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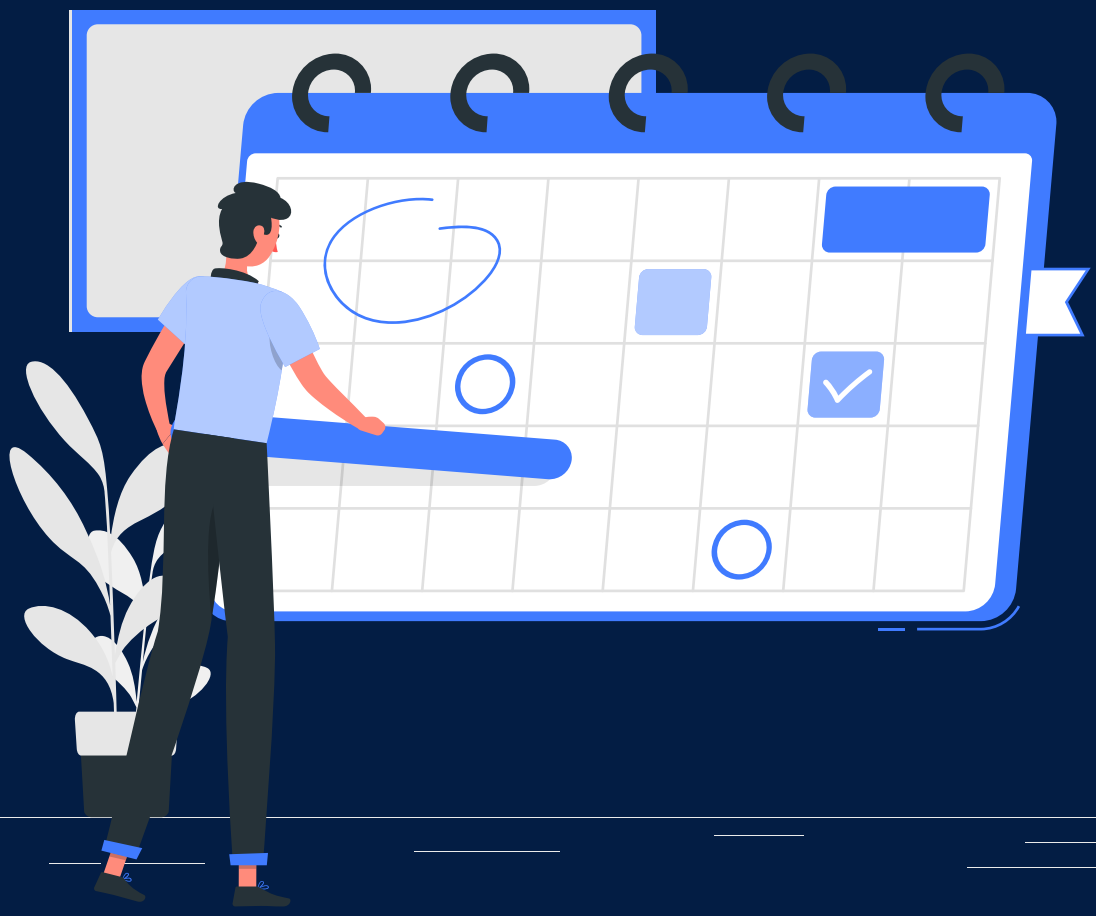
Intelligent Planning & Scheduling

Planning and Scheduling

the Vital Industry 4.0 Transformation Component



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Industry 4.0 envisages a flexible system of connected network of Cyber Physical System (CPS) working autonomously that can self-optimize performance across the network. Optimizing the sub-components of the system does not necessarily optimize the overall system [8].

To achieve a synergy, there is a need for a more global optimization of the entire system. Decisions like what to make, when to make and where to make have a system-wide impact. Hence there is a need for Industry 4.0 functions that makes these decisions with a global viewpoint; without it, the realization of Industry 4.0 will be far from optimal.

This is the domain of Advanced Planning and Scheduling (APS) and realizing the full benefits of Industry 4.0 requires the next generation of APS solutions – Planning and Scheduling 4.0.

A historical perspective

Much like all of manufacturing, Planning and Scheduling has gone through multiple generational cycles:

P&S 1.0: Manual generation of plans and schedules. For much of manufacturing history, this was the way production was organized.

P&S 2.0: With the advent of computers, mainframe applications and custom spreadsheets were used in creating plans and schedules. This is still the way most planning and scheduling is done in 2018. It is important to note that there is still considerable manual intervention involved, as this generation of APS systems cannot handle the detail and complexity of today's manufacturing.

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P&S 3.0: Advances in algorithms, the availability of low cost, high performance computing and the ubiquity of network services enabled the next generation of APS solutions. Optessa MLS V1 – V6 are exemplars of this generation, characterized by sophisticated data models to describe real-world detail, and state of the art algorithms to solve the resulting complexity. Browser based interfaces replaced the need for client specific interfaces. These systems can generate plans and schedules requiring little or manual adjustment of plans and schedules, with the resulting optimal quality assuring ROI in a matter of weeks.

P&S 4.0: While P&S 3.0 systems represent a dramatic improvement over capabilities of earlier generation APS systems, the same technological advances that are transforming manufacturing are also transforming APS, providing hitherto undreamt-of capabilities that turn out to be key enablers of Industry 4.0. Optessa MLS V7+ represent this next generation.

Technology Drivers

Here are some of the ways that the same technology drivers that undergird Industry 4.0 are transforming planning and scheduling:

Algorithms & Data Models: More global optimization of plans and schedules, scaling to very large problem sizes, real-time rescheduling.

AI / Machine Learning: Autonomous execution of planning and schedule processes, real-time response to changes.

IoT: Makes available high resolution, high volume data that provide timely and accurate information on the state of the factory, as well as the supply chain.

Big Data & Analytics: Processing of large volumes of data to provide the inputs needed to generate more global and real-time plans and schedules.

Digital Twin / Simulations: Go hand in hand with P&S 4.0 as a digital twin that does not model planning and scheduling cannot capture the operation of the factory.

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Cloud: On-demand, affordable computing with the capacity to execute P&S 4.0 algorithms.

Cyber-Physical Systems: Empower users to solve the most complex of planning and scheduling problems.

Digital SCM: Enables a more global, multi-tier approach to optimizing the supply chain.

Blockchain: Secure and auditable communication between autonomous systems.

Mobility: Smart phones and tablets, bring the power of P&S 4.0 to users wherever they might be.

Planning & Scheduling 4.0

The defining characteristics of Industry 4.0 are Connected, Transparent, Proactive, Agile and Optimized [7]. P&S 4.0, as a vital component of Industry 4.0, also displays these characteristics.

Being Agile means responding to change in customers' requirements or change in operating conditions. Being Connected enables co-operation between systems.

Being Proactive is to anticipate changes and be prepared accordingly. Being Transparent enables sharing useful and actionable information.
Being Optimized mean all its actions are coordinated to realize defined goals.

The following illustrates several new use cases that P&S 4.0 enables.

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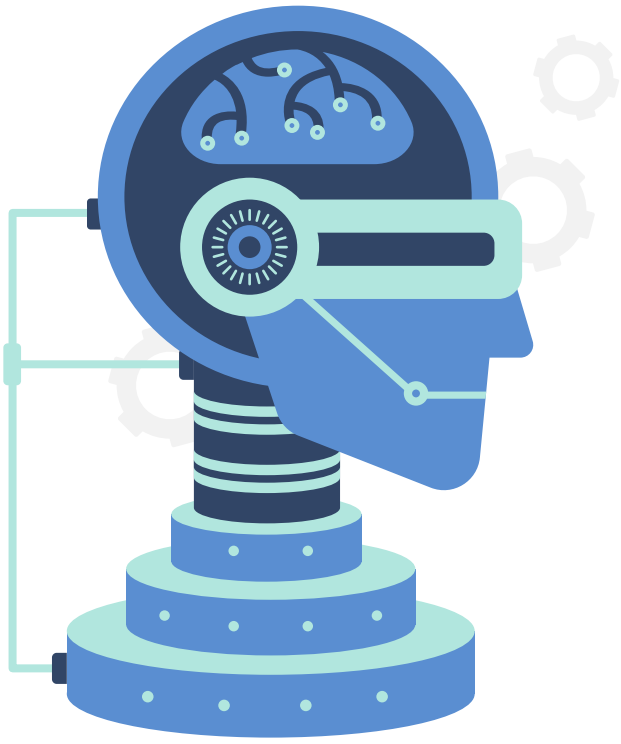
Global Optimization

Planning and scheduling are among the most computationally intractable of all engineering problems and need to be broken into sub-problems which are then solved. While this enables solutions that can be deployed in practice, as discussed earlier, some degree of optimality is lost [8]. The enhanced capabilities of P&S 4.0, in terms of deeper and wider visibility into the supply chain, and advances in algorithms and computing means that sub-problems can be combined to yield more global formulations and yield ever more high quality plans and schedules. A case in point is multi-tier planning of the entire Supply Network. Another is the Virtual Flow. Line (VFL) capability of Optessa MLS V7+ that can do holistic optimization of multiple production stages.

Real-Time Rescheduling

A Proactive and Agile factory requires a Proactive and Agile P&S. Connectivity provides the P&S 4.0 with accurate and timely data (equally, the benefits of IoT and Big Data are not fully realized without P&S 4.0, and other analytics systems that leverage this data). With real-time data - orders, forecasts, inventories, resource status - from across the factory and the supply chain, coupled with Analytics, it is possible to determine that the in-place plan or schedule is no longer optimal, or (in extreme cases) even buildable.



Given advances in algorithms and computing, P&S 4.0 can re-optimize the plan or schedule on the fly. AI / Machine learning enables the system to autonomously respond to a full range of failure events that impact execution.

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High Fidelity Scheduling

P&S 3.0 have the capability to describe and solve planning and scheduling problems of great detail and complexity but are often hindered by the lack of relevant data – for example, accurate counts of parts and finished goods inventories. With the availability of high-resolution data, P&S 4.0 can generate highly fidelity schedules that are both buildable and more optimal.

The above examples illustrate the transformational capabilities of P&S 4.0, and how a Connected, Transparent, Proactive, Agile and Optimized P&S is a vital component to realize Industry 4.0.

About Optessa

Optessa is a leader in intelligent planning, sequencing, and scheduling optimization software with many successful implementations among top tier global manufacturers.

Optessa products have wide applicability in industries as diverse as auto OEMs, suppliers, power equipment, electronics, semiconductor, and mills; batch process industries such as food and beverage, and paints; as well as shipping and logistics. The company has offices in Edmonton, Alberta, Canada; Hazlet, New Jersey, USA; and Goa, India. Optessa's leadership team combines deep expertise in software, mathematics, manufacturing, and optimization technologies with unmatched customer commitment.

Optessa supports global deployment at more than 100 distinct manufacturing facilities and production areas. We also partner with industry leaders, Deloitte and Tech Mahindra, to further enhance our client support.

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