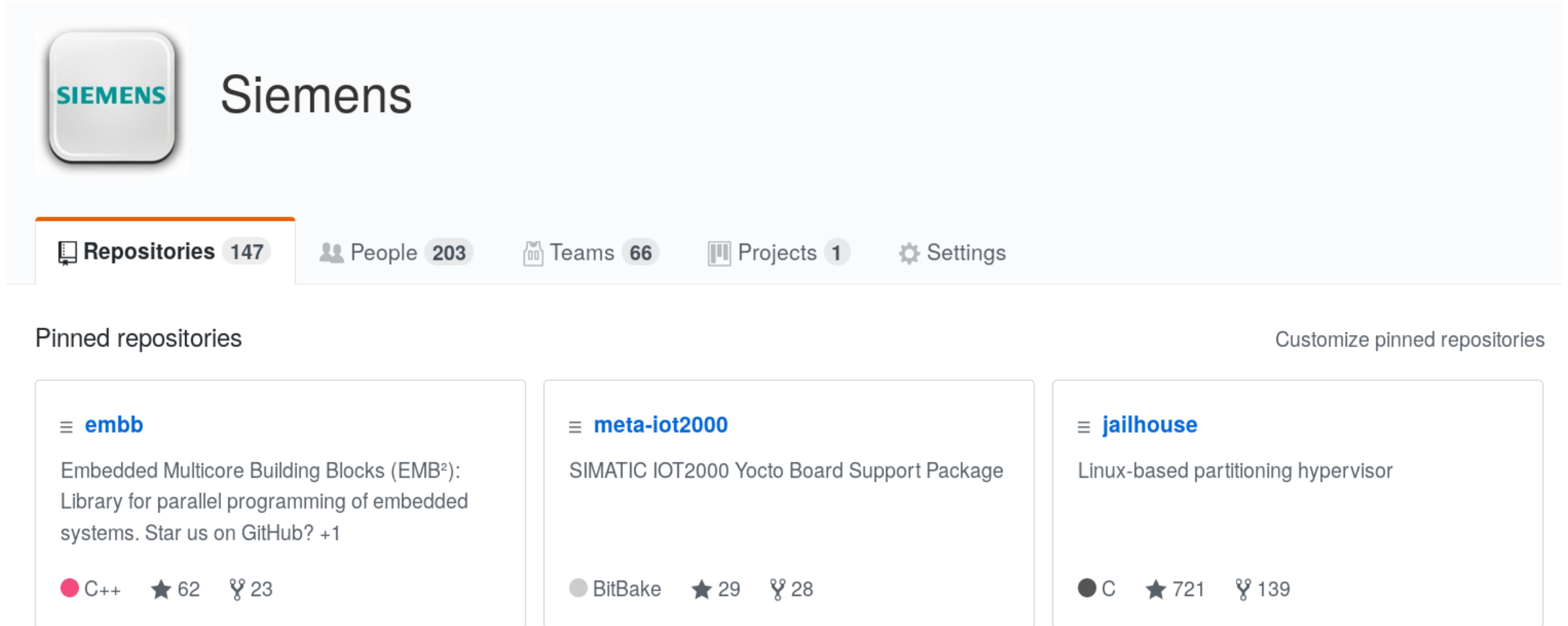
Community mainline

Siemens R&D

bring changes up-stream

adapt

patch

Products
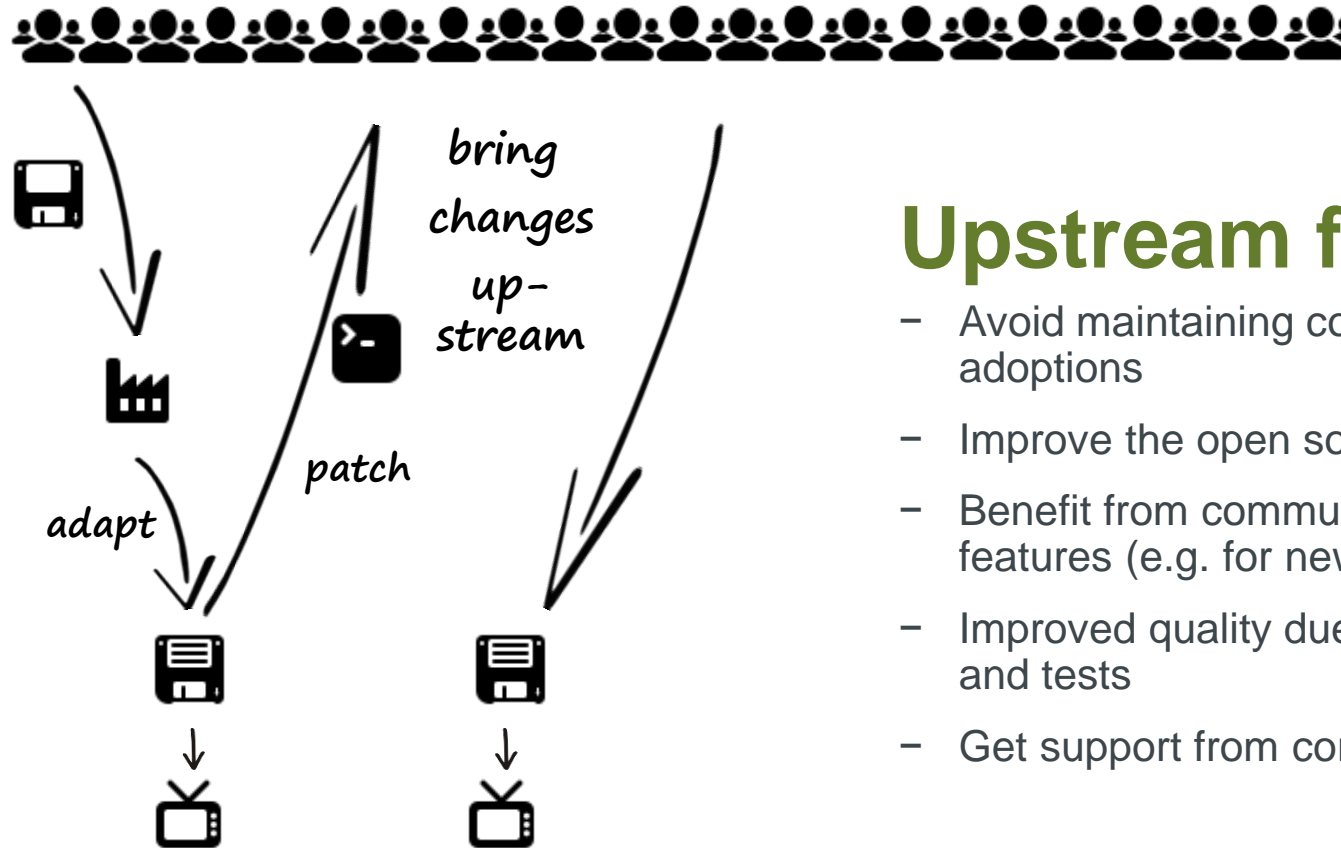
Upstream first

- 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, …

Siemens

Repositories 147   **People** 203   **Teams** 66   **Projects** 1   **Settings**

Pinned repositories   Customize pinned repositories

≡ **embb**	≡ **meta-iot2000**	≡ **jailhouse**
Embedded Multicore Building Blocks (EMB²): Library for parallel programming of embedded systems. Star us on GitHub? +1	SIMATIC IOT2000 Yocto Board Support Package	Linux-based partitioning hypervisor
● C++ ★ 62 ⑂ 23	● BitBake ★ 29 ⑂ 28	● C ★ 721 ⑂ 139

Examples: github.com/siemens (> 80 projects: Jailhouse, ROS#, kas, FOSSology, drace…), coaty.io

Increase relevant communities by engagement – Software Update example
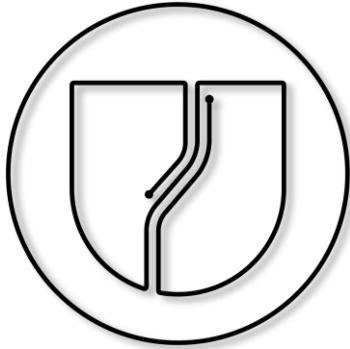
SWUpdate
https://github.com/sbabic/swupdate

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

SWUpdate / Suricatta
https://sbabic.github.io/swupdate/suricatta.html
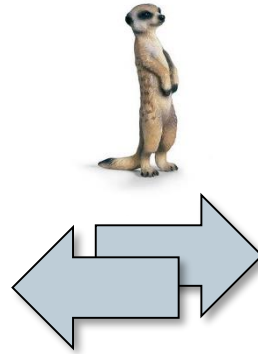
Extensible Framework within SWUpdate to connect it to remote (cloud) services orchestrating the updates

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

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, …

**CIVIL
INFRASTRUCTURE
PLATFORM**

https://cip-project.org

"Hidden" Industrial IoT Systems

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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

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Consumer IoT

End user interfaces and comfort features

e.g. car

Single or few operator companies

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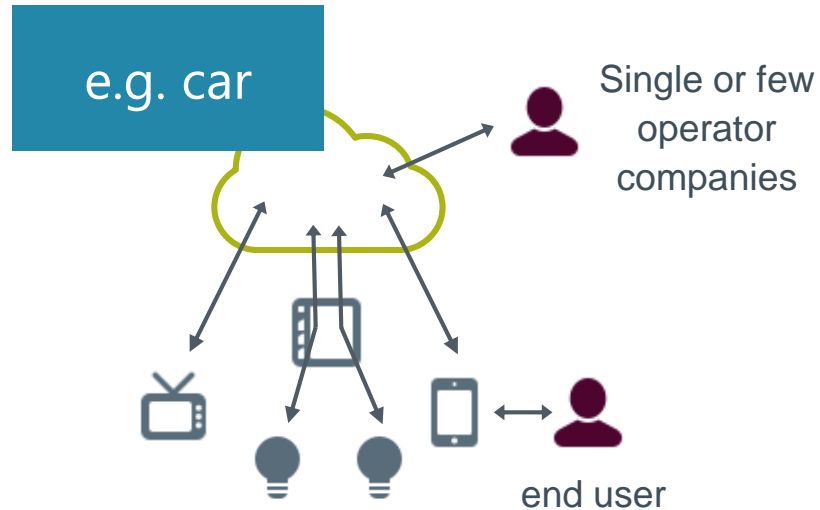
Permanent cloud connection required.
Quality and availability: Best effort
Low-cost / high volume

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
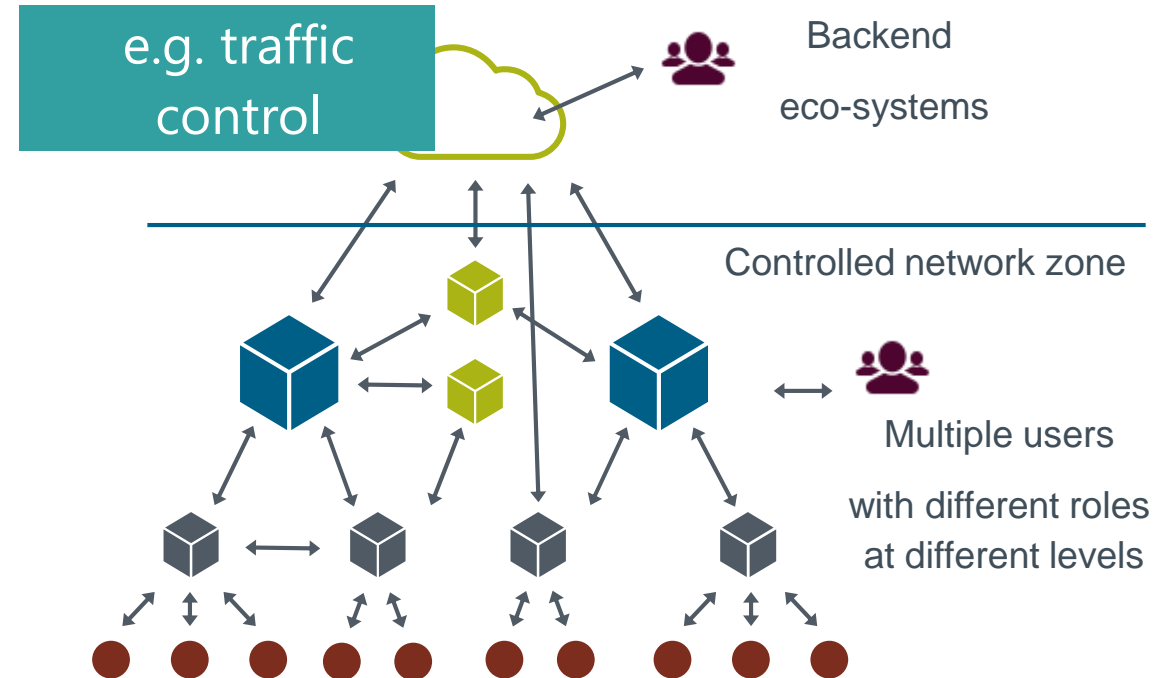
Complex systems: local intelligence + centralized intelligence
24/7 operation even with no connection to backend.
Guaranteed latency, throughput, and responsiveness.

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
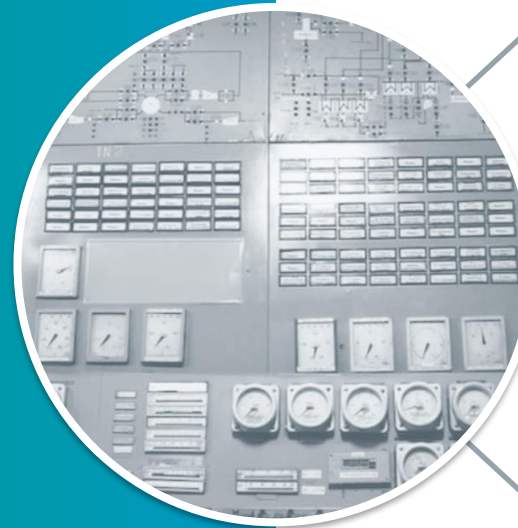
Security

...for millions of devices

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

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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

Sustain-ability
- Product life-cycles of decades
- Backwards compatibility
- Standards

Security
- Security & vunerability managment
- Firmware updates
- Minimize risk of regressions

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**We maintain different
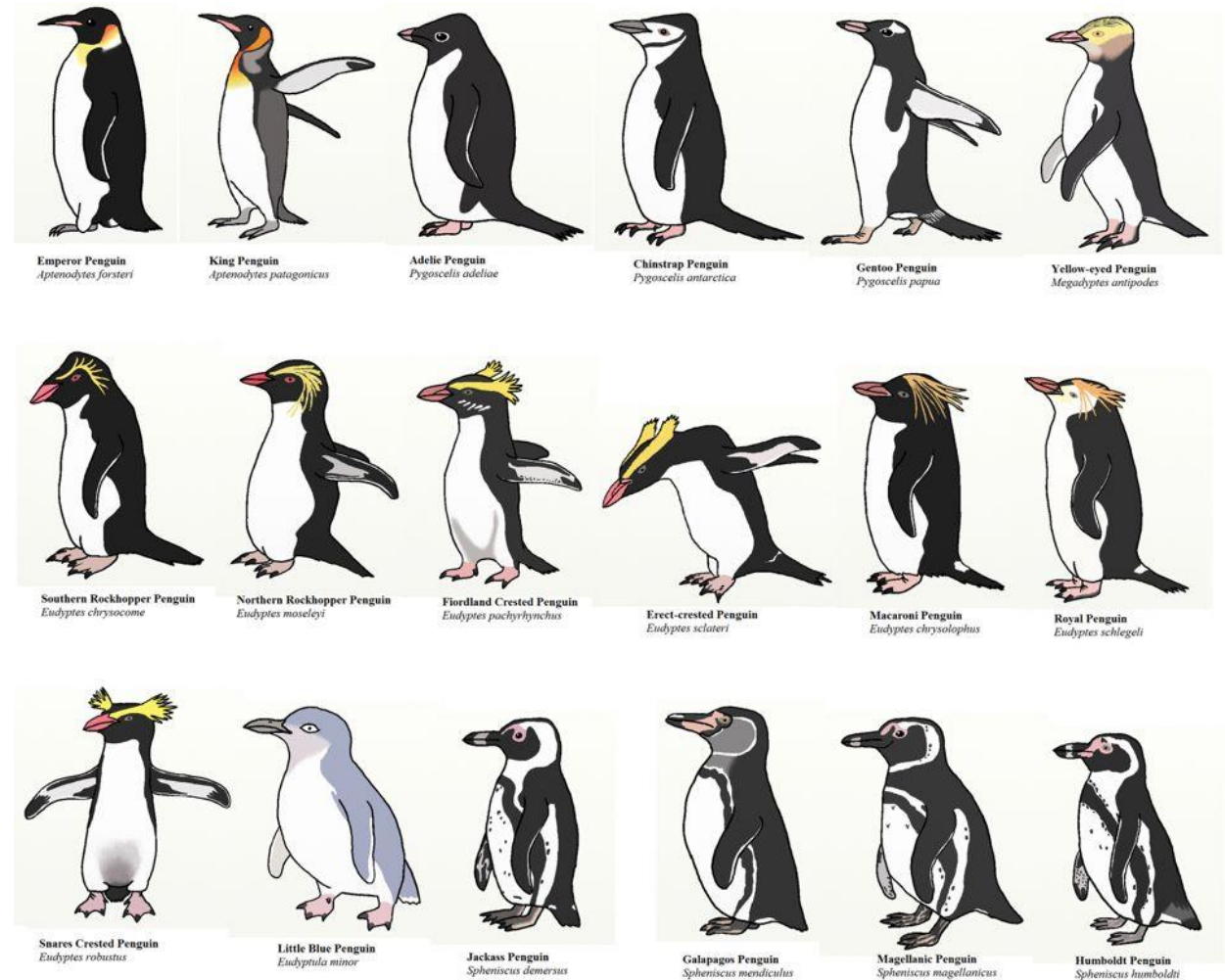industrial flavors and
versions of Linux**

…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

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

Established April 2016

THE LINUX FOUNDATION

CIVIL INFRASTRUCTURE PLATFORM

SIEMENS

TOSHIBA
Leading Innovation »»

HITACHI
Inspire the Next

RENESAS

MOXA®

Codethink
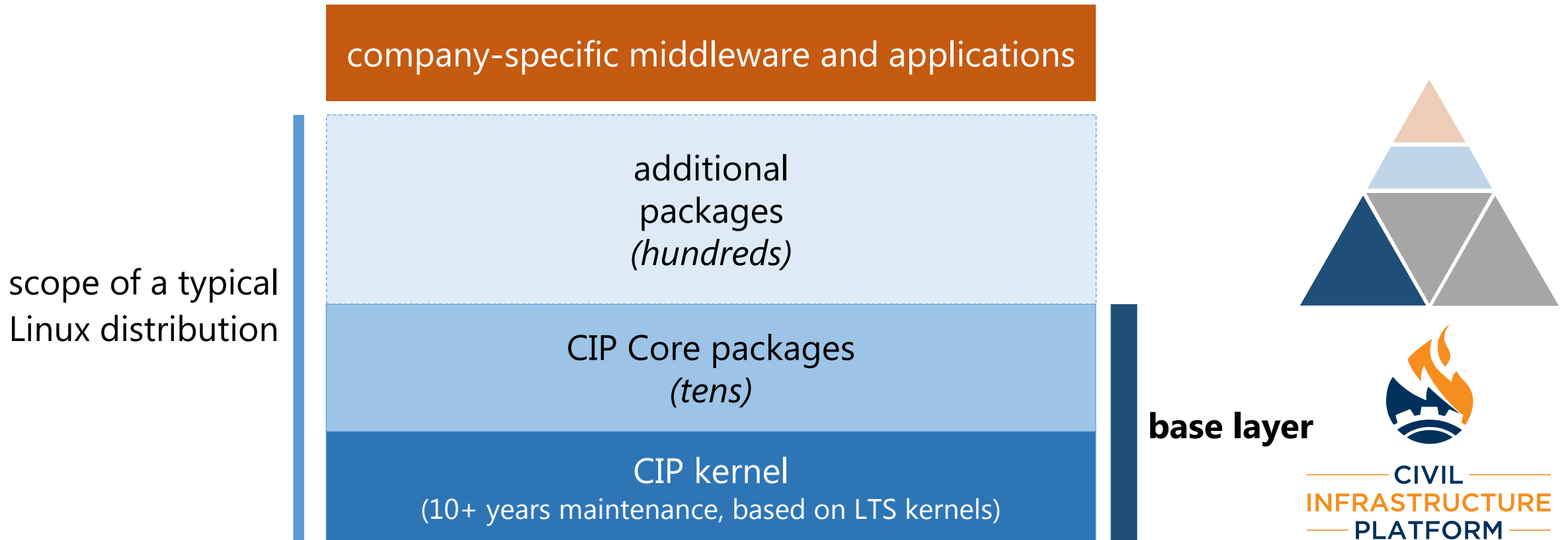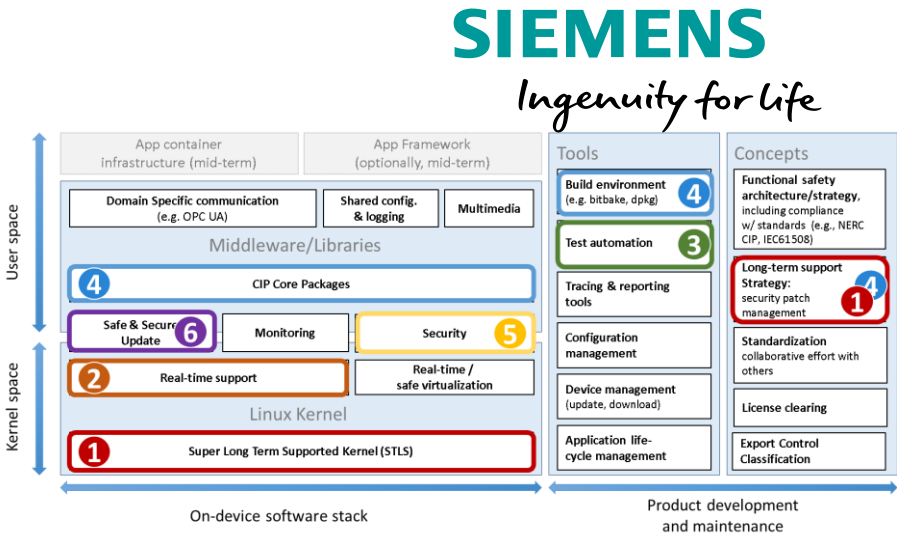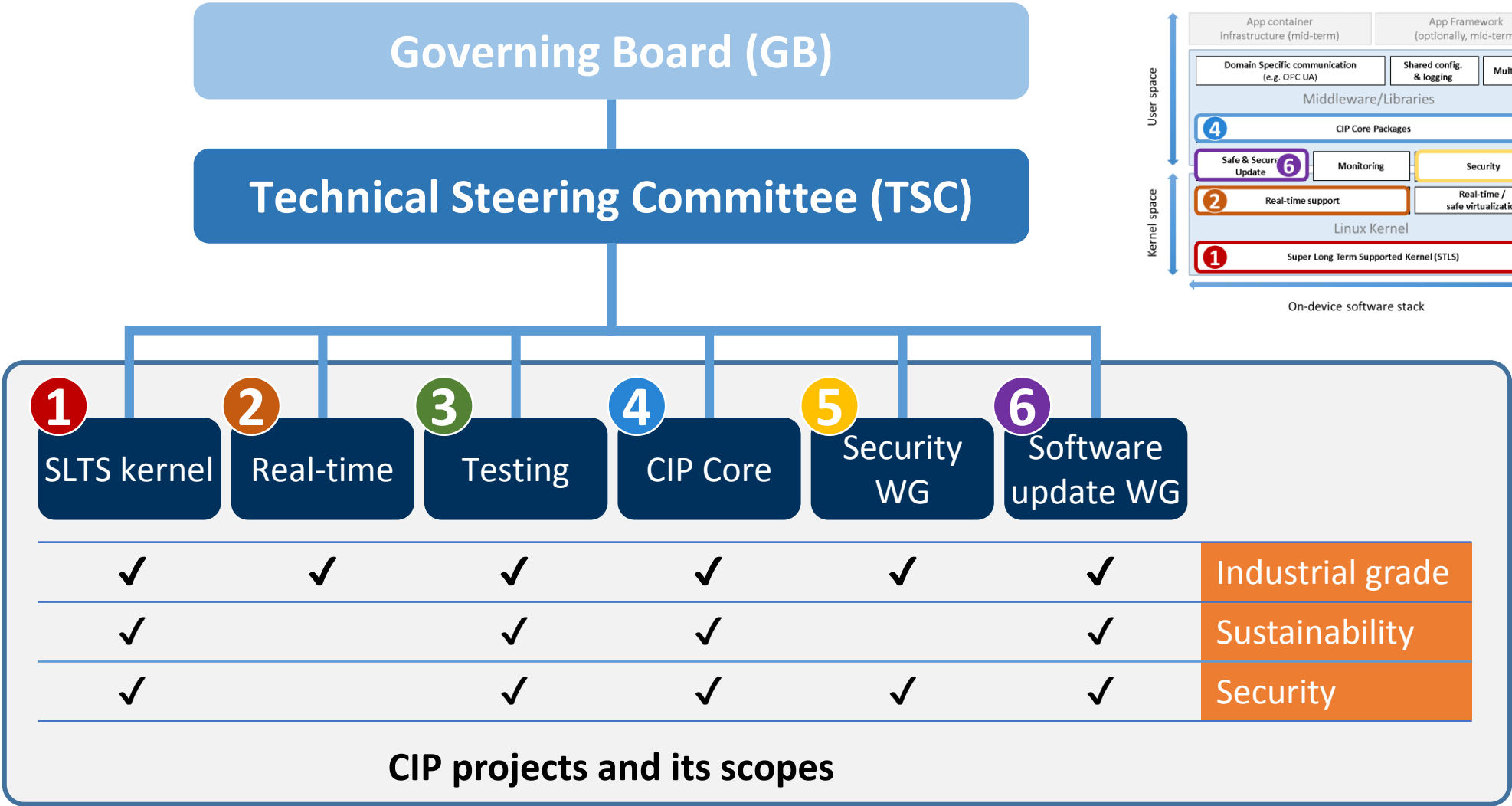
cybertrust

Plat'Home
There, we are. Internet of Things

http://collabprojects.linuxfoundation.org/   http://cip-project.org

Creating an "Open Source Base Layer"

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

company-specific middleware and applications

scope of a typical Linux distribution

additional packages
(hundreds)

CIP Core packages
(tens)

base layer

CIP kernel
(10+ years maintenance, based on LTS kernels)

CIVIL INFRASTRUCTURE PLATFORM

CIP Civil Infrastructue Platform Project (https://www.cip-project.org/)   **LTS** Long Term Support

CIP governance structure and projects

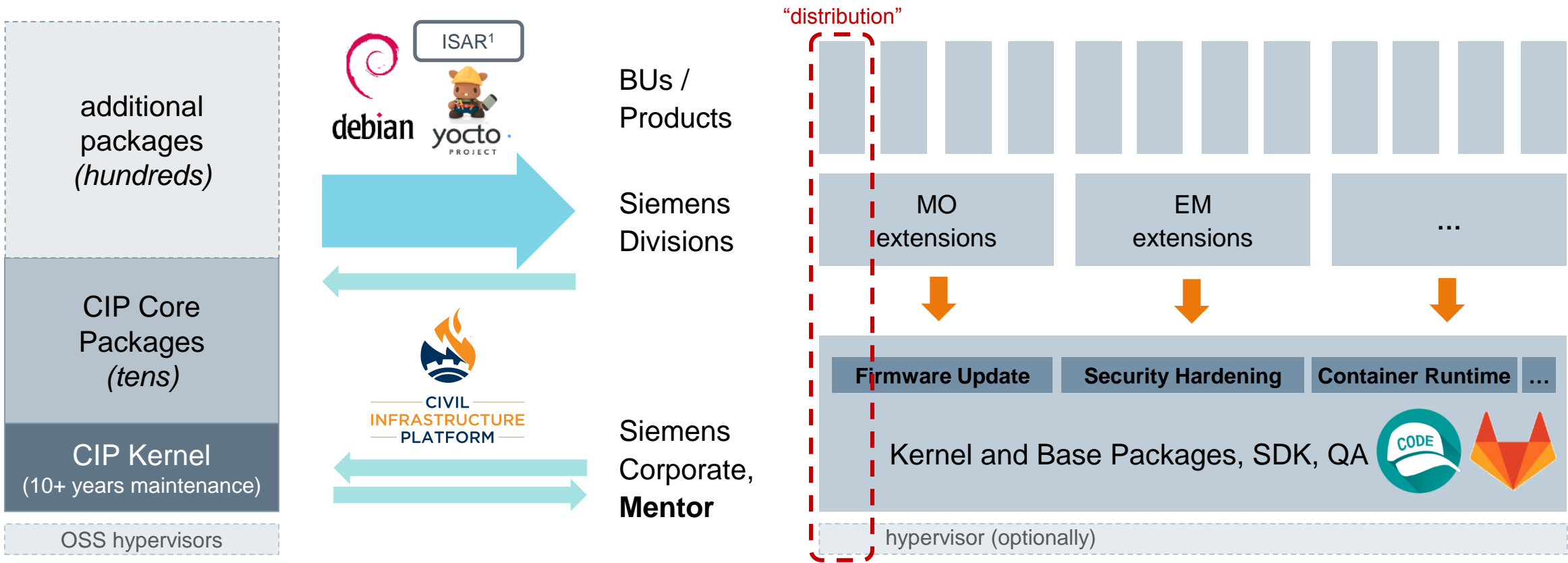**SIEMENS**
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WG work group

The backbone of CIP are the member companies
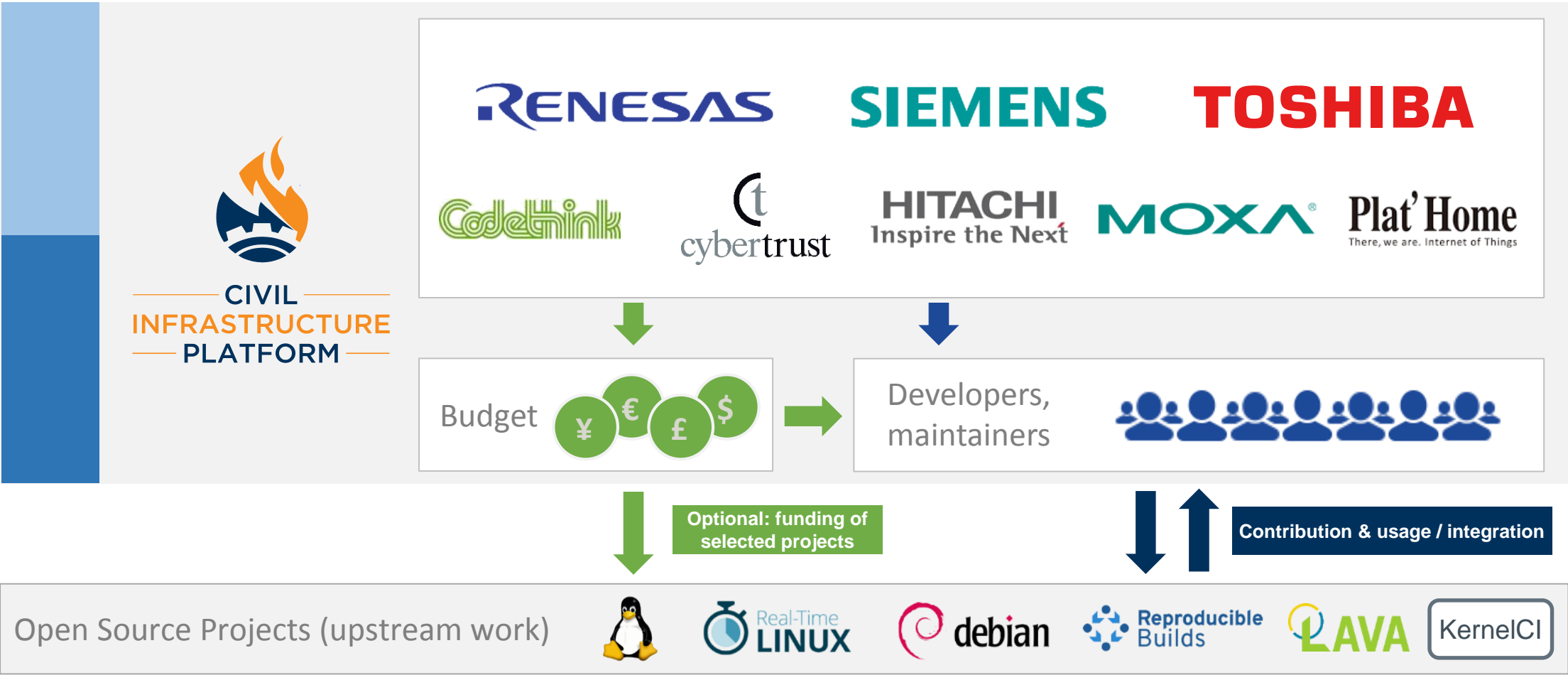
Mapping CIP into the company

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

"distribution"

additional packages *(hundreds)*

CIP Core Packages *(tens)*

CIP Kernel (10+ years maintenance)

OSS hypervisors

ISAR[1]

debian   yocto PROJECT

CIVIL INFRASTRUCTURE PLATFORM

BUs / Products

Siemens Divisions

Siemens Corporate, **Mentor**

MO extensions   EM extensions   ...

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.

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

Influence OSS projects by working upstream first.

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

Engage in and steer OSS communities by contribution and partnering.

International partnership established with big industry players to share efforts.

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

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

Drive **cross-division collaboration** copying OSS best practices.

Inner Source community started, integration contributions by above mentioned parties and BUs.

OSS Open Source Software

**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

Thank you!

Contact

SIEMENS
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Urs Gleim
Corporate Technology
Smart Embedded Systems

Munich & Erlangen, Germany

Mobile: +49 173 70 68 922

E-mail
urs.gleim@siemens.com

Intranet
linux.siemens.com, multicore.siemens.com, iot.siemens.com

Internet
cip-project.org, siemens.com/corporate-technology

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