

NEOMATRIX

CASE STUDY

Lucid Motors

Asset Performance Management

Lucid AMP-1 in Casa Grande, Arizona, is the first greenfield or purpose-built electronic vehicle (EV) factory in North America, outfitted with the world's most advanced production line equipment. The company wanted its manufacturing processes to be highly automated and coupled with integrated industrial software platforms providing access to production, quality, and performance data to the entire manufacturing team.

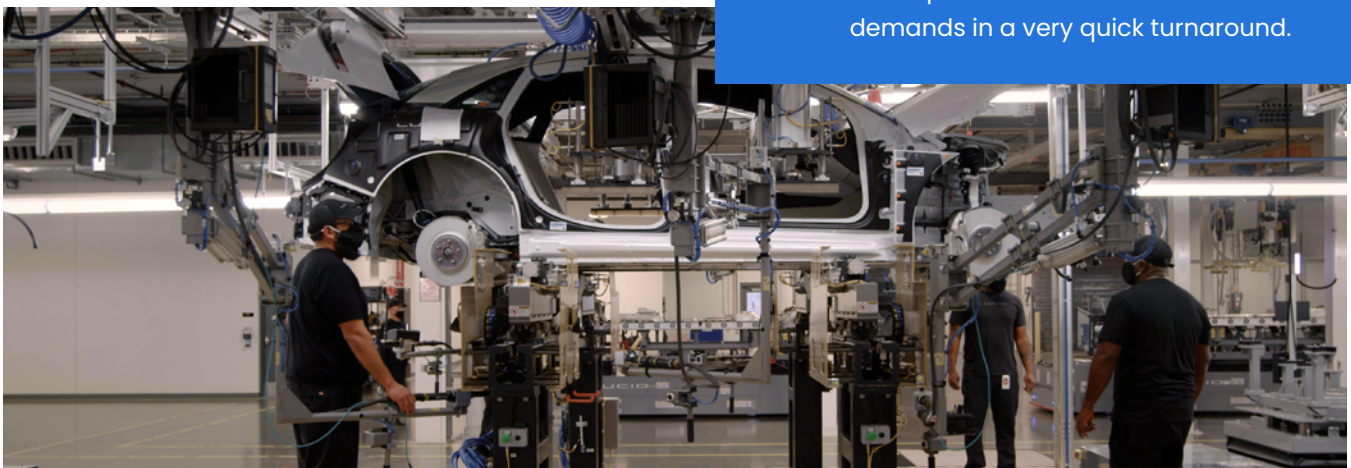
CHALLENGE

Lucid had standardized on platforms for plant floor control (Allen Bradley & Siemens PLCs), MES (Rockwell), CMMS (FIIX) and ERP (SAP) systems. As the implementation of these platforms progressed, it became apparent that a gap existed with their existing software platform implementations and their desire to:

- › Provide digital Andon dashboards on ~100 smart TVs throughout their 1M SF manufacturing facility. Andon dashboards increase efficiency across the shop floor by providing operators and supervisors real-time access to critical performance indicators:
 - Line/Cell Status (Running, Blocked, Starved, Faulted, Over Cycle)
 - Alarm/Fault Status
 - Operator Quality, Help and Material Calls
 - Jobs Per Hour Actual vs. Target
 - Cycle Times
 - First Pass Yield
 - Buffer Inventory Counts
 - OEE (Availability, Performance & Quality) KPIs
- › Aggregate and compute the information and KPIs required for the Andon dashboards from the PLC and MES data sources.
- › Perform off-line alarm/fault and OEE analytics.
- › Feed real-time asset events and meter readings to the cloud-based CMMS system via a REST API:
 - Critical faults automatically generate electronic work orders without operator intervention.
 - Asset meter readings (run hours & cycle counts) are automatically sent periodically which trigger PMs.



On top of the above requests, Lucid had a very tight timeline and needed a solution and a partner that could meet the above demands in a very quick turnaround.



SOLUTION

NeoMatrix was awarded the bid due to our technical approach and relevant MES experience. Our solution utilizes the Ignition platform from Inductive Automation and OEE Module from Sepasoft. The Ignition platform met the technical requirements of the project and provided the flexibility to design an architecture that can scale with the rapid growth Lucid will undergo over the next several years. From a technical perspective the project required connectivity to several disparate data sources, large volumes of data, and a modern visualization requirement. Out of the box Ignition provided the ability to:

- Connect to required data sources:
 - Allen Bradley & Siemens PLCs
 - SQL Databases
 - REST APIs
- Monitor and log 75000 tags in real-time.
- Provide a visualization solution to 100+ clients which supports HTML5 compliant browsers.
- Provide a platform for modular design with object-oriented data structures and templates enabling rapid configuration and deployment.

The solution required an architecture which easily scales to both local expansion and new sites around the globe. NeoMatrix took advantage of Ignition's modular platform and designed a 'Scale-Out' architecture. Edge gateways at each shop handle device data and a front-end gateway handles the client applications. The 'scale-out' architecture balances the workload across multiple servers while simultaneously reducing the risk of a single point of failure.

AMP-1 Casa Grande, AZ

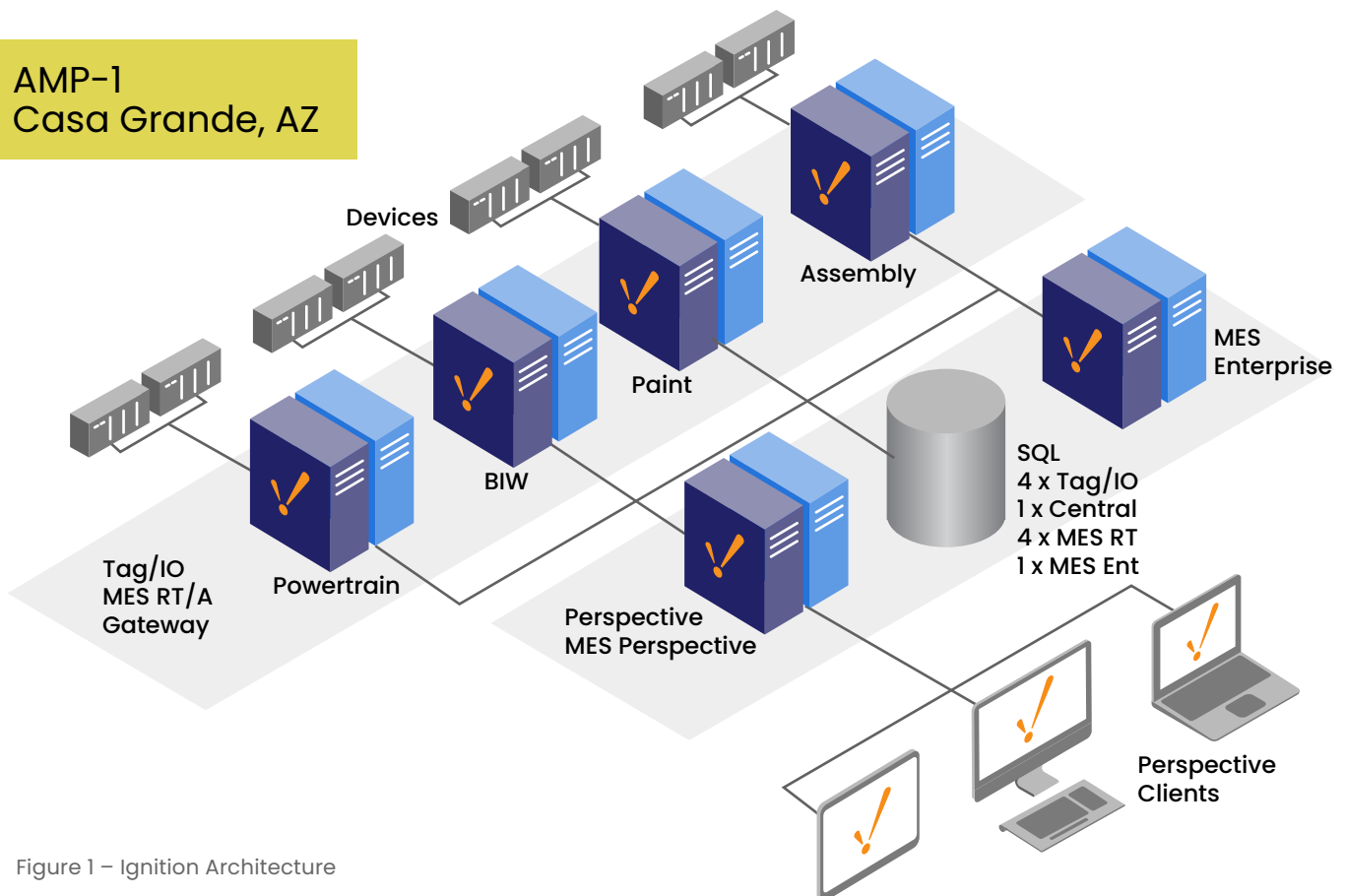


Figure 1 – Ignition Architecture

Redundant gateways were added for each node which:

- Provide failover in the event of a failure of the primary gateway.
- Provide the ability to perform system upgrades and critical OS patches without interruption to the system.

In addition to the technical capabilities and architecture flexibility, the Ignition licensing model provided the ability to design a solution without limitation:

- Unlimited connections (65 PLC & 10 Database Connections)
- Unlimited tags (75000)
- Unlimited clients (150+ and growing)
- Unlimited OEE equipment (~ 400 process cells & lines)

The Sepasoft OEE solution was specified to provide the KPIs that for the Andon dashboards. Built on the Ignition platform, the Sepasoft modules also provided the ability to build a robust architecture to support the AMP-1 plant as well as future expansion.

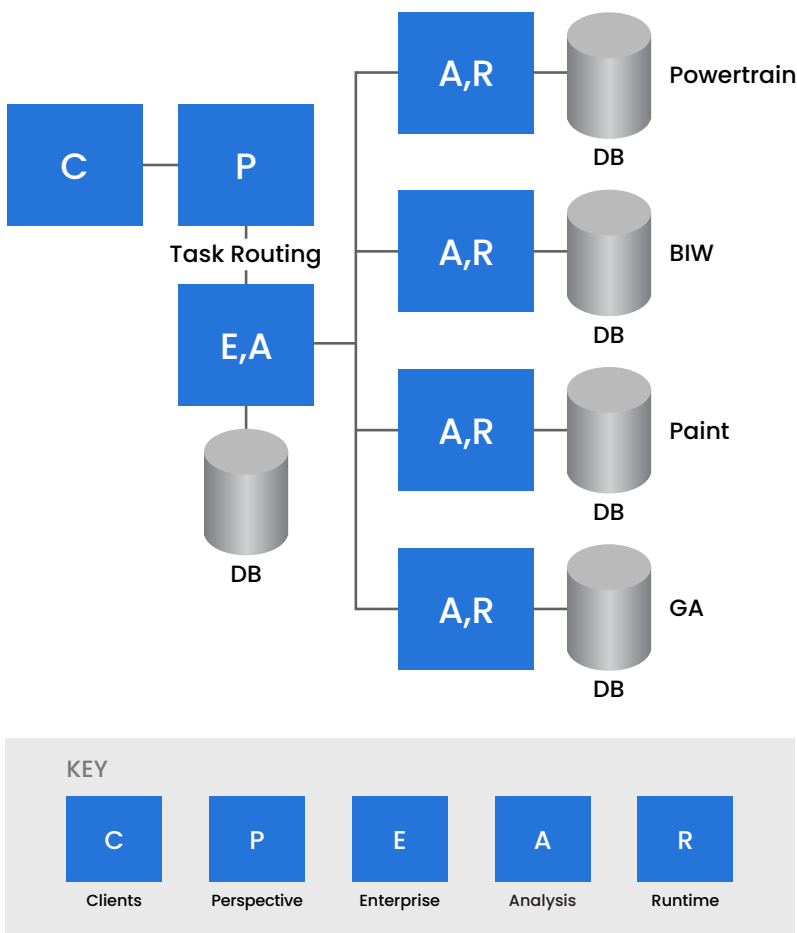


Figure 2 – Sepasoft Task Routing

The Sepasoft system provided the ability to build out a production model based on the ISA 95 standard. Each line and cell were 'wired' to the required inputs to calculate jobs per hour, cycle time, OEE and other relevant metrics. The OEE module provided the ability to handle the complexity of a multi-process work-center to allow for different downtime detection modes to determine line state.

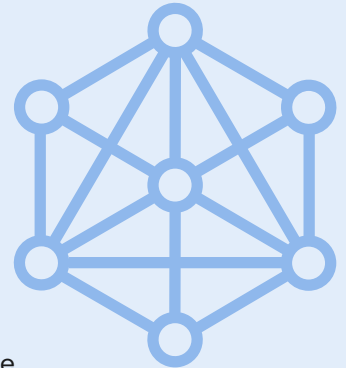
The Sepasoft Module supports the 'Scale-Out' architecture. Analysis and runtime engines were placed on each of the shop edge nodes. The Enterprise module was installed on a 6th gateway and the data was rolled up to the enterprise database. Lastly, the task routing feature was used to render OEE information on the Perspective gateway.

Implementing 61 dashboards for 400 process cells across 65 PLCs is a considerable task. Considering the underlying systems programming was done by various OEMs and vendors increases the complexity. NeoMatrix simplified the implementation by developing standardized modular code. At the control layer NeoMatrix developed an add on instruction (AOI) which provided all the necessary status, production counts, work order information, etc. Within Ignition a UDT was mapped to the PLC AOI and provided a standardized format to drive the OEE engine. At the visualization layer reusable embedded views were created for each required dashboard widget. The 61 dashboards were built by dropping and configuring the required widgets for each process location.

RESULTS

The project helped Lucid achieve their objectives by filling the gaps within their existing manufacturing software stack, including the implementation of:

- › Andon dashboards that are visible on every manufacturing line in the plant allowing operations to quickly react to equipment, material, or operator issues in real-time.
- › A standardized, modular system to collect all pertinent KPIs, OEE and alarm analysis data.
- › Maintenance work orders and meter readings that are automatically fed to the CMMS system, improving the accuracy and timeliness of the data and eliminating data entry time.



Having connected their data sources, Lucid immediately benefited from improved production efficiency, quality, and performance data. Looking to the future, Lucid has a solid industrial software platform which will enable rapid deployment for future expansion initiatives at the AMP-1 facility as well as other plants around the globe.

