Automation Systems & IT within Intel's High Volume Manufacturing

2006 MIT Manufacturing Summit

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intel

AGENDA

- Intel's Manufacturing Environment
- Automation Drivers/Domains
- Focus Topic: Automated Mat'l Handling
- Focus Topic: Process Control Systems

Environment: Highly Global

Challenge: Deploy CE! IT capabilities across the globe

Manufacturing Environment Vectors

18 month cycles

Global dispersion

Technologies

Affordability

Computing security

Competitive challenges

Automation reliability

Quality expectations

Cost of excursions

Supply chain optimization

Each are drivers as well as opportunities for IT

IT Infrastructure Challenges in Mfg

Environmental vectors are confound by key challenges including…

- Complexity
- Exploitation of security vulnerabilities
- Explosive usage growth of products and services

Equates to continued cost pressures

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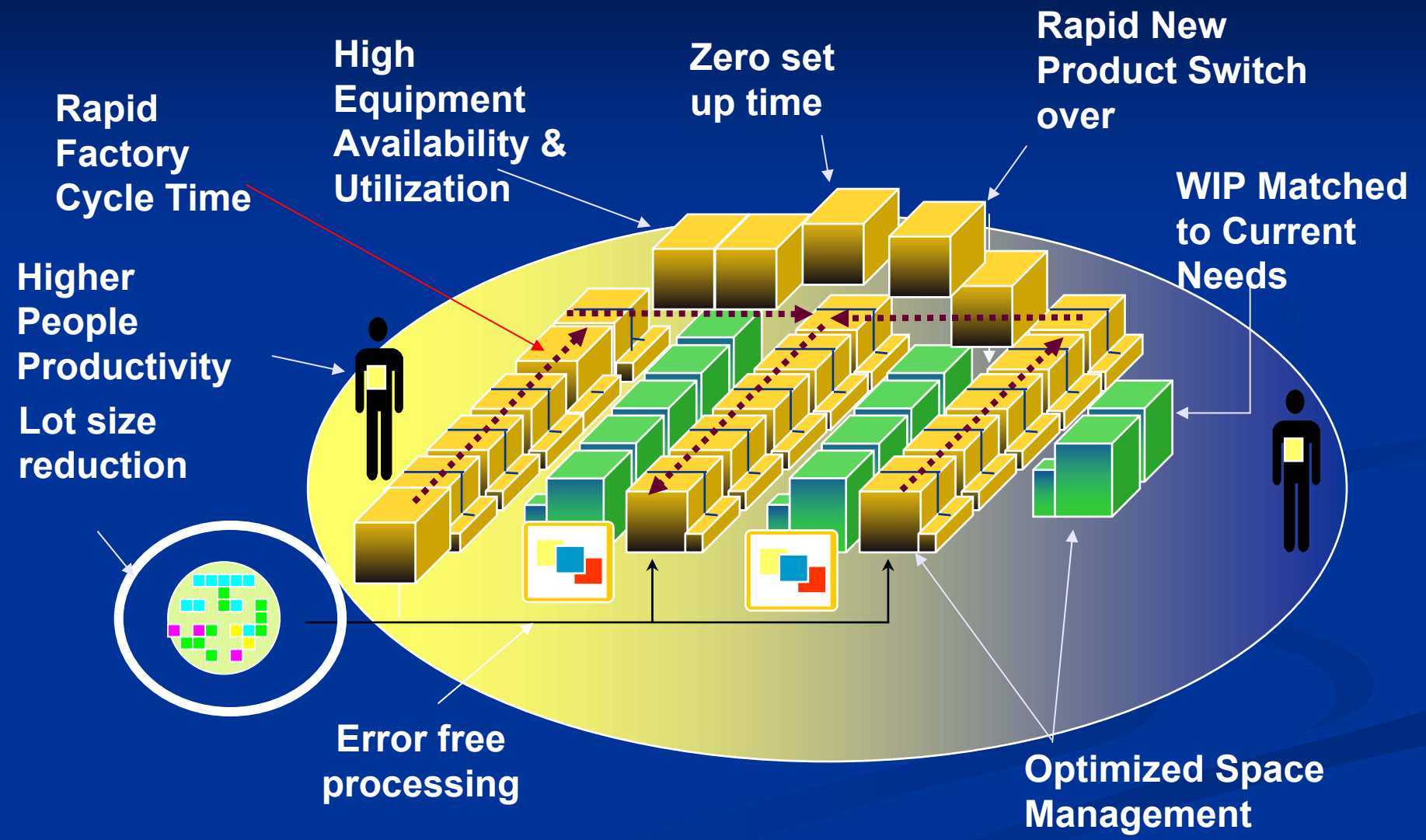
Key Automation Drivers for Mfg



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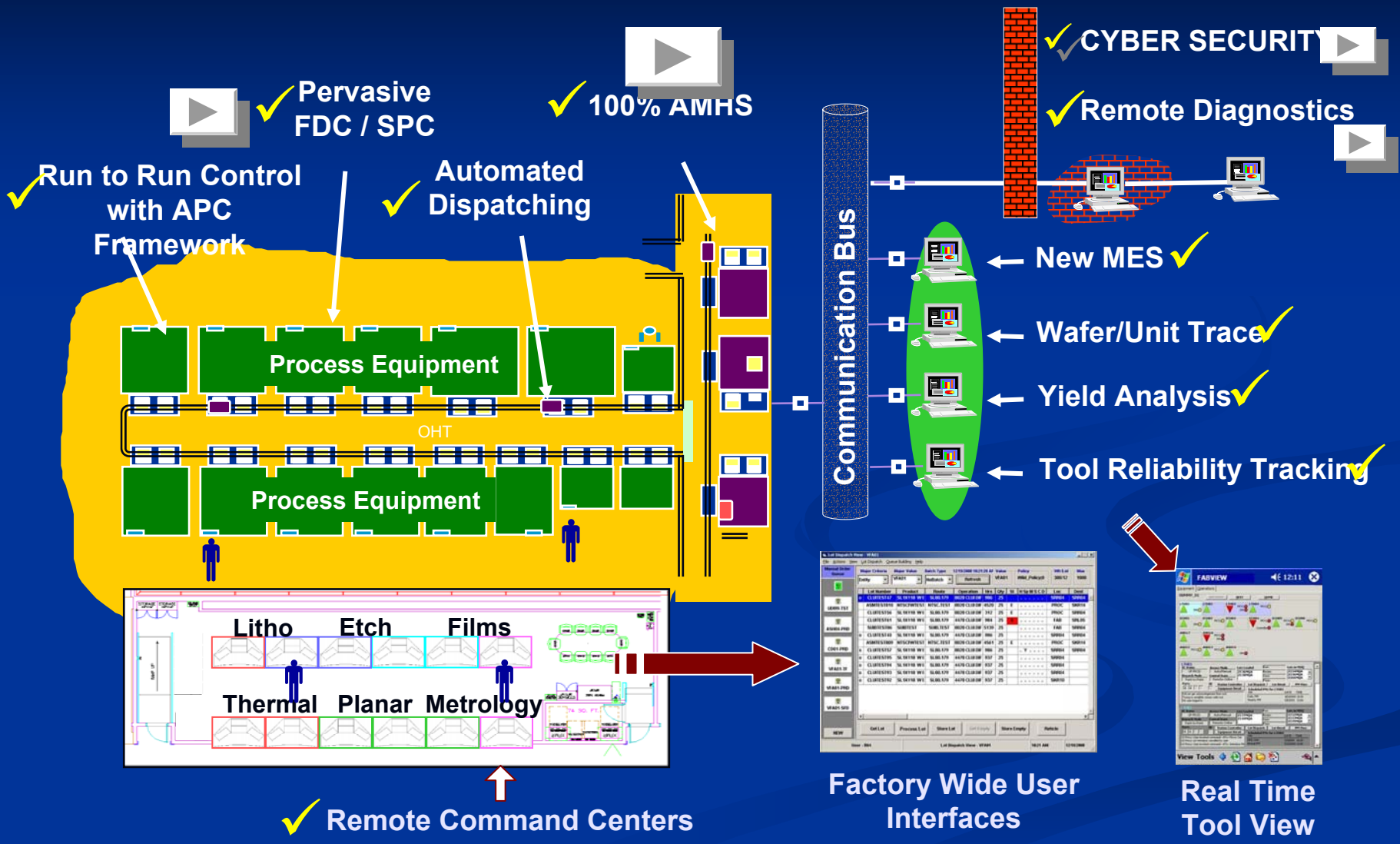
Automation/IT role in 300mm Mfg



AMHS Components

Key Points:

1. Production Equipment standards and capabilities were Critical to achieving 100% Intrabay Automation
2. AMHS Standards enable mix and match of supplier tools to get Best In Class equipment
3. Major time focus was spent integrating software capabilities with Production and AMHS Equipment
4. All in-line process and metrology equipment must be [and has been] connected to the AMHS

Dispatcher | Tracking | System (MES)

300mm Automation – Fully Integrated

Goal: Direct Tool to Tool WIP Movement without human intervention

F11x → 2.6miles of track

Remote Operations Center in F11x

AMHS Summary

- Intel has achieved 100% Integrated Intrabay AMHS in its 300mm Fabs
- 100% integrated intrabay could not have been achieved in the same timeframe without open industry standards
- Rapid throughput AMHS transport systems are needed to meet demanding lot cycle times, fast run rate production equipment, and complex process technology scenarios
- Future capabilities are planned to extend the current technology to fully (near 100%) automated decision making for intrabay scheduling and dispatching

Process Control Systems

- Automated Process Control (On Line)
- Fault Detection Systems (On Line)
- Statistical Process Control Systems (Off Line)

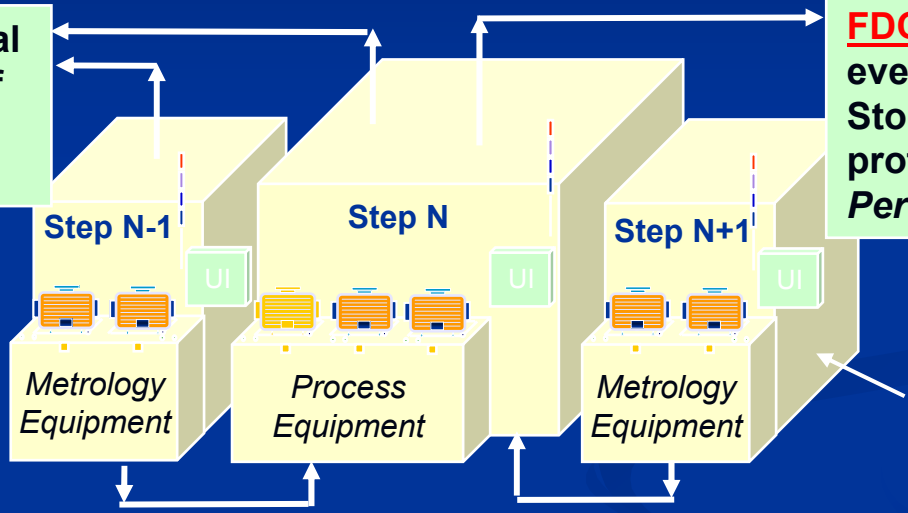
Overview of Process Control Systems

Typical Usage of Process Control at a Process Tool

SPC – Monitor statistical data and stop the tool if trending to OOC
100% of the Fab

FDC – Monitor equipment event and time series data. Stop tool when ranges or profiles are exceeded
Pervasive Implementation

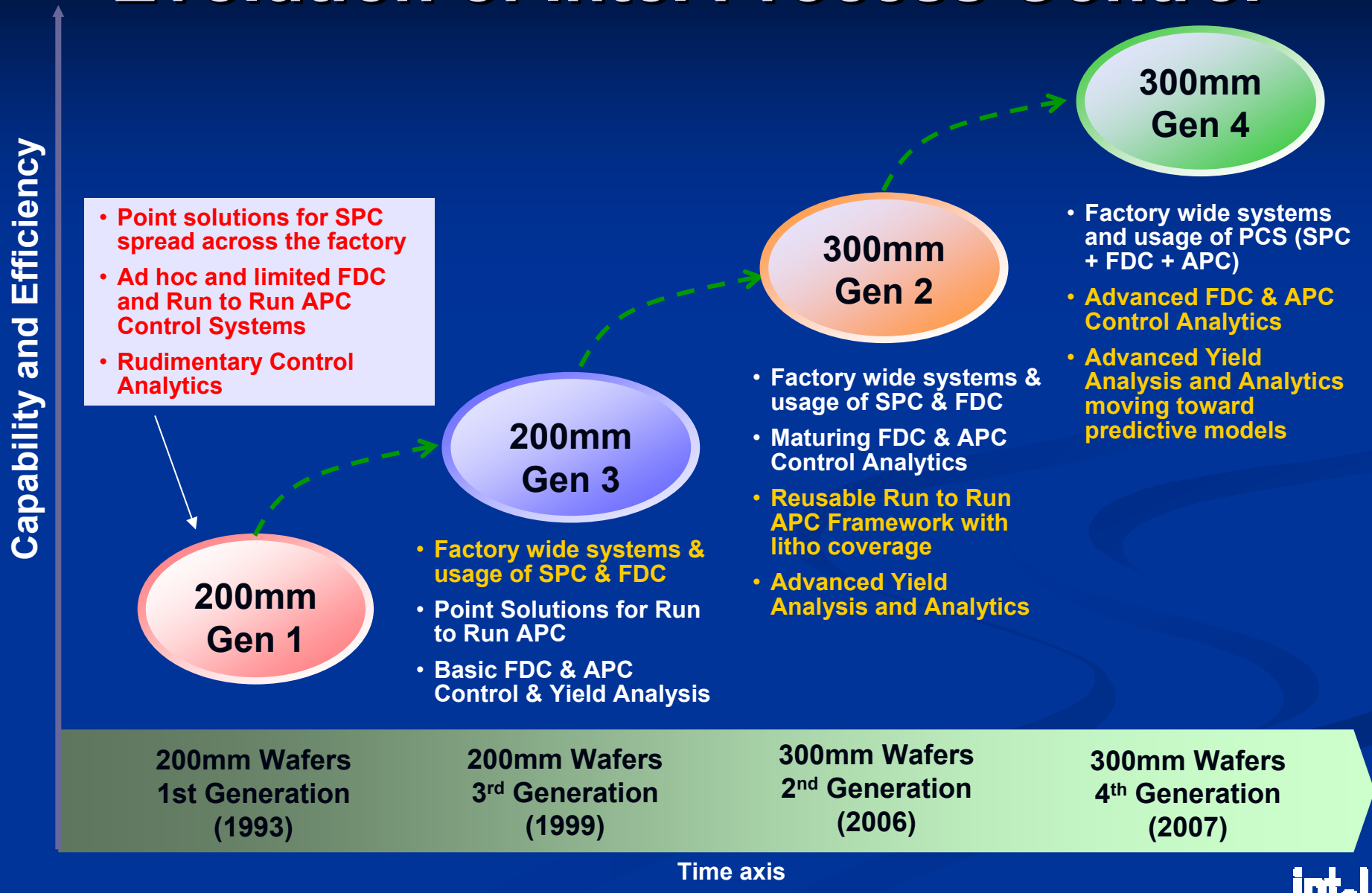
Essential Data standards include SEMI E40, E94, E90 for wafer level control & tracking



Run to Run APC - Use feedback and feed forward metrology and sensor data to adjust processing at the lot and wafer level. Drive for multi-step control.
Various % - Decision is based on problem being solved

Sensors – Use 3rd party and embedded sensors to provide FDC & R2R APC data
Various % - Decision is based on problem being solved

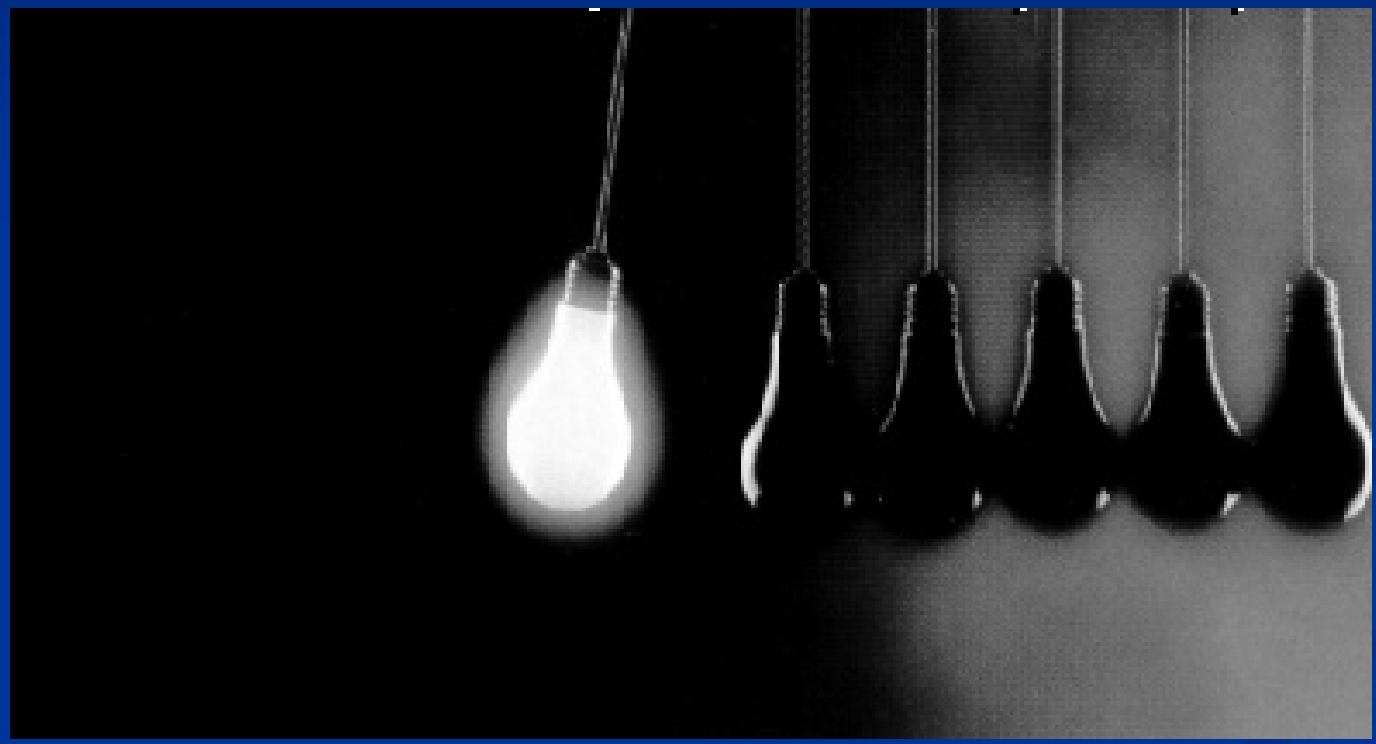
Evolution of Intel Process Control



SUMMARY

- High Volume manufacturing in Semi industry presents many unique challenges
- Advances in AMHS and PCS has been key to addressing some of these challenges
- Continued advances needed in these two areas to keep pace with the “Moore’s law” and rapid pace of the Semi technology

Questions



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