Reduction of Factory Ramp-up Time by Early MES Integration using InFrame Synapse Platform

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Abstract

In nowadays, all modern factories are controlled by IT systems. Most of them are fully automated and the Manufacturing Execution System (MES) controls the activities in the factories. There are only a few operators in the line, supervising that the transport systems and equipments work according to the commands received from the MES.

There are several MESes on the market, capable of fully controlling the processes in a factory. These are standard systems and must the customized according to each customer needs and integrated with the equipments which it controls. Unfortunately, only in few industries there are standards for the integration of the MES with the equipments and, also where there are standards, not all equipments implement the compete standards interfaces. Therefore, it takes a very long time, from several months to a few years, until a factory can run controlled solely by the MES system, with no operator control.

In this paper we will present how can be reduced the ramp-up time of a new factory, by using the solution of integrating the MES with a virtual factory, solution provided by acp-IT's platform, InFrame Synapse.

acp-IT in Stuttgart, Germany, has proven to be a trusted international partner offering professional software solutions and consulting services for high-tech production industries like semiconductor, electronics, photovoltaic and automotive production. Especially with regard to Manufacturing Execution System (MES), Process Control Systems (PCS), Equipment Integration (EI), Scheduling and Logistics Simulation (LS), acp-IT provides broad experience and references at well known customers.

InFrame Synapse is the state of the art Production Control Software Platform of acp-IT, which has been developed on Web based technologies and uses a service oriented architecture, which guarantees high performance and extendibility. InFrame Synapse is a modular solution, which can be adapted and implemented stepwise according to the customer needs and capabilities.
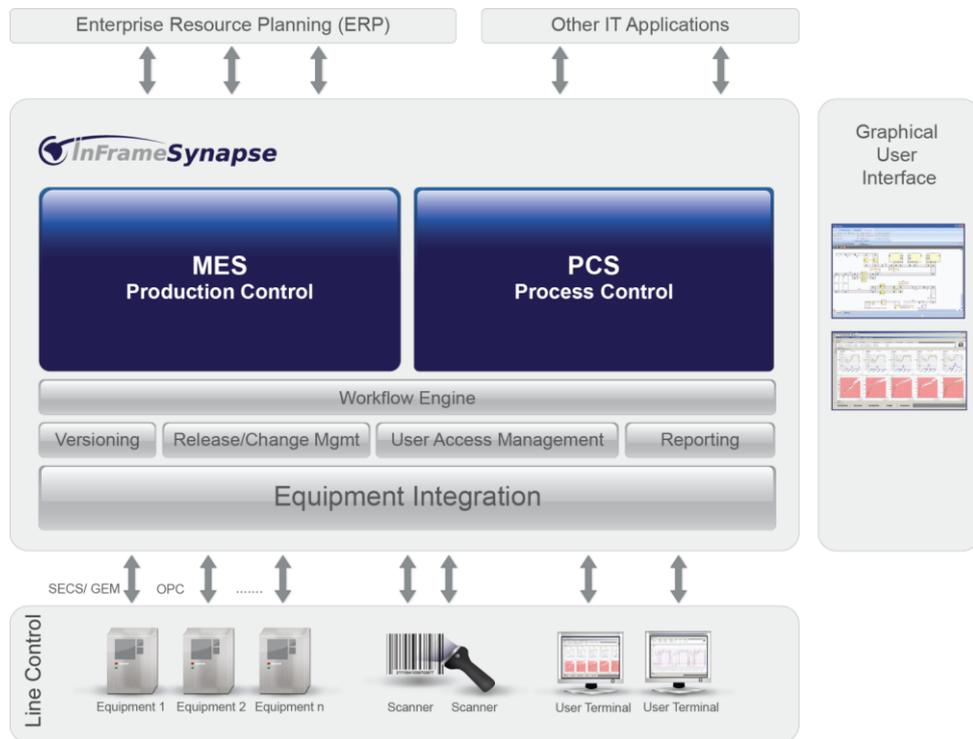
Figure 1 - InFrame Synapse Platform Architecture

Based on InFrame Synapse Platform, we are the only providers in the area of Production Control Software Services, which, with support of our platform, cover the full spectrum of a Fab lifecycle, starting from planning of the new production facility, till ramp-up and operation phases, and also during technology changes:
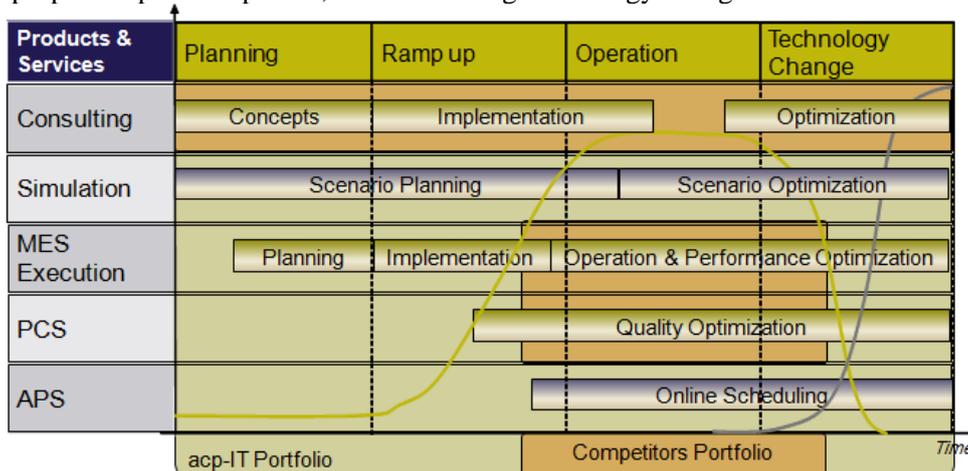
Figure 2 - Fab Lifecycle Coverage with InFrame Synapse

- Using InFrame Synapse Simulation Suite, based on Anylogic Simulation Engine, the customer can plan and optimize the new Fab layout during the Fab planning phase.

- Using InFrame Synapse Emulators, connected with the InFrame Synapse MES thru InFrame Synapse PLC-Connector (SECSSII/GEM), a configurable EI bridge between MES and equipments, the customer integrates the control software already from the early ramp-up phases.
- Implementation of the InFrame Synapse MES allows the customer to operate the Fab in different scenarios, from simple Tracking and Tracing scenarios up to active control of complex production facilities, operations and resources, using the Scheduler component.
- Connection and integration of InFrame Synapse PCS enables the customer to perform statistical process control, failure detection and classification and advanced process control of equipment, process and quality data during full-operation phases.

InFrame Synapse Virtual Fab is the newest member of the InFrame Synapse Suite, starting End of 2009. In the Virtual Fab, the customer can easily connect the MES and PCS Systems with a virtual production facility, taking advantage of the following innovative features:
- Define and test the feasibility of production master data already in the capacity planning phases.
- Define and test the dispatch rules and scheduling algorithms in the early planning phases in the virtual environment.
- Start integration, customization and testing of the MES and PCS systems already in early planning phases
- Generate MES and PCS master data (resource models, process plans, product definitions etc.) directly from the simulation model used during the capacity planning phase
- Generate the MES dispatch rules and scheduling algorithms for the complex automated material handling systems out of the simulation model. The rules and algorithms were defined and tested in the planning phases and they must not be redefined again in the real control system.
- During late operation phases, generate simulation models out of the MES historical data. This way the customer can simulate new manufacturing scenarios before deciding on operative changes.
- With a generated simulation model, in operation phases, the customer can accurately test new dispatching rules and scheduling algorithm and transfer them back to the MES. This way rules which prove to have a negative impact do not reach the operative system.
- Test different scheduling configurations and policies against the Virtual Fab, evaluate rescheduling strategies in case of out-of-plan situations.
- Generate virtual production history data for new MES ramp-ups in existing running fabs.
- Generate equipment parameters for the manufacturer requirements based on production targets (i.e. if a new equipment is to be bought, parameters like equipment availability and maintenance plans can be generated and send to manufacturers)
- Use the Virtual Fab as training environment for engineers and operators, already when no equipments are available

Beside these new innovative features, now the standard features of our Simulation Suite can be used and performance evaluated against the real production control systems:
-    find out the type and number of required equipments already from the future factory planning phase;
-    evaluate different layout alternatives, from throughput and utilization perspectives;
-    inspect possible bottlenecks in the material flow;
-    identify a minimal buffering capacity;
-    evaluate operator behaviour impact on the Fab output;
-    test maximum maintenance time window;
-    identify the Fab behaviour in case of breakdowns;
-    identify scrap probability;
-    evaluate performance due to setup downtimes caused by product change;

With the new Virtual Fab, customers of InFrame Synapse can drastically reduce ramp-up time, as well as easily validate the feasibility of changes in production facilities running at high capacity. The figure below shows how much can be reduced the ramp-up time using early integration of Production Control Software with the Virtual Fab, the blue chart showing a regular ramp-up plan, while the red chart shows the enhanced one.
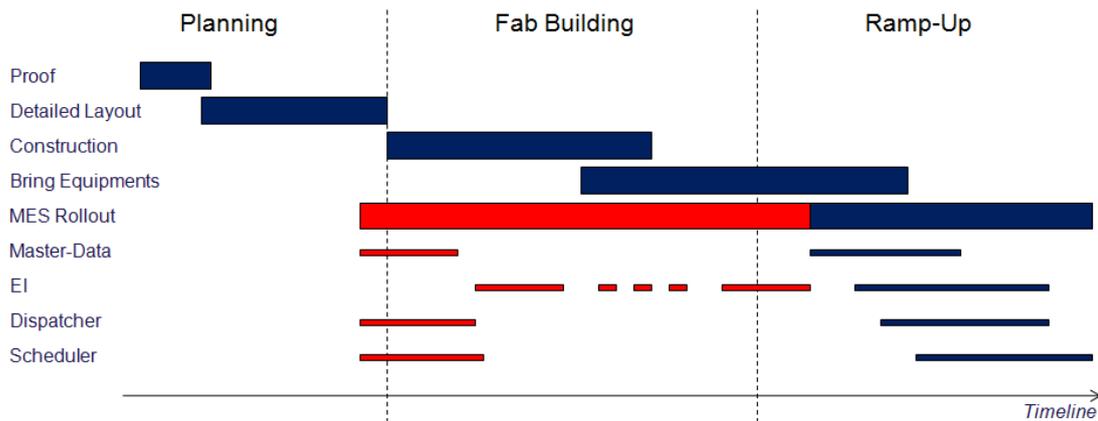
Figure 3 - Reduction of Ramp-Up Time with Virtual Fab