IBM Mask House Tool Automation Strategy

February, 2005

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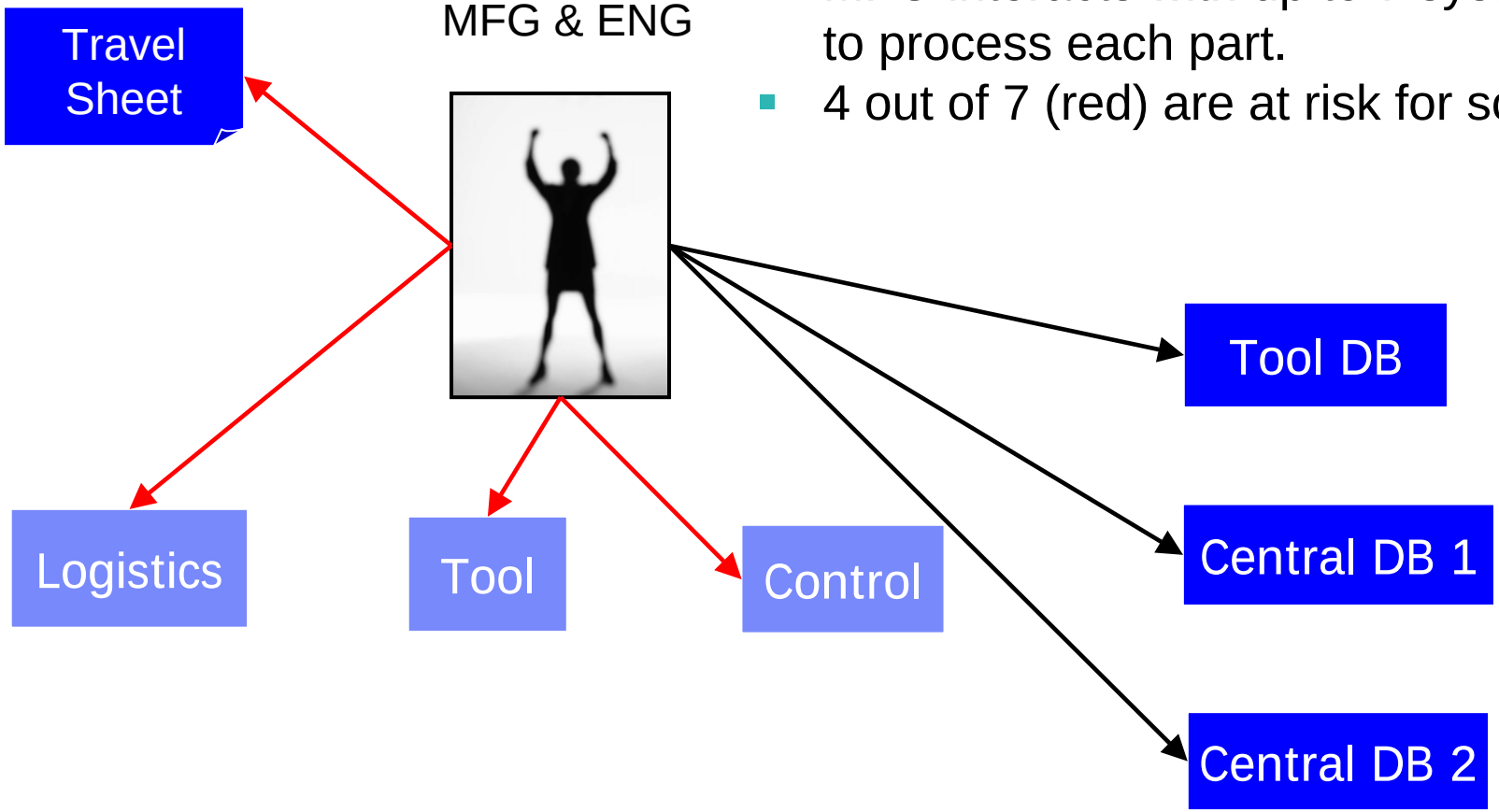
Why is tool automation necessary?

- What does it provide?
  - Remote communication and control of tool operations.
  - Decrease manufacturing complexity.
  - Increase procedural and measurement data accuracy.
    - No manual entry of mask spec or measurement results.
- What is needed?
  - Host communication via SECS/GEM I/II
- What is SECS/GEM?
  - Industry host communication protocol.
    - SEMI standards E30 and E5
  - No customization necessary per tool order.

Automation: Before SECS/GEM

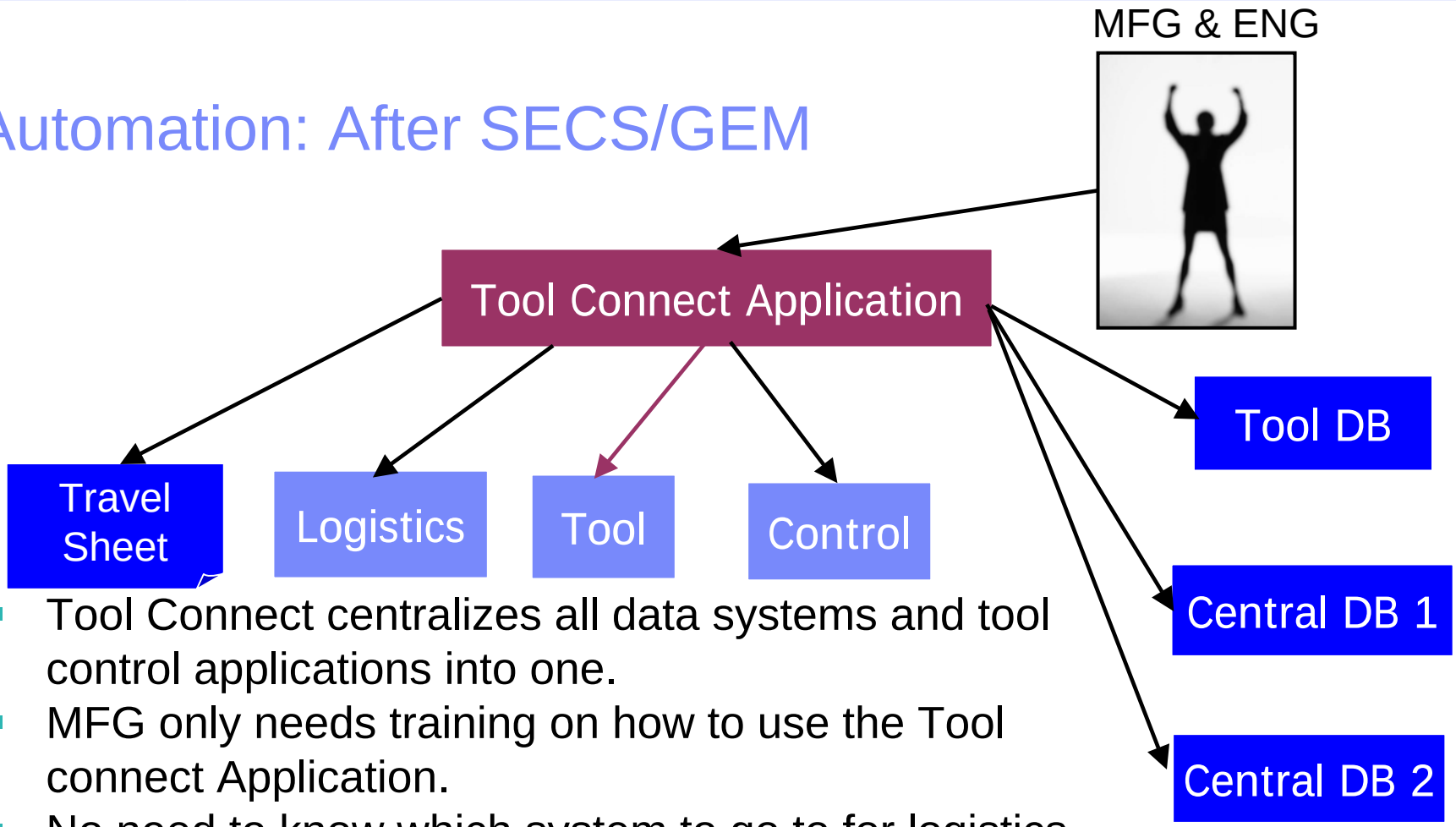


- MFG interacts with up to 7 systems to process each part.
- 4 out of 7 (red) are at risk for scrap.

Recipe Download

- Before SECS/GEM and tool connect
  - Information necessary for recipe selection is written on the travel sheet which accompanies every mask in process.
  - Operators use posting next to the tool to determine the correct recipe to use.
  - Masks scrapped for wrong recipe used due to fat fingers, miss reading of the posting, wrong recipe selection, etc.
- Post SECS/GEM and tool connect implementation
  - Mask identification, Lot ID, enters into logistic system.
  - Logistic system communicates recipe selection information to host.
  - Host selects the correct recipe.
  - Recipe downloaded to tool via tool connect application.

Automation: After SECS/GEM



- Tool Connect centralizes all data systems and tool control applications into one.
- MFG only needs training on how to use the Tool connect Application.
- No need to know which system to go to for logistics, control, etc.
- Tool Connect Application is on the host system.
  - Can be implemented only if tool has SECS/GEM and host communication.

Recipe Download Benefits

- No need for manufacturing to figure out which recipe to use.
- More recipes per tool to improve yield and increase engineering efficiency while conducting experiments.
  - No fear of confusing manufacturing
- No need to print recipe selection information on the travel sheet.
- No recipe posting needed.
- Tool processing data gathered real-time.
  - Models built to monitor tool performance
  - Deviations will inhibit the tool to prevent processing at risk.

Yield and TAT Benefits

- Minimize scrap due to human errors.
- Reliable data for engineering analysis and yield improvement.
- Infrastructure in place for real-time tool & process control
  - Real-time feedback of process data
  - Control model updated real-time to include process and tool drifts
- Minimize masks on hold to engineering
  - Engineering specific recipes are host connected ahead of time.
- Less manufacturing confusion results in less masks on hold.

SECS/GEM: Industry standard

- None of the above is possible without SECS/GEM for tool and host communication.
- Most MASK tool suppliers indicate SECS/GEM is an unique IBM request.
  - Lack of knowledge to the SEMI standards, which are standard for most wafer manufacturing tool sets.
  - 9 out of 10 mask tool suppliers need SECS/GEM education from IBM.
  - Compliance test tend to be overlooked during tool acceptance and qualification.
  - Lack of compliance is considered a software issue that will be resolved at a later day.
  - Risk: delay release to MFG
- All tools must conform to SECS/GEM standard
  - Improves tool connect application development efficiency.
  - Improves support and maintainability.

Summary and Recommendation

- SECS/GEM is the microelectronic industry standard for tool and host communication protocol.
- Every IBM Mask House tool RFQ requires SECS/GEM I/II.
- The seemingly lack of SECS/GEM knowledge causes delays in tool evaluation and acceptance/qualification.
- SECS/GEM is essential for:
  - Manufacturability
  - Real-time tool and process control
  - Paperless mask manufacturing