# Monitoring IT, OT and IIoT with Paessler PRTG: use cases and dashboards

Examples of how PRTG can be used to monitor and visualize your industrial IT





# Content

Monitoring IT and OT convergence	3
Business process view	4
Industry and IT view – health of various components	5
Production environment	5
IT Environment	6
Building Technology	6
Industrial infrastructure monitoring	6
Industrial communication equipment	6
Industrial enclosures	7
Gateways	9
Controller and execution systems	10
Industrial cyber security	10
Production process data	11
Industrial IT connectivity	12



Digitalization and the convergence of IT and OT makes it crucial to have a unified view of your entire infrastructure. From machines on the factory floor, PLCs, programmable logic controllers and IIoT devices, through to industrial gateways and IPCs – you need to know the status and condition of it all.

Paessler PRTG provides monitoring software that lets you get an overview of your IT, OT and IIoT, all in one place.

#### How PRTG gets its data from IT, OT and IIoT

**IT monitoring:** PRTG monitors IT infrastructure by using common protocols and methods like SNMP, Netflow, WMI, and more.

**OT monitoring:** PRTG can obtain information from OT devices and systems by using industrial standards like OPC UA and Modbus TCP. The ability to customize sensors opens new possibilities for bringing in data from the OT environment.

**IIoT monitoring:** Using protocols like MQTT, PRTG can bring metrics from IIoT devices – such as temperature, humidity, and more – into the monitoring concept.

However, simply having all this data is not enough. You also need to be able to act based on the information you have. Here's how PRTG lets you turn your monitoring data into actionable insights:

- **Customizable dashboards** let you visualize either your entire industrial environment, or partial views with customized information for different users, so that the right teams get the information they need.
- · Thresholds and alerts trigger notifications when configured values are exceeded.

# Monitoring IT and OT convergence

When you have so many different components from different worlds working together, you need to be able to see if all the gears are meshing. And you need to do it at a glance, if possible. This means getting a quick view of the status of different components.

The best way to do this is through the creation of customized dashboards. But what might a view of IT and OT convergence look like? Here are two examples.





#### EXAMPLE 01

#### Business process view

Ο

A business process view is a visualization of the health and status of entire data flows in your organization. Here is a typical dashboard display:



#### What you see

The dashboard gives you a very high-level summary of several areas of the enterprise – the overall health and status of the customer portal, the status of the corporate infrastructure, and the status of the production environment. The health of each area is dependent on a subset of components, and you can quickly see if any of these components are down – and also how the overall area is affected.

PRTG gets information about the various systems and devices by using sensors (think of these as "data collectors"). Let's look at the Production/Logistics section of the dashboard as an example. Here's how the various aspects of the industrial environment are being monitored:

Component	Description	How monitored?
ERP, MES and SCADA systems	Standard in industrial architecture.	Health and status details of the systems can be obtained using the PRTG REST Custom sensor, or SNMP sensors.
OPC UA server	OPC UA servers can run on devices like PLCs or IPCs.	OPC UA Server Status sensor, OPC UA Certificate Sensor
MQTT broker	Used to transmit data via a publish-subscribe mechanism to other systems, e.g. IoT data like environmental metrics (temper- ature and humidity) from the plant floor to other systems, or industrial data using Sparkplug	MQTT Statistics Sensor, MQTT Round Trip Sensor, MQTT Subscribe Custom sensor
Intrusion Detection System (IDS)	System for detecting anomalies in the industrial environment, for example: Rhebo Industrial Protector.	Custom integration via APIs using REST Custom sensor, Python scripts or custom solu- tions using PRTG Custom Exe Advanced sensors
Industrial Ethernet devices	This includes devices such as industrial firewalls, routers, switches and so on.	SNMP sensors, REST custom sensor, and others
Printer	A standard printer	SNMP sensors, REST custom sensor





This data is summarized into the traffic light sensor using the PRTG Business Process sensor.

#### The benefit

Ο

This view lets you quickly inspect the health of entire areas and combines the IT and OT worlds into one overview. If there are problems, you can drill down into greater detail by clicking on the relevant sensor.

#### EXAMPLE 02

#### Industry and IT view – health of various components

Here is another example of a convergent view of an industrial environment.



#### What you see

In addition to a view of IT and OT, this dashboard also includes metrics to do with the facility itself. It's easy to see at a glance if something, somewhere is in a failed or warning state.

Here is a summary of the various components of each section.

#### Production environment

In just this view alone, engineers already have a summary of some of the most vital aspects of their OT area. Here is an explanation of the subsections:

#### Industrial IoT

In this example, this includes a Soffico Orchestration Engine, a Rhebo Industrial Protector, a Beckhoff IPC, a CloudRail box, and a Rittal CMC III processing unit. Additionally, some devices are being monitored using Modbus TCP and OPC UA.

#### UPS

An Eaton 9SX 1000i is the UPS in this scenario. There are various aspects being monitored, such as the device itself, the battery status, and other metrics. In the above example, it is immediately clear that there is an issue with the UPS that needs to be addressed.

#### Air conditioning system

There are several metrics behind this sensor – for example, temperature measurements, uptime of the unit, and so on. Additionally, the sensor can also display error codes in the case of an air conditioning system failure. This way, you can not only immediately see when there is a problem, but you can also quickly find out what the issue is, and thus know who to contact for technical assistance.



#### OPC UA Server status

With OPC UA becoming a widely adopted standard in industrial environments, OPC UA servers play a crucial role in communication between various elements in the infrastructure. The OPC UA Server Status sensor of PRTG constantly checks that OPC UA servers are up and running and gathers information about the servers' uptime and diagnostic data.

#### Bandwidth usage

The two graphs on the dashboard show bandwidth usage of the factory floor uplink (which is provided by a Nexus 3132Q-X switch in this example) and the "Shopfloor line 1". This is a great way to watch for bottlenecks in communication between the factory floor and other areas. Not only that, but the graphs can help you identify patterns over time, which can help you with optimizing processes or the infrastructure.

#### IT environment

This section gives an overview of the IT infrastructure. It does this using a sunburst view, which is a great way of seeing the status of all devices of a specific type.

You can also see the traffic lights of the Business Process sensor, which gives an overview of the overall status of a specific service.

The dashboard also shows several other IT-related metrics, such as the status of the virtual environment, corporate Website, and cloud services. You can also see bandwidth usage on the WAN over a period of time.

#### **Building technology**

This section shows various metrics from the building facilities. For temperature and humidity data, we are receiving data from IoT devices that monitor environmental conditions. We have also configured sensors to get data from the building access system, the alarm system, and the emergency power supply.

#### The benefits

Each of these views – the production view, the IT view, and the building technology view – could be separate dashboards, used by the relevant teams. But the real benefit is having all these views on one dashboard, side-by-side. This makes it possible to keep an eye on the health of the entire IT and OT infrastructure.

# Industrial infrastructure monitoring

Any industrial environment has infrastructure components that need to be monitored. Let's look at some of these components, and how PRTG can help with monitoring them.

#### Industrial communication equipment

Industrial communication equipment, which includes the industrial Ethernet, refers to networking devices similar to the IT world – routers, firewalls, switches, etc. – that have been customized for industrial environments through extra protection against dust, vibrations, water, and other conditions found in industrial settings.



The availability and performance of the devices and systems introduced by the Industrial Ethernet can be monitored in various ways. Just like traditional Ethernet devices, industrial devices commonly offer SNMP as a communication option, which can be used to get vital data about the devices' operation.

Data required for monitoring is also often available through OPC UA, a widely adopted standard in industrial IT communications. Additional mechanisms that can be lever-aged for monitoring might include APIs, MQTT, and more.

#### Industrial enclosures

A typical industrial cabinet has multiple pieces of hardware and many, many cables, and so it can be difficult to keep an eye on what's inside. To demonstrate how PRTG can help with this, here's an example of a dashboard.

The goal of this dashboard is to have a way to quickly get an overview of the contents of the cabinet, but also be able to drill down to a more granular view if we need to. Here is the overview:



#### Here's what you can see at a glance:

#### CMC III Gateway and Sensor Hardware Status

The cabinet in our example is cooled by a Blue e+ system that is connected to a Rittal CMC III IoT gateway. Additionally, there are CMC III temperature sensors inside the cabinet for monitoring the current temperature, and these are also connected to the Rittal gateway. Using the CMC III Hardware Status sensor of PRTG, you can ensure the gateway as well as all connected sensors are functioning properly.

#### Server status

Our cabinet contains an Industrial PC, which is running an OPC UA server. The PRTG OPC UA Server Status sensor lets us ensure that it is up and available.

#### UPS

Despite being critical to keeping industrial environments running, it's easy to forget about UPS systems in the dark corners of cabinets. And this would be a mistake, because there are many important things you need to keep an eye on: the health of the UPS device, the battery life, as well as how long the UPS can provide backup power if the main power supply fails are all good examples. Our dashboard shows the status of the UPS using SNMP sensors.



#### Cloud status

In the case that devices in the cabinet require an internet connection, it is also useful to know if the cloud service is available. To monitor this, we use our Cloud Ping sensor.

All this information is great for a quick glance at your dashboard, but if one of these sensors was orange or red (indicating a warning or down state respectively), you will need a more detailed view to start investigating the issue. Clicking on the dashboard will bring up an expanded view of the cabinet.

Here's a screenshot of the detailed dashboard:



#### Now let's look at some highlights of what we can see:

#### Blue e+ health and temperature trends

Here you can see more detailed metrics about the Blue e+ cooling system, such as the mode it's operating in, the fan mode, and the current state. Also included is a display of an error code. In this example, you can immediately see that there is no active error; however, if there was, the error code would be shown. This would help you to instantly take steps to alleviate the issue. The hardware status here is monitored by the CMC III Hardware Status sensor.

You can also see a graph showing the recent temperature values. This can help you spot historical trends and identify patterns that indicate potential issues. This data is obtained using customized SNMP or OPC UA custom sensors.

#### Connectivity

Here we can quickly see the connectivity of various devices in the cabinet, as well as bandwidth usage. We're also monitoring the Fortinet Fortigate firewall using SNMP sensors. You can immediately see if a connection has failed, or if high bandwidth is slowing the system down.



#### DCS

Keeping an eye on the DCS is critical too. Using the Ping sensor, PRTG continuously checks if the unit is up and available. We also monitor Port 200, which – in this example – provides access to a Web server running on the DCS.

Also of interest is the number of processes being handled by the DCS, the average load of processes per minute, and the number of systems and users connected to it. We can also see how long the system has been up.

#### Power

This collection of metrics gives us a detailed overview of the current power consumption (amps in use, frequency in Hz, voltage, and total energy usage in KWh). This data is retrieved from installed devices such as power meters, power quality devices or power management units that can communicate via Modbus TCP or OPC UA.

#### Gateways

Gateways are devices that provide the bridge between different environments. They do this by translating between different protocols, and by aggregating data and sending them to various end points.

In a typical industrial environment, gateways form the connection between the factory floor and various other systems. These could be hardware gateways, or software gateways.

Here is a typical architecture featuring a hardware gateway (in this example, the gateway is an INSYS icom device):



PRTG can monitor the condition of the gateway itself, using SNMP or a RESTful interface on the gateway. However, the MQTT and OPC UA sensors can also be utilized to get data from the OT environment through the gateway.

The scenario is similar for software gateways. Here's an example featuring a Softing gateway:





### Example: Getting data from the factory floor (hardware gateway example with an INSYS gateway)

In the OT environment of this example, there is a Logo! 8 Programmable Logic Controller (PLC) that we want to monitor. The PLC is connected to an INSYS icom gateway. We also have connected the icom gateway device to an MQTT broker (in our example, the broker is Thingsboard).

#### Data from the PLC can be brought into PRTG as follows:

- 1. On the INSYS icom device, you can define data points for connected devices in our case, the Logo! 8 PLC.
- **2.** On the INSYS icom gateway, you set up MQTT messages to send data from the Logo! 8 PLC to the Thingsboard MQTT broker.
- **3.** In PRTG, you then set up the MQTT Subscribe sensor and configure it to subscribe to the topic related to the PLC. This means that it will receive the messages from the broker (once it has received them from the INSYS icom gateway). Then you configure the sensor to query the relevant information in the message (using a JSON) and display the data in PRTG.

Doing this, you will receive the data that was originally sent by the PLC in PRTG for monitoring. PRTG is particularly suited to use cases like monitoring if a machine is on or off, if a filer is full or not, or if a cabinet door is closed or open.

# Controller and execution systems

Systems like SCADA and MES are vital to industrial architecture, and so it is necessary to constantly monitor the condition of these systems. After all, if they go down, the results can be costly.

PRTG provides the tools to keep a close watch on the environment that these systems run in. This includes CPU load, memory, storage space, performance, related databases and more. Using SNMP, PRTG can also ensure that the systems themselves are up and running and provide alerts in the case of issues.

# Industrial cyber security

There are a lot of reasons for security risks in the industrial world. Firstly, there is the exponential rise in cyberattacks in recent years. Then, the convergence of IT and OT places industrial IT networks at more risk, since OT networks are being connected to new systems and devices. PRTG offers various ways to help protect industrial environments.

#### Defense in depth

To protect OT networks, several specialized defense layers are required. This concept, known as "Defense in Depth", operates on the assumption that if you have multiple layers of security, you keep your core network safer. For OT, industrial firewalls commonly provide a layer. Another possibility is network segmentation, where the OT network is either separated from the IT network by an industrial demilitarized zone (vertical segmentation), or where the OT network itself is separated into several zones (horizontal segmentation). PRTG can perform a critical part of a defense in depth approach by watching over the industrial firewalls, the interfaces between segments, and other factors like open ports.



#### OPC UA certificate monitoring

OPC UA certificates help provide a level of security between communicating components. PRTG can monitor these certificates using its OPC UA Certificate sensor. Using it, you can get details of a certificate on an OPC UA server, such as the number of days to expiry, whether or not it is self-signed, and the public key length. You can also set up alerts that will warn you when the certificate is approaching expiry.

Overview	(*) Live Data	2 days	30 days	365 days	🛤 Historic Data	E Log	O Settings	A No	otification Tri
ys to Expiration	Public Key Langth	Self Signed							
85 day(s) <sup>O</sup> clay(s)	3,432 dayid 3								
85 day(s) O day(s)	3.432 duyld 0.8	Last Value 0			Minimum ©			Maximum 0	
0 day(s) Channel - Days to Expiration	3,432 day(4) 0,1	Last Value © 3,385 day(s)			Minimum © 3,385 day(s)			Maximum © 3,432 day(s)	,o
Channel - Days to Expiration Downtime	3,432 dayjej 3,432 dayjej 4,532 dayjej 4,53	Last Value ≎ 3,385 day(s)			Minimum © 3,585 day(s)			Maximum © 3,432 day(s)	°°
Channel - Days to Expiration Downtime Public Key Length	3,432 day/d) 0 0 -4 1	Last Value ≎ 3,385 day(s) 2,046 bit			Minimum © 3,385 day(s) 2,046 bit			Maximum © 3,432 day(s) 2,048 bit	°° °°

#### Integration with third party solutions

Two common approaches for ensuring cyber security are Intrusion Detection Systems or Intrusion Protection Systems. PRTG can work together with these systems to add an extra layer of defense to your security strategies. For example: Rhebo Industrial Protector provides passive OT anomaly detection and security functionality. PRTG can be connected to Rhebo Industrial Protector using its MQTT and OPC UA sensors to gain even more insight into the environment, without adding more traffic to the OT network (since the OPC Client or MQTT broker are queried rather than the devices directly).

## Production process data

The industrial IT functionality of PRTG – specifically its OPC UA and MQTT capabilities – means that it can be a useful addition to your condition monitoring concept.

#### Industrial condition monitoring definition

Condition monitoring is the regular or continuous measurement and recording of parameters such as speed, volume temperatures, fill levels, pressure or vibrations in a production environment. These values serve as physical indicators to determine the condition of the machine.

PRTG supports your condition monitoring hardware and processes by getting factory floor data using OPC UA and MQTT. This means that you can add values for condition monitoring related to the status of the overall system, such as data related to the communication infrastructure or by using flow sensors to check on industrial routers.



#### Some examples of data that PRTG could access:

- · Status of the communication structure by monitoring the OPC UA servers
- · Industrial router status using flow sensors
- · The status of sensors in an industrial enclosure
- The operational status (on/off/fault) of pumps and motors, as well as random sampling of flow, pressure, volume, temperature, and torque
- Fill level data of large tanks, which PRTG can use to generate an alarm or notification when maximum or minimum fill value is reached
- · Filter status, so that you know when a filter needs replacement
- Machine outages during unmanned production facilities (for example, during night shift)
- Temperature, humidity, dust concentration, volatile organic compounds (VOC), CO2 concentration, ozone concentration, etc. from ambient/environmental sensors

## Industrial IT connectivity

Over and above the IT functionality of PRTG, it provides support for protocols and standards that are common in industrial environments, including:

- OPC UA, used for getting the health and status of devices using OPC UA, checking on the status of OPC UA servers, and monitoring OPC UA certificates
- MQTT, used to gain insight into MQTT installations (such as number of messages, health of the broker, and so on) as well as to monitor data from IIoT devices
- Modbus TCP and Modbus RTU, to get the data from devices using Modbus, such as health and status of the device, error messages and more

#### Sensors monitoring your industrial environment

- MQTT Roundtrip Sensor: Monitor the health of your MQTT implementation by measuring the message round trip time (RTT), round trip status, publisher connection time, and subscriber connection time
- MQTT Statistics Sensor: Monitor statistics for MQTT topics, such as number of incoming messages and the received payload
- MQTT Subscribe Custom Sensor: Subscribe to an MQTT topic and monitor up to ten values
- Modbus TCP Custom Sensor: Monitor your Modbus TCP server and keep an eye on peripheral devices like cooling units, power supplies, temperature, and more
- Modbus RTU Custom Sensor: Connect to a Modbus RTU server to monitor serially-connected devices
- Rittal CMC III Hardware Status: Monitor the hardware status and performance of a Rittal CMC III processing unit and all attached external Rittal sensors - to make sure that the monitoring infrastructure inside the enclosure is actually functional.
- ✓ OPC UA Server Status Sensor: Ensure that your OPC UA server is up and running by tracking the operation status, uptime, and diagnostic information.
- OPC UA Custom Sensor: Monitor up to ten values from an OPC UA server, including metrics like PLC state, device failure, battery status, error codes, and more.



- ✓ OPC UA Certificate Sensor: Monitor the OPC UA certificates in your environment and prevent certificate expiry from impacting production.
- ✓ OPC UA Notifications: Enables you to forward PRTG alerts by writing them to a predefined OPC UA tag on an OPC UA server like SCADA, DCS, or any other system that provides OPC UA server capability.
- Beckhoff IPC System Health Sensor: Monitor the health status of Beckhoff industrial PCs by watching the CPU load and temperature, available memory, mainboard temperature and RAID controller status.

# Find out more

WWW.PAESSLER.COM/INDUSTRIAL-IT-MONITORING

#### ABOUT PAESSLER AG

Paessler believes monitoring plays a vital part in reducing humankind's consumption of resources. Monitoring data helps its customers save resources, from optimizing their IT, OT and IoT infrastructures to reducing energy consumption or emissions – for our future and our environment. That is why Paessler offers monitoring solutions for businesses across all industries and all sizes, from SMB to large enterprises. Paessler works with renowned partners, and together they tackle the monitoring challenges of an ever-changing world.

Since 1997, when Paessler first introduced PRTG Network Monitor, it has combined its in-depth monitoring knowledge with an innovative spirit. Today, more than 500,000 users in over 170 countries rely on PRTG and other Paessler solutions to monitor their complex IT, OT and IoT infrastructures. Paessler's products empower its customers to monitor everything, and thus help them optimize their resources.

Check out all the possibilities within the Paessler Solutions Universe













. . .

HEALTHCARE

MANUFACTURING

EDUCATION

FINANCE

GOVERNMENT

ссти

MANY MORE

Paessler AG // info@paessler.com // www.paessler.com