



Toward Factory Optima: A Web-based System for Composition and Analysis of Manufacturing Service Networks based on a Reusable Model Repository

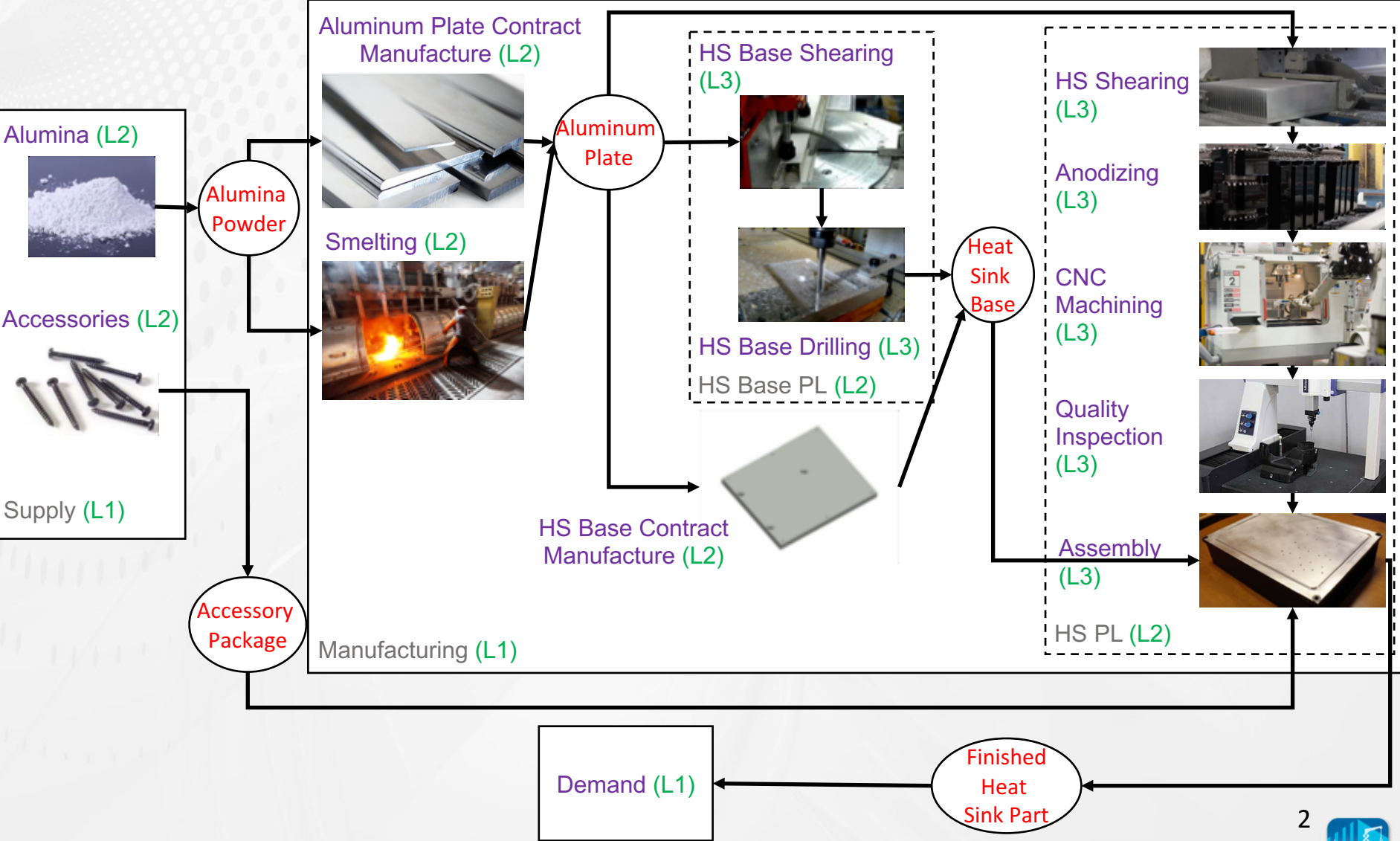
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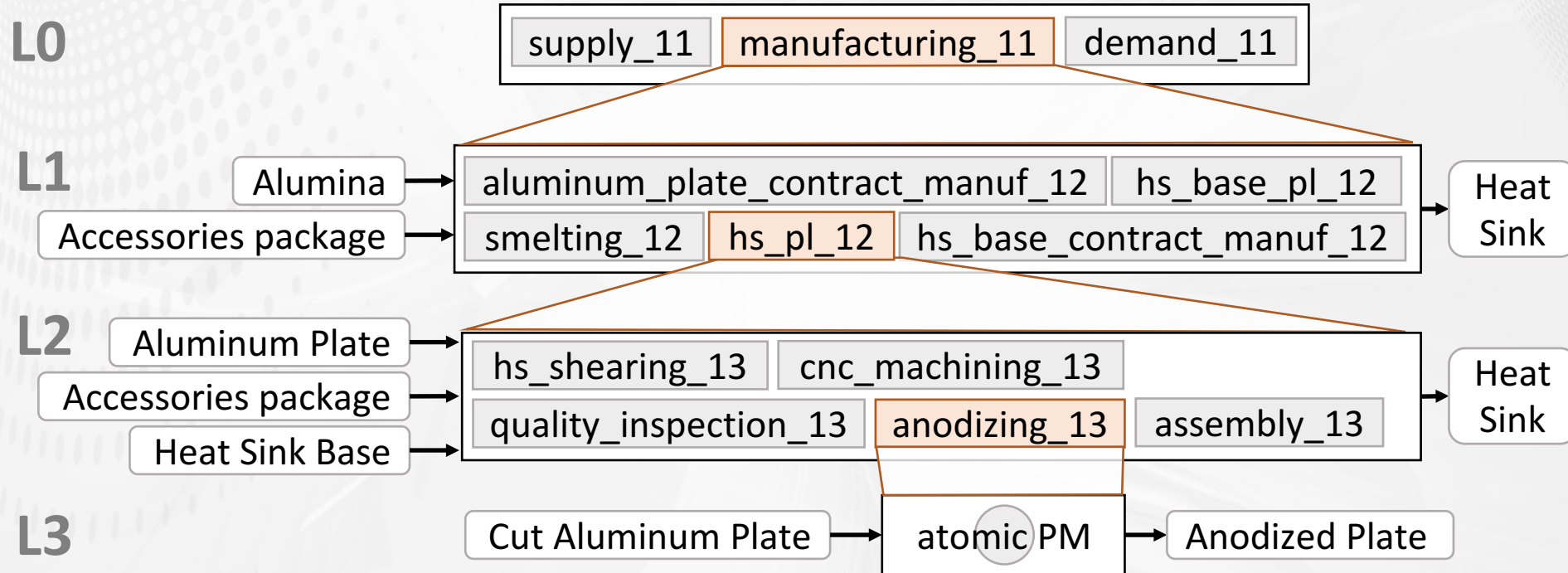
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Manufacturing Service Network example: Heat sink (HS) production and supply chain

Heat Sink Supply Chain (L0)



Composition of service network



Factory Optima

- Web-based system to compose, optimize and perform trade-of analysis of arbitrary complex service networks:
 - UMPs
 - cells, production lines, factories, supply chains, ...
- Based on a reusable repository of performance models (PMs) of
 - UMPs
 - supply chain components
- Unique in modular, reusable modeling like in simulation models, yet efficiency of best MP algorithms due to symbolic analysis and meta-optimization
- Based on Unity Decision Guidance Management System



Factory Optima Architecture

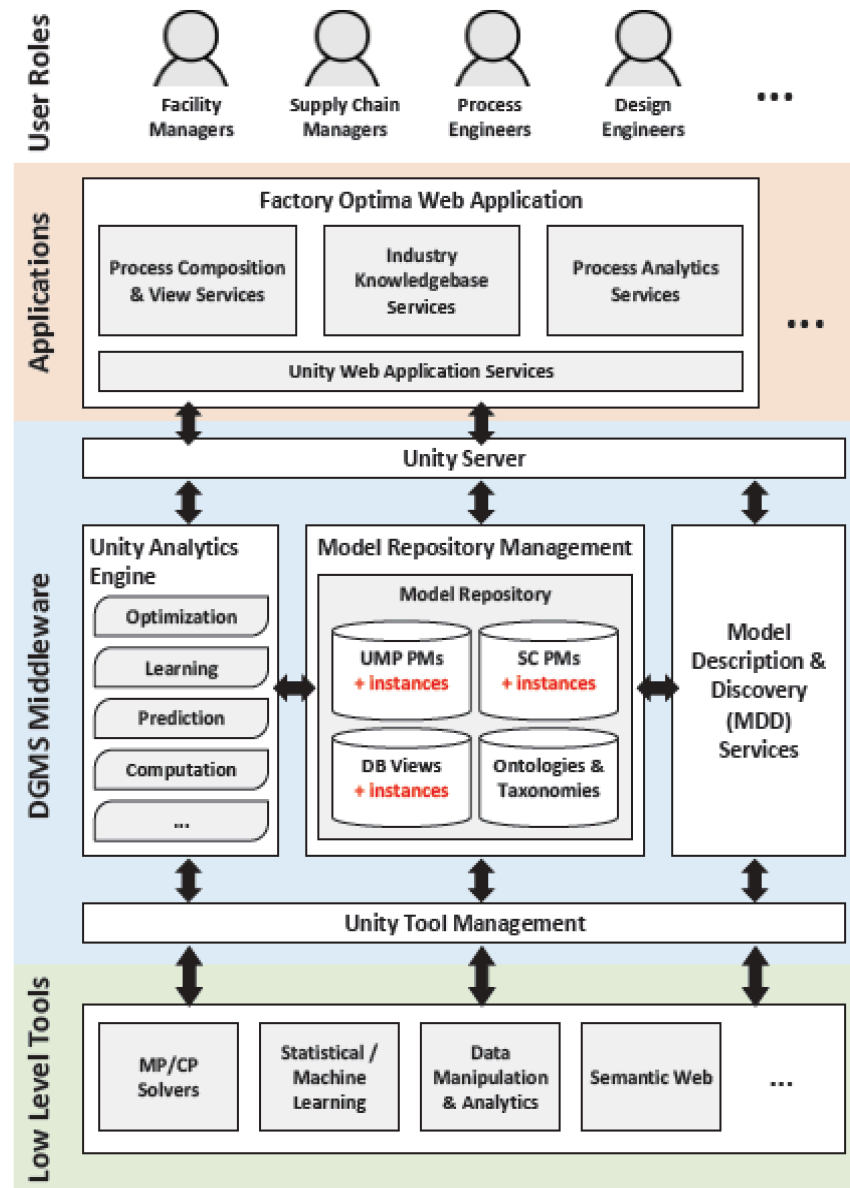
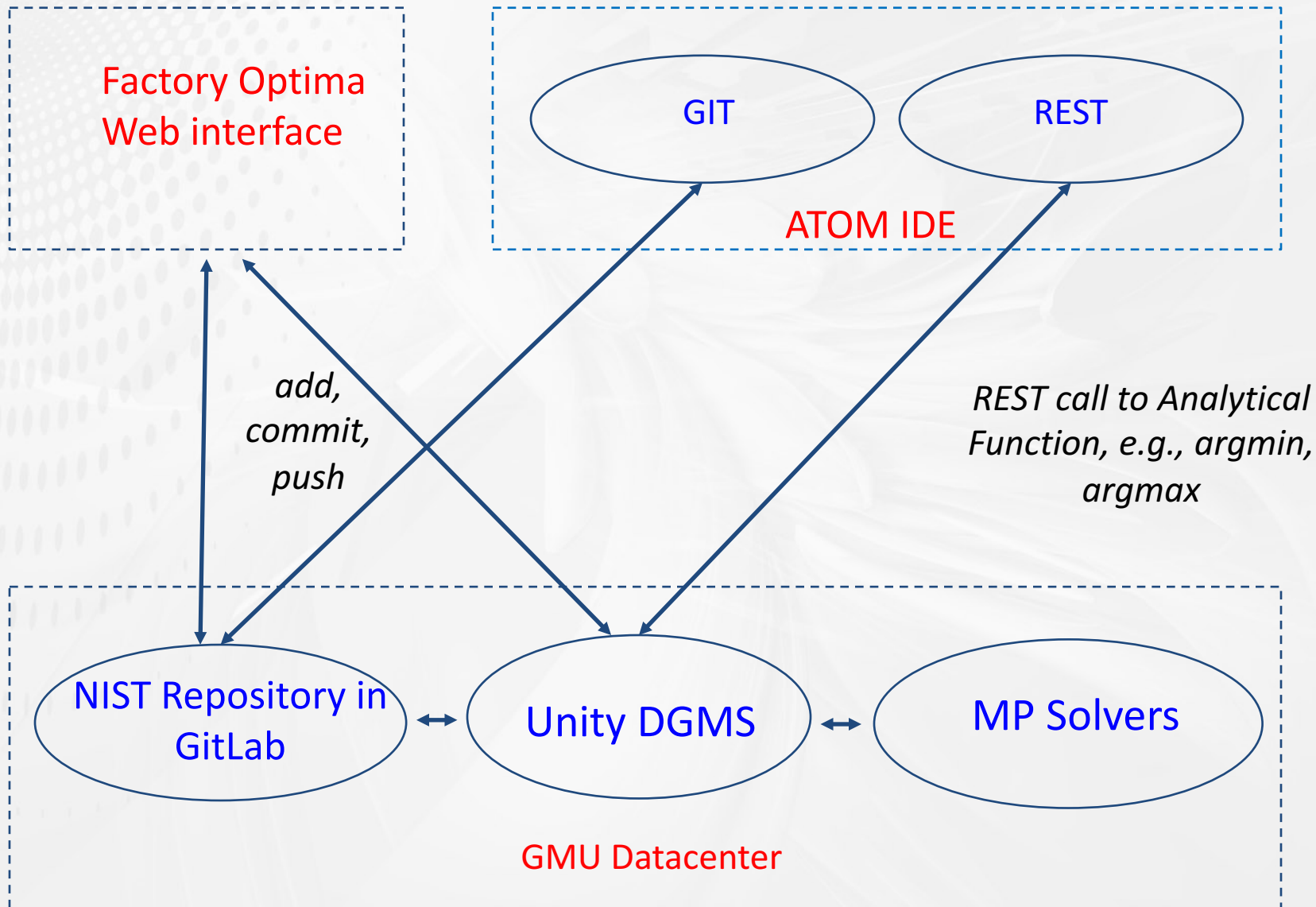


Figure 11. Conceptual architecture of Factory Optima and underlying software system based on reusable model repository and Unity DGMS. Adopted from (Brodsky et al. 2017).

Initial deployment architecture



Ontology + Repository views

The screenshot displays the Factory Optima software interface, which is used for managing industrial data and ontologies. The interface is divided into several sections:

- Top Bar:** Shows the current workspace as "ACME / ProductWorkspace" and the active file as "heat_sink_service_network.json".
- Left Panel (Repository View):** A tree view showing the hierarchical structure of the workspace. The "ProductWorkspace" folder is expanded, revealing subfolders like "MaterializedViews", "ProductServiceSystem", "Design", "DownstreamProcess", and "ServiceNetworks". The "ServiceNetworks" folder is further expanded, showing "Production" and "ProductionLines". The "ProductionLines" folder is expanded, showing files like "heat_sink_base_production_line.json", "heat_sink_production_line.json", "heat_sink_manufacturing.json", "heat_sink_service_network.json" (which is selected), and "heat_sink_supply.json".
- Right Panel (Ontology View):** Displays the selected file "heat_sink_service_network.json" in a JSON format. The view shows a hierarchical structure of the ontology, with nodes like "root", "config", "input", "kb", "heat_sink_part_service_network", "combined_supply", "combined_manuf", "demand", and "alumina_supplier". Each node has a "JSON" button and a "Properties" button.



Ontology + Repository views

The screenshot displays the Factory Optima web application interface. The browser address bar shows the URL `localhost:8080/unity-server/ACME/ProductWorkspace/tree`. The application header includes the breadcrumb `Factory Optima > ACME > ProductWorkspace` and a toolbar with buttons for `+ New`, `Artifact`, `Analytics`, `Save`, `Properties`, `Manage`, and `Run`.

The main content area features two tabs: `Repository` and `Ontology`. The `Ontology` tab is active, showing a hierarchical tree structure of the ontology. The tree is organized as follows:

- `PerformanceModel`
 - `ServiceNetworkPerformanceModel`
 - `ProductionService`
 - `CompositeService`
 - `ContractService`
 - `EngService`
 - `MfgService`
 - `PackagingService`
 - `QCService`
 - `RepairService`
 - `TransportService`
 - `VendingService`
 - `UnitManufacturingProcessPerformanceModel`
 - `ShapingProcess`
 - `AdditiveProcess`
 - `SolidificationProcess`
 - `Casting`
 - `MetalPowderSolidification`
 - `Smelting`
 - `Molding`
 - `SubtractionProcess`
 - `MechanicalSubtraction`
 - `AbrasiveMachining`
 - `Separating`
 - `Blanking`
 - `Piercing`
 - `Shearing`
 - `MultiPointCutting`
 - `CompositeMachining`
 - `SinglePointCutting`
 - `ChemicalSubtraction`



Optimization, analysis, results

The screenshot displays the ACME ProductWorkspace interface. The left sidebar shows a tree view of the workspace, with the 'OptimizationView' selected. The main area is titled 'Results' and shows a hierarchical tree of optimization results. The 'root' node is expanded, showing 'config', 'input', 'kb', 'supply', 'analyticalModel', 'inputThru', 'outputThru', and 'Alumina'. The 'Alumina' node is selected, and its 'Decimal' value is highlighted with a red circle, showing the value 13.73462860234753.

ACME / ProductWorkspace - [X] +

localhost:8888/unity-server/ACME/ProductWorkspace/tree/ACME/ProductWorkspace/Run/OptimizationView

Factory Options - ACME - ProductWorkspace

+ New - Artifact - Analytics - Save

/ ACME - ProductWorkspace - Run - OptimizationView

Repository - Catalog

- ProductWorkspace
 - MaterializedView
 - ProductServiceSystem
 - Run
 - OptimizationView
 - atalogsowl
 - packages.json
- @ACME/Enterprise [master]
 - Catalog
 - ContractSet of Providers
 - MyServiceProviders
 - aluminum_plate_contract_manifest.json
 - hs_base_contract_manifest.json
 - BindingSet of Providers
 - accessories_vendor.json
 - alumina_vendor.json
 - ProductionServiceResources
 - Demand
 - demand_manifest.json
 - PhysicalResources
 - oneindirectturnservice
 - anodizing.pon
 - mc_machining.pon
 - hs_base_drilling.pon
 - hs_base_shearing.pon
 - hs_shearing.pon
 - smelting.pon
 - assembly.pon
 - it_input.pon
 - drilling.pon
 - quality_inspection.pon

Results

root [icon] [JSON] [Properties] [Import]

config [icon] [JSON] [Properties] [Import]

input [icon] [JSON] [Properties] [Import]

root
host_sml_part_sensor_network_root

kb [icon] [JSON] [Properties] [Import]

supply [icon] [JSON] [Properties] [Import] [Import]

analyticalModel [icon] [JSON] [Properties] [Import]

inputThru [icon] [JSON] [Properties] [Import]

outputThru [icon] [JSON] [Properties] [Import]

Alumina [icon] [JSON] [Properties] [Import]

Decimal value
13.73462860234753

lb
0



