

An Introduction to SECS/GEM

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SECS/GEM

Why SEMI Built a Universal Tongue

Standardization needed

In the 1980s, semiconductor manufacturing faced significant challenges due to proprietary communication protocols used by different equipment manufacturers. This led to interoperability issues and complex integration processes, making it difficult to achieve seamless communication between devices and factory systems.

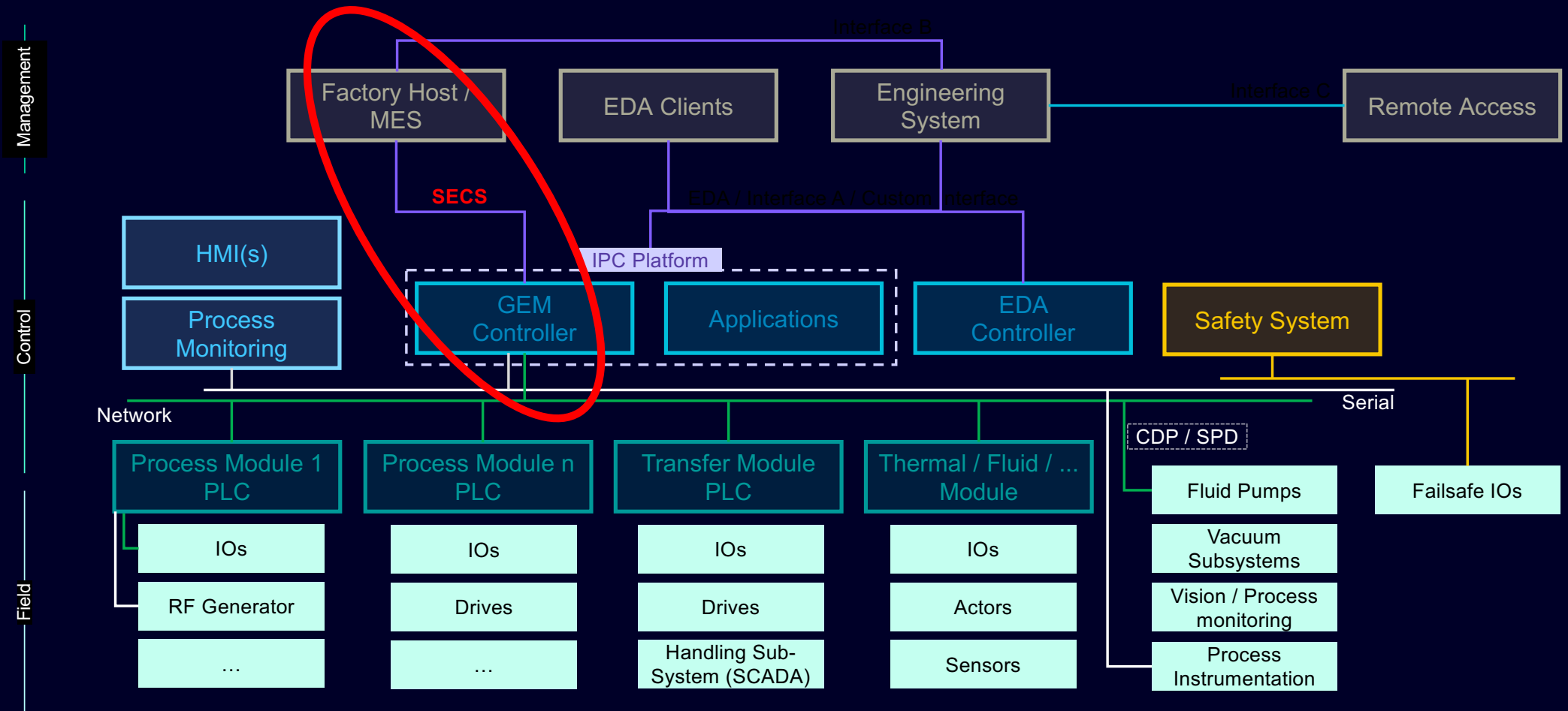
SEMI's Solution

To address these challenges, SEMI, the global semiconductor manufacturing industry association, initiated the development of a universal communication standard. This standard aimed to provide a common language for equipment and factory systems, facilitating smoother integration and automation.

Impact on Industry

The creation of SECS/GEM revolutionized the industry by enabling standardized communication between devices and factory systems. It reduced integration time, improved yield, and laid the foundation for modern automated manufacturing processes in semiconductor, SMT, PV, and other industries.

Typical FAB Communication Structure



Why SEMI Built a Universal Tongue



SMT Machine



SECS/GEM CPU Unit

PC sends command
to machine via
SECS

PC receives
data/events/alarms
from machine via
SECS



PC

SEMI Standards Overview

Relevant SEMI standards

SECS/GEM is composed of several key SEMI standards: **E37 (HSMS)** for TCP/IP transport, **E5 (SECS-II)** for message grammar, **E30 (GEM)** for behavior rules, and **E4 (SECS-I)** for legacy serial communication. Each standard plays a crucial role in defining how equipment communicates with factory systems.



SEMI Standards Overview

SEMI Standard	8 inch	12 inch	Function
E5	√	√	SECS-II
E30	√	√	GEM
E37	√	√	HSMS
E40		√	Process Job Management
E94		√	Control Job Management
E87		√	Carrier Management
E90		√	Substrate Tracking
.....		√	



HSMS(E37)

HSMS Overview

HSMS, defined by SEMI E37, is a TCP/IP-based protocol that replaced the older serial SECS-I. It provides high-speed communication between equipment and factory systems, ensuring efficient data transfer.

Key Timers

HSMS includes several key timers such as T3, T5, T6, T7, and T8. These timers manage communication delays and ensure that messages are sent and received within acceptable time frames, maintaining system responsiveness.

Connection Management

The Select.Request and Select.Response mechanism in HSMS ensures reliable connections between equipment and factory systems. This handshake process is critical for establishing and maintaining communication links.

Network Considerations

Understanding HSMS is essential for configuring firewalls, VLANs, and VPNs in manufacturing environments. Proper setup ensures that equipment can communicate seamlessly with factory systems despite network complexities.

SECS-II(E5)

Encoding

Fill in the business data into List Item according to the E5 template, and then convert it to binary

Sending

Insert the Stream/Function into the HSMS header, and the Payload will be the just-encoded Item stream

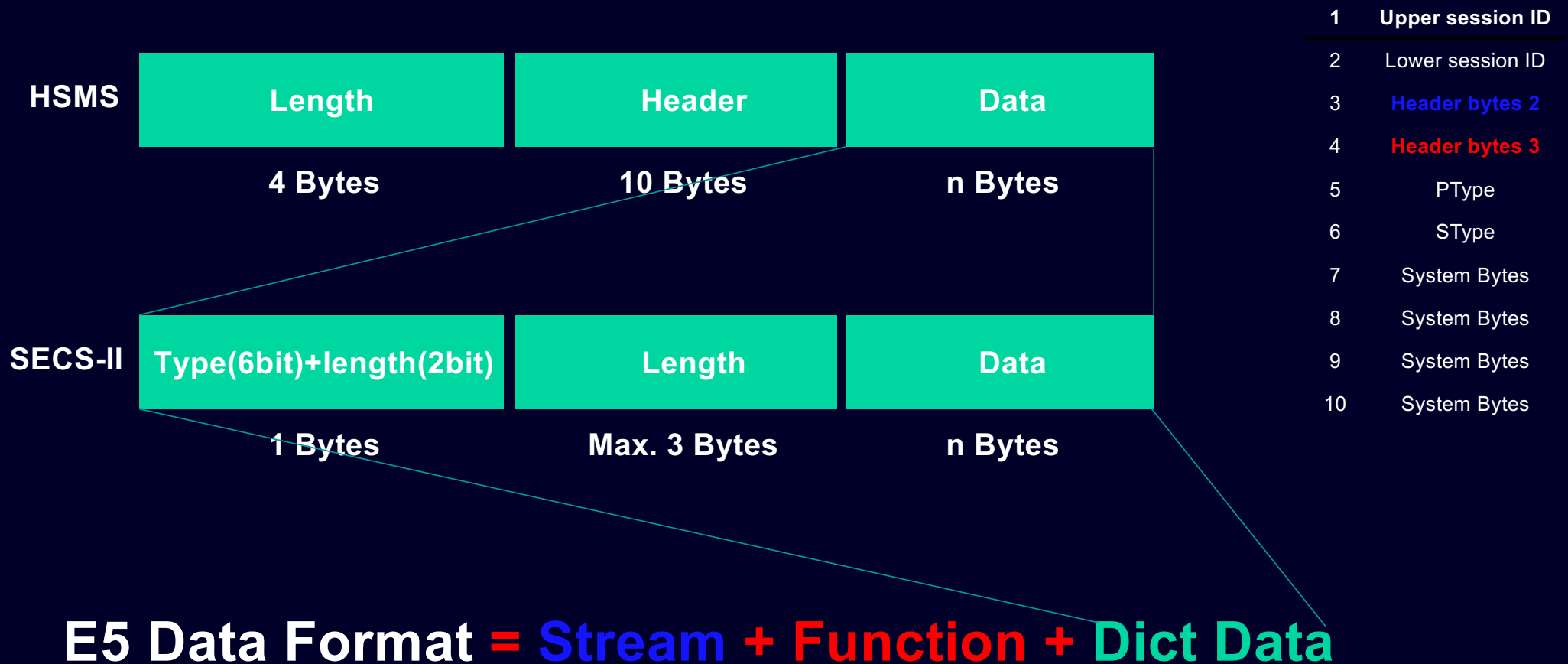
Decoding

After receiving the message, first unpack it according to the Item syntax, and then map it to the business object

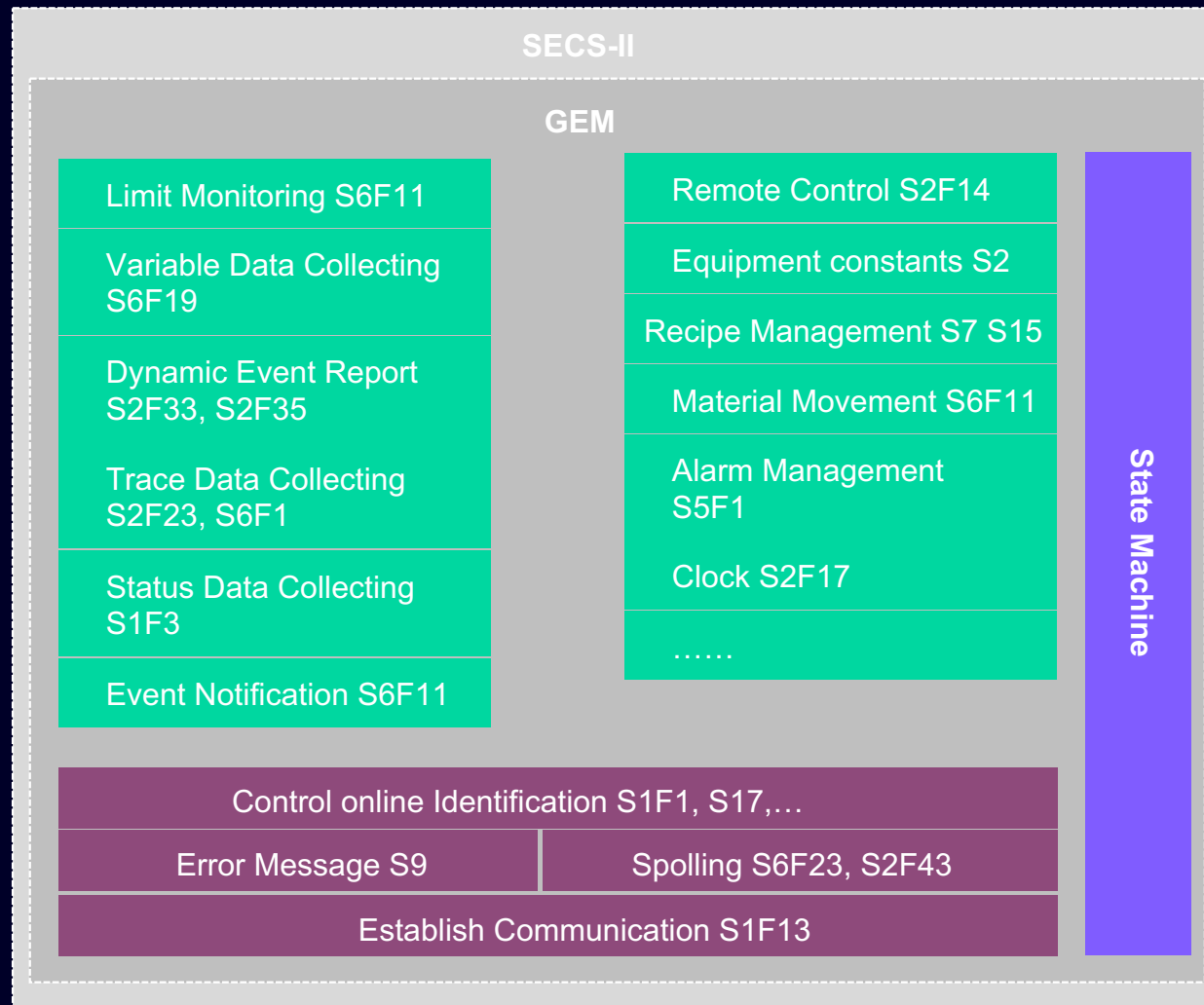
Answering

Odd functions must return even functions. When W-Bit=1 times out, a retry or an error must be reported

Packet Format



GEM(E30)



Open Source Implementation

secs4net

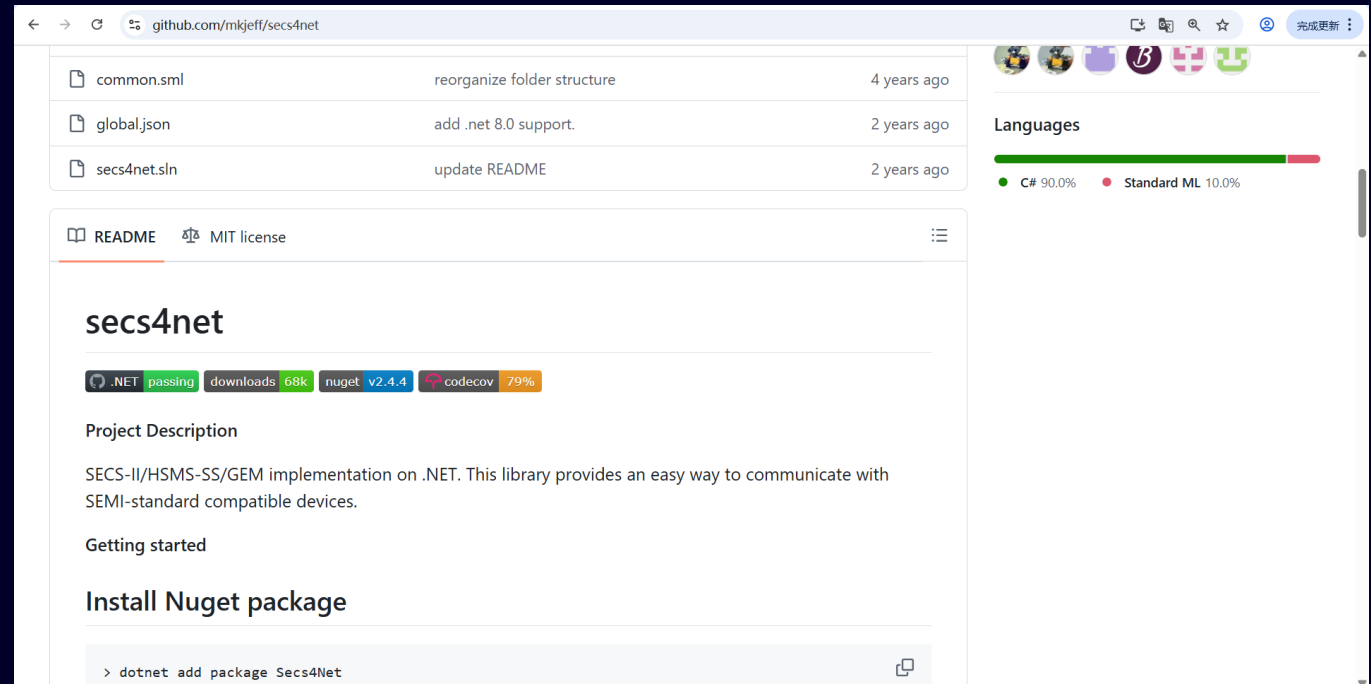
secs4net is a LGPL 2.1 licensed .NET implementation of SECS-II/HSMS-SS/GEM.

Pro

To our knowledge this is the most complete Open Source implementation. Actual documented usage in the field.

Con

.NET doesn't fit well into our Edge Stack.



<https://github.com/mkjeff/secs4net>

secsgem

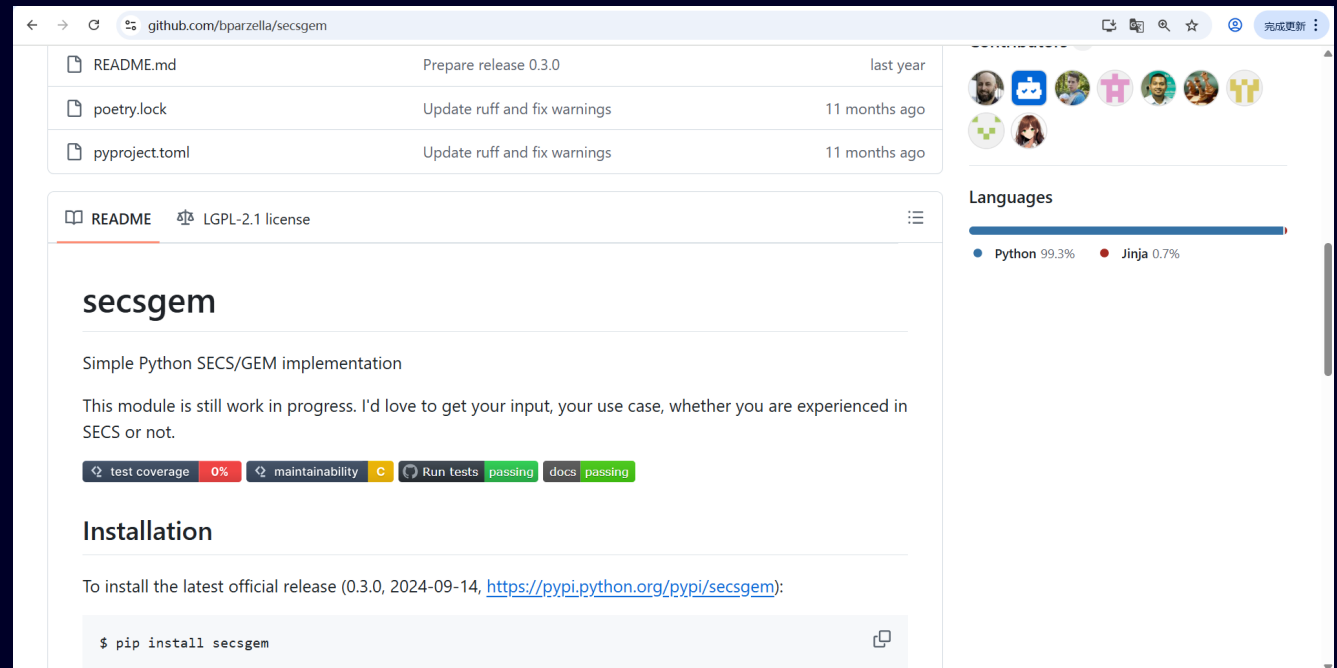
secsgem is a MIT licensed Python library that offers native asyncio support for SECS/GEM.

Pro

Far easier to use on our Edge stack, though still not optimal implementation for us.

Con

More or less single maintainer.
Not feature complete



<https://github.com/bparzella/secsgem>

No FAB, no Problem

Interaction without real machines

Certifications

SEMI certification involves rigorous testing of timing, recovery, and edge cases. This ensures that SECS/GEM implementations meet industry standards for reliability and performance.

Simulation tooling

Free test tools are available. These tools help developers simulate various scenarios and identify potential issues before submitting their implementations for certification.

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Semiconductor SECS/GEM

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SECS/GEM Tester Download

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The SECS/GEM Tester is a basic, standalone tool to validate communication to process equipment

When you're ready for more...

The SECS Tester is built with our TransSECS and MiStudio products and you can easily build automation solutions the same way.

ErgoTech's TransSECS software is the fastest way to create both equipment and host SECS/GEM interfaces. TransSECS always includes the ability to simulate either your tool or host applications. SECS/GEM is widely used in the Semiconductor and Electronics assembly industries.

With the TransSECS editor you build complete SECS/GEM interfaces within the editor. You can go live-online with the tool for characterization and testing. You can then use the TransSECS generated interfaces with IIoT/Cloud applications, PLCs, REST, MQTT databases, and many other automation systems. If you need user interfaces or automation and control, you can build applications programmatically in Java, .NET or a variety of scripting languages or use ErgoTech's *MSStudio* graphical drag-and-drop application builder to create complete tool or host applications without programming - even with Cloud deployment. TransSECS can also be part of your full [Industry 4.0 Semiconductor Vision](#).

TransSECS SECS/GEM interfaces can be deployed on any Windows, Unix or Linux platform (including the Raspberry Pi) and on many embedded systems or to your Cloud platform. You can even run the applications on Android.

The TransSECS editor changes the generalities of the SECS/GEM standard

<https://ergotech.com/secstesterdownload>

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EIGEMSim

EIGEMSim is a SECS/GEM simulator software that is used for testing SECS/GEM compliance of your equipment software. It simulates Factory Host with most SECS messages that are used for testing pre-bundled.

Request A Demo

30 days FREE TRIAL

SECS/GEM Communication Simulator Software

We use cookies to ensure that we give you the best experience on our website. If you continue to use this site we will assume that you are happy with it.

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7-Day Free Trial

<https://www.einnosys.com/eigemsim/>

gitcode.com/Universal-Tool/3181f

万能工具箱/SECSEmulatorsecsgem调试--

代码 Issues Pull Requests 讨论 分析

LICENSE

Initial commit

6个月前

README.md

add README.md

6个月前

README

MIT

SECS Emulator secs gem调试工具介绍

SECS Emulator是一款专业的secs gem调试工具。其主要功能适用于测试半导体设备的通讯功能。本工具由ITR开发，能够读取SML档案，支持SECS-I/SECS-II/HSMS-SS通讯协议，以及SML格式，让用户能够进行强大且易用的自动化测试。

主要特点

- 免安装即开即用：SECS Emulator无需复杂的安装过程，只需拷贝文件到指定目录即可使用。
- 支持多种通讯协议：工具支持SECS-I/SECS-II/HSMS-SS通讯协议，满足多种测试需求。
- 强大的自动化测试功能：SECS Emulator提供了强大的自动化测试功能，帮助用户轻松完成测试任务。

使用说明

在使用SECS Emulator之前，请确保已经将RS232连接正确连接。启动软件后，选择檢視功能，然后在SECS-I对话框中输入相关的通讯参数。

注意：请按照说明书的要求正确操作，以确保测试的准确性和设备的安全性。

项目

Star

3提交

定制我的领域

README

规则集

单独项目

下载使用量

99

项目总下载次数（含Clone、Pull、zip包及release下载）每日凌晨更新

发行版

暂无数据

<https://gitcode.com/Universal-Tool/3181f>

开源工具箱/半导体标准EAP系统与SECSG--

代码 Issues Pull Requests 讨论 分析

README.md

add README.md

1年前

SECSComEnable.rar

add SECSComEnable.rar

1年前

README

半导体标准EAP系统与SECS/GEM测机工具

简介

本仓库提供了一个专为半导体行业设计的标准EAP系统与SECS/GEM测机工具。该工具旨在满足8寸和12寸半导体厂的所有EAP能力测试需求，特别适用于SECS/GEM通讯测试。

功能特点

- SECS/GEM通讯测试：专为SECS/GEM通讯协议设计的测试工具，确保通讯的稳定性和可靠性。
- 兼容性：支持8寸和12寸半导体厂的EAP系统，满足不同规格厂区的测试需求。
- 全面测试：涵盖所有EAP能力测试，确保系统在实际应用中的高效运行。

使用说明

1. 下载资源文件：从本仓库下载所需的资源文件。

项目

Star

1

定制我的领域

README

规则集

单独项目

下载使用量

91

项目总下载次数（含Clone、Pull、zip包及release下载）每日凌晨更新

发行版

暂无数据

贡献者

1

<https://gitcode.com/open-source-toolkit/d4343>

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SIEMENS

Old, yet still evolving

GEM3000 and beyond

GEM300

As manufacturing processes become more complex, GEM300 standards are essential for carrier ID, substrate tracking, and recipe approval. These enhancements support advanced automation and data management in modern fabs.

Looking ahead

SECS/GEM is evolving to integrate with communication technologies like OPC-UA and MQTT. This integration will enable more efficient data exchange and control, supporting the next generation of smart manufacturing.

Summary

Protocol Availability

Evaluation of niche protocols is easier than ever with open available implementations. We prefer running code over extensive documentation.

Check your “supplier”

Rating the quality of a project is a non-trivial task. Good starting points are: repository activities, error reports, source of commits (individual contributor vs. professional). SCES/GEM papers should be .

Mature simulation eco-system

If you like to look behind the scene of a fab but you can't afford the actual machines, you can abuse the simulation tooling traditionally used for certification processes.

Thanks and any questions?

**You probably will never use SECS/GEM directly.
But your tape-out is only possible because of it.**