Astrikos Consulting

ICT | SMART CITY | SMART INDUSTRY

ISO/IEC	ISO/IEC	ISO/IEC	ISO
21823-1:2019	20000-1:2011	27001-1:2013	9001:2015

ABOUT ASTRIKOS

Astrikos Consulting are into the areas of Technology (ICT/IoT) Consulting, Implementation of Technological applicability to Public/Enterprise Policy. Areas of focus are ICT, Next Generation Data Centers, Smart Cities, Smart Infrastructure, Smart Industries and Smart Analytics.

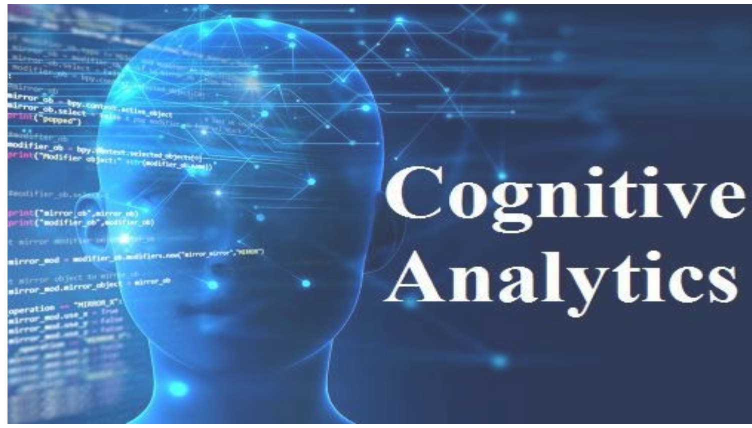
Astrikos Consulting provide advisory and implementation efforts to industries on migration/ implementation of Industrial Automation, Industry 5.0 and IIoT by means of cognitive intelligence and data science product lines.

Smart !nterop Analytical Platform

A.K.A. S!aP is an Intelligent Platform that mines the IoT data from smart infrastructure, industrial systems, and data centers in cross-platform analytics using high performance frameworks and ML libraries for actionable insights.

SALIENT FEATURES

- Advanced artificial intelligence-based machine learning and deep learning techniques and methods designed using proprietary algorithms
- Specialized Intellectual properties on Collaborative and Correlative Data Analytic and Science
- Process Historical, Descriptive, Predictive, and Prescriptive Analytics
- Built-in Telemetry device Management and IoT edge firmware push plugins
- Operationalize recommendations using Machine Learning
- IoT Edge Device firmware push via wizard-based configuration, and patching plugins
- GIS-integrated dashboards, reporting and visualization
- Security breach detection in IoT devices using Machine learning algorithms
  Open streaming data connectivity



APPLICATIONS

- Heterogeneous multi-pattern Data Analytics using Neural Networks - Historical, Descriptive, Predictive, and Prescriptive
- Alerts from Time-Series Analysis
- Dynamic Feedback Mechanism
- Operational Intelligence
- Platform Cooperativism

EDGE-COMPUTING DOMAINS

- Smart Infrastructure Optimization
- Industrial IoT Systems
- Data Center and Communication Networks

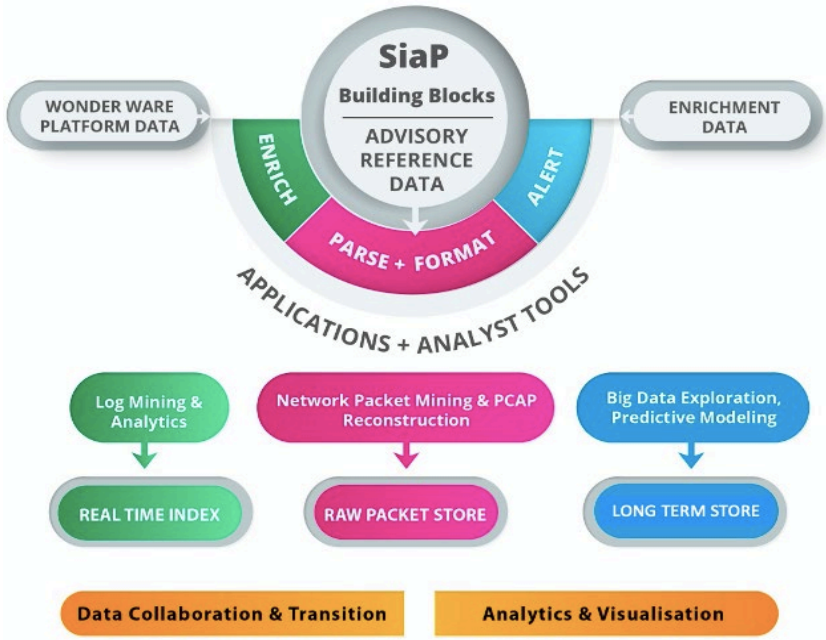
The *S!aP* platform mines heterogeneous and multi-dimensional data on a modular application framework, addressing the high volume and rate of unstructured and streaming data i.e. 3V's (volume, variety, and velocity) of unlabeled data.

Our ML algorithms are adapted for scalable models, efficient sampling, and continuous learning in the context of dynamic environments, with IoT communications being a critical interface.

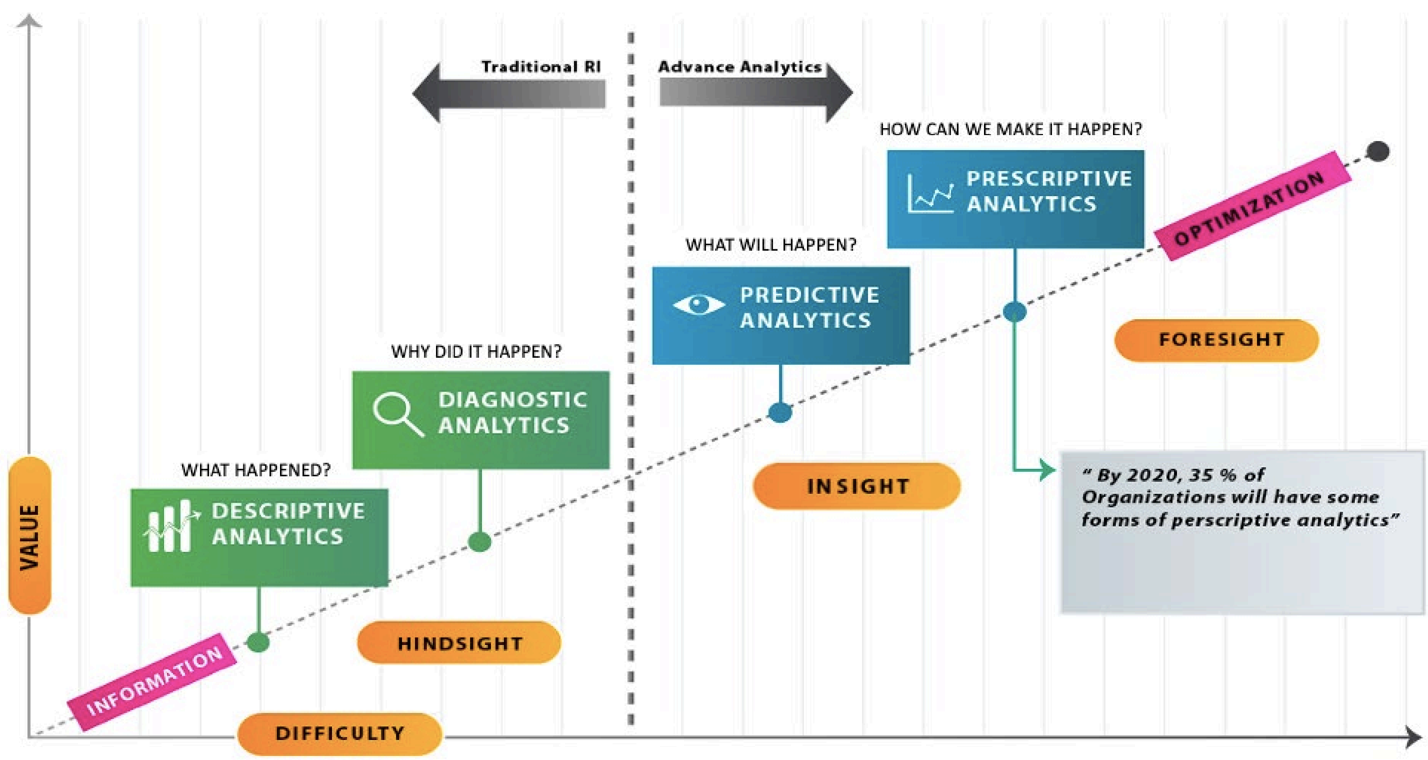
S!aP ARCHITECTURE

S!aP works based on a multi-tier distributed architecture that is scalable for any infrastructure may it be Industry, Public infra, Data Centers etc.,. agnostic to heterogeneity of the data sources available in all these domains.

S!aP uses a powerful data extraction and translation mechanism along with advanced ML and DL algorithms that are capable of deconstruction and reconstruction of the data sets to build the best in class analytical framework. The user-friendly ML Work Bench feature provides the complete freedom to the users to define their own data models and identify the use cases suitable to their respective environments.

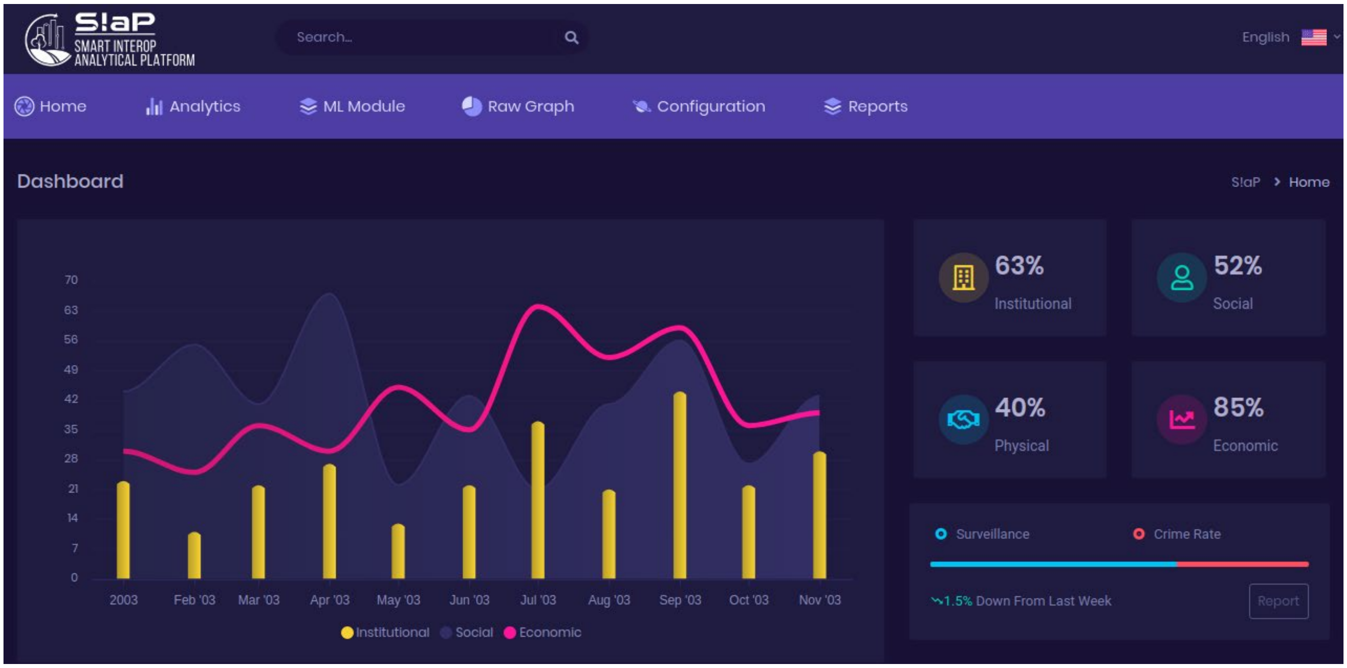


Data Model and Analytical Framework

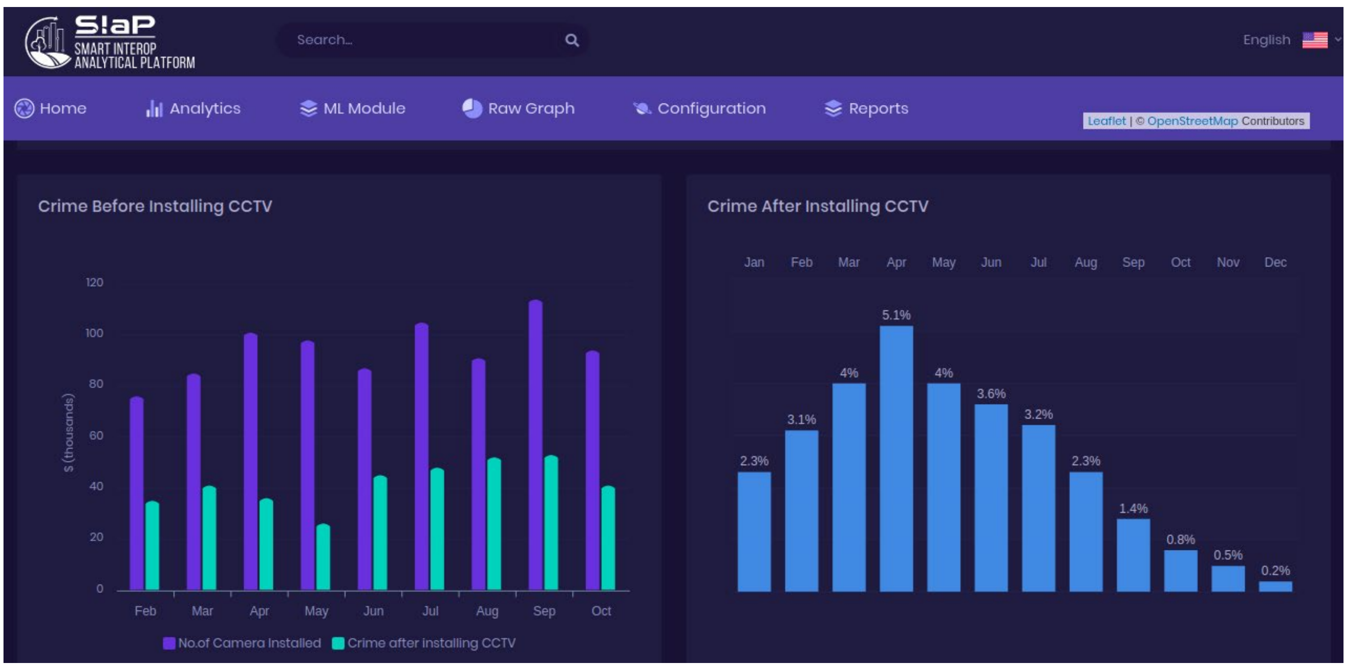


USABILITY GLIMPSES

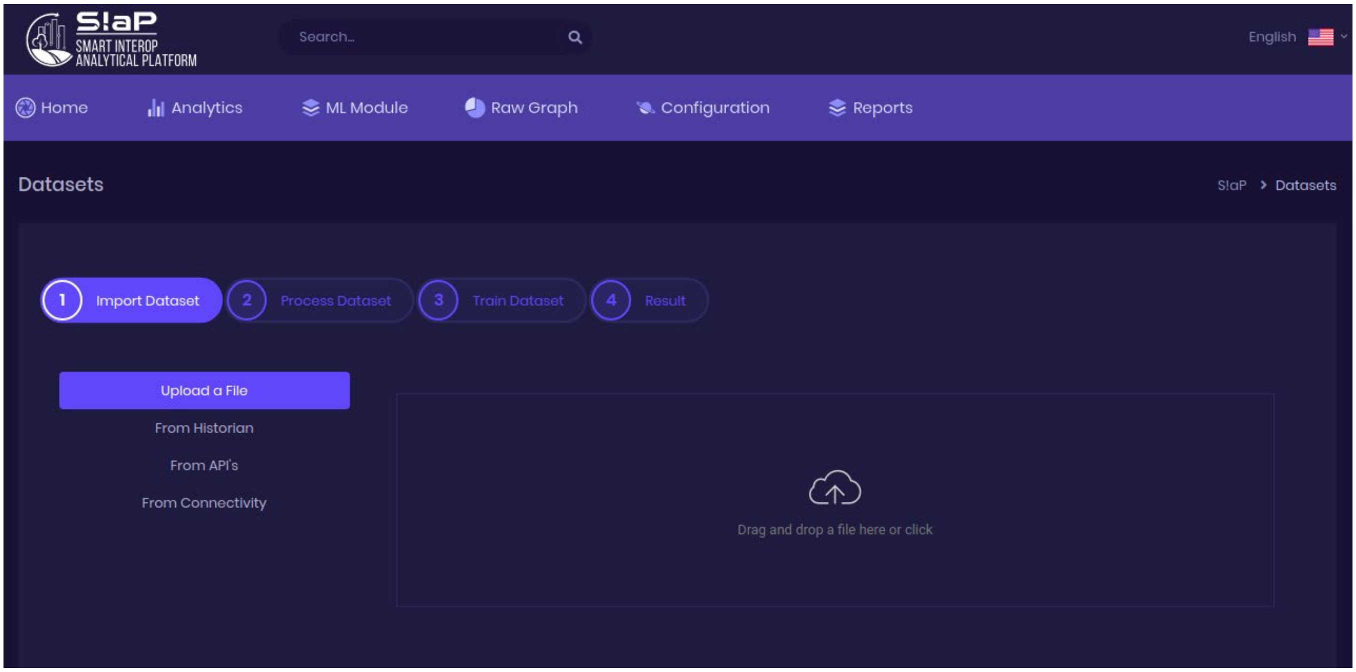
Example: Livability Index of Smart City



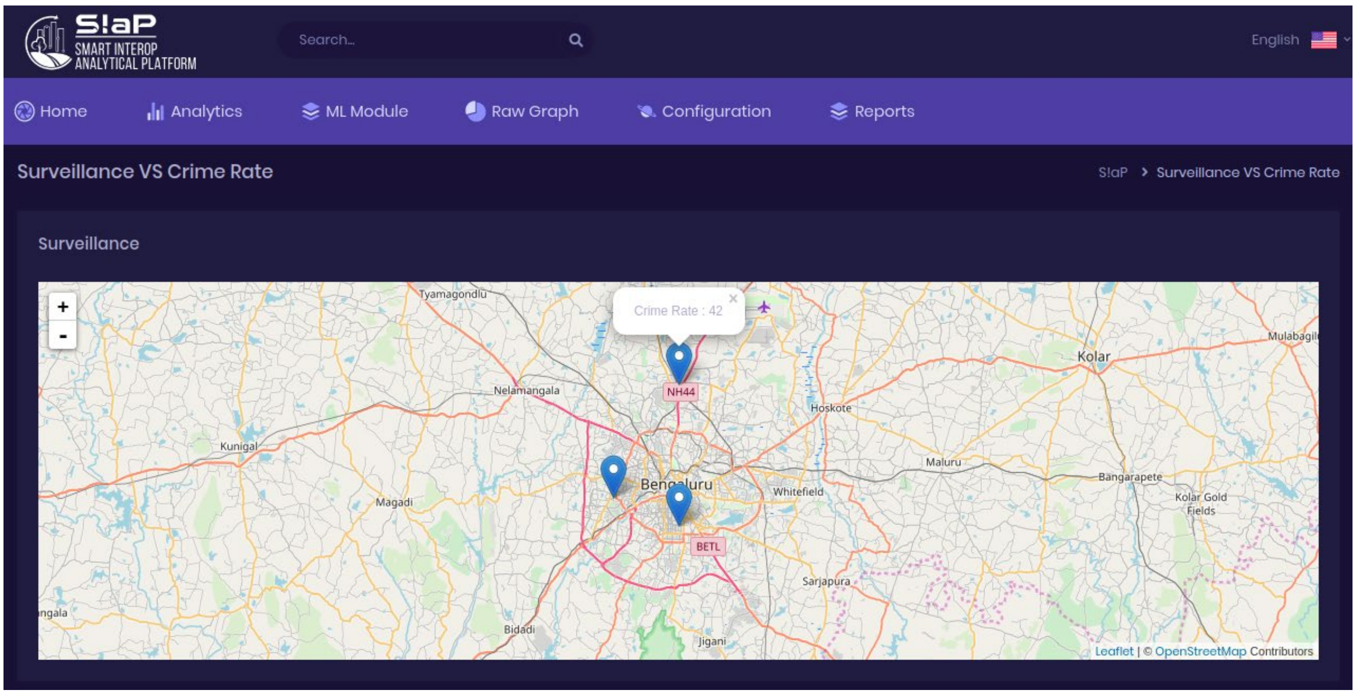
Example: Correlative Analytics Smart City



Example: You Can Choose Your Data Sources on a Work-Bench …!!!



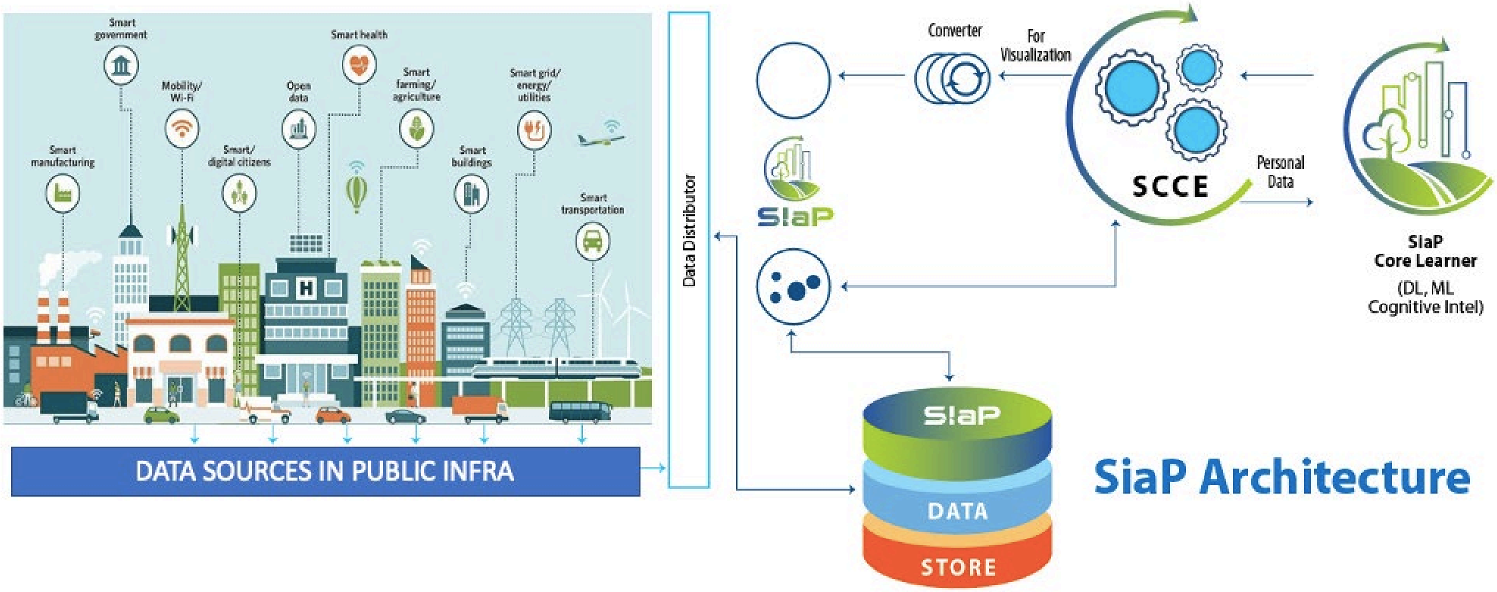
Example: Visualize Your "Infrastructural Prescription" on Geo-Map



INDUSTRY USE CASES

1. S!aP FOR PUBLIC INFRASTRUCTURE

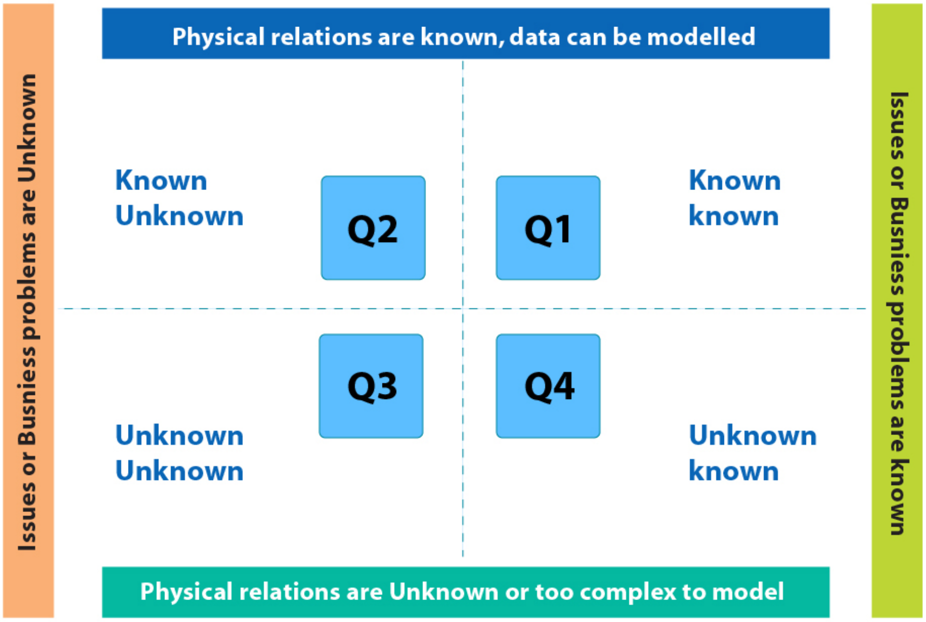
Uses Machine Learning to accelerate edge-computing for convergence of **Operational Technology** capabilities (e.g. OPC, Human Machine Interface connectivity with PLCs, SCADA, and other infrastructure command and control systems) with **enterprise applications** (Business Intelligence, e-Governance, Mobile Apps, and Big Data in Web 2.0).



Public infrastructures such as smart cities collect terabytes of data from different sources to manage different cyber-physical systems, monitor important parameters like pollution, traffic, etc. and improve life of citizens in the city. Many aspects of city life are interconnected e.g. pollution and traffic. The number and location of CCTVs in the city help police to fight crimes. Weather, temperature and pollution have direct impact on health of the citizens. It is hence critical understand the relationship between data from different sources/domains, and use the power of machine learning and data science to provide actionable insights, and guide policy frameworks.

S!aP platform can ingest data from multiple sources, process them, and create predictive models and analysis reports. The predictive models are built using machine learning methods on streaming data such as regression, classification or time series.

Use cases vary from known system models to unknown, and from known to unknown cause-effect relationships, and predictive insights are crucial as in the following situations.



ILLUSTRATIONS

Correlation and Prediction of Pollution vs. Power consumed

Industrial areas release hazardous emissions/pollutants and their production activity consumes a lot of electric power. The volume of pollutant gases released by the factories as measured by environmental sensors, can thus be correlated with power consumed.

In the first step, the *S!aP* model is built using historical data from plant power consumption and emission sensors, algorithms are trained to describe the cause-effect relationships.

We can use a LSTM time-series regression model to predict quantity of different pollutants (COX, NOX, SOX, PM) using the past pollution data and power consumption data. We can use time series models to tell in advance the amount of pollution in different areas of the city, thereby helping authorities to fight pollution.

Prediction of Pollution using Traffic ITMS data

Using data from Intelligent Traffic Management Systems, we calculate vehicle density in different areas i.e. number of vehicles passing through a location per hour. We build a 'descriptive' time series regression model with past i.e. 'historical' pollution data and vehicle density in the surrounding area as input and pollution level as output. Using this model, we can predict, i.e. calculate pollution level in advance, for dynamically varying traffic densities.

Analysis and prediction of Crimes

Many research studies have shown that there is usually a pattern in how criminals target victims, location, and time of crime. This pattern along with 'historical' i.e. past crime data, provides us the ability to model (descriptively), analyze and predict criminal activities. Police depend on CCTV data to fight and prevent crime. *S!aP* platform helps detect the patterns and predict the incidence of crimes in relation to the deterrence provided by CCTV i.e. before and after CCTV installation, thus can guide the optimum deployment for effective use of CCTV in different areas of city.

Correlative LIVE-BOARDS & LIDGETS Example:

Air Quality Visualization Dashboard

The Live-Boards feature LIDGETS (Lite Widgets) help the city authorities and ICCC operators to keep an eye on how the city transport and traffic are impacting the city pollution levels and hence the same information can be circulated with the City Healthcare Authorities.

Standard, User Defined & Customizable Reports - REPOWISE Module

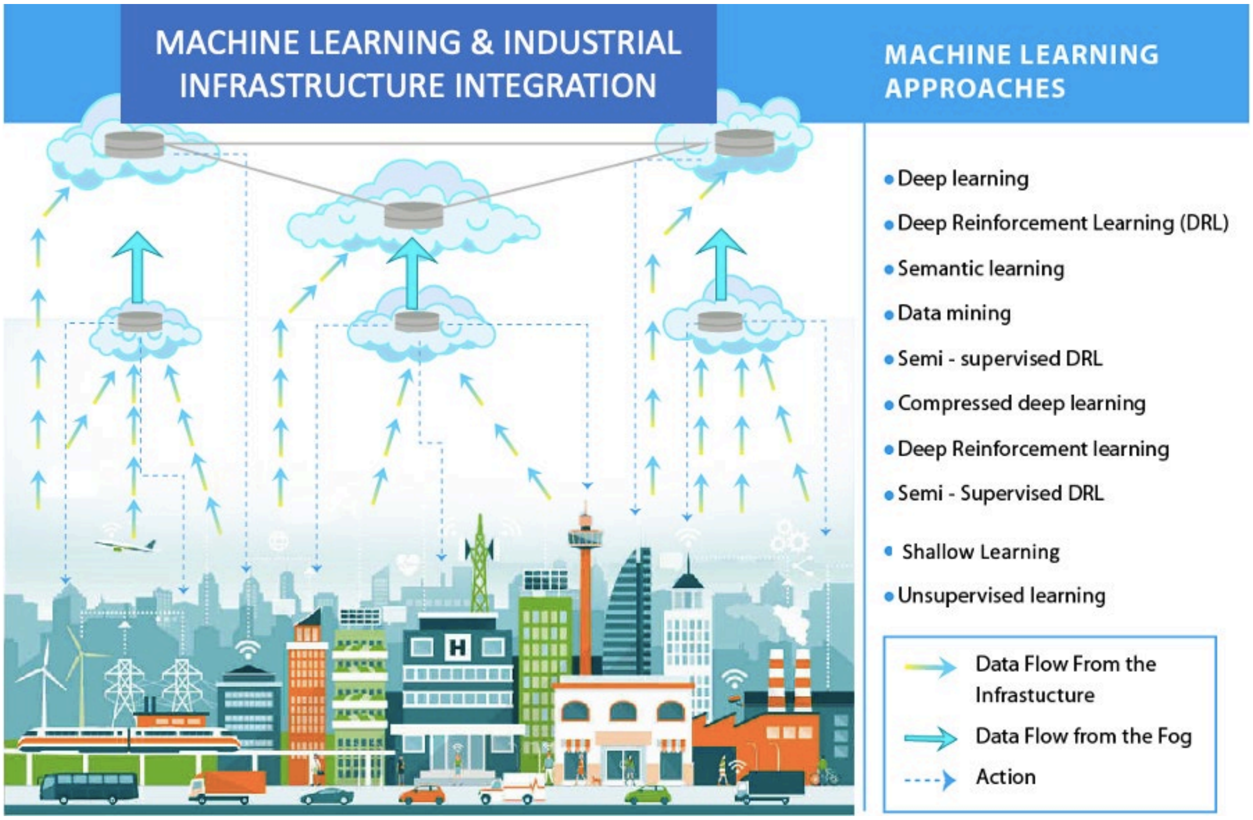
S!aP provides **REPOWISE** - a reporting module of smart infra data i.e. reports built for "city wisdom".

Data/Information Portability

REPOWISE provides the facility to export the reports, visual widgets leveraging the LIDGETS, LIVE-BOARDS into various file formats including CSV/XLS/XLSX, PDF, JSON/XML and RPT formats. The JSON/XML dashboards can be easily imported into any other visualization tools for a seamless analysis portability.

2. S!aP FOR SMART INDUSTRIES

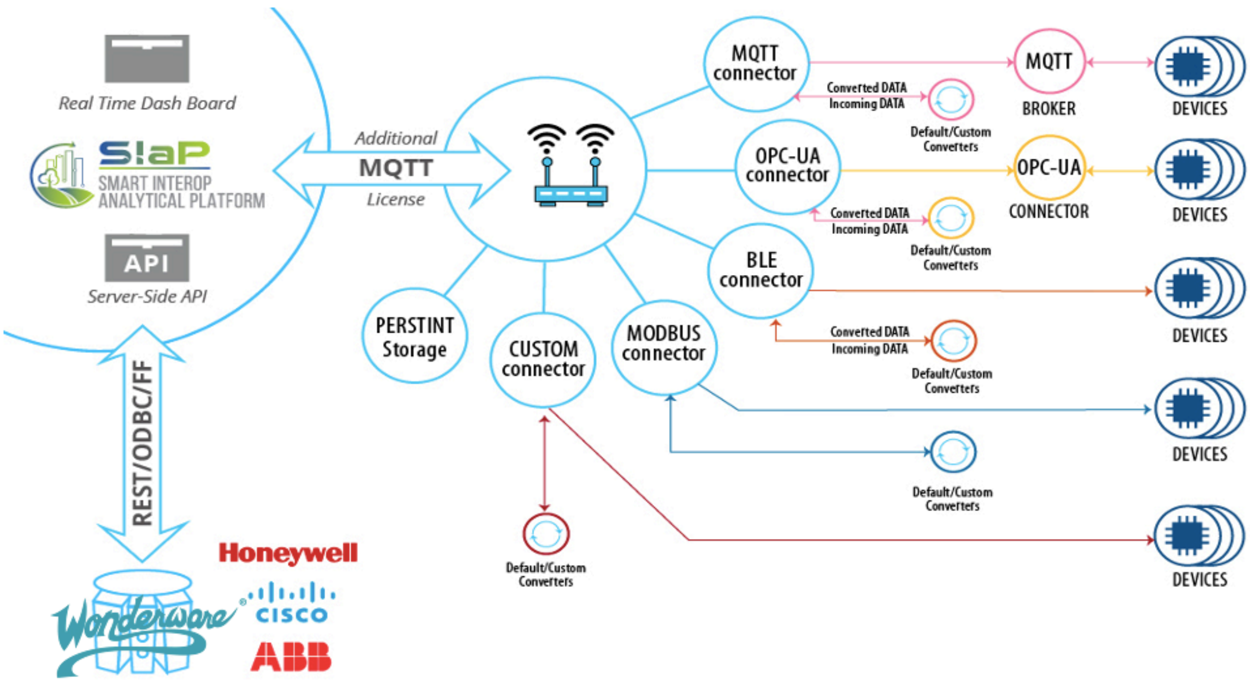
Machine Learning Applications in S!aP for Industry 5.0



Smart Industry aka Industry 4.0 means digital-industrial transformation by implementing information and communication (ICT) technology with automation in the production and operations of a factory. The fundamental concept for Industry 4.0 is the Industrial Internet of Things (IIoT), which provides connectivity for machines, industrial infrastructure, management systems etc. It helps in streamlining business operations, creating intelligent, self-optimizing industrial equipment and facilities leading to improving efficiency, reliability, and availability of industrial processes and products. At the next level, Industry 5.0 enables the smart facilities with IIOT to utilize cognitive computing consisting of machine learning, deep learning, neural networks, NLP and semantic analysis. It focuses on the collaboration of man and machine in the connected IIOT cyber-physical framework.

This connectivity between the plant machinery, sensors, telemetry devices, etc. generate a lot of data, from different sources i.e. the ICT-OT-IoT convergence at the edge gateway and in the cloud. This heterogeneous data must be efficiently harnessed to build intelligent systems, and to monitor important cross-functional parameters like pollution, in-plant traffic, effective and efficient use of resources, functioning of equipment, detection and prevention of production loss, data and operational security operations. Therefore, it is paramount to study and use the interrelationships between data from different sources and domains and use the power of machine learning and data science to provide predictions and insights to industry operation executives to make informed decisions to optimize their factory production while adhering to regulatory norms in minimizing the carbon and resource footprint.

S!aP provides the ability to process data from multiple sources and create predictive models and analysis reports. The predictive models are built using machine learning methods such as regression, classification or time series. With *S!AP* you'll be able to optimize the manufacturing process by mining real-time data coming in from the field, leading to the transition into Industry 5.0.*S!aP* preprocesses and analyzes data from industrial systems at the edge gateway, and optimizes parameters over varying periods of time. Use cases vary from known **system models** to unknown, and from known to unknown **failure modes**. Thus, predictive insights are crucial as in the following situations.



Machine Learning Use Cases

Here descriptive models are built and trained using past data and deployed to predict future scenarios.

Predict Component Failure

In factories, it is critical to ensure that the hundreds or thousands of machine components running simultaneously, be continuously monitored. If some critical components fail, the entire production can stop, with implications on safety as well as output.

As components approach imminent failure, sensors capture the symptoms as a time-series, and analytics can provide insights for corrective action.

Predicting manufactured product quality from input material parameters

In complex operations like manufacturing, final output quality depends on many input parameters e.g. raw materials, process, and factory conditions. Some parameters are controllable, but others are not. Modelling in *S!aP* of the relationship between upstream parameters e.g. input material parameters vs. output product quality via ML-based analytics can track and predict quality of final product.

Predicting Environmental Parameters

In a factory, machinery must operate in controlled environments e.g. semiconductor, pharmaceutical, computing, and other high precision equipment. But because of fluctuations in power consumption and equipment operations, heat energy might raise the temperature above a critical point, causing failure. Hence it is critical to predict the operating temperature in advance with alerts to operator to prevent machine failure.

Condition Based Monitoring to Predict Component Failure

Inadequate lubrication or cooling over time causes wear and tear, and sensor data on temperature and bearing-grease can be monitored for trends for predictive maintenance (PM).

Correlation Use-Cases

Power Input and component Dimension:

When manufacturing components, as the raw material goes through multiple processes, which change the component dimension (by material addition or removal, or shape transformation). Power input can have direct influence on the component dimension, which must be kept within specified tolerance limits. This correlation must be correctly modeled to provide alerts to the machine operators to adjust the input power. *S!aP* provides the ML models to yield these insights and alerts.

Pollution and Production:

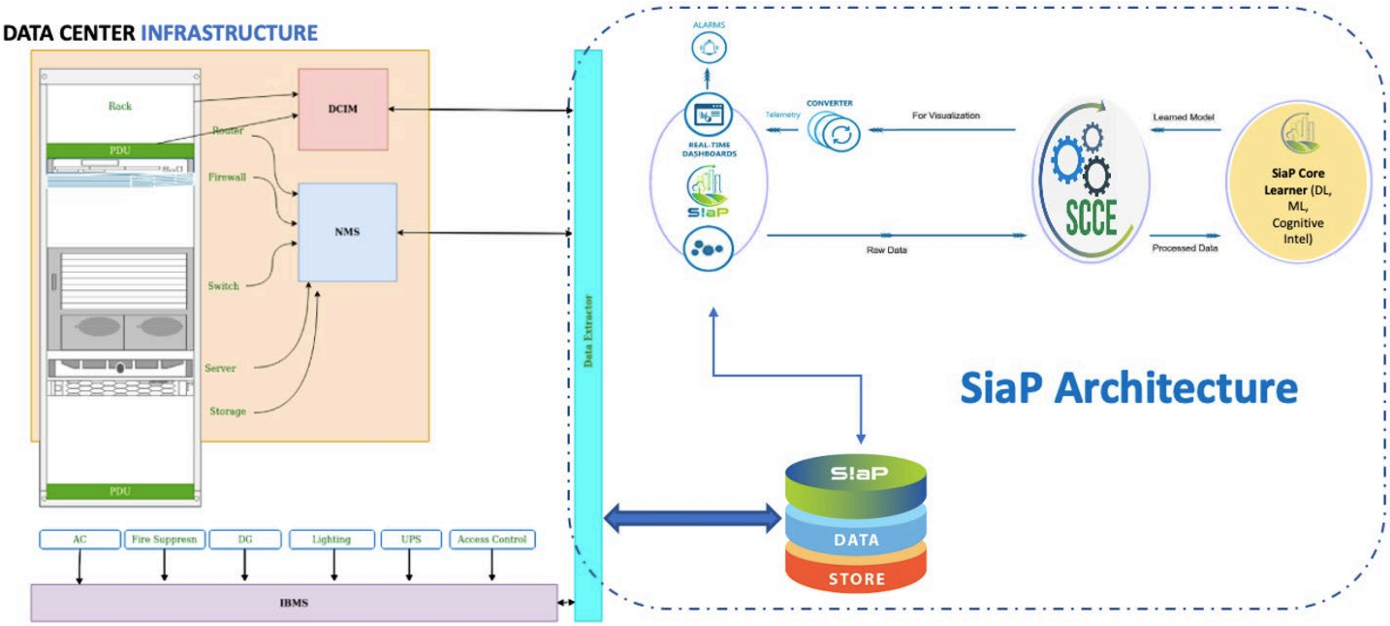
Many factories release dangerous pollutants into the atmosphere and water bodies. Industrial Systems must comply with pollution control regulations even as production volumes continue to rise. *S!aP* can help us to establish the correlations between pollution caused by the plant vs. factors like production volume and power consumption, to help optimize operations while minimizing environmental impact and keeping costs under control. *S!aP* can build a correlation model to predict the quantity of pollutants generated as a function of production volume.

Production and Power consumption:

In flexible manufacturing systems, power consumption can vary dynamically, and at large scale can drive up costs if not adaptively controlled. By building a correlation model, we can estimate the optimum power needed for a particular batch size of production.

3. S!aP for Data Centers and Communication Networks

Digitalization of Data Centers now requires advanced intelligence to advise and optimize the complex interplay across IT systems (servers, network and security devices), electro-mechanical, electrical control and distribution systems (PLCs, Drives, Field IOs, Digital Switchgear, UPS, and circuit monitoring) and cooling optimization requirements. For instance, it is critical to monitor server utilization conditions, vs. power quality, and load-efficiency curves.



Data Center requirements

Data is the engine of the IoT ecosystem, and it is critical to manage the data centers where petabytes of streaming data is being processed and exchanged in real-time across billions of devices. The ever-increasing load on data centers (servers) and support infrastructure (electrical and cooling systems) must be monitored, trends predicted, and operating parameters must be controlled to minimize downtime.

Energy Efficiency (minimize losses and reactive power), scaling or increasing density (from 4 kw/rack in 2016 to 50+ kw/rack by 2025), high availability, and control of unplanned outage are the key operating requirements. The impact or average cost of unplanned outage has increased by 50% in the last seven years. In this scenario, efficient mining (cross-systemic analysis) of vital statistics of the cyber-physical platforms is critical to optimizing data center operations. Key operating parameters must be monitored and trends must be predicted - for instance, by analyzing energy efficiency and cooling efficiency (part of Intelligent Building Management Systems) asset performance and scalability, power generation and utilization, and capacity management, for reliability, availability, and serviceability (RAS).

The power of *S!aP* is in modeling the interaction and cross-correlation across these parameters, such as: Server Utilization vs Power consumption, Asset efficiency vs Scalability, System Availability vs cooling efficiency/Power efficiency.

Sample Business Cases:

Regression Analytics	• Power utilization trend analysis and Power Utilization Effectiveness • DC temperature trend analysis and effectiveness analysis • Resource allocation analysis – Racks, Spaces, Floor Area, Power, Computer
Insights	• High energy consumption clusters • Thermal Profile of the floor • Floor susceptibility zoning and demarcation • Service Management Health Indices
Prediction Analytics	• Power forecasting – shortage analysis, requirement planning • Cooling anomaly predictive detection • Rack/Module health rating and fault prediction • Segmental failure forecasting • Bandwidth forecasting
Correlative Analytics	• Relational analysis of bandwidth consumption and power consumption • Relation between Data security compute load (multiplied duty) and resource load • Influence of compute segment’s performance on DC environment and temperature
Collaborative Analytics	• IT components health v/s Environmental Influences • Resource utilization trend v/s Power requirement trends and forecasts • Thermal Profile v/s Energy demand analysis • Root cause predictive analytics based on heuristics and cognitive analysis

Prescriptive Advisory	• Remediation advisory for power demand/optimization/planning • Remediation advisory for environmental control optimization • Capacity Planning advisory for rack space, modules, computer