

Process Analytics & Optimization from GE Digital

In partnership with TrendMiner, a Software AG company



Avoid production loss and optimize overall production performance with the right process data and insights

TrendMiner is an intuitive web-based industrial process analytics application to visualize, analyze, monitor, and predict sensor generated time-series and contextualized data. With TrendMiner's embedded problem-solving capabilities, process engineers and operators can easily search for trends, analyze, and question the process data themselves to get the right answers – when they need them, without the help of a data scientist.

User Experience

ENTERPRISE



Fact based; data driven decision making



Continuously improve operational performance



Employee efficiency for all stakeholders



Cross functional and global collaboration

ENGINEERS



Efficient and effective contribution to improve performance



Find more answers, faster resolution to day-to-day challenges



Solve the unresolved cases



Automate findings into early warnings to prevent failures

DATA SCIENTISTS



Smooth collaboration without miscommunication



Easy data preparation by process experts



All process related and contextualized data incorporated



Reduced process throughout time and easy model deployment





Analyze, Monitor & Predict

Self-Service Analytics Platform – High-speed search engine uses patented pattern recognition technology and advanced algorithms to provide recommendations to uncover hidden correlations and root causes to process issues.

Trend Views – Graphical representation of a vast amount of historical time-series data captured from historians.

- **Data Visualization Modes** – Time trends plus multiple tags in sequences or grouped in swim-lanes for multivariate analysis.
- **Fast Filtering** – Static filters can be created manually on top of search results applied to certain time periods to exclude irrelevant time periods. Dynamic criteria-based filters are created to automatically apply historical and new/incoming data.
- **Tag Builder** – Creation of time-series data using formulas on and aggregations of tags resulting in visualizations of tag data. Importing time-series data via CSV is also available.

- **Similarity Search & Advanced Search Options** – Find similar past patterns, most important is emphasized in weighted graph to improve accuracy.
- **Digital Step** – Switch or transition in process performance, example grade change.
- **Area Search** – Gain new pattern-based insights to detect anomalies outside of best operating zones.
- **Value Based Search** – Find anomalies in time-series data by analyzing criteria, numerical values, and limits.
- **Context Item Search** – Similar past annotations automatically, manually, or externally created context items.

Cross Asset Search – Search similar assets using pre-defined templates within asset framework. Analyze parallel reactors or production lines, multiple pumps, or heat exchangers by same type and compare data across production plant or product fleet globally.

Layer Compare – Layer periods of time to compare patterns and understand differences. Software instantly finds similarity over multiple years of process behavior to understand historical performance of processes.

Compare Table – Discover tags with significantly different values by comparing layers or time periods. Seeing statistical data distributions and evolutions help find performance anomalies

Influence Factors & Time Shift – Automatic time shift detection finds influence factors to discover root cause of process anomalies – the influence factor can be found even if it took place before tag was impacted.

Recommendation Engine – Provides suggestions for correlations and fingerprint deviations. Using selected time frames, tags, and layers. Using automatic time shifts, it helps detect early indicators or deviating behavior.

Fingerprinting – Search can be used to find and overlay optimal dynamic behaviors – best batches, transitions, and start-ups. Combine multiple periods of best performance into an envelope or “fingerprint” used to monitor process.

Best Operating Zone – Create “scatter” plots on best operating zones. Set alarms to notify when deviations are detected to monitor unnecessary equipment stress, increase asset reliability, and extend equipment lifetime.

Alerts & Notifications – Input automatic notifications to alert patterns of interest are detected. Various notification mechanisms are supported including inbox and email. Receive suggested course of action and designate to trigger a webhook to fire a workflow in other business applications, such as a CMMS.

Events of Interests – Capture specific events labeled automatically, based on monitoring alerts, saved search patterns, fingerprints, and rules. Monitoring event frequency helps control overall production performance.

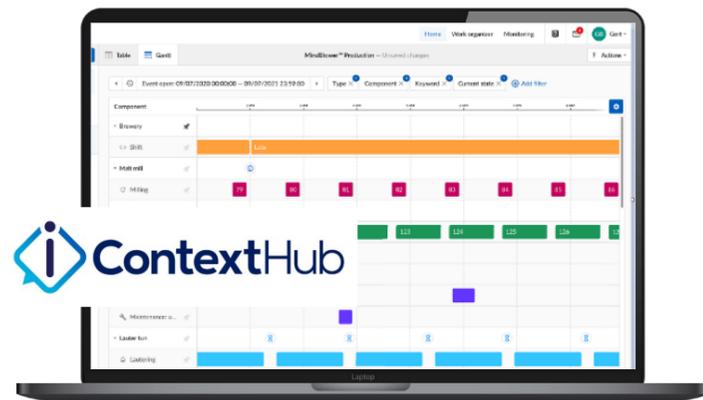
Model-Free Predictive Mode – Patented Interactive and model-free prediction mode calculates possible trajectories of processes, predict evolutions of key variables, and process behaviors using historical data

Interactive Sensor Design – Create and deploy soft sensors using interactive step-by-step approach accessing all process data. Build predictors or future performance without the need for a data science project.

Early Warnings – Indicators for anomalies of interest. Notifications are received by alerts, email, or external apps and may include instructions to act.



Module Features



Contextualization

Capturing Events – Using fingerprints and monitors, context items are captured automatically, but can be entered manually. Speed up search and filter action in time-series data. Classify context item by type and assigned specific actions including suggestions.

Commenting & Collaboration – Contact items have many properties. Within context panel, add comments, start discussions, and attach files to assist in issue resolution.

Gantt View – Contextual information includes start and end time, which is used to present events in sequence diagram or Gantt chart. Per asset, all related tags are grouped and listed. Each tag – all context types – is presented in time series. This view gives a different starting point for operational performance analysis and provide new insights.

Live Event Updates – Events are generated automatically through live monitoring of process performance. New events are shown in both list tables & Gantt view.



Visualization & Collaboration

Personalized Operational Dashboards – Each operator can create personal dashboards and add trend views and context items based on areas of operations and interests. Empower each user with actionable analytics-driven information – from the operations floor to boardroom.

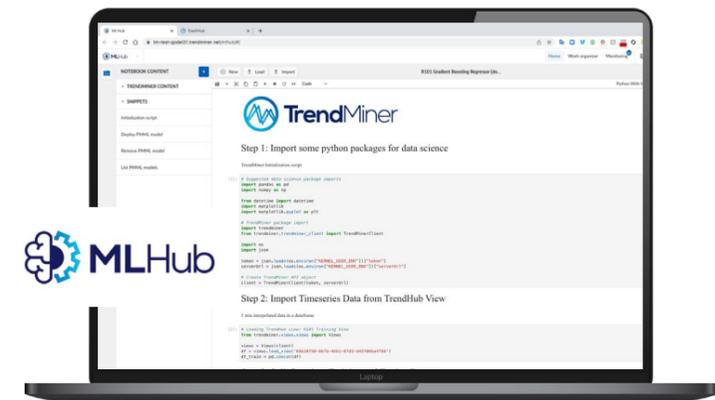
Tile View – Drill down into information further using interactive views including tiles, trend-value, Gantt and more. If out-of-spec performance is shown in the dashboard, directly investigate difference from good performance, search root cause, and act. Additionally, add comments for other team members to act upon.

Context Analytics – Create view on process analytics work and integrated 3rd party contextual information. Quickly make the right decisions from multiple systems that are in place.

Live Production & Historical Views – Streamline information flow and reproduce anywhere to increase collaboration between shifts, teams, and engineers.

Reporting – Various reporting options that can be tailored by organizational needs – embed views, print charts, create report notifications during productions, trigger shift handover reports, or download periodic loss accounting reports.

Collaboration – Share views, dashboards, and fingerprints. Comments and context conversations and send requests. Issue approvals and send attachments based on access permissions.



Machine Learning

Clean Data Collection – Save interesting fragments of time-series and contextualized data into data frames for deeper analysis.

Flexible Modeling – Build and train ML models with built-in toolkits, or import models directly from third-party environments including AWS Sagemaker or Microsoft Azure.

Open-Source Algorithms – Jupyter Notebook environment comes pre-loaded with most common algorithms for data processing. Further, users can import custom tools.

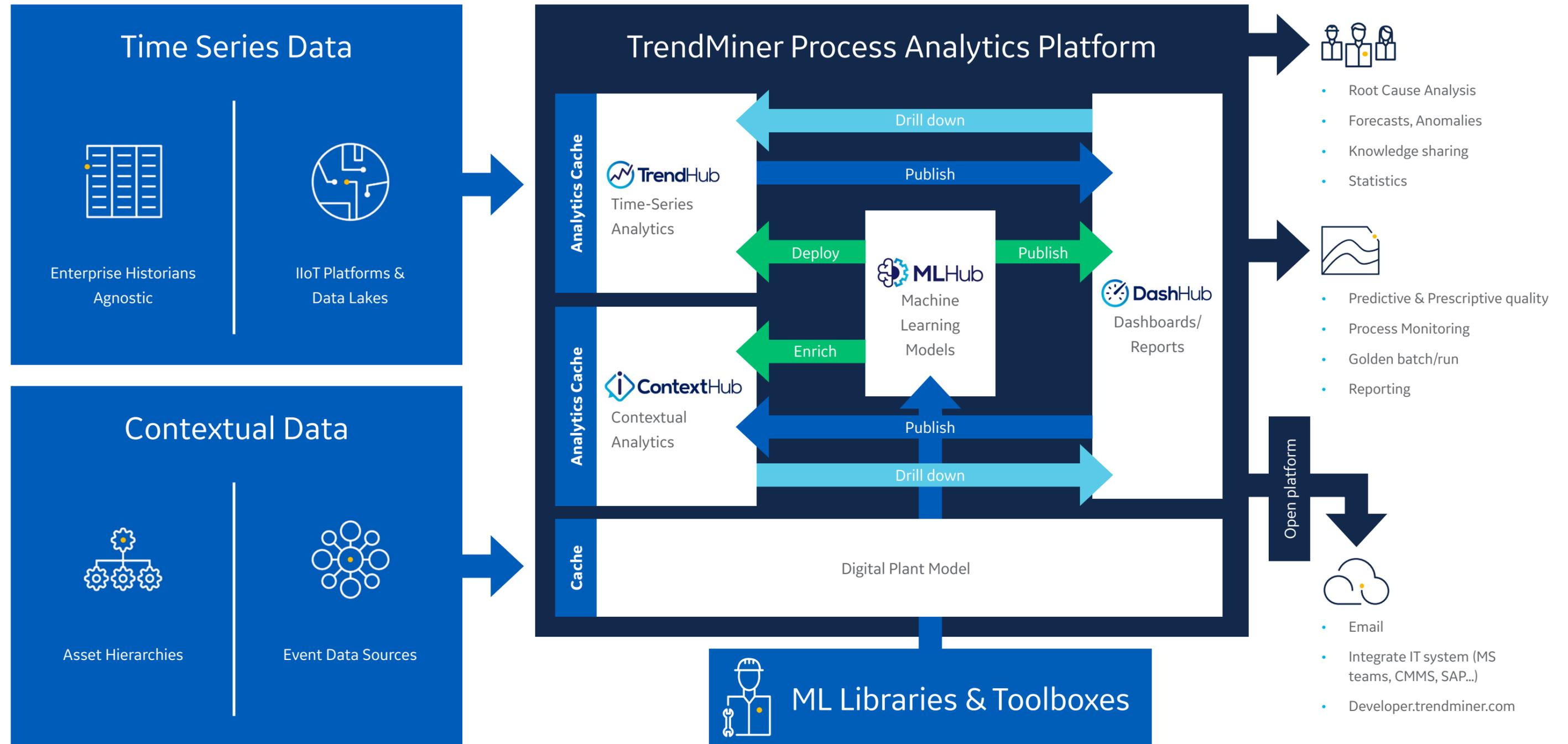
Model Tags – No-code interface leveraging ML results for any operations user, like any other tag (sensor reading), or greater insights on process behavior.

Cross-Platform Interoperability – Augment operational analytics by using ML models throughout TrendMiner solution.

- **TrendHub** – Similar to other tag for descriptive analytics, visual exploration, value-based or threshold searches, and or monitoring
- **ContextHub** – Deployed models are used to enrich process events
- **DashHub** – Incorporate additional visualizations



How it works – Deployment and Integration



Components

TrendMiner Instances deployed in Linux virtual machine (VM), multiple instances at different locations are supported

Plant Integration Connectors – Securely connects to historians

- Available as one or multiple (not required)
- Net application in Internet Information Services (IIS)
- Can be interconnected in chain

Implementation & Specification Guides

[Cloud Implementation](#)

[TrendMiner Installation Guide](#)

[Cloud Implementation](#)

[API Development Portal](#)

Technical Advantages

Single Node Architecture – Architecture ranges from couple or thousands of tags and scale-out architecture for 50+ million tags. Supports single site to globally operating business units.

Plug-and-Play Solution – Seamlessly fits in current IT landscape. Integrates with Active Directory and supports SAML compatible authentication providers for Single Sign On.

Out-of-the-Box Connection – Connects to a range of existing data infrastructures and vendor historians. TrendMiner reads from data level, no direct connection with Distributed Control System (DCS) is required.

Vendor Agnostic – Connects and supports to various historians and residing data analytics. System diversity allows for cross-site analytics for business units regardless of systems

TrendMiner API – Provides programmatic integration to synchronize into other business system's context data or develop a Business Intelligence (BI) dashboard on top of TrendMiner.

Data Connections & Integrations

Software AG WebMethod API – Supports more complex integrations, such as SAP.

Pull Based – Plant Integration Connectors support multiple historians and generic interfacing. Customer connectors can be implemented through TrendMiner's Plant Integrations Connector API.

Push Based – Native REST APIs to connect other types of data other than time-series, such as third-party contextual systems.

Supported Business Applications and Systems*

- Batch Record Systems – GE, OSIsoft Event Frames, AspenTech, and more
- Laboratory InfoSystems – Labware, LabSoft
- Maintenance Management Systems – SAP, Maximo, and other MES vendors
- OEE Applications – io.Performance, Evocon, etc.
- SQL Databases – MySQL, Microsoft SQL Server, and more
- Shift Logbook Applications – Such as Shiftconnector io.
- Business Intelligence Tools – Tableau, Power BI, and others.
- Additional integrations are available via APIs and import capabilities.

Historians & Time-Series Data Stores – Interoperable with GE and other major providers

IoT Platforms & Data Lakes – Cumulocity IoT, Microsoft Azure, AWS, MindSphere, and ADAMOS

Supported Languages

English	Deutsch
Français	Português
Netherlands	简体中文
Español	繁體中文

Flexible Deployment Options

Private Cloud – Two options available for cloud deployments a) Customer account in hyperscale platform (e.g., Azure, AWS, Cumulocity) or b) Installing Plant Integrations Connectors in IIS on Windows Server Virtual Machine (not recommended with on-site historians).

On Premises – Instance can be deployed in organizations own data center as single node. Options include a) prepackaged virtual machine managed by TrendMiner, or b) manual setup in self-managed operation system. Plant Integration Connectors can be installed in Internet Information Server (IIS) on Historian server for low latency, or using an IIS dedicated server as a single integration point.

Software as a Service (SaaS) – Managed service subscription is hosted on Microsoft Azure Cloud managed and hosted by TrendMiner.

Hybrid Model – Onsite installations either in a virtual machine provided by TrendMiner or in self-installed environment. Additional instances in the cloud connect to multiple on-site Plant Integrations Connectors. Cloud instances are either self-managed/hosted or available as SaaS



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a GE representative

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Visit GE's [TrendMiner Process Analytics](#) to learn more

*Application support and integration is always expanding. Visit TrendMiner Software Connections for full list and updates