Using OMAC PackML for sample preparation equipment
- a preliminary study

One Source

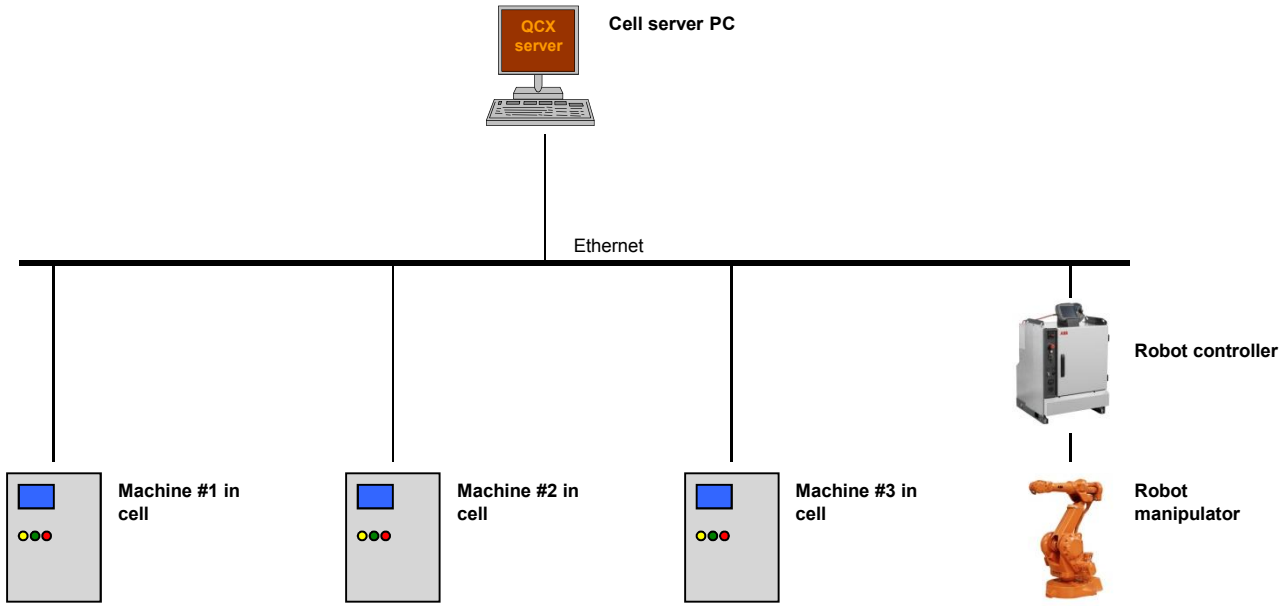
For internal use in SESAM Make2Pack workgroup

Applications where OMAC PackML could be relevant

- Fully automated laboratories for the cement and minerals industries
- Automated sampling equipment

Control concept

- Low-level control in PLC's / controllers
- High-level control in cell server PC (recipe execution, coordination control)
- Machines do not know each others existence



Overall impression

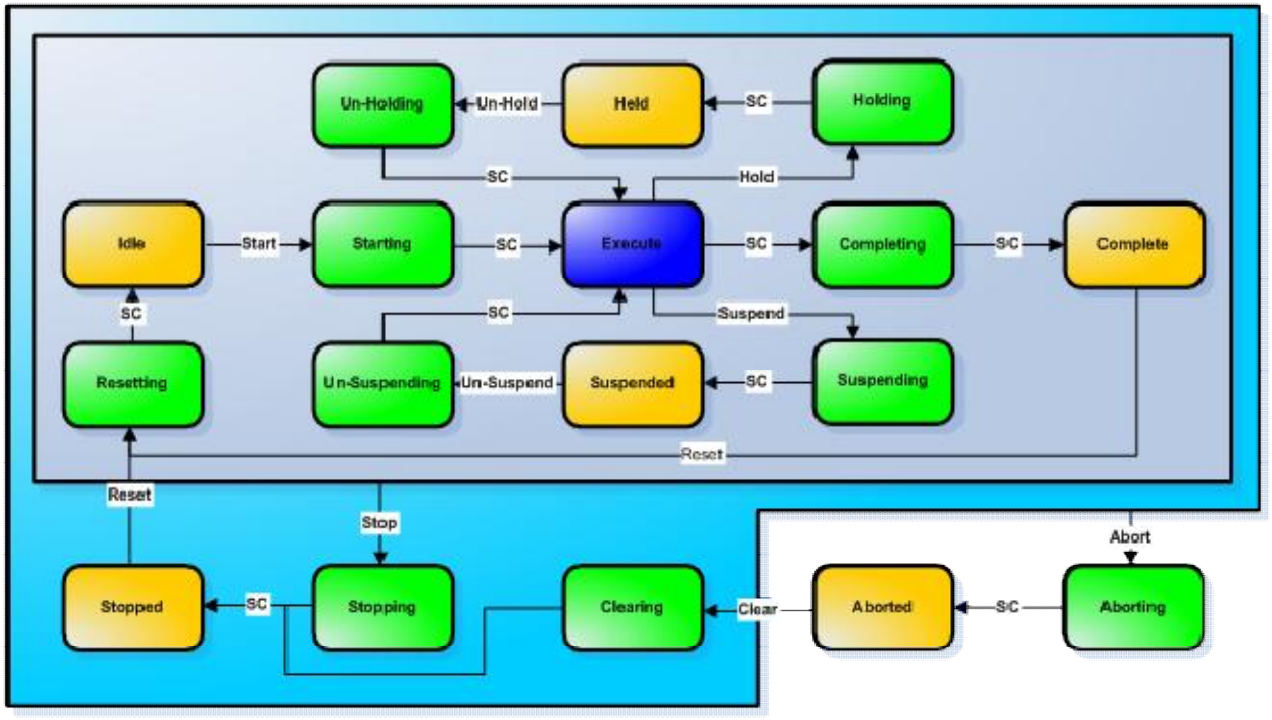
- OMAC PackML / Make2Pack are VERY GOOD initiatives
- But still some time until the standards are matured
- And modifications will probably be necessary as the standards extend beyond the packaging line

Challenges foreseen if we go PackML (or partly PackML)

- Discrepancies between OMAC PackML v3.0 and ISA 88 part 5 (draft 6) - what will ***the*** future standard be?
  - Details on slide 6 - 7 - 8
- Difficult to fit our world into the PackML v3.0 state model
  - Details on slide 9
- The meaning of "suspended" vs. "held" not quite clear
  - Details on slide 10
- Safe states
  - Details on slide 11
- Only few modes described in the standards
  - Standardized names for the more sophisticated modes would be useful (e.g. single-step, cleaning etc.)
- Alarm handling not described in the standards
  - A common standard would be extremely useful (though probably difficult to agree upon)
- Translations and/or standardized icons for state names, mode names etc. would be useful
- How well will PackML tags fit to our purpose?
  - Currently very dedicated to packaging lines

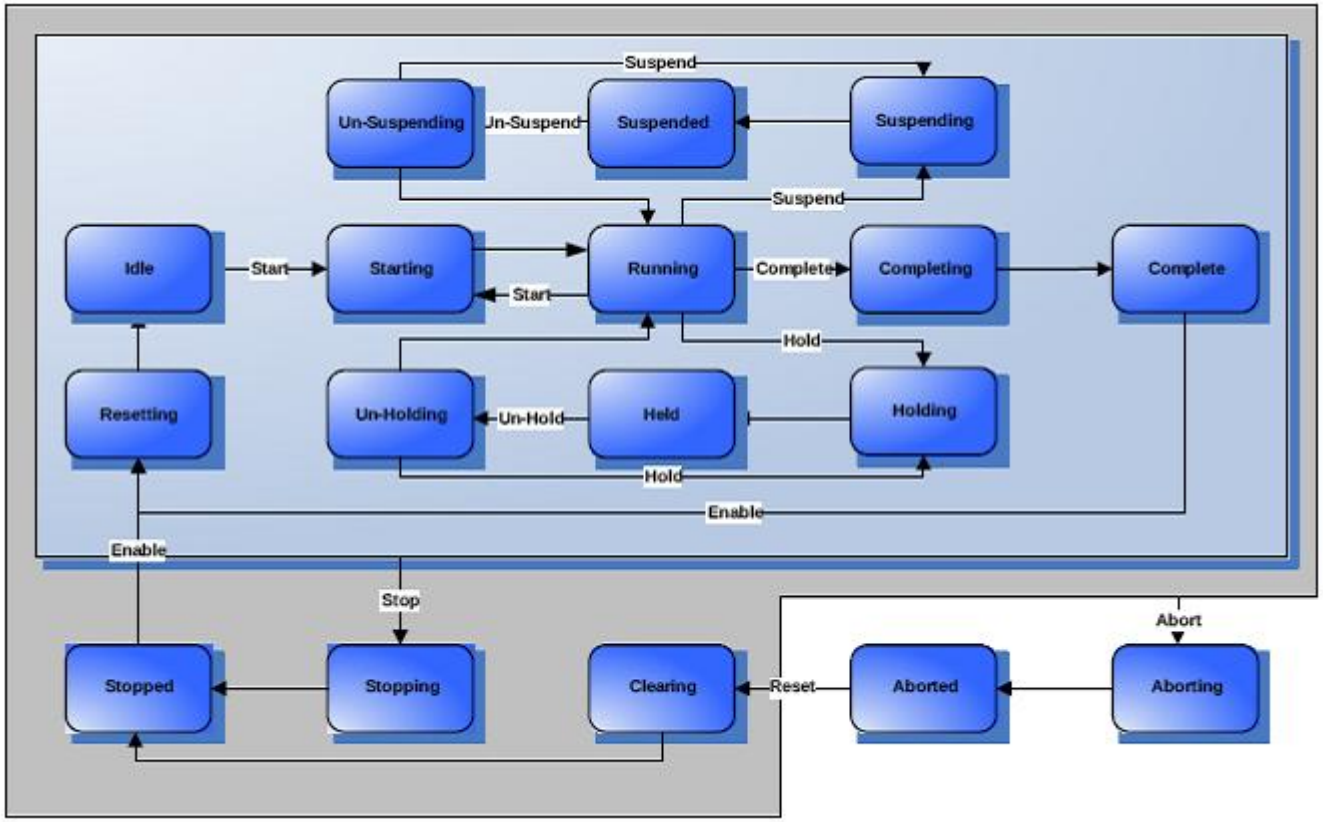
Discrepancies between OMAC PackML v3.0 and ISA 88 part 5 (draft 6)

- State model as defined in OMAC PackML v3.0 (and ISA–TR88.00.02):



Discrepancies between OMAC PackML v3.0 and ISA 88 part 5 (draft 6)

- State model as defined in ISA 88.00.05 working draft 06:

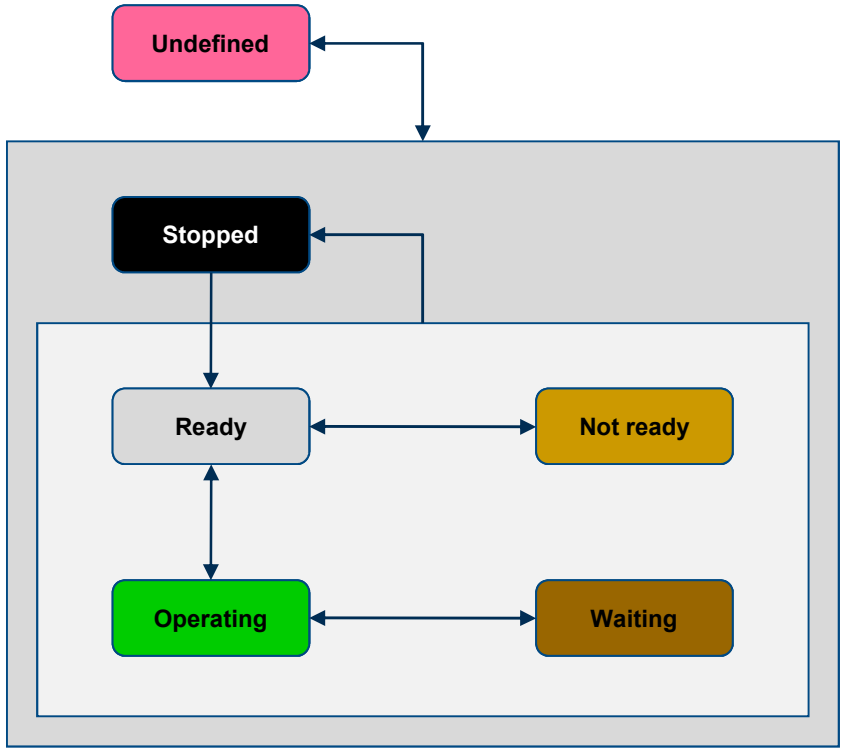


Discrepancies between OMAC PackML v3.0 and ISA 88 part 5 (draft 6)

- It can be seen that three transitions have been added, and that some transitions have been renamed:
  Reset -> Enable
  Clear -> Reset
- States are, however, not renamed accordingly, so we guess that the model is still very much up for discussion.
- The renaming can make good sense, but it is - on the other hand - unfortunate to have two almost identical standards, where the term "Reset" refers to very different actions. It's easy to imagine the confusion if the standards are mixed on the same production line...
- So, the big question: Shall we expect that the OMAC PackML v3.0 state model will be superseeded by a (slightly) different ISA 88 part 5 state model in the near future?
- Or, will the OMAC model survive as a standard for packaging machinery?

Difficult to fit our world into the PackML v3.0 state model

- Our equipment is not typical packaging equipment
- May be in state "Ready" most of the time, while waiting for the next sample
- This is a fully normal condition, and it could be confusing to refer to this as "Suspended"
- How do other users deal with this?



The meaning of "suspended" vs. "held" not quite clear

Suspended	Held	Source
The machine may be running at the relevant setpoint speed, there is no product being produced. This state can be reached as a result of a machine status, and differs from HELD in that HELD is typically a result of an operator request.	The HELD state would typically be used by the operator to hold the temporarily hold the machine's operation whilst material blockages are cleared, or to stop throughput whilst a downstream problem is resolved.	Packaging Machine Language V3.0 Mode & States Definition Document
Suspending: This state is a result of a change in monitored conditions due to process conditions or factors. The trigger event will cause a temporary suspension of the EXECUTE state. SUSPENDING is typically the result of starvation of upstream material in-feeds (i.e., container feed, beverage feed, crown feed, lubricant feed, etc.) that is outside the dynamic speed control range or a downstream outfeed blockage that prevents the machine from EXECUTING continued steady production. During the controlled sequence of SUSPENDING the machine will transition to a SUSPENDED state. The SUSPENDING state might be forced by the operator. Suspended: The machine may be running at a relevant set point speed, but there is no product being produced while the machine is waiting for external process conditions to return to normal. When the offending process conditions return to normal, the SUSPENDED state will transition to UNSUSPENDING and hence continue towards the normal EXECUTE state. Note: The SUSPENDED state can be reached as a result of abnormal external process conditions and differs from HELD. HELD is typically a result of an operator request or an automatically detected machine fault condition that should be corrected before an operator request to transition to the UNHOLDING state will be processed.	Holding: When the machine is in the EXECUTE state, the Hold command can be used to start HOLDING logic which brings the machine to a controlled stop or to a state which represents HELD for the particular unit control mode. A machine can go into this state either when an internal equipment fault is automatically detected or by an operator command. The Hold command offers the operator a safe way to intervene manually in the process (such as removing a broken bottle from the in-feed) and restarting execution when conditions are safe. To be able to restart production correctly after the HELD state, all relevant process set points and return status of the procedures at the time of receiving the Hold command must be saved in the machine controller when executing the HOLDING procedure. Held: The HELD state holds the machine's operation while material blockages are cleared, or to stop throughput while a downstream problem is resolved, or enable the safe correction of an equipment fault before the production may be resume .	ISA–TR88.00.02 Machine and Unit States: An Implementation Example of ISA-88
SUSPEND commands are usually generated as a result of internal events that require a temporary stop... This state is usually used for a short term stop.	HOLD commands are usually generated as a result of external events that require a temporary stop... This state is usually used for a short-term stop.	ISA 88 Part 5 (draft 6)

Safe states

- The terms "Start" and "Stop" have become quite "holy" with the Machinery Directive 2006/42/EC.
- Many of us are probably reverting to hard-wired start-stop circuits to avoid PLC validation requirements.
- Would be nice if we could define some of the OMAC states as safe, and have well-defined actions for getting to and from the safe states (start button resp. stop button).

1.2.3. *Starting*

It must be possible to start machinery only by voluntary actuation of a control device provided for the purpose.

The same requirement applies:

— when restarting the machinery after a stoppage, whatever the cause,

— when effecting a significant change in the operating conditions.

However, the restarting of the machinery or a change in operating conditions may be effected by voluntary actuation of a device other than the control device provided for the purpose, on condition that this does not lead to a hazardous situation.

For machinery functioning in automatic mode, the starting of the machinery, restarting a change in operating conditions may be possible without intervention, provided this does dous situation.

Where machinery has several starting control devices and the operators can therefor danger, additional devices must be fitted to rule out such risks. If safety requires that sta must be performed in a specific sequence, there must be devices which ensure that performed in the correct order.

1.2.4. *Stopping*

1.2.4.1. **Normal stop**

Machinery must be fitted with a control device whereby the machinery can be brought safely to a complete stop.

Each workstation must be fitted with a control device to stop some or all of the functions of the machinery, depending on the existing hazards, so that the machinery is rendered safe.

The machinery's stop control must have priority over the start controls.

Once the machinery or its hazardous functions have stopped, the energy supply to the actuators concerned must be cut off.