

Integrated Equipment Data Collection and Management for Smart Manufacturing

16 March 2018
Cimetrix Incorporated

Outline

- Key messages
- Smart Manufacturing context
- Factory stakeholders
- Equipment model value chain
- SEMI Standards support
- Integrated data management
- Application examples

Key messages

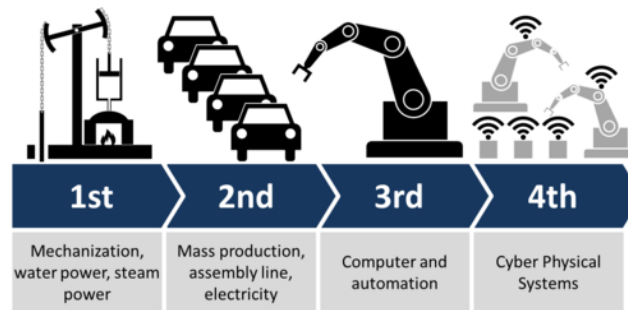


- Stakeholder needs drive all requirements
- Equipment models are key technology
 - Content determines system capability
 - Management tools determine user experience
- Service-oriented architectures enable smooth technology evolution through decoupling
- Current SEMI Standards provide direct support
- Consistent user experience is vital for stakeholder satisfaction and system adoption
- Chinese semiconductor industry is in perfect position to leverage all the above

What is “Smart Manufacturing?”

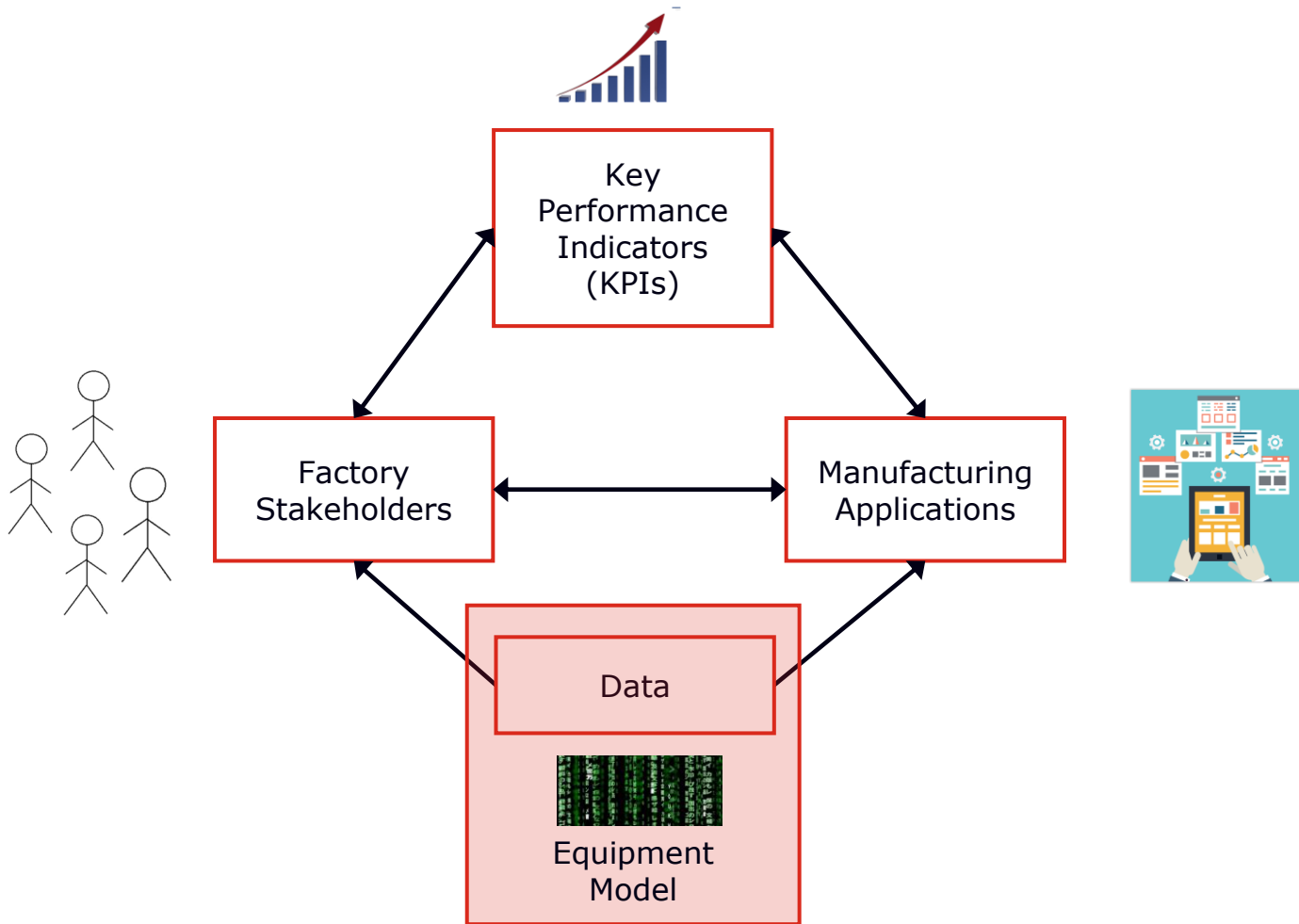
From Industry 4.0 Wikipedia...

- “... cyber-physical systems monitor physical processes, create a *virtual copy of the physical world* and make decentralized decisions.
- Over the Internet of Things, cyber-physical systems *communicate and cooperate* with each other and with humans in real time...”



Factory stakeholders

KPIs, applications, equipment models...



Equipment model value chain

Fundamental concept for application integration

Control Connect Collaborate Visualize Analyze Optimize

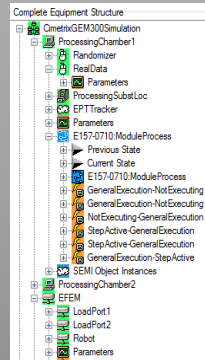
Equipment Components

Equipment Developers

Cimetric Software

Standardized Equipment Models

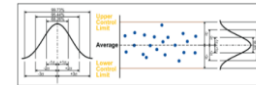
EDA Model (SEMI E164)



Pilot Factory Operations



Process Engineering



High-Volume Factory Ops



KPIs (metrics)

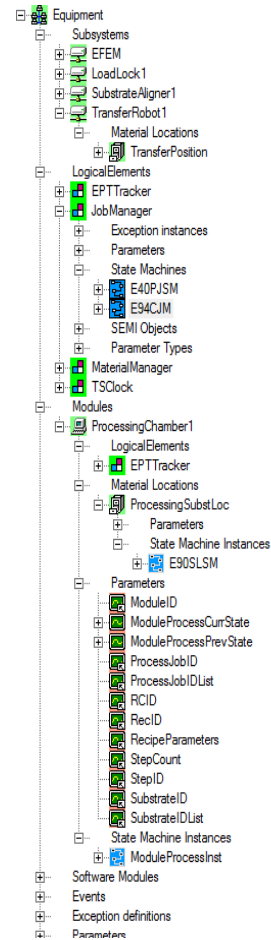
- Time to money
- Yield
- Productivity
- Throughput
- Cycle time
- Capacity
- Scrap rate
- EHS

SEMI Standards support

Why is E164 so important?*

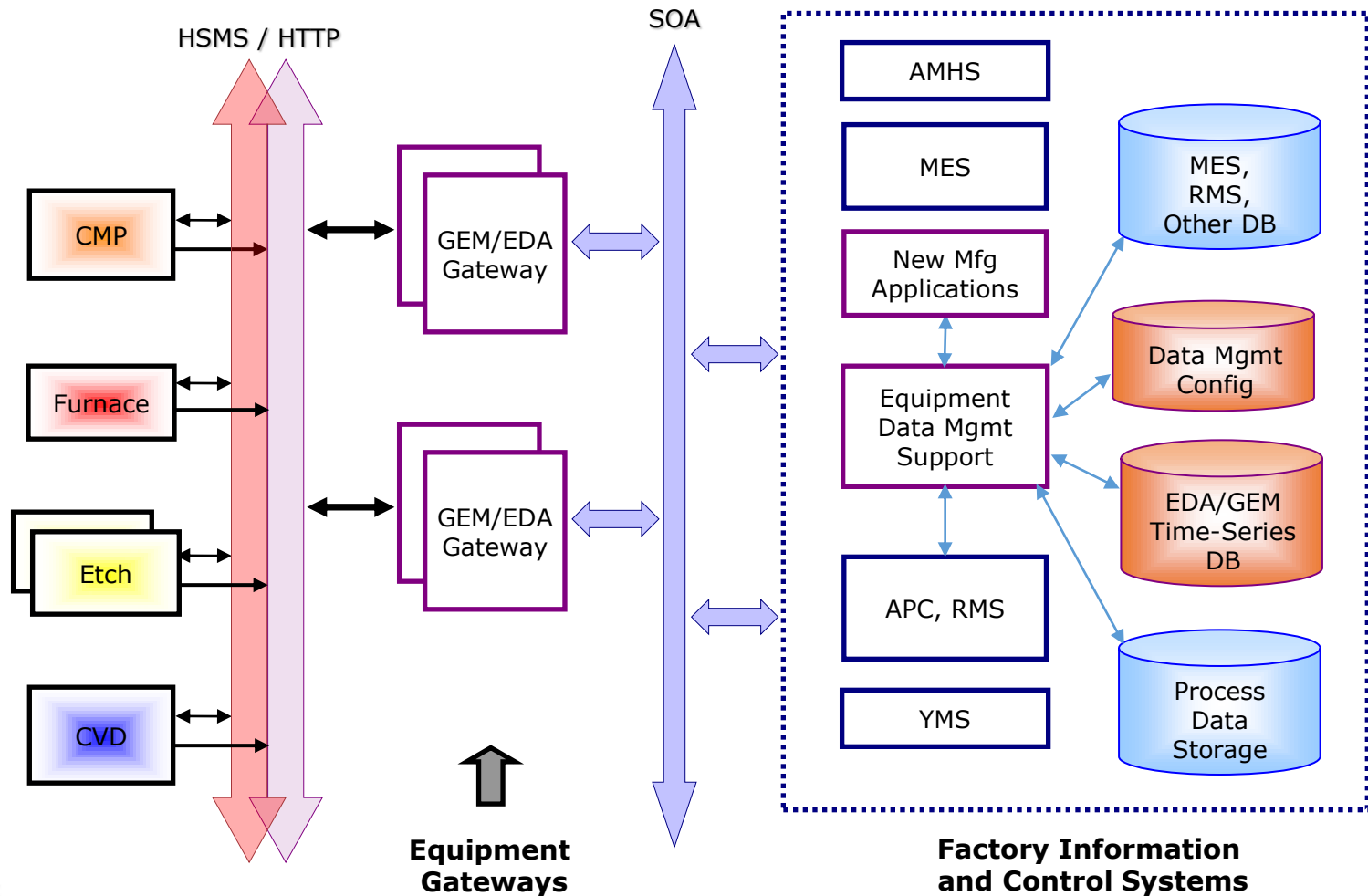
- Consistent implementations of GEM300
- Commonality across equipment types
- Automation of data collection processes
- Less work to interpret collected data
- Enables true “plug and play” applications
- Major increases in engineering efficiency

E164 is to EDA what GEM was to SECS-II



Equipment data management

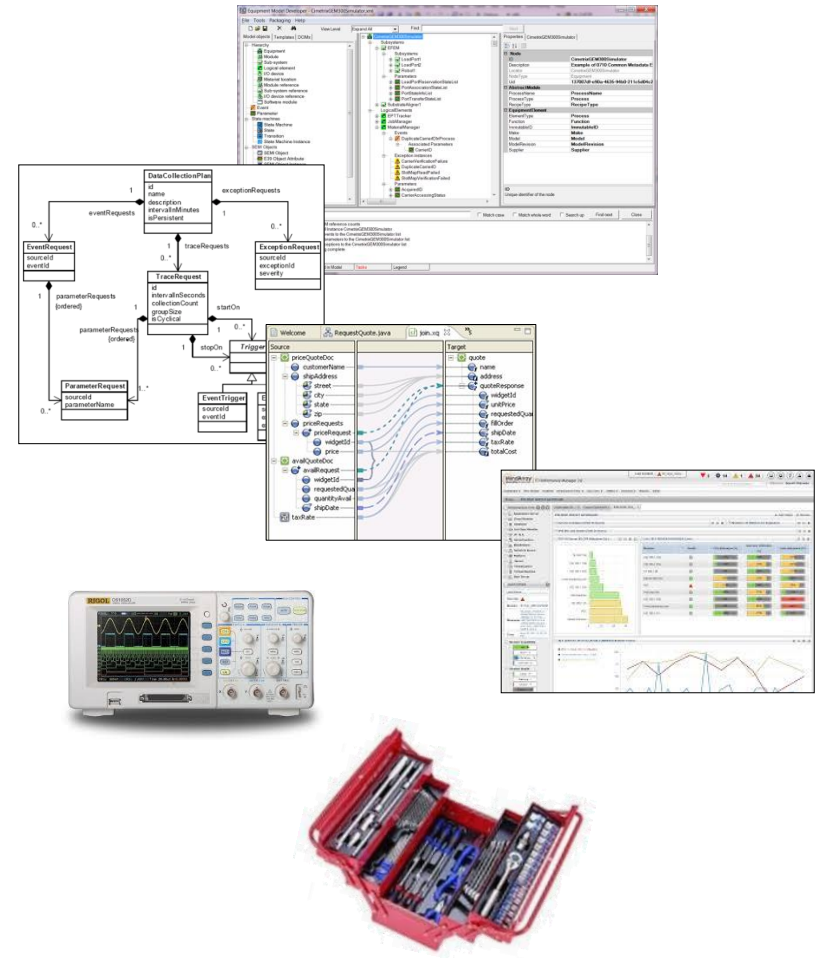
Integrated production system architecture



Equipment data management

Major system components

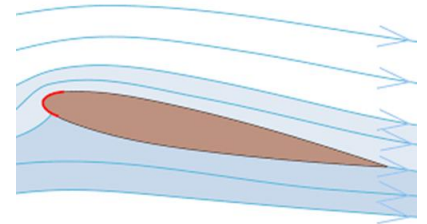
- Model Manager
- Plan Manager
- Equipment Gateway
- Data Mapper
- Data Router
- Data Repository
- Data Scope
- Synchronization Engine
- Performance Monitor
- Administrator Toolkit



New manufacturing applications

Current leading edge

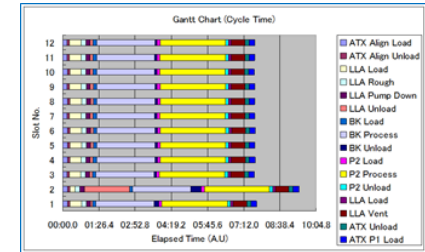
- Real-time throughput monitoring
- Precision FDC feature extraction
- Specialty sensor data access
- Fleet matching and management
- eOCAP execution support
- Sub-fab data integration/analysis
- Automated equipment characterization



Wide range of stakeholder coverage

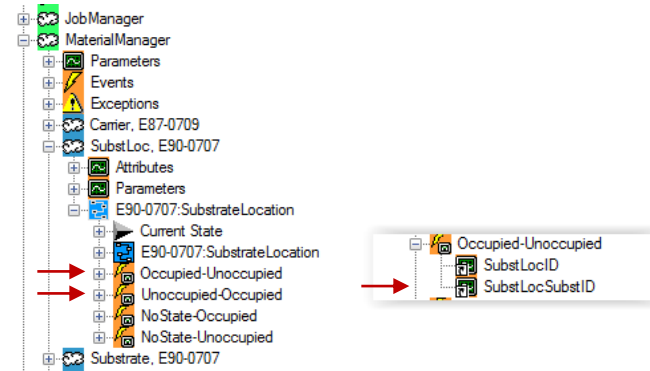
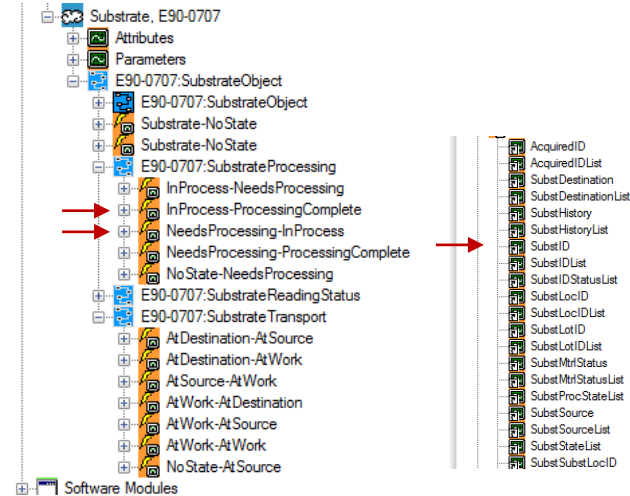
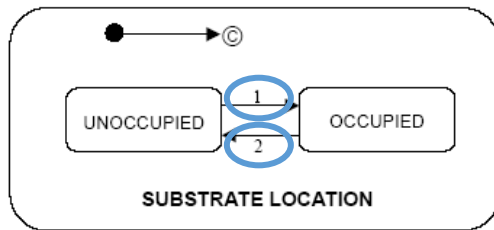
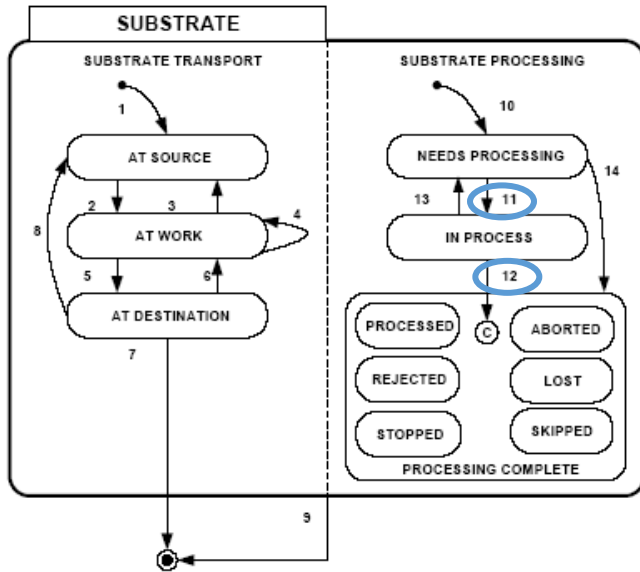
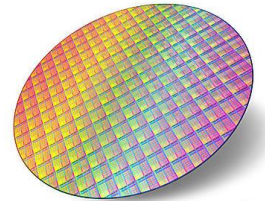
Application example

Real-time throughput monitoring



- Problem statement
 - Monitor bottleneck (e.g., litho) tool throughput performance to know when it drifts away from “normal” for whatever reason
 - This is important because any loss of throughput ripples throughout the line
- Solution components
 - Monitor events and calculate process time “on the fly”
 - Evaluate context to compare “equivalent” runs; flag outliers
- Equipment model leverage
 - Standard material movement and recipe execution events
 - Context available at event occurrence
- Key ROI factors
 - Cycle time, productivity excursion MTTD (50% reduction), equipment throughput improvement (3-5%)

Real-time throughput monitoring SEMI E90 state machines and model



Thank you

- 謝謝
- 감사합니다
- Merci
- Danke
- 多謝
- ありがとうございます
- Gracias