

# 工业开源

# Industrial Open Source

by Daniel Bovensiepen

## 目录 Table of Content

1. 介绍 Introduction
2. 许可证 Licenses
3. 协作与社区 Collaboration and Community
4. 商业模式 Business Models
5. 收益与挑战 Benefits and Challenges
6. 案例研究 Case Studies (SW, HW, Semi, Infra, AI)
7. 总结与结论 Summary and Conclusion

你知道什么是开源吗？

Do you know  
what Open Source is?

你使用开源软件吗？  
Do you use  
Open Source?

在座的每一个人  
都在使用开源软件！  
Everyone in this room  
is using Open Source!

# 1. 介绍 Introduction

## 1. 介绍 Introduction – Daniel Bovensiepen

### **Name**

Daniel Bovensiepen

### **Affiliation**

西门子 Siemens

### **Activity**

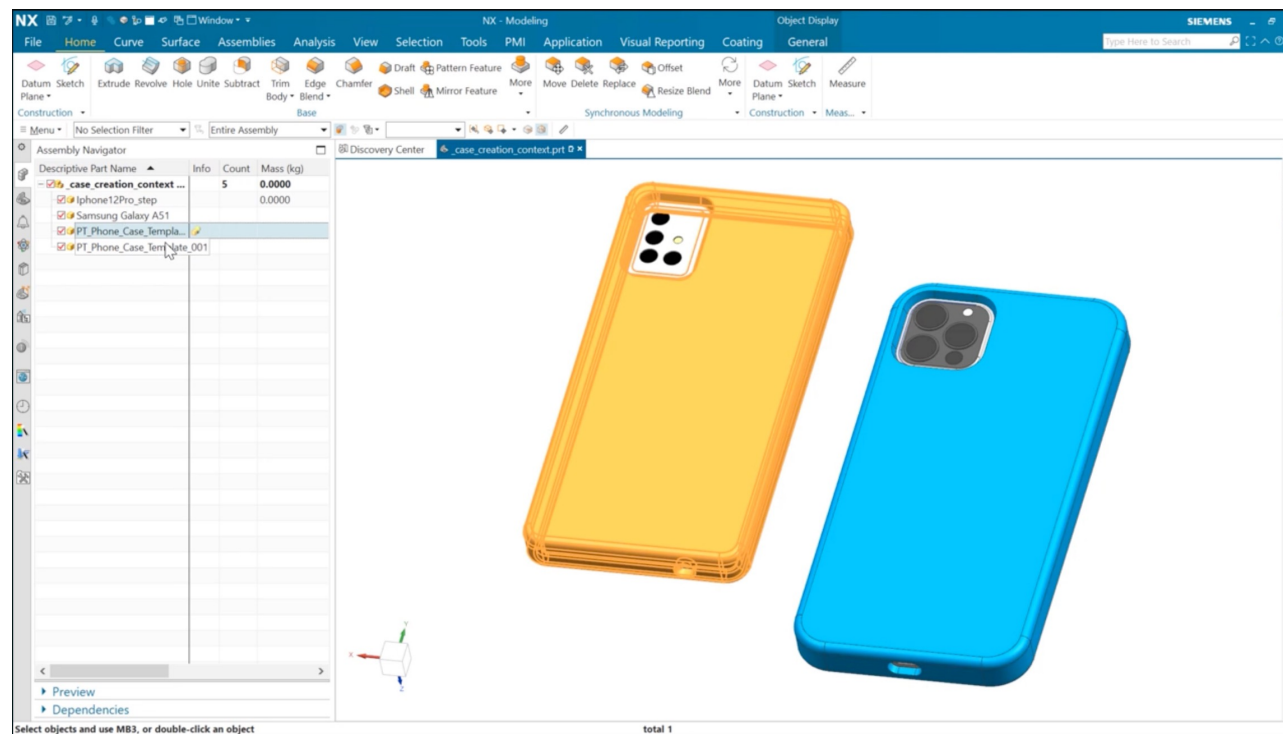
Research on Industrial Software-defined Connectivity.  
I make industrial systems “talk” to each other in a  
deterministic, cost-effective and reliable manner.

# 西门子做什么？ What does Siemens do?

## 1. 介绍 Introduction – Siemens

你的手机设计者是...

Your phone was designed by...

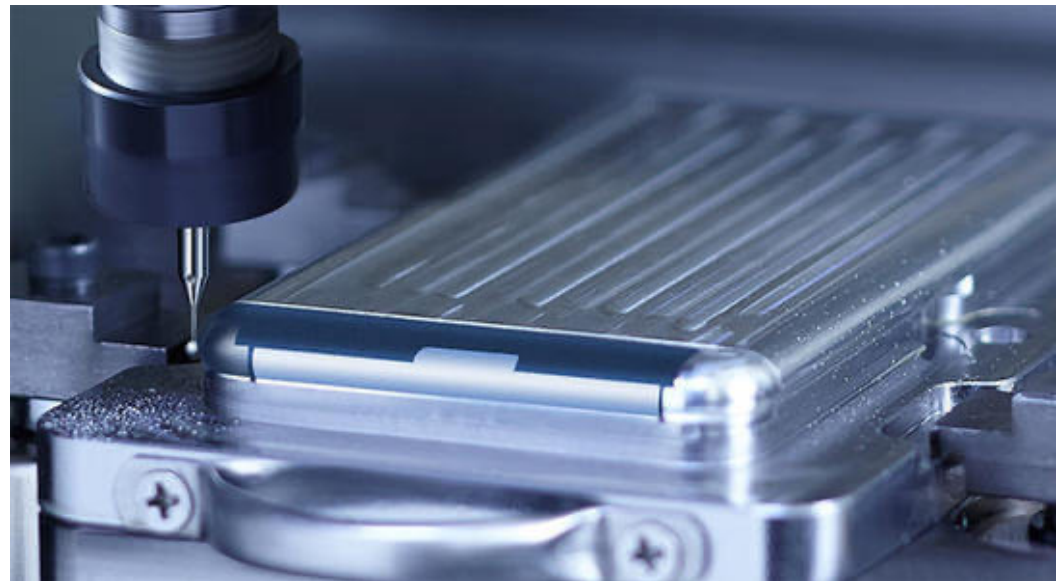


Siemens NX

## 1. 介绍 Introduction – Siemens

你的手机制造者是...

Your phone was manufactured by...



Siemens SINUMERIK

## 1. 介绍 Introduction – Siemens

我们为您的手机提供能源...  
Your phone was charged by...



西门子电源插座  
Siemens Power Outlet



西门子断路器  
Siemens Circuit Breaker



西门子中压开关变电站  
Siemens Medium Voltage Switching Sub-Station

## 1. 介绍 Introduction – Siemens

我们为您的出行提供便捷...  
Your transportation was build by...



西门子列车控制  
Siemens Train Control

## 1. 介绍 Introduction – Siemens

我们为您的健康提供保障...  
Your health check was enabled by...



西门子磁共振断层扫描  
Siemens MRI



西门子超声波  
Siemens Ultrasound



西门子血管造影  
Siemens Angiographie

## 1. 介绍 Introduction – Siemens

我们为您的供暖防火提供安全保障...

Your heating, lightning and safety is established by...



西门子火灾探测  
Siemens Fire Detection



西门子暖通空调阀门  
Siemens HVAC Valves

# 与开源有什么联系？

## What is the connection to Open Source?

## 1. 介绍 Introduction – Industrial Open Source

所有这些都基于开源！  
All of that is based on Open Source!



## 1. 介绍 Introduction – Open Source

传统上，软件不被认为有价值。

Traditionally software was not considered valuable.

- 公司希望销售硬件而不是软件  
companies wanted to sell hardware not software

在90年代，软件公司成为了世界上最有价值的公司。

In the '90s software companies became the most valuable companies in the world

- 由于复制生产带来的边际成本递减。  
due to the reduced marginal cost of replication

今天，软件太重要且太复杂，无法将其封闭起来。

Today software is too important and complex to keep it closed

- 因此，所有公司至少部分地使用开源软件。  
hence all companies are using at least partially Open Source

**开源让创意人人可及。**

**Open Source is a concept to keep ideas freely available for everyone**

## 1. 介绍 Introduction – Free Software / Open Source

什么是自由？ What means free？

1. 自由使用和研究 Free to use and study
2. 自由修改 Free to modify
3. 自由传播 Free to distribute
4. [有争议的 debatable] 继承自由 inherit freedom
5. [有争议的 debatable] 使用OSI批准的许可证 usage of OSI approved license

自由是指自由权，而不是免费啤酒的“免费”！  
Free like in freedom, not like in free beer!

**因此，我们称之为开源软件而不是自由软件。**  
**Hence we call it Open Source not Free Software.**

你知道什么是开源吗？

Do you know  
what Open Source is?

你使用开源软件吗？  
Do you use  
Open Source?

## 2. 许可证 Licenses

## 2. 许可证 Licenses - Proprietary

通过限制使用、修改和传播软件的权利来确保公司的独特卖点。  
Ensure unique selling point for a company by restricting the right to use, modify and distribute software.

### 产品示例 Product examples

- Microsoft Windows and Office
- Adobe Photoshop
- OpenAI ChatGPT

## 2. 许可证 Licenses – Inner Source

确保公司内部的软件重复使用。

Ensure the re-use of software inside of a company.

### 公司示例 Company Examples

- Microsoft<sup>1</sup>
- Paypal<sup>2</sup>
- Mercedes<sup>3</sup>
- IBM<sup>4</sup>
- 西门子 Siemens: code.siemens.com (~75k developers, ~238k projects)

<sup>1</sup> <https://www.youtube.com/watch?v=eZdx5MQCLA4>

<sup>2</sup> <https://innersourcecommons.org/fr/learn/books/getting-started-with-innersource/>

<sup>3</sup> <https://www.youtube.com/watch?v=hVcGABbml4Y>

<sup>4</sup> <https://resources.github.com/software-development/innersource/>

## 2. 许可证 Licenses – Open Source

确保每个人都有“自由”使用、修改和传播软件的权利。  
Ensure "freedom" for everyone to use, modify and distribute.

### 许可证示例 License Examples

- MIT<sup>1</sup> (permissive)
- BSD<sup>2</sup> (permissive)
- Apache<sup>3</sup> (permissive)
- LGPL<sup>4</sup> (copyleft)
- GPL<sup>5</sup> (copyleft)
- AGPL<sup>6</sup> (copyleft)

<sup>1</sup> <https://opensource.org/license/mit>

<sup>2</sup> <https://opensource.org/license/bsd-3-clause>

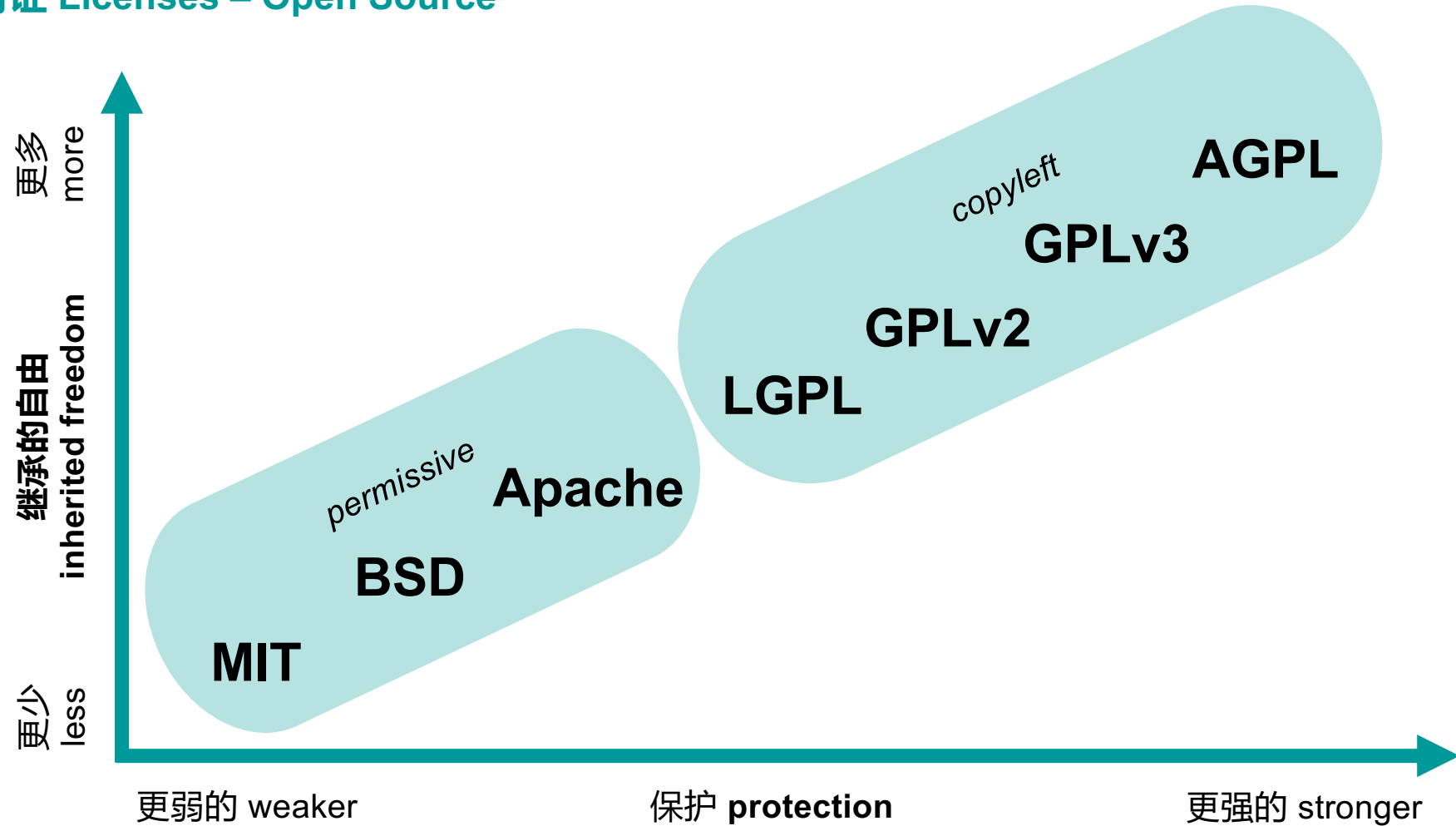
<sup>3</sup> <https://www.apache.org/licenses/LICENSE-2.0>

<sup>4</sup> <https://www.gnu.org/licenses/lgpl-3.0.en.html>

<sup>5</sup> <https://www.gnu.org/licenses/gpl-3.0.en.html>

<sup>6</sup> <https://www.gnu.org/licenses/agpl-3.0.html>

## 2. 许可证 Licenses – Open Source



## 2. 许可证 Licenses – Summary

限制或提供使用、修改和传播软件的权利

Restrict or provide rights to use, modify and distribute software

### 专有软件 Proprietary

- 限制使用、修改和传播的权利  
restrict rights to use, modify and distribute

### 内部源 Inner Source

- 提供公司内部使用、修改和传播的权利  
provide rights to use, modify and distribute inside a company

### 开源 Open Source

- 提供所有人使用、修改和传播的权利  
provide rights to use, modify and distribute to everyone

你知道是谁在创造开源吗?  
Do you know  
who is creating Open Source?

### 3. 协作与社区 Collaboration and Community

### 3. 协作与社区 Collaboration and Community

谁在创建和维护开源软件

Who is creating and maintaining open source

传统上 **Traditionally**

- 私人个人（例如作为业余爱好）  
private individuals (e.g. as a hobby)
- 学生（例如作为研究项目的成果）  
students (e.g. as an output of a research project)

如今 **Nowadays**

- 专业软件开发人员（例如通过公司）  
professional software developers (e.g. via company)
- 基金会（例如通过赞助）  
foundations (e.g. via sponsoring)

### 3. 协作与社区 Collaboration and Community

#### 谁在为开源做贡献以及原因 Who is contributing to open source and why

- 想要修复错误的个人  
private individuals who want to fix bugs
- 希望他们的研究有实际应用的学生（例如：LLVM）  
students who want their research to be applicable (e.g. LLVM)
- 需要向客户交付功能的公司（例如：RedHat）  
companies who need to deliver features to their customers (e.g. RedHat)

#### 什么是贡献 What is a contribution

- 软件代码 software code
- 注释 documentation
- 测试/错误报告 testing / bug reports

### 3. 协作与社区 Collaboration and Community

#### 如何贡献 **How to contribute**

1. 在GitHub<sup>1</sup>、Gitlab<sup>2</sup>、Gitee<sup>3</sup>等平台上找到上游项目（不要分叉）  
identify the upstream project on GitHub<sup>1</sup>, Gitlab<sup>2</sup>, Gitee<sup>3</sup>, etc. (**DO NOT FORK**)
2. 根据你的更改创建一个补丁（在进行大规模更改之前进行沟通）  
create a patch based on your change (**communicate before performing large changes**)
3. 提交到上游项目（例如：通过合并/拉取请求或电子邮件）  
submit to the upstream project (e.g. via merge/pull request or e-mail)

<sup>1</sup> <https://github.com/>

<sup>2</sup> <https://gitlab.com/explore>

<sup>3</sup> <https://gitee.com/explore>

# 如何通过开源赚钱？

## How to make money with Open Source?

# 4. 商业模式 Business Models

## 4. 商业模式 Business Models – Charity

出于意识形态或哲学原因，人们提供免费劳动力来创建开源软件。

For ideological or philosophical reasons people provide free labour to create Open Source.

### 动机 Motivation

- 解决自己的问题 solving own problems
- 展示技能和想法 showing-off skills and ideas
- 推广理念 promote ideology

### 备注 Remarks

- 大多数开源项目 majority of open source projects
- 可能无法扩展 might not scale
- 可持续性存疑 sustainability is questionable

## 4. 商业模式 Business Models – Sponsoring

专业软件开发人员要求/推荐用户提供资金支持（例如，通过Github赞助，Patreon<sup>1</sup>）  
Professional software developer requires/recommends users to provide funding  
(e.g. via Github Sponsoring, Patreon<sup>1</sup>)

### 动机 Motivation

- 将慈善项目专业化 professionalize charity project
- 全职开源开发 full-time open source development

### 备注 Remarks

- 赞助的受欢迎程度在提高（例如，西门子赞助项目）  
sponsorship is increasing in popularity (e.g. Siemens sponsors projects)
- 可持续性有所改善但尚未完全解决  
sustainability improved but not completely solved

<sup>1</sup> <https://www.patreon.com/>

## 4. 商业模式 Business Models – Open Core

公司提供一个开源项目，其中某些功能仅对付费客户开放。

A company provides an Open Source project in which certain features are only available to paying customers.

### 动机 Motivation

- 围绕开源公司建立公司  
establish a company around an Open Source company
- 创建可持续的商业模式  
create a sustainable business model

### 备注 Remarks

- 有成功的案例研究（例如Gitlab<sup>1</sup>）  
successful case-studies available (e.g. Gitlab<sup>1</sup>)
- 有失败的案例研究（例如Elastic<sup>2</sup>）  
failed case-studies available (e.g. Elastic<sup>2</sup>)
- 商业模式限制了开源贡献  
business model limits Open Source contribution

<sup>1</sup> <https://about.gitlab.com/blog/2022/07/14/open-core-is-worse-than-plugins/>

<sup>2</sup> <https://www.elastic.co/pricing/faq/licensing>

## 4. 商业模式 Business Models – Product Integration

公司将开源软件集成到更大的系统中，并提供资金和/或维护。

A company integrates Open Source into a larger system and provides funding and/or maintenance.

### 动机 Motivation

- 减少重复的研发工作（专注于增值）  
reduce redundant R&D work (focus on value-add)
- 消除竞争对手的独特卖点（例如，Meta LLM<sup>1</sup>对比OpenAI LLM）  
kill unique selling points of competitors (e.g. Meta LLM<sup>1</sup> vs. OpenAI LLM)

### 备注 Remarks

- 常见的商业模式  
common business model
- 大多数公司不回馈贡献  
most companies do not contribute back
- 依赖于善意和对软件开发的深刻理解  
relies on good-will and deep understanding of software development

<sup>1</sup> <https://ai.meta.com/blog/meta-llama-3/>

## 4. 商业模式 Business Models – Product Integration

专有独特卖点  
Proprietary Unique Selling Point

非差异化技术  
non-differentiating technology

e.g. MS Office -> LibreOffice

非差异化技术  
non-differentiating technology

e.g. VMWare -> QEMU

非差异化技术  
non-differentiating technology

e.g. MS Windows -> GNU Linux

Legend:

Closed Source

Open Source

**SIEMENS**

## 4. 商业模式 Business Models – Summary

工业开源需要资金支持

Industrial Open Source needs funding

慈善 **Charity**

- 大多数开源项目，但不可持续  
majority of Open Source but not sustainable

赞助 **Sponsoring**

- 个人开源维护者的流行商业模式  
popular business model for individual Open Source maintainers

开源核心 **Open Core**

- 开源公司的流行商业模式  
popular business model for Open Source companies

产品集成 **Product Integration**

- 公司常用的方法，但缺乏可持续性  
common approach by companies but lacks sustainability

# 为什么会有人使用开源?

## Why would anyone use Open Source?

## 5. 收益与挑战 Benefits and Challenges

## 5. 收益与挑战 Benefits and Challenges

### 收益 Benefits

- ❖ 加速研发（专注于增值功能）  
acceleration of R&D (focus on value-added features)
- ❖ 更高的安全性<sup>1</sup>（开源软件每行代码的漏洞更少）  
higher security<sup>1</sup> (open source has less vulnerabilities per LOC)
- ❖ 无供应商锁定  
no vendor lock-in

<sup>1</sup> <https://www.wired.com/2004/12/linux-fewer-bugs-than-rivals/>

## 5. 收益与挑战 Benefits and Challenges

### 挑战 Challenges

- ❖ 垄断更能有效地最大化利润  
monopolies are more effective to maximize profits
- ❖ 独特卖点可能会丧失  
unique selling points might get lost
- ❖ 缺乏社区和/或协作  
there is no community and/or collaboration

# 开源的影响是什么？ What's the impact of Open Source?

# 6. 案例研究 Case Studies

## 6. 案例研究 Case Studies – Open Source Software

**Linux<sup>1</sup>**是一个**GPLv2**许可的**操作系统**，广泛用于世界上大多数的服务器、智能手机、网络设备和物联网设备中。  
**Linux<sup>1</sup>** is a **GPLv2** licensed **operating system** used in the majority of all servers, smartphones, network devices and IoT devices in the world.

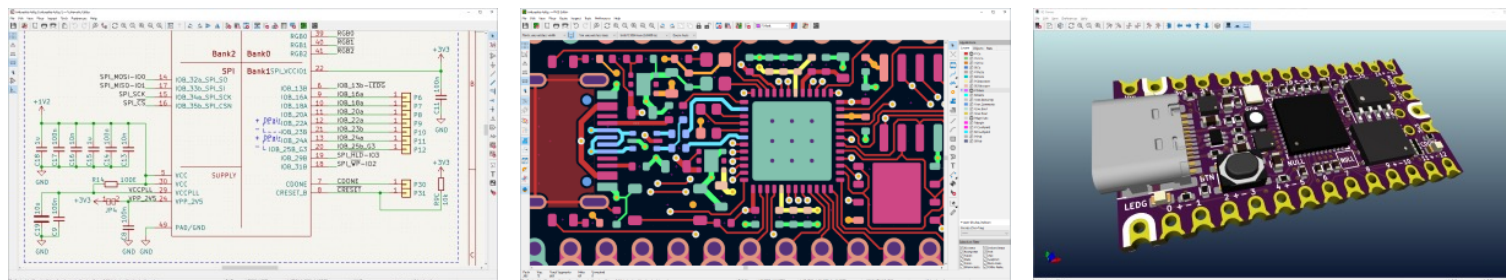
它最初由**一名学生**开发，  
但如今每年有**4000多名开发人员**做出贡献。  
It was originally developed by a **single student**  
yet today **4000+ developers** contribute each year.

<sup>1</sup> <https://kernel.org/>

## 6. 案例研究 Case Studies – Open Source Hardware

**KiCAD<sup>1</sup>**是一款**GPLv3**许可的**PCB布局**和**布线**软件。它允许创建、修改和使用硬件设计而无需额外许可证，从而实现开源硬件的创建。

**KiCAD<sup>1</sup>** is a **GPLv3** licensed **PCB layout and routing** software. It enables the creation of Open Source Hardware by allowing the creation, modification and usage of hardware designs without additional licenses.



<sup>1</sup> <https://www.kicad.org/>

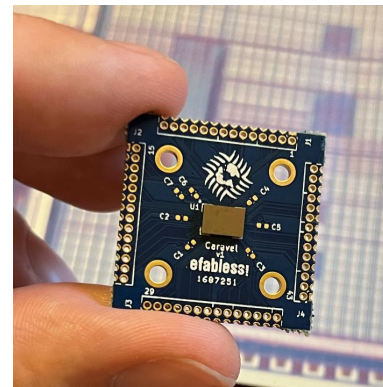
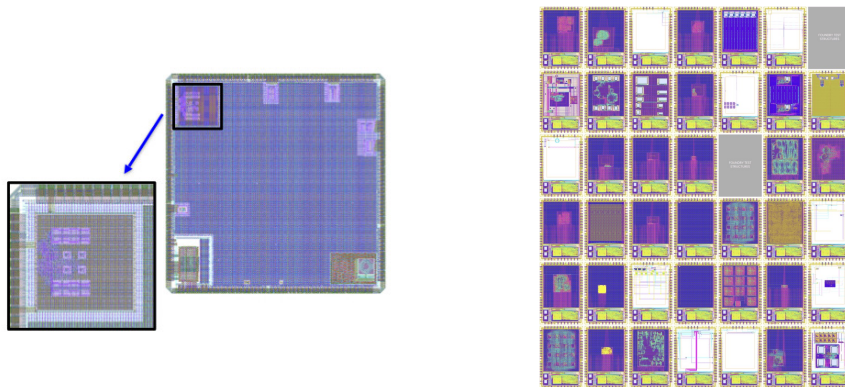
## 6. 案例研究 Case Studies – Open Source Semiconductors

**OpenROAD**是一个由DARPA资助并采用**BSD**许可证的工作流程，用于布线、检查和生成半导体设计。

**OpenROAD** is a DARPA funded and **BSD** licensed workflow to route, check and generate semiconductor designs.

结合半导体工厂的**Open PDKs**，它首次允许将半导体设计作为开源进行共享。

In combination with **Open PDKs** by semiconductor fabs it allows for the first time to share semiconductor designs as Open Source.



<sup>1</sup> <https://theopenroadproject.org/>

## 6. 案例研究 Case Studies – Open Source Infrastructure

像**清华大学**的**TUNA**这样的软件镜像是开源环境的重要组成部分。  
Software mirrors like **TUNA** by the **Tsinghua University** are an essential part of the Open Source environment.

它们通常由计算机科学专业的学生维护，并由**科技公司**赞助。  
They are often **maintained by students** from the CS majors and **sponsored by technology companies**.

**在中国尤其重要**，以维护**基于开源产品**的可靠构建环境。  
Especially **important in China** to maintain reliable build environments **for Open Source based products**.

## 6. 案例研究 Case Studies – Open Source AI

今天大多数AI环境不是开源的！

Most AI environments today are not open source!

**AI加速器**可能运行在Linux上，但**专有驱动程序**是针对**固件BLOBs**开发的。

**AI accelerators** might run on Linux but **proprietary drivers** are developed against **firmware BLOBs**.

**AI框架和训练数据**可能是开源的，但生成的**网络权重通常是封闭的**。

**AI frameworks and training data** might be open source but the resulting **network weights are usually closed**.

由在开源上训练的LLM**生成的AI代码**并不是立即开源的。

**AI generated code** by a LLM trained on Open Source is not immediately Open Source.

# 7. 总结与结论 Summary and Conclusion

## 7. 总结与结论 Summary and Conclusion

开源是 Open Source is...

- ... 无处不在 everywhere
- ... 安全的 secure
- ... 灵活的 flexible
- ... 不仅仅是软件（还有硬件、数据.....）  
... is not just software (but also hardware, data, ...)

许可证很复杂 Licenses are complicated

- 尝试了解 MIT、LGPL、GPL 和 AGPL 之间的区别  
try understand the difference between MIT, LGPL, GPL and AGPL

社区和协作是开源的核心优势！

Community and collaboration is the core advantage of Open Source!

## 7. 总结与结论 Summary and Conclusion

### 未来如何与开源互动

How you can interact in the future with Open Source

- ✓ 了解您工作领域的开源软件  
know the open source software in your field of work
- ✓ 创建开源记录  
create an open source track-record
- ✓ 以开源方式发布您的学士/硕士/博士学位论文  
publish your bachelor/master/PhD thesis as open source

## 7. 总结与结论 Summary and Conclusion

### 开源的未来趋势

#### Future Trends of Open Source

- 供应链改进（避免法律/技术中断）  
supply-chain improvement (avoid legal/technical disruption)
- 许可证清算自动化（即 SBOM、SPDX）  
automation of license clearing (i.e. SBOM, SPDX)
- 安全责任（例如 EU CRA – 网络弹性法案）  
security responsibilities (e.g. EU CRA – cyber resilience act)
- 更多采用.....  
even more adoption...

# 接触 Contact

Published by Siemens 2024

**Daniel Bovensiepen**

Senior Key Expert Research Scientist

Technology / China / T CED INW-CN

7, Wangjing Zhonghuan Nanlu

100102 Beijing

China

E-mail [daniel.bovensiepen@siemens.com](mailto:daniel.bovensiepen@siemens.com)