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EES Capability Implementation Approach for 200mm Tools with Improved Data Resolution

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SystemV Corporation

Brief Introduction of SystemV

- Software Vendor
  - research-and-development type company
  - used to be dedicated in mainly tool controller
  - various SEMI-Std. software packages are also supplied
- has been involved in
  - EES/GEM300 activity since 1999
  - Selete/JEITA e-manufacturing activity since 2000

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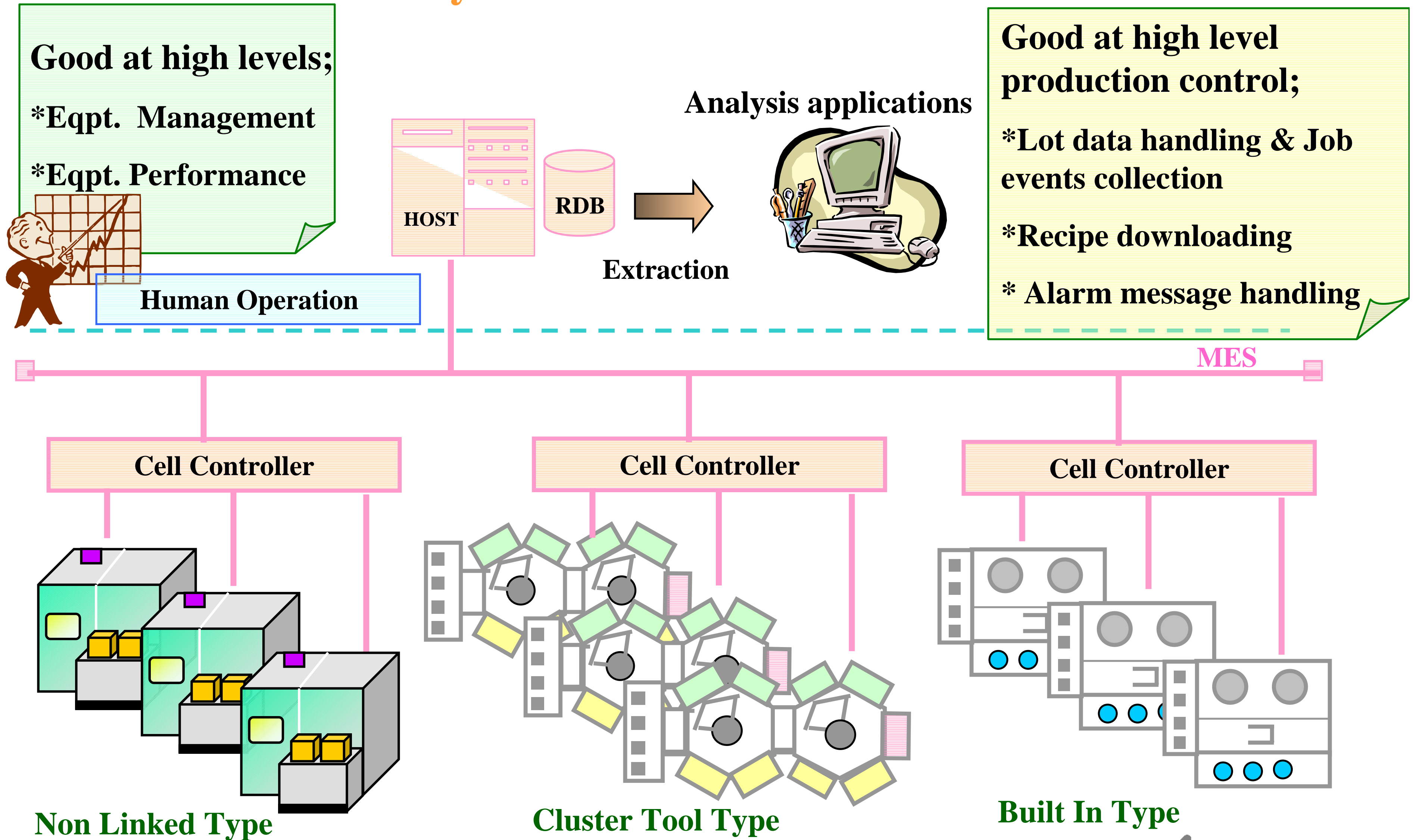
Host System of Current 200mm Fab



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Equipment Engineering Data Needed for EES

Necessary EE Data

- Process settings & measured process parameters
- # of processed wafers, process time
- Alarm events
- Pumping speed/ultimate pressure
- Life monitor of consumables and material
- ☆ Valve operation time
- ☆ Accumulated # of valve operation
- ☆ Wafer transfer time between modules

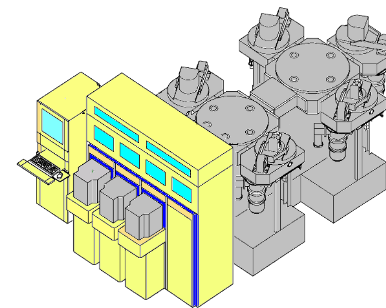
1. Generate/Collect DEE data
2. EE Data per tool group or process step
3. Correlate DEE Data with relevant process data and store accordingly
4. Analyze per purpose

Earlier tool defect detection

Reduction of diagnosis time

Assist to preventive maintenance operation

OEE Up !!



DEE:Detailed Equipment Event

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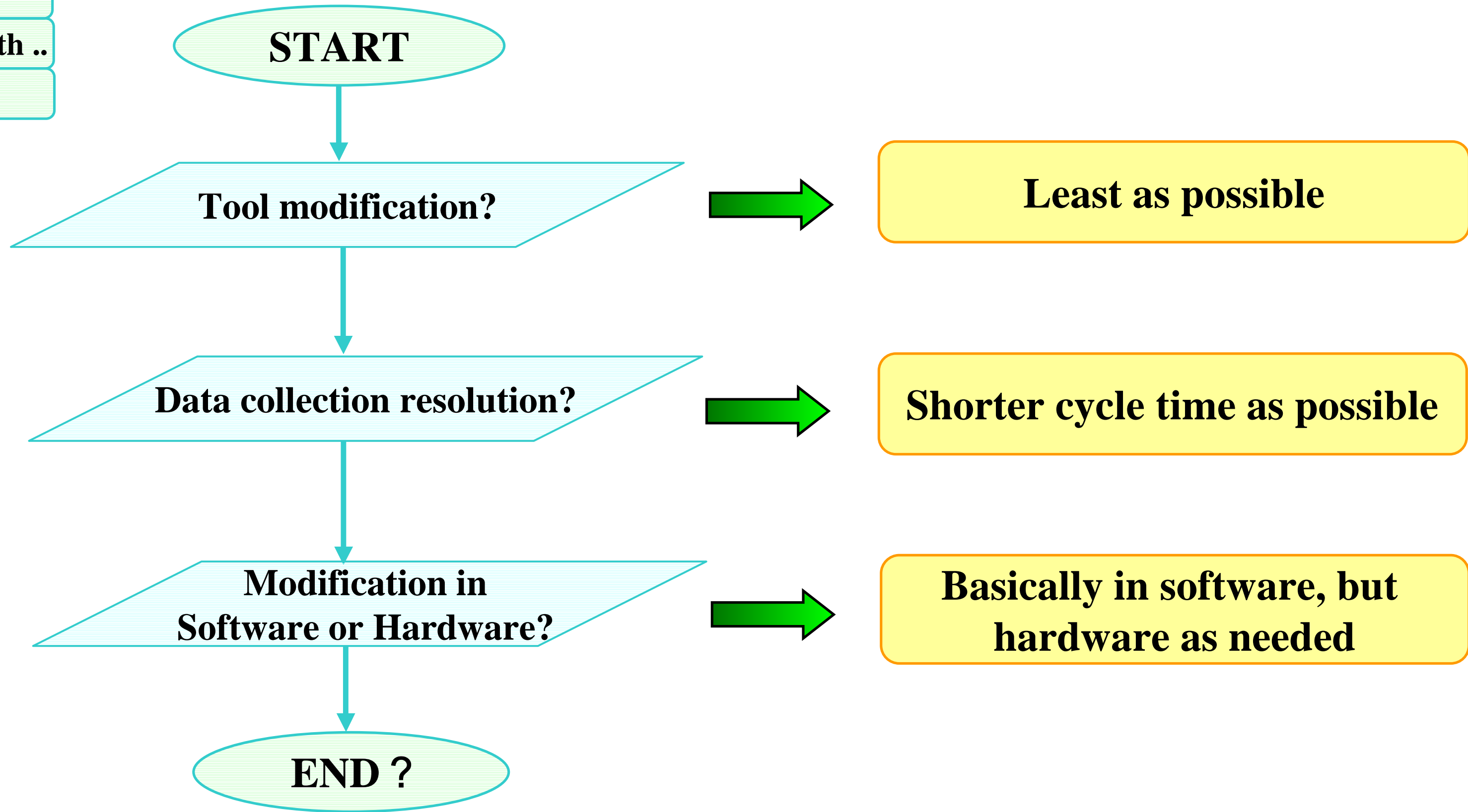
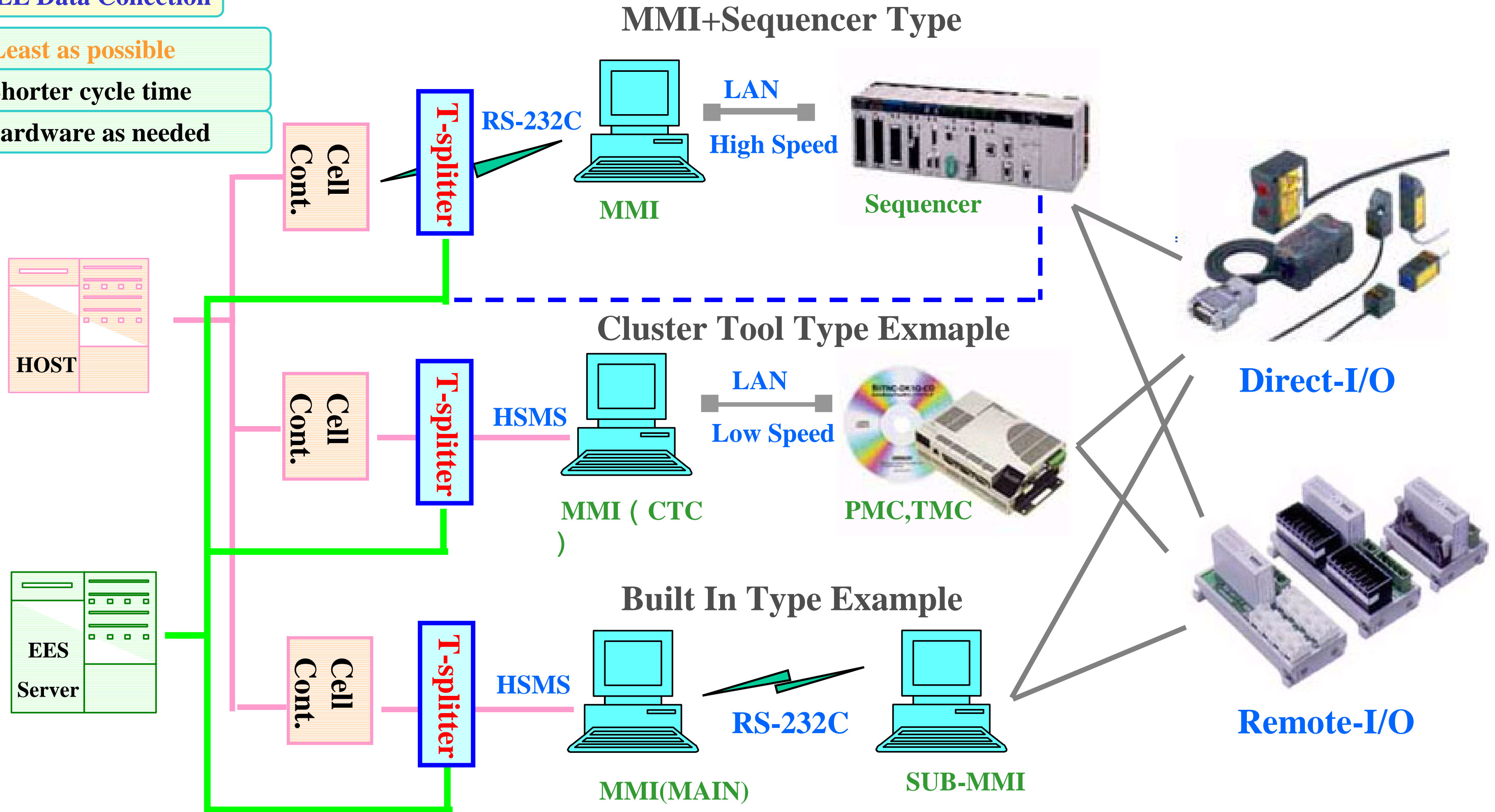
Detailed Data Acquisition from Equipment

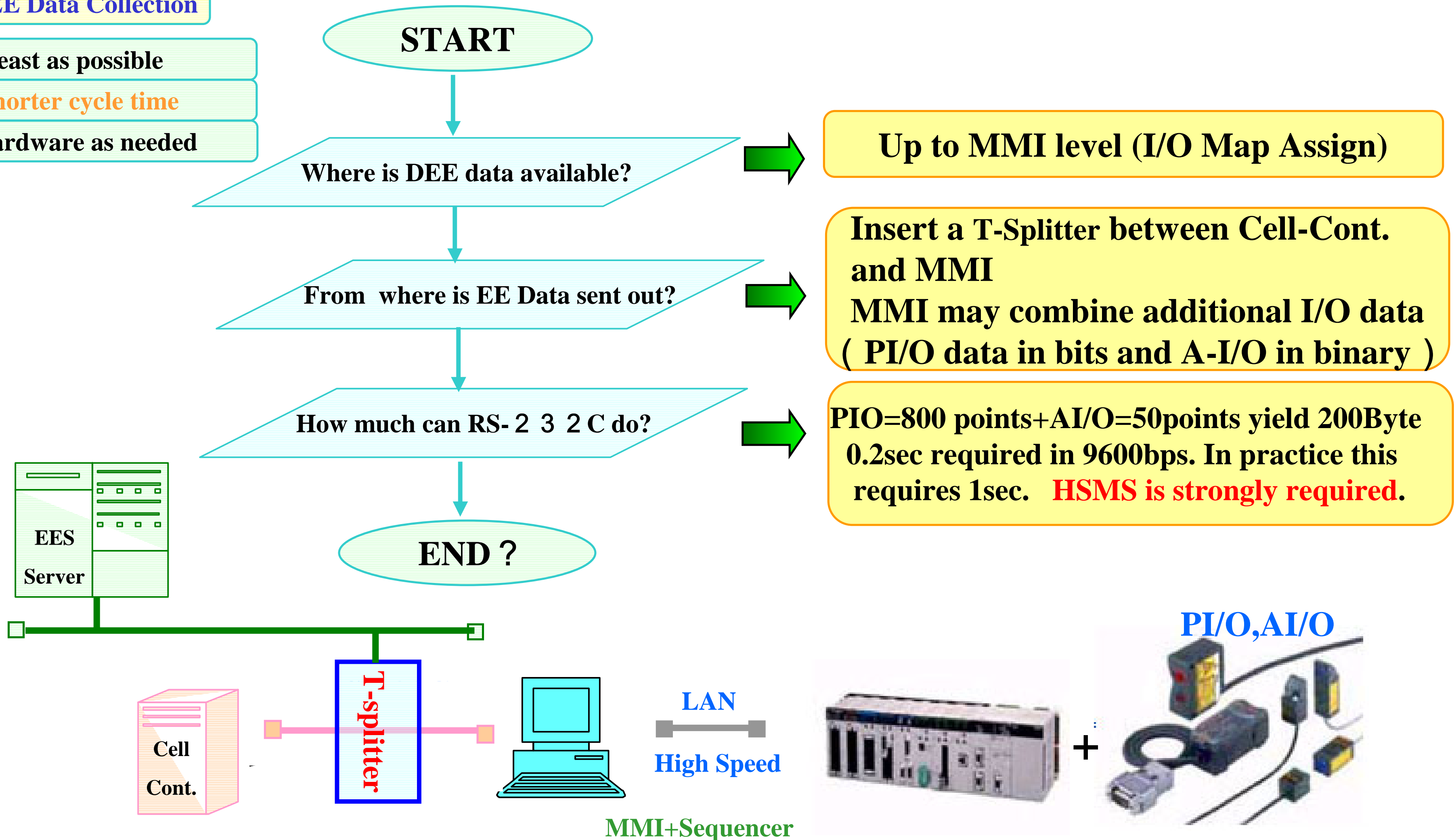
1. DEE Data Collection
2. Collect per a tool…
3. Correlate DEE Data with ..
4. Analyze per purpose



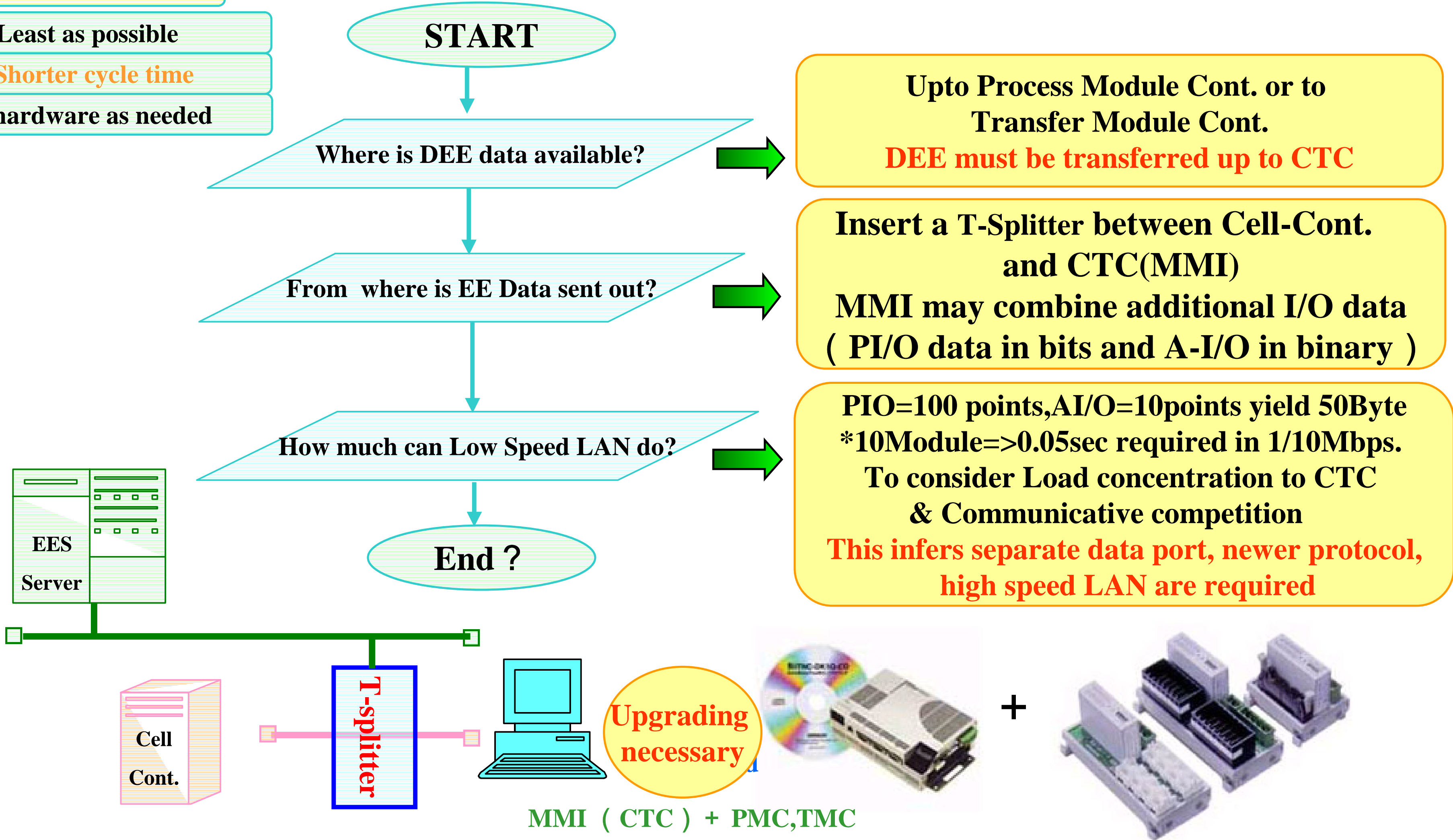
Tool Embedded Controller Configuration and DEE Data Collection



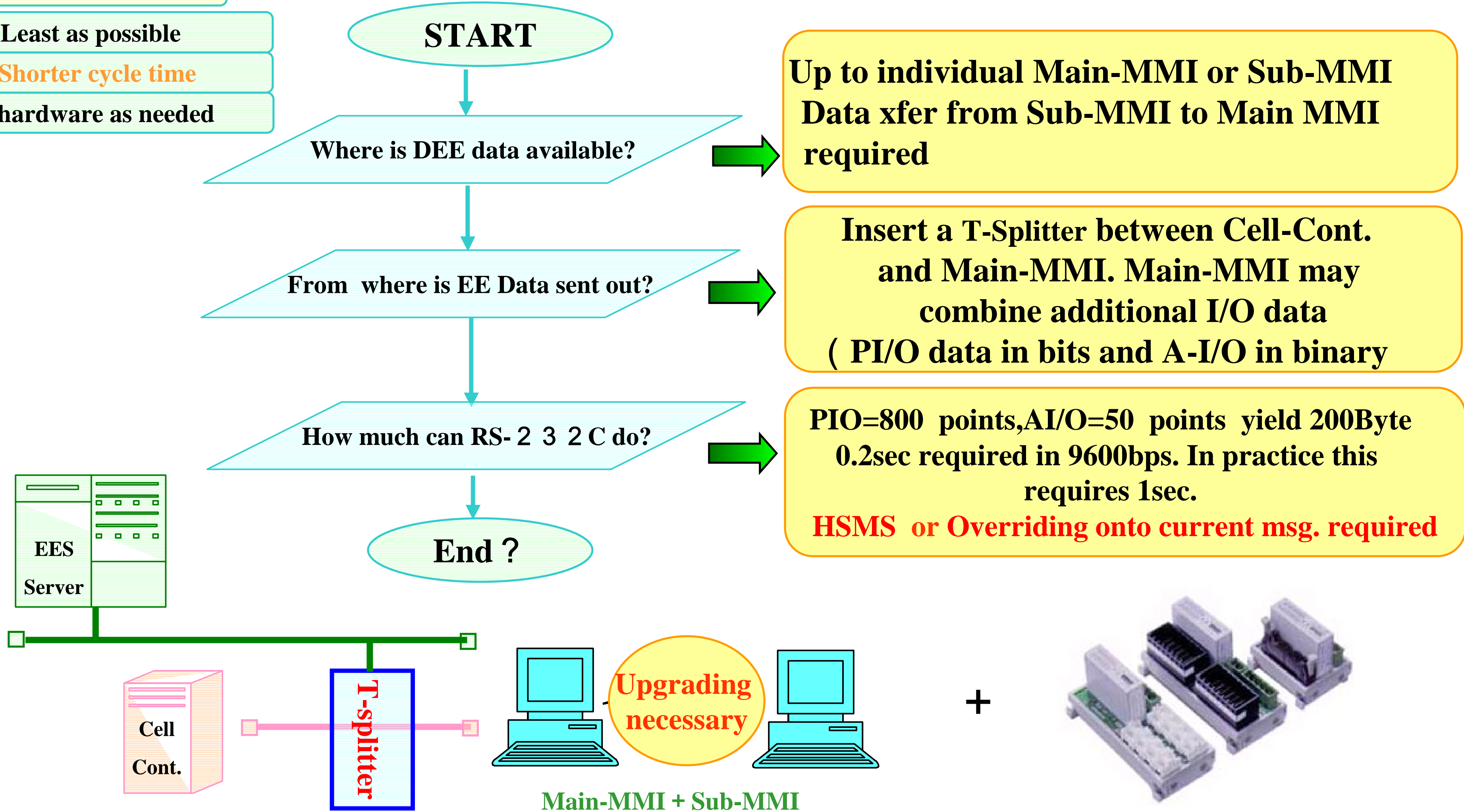
How can we collect DEE Data in a short cycle time? (*MMI+Sequencer* configuration example)



How can we collect DEE Data in a short cycle time? (*Cluster Tool* configuration example)

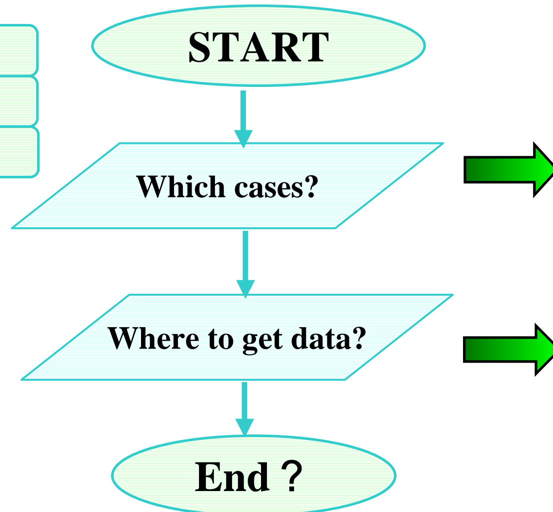


How can we collect DEE Data in a short cycle time? (*Built-In* configuration example)



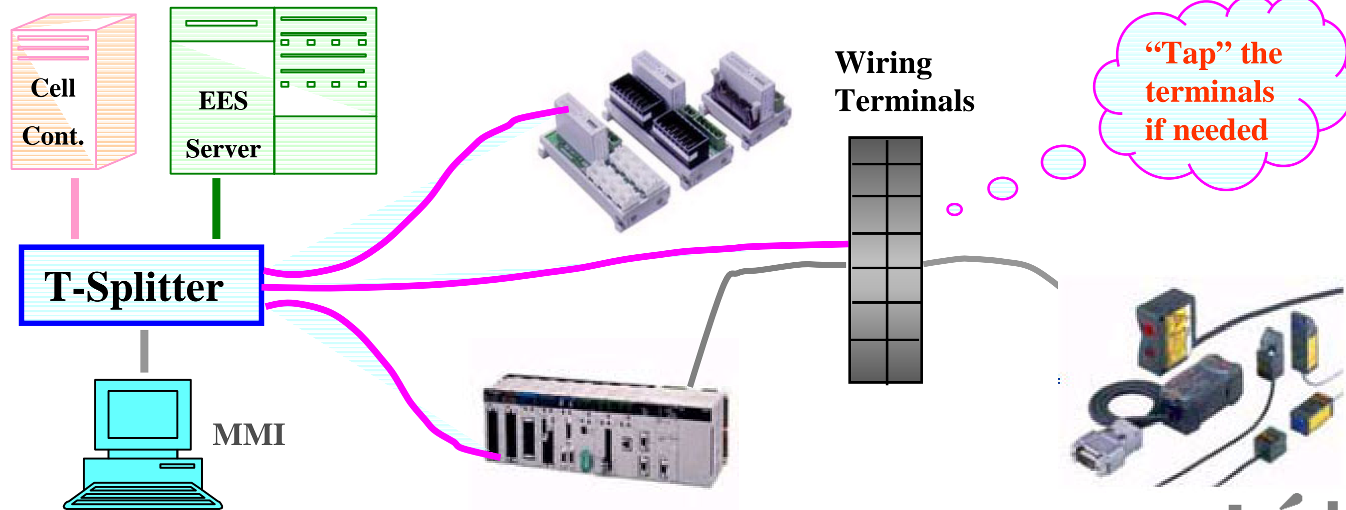
In a Case Detailed Event Data is not Available Software-Wise

1. DEE Data Collection
- a) Least as possible
- b) Shorter cycle time
- c) hardware as needed



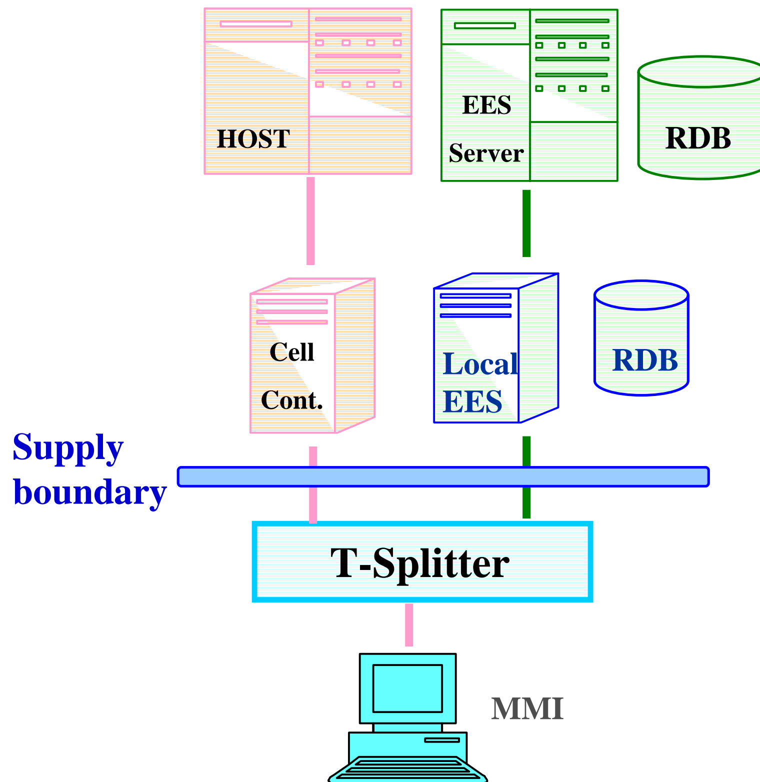
Tool cont. can not be hooked up with LAN
Tool cont. has no more power
Source program is not available
(by accident or terrorism!?)

Data should be obtained hardware-wise
Sequencer may provide a com. Module
In the case of "Remote I/O", a monitor module may be provided
In the case of Direct-PI/O, A-I/O, data be obtained from "terminals"



EE Data Collection per a tool group or process step

1. DEE Data Collection
2. Collect per a tool…
3. Correlate DEE Data with ..
4. Analyze per purpose

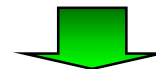


Minimum tool modification required

Tool matching func. is required
if Data superposition is possible

Within a process step, tool performance
comparison be made possible among
the tools from different suppliers

No Middleware is employed
Bandwidth can be responded at least
Need common *EES func. through* Fab



Local EES is suitable for upper requirement
Supply boundary is best suited just above "T-splitter"

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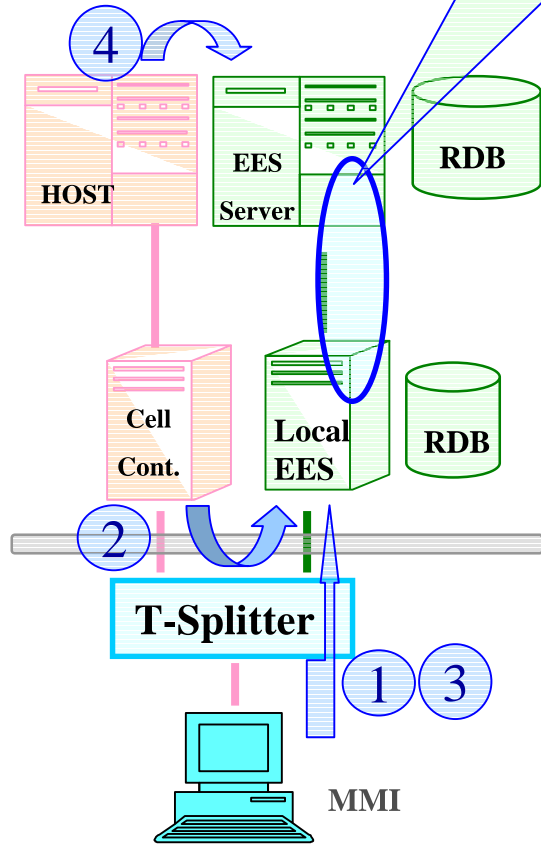
EE Data Correlation and Assortment at Device Maker

1. DEE Data Collection
2. Collect per a tool…
3. Correlate DEE Data with ..
4. Analyze per purpose

EE Data Correlation and Assortment takes place in two places



MES/YMS Data 4

- YMS Data
- Production control

Equipment base functionality performance data 3

- Pumping speed/ultimate pressure
- Life monitor of consumables and material

HOST com. data 2

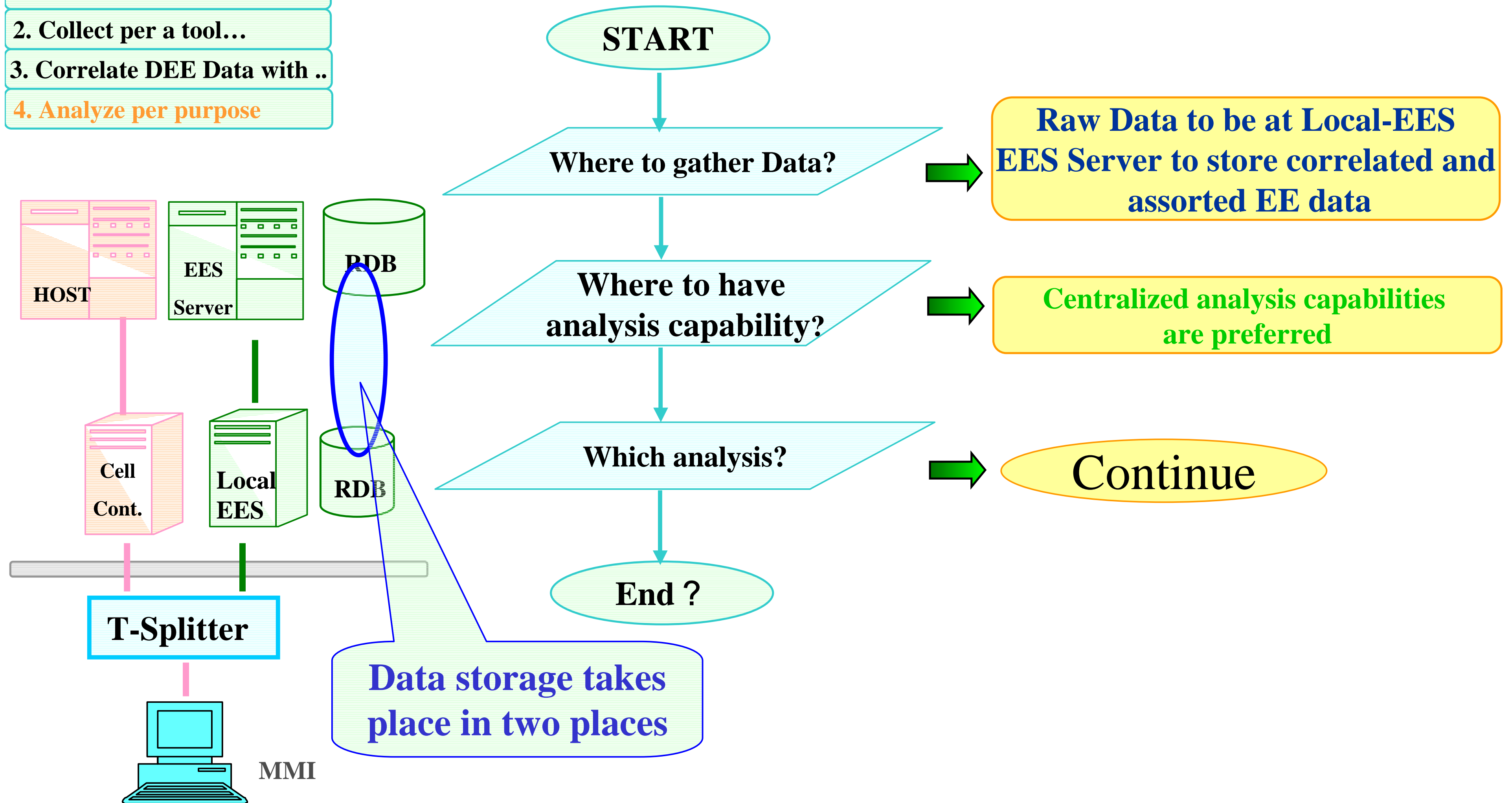
- Process settings & measured process parameters
- # of processed wafers, process time
- Alarm events

DEE Data 1

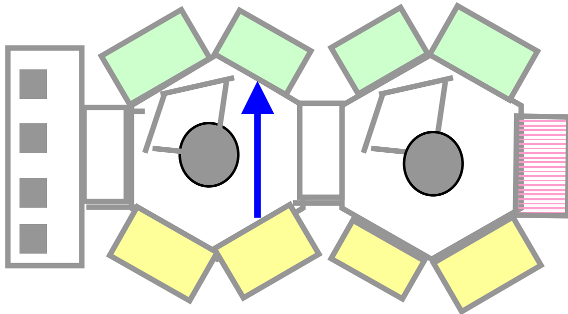
- Wafer transfer time between modules
- Accumulated # of valve operation
- Valve operation time

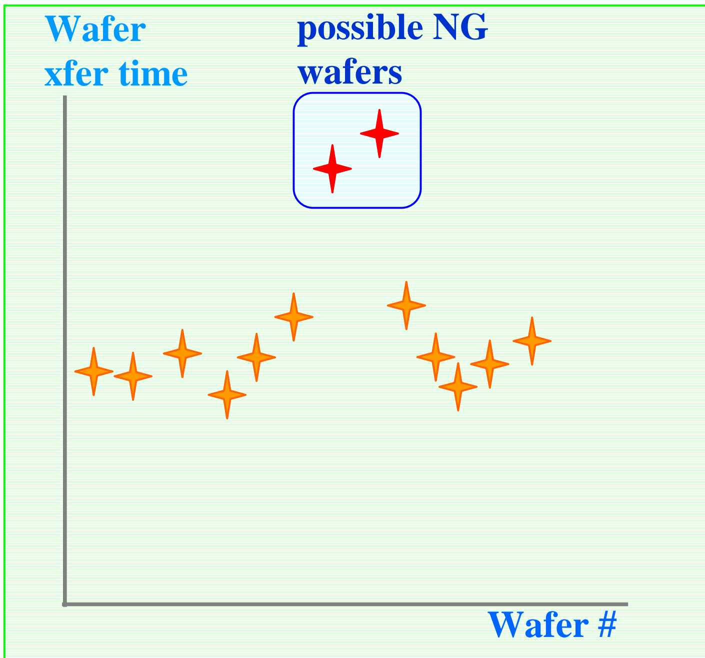
Correlate and assort in accordance with time stamp key

Device Maker's Data Analysis Operation



Detailed EE Data Analysis Example at Device Maker





End Result :2 out of 13 failed in "film reflectivity"

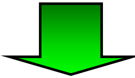
What macroscopic data tells

Alarm event	No record!
Settings (gas flow, heating temp., sputtering current)	No abnormality found
Resulting settings (wafer temp., sputter current)	No abnormality found

What Detailed EE Data tells

Total processing time (load-lock in and out time)	Failed wafers have longer time
Wafer Xfer times	Failed wafers have longer time
Deduced cause of failure	Wafer temp. should be lower due to longer time to reach to deposition

Action required



Tool supplier : do improvement in wafer xfer time constancy
Device maker: add a capability to monitor wafer xfer abnormality

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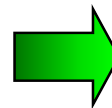
Generalized Implementation Including 300mm Tools SV Recommendation

Client's requirement

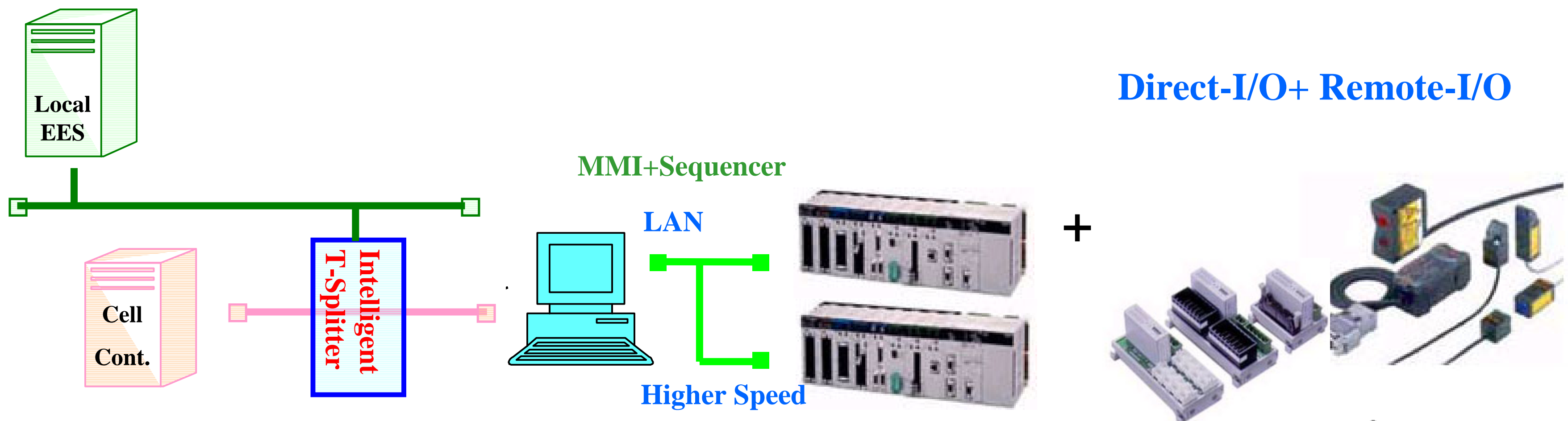
- Needs GEM300(CMS) and EES in 300mm tools
- Needs EES in 200mm tools
- Do need least modification to the current tools and fab system architecture
- A MMI may be added above the "tool" where E84 function is handled
- Accept change from SECS-I/II to HSMS connection
- Configure CJ,PJ, OSS, STS, XML, OBEM, EPT, ARAMS in the big picture
- Need to be compatible to EES middle ware where necessary



Use Intelligent T-Splitter

(as GEM300 package extension)

Assume tool suppliers to provide "Local EES"



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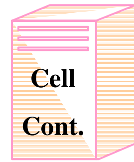
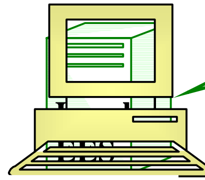
Intelligent T-Splitter

300mm Example



Local EES

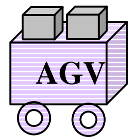


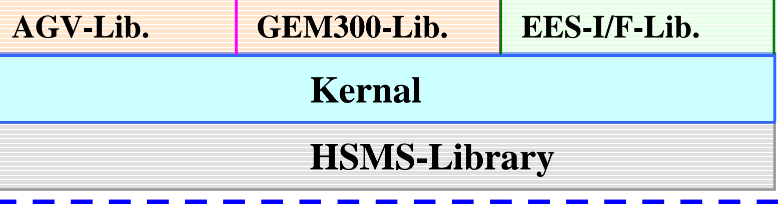
EPT, ARAMS are best handled here.
MW compatibility available

Capable of XML message format (directly from tool)

Detailed data enables OBEM,EPT,ARAMS compatibility

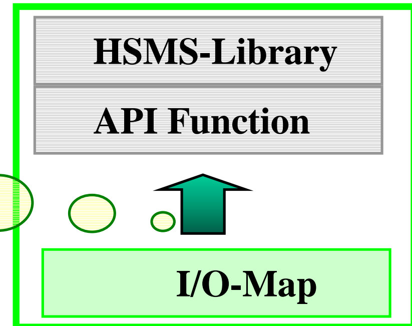
T-splitter can be intelligent enough to handle some APC





Intelligent T-Splitter

Reporting based on change in I/O Data, By API function



MMI

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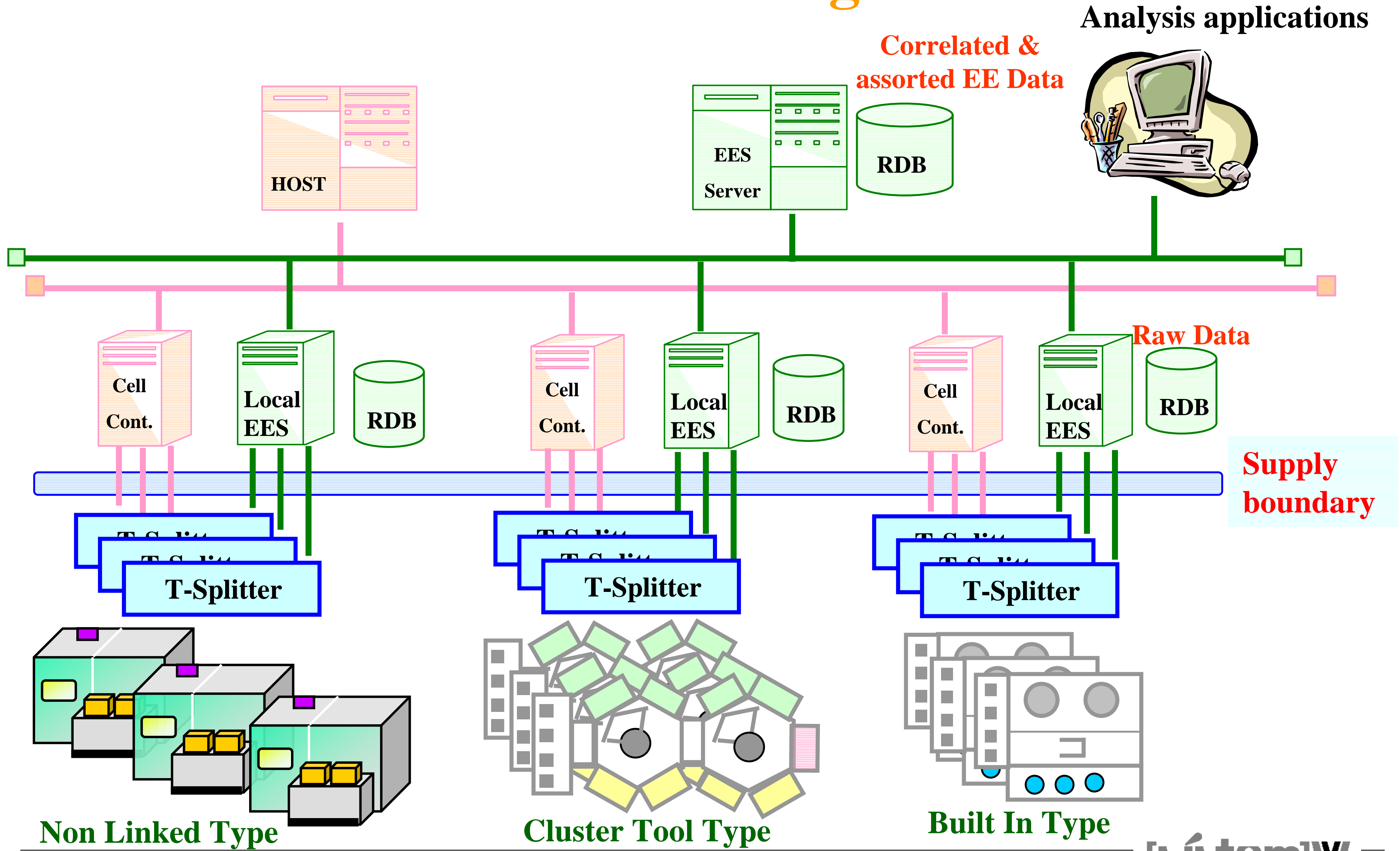
200mm MES/EES Big Picture



300mm MES/EES Big Picture

Analysis applications

Correlated & assorted EE Data

RDB

EES Server

HOST

Middle Ware

Cell Cont.

Cell Cont.

Cell Cont.

Supply boundary

RDB

RDB

RDB

Raw Data

Intelligent T-Splitter

Intelligent T-Splitter

Intelligent T-Splitter

Non Linked Type

Cluster Tool Type

Built In Type

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Conclusion (1/3)

- 200mm EES requirement is summarized as follows;
  - – Least additional burden to the tool controller
    - Minimum modification in communication protocol
    - Minimal hardware modification may be necessary
  - – Detailed EE Data be available for EES

Conclusion（2/3）

- Recommend 200mm EES implementation as follows;
  - T-Splitter is viable way to gather data out of tool
    - EE Data may be overridden onto MES connection
    - Use data format so as to minimize EE Data
  - Supply boundary be between T-splitter and local EES server
    - Supplier confines on detailed data transmission out of their tool
  - Store detailed data in local EES server and global EES server
    - EES Higher resolution and less correlation/assortment in local
  - Significant EE Data analysis should take place in global EES server

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Conclusion (3/3)

- **Recommend 300mm EES implementation as follows;**
  - **T-splitter be made intelligent enough to correspond to various demands**
  - **Supply boundary be between local EES server and global EES server**
  - **Need clear task sharing plan between L-EES and EES servers**