

JEITA Update

Results of December 6th Meeting

EE Discussion Materials

Contents:

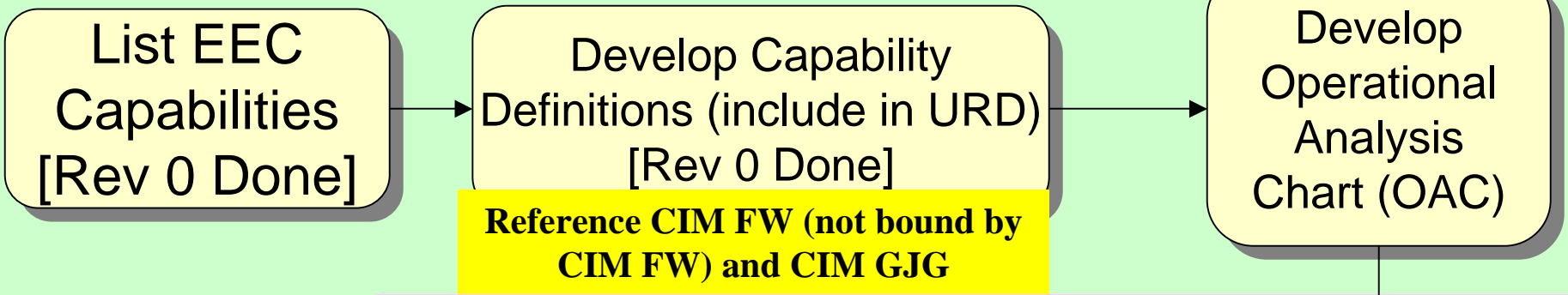
1. EE Collaboration Process
2. EE Capability List
3. EE Capability Definitions
4. EE OAC Examples
5. Next Steps / Future Meetings

Collaboration Groundrules

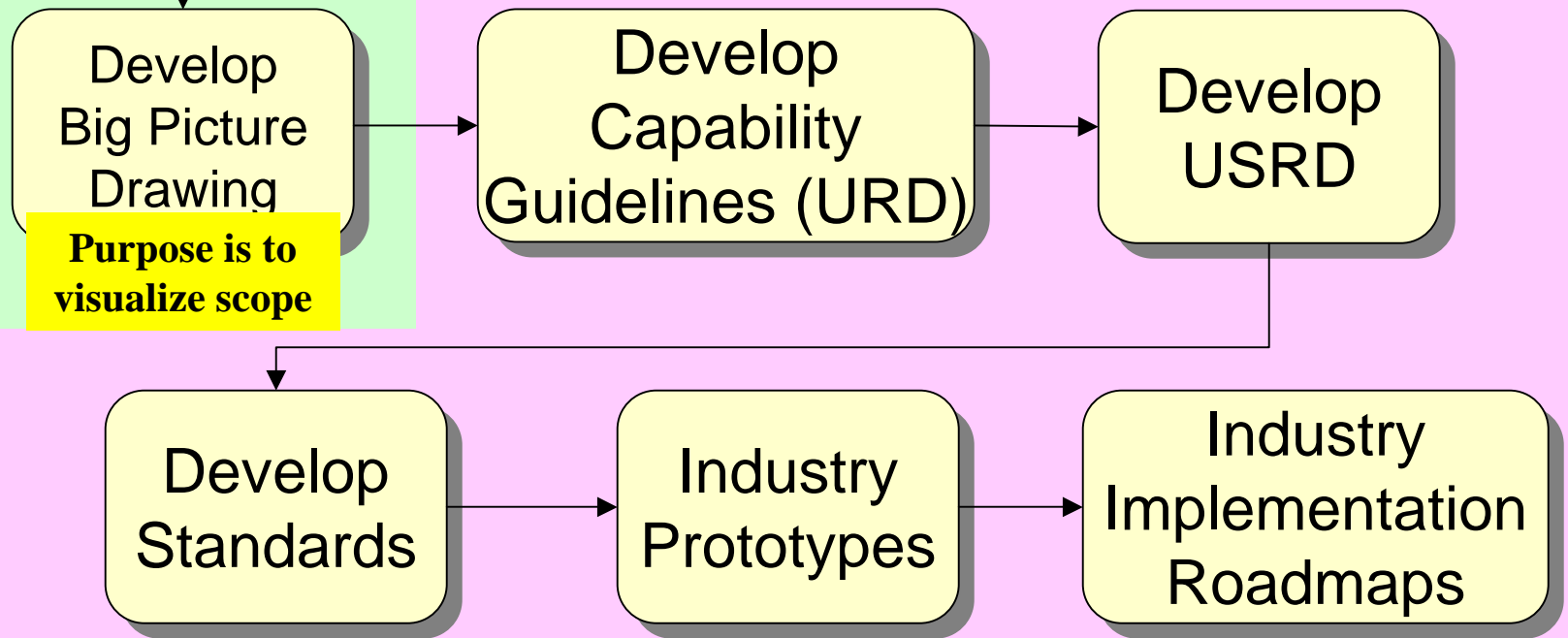
- Planning meetings will be between ISMT and Selete
 - IC Makers Only
 - Purpose is to set schedule and process
- Suppliers may not be interested in all capabilities and should attend relevant meetings

EE Collaboration Process

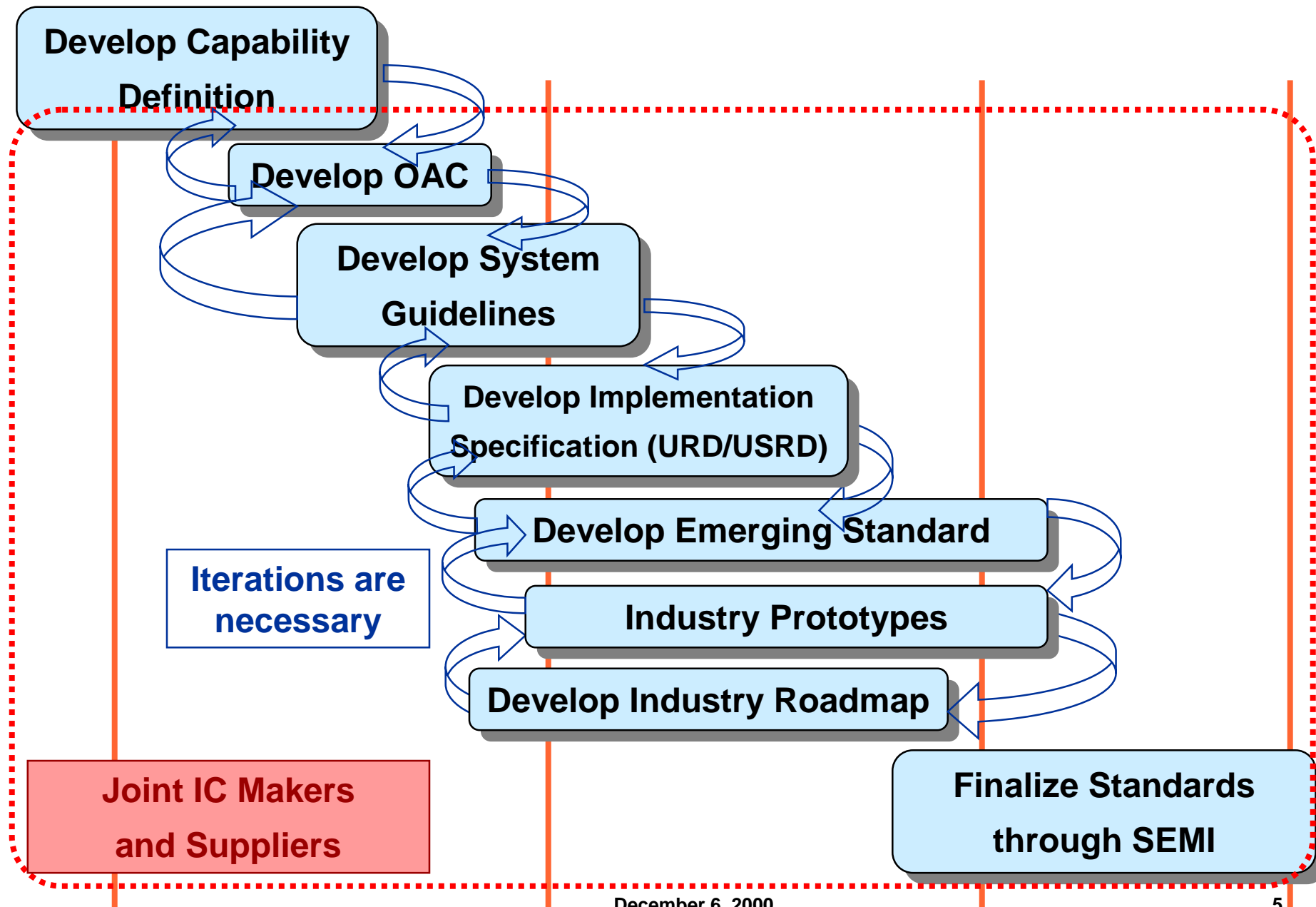
For all Capabilities



For each Capability



Equipment Engineering Capability Definition Timeline



EE Collaboration Capability List

- APC

- APC1 - Real time process control (in-situ)
- APC2 - Feedback (Wafer/Lot)
- APC3 - Usage Adjustment (Equipment)
- APC4 - Feed Forward (Wafer/Lot)

- FDC

- FDC1 - Fault Detection & Classification
- FDC2 - SPC

- Recipe Management

- Equipment Engineering

- EEC1 – Tool Operations Tracking
- EEC2 – M2M Difference Mgmt
- EEC3 – e-Diagnostics
- EEC4 – Spare Parts Mgmt
- EEC5 – Maintenance Scheduling
- EEC6 – Maintenance and Trouble shooting assistance

EE Collaboration Capability Definitions

EEC1 – Tool Operations Tracking

- **IC Maker needs**
 - Purposes: line management, production control scheduling, dispatching, line capacity census
 - Resolution: “Macro” or “lot by lot”
 - Data example: PM prediction, consumables supply timing, ...
- **Supplier needs (for individual tools)**
 - Purpose: malfunction monitoring, M-to-M difference monitoring and correction, tool performance improvement, Tool performance verification
 - Resolution: “Micro”, or “wafer by wafer”, “component by component (module or chamber)”, “Batch by Batch”, “Recipe by Recipe (maybe?)”
 - Data example: Gantt charts for individual wafers, components operation state history, consumables live data to predict PM, ...

EE Collaboration Capability Definitions

EEC1 – Tool Operations Tracking (cont)

- Equipment state identification
 - E10 states
- Equipment Performance (requires only equipment data)
 - Examples
 - # of interrupts
 - Alarms
 - Recipe Performance
 - Productive Time
- Availability/Utilization (requires MES data)
 - Examples
 - Mean Time Between Failures / Assists
 - PM time
 - Engineering Time
 - Standby time

EE Collaboration Capability Definitions

EEC2 – M2M Difference Mgmt

- Purpose: Obtain identical performance on different machines using the same recipes
- tune the individual tools by adjusting static constants or offset values
 - let all the tools in that group pretend to have almost the same faces
 - assume the same recipe among the tools in that group
 - these constants are hidden from recipes
 - retain M-to-M Difference adjustment history
- Recipe performance
- Module or chamber performance

EE Collaboration Capability Definitions

EEC3 – e-Diagnostics

- Purpose: Reduce equipment support costs and improve equipment MTTR
- Capability to enable an authorized equipment supplier's field service person to access any key production or facilities equipment from outside the IC maker's facility/factory via a network connection.
- Access includes ability to remotely monitor, diagnose problems or faults, and configure/control the equipment in order to bring it into full productive state rapidly, within security and safety guidelines.

EE Collaboration Capability Definitions

EEC4 – Spare Parts Mgmt

- Purpose: Ensure spare parts available when needed, Minimize parts inventory in IC makers side.
- Understand parts availability and storage location
 - Possible locations:
 - tool supplier
 - in-house (IC maker factories) storage
 - local parts vendors
 - Availability status inquiry like an internet auction!?
 - examine how quick and how much
 - Standard parts and parts sharing
 - Primary source and secondary source
- Prediction of spare parts requirements
 - Enable 'just in time' parts ordering
 - Support inventory reduction
 - Synch with equipment maintenance schedule
 - Ensure availability in pre-determined time

EE Collaboration Capability Definitions

EEC5 – Maintenance Scheduling (PM case)

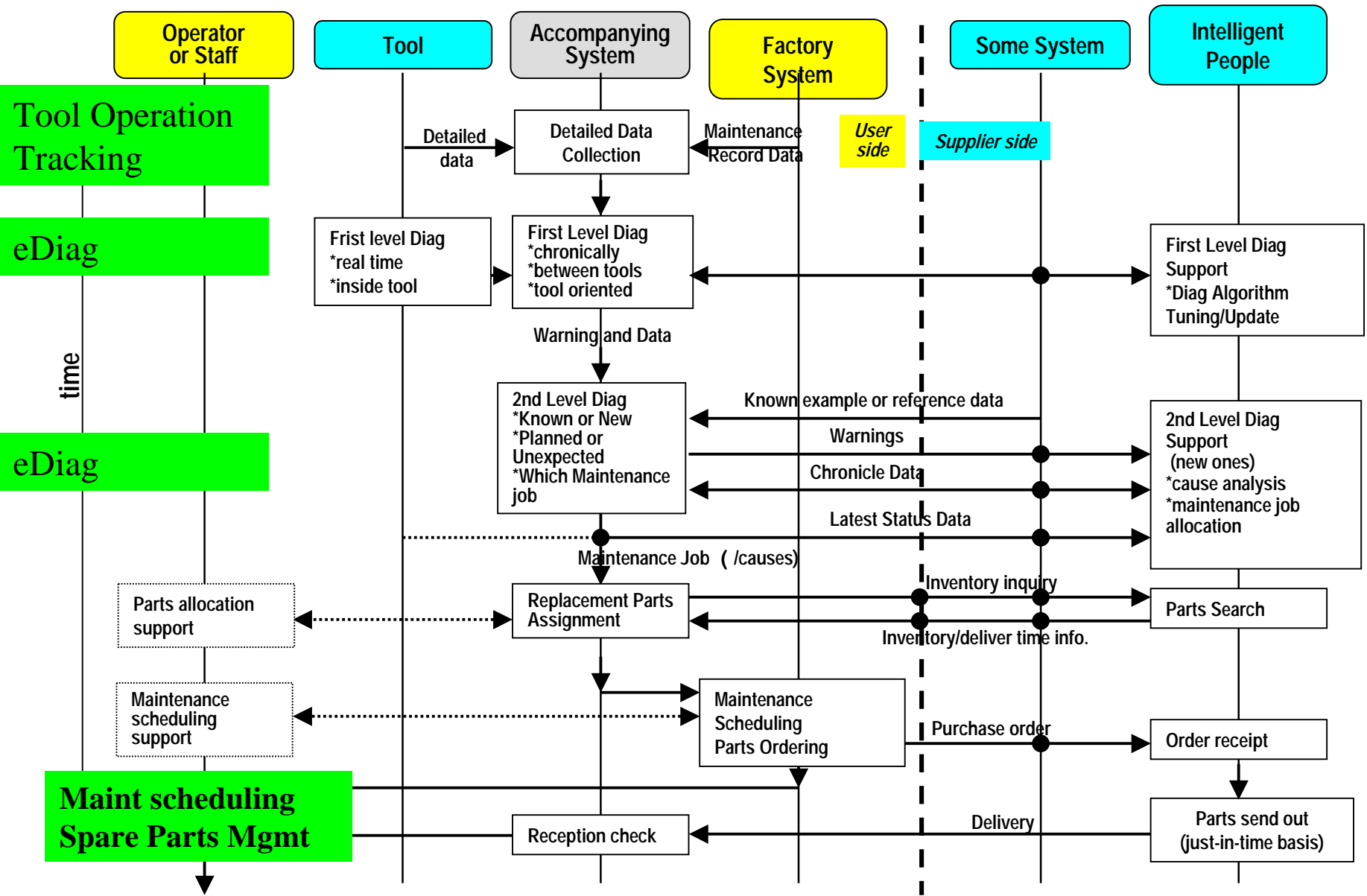
- Purpose: Minimize factory disruption due to tool maintenance (scheduled and unscheduled).
- Predict tool downtimes in advance in order to minimize factory disruptions
- Optimize PM schedules (key indicator based PM's)
- Monitor equipment performance to avoid unscheduled downtimes
- Hardware and process performance

EE Collaboration Capability Definitions

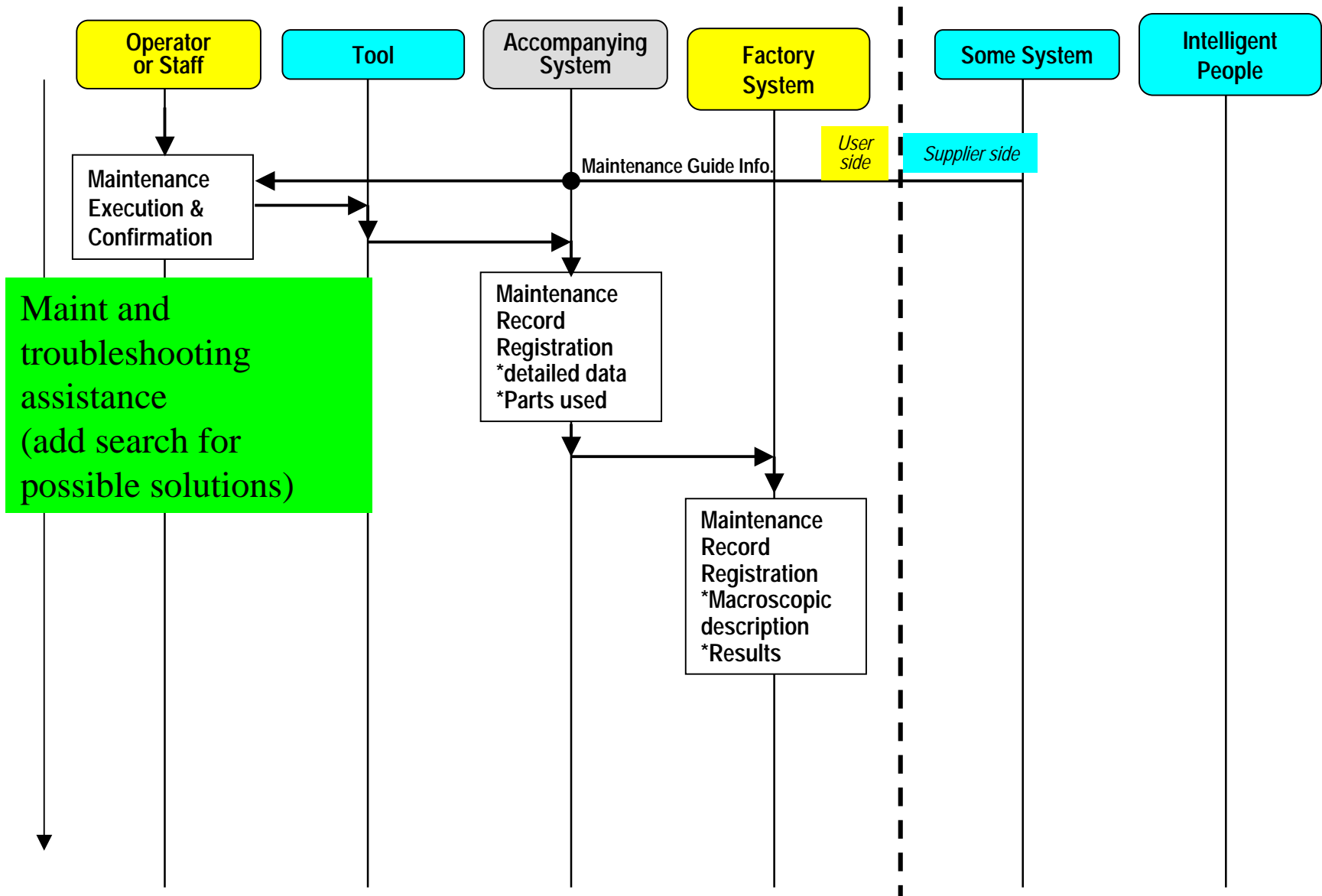
EEC6 – Maintenance and Trouble shooting assistance

- Purpose: Allow small equipment and/or process issues to be identified and resolved quickly/easily
- “Troubleshooting” guide and assist capability
 - Provide equivalent capability of “on site electronics service manual”
 - Accurate support documentation version updating through internet for the tool & components
 - Real time response to inquiry of troubleshooting knowledge database and design information
- Recording of maintenance and troubleshooting
 - Record can be best accurate since it is entered as it is done
 - Templates should be provided to ease record data input at the same time as troubleshooting.
 - Reference to the histories of
 - modification
 - maintenance
 - troubleshooting and servicing

PM: Tool Maintenance Operation (final version)

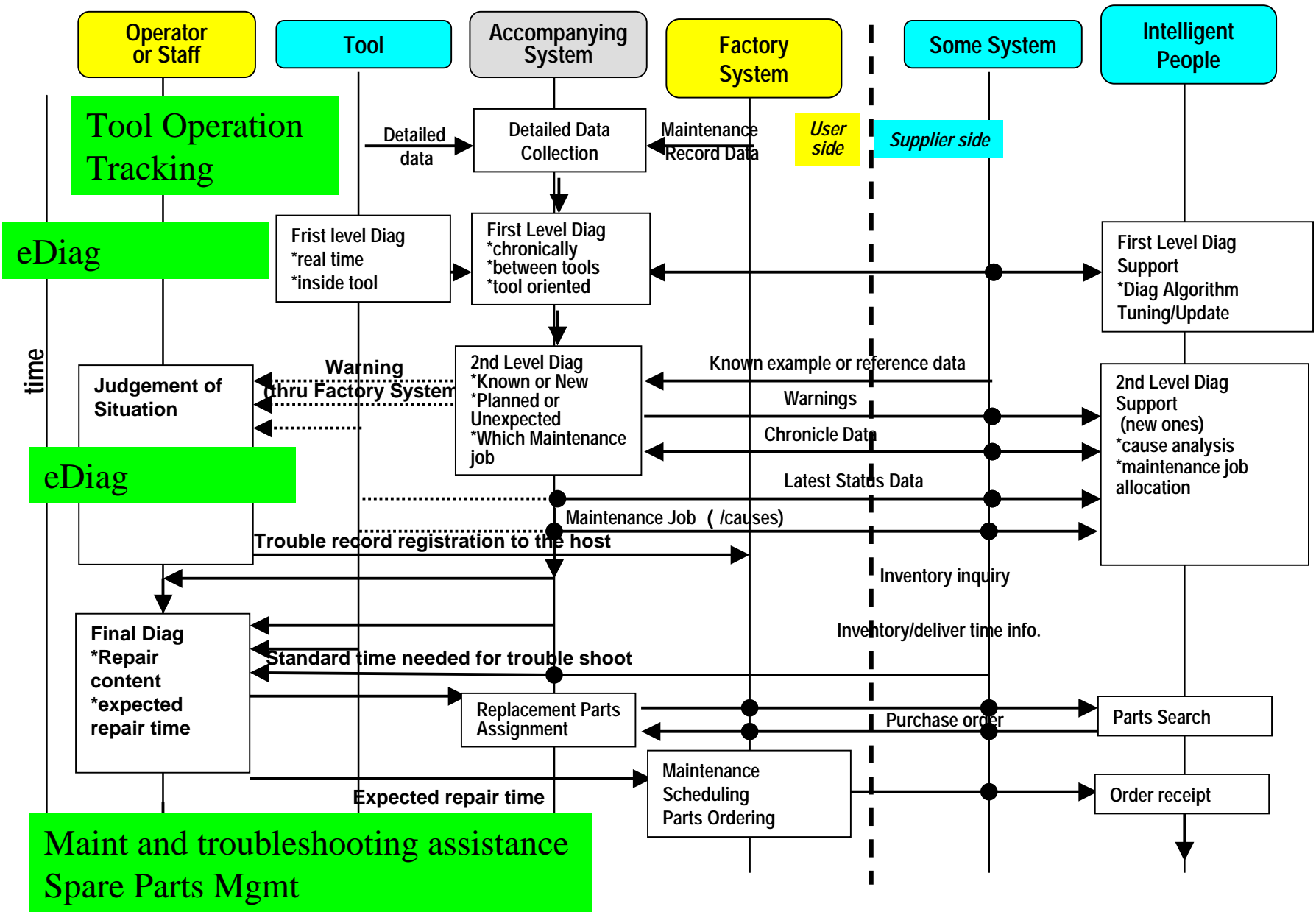


Maintenance: Common Part

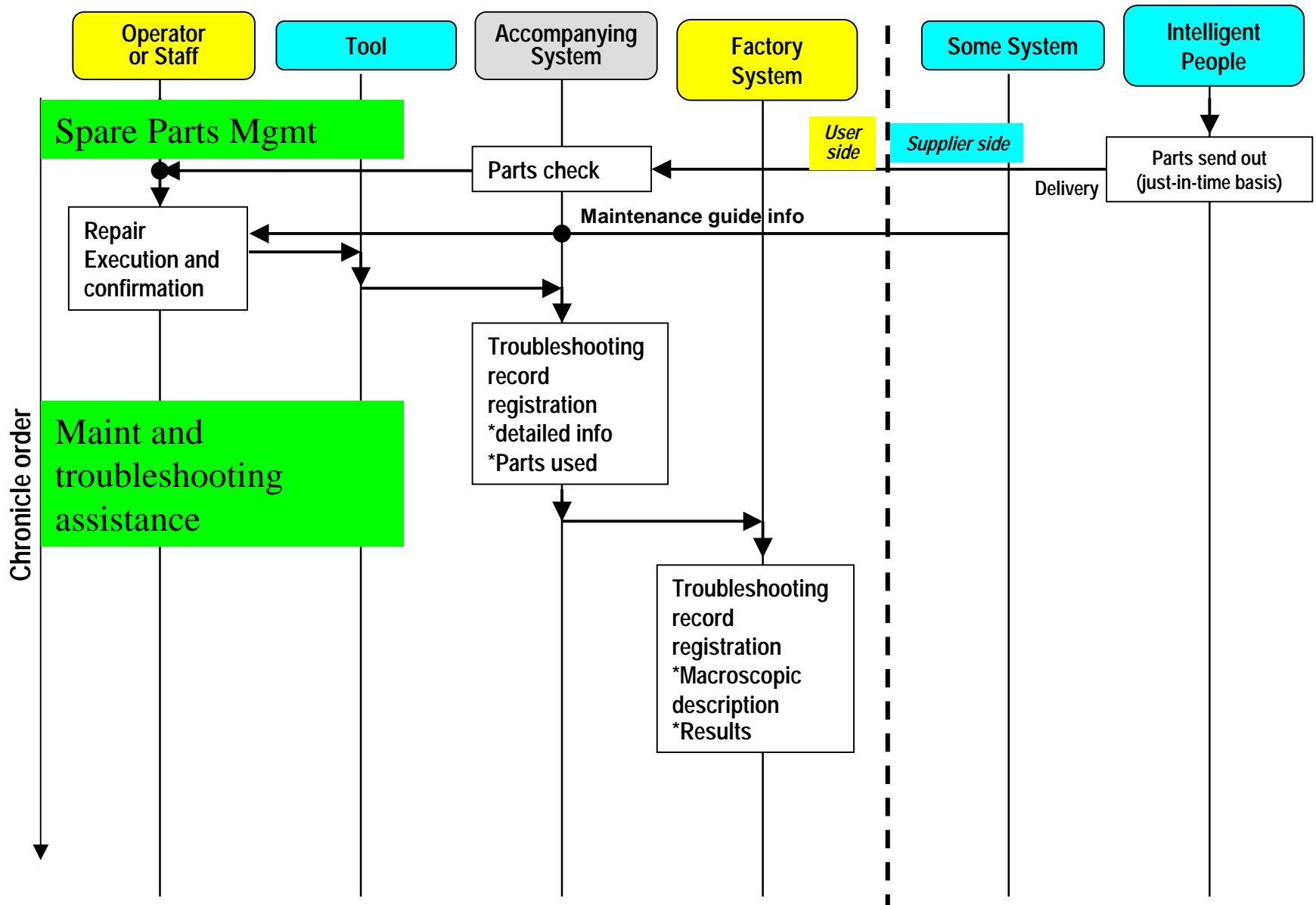


Troubleshoot Operation (final version)

unscheduled

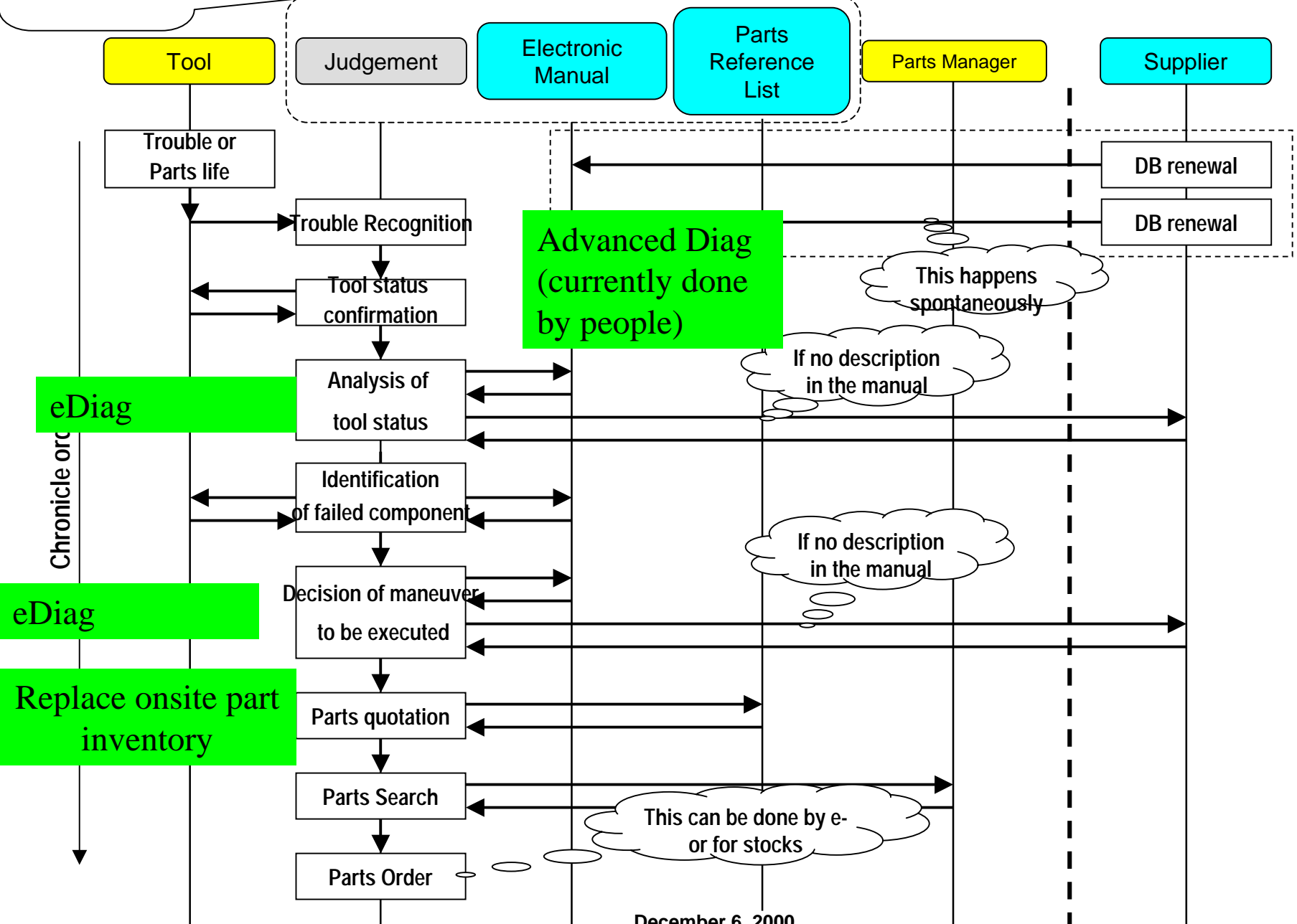


Troubleshooting Operation (final version)



Spare Parts Management

Accompanying System with a group of Tools



APC/FDC Capability Definitions

- APC
 - APC1 - Real time process control (in-situ)
 - APC2 - Feedback (Wafer/Lot)
 - APC3 - Usage Adjustment (Equipment)
 - APC4 - Feed Forward (Wafer/Lot)
- FDC
 - FDC1 - Fault Detection & Classification
 - FDC2 - SPC

Measurement Examples

- Wafer Measurement
 - Etching Thickness
 - Film Thickness
- Equipment Measurement
 - MFC, Gas flow
 - Pressure
 - Temperature
- Process Measurement
 - Plasma Density
 - Reactive Species, RGA

APC1 – Real time process control (in-situ)

- Use of in-situ sensors for real-time adjustments
- ex:
 - Endpoint
 - temperature control
 - RF power control

APC2 - Feedback (Wafer/Lot)

- Use of integrated or in line metrology
- R2R Control
- Post measurement on wafer or lot for a adjusting a parameter(s) on a previous tool
- ex:
 - CD
 - Film Thickness, Uniformity
 - Etching Depth

APC3 – Usage Adjustment (Equipment)

- Compensate for equipment systematic variations
- Use equipment history to adjust recipe setting
- Ex:
 - CMP pad life
 - Sputter target life

APC4 - Feed Forward (Wafer/Lot)

- Use of integrated or in line metrology
- R2R Control
- Pre measurement on wafer or lot for a adjusting a parameter(s) on a subsequent tool
- ex:
 - CD -> Gate Etch
 - Film Thickness -> CMP

FDC1 – Fault Detection & Classification

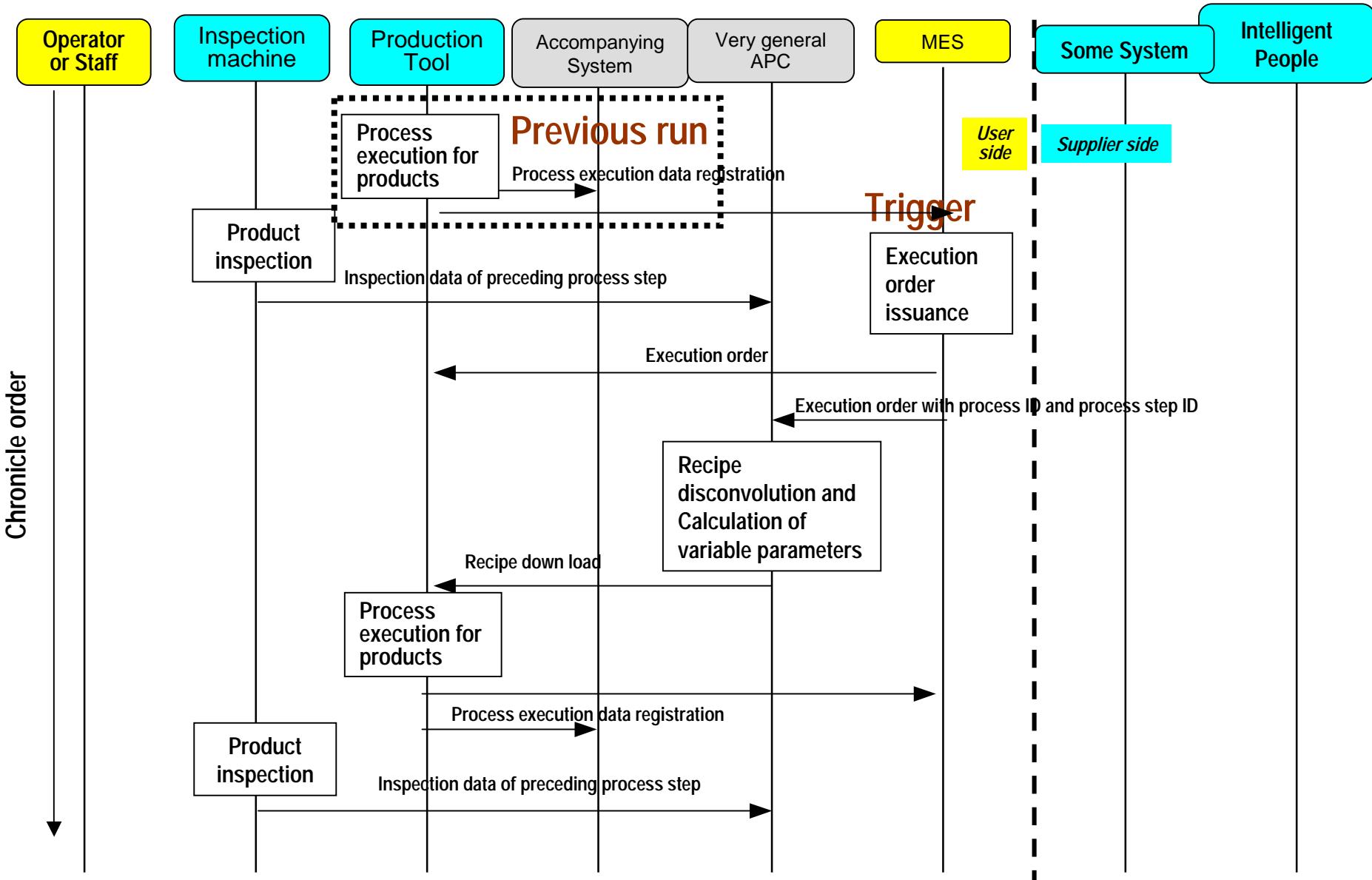
- Collection of data against either the actual manufactured product or the equipment which manufactures it
- Mathematical analysis of equipment or wafer/lot data for the purposes of determining whether a manufacturing process is behaving abnormally
- Error actions are taken automatically should aberrant process behavior be observed. This can include cessation of processing on equipment.
- Ex:
 - Hardware failure - MFC
 - Particle count exceeds limit
 - End point signal excursion or abnormality

FDC2 – SPC(Statistical Process Control)

- Special case of FDC
- Ex:
 - Particle count
 - Film thickness
 - Gate length
 - Pressure

APC2a – Feedback (Wafer/Lot)

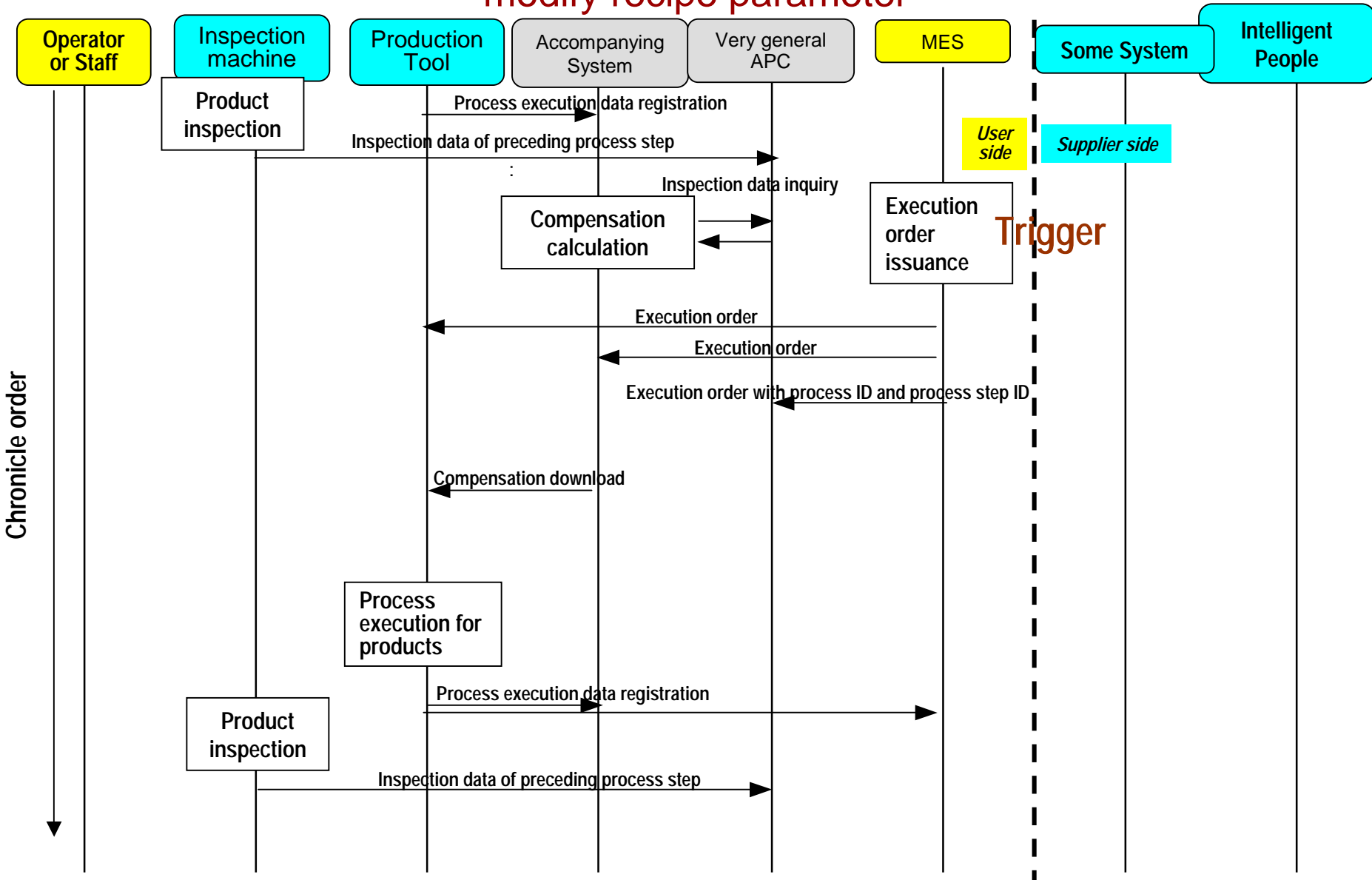
download recipe



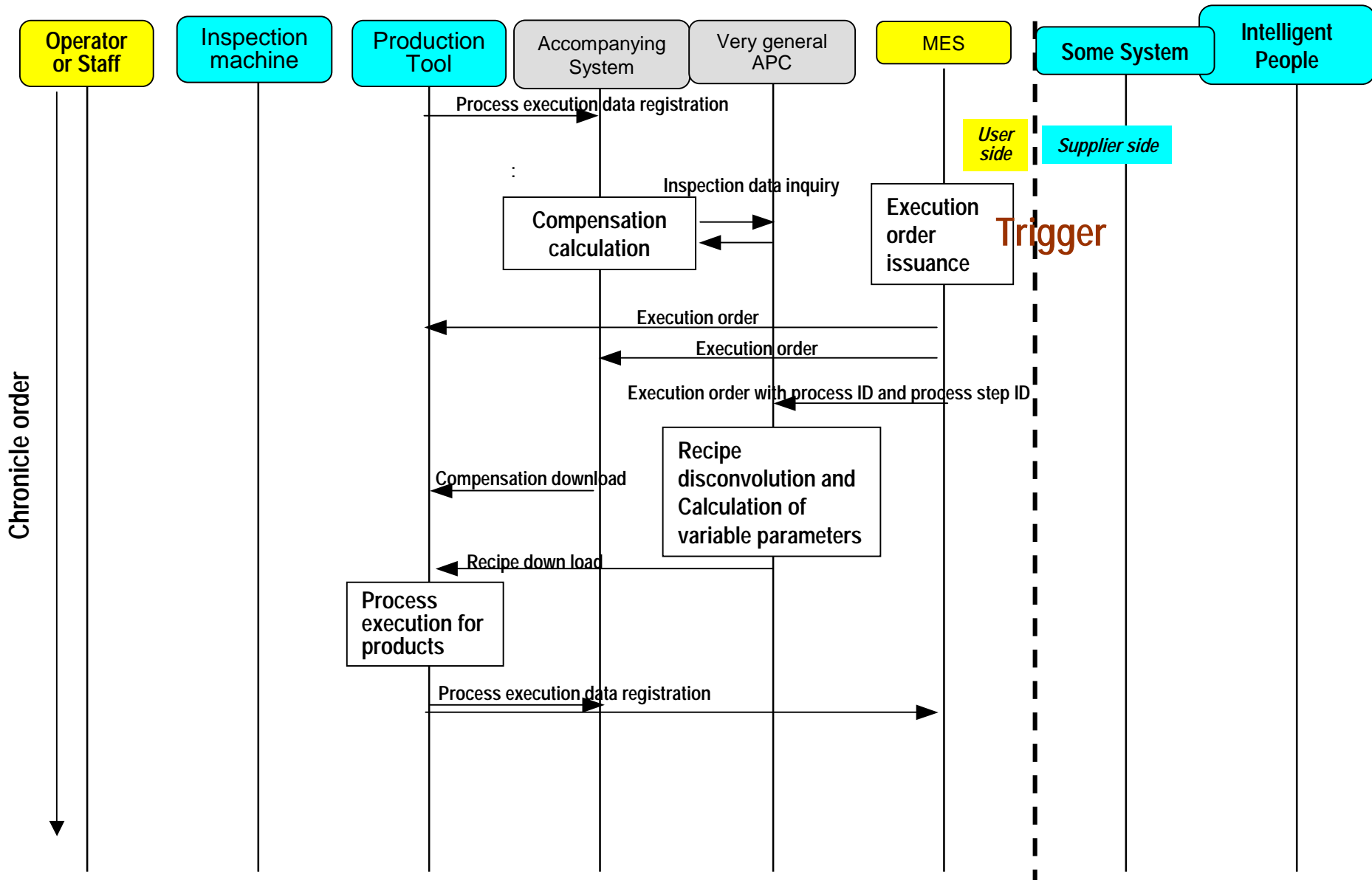
Chronicle order

APC2b – Feedback (Wafer/Lot)

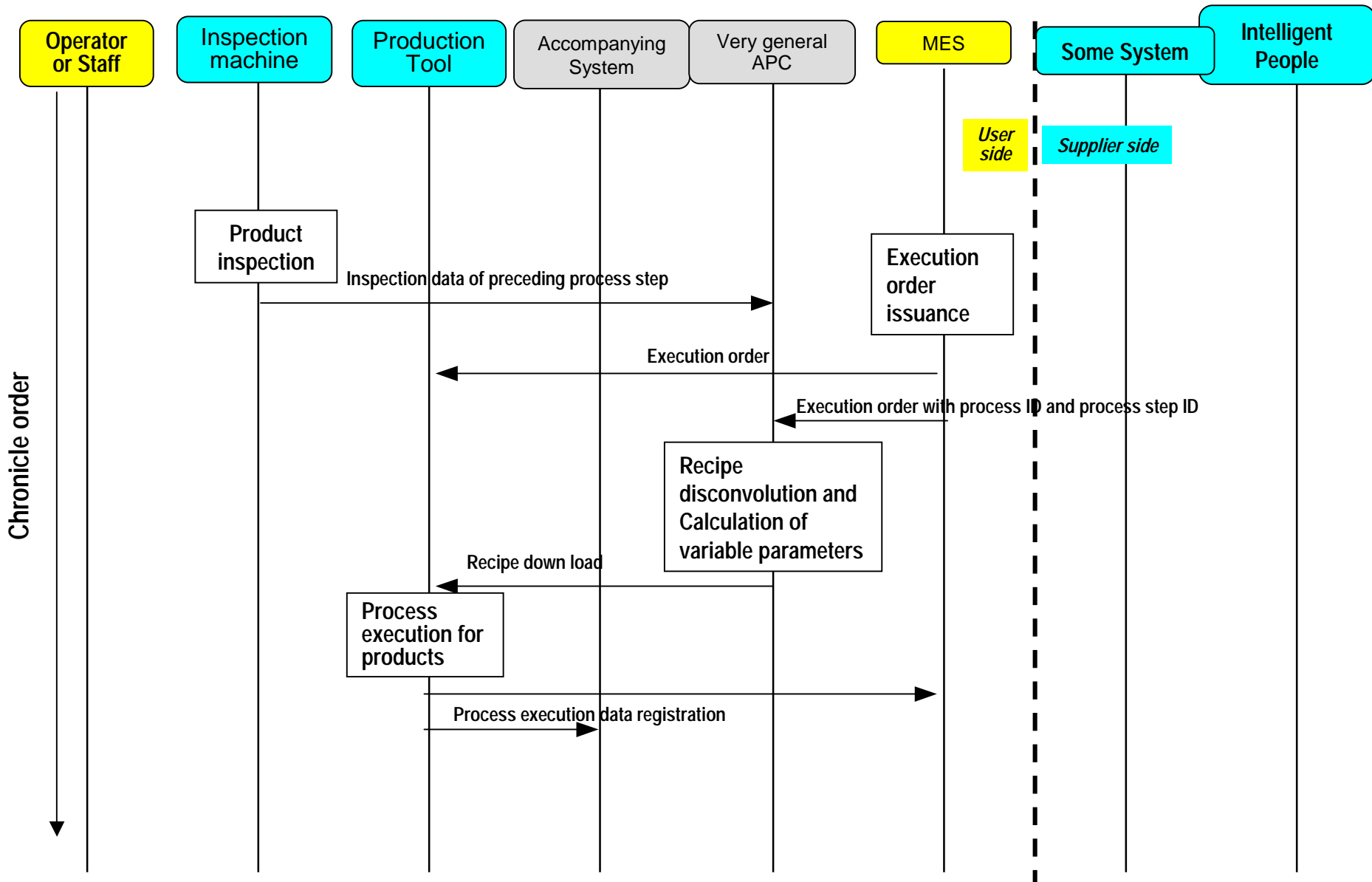
modify recipe parameter



APC3 – Usage Adjustment (Equipment)



APC4 – Feed Forward (Wafer/Lot)



Next Steps

- Review and adjust definitions and OAC's
 - Complete missing information
 - Add anything that has been left out
- Develop capability guidelines (for each capability)
- Formalize definitions, OAC's and guidelines into URD documentation
- Begin USRD analysis

Future Global Meeting Schedule

- Jan TC
- Feb F2F in Tokyo (early Feb)
 - Prep for Feb 23 Tokyo workshop
- March F2F in La Jolla (Mar 19 – 22)
- April F2F in Europe (April 24 – 26)
- May TC
- June TC
- July F2F in San Fran
- Aug TC
- Sept TC
- Oct F2F in Austin
- Nov TC
- Dec F2F in Tokyo