What is EES all about?

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  - Need more help from suppliers
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300mm Fab Line Challenges

- **Material handling by machine is mandatory**
  - Weight exceeds 8kg if loaded to full capacity
- **Heavy product-mix**
  - Operators can't handle as routine
  - Pilot sample wafers go together
  - individual wafer control
- **QTAT and Low WIP**
  - Comprehensive and real time recognition
  - High degree of controllability over fab
- **Non Stop Operation**
  - yet higher tool availability needed
  - process parameter adjustment is a big problem
- **Thus high degree FA and CIM are MUST.**

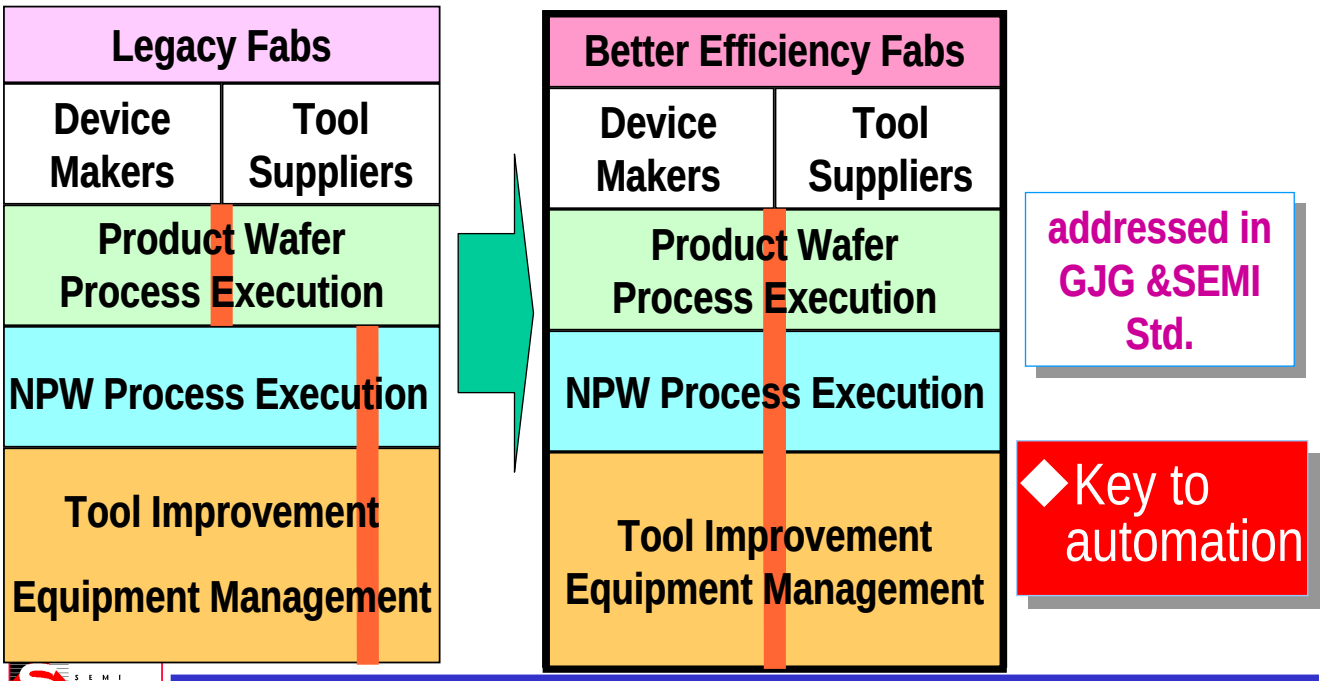
What have to be done next

- **MES Capabilities**
  - Global production scheduling
  - Product mix and single wafer control
- **AMHS**
  - Interoperability through integrator
- **Round Trip Scenario Capabilities**
  - Base Functionality Requirement
  - Tool S/W Functionality Implementation

addressed in GJG &SEMI Std.

- **Tool Availability Improvement**
  - more than legacy "equipment management"
- **Better Process Control Capabilities**
  - AEC/APC Capability Implementation
  - Cross Machine Difference Control

Device Makers Need More Help from Tool Suppliers for Better Fab

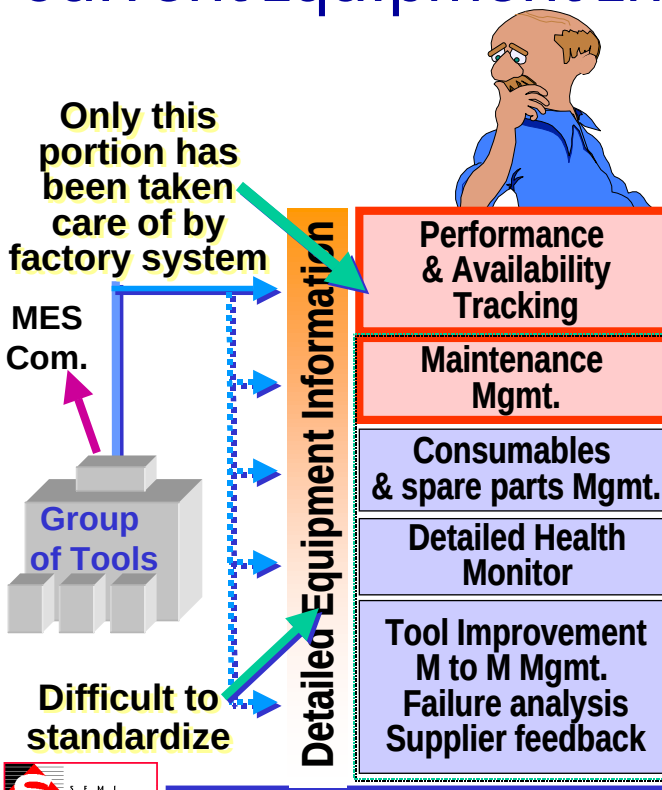


Equipment Engineering Operations

◆**Equipment Engineering refers all operations for tool availability improvement and performance maintenance in and out of the factory**

- Line throughput maintenance and improvement
- Tool health monitoring and troubleshooting
- Tool performance improvement
  - especially newly introduced tools
- Collaboration with suppliers (improvement, troubleshooting, ...)
- Tool, parts, assembly versions, modification management
- Maintenance operation management, planning, preparation
- Process performance adjustment

Current Equipment Engineering Operation



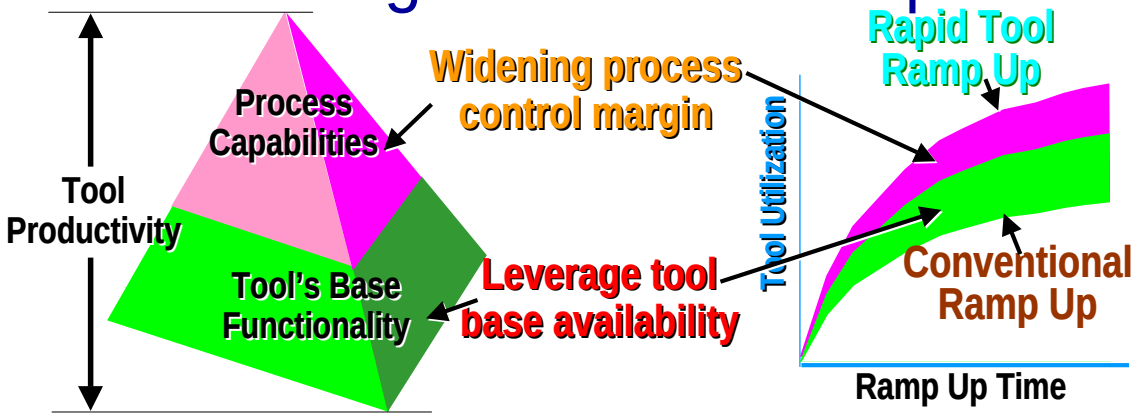
- Tool suppliers receive EE info through this guy
- This guy does everything
  - Communicate with suppliers
  - Collects EE info
  - Analyze & make decision
  - Adjustment of process parameters under one single recipe

Not all EE info is utilized effectively

What is the Better Equipment Engineering?

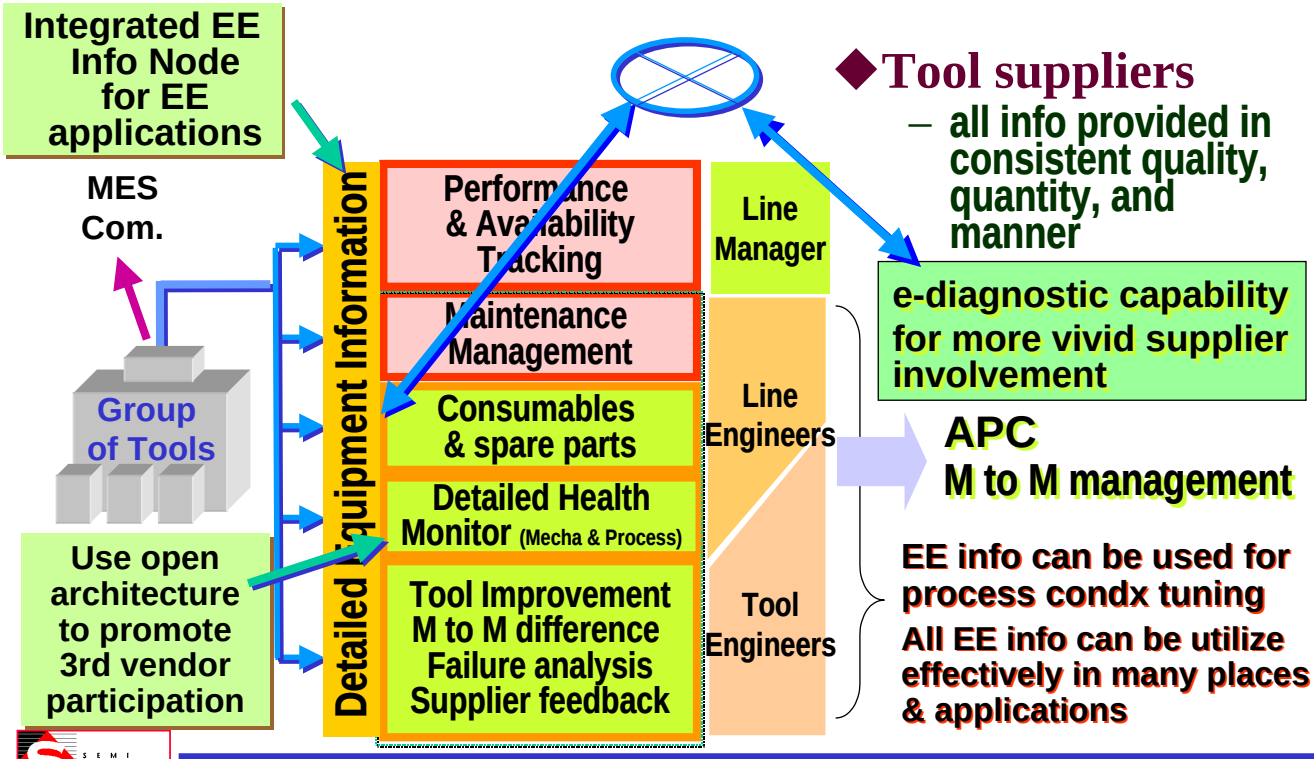
- The factory system supports line throughput management with tool level resolution
  - Host sees tools according to host's own modeling
  - does not get into the black box
- Actual EE operations is below this resolution
  - We need to go over to finer resolution
- For EE system to work
  - Higher resolution needed than legacy system
    - So as to deal with that tool specific tool technology
    - This resolution can not be utilized at user side
      - New tool's knowledge and its implementation into factory system can not be done at the time of tool delivery

What is missing from Better EE Operation?



- Device makers do concern what they understand or feel responsible to
  - Process performance is our primary concern
- Supplier's FDC or Device maker's FDC, or both?
- Who should take care of tool's base functionality
  - Suppliers should obtain information for tool improvement
  - Industry to share responsibility of new infrastructure to leverage tool base functionality

EE Information and Responsibility Sharing



- Tool suppliers
  - all info provided in consistent quality, quantity, and manner

e-diagnostic capability for more vivid supplier involvement

APC
M to M management

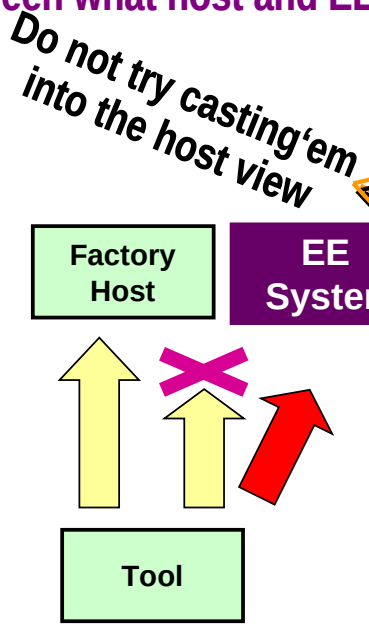
EE info can be used for process condx tuning

All EE info can be utilize effectively in many places & applications

What is needed for the better Equipment Engineering?

Discrepancy between what host and EE activity wants to know

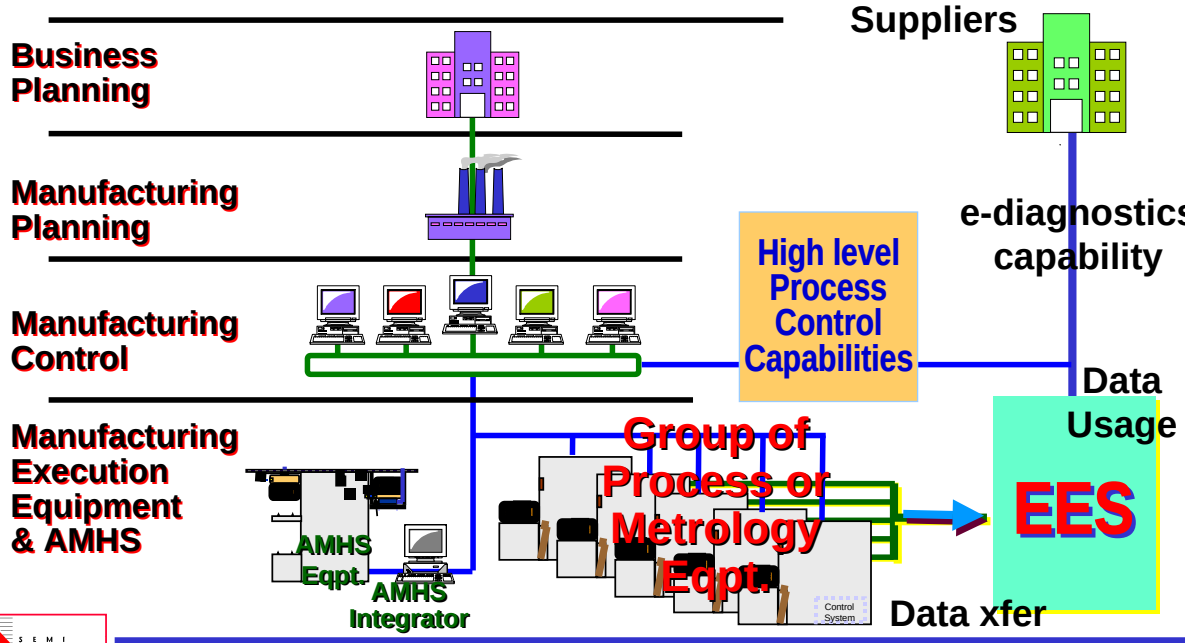
- **Examples of host view info**
  - Event reports of processing
  - Alarm / warning report
  - EFEM status
- **Let's not go beyond EFEM**



- **Examples of equipment view info**
  - Components and sub-assembly status
  - Consumables & parts life status
  - Actual process condition
- **Ask supplier**
  - to provide necessary EE info
- **Let EES grow for itself**

Big Picture

- **EES Independency and Linkage**
  - Some systems need link between MES & EES



Equipment Engineering Evolution

- **Enable detailed eq. data collection/utilization**

- **Systemize EE operation with EE capabilities**
  - replace current EE operation with suppliers' involvement

- **Free EE system from MES constraints**
  - EE system as a paralleling system with MES
  - Define open interfaces thus encourage rapid development

- **Propose new IT infrastructure**
  - Induce industry's consensus and benefit

EE Wish List under Study

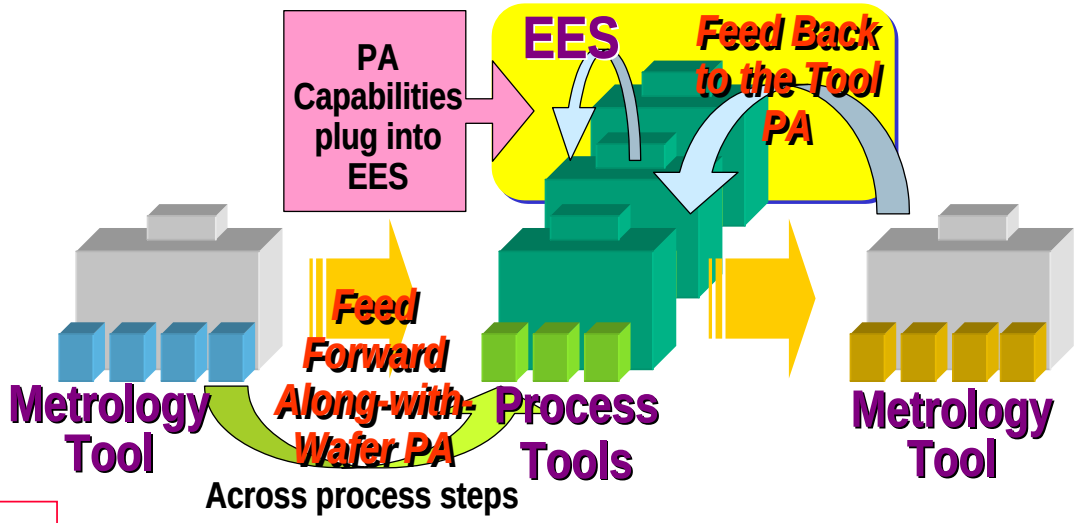
- **Following operations have been studied intensively**
  - Category1 (Appreciable systemization made)
    - manufacturing instruction and tool's macroscopic status management
  - Category2 (Not much done yet, anticipated from where we are)
    - Detailed tool monitoring down to level of subsystems
    - Tool and parts version and modification management
    - Maintenance operation aid
  - Category3 (not directly anticipated: newer capabilities)
    - Rapid tool improvement thru sharing detailed tool operation data with suppliers
    - More 3rd vendor involvement for more application S/W
    - More direct supplier involvement by remote diagnosis
    - Tool performance adjustment under automation context

The Latest Thought of JEITA/Selete

- **As JEITA/Selete's detailed study goes on, following is emerging**
  - Tool side of the factory system can be "FULLY ARMED"
    - EES can establish a farm ground for *Tool* FDC
    - Introduction of EES can give APC a full access to EE information in an organized way
  - "Fully armed tool side system" will set up a start line for e-Manufacturing
    - We should start thinking what will further necessary beyond EES

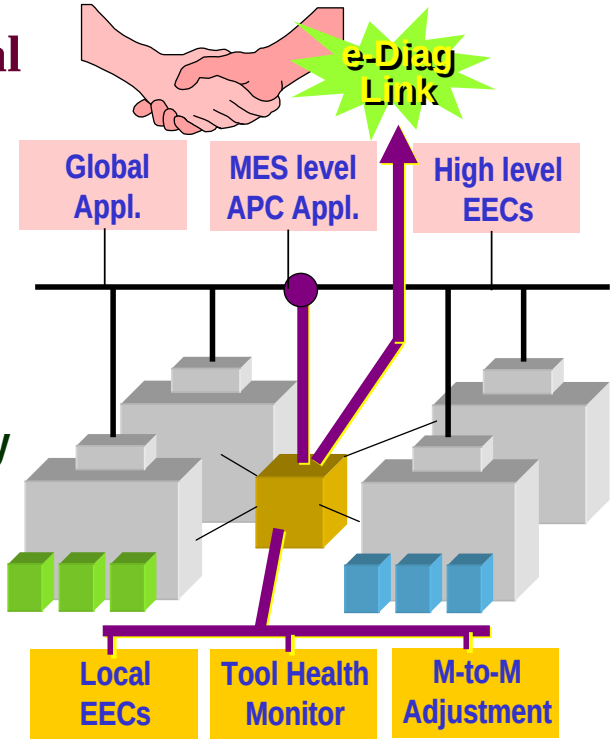
Process Adjustment Capabilities Study

- **Some PA capabilities can be better handled by EES**
  - M-to-M and predictable process adjustment
- **Some of EE info is needed in high level PA capabilities and high level FDC**



International EE Capabilities Collaboration

- **New Infrastructure Proposal**
  - Another ISMT & JEITA/Selete consortia driven global activity
- **Area of collaboration**
  - Establish international consensus on EE Capabilities
    - based on factory system architecture consensus
  - Introduction of EECs into factory frame work
- **Unified message mandatory**
  - Unified requirements
  - Roll out guidelines and best practice documents in FY2001



Summary of What EES is All About

- **Introducing an EES platform concept**
  - Enable implementation of detailed eq. management and capabilities in EE wish list for both sides of the industry
    - not possible with the current factory system
  - Encourage 3rd party involvement
    - High potential of improving EE operation
  - Encourage e-Diagnostics implementation
- **Possible PA capabilities assignment**
  - EES to have PA capabilities for M-to-M and tool F/B
  - MES to have cross process step PA capabilities
- **EES should be introduced**
  - with certain independence from current factory system
  - as a MUST weapon for leverage of tool base functionality in factories of today and tomorrow