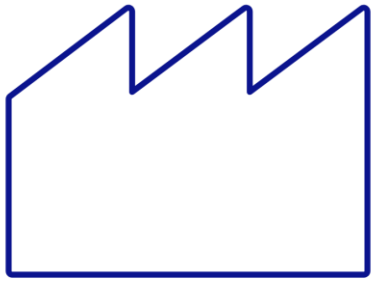


OpenI40

OPEN SOURCE INDUSTRY 4.0

Concepts & Technology, architecture overview

Openi40 APS features – 1/4 internal MRP

- OpenI40 has an internal management resource planning (MRP)
  - Manages products/production cycles, phases, bill of materials
  - Manages production resources: complete companies/plants/departments/warehouses/work centers/machines and secondary resources (employees, other equipments) data model and management.
  - Manages purchase/sales/working/transfer orders
  - Can create work orders and working tasks from sales order lines and production cycles informations.
  - Manages tasks and work orders relations.
  - Manages material and missing material according to basic needs algorithms or with level of reorder algorithm.
  - Can create missing purchase orders and work orders.

Openi40 APS features – 2/4 internal APS Engine

- The internal scheduling system supports:
  - Forward and backward scheduling (also mixed)
  - Infinite/finite capacity scheduling.
  - Various kind of supplier/consumer tasks time alignment due to material transfer strategies.
  - Complex per “ machine “ and per “secondary resource” calendar allocations.
  - Complex machines/secondary resources setup and work configurations with coherent timeline calculations.
  - Setup time calculations with optional changeover matrix configuration.
  - Work time calculation with various logics (also customizable).
  - Timeline and gantt calculation according to various optimizations options.

Openi40 APS features – 3/4 integration layers

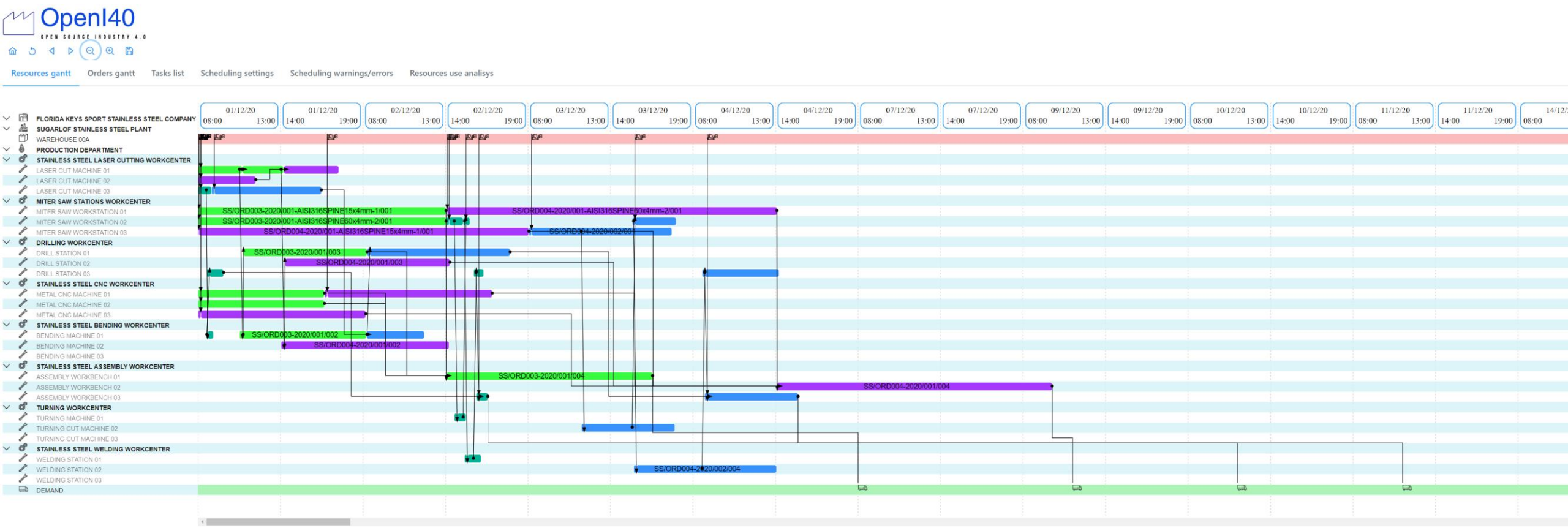
- The APS has multiple layers of integration:
  - A native database interface layer for standalone installations (compatible with all commercial and non commercial databases).
  - A REST interface layer to directly load and save to 3rd party systems.
  - A JSON format file loader layer.
  - Custom integration layers can be easily developed for custom purposes.

These layers options let OpenI4.0™ being suitable from standalone installations scaling up to a fully integrated tool inside a 3rd party software suite.

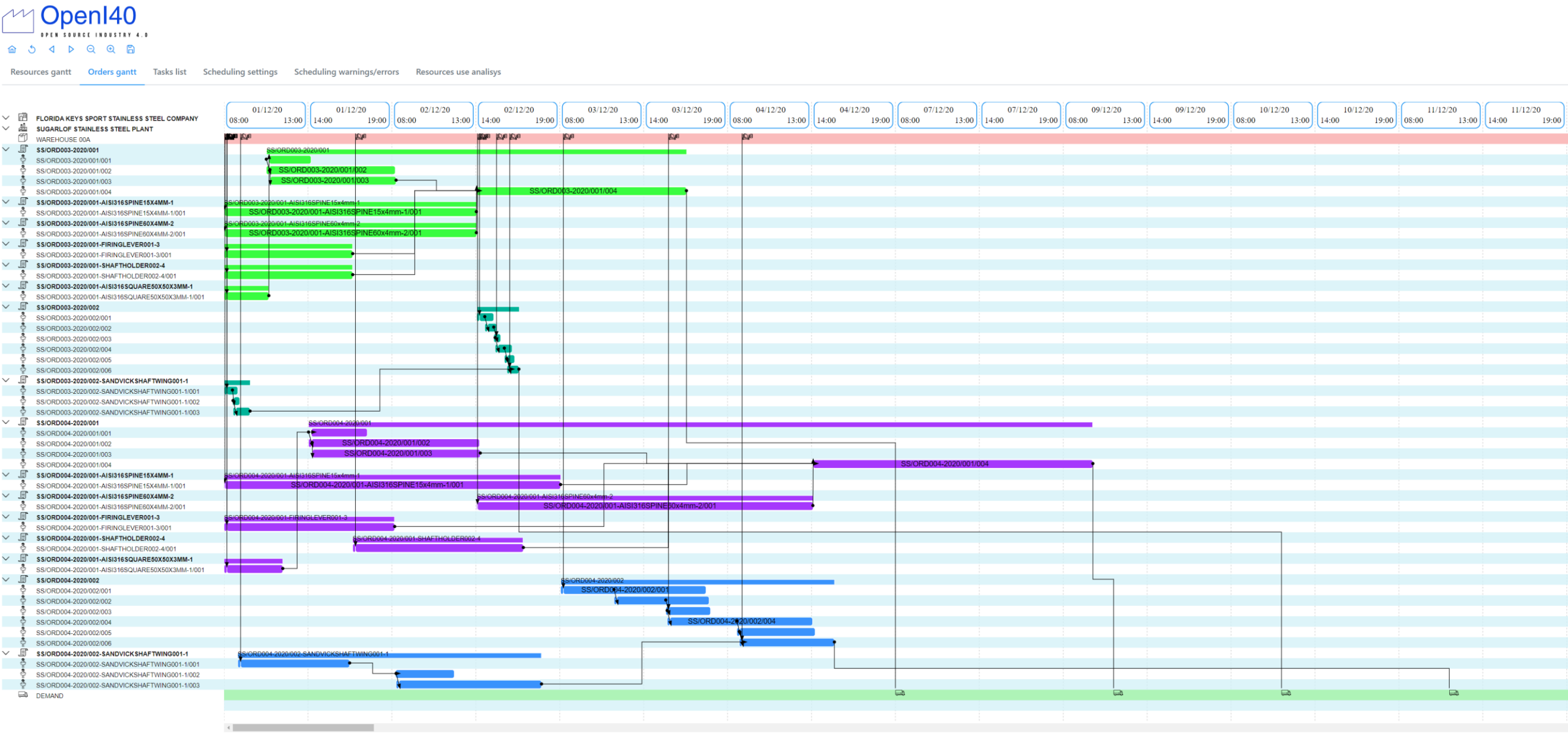
Openi40 APS features – 4/4 APS Gui

- The web gui of scheduling system supports:
  - Resources gantt
  - Work orders gantt
  - Resources loading/use graphics
  - In depth detail of each tasks with its material/cycle/phase/bill of material infos.
  - Scheduling problems overview.
  - Scheduling configuration settings to mix multiple algorithms and options for work orders sets.

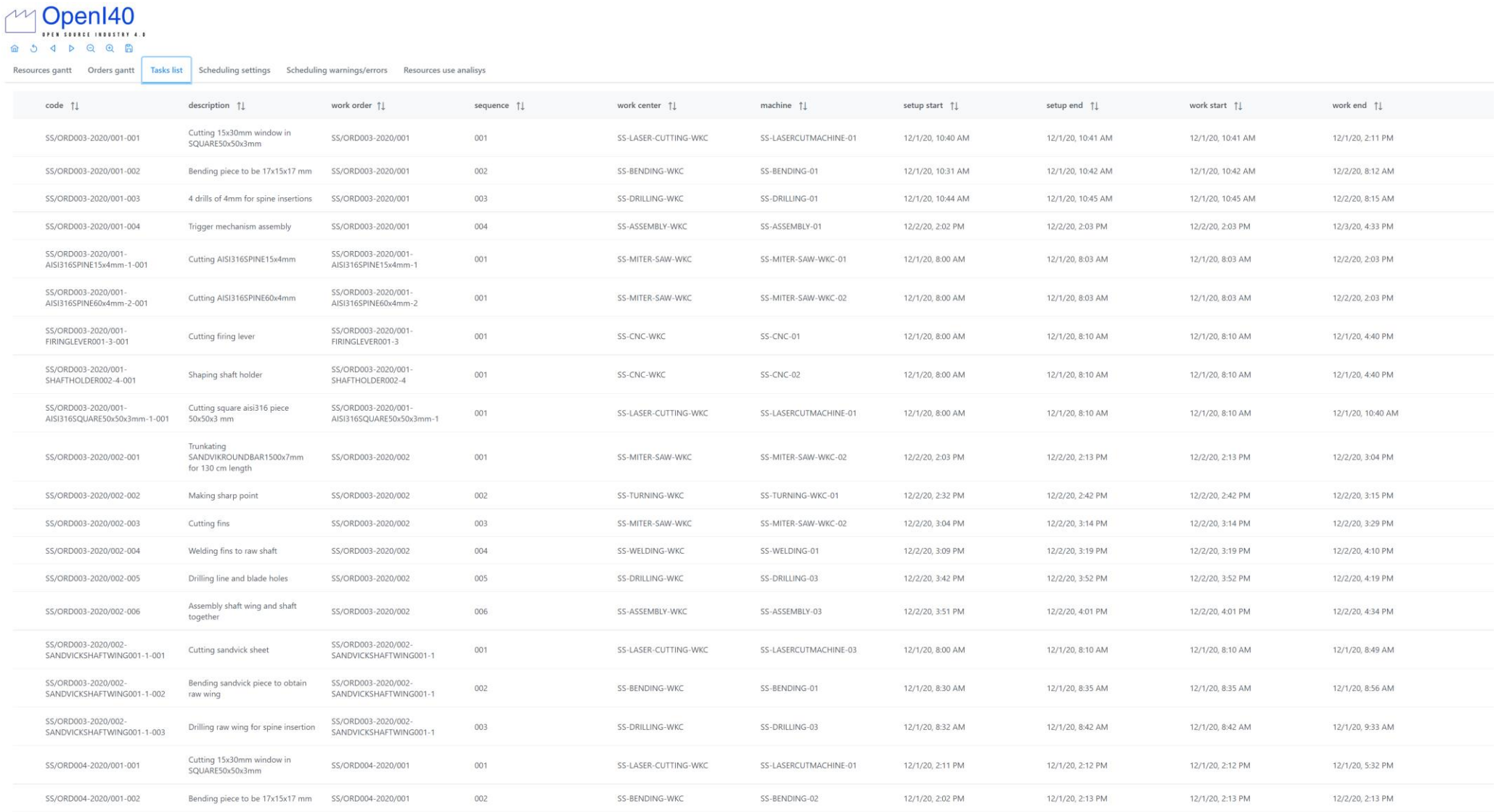
Openi40 APS GUI features – Resources Gantt



Openi40 APS GUI features – Orders Gantt

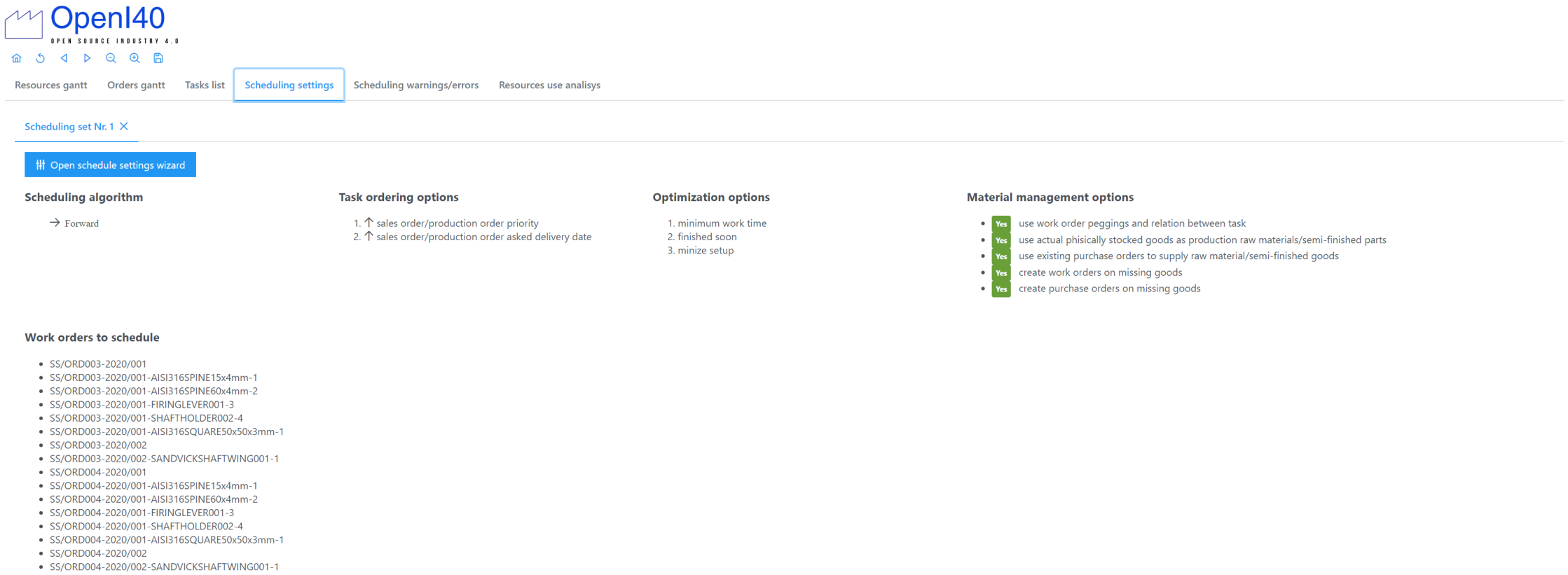


Openi40 APS GUI features – Tasks list



code	description	work order	sequence	work center	machine	setup start	setup end	work start	work end
SS/ORD003-2020/001-001	Cutting 15x30mm window in SQUARE50x50x3mm	SS/ORD003-2020/001	001	SS-LASER-CUTTING-WKC	SS-LASERCUTMACHINE-01	12/1/20, 10:40 AM	12/1/20, 10:41 AM	12/1/20, 10:41 AM	12/1/20, 2:11 PM
SS/ORD003-2020/001-002	Bending piece to be 17x15x17 mm	SS/ORD003-2020/001	002	SS-BENDING-WKC	SS-BENDING-01	12/1/20, 10:31 AM	12/1/20, 10:42 AM	12/1/20, 10:42 AM	12/2/20, 8:12 AM
SS/ORD003-2020/001-003	4 drills of 4mm for spine insertions	SS/ORD003-2020/001	003	SS-DRILLING-WKC	SS-DRILLING-01	12/1/20, 10:44 AM	12/1/20, 10:45 AM	12/1/20, 10:45 AM	12/2/20, 8:15 AM
SS/ORD003-2020/001-004	Trigger mechanism assembly	SS/ORD003-2020/001	004	SS-ASSEMBLY-WKC	SS-ASSEMBLY-01	12/2/20, 2:02 PM	12/2/20, 2:03 PM	12/2/20, 2:03 PM	12/3/20, 4:33 PM
SS/ORD003-2020/001-AISI316SPINE15x4mm-1-001	Cutting AISI316SPINE15x4mm	SS/ORD003-2020/001-AISI316SPINE15x4mm-1	001	SS-MITER-SAW-WKC	SS-MITER-SAW-WKC-01	12/1/20, 8:00 AM	12/1/20, 8:03 AM	12/1/20, 8:03 AM	12/2/20, 2:03 PM
SS/ORD003-2020/001-AISI316SPINE60x4mm-2-001	Cutting AISI316SPINE60x4mm	SS/ORD003-2020/001-AISI316SPINE60x4mm-2	001	SS-MITER-SAW-WKC	SS-MITER-SAW-WKC-02	12/1/20, 8:00 AM	12/1/20, 8:03 AM	12/1/20, 8:03 AM	12/2/20, 2:03 PM
SS/ORD003-2020/001-FIRINGLEVER001-3-001	Cutting firing lever	SS/ORD003-2020/001-FIRINGLEVER001-3	001	SS-CNC-WKC	SS-CNC-01	12/1/20, 8:00 AM	12/1/20, 8:10 AM	12/1/20, 8:10 AM	12/1/20, 4:40 PM
SS/ORD003-2020/001-SHAFTHOLDER002-4-001	Shaping shaft holder	SS/ORD003-2020/001-SHAFTHOLDER002-4	001	SS-CNC-WKC	SS-CNC-02	12/1/20, 8:00 AM	12/1/20, 8:10 AM	12/1/20, 8:10 AM	12/1/20, 4:40 PM
SS/ORD003-2020/001-AISI316SQUARE50x50x3mm-1-001	Cutting square aisi316 piece 50x50x3 mm	SS/ORD003-2020/001-AISI316SQUARE50x50x3mm-1	001	SS-LASER-CUTTING-WKC	SS-LASERCUTMACHINE-01	12/1/20, 8:00 AM	12/1/20, 8:10 AM	12/1/20, 8:10 AM	12/1/20, 10:40 AM
SS/ORD003-2020/002-001	Trunkating SANDVIKROUNDBAR1500x7mm for 130 cm length	SS/ORD003-2020/002	001	SS-MITER-SAW-WKC	SS-MITER-SAW-WKC-02	12/2/20, 2:03 PM	12/2/20, 2:13 PM	12/2/20, 2:13 PM	12/2/20, 3:04 PM
SS/ORD003-2020/002-002	Making sharp point	SS/ORD003-2020/002	002	SS-TURNING-WKC	SS-TURNING-WKC-01	12/2/20, 2:32 PM	12/2/20, 2:42 PM	12/2/20, 2:42 PM	12/2/20, 3:15 PM
SS/ORD003-2020/002-003	Cutting fins	SS/ORD003-2020/002	003	SS-MITER-SAW-WKC	SS-MITER-SAW-WKC-02	12/2/20, 3:04 PM	12/2/20, 3:14 PM	12/2/20, 3:14 PM	12/2/20, 3:29 PM
SS/ORD003-2020/002-004	Welding fins to raw shaft	SS/ORD003-2020/002	004	SS-WELDING-WKC	SS-WELDING-01	12/2/20, 3:09 PM	12/2/20, 3:19 PM	12/2/20, 3:19 PM	12/2/20, 4:10 PM
SS/ORD003-2020/002-005	Drilling line and blade holes	SS/ORD003-2020/002	005	SS-DRILLING-WKC	SS-DRILLING-03	12/2/20, 3:42 PM	12/2/20, 3:52 PM	12/2/20, 3:52 PM	12/2/20, 4:19 PM
SS/ORD003-2020/002-006	Assembly shaft wing and shaft together	SS/ORD003-2020/002	006	SS-ASSEMBLY-WKC	SS-ASSEMBLY-03	12/2/20, 3:51 PM	12/2/20, 4:01 PM	12/2/20, 4:01 PM	12/2/20, 4:34 PM
SS/ORD003-2020/002-SANDVICKSHAFTWING001-1-001	Cutting sandvick sheet	SS/ORD003-2020/002-SANDVICKSHAFTWING001-1	001	SS-LASER-CUTTING-WKC	SS-LASERCUTMACHINE-03	12/1/20, 8:00 AM	12/1/20, 8:10 AM	12/1/20, 8:10 AM	12/1/20, 8:49 AM
SS/ORD003-2020/002-SANDVICKSHAFTWING001-1-002	Bending sandvick piece to obtain raw wing	SS/ORD003-2020/002-SANDVICKSHAFTWING001-1	002	SS-BENDING-WKC	SS-BENDING-01	12/1/20, 8:30 AM	12/1/20, 8:35 AM	12/1/20, 8:35 AM	12/1/20, 8:56 AM
SS/ORD003-2020/002-SANDVICKSHAFTWING001-1-003	Drilling raw wing for spine insertion	SS/ORD003-2020/002-SANDVICKSHAFTWING001-1	003	SS-DRILLING-WKC	SS-DRILLING-03	12/1/20, 8:32 AM	12/1/20, 8:42 AM	12/1/20, 8:42 AM	12/1/20, 9:33 AM
SS/ORD004-2020/001-001	Cutting 15x30mm window in SQUARE50x50x3mm	SS/ORD004-2020/001	001	SS-LASER-CUTTING-WKC	SS-LASERCUTMACHINE-01	12/1/20, 2:11 PM	12/1/20, 2:12 PM	12/1/20, 2:12 PM	12/1/20, 5:32 PM
SS/ORD004-2020/001-002	Bending piece to be 17x15x17 mm	SS/ORD004-2020/001	002	SS-BENDING-WKC	SS-BENDING-02	12/1/20, 2:02 PM	12/1/20, 2:13 PM	12/1/20, 2:13 PM	12/2/20, 2:13 PM

Openi40 APS GUI features – Scheduling settings



Openi40 APS GUI features – Resources use analisys

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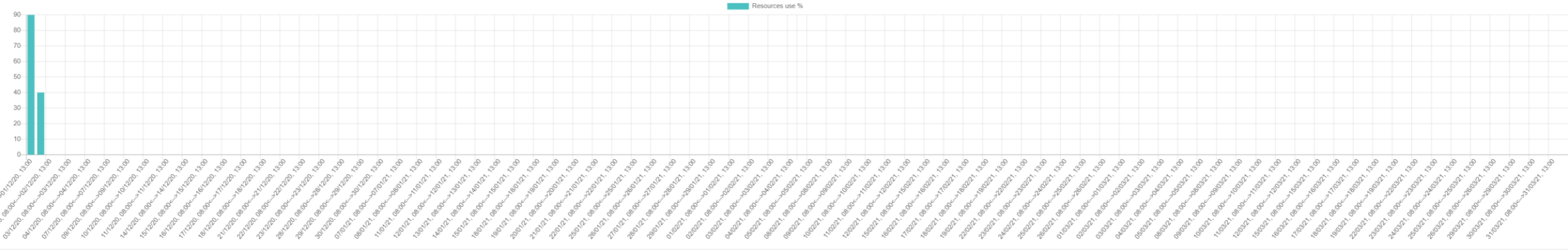
Resources gantt | Orders gantt | Tasks list | Scheduling settings | Scheduling warnings/errors | Resources use analisys

Resources use

- Florida keys sport stainless steel company
  - Sugarlof Stainless steel Plant
    - Production department
      - Workcenters

Stainless steel laser cutting workcenter

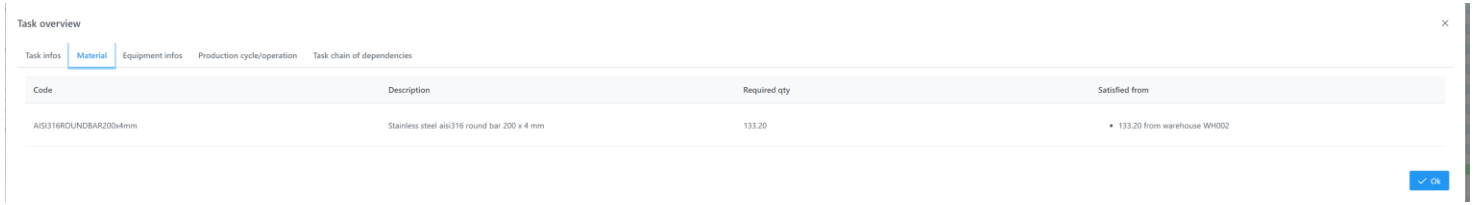


Miter saw stations workcenter

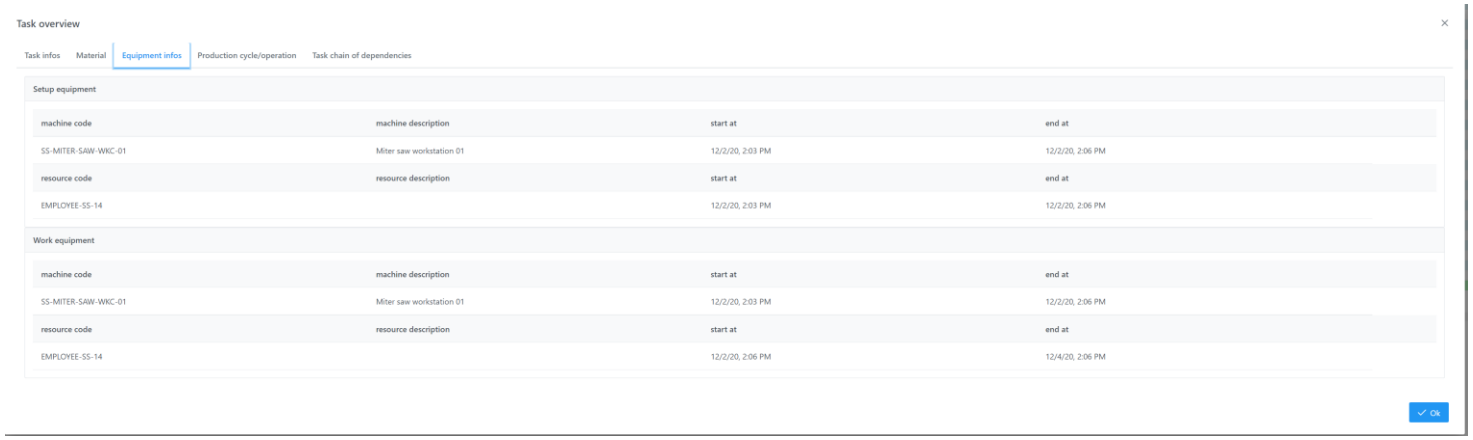
Openi40 APS GUI features – Task details (1/2)

Task infos

Task materials

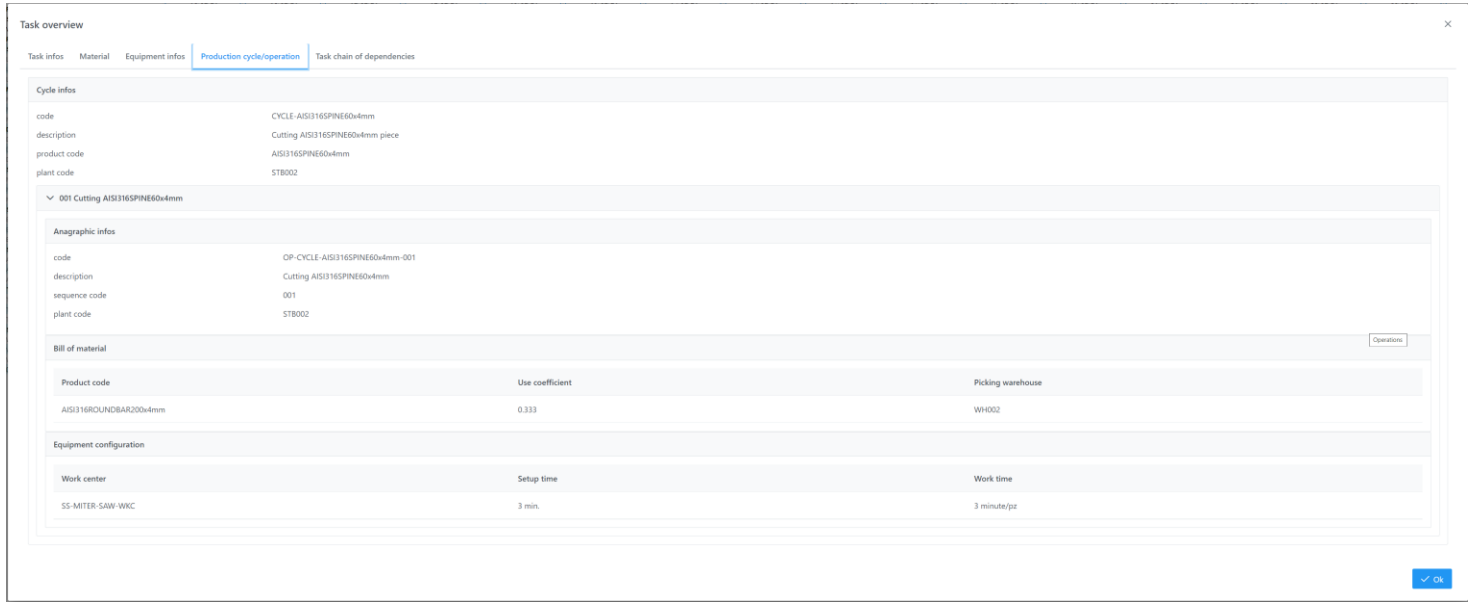


Task equipment infos

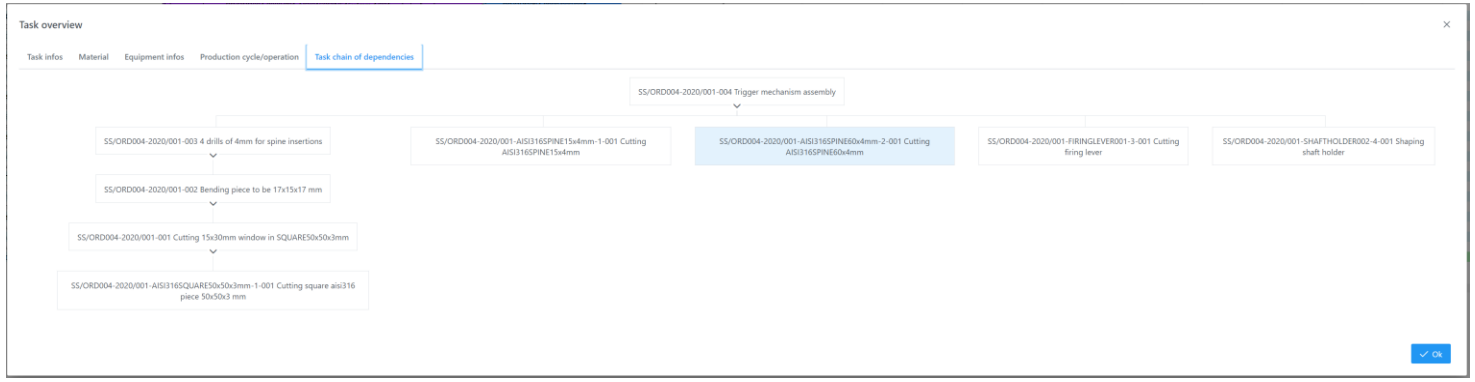


Openi40 APS GUI features – Task details (2/2)

Production cycle/operation



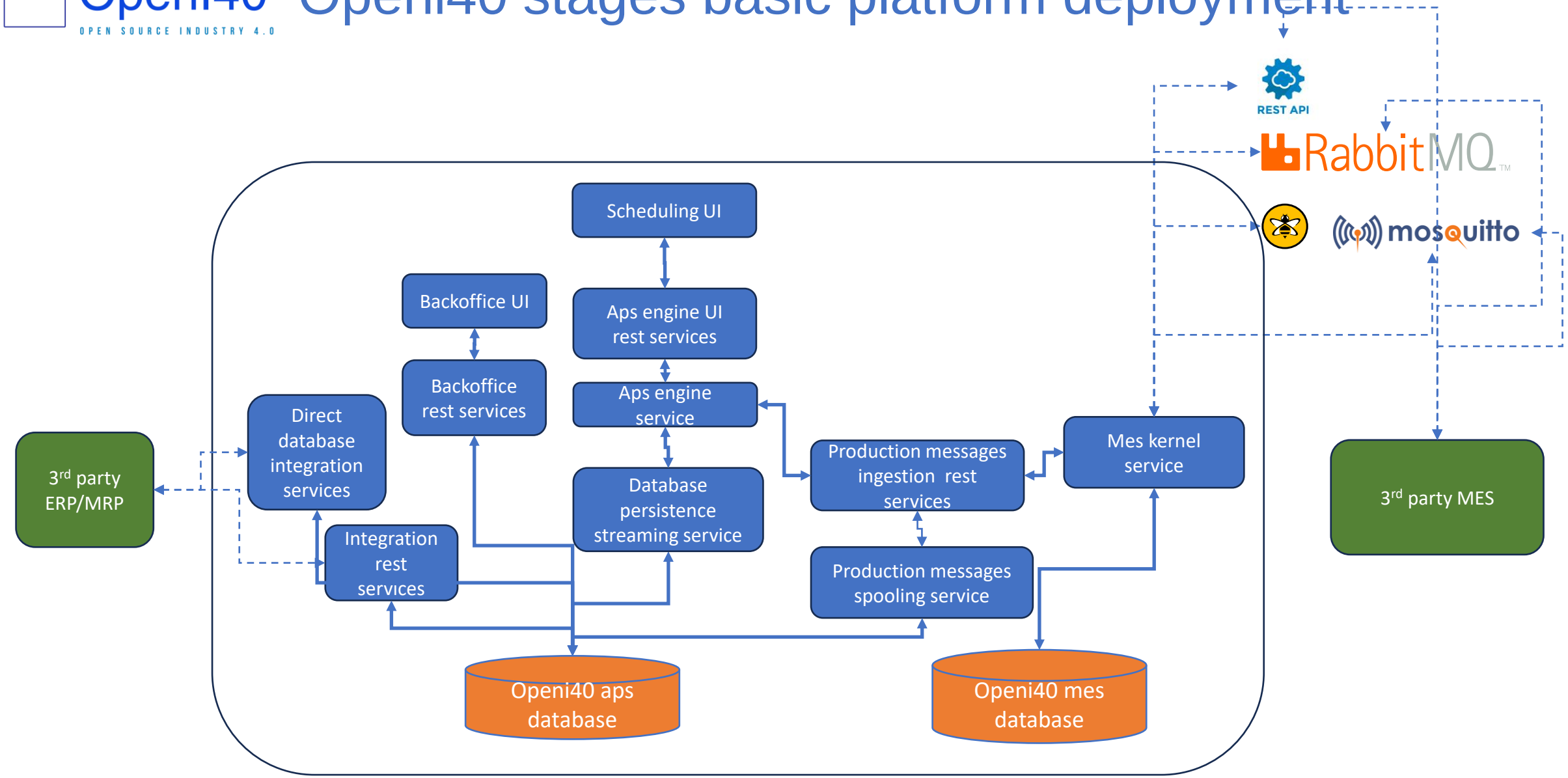
Task chain of dependencies



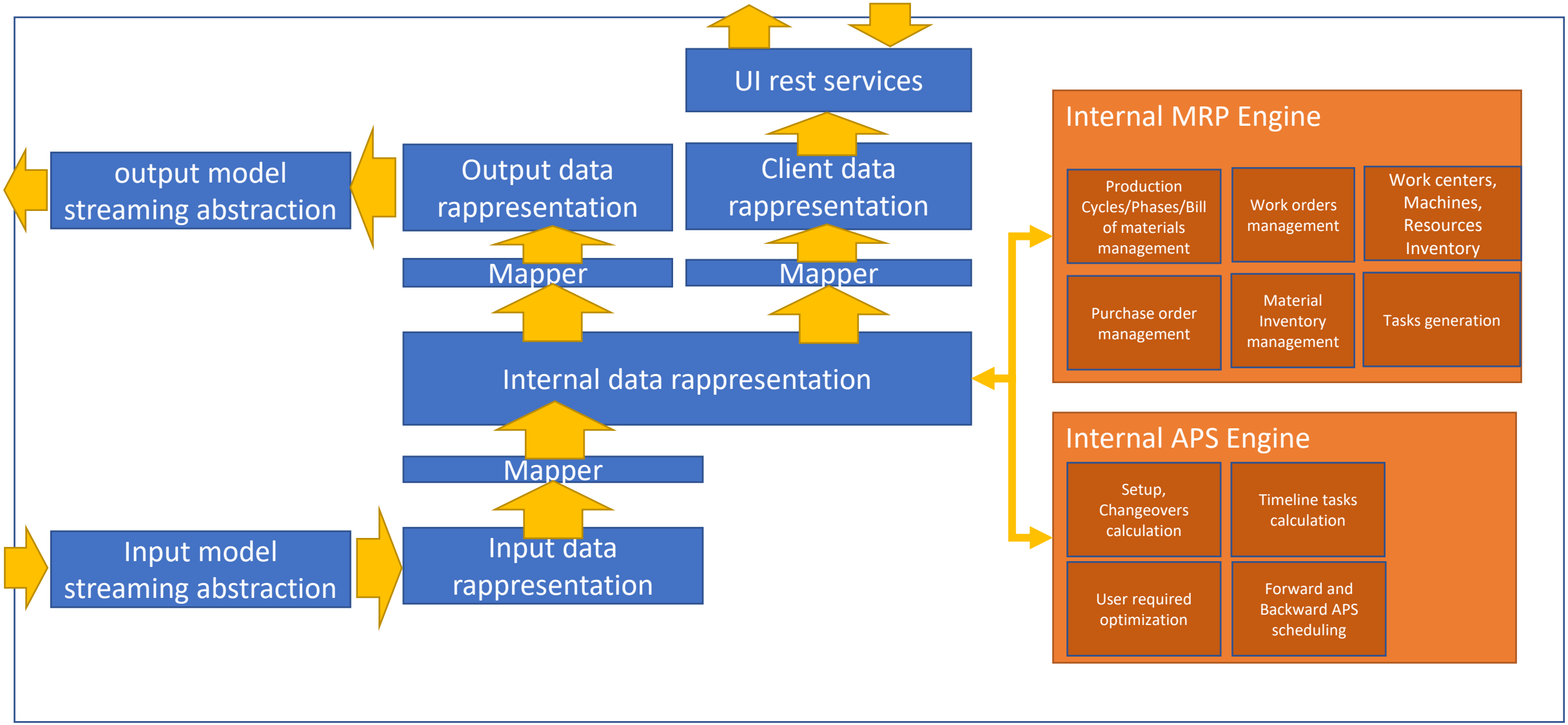
Openi40 platform architecture

- The platform is implemented with spring boot microservices architecture design.
  - Is splitted in interoperable stages with multiple packaging options
  - Each single stage can be installed on dedicated server to maximise throughput and configurable to connect to the other stages
  - Monolithic multiple stages assemblies are available for simple deploy
  - Has an high availability configuration for active/active clustering based on apache ignite distribuited transactional cache engine.
  - Integrates a minimal MES kernel to receive MQTT, RABBITMQ, REST notifications and transcode them in production update messages for the APS engine
  - Multi datasources/multi tenant
  - It can integrate every cloud/monitoring/docker integration, native binary generation option of the spring boot platform.

Openi40 stages basic platform deployment



Openi40 APS engine service



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Based on solid industry standard technologies

Runs on:

Web browsers:

Database platforms: