

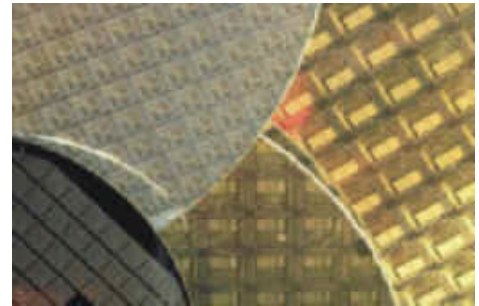
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# Generic Equipment Manager (GEMG)



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**Feb. 14, 2001**

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# AGENDA

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- **CIM Global Joint Guidance for 300mm Semiconductor Factories**
- **Generic Equipment Manager (GEMG)**
- **Integration of GEMG into SiView**



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- **CIM Global Joint Guidance for 300mm  
Semiconductor Factories**

# CIM Global Joint Guidance for 300mm Semiconductor Factories

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300 mm  
INITIATIVE



Japan  
300mm Semiconductor  
Technology Conference

## 1.1 Single Communication Link

A single physical communication connection must link the production equipment to the Host. The supplier must provide hardware on the equipment to connect to the factory **Local Area Network (LAN)** per IC manufacturer's requirement. This communication connection must comply with **HSMS protocol** and be able to transmit and receive all **SECS-II messages**.

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•Source: *CIM Global Joint Guidance for 300 mm Semiconductor Factories: Release Five, I300I;J300, 18 April 2000, SEMATECH DOC ID #: 98063534DENG*

# CIM Global Joint Guidance for 300mm Semiconductor Factories(cont.)

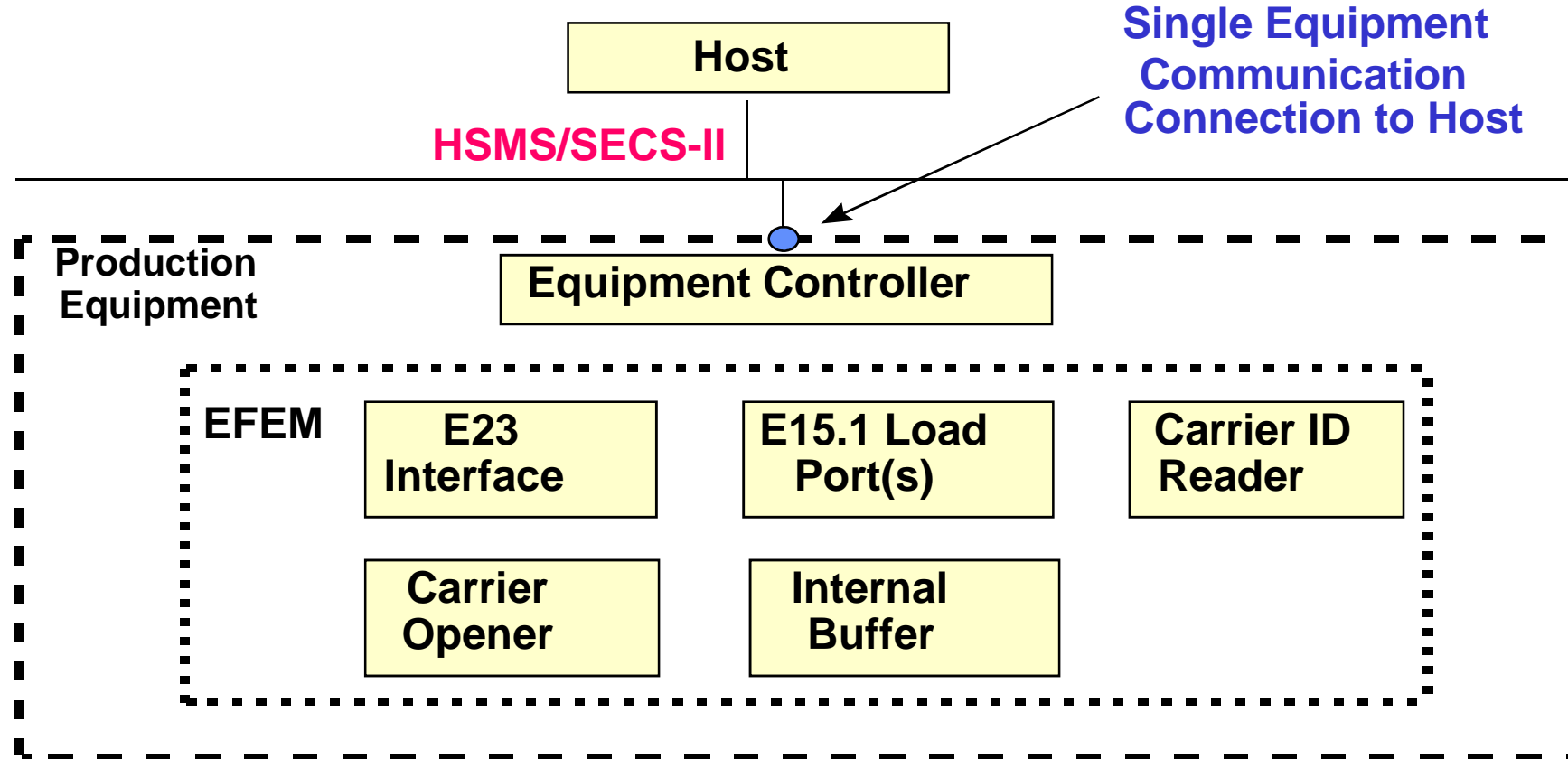
## 1.1 Single Communication Link (cont.)



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**EFEM = Equipment Front End Module**

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# CIM Global Joint Guidance for 300mm Semiconductor Factories(cont.)

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## 1.2 Compliance to Communication Standards

Production equipment must comply with **SECS-II** standard messages to communicate with the Host. Production equipment must also use standard state models for control and data processing. Automation software products must comply with these same standard messages and state models when communicating with and controlling production equipment. **HSMS Single Session Mode is a minimum requirement.**

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# CIM Global Joint Guidance for 300mm Semiconductor Factories(cont.)

## 1.3 Utilization and Reliability Management



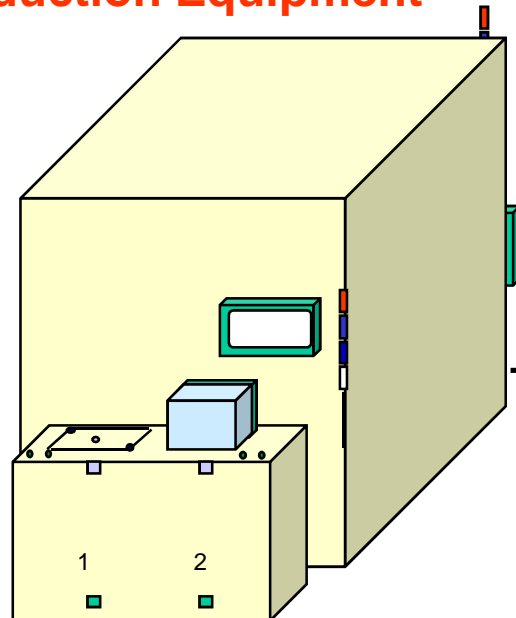
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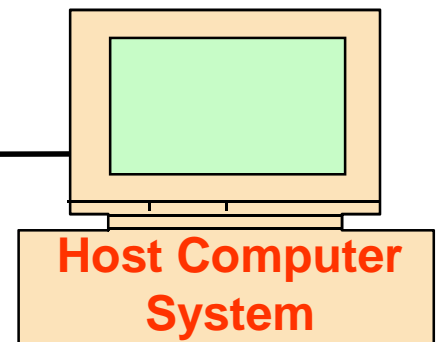
Production equipment must communicate **utilization and reliability data** to host systems using standard messages and state models. This is required to enhance data collection and analysis of equipment performance.

### Production Equipment



SECS-II, GEM, HSMS single session mode  
Production Equipment utilization and  
reliability data to the host (ARAMS)

Network



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## 1.4 Reliable Data Collection

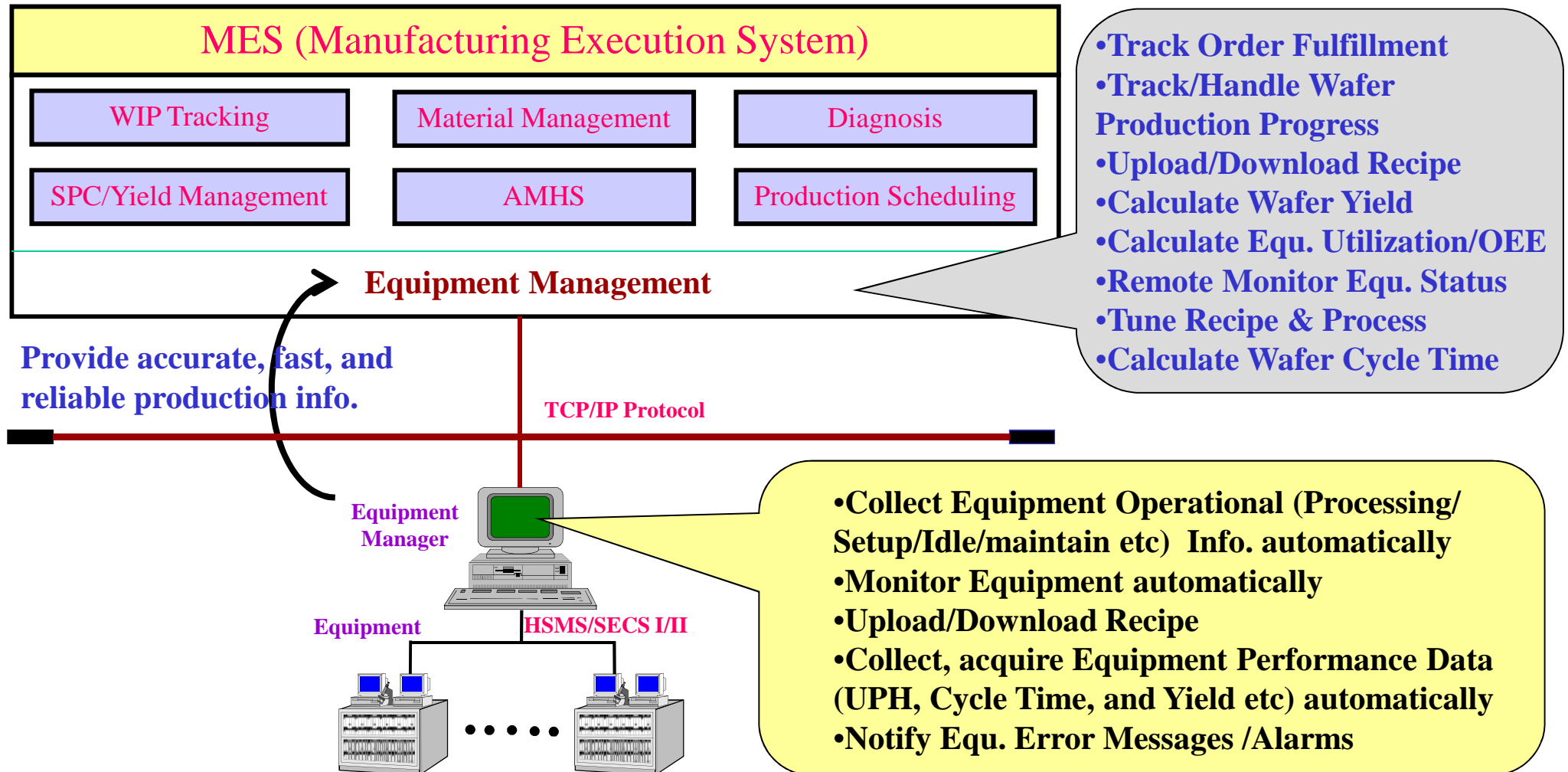
Data collected by production equipment must be time-stamped at the time of collection and not at the time of transmission.

## 1.5 Variable Parameter Support

Production equipment must support variable parameters sent by the host or set from the operator interface.



# What are the Critical Requirements of Equipment Management?



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- **Generic Equipment Manager (GEMG)**



# Design Goals

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- GEMG can operate stand-alone or become a pluggable component of the Framework MES.
- GEMG can be reused even when the **Business Rules** of a company and/or the **Equipment Rules** of an equipment have been changed.
- **Business Rules** and **Equipment Rules** can be easily built by filling in the corresponding parameters in the **Scenario Tables** and **Behavior Tables**.
- GEMG is easy to deploy (with Wizards) and maintain (with Version Control).

# Functions/Capabilities

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- **Integrate with SECS/GEM equipment (via CSD001 Driver for SECS-I or CSD002 Driver for HSMS).**
- **Manage and control several (different) machines concurrently.**
- **Setup machine parameters.**
- **Manage upload/download operations of recipes.**
- **Monitor, collect, and report events, machine status, alarms, and engineering data.**
- **Integrate with External Systems (i.e., SiView, FACTORYworks, etc.).**

# Design Principles

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- **Maximize Generality**
- **Emphasize Reusability**
- **In order to accomplish Generality and Reusability, the governing rules of GEMG are divided into three independent portions:**
  - **System/Framework Rules**
  - **Business Rules**
  - **Equipment Rules**

# Three Independent Governing Rules

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- **System/ Framework Rules**

- Specify the requirements to become a pluggable component of External Systems (i.e., CyberLink, SiView, FACTORYworks, etc.).

- Need an **External Interface** model.

- **Business Rules**

- Company-dependent and equipment-independent.

- Need a **Configuration Controller** module.

- **Equipment Rules**

- Equipment-dependent and company-independent.

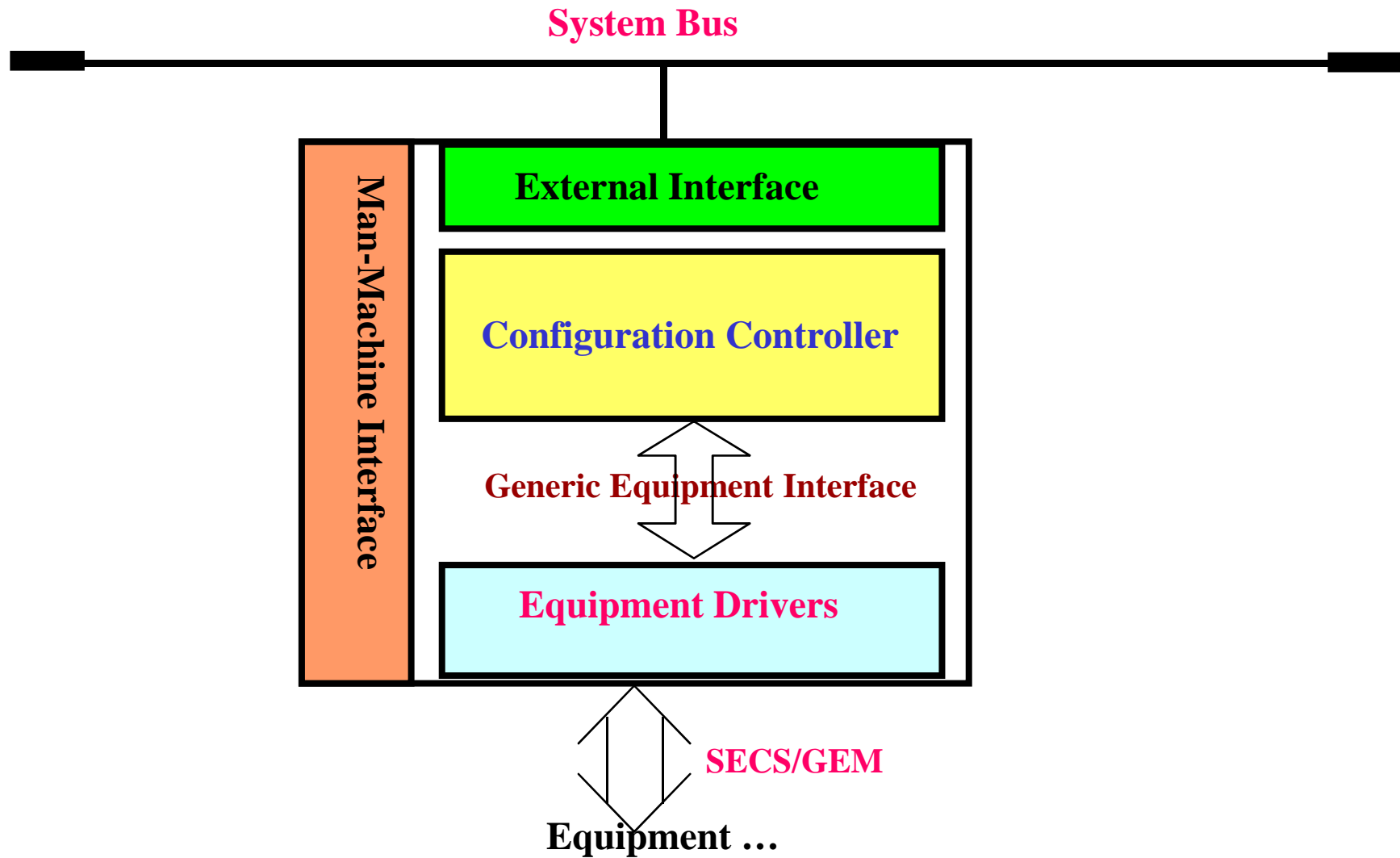
- Need an **Equipment Driver** module.

# Generic Equipment Interface (GEI) Messages

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**GEI messages which are company-independent and equipment-independent are defined to be the communication messages between the Configuration Controller and Equipment Driver.**

# Brief Architecture





# Concept Realization

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- **External Interface**

By implementing 1) IDLs of Framework MES or  
2) Servlets of a Web Server.

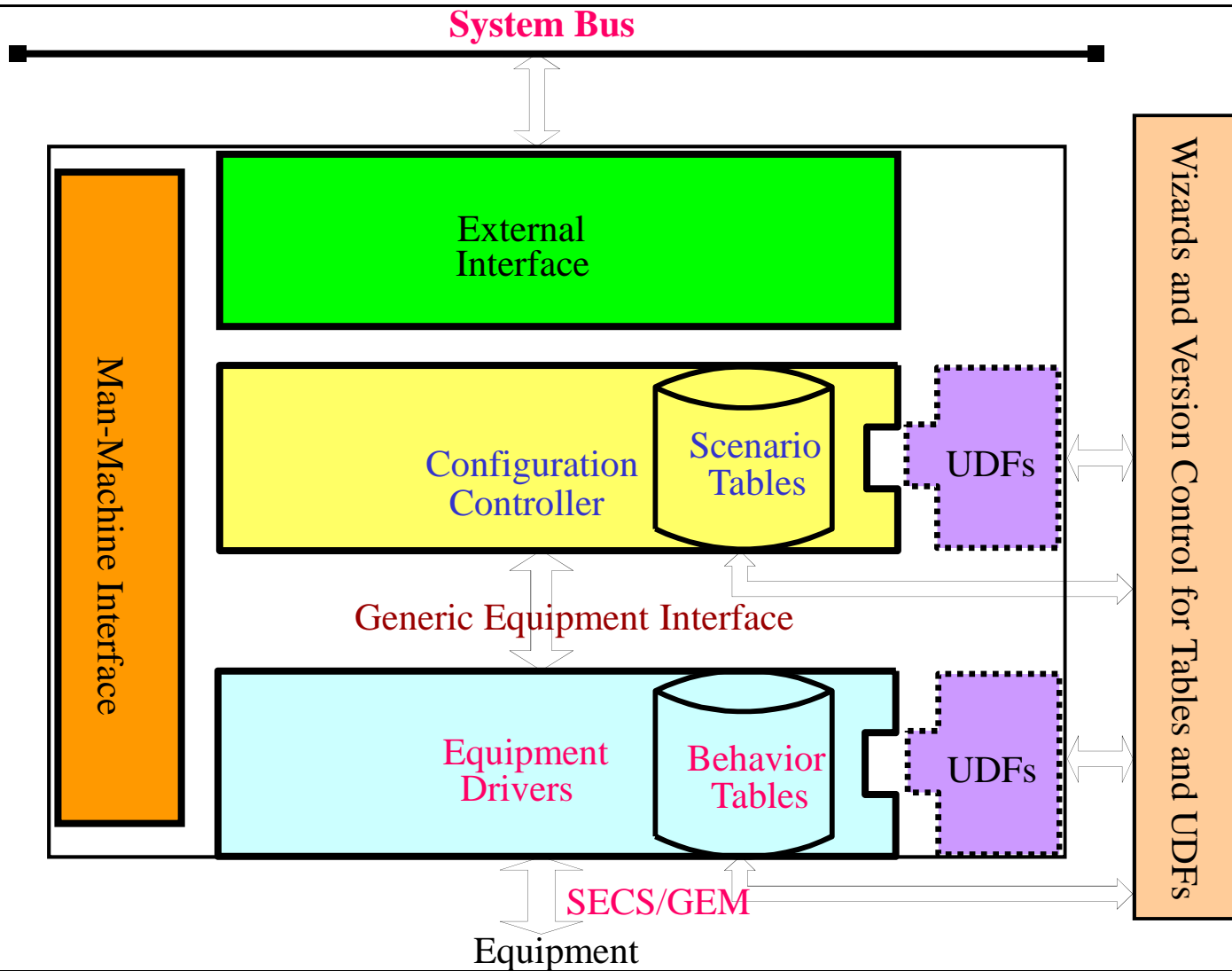
- **Configuration Controller**

By setting up **Scenario Tables** to accomplish **Business Rules**.

- **Equipment Driver**

By setting up **Behavior Tables** to accomplish **Equipment Rules**.

# Detailed Architecture



# Other Functional Modules

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## ♦ Man-Machine Interface

Graphic user interface between operators and GEMG.

## ♦ User Definition Function (UDF)

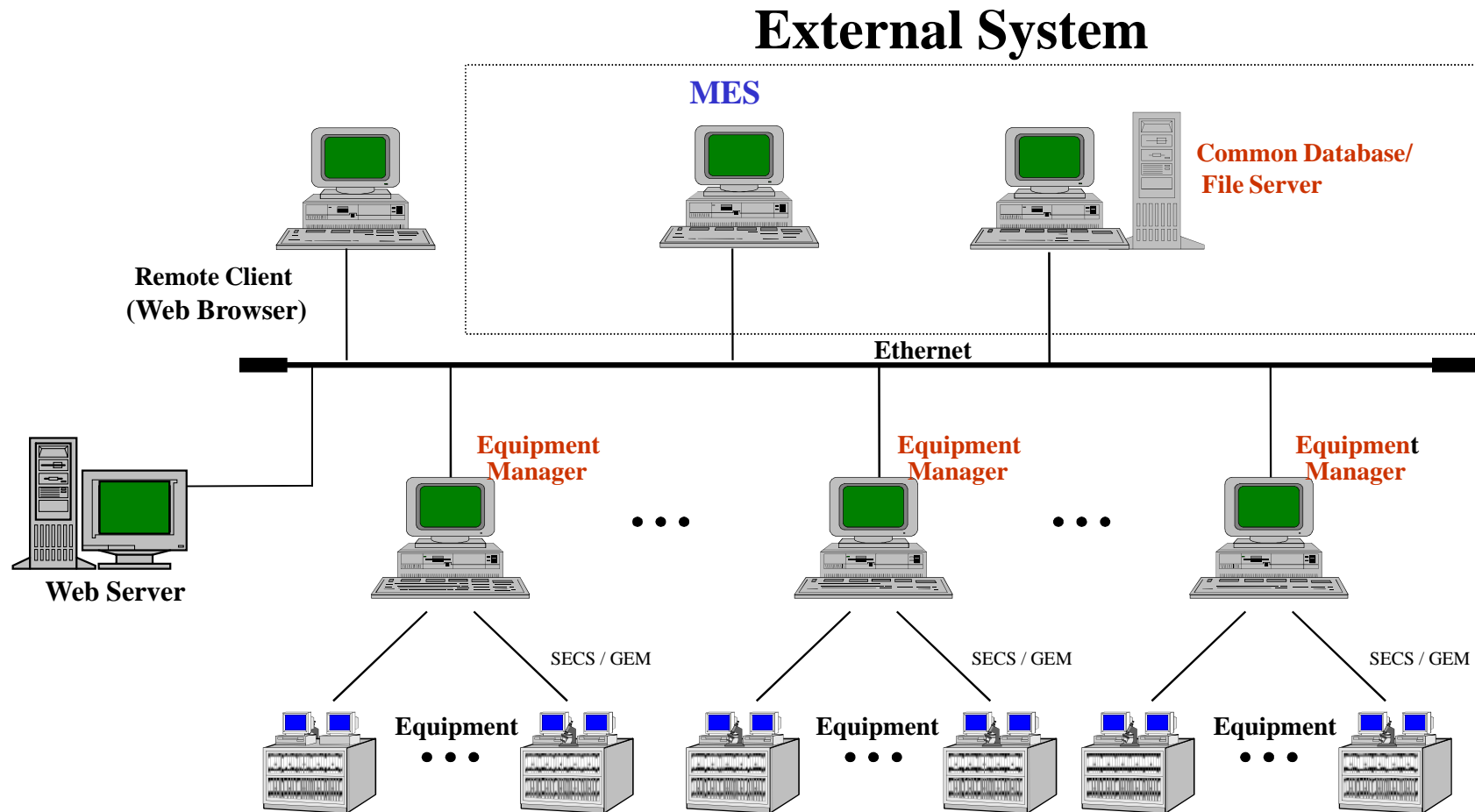
A **UDF** will be required if a specific function cannot be fulfilled by merely editing **Scenario/Behavior** Tables.

# Wizards and Version Control for Tables and UDFs (Concept for GEMG Recipes)

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- ◆ **Scenario/Behavior** Tables and **UDFs** are, in fact, the Recipes of GEMG.
- ◆ For easy deployment of **Scenario/Behavior** Tables and **UDFs**, several foolproof wizards are designed.
- ◆ For easy maintenance and version control of GEMG's recipes (i.e., **Scenario/Behavior** Tables and **UDFs**), a Version Control module is developed.

# Deployment Diagram of GEMG



# Reusability Considerations of GEMG

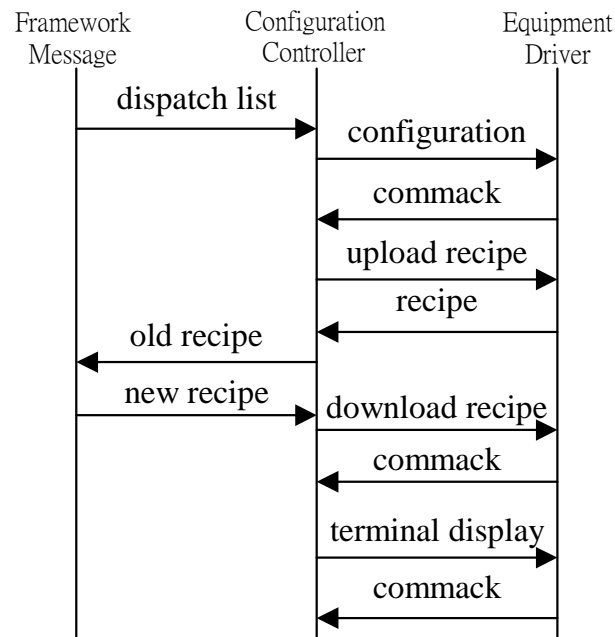
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- ◆ When **System/Framework Rules** are changed, we only have to modify the **External Interface** module.
- ◆ When **Business Rules** are changed, we only have to modify the **Scenario Tables** of the **Configuration Controller** module.
- ◆ When **Equipment Rules** are changed, we only have to modify the **Behavior Tables** of the **Equipment Driver** module.

# Example for Different Business Rules

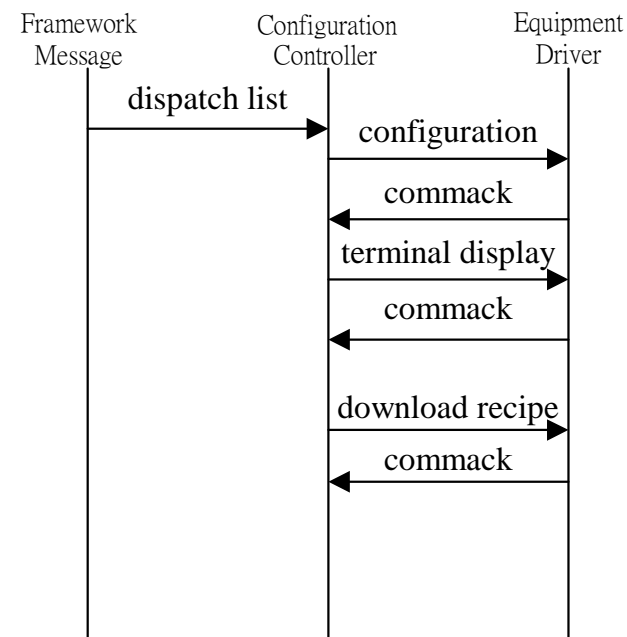
## Factory A

- Accept dispatch list from system
- Set up parameters
- Upload old recipe by brute force
- Download new recipe
- Display dispatch outline on the terminal



## Factory B

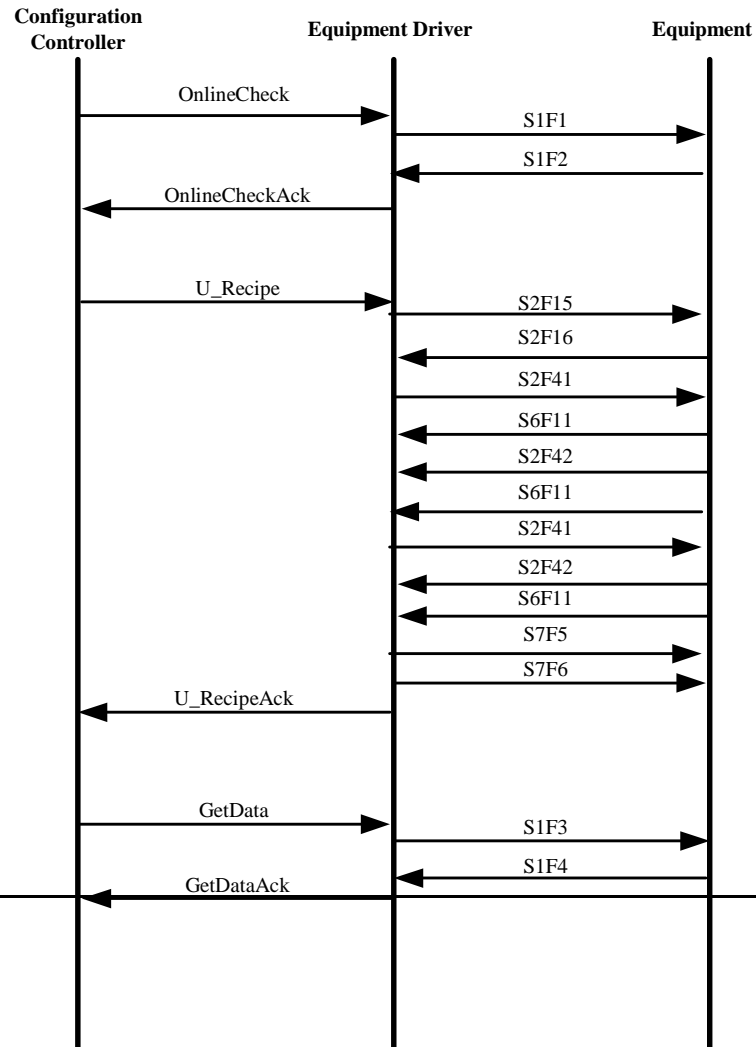
- Accept dispatch list from system
- Set up parameters
- Display dispatch outline on the terminal
- Download recipe



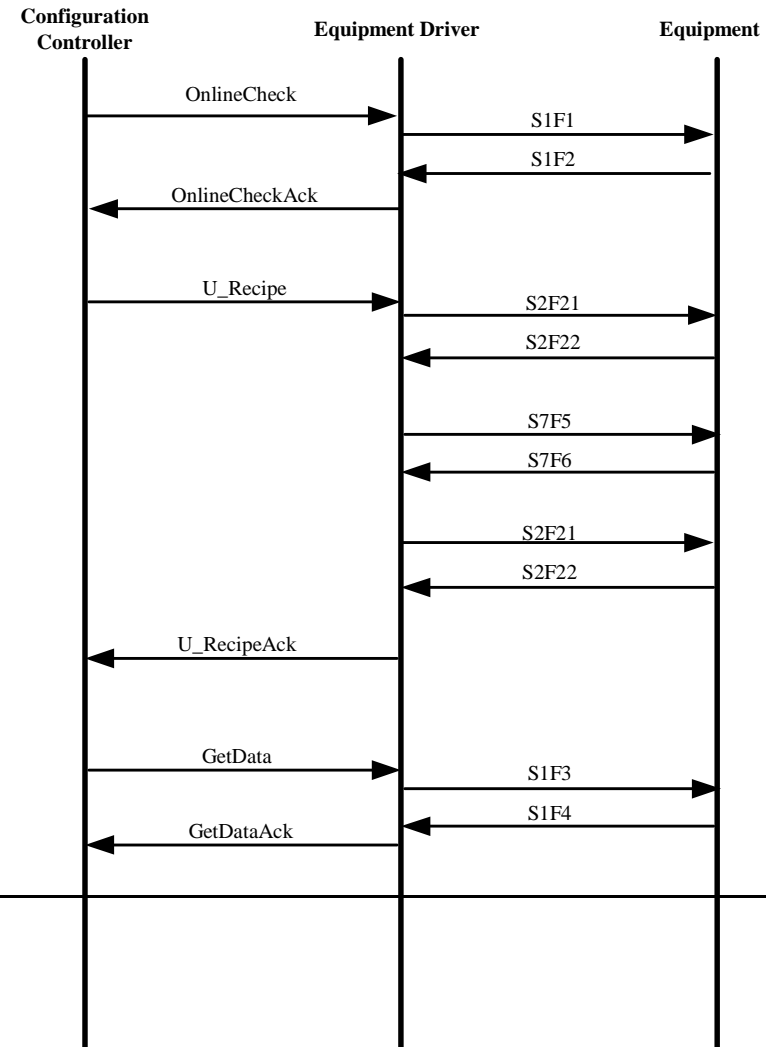
# Example for Different Equipment Rules

In a factory, we may use the same **Business Rules** while control two different machines.

## K&S 8028 Wire Bonder



## Shinkawa UTC-300 Wire Bonder



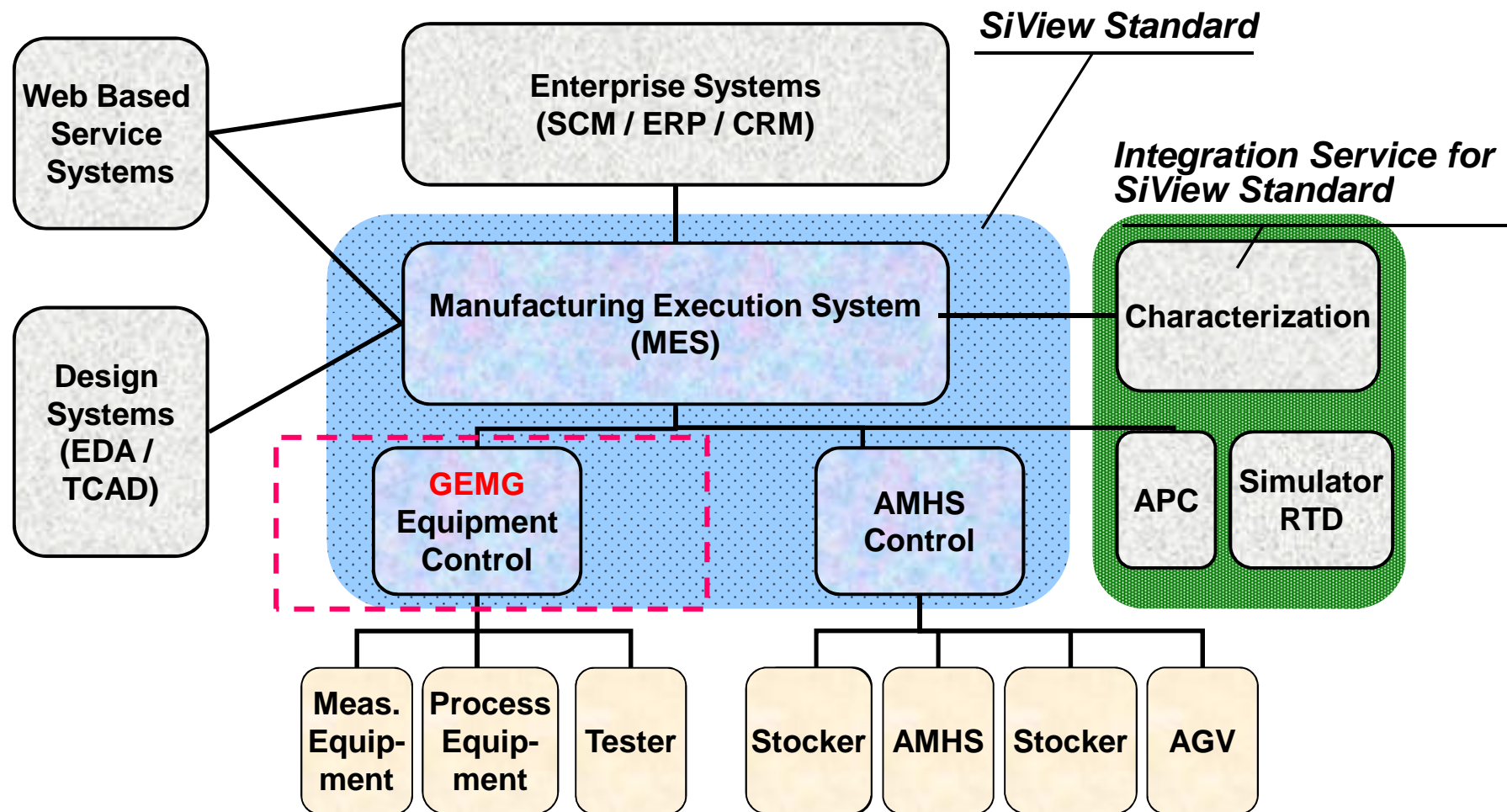


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- **Integration of GEMG into SiView**



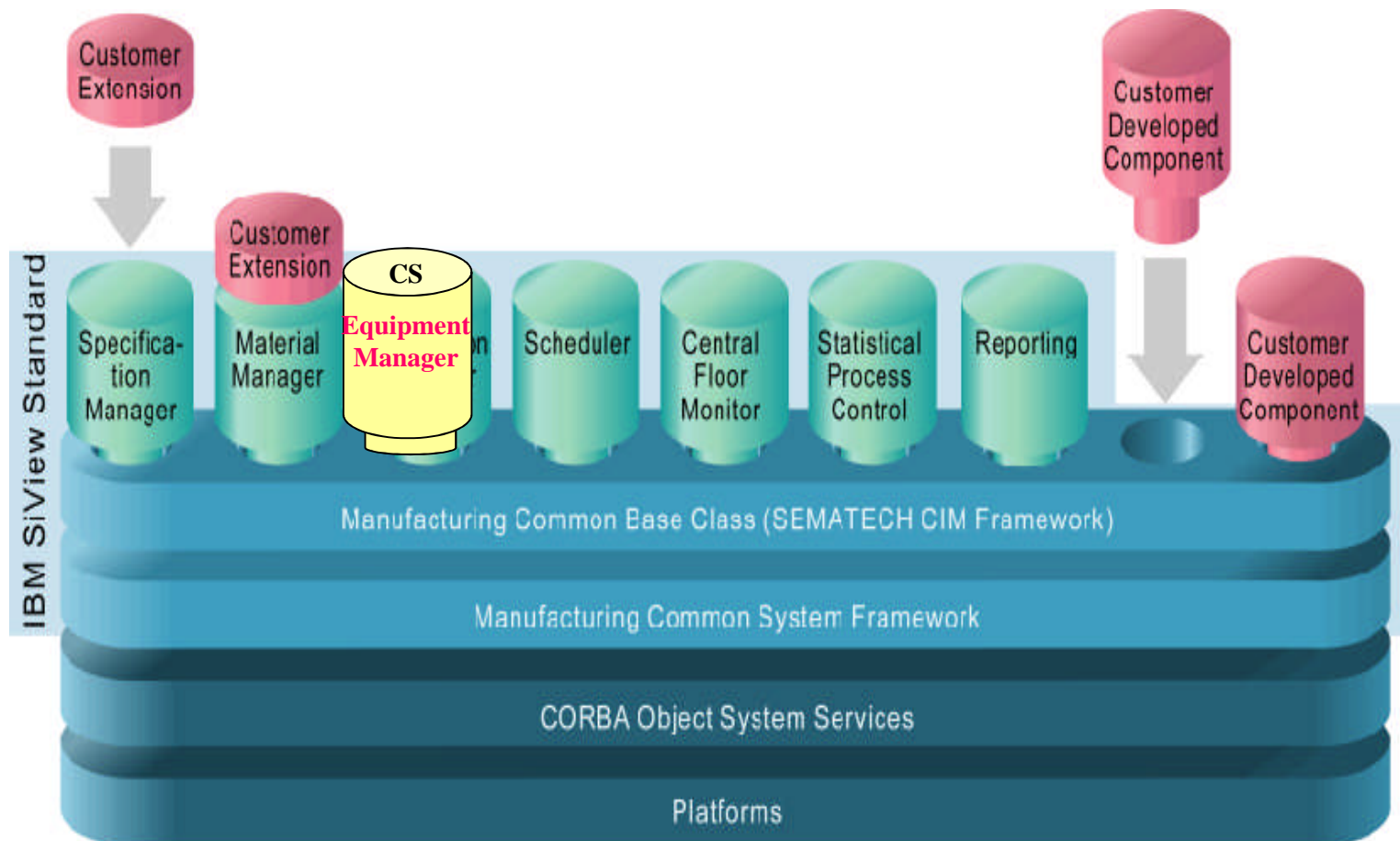
# Integration of GEMG into SiView

## Functional Scope of SiView



# Integration of GEMG into SiView

## IBM SiView Standard Application Architecture



# References

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- [1] H.-C. Yang, F.-T. Cheng, and D. Huang, "Development of a Generic Equipment Manager for Semiconductor Manufacturing," in *Proc. 7th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA'99)*, Barcelona, Catalonia, Spain, pp. 727-732, October 1999.
- [2] F.-T. Cheng and C.-Y. Teng, "Equipment Management Method," Taiwan, R.O.C. patent no. I233141, issued on May 21, 2005; and US patent no. 7,003,367, issued on February 21, 2006.