



e-Diagnostics Latest News

www.sematech.org/public/resources/ediag/index.htm

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e-Diagnostics Vision

Why e-Diagnostics?

- Significant reduction in Repair Time = higher Availability = Increased Output.
- Significant reduction in the time it takes to qualify a new tool.
- Anticipate problems before they occur.
- Provide data to support continuous improvement and new product development.

Internet

- Mainstream Computing Technologies
- Open Architectures

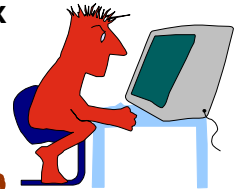
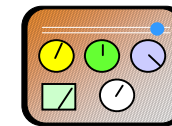
Protocol Options

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

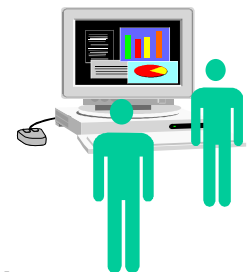
Firewall & Authentication

- Data Security
- Safety Infrastructure

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



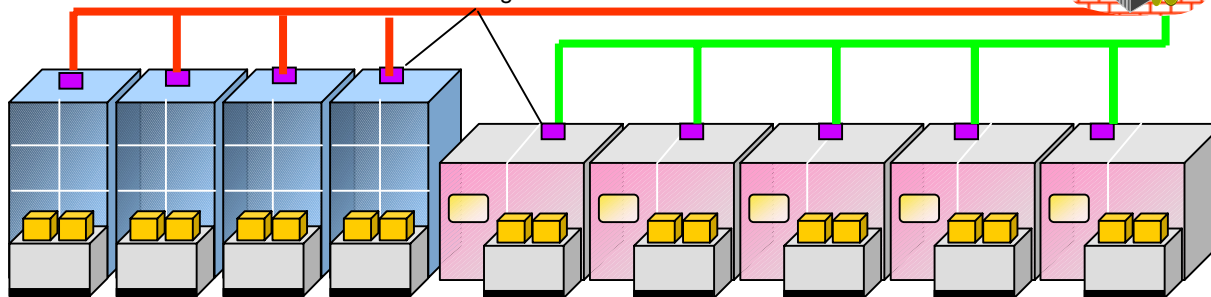
Supplier A Main Office



Remote monitoring
Remote diagnostics
Remote de-bugging/fix
Remote sensing
Model tool behavior
Supplier B Main Office

Factory floor

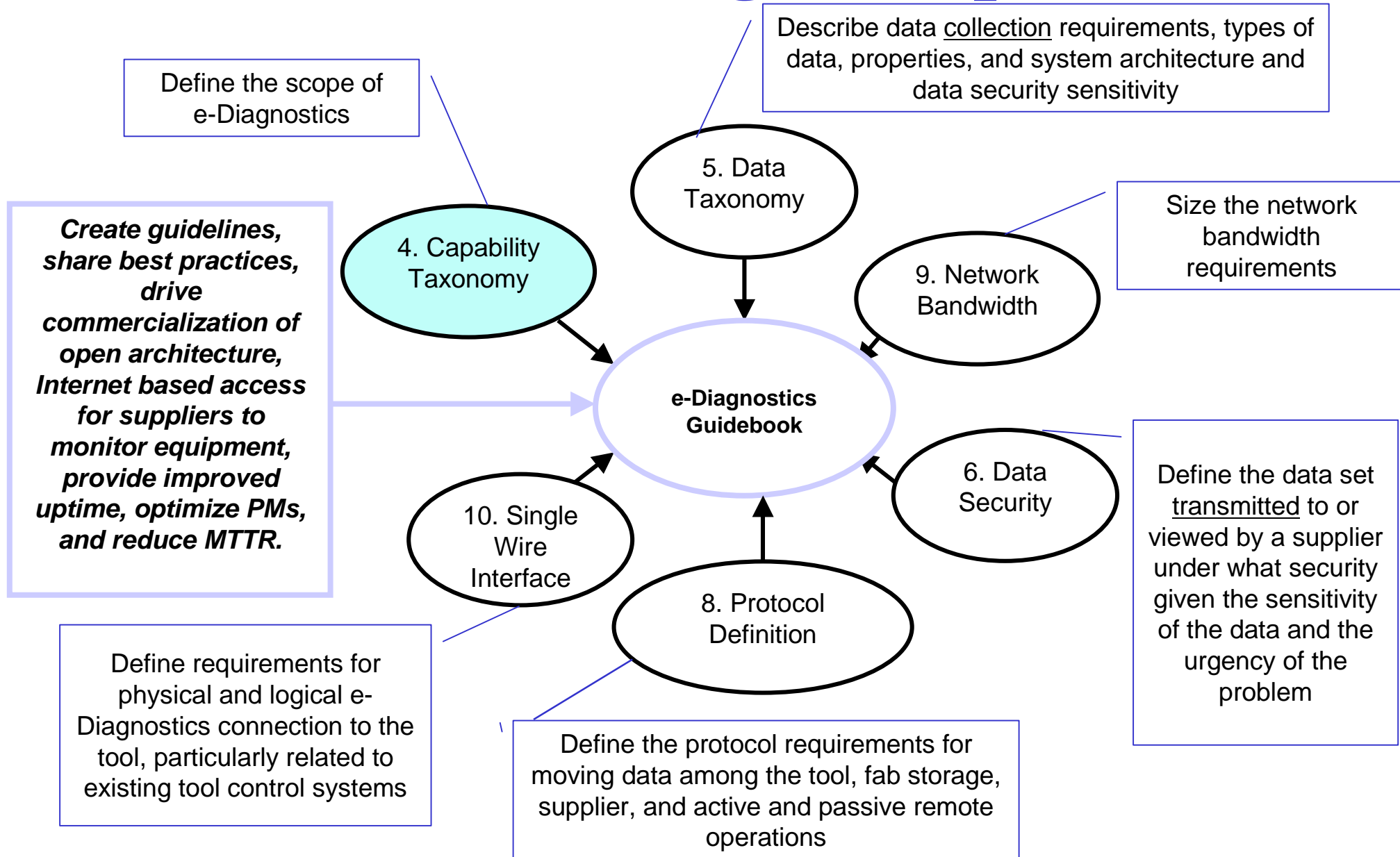
e-Diagnostic enabled Controllers



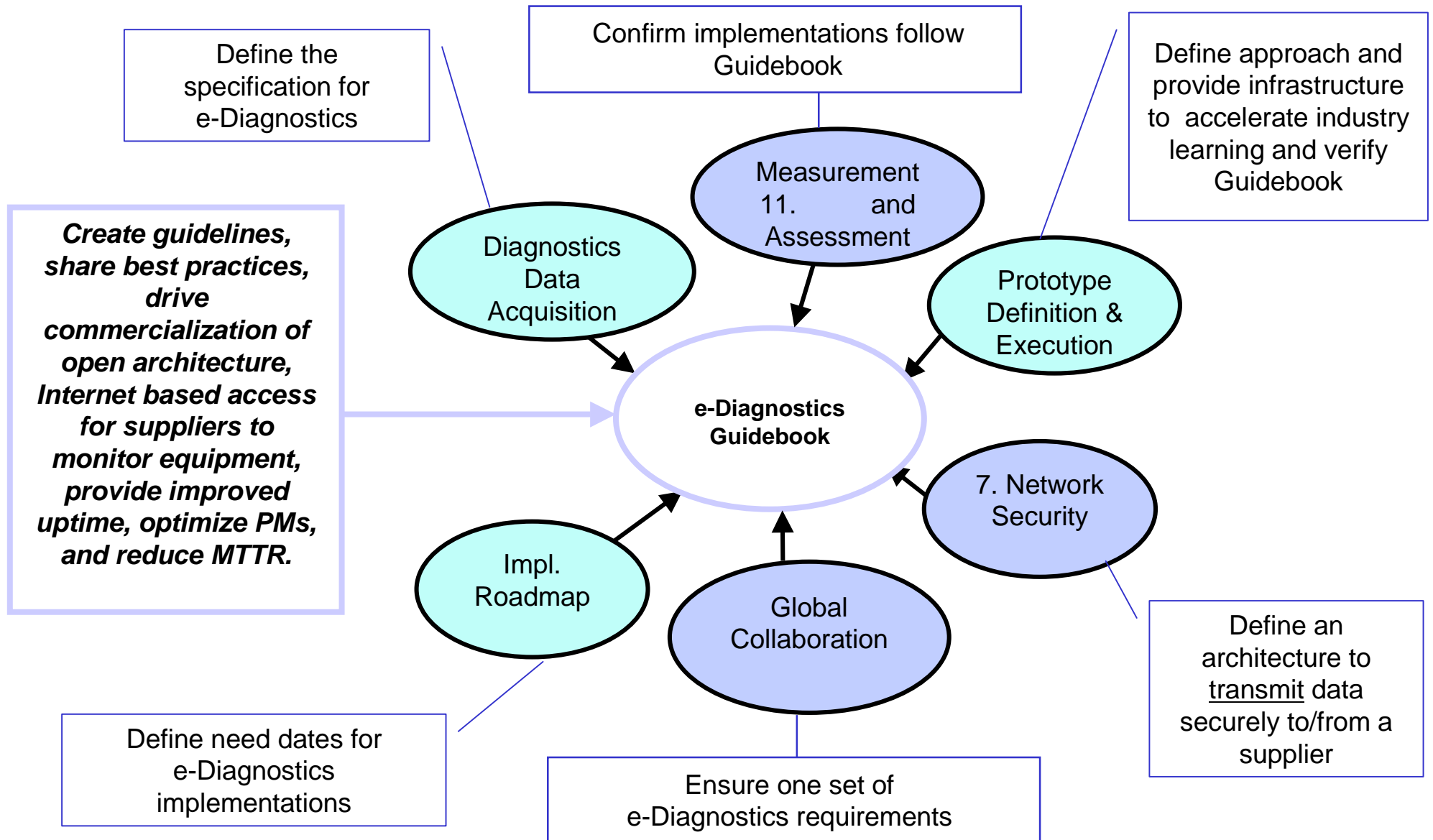
Equipment A

Equipment B

How do the Working Groups fit?



How do the Working Groups fit?



ISMT e-Diagnostic Capability Definitions

Level 3 - Prediction:

Predictive Maintenance, Self
Diagnostics, Automated Notification

Level 2 - Analysis:

Automated Reporting and Advanced
Analysis with SPC capability

Level 1 - Collection and Control:

Remote Tool Operation, Remote Performance Monitoring,
Remote Equipment Configuration

Level 0 - Access and Remote Collaboration:

___ Remote connectivity to the tool and remote collaboration
capabilities (text, audio, video), **Field service access**

Full capability definition document available at:

<http://www.semtech.org/public/resources/ediag/index.htm>

e-Diagnostics: from Defacto to SEMI Standard

- **Charter:** Provide data acquisition interface to semiconductor equipment supporting the diagnosis of equipment health issues
 - ✓ SECS gap analysis - White Paper available
 - ✓ Standards/Information Model gap analysis
- **Scope:** What should be expected of the equipment interface in order to support e-Diagnostics objectives?
 - Do the current SEMI equipment software standards support these objectives?
 - If not, what is the best approach for closing?
 - Require implementation of existing standards
 - Modify existing standards
 - Create new standards

Guidelines accelerate standards creation

SECS Gap Findings

- **e-Diagnostics includes two fundamental requirements regarding data collection**
 - Ability to collect data in near-real-time independent of the control relationship between the host and the equipment
 - Preservation of a single point of equipment control (data collection clients must not be able to affect or control processing)
- **The SECS communication technology can not currently provide a mechanism for guaranteeing a single point of control in a multi-client environment**
 - SECS-I can not reasonably support multiple clients
 - HSMS *can* technically support multiple clients, but...
 - Once two HSMS clients have connected with the equipment, there are no facilities in the communication stack (TCP/HSMS/SECS-II) to distinguish between the two clients, other than by IP address
 - There is no facility in the SEMI standards for establishing communication roles for equipment clients in order to enforce who can/can not send control commands
- **Please read the DDA SECS Gap Analysis document to understand the details of this problem (sematech.org/public/resources/ediag/documents/SECSGap1.0.pdf)**

Information Gap Findings

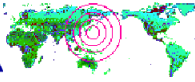
- **In general, much of the steady state contextual information for e-Diagnostics is currently modeled in standards**
 - **Control job, process job, carrier management, substrate tracking**
- **Some information is specified or in the process of being specified, but not currently widely implemented**
 - **Equipment structural (OBEM), utilization (EPT), exception resolution tracking (Exception Management)**
- **Some existing specifications may need modification**
 - **OSS (E39), Exception Management (E53), OBEM (E98), SAN (E54), Substrate Tracking (E90)**
- **Some needs are not explicitly modeled at all**
 - **Diagnostic tests and results, recipe success results, control system software version management**

DDA Status

- **Team reviewed gaps in current standards, identified steps to close**
 - **Adoption of E98 (OBEM) structural model**
 - **Modifications to E39 (OSS), E53 (Evt. Mgmt.), E54 (Sensorbus), and E98 (OBEM)**
 - Team will document needs and present to active TF's for resolution
 - **Development of “big picture” guide to describe pertinent standards, migration options, technology issues, etc.**
 - **Development of authentication/authorization spec**
 - **Development of diagnostics information model spec**
- **Will establish consistency between**
 - **Equipment structural model (E98)**
 - **Data collection ‘plans’ (E98, E53, RAP)**
 - **Jobs (E40, E97)**
 - **Recipes (RAP)**

DDA Summary

- **DDA will be drafting a SEMI guide to provide “the big picture” and address migration, phasing, and requirements/compliance issues**
- **Pursuing multiple e-Diagnostics data collection paths**
 - Existing standards will be modified
 - Currently unimplemented standards will become required
 - New standards may be drafted
- **DDA would like to produce a single interface technology to support these needs**
 - Would like to take advantage of XML-based technologies



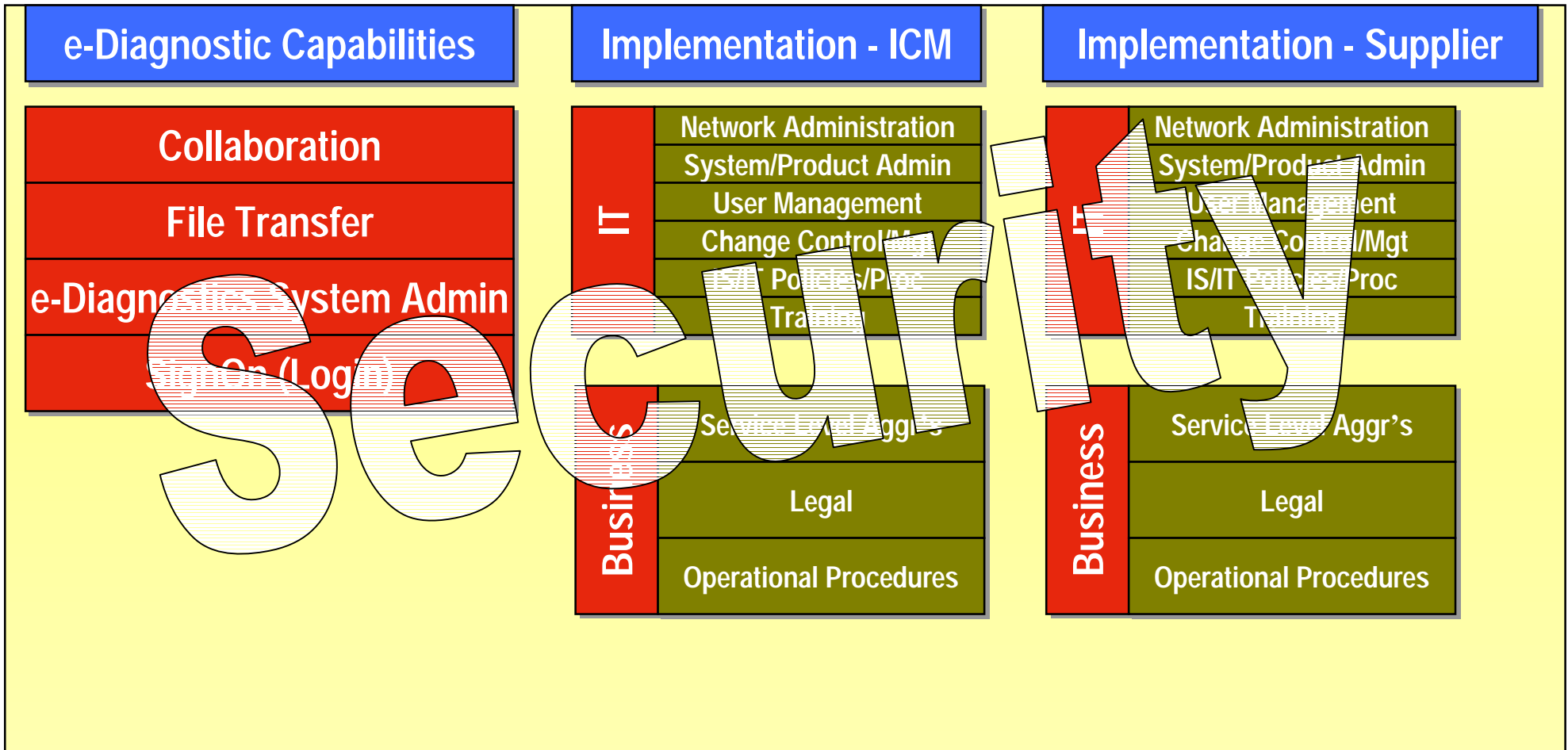
Measurement & Assessment Team Goals

- **Define the process and mechanisms by which IC Makers and Suppliers can assess guideline compliance of e-Diagnostics solutions**
- **Keep the compliance metrics or scorecards as simple as practical**
- **Define opportunities for shared understanding between IC Makers and e-Diagnostics Suppliers**

M&A Sub-team Guidelines/Principles

- Assessment metrics based on e-Diagnostics Capability definitions & Use Case scenarios**
- Pass/Fail scorecards to assess tangible parts of e-Diagnostics solutions with compliance requirements**
 - Factory Tool and e-Diagnostics Server(s)**
 - Security aspects of solutions**
- Provide specific guidance to IC Maker/Supplier pairs as they plan for and implement specific solutions**
 - e-Diagnostics Capability, IC Maker, and Supplier Implementation Scorecards**

e-Diagnostics Checklist Structure



e-Diagnostics Checklist Details

Compliance Element Code

Capability Description

Area of Focus

Compliance Element Code

Mandatory

Optional

Feature

Feature Description

Area of Focus	Compliance Element Code	Mandatory	Optional	Feature	Feature Description
Collaboration	TS-CL0.8			<ul style="list-style-type: none"> Voice transmission 	Ability to provide Voice over IP between the ICM and Supplier during a collaboration session.
				Video transmission	Ability to provide streaming video between the ICM and Supplier during a collaboration session.
				Still image capture	Ability to exchange still images between ICM and Supplier during a collaboration session.
	TS-CL0.5			<ul style="list-style-type: none"> Real-time white board drawing 	Ability to provide basic "white board" capability between ICM and Supplier during a collaboration session.
	TS-CL0.4			<ul style="list-style-type: none"> Real-time application sharing 	Ability to share applications necessary for collaboration. Does not include remote administration or remote tool control applications covered in Capability Level 1.
	TS-CL0.3			<ul style="list-style-type: none"> Chat Capability 	Ability to support multi user Text Chat sessions among all ICM and Supplier participants during a collaboration session.
	TS-CL0.2				If conferencing is available, the eDiagnostic system must provide the mechanisms to ensure that only authorized personnel have access into the secure conference.
	TS-CL0.1				The Collaboration technologies used must be agreed upon between IC Maker and supplier. This includes Data, Voice, and Video.

Area of focus

Feature Requirement

e-Diagnostics Capability, Level 0

Area of Focus

Collaboration

Compliance Element Code	Mandatory	Optional	Feature	Feature Description
TS-CL0.8	●		Voice transmission	Ability to provide Voice over IP between the ICM and Supplier during a collaboration session.
TS-CL0.7	●		Video transmission	Ability to provide streaming video between the ICM and Supplier during a collaboration session.
TS-CL0.6	●		Still image capture	Ability to exchange still images between ICM and Supplier during a collaboration session.
TS-CL0.5	●		Real-time white board drawing	Ability to provide basic "white board" capability between ICM and Supplier during a collaboration session.
TS-CL0.4	●		Real-time application sharing	Ability to share applications necessary for collaboration. Does not include remote administration or remote tool control applications covered in Capability Level 1.
TS-CL0.3	●		Chat Capability	Ability to support multi user Text Chat sessions among all ICM and Supplier participants during a collaboration session.
TS-CL0.2	●		Secure Conferencing	If conferencing is available, the eDiagnostic system must provide the mechanisms to ensure that only authorized personnel have access into the secure conference.
TS-CL0.1	●		Technologies	The Collaboration technologies used must be agreed upon between IC Maker and supplier. This includes Data, Voice, and Video.

e-Diagnostics Capability, Level 0

File Transfer	TS-FT0.4	●	Dynamically authorize files for transfer	The ability to request and grant permission to transfer files not on the pre authorized list.
	TS-FT0.3	●	Pre-authorized File Transfer	The ability to provide certain users with the capability to transfer pre-authorized files without requiring permission for each instance.
	TS-FT0.2	●	Two Step File Transfer-To Tool	File uploads are done in two steps ending in a pre-defined staging area on the tool. Executing or incorporating files must be done by a separate procedure. Every transfer is recorded, including what was transferred and who did it.
	TS-FT0.1	●	Two step file transfer-From Tool	File transfer is done in two steps, tool-server-user. There is no direct access to the tool. Every transfer is recorded including what was transferred and who did it.
e-Diagnostics System Administration	TS-AD0.3	●	Network Performance Management	The e-Diagnostics system shall provide Network Performance Management (potentially via the Application Layer) to stay within acceptable network limits. Network performance includes bandwidth and latency.
	TS-AD0.2	●	e-Diagnostics Administration Capabilities	The e-Diagnostics System administration capabilities must include User and Server Management capabilities. It should also include Vendor Tool management as well as e-Diagnostics Network management where necessary.
	TS-AD0.1	●	Remote Admin of e-Diagnostics Server	The e-Diagnostics system must have the capability for secure and controlled administration across the wire. The security to control access for admin needs special consideration vs. end users.

e-Diagnostics Capability, Level 0

SignOn (Login)

TS-SE0.5	●	Access control mechanisms	The e-Diagnostics System must provide access control mechanisms to provide protection for IC maker and Supplier information, data, applications.
TS-SE0.4	●	Complete Audit Trail of user history within e-Diagnostics environment	A record of users logging in/out of the e-Diagnostics environment as well as actions performed.
TS-SE0.3	●	Authorization within the e-Diagnostics	The user is granted the appropriate capabilities or privileges based on role and policies within the e-Diagnostics System.
TS-SE0.2	●	Credentials for the e-Diagnostics System	The e-Diagnostics System must allow for Remote Users credentials to be integrated into the Authentication Subsystem of e-Diagnostics Security System.
TS-SE0.1	●	Centralized access into e-Diagnostics System	All access into the e-Diagnostics System must go through a central point where each user will be properly authenticated and authorized. Access will be denied without successful authentication and authorization.

Integrated Chip Maker Checklist, Level 0, IT

Area of Focus	Compliance Element Code	Mandatory	Optional	Shared Responsibility	Feature	Feature Description
Network Administration	ICM-NA.4	●			Physical Network	Physical network connectivity for Inter Company Networks, e-Diagnostics DMZs & Factory Equipment.
	ICM-NA.3	●			e-Diagnostics DMZs - logical - layer	Public IP addresses assigned with routing configured and documented from DMZ to external and DMZ to internal interfaces.
	ICM-NA.2	●			Network Access Control - logical layer	Access controls (SRC-DEST-PORT) configured and documented for DMZ to external and DMZ to internal interfaces.
	ICM-NA.1		●		Factory network integration of equipment	Integration of the e-Diagnostics network connection with other network connections, such as GEM/SECS, implemented, tested and documented.
System & Product Administration	ICM-SA.3	●	●		e-Diagnostics Servers	System hardware, operating system and e-Diagnostics software installed and configured (hardened) for e-Diagnostics services according to agreed upon procedures.
	ICM-SA.2	●	●		Infrastructure Services	Infrastructure hardware, operating system and software installed and configured (hardened) as required by e-Diagnostics services (Directory, Authentication, Authorization, DNS, Email, HTTP Proxy, etc.) as agreed upon with the supplier.
	ICM-SA.1	●	●		Equipment Computers	Tool hosts/cell controller hardware, operating systems, and software configured and available for e-Diagnostics services.

Integrated Chip Maker Checklist, Level 0, IT

User Management	ICM-UM.4	●	Authentication at Signon	Processes for adding/removing/modifying users to the community of e-Diagnostics users documented and instituted for e-Diagnostics.
	ICM-UM.3	●	Remote User Credentials	Processes for providing or integrating existing user credentials into the authentication system documented and instituted for e-Diagnostics.
	ICM-UM.2	●	Authorization at Signon	Processes for adding role-based and policy based user group profiles documented and instituted for e-Diagnostics.
	ICM-UM.1	●	Equipment Computer Privileges	Processes for user management on the equipment computers are documented and instituted (if necessary).
Change Control	ICM-CC.1	●	Change Control Processes	Change management and control procedures for IT activities (hardware and software) documented and instituted for e-Diagnostics.
	ICM-SPP.5	●	Backups	Secure backup and recovery procedures for e-Diagnostics system components (e.g., keys, intellectual property, etc.) are documented and instituted.
Information Security Policies & Procedures	ICM-SPP.4	●	● Security Incident Handling	Incident handling and escalation procedures documented, instituted and agreed upon with suppliers.
	ICM-SPP.3	●	System Hardening	Processes and procedures for hardening applications and OS (e.g., applying recommended security hot fixes, removal of unnecessary services, etc. as documented in the e-Diagnostics Guidebook) documented, instituted, and agreed upon by suppliers.
	ICM-SPP.2	●	Audit Standards	Security audit items, standards, and procedures are documented and instituted for e-Diagnostics.
	ICM-SPP.1	●	Anti-Virus	Processes and procedures for e-Diagnostics system for compliance within the company wide anti-virus standards and interoperability with e-Diagnostics software.
	ICM-TRN.1	●	Training Plan	Training plans, procedures, and processes are documented and instituted. (Refer to the e-Diagnostics Guidebook for suggested roles, owners, ...).
Training				

Integrated Chip Maker Checklist, Level 0, Business

Service Level Agreements	ICM-SLA.5	●	●	User Management	IC Maker and Supplier shall document responsibility for the User Management processes. (i.e., on-going user admin functions, user credential process, training, and documentation, etc.).
	ICM-SLA.4	●	●	Maintenance and Modifications	IC Maker and Supplier shall document responsibility for the support and maintenance of the e-Diagnostics systems and technology (includes timely notification of patches, fixes, updates, and documentation).
	ICM-SLA.3	●	●	Functional Performance of technology	IC Maker and Supplier shall document their expectations regarding functional performance of the e-Diagnostics systems and the methods of performance measurement.
	ICM-SLA.2	●	●	Availability and Performance of Support	Availability and performance of Service Delivery and Support. (includes response time, coverage hours, tie in to escalation processes, etc.).
	ICM-SLA.1	●	●	Uptime of "systems and technology"	The expected uptime of the e-Diagnostics "systems and technology" will be documented.
Legal	ICM-LGL.2	●	●	Contracts	Contract shall specifically reference e-Diagnostic responsibilities of ICMaker and supplier. (For example, the contract should specify ICMaker's and supplier's responsibilities for specific e-Diagnostic capabilities, authentication, authorization, administrative procedure, etc.)
	ICM-LGL.1	●	●	Equipment data IP	All supplier accessible e-Diagnostic data and the data's security classification mutually identified and agreed upon by the ICMaker and the supplier. The supplier and ICMaker shall agree on processes to maintain data security classification and data management.
Operational Procedures	ICM-OP.4	●	●	e-Diagnostic Operational Guidelines	Rules for requesting and granting use of the e-Diagnostics system are documented and communicated to factory personnel and to suppliers.
	ICM-OP.3	●	●	e-Diagnostic Safety Guidelines	Rules for safe use of the e-Diagnostics system are documented and communicated to both factory and supplier personnel. This includes both general guidelines and tool specific rules.
	ICM-OP.2	●	●	Disaster Recovery	The ICMaker disaster recovery plan is documented and includes the e-Diagnostics system.
	ICM-OP.1	●	●	Auditing	Procedures are documented and instituted for the analysis and communication of e-Diagnostic system security audit findings.

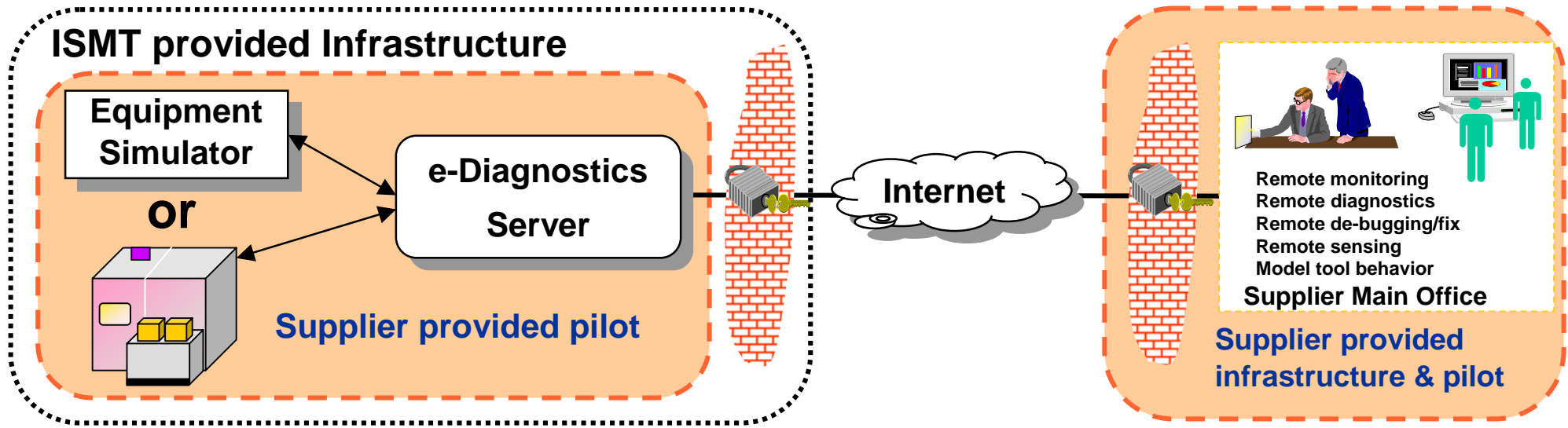
What's Next

- **Dec '01** **Finalize Level 0, Supplier checklist**
- **Dec '01** **Include Level 0 checklist in e-Diagnostics Guidebook**
- **Dec '01** **Standalone checklist on ISMT web site**
- **Jan '01** **Define Level 1 e-Diagnostics Capability Scorecard**
- **Q1 '02** **Define Level 2& 3 e-Diagnostics Capability Scorecard**

Implementation Roadmap

Equipment Type:		Etch	Litho/Track	Implant	Diffusion	Test	Metrology	Wets	CMP	AMHS	Assembly	Facilities	IC Infrastructure
Priority:		a	a	b	b	c	c	d	d	d	e	e	a
LEVEL 0:													
Remote connectivity:													
	Tool connectivity to interim server	Q301	Q301	Q301	Q302	Q301	Q401	Q401	Q401	Q401	Q401	Q102	Q301
	Interim server	Q102	Q102	Q102	Q402	Q102	Q102	Q102	Q102	Q102	Q102	Q102	Q102
	Remote collaboration	Q102	Q102	Q102	Q402	Q102	Q102	Q102	Q102	Q102	Q102	Q102	Q102
LEVEL 1:													
	Remote Performance Monitor	Q102	Q102	Q102	Q402	Q102	Q102	Q102	Q102	Q102	Q102	Q102	Q102
	Data collection/storage	Q102	Q102	Q102	Q402	Q102	Q102	Q102	Q102	Q102	Q102	Q102	Q102
	Remote tool control	Q302	TBD	Q302	Q103	Q302	Q302	Q302	Q302	Q302	Q302	Q302	TBD
LEVEL 2:													
	Automated Reporting (std & ad hoc)	Q102	Q102	Q102	Q402	Q102	Q102	Q102	Q102	Q102	Q102	Q102	Q102
	Advance Analysis w/SPC Cap	Q202	Q202	Q202	Q103	Q202	Q202	Q202	Q202	Q202	Q202	Q202	Q202
LEVEL 3:													
Predictive maintenance/self-diagnosis:													
	On-tool analysis	Q402	Q402	Q402	Q103	Q402	Q402	Q402	Q402	Q402	Q402	Q402	TBD
	Tool data/supplier analysis	Q302	Q302	Q302	Q203	Q302	Q302	Q302	Q302	Q302	Q302	Q302	Q302
	MES/tool data - supplier analysis	Q402	Q402	Q402	Q303	Q402	Q402	Q402	Q402	Q402	Q402	Q402	Q402
	Automated notification	Q202	Q202	Q202	Q103	Q202	Q202	Q202	Q202	Q202	Q202	Q202	Q202

e-Diagnostics Prototype



★ ISMT Provides

- 👉 Network infrastructure, internal firewall, hosts pilot activities, \$\$

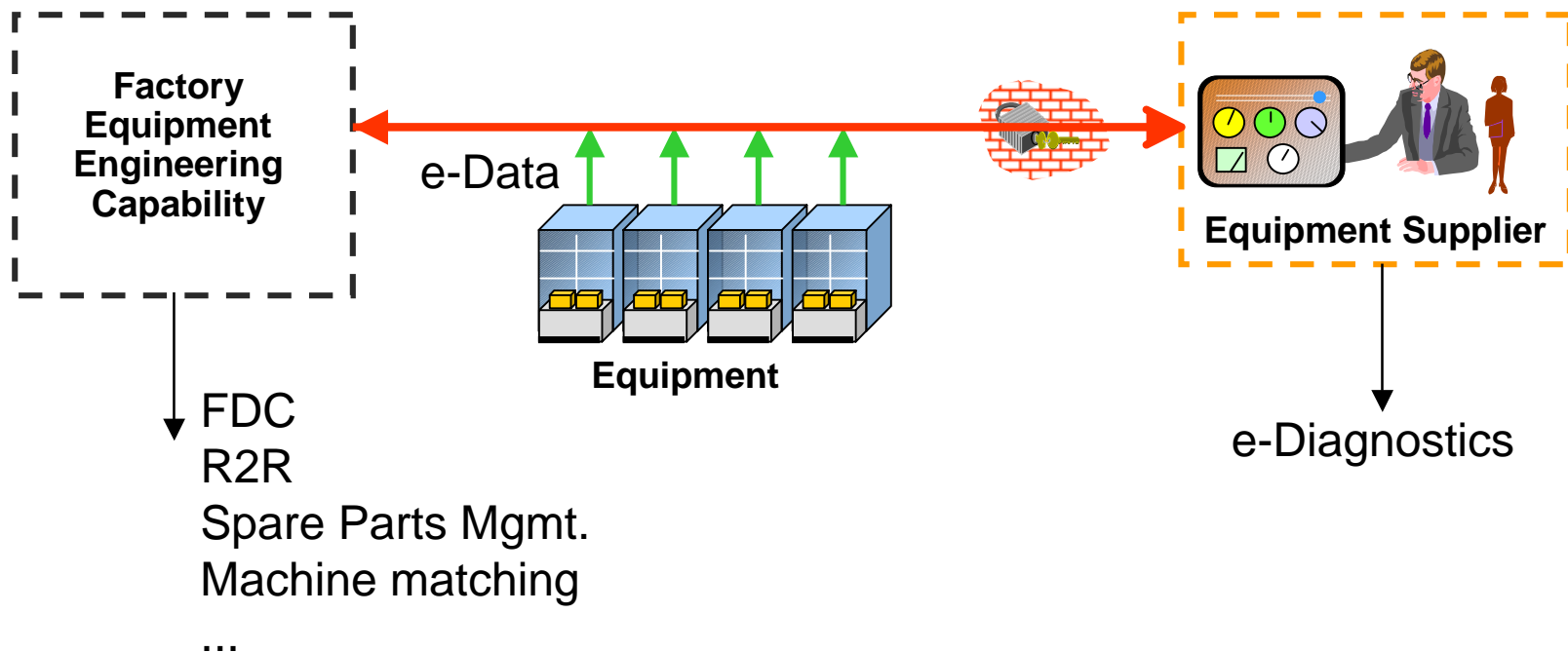
★ Supplier Provides

- 👉 Equipment simulator or tool, e-Diagnostics pilot, remote pilot
- 👉 Must include OEM, but may also include 3rd party

★ e-Diagnostics Working Group provides

- 👉 Prototype (Guidebook) evaluation criteria, evaluation results

e-Diagnostics Leads into EEC and e-Manufacturing



Path to e-Manufacturing

- **Build e-Mfg vision and roadmap consensus**
 - Refine and execute e-Diagnostics and EEC roadmaps
 - Transition guidelines (requirements) to standards
 - Prototype solutions to verify guidelines
 - Confirm data integrity
 - Develop factory “e” migration strategy
- **Continue e-Manufacturing global collaboration**
 - **Workshop - Future SEMICONs and APC Symposiums**

Thanks for your engagement and support!!