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SIMULATION BASED PLANNING & SCHEDULING SYSTEM: MOZART®

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ABSTRACT

In the FAB industries, key objectives of planning and scheduling might be 1) to meet the due date, 2) reduce the cycle time and 3) maximize machine utilization. MozArt has played a vital role in achieving the goals mentioned above in Korean semiconductor and display manufacturers. Its backward planning (pegging) engine finds the progress for each demand, while forward planning (loading simulation) engine considers factory capacity. Several experiences and practices including what-if simulation scenario will be discussed.

1 INTRODUCTION

Typical FAB planning and scheduling process consists of master planning (MP), factory planning (FP), scheduling, and dispatching as shown in Figure 1 (Park et al. 2008). MP decides a weekly production target on which sales and manufacturing departments agree. FP determines daily FAB in and out plan which meets the weekly target. Scheduler generates tool schedule within which dispatcher selects a lot. MozArt RTF (return to forecast) equipped with backward planning engine provides the progress of each demand and generates step target through demand and lot pegging. MozArt LSE (loading simulation engine) fitted with forward planning engine is a what-if simulator which estimates moving and WIP trend (VMS Solutions 2013).

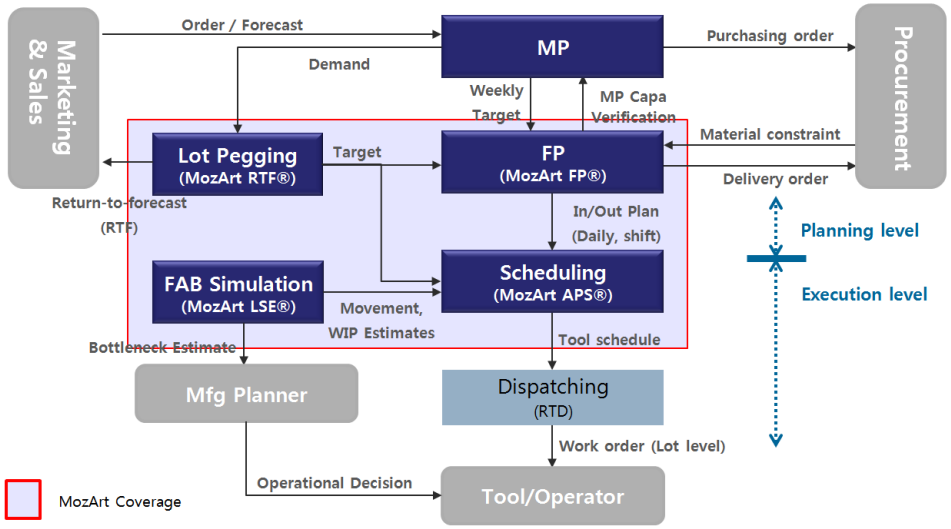

Figure 1: Coverage of planning & scheduling process by MozArt®

2 BACKWARD & FORWARD PLANNING ENGINES

Pegging is a process of mapping a lot onto a demand which is specified by the due date, quantity, and product specifications including customer information (Ko 2010). MozArt backward pegging engine calculates in and out target for each step with current step WIP, lead time and yield in a backward stepwise. As a result of pegging, lots are divided into *pegged* lots who have its demand and *unpegged* ones. The position of the last pegged lot indicates the progress for its demand. Unpegged lots should be justified its unpeg reason and minimized to reduce the cycle time. MozArt RTF® usually covers all sites and areas around the world including FAB, probe, and backend. Its step target is used in daily planning and scheduling, which makes shop floor operation integrated and consistent with the customer demand.

MozArt forward simulation engine based on discrete event simulation (DEVS) mimics the real factory operation. It especially focuses on the loading and unloading event, and generates loading history for each machine, step movement and WIP trends. Its result can be interfaced to legacy line or area scheduler, PM scheduler, and dispatcher. MozArt LSE® enables the planner to test various scenarios, for instance, product mix, PM schedule change and tool dedication modification. It also detects bottle neck steps or machine groups by analyzing the WIP and movement trends.

3 INTEGRTED PLANNING & SCHEDULING APPLICATION

MozArt FP® and MozArt APS (advanced planning and scheduling) have not only backward/forward engines but also optimization engine. Backward pegging engine generates step target which is used in the following forward loading simulation to generate daily plan or machine schedule. Optimization engine solves specific issues such as line allocation, pairing or kitting. The optimal solution can be used as an input or constraints while forward loading simulation is in execution.

MozArt FP® runs every day with several weeks horizon, and generates daily in and out plan. The result satisfies capacity constraints, is synchronized between lines and sites, and maintains reasonable WIP level. Daily plan generated by FP verifies if MP demands are to be met. It periodically generates an *initial version* plan. After a planner modifies input data including tool dedication, PM schedule, it makes *modified versions*. When the planner selects one version and amends its result, *final version* is released.

MozArt APS® generates wafer release plan and machine schedule which satisfy production constraints including setup availability and queue time limit. Beginning on hand lots and newly released lots are put into the waiting lot list. In the simulation model, each machine has a dispatching rule which selects the best lot from loadable lots. Weighted sum rule, commonly used dispatching rule, is configured to meet the target, reduce cycle time, minimize job change, and keep the WIP balance. The simulation approach also provides result tracking and job change reasons.

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