

# **International SEMATECH e-Manufacturing Working Group**

**Jointly prepared by IBM and Intel  
June 29, 2000**

# Improve Equipment Productivity

<i>Year</i>	<i>1999</i>	<i>2002</i>	<i>2005</i>	<i>2008</i>	<i>2011</i>	<i>2014</i>
<i>Technology Node</i>	<i>180 nm</i>	<i>130 nm</i>	<i>100 nm</i>	<i>70 nm</i>	<i>50 nm</i>	<i>35 nm</i>
<i>Wafer Diameter</i>	<i>200 mm</i>	<i>300 mm</i>	<i>300 mm</i>	<i>300 mm</i>	<i>300 mm</i>	<i>450 mm</i>
Bottleneck production equipment OEE [3] (SEMI E79)	75%	87%	89%	91%	92%	92%
Average production equipment OEE [3] (SEMI E79)	55%	65%	71%	78%	80%	82%
% Capital equipment reused from one process node to next	> 70%	> 0%	> 80%	> 80%	> 80%	>20%
Production equipment lead time (months from order to full throughput capability) [5]	< 9 months	< 8 months	< 7 months	< 6 months	< 5 months	<5 months
Process equipment availability [6] (SEMI E10)	> 85%	> 90%	> 93%	> 95%	> 95%	> 95%
Metrology equipment availability [6] (SEMI E10)	> 90%	>95%	>95%	>98%	>98%	>98%
% of equipment to factory systems interface standards defined [2]	75% 300 mm	100% 300 mm	100% 300 mm	100% 300 mm	80% 450 mm	100% 450 mm
% conformance: equipment to factory systems interface standards [2]	100% 200 mm	100% 300 mm	100% 300 mm	100% 300 mm	100% 300 mm	100% 450 mm

SOURCE: 1999 ITRS

- ★ Equipment productivity (availability and overall effectiveness) are not meeting roadmap targets. Need to update tables with actuals + gaps and drive improvements through potential solutions
- ★ 300mm software interface standards are defined, but industry implementation is not meeting expectations

# e-Diagnostics ISMT FOCUS AREA

## Why E-Diagnostics?

- ★ Goal is 66% reduction in equipment support dollars
- ★ Significant reduction in Repair Time = higher Availability = Increased Output
- ★ Anticipate problems before they occur
- ★ Provide data to support continuous improvement and new product development

Internet

- Mainstream Computing Technologies
- Open Architectures

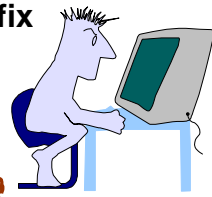
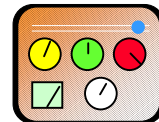
Protocol Options

- Serial line IP
- Remote Cntl
- Telnet
- Ethernet IP
- VPN

Firewall & Authentication


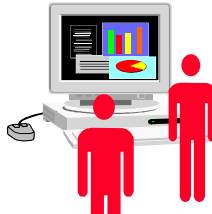
- Data Security
- Safety Infrastructure

Remote monitoring  
Remote diagnostics  
Remote de-bugging/fix  
Remote sensing  
Model tool behavior

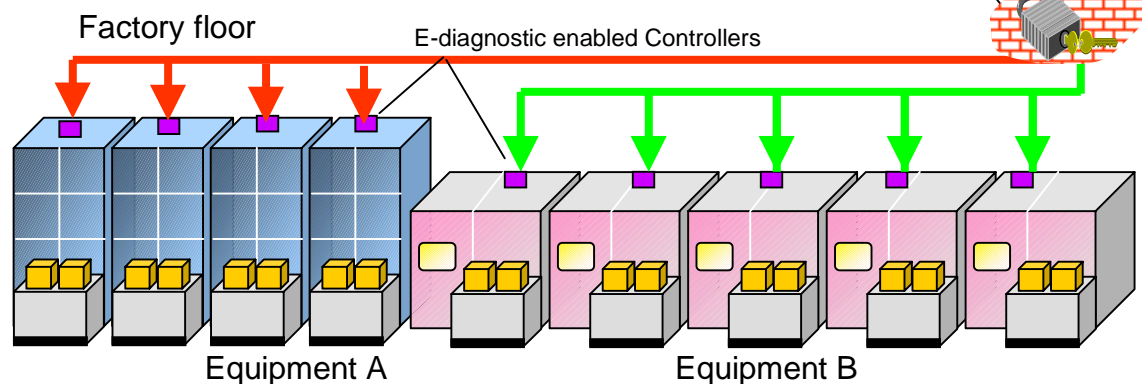



**Supplier A Main Office**

Remote monitoring  
Remote diagnostics  
Remote de-bugging/fix  
Remote sensing  
Model tool behavior

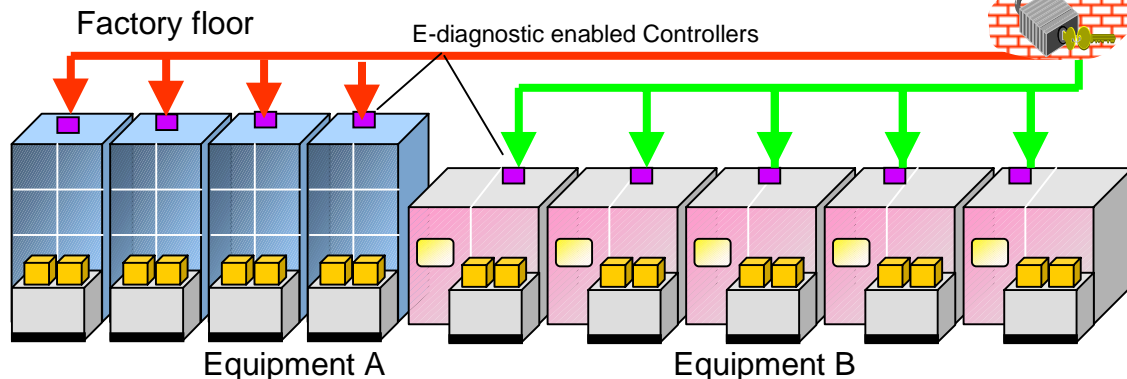



**Supplier B Main Office**

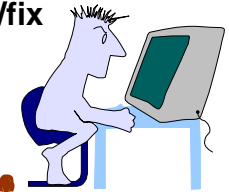
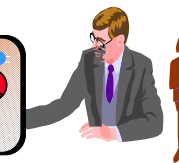
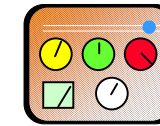


# ISMT e-Diag. Guidelines

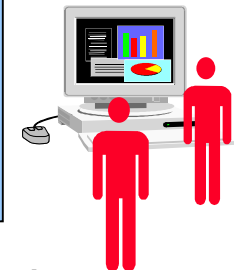
- ★ **Equipment diagnostics data is available via remote access capability**
  - ☞ Detect issues before they occur and also determine whether equip is running to specs by remote supplier service experts
  - ☞ Detect equipment variations from baseline performance
- ★ **Equipment is remotely configurable for initial set-up or to resolve and debug issues**
- ★ **PM utilities are available to fix issues in advance of problems**
- ★ **Has built-in intelligence to determine whether to allow specific remote capabilities to be run**
  - ☞ Identify specific functions that can be executed during specific equipment states
- ★ **Permit using enabling audio-visual capabilities such as video collaboration**
  - ☞ Enable remote experts to view/diagnose the equipment or its sub-assemblies in real time



Remote monitoring  
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Remote de-bugging/fix  
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Model tool behavior



**Supplier A Main Office**



Remote monitoring  
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**Supplier B Main Office**

# Remote Diagnostics is Essential to Improve Equipment Productivity

## ★ Problem Statement:

- ☞ Mean time to repair equipment is high due to long time (80% of resolution time) to diagnose issues (high equipment complexity and low support expertise at factories)

## ★ Key Objectives:

- ☞ Reduce time to resolve equipment process or reliability issues.
- ☞ Improve support efficiency and reduce cost by allowing supplier's to service equipment remotely from their field service centers

## ★ Tactics:

- ☞ Leverage supplier expertise to resolve factory issues from personnel at their service and design centers
- ☞ With access to factory equipment from their service and design centers,, suppliers can more easily apply design changes based on knowledge acquired
- ☞ Leverage mainstream computing technology to attract richer depth of technical experts

## ★ Remote Equipment Diagnostics Defined:

- ☞ Capability for a supplier field service engineer to access factory equipment from outside the IC maker's factory (e.g., their field service centers) via a network or modem connection. Access includes ability to remotely monitor, configure, and control equipment.

# Remote Equipment Diagnostics is Essential to Improving Support Productivity

## ★ Key Capabilities (Rev 0 for discussion)

- ☞ **Equipment diagnostic data is accessible via remote access capabilities**
  - Data is used to detect issues or comprehend when the tool is running normally by the supplier's service experts
- ☞ **Equipment is remotely configurable for initial setup or to resolve issues**
- ☞ **Preventative maintenance utilities to fix equipment issues in advance before equipment stops working properly**
- ☞ **Equipment has built-in intelligence to determine when to allow specific remote capabilities to be run. Identify specific functions that can be executed during specific equipment states**
- ☞ **Use video collaboration techniques to allow remote experts to be able to view the equipment real-time**

## ★ Barriers to Implementation

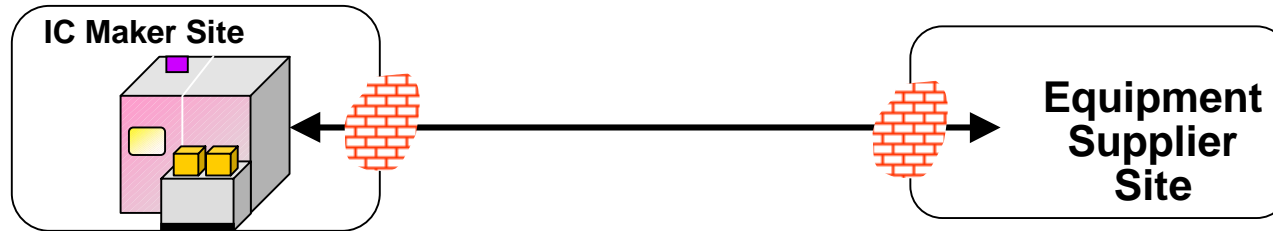
- ☞ **Security concerns by IC makers, Equipment Suppliers, other subcontractors**
- ☞ **Lack of IC maker and supplier infrastructure to implement remote diagnostics**
- ☞ **Lack of diagnostic capabilities on embedded controllers**
- ☞ **Cost -> ensuring "right" level of diagnostics capability is implemented to reduce cost of ownership longer term**

## ★ Not a substitute for ensuring good equipment design!!

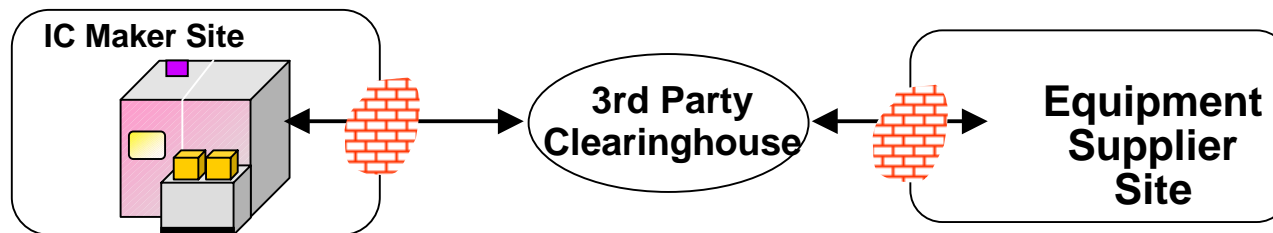
# Data Distribution

## ★ Two basic concepts are being discussed

☞ Equipment data directly from IC maker factory to supplier site



☞ Equipment data from IC factory to clearinghouse to supplier site



★ No industry consensus on benefits or liabilities of either approach

★ ISMT Working Group to evaluate these (and other) options after basic security, connectivity, and capability guidelines and standards are in place

# ISMT e-Manufacturing Roadmap

2000

2001

