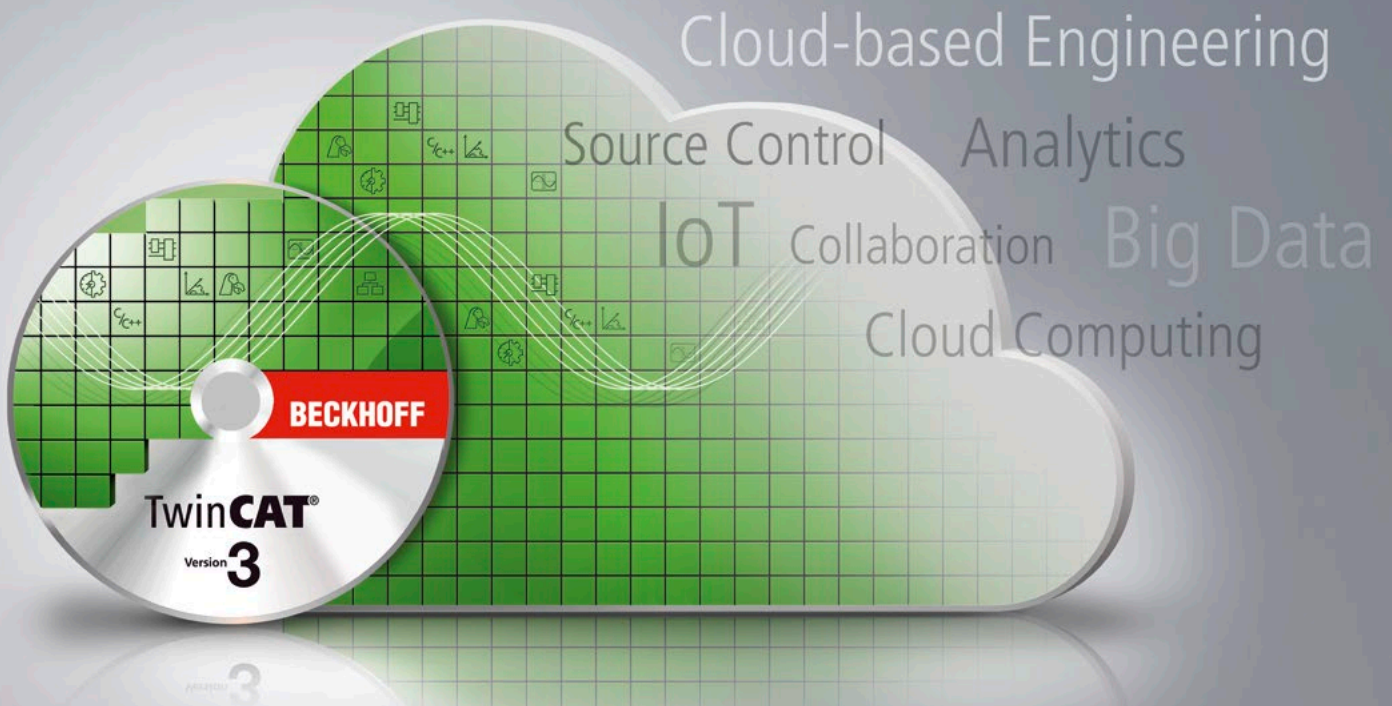


BECKHOFF New Automation Technology

Smart engineering in the cloud: TwinCAT Cloud Engineering



Cloud computing: automation's future is connected

Connectivity is making a world of difference: In 2018, there were more than 7 billion active Internet of Things devices worldwide, and experts predict that this figure could increase threefold to 22 billion by 2025. All these devices are able to interconnect via a scalable infrastructure provided by the cloud. Cloud computing also presents a huge opportunity for machine builders and plant operators: By maximizing the potential of PC- and cloud-based control technology to create automation networks, they can gain and retain a competitive edge over the intermediate and longer term. Connecting machines and equipment – both locally and, more importantly, across multiple

locations – not only breaks ground for new business models, it also boosts efficiency throughout production processes – from engineering to cloud-based operational data analysis to dependable predictive maintenance strategies for greater availability and less downtime. As a specialist in PC-based control, Beckhoff helps users implement highly efficient IoT-based automation strategies: It integrates the full range of machine functionality – from PLCs and motion control, to robotics, machine vision, HMIs and machine learning – on an open, central control platform. With PC-based control technology, users can connect their machines, equipment and production lines to tap

Cloud co

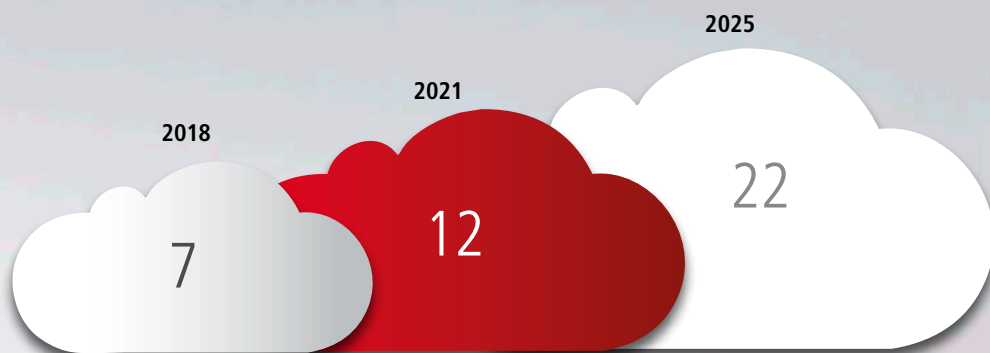
Global availability

Cloud providers are building interconnected data centers around the world to enable global enterprises to deliver applications to a geographically dispersed user base.

Scalability

The cloud provides scalable computing capacity to support rapidly expanding infrastructures.

into potential efficiency gains across all their processes. TwinCAT Cloud Engineering offers an ideal foundation by enabling users to create and manage instances easily in the cloud, complete with integrated analytics and HMIs.



Projected numbers of active IoT devices (billion)

Source: iot-analytics.com, 2018

Computing

Big data

Cloud providers offer a range of data storage options to enable big data applications.

Security

The core infrastructures of cloud providers meet the wide-ranging security requirements of global businesses, banks, military institutions, and other organizations.

TwinCAT Cloud Engineering: for all instances and controls

For businesses in the industrial sector, the ability to use cloud services efficiently is becoming an increasingly critical competitive factor. Cloud services now make it possible to implement scalable applications easily and with significantly less effort than in the past. At the same time, information technology, operational technology and automation technology continue to converge, creating new challenges for machine builders. Here, PC-based control technology offers a way forward, providing a comprehensive platform that enables them to exploit IoT infrastructures to advance globalized industrial production. Setting up secure and scalable connections between geographi-

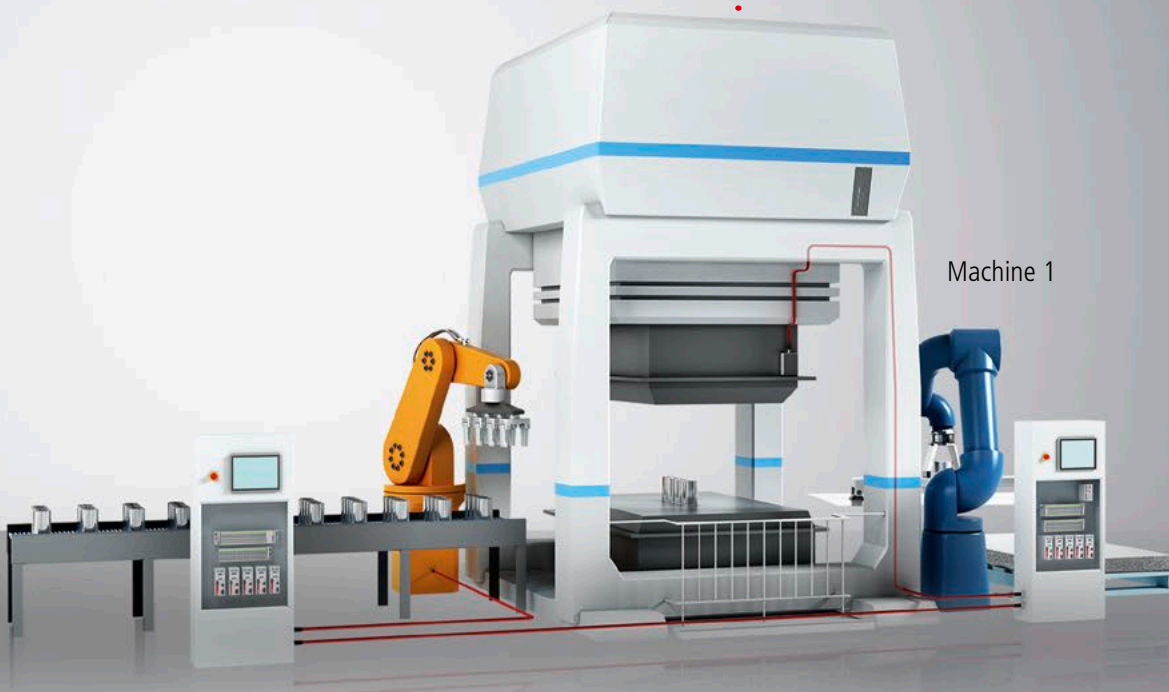
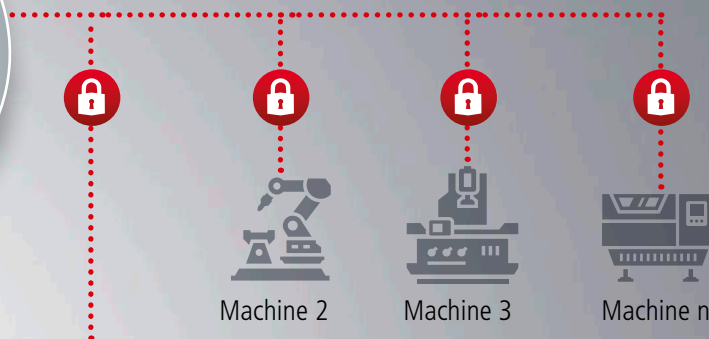
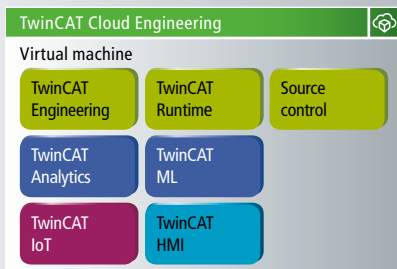
cally distributed control systems – to support big data or analytics scenarios, for example – is only the first step; the second is to ensure that these interconnected systems are as easy as possible to operate and maintain remotely. And this is where TwinCAT Cloud Engineering comes in: It enables the TwinCAT Engineering and Runtime products from Beckhoff to be instantiated and operated directly in the cloud. With easy access through the Beckhoff website, this cloud-based solution allows registered users to perform a range of tasks, including the creation of TwinCAT Cloud Engineering instances; these instances can connect to physical control hardware over a secure transport channel.



Access is charged for according to a fair pricing model under which users can initially try the cloud service for free, then choose whether to continue using their instance once the trial phase expires. Users also enjoy all the benefits of the TwinCAT control architecture, plus location-independent collaboration options based on a source control repository.

The key benefits of TwinCAT Cloud Engineering:

- instantiation and operation as a virtual machine in the cloud
- direct access through the Beckhoff website
- simple, secure access to control hardware
- all the benefits of the TwinCAT architecture
- simplified collaboration
- a choice of user models



TwinCAT Cloud Engineering for machine builders and operators

TwinCAT is a platform for PC-based control systems which provides professional users with a wide range of options for creating and expanding machine projects. With TwinCAT Cloud Engineering, users can continue to use existing TwinCAT software components along with the entire TwinCAT architecture, but on a virtual machine in the cloud rather than on a local PC. Importantly, TwinCAT Cloud Engineering does not require users to adjust to a new software environment, because they can simply continue to work as before with the same familiar development environment. Another advantage is that it eliminates the need to install and maintain separate software versions

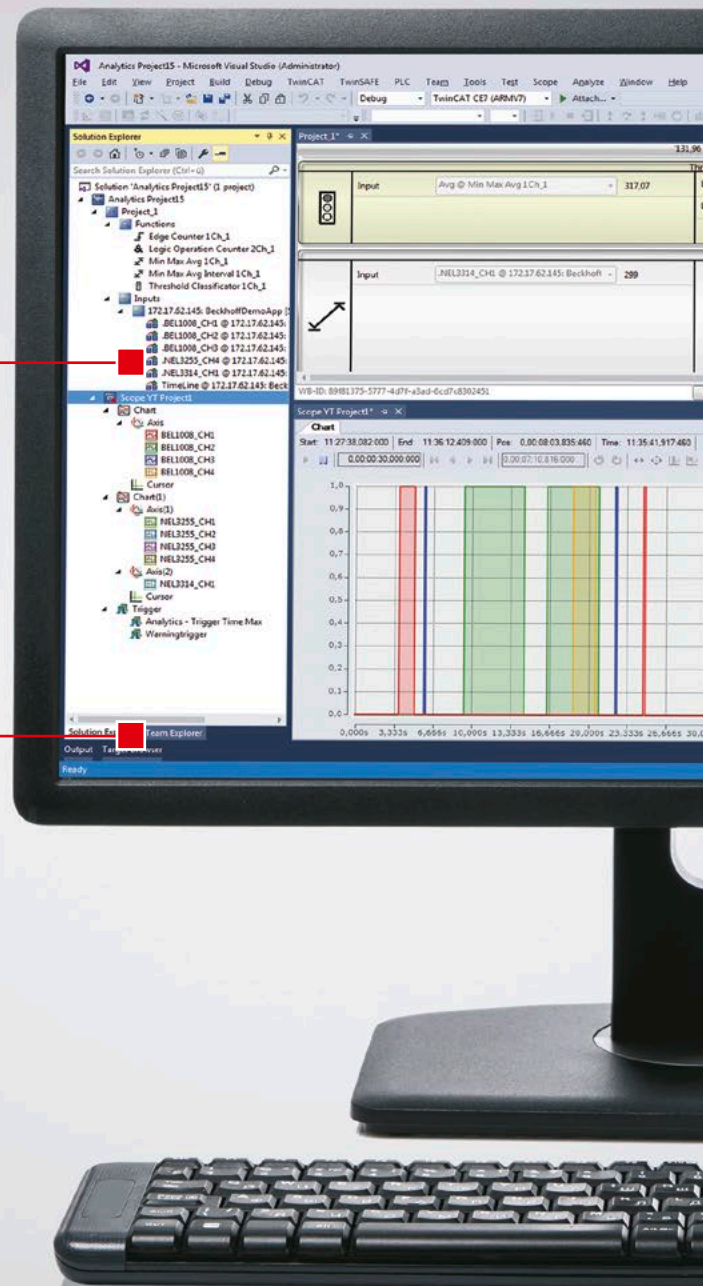
for different machine generations on the same PC. Instead, users can run separate instances of TwinCAT Cloud Engineering with different versions that they can access remotely and needs-based. This way, users always have the right software version immediately to hand for any given machine. Project files are kept in a source code control repository, available directly from within TwinCAT XAE.

TwinCAT Multi-User

Streamlined collaboration through direct integration of source control into the automation workflow.

Source control

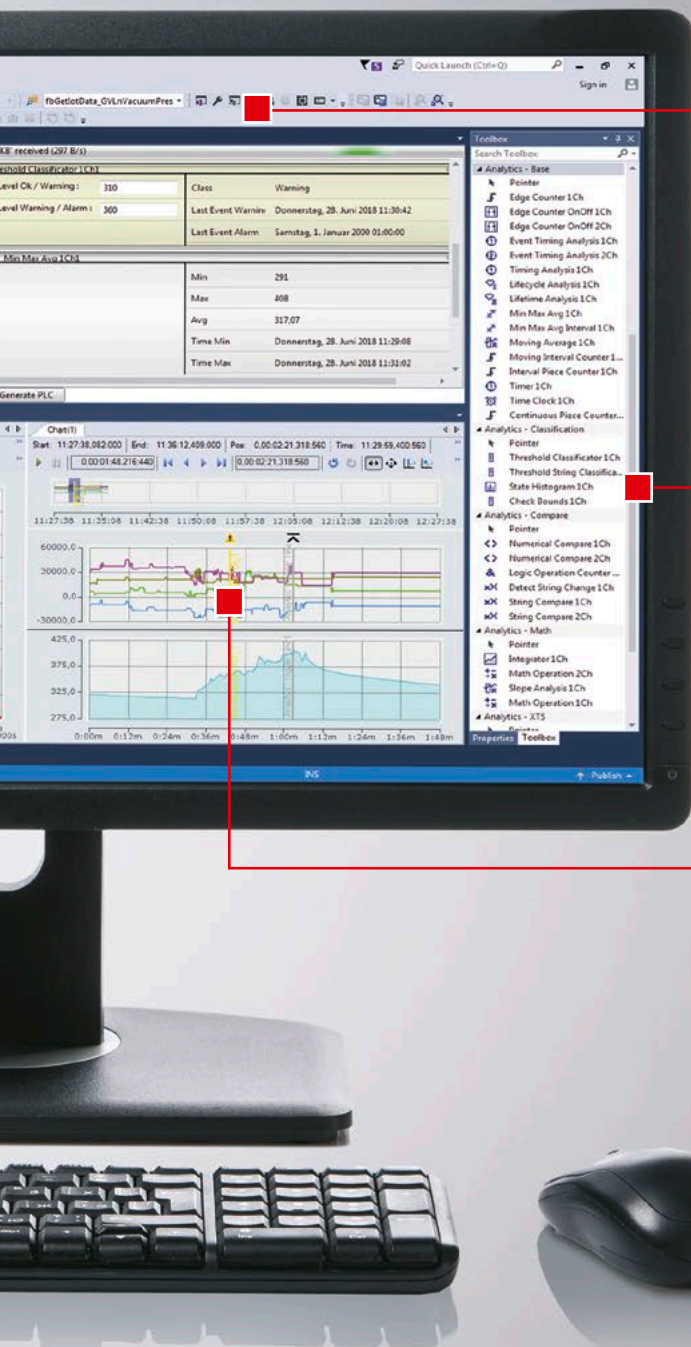
Cloud-based source control infrastructure combines anytime, anywhere access with strong automation project security.





Engineering benefits for professional users:

- automation project engineering in Visual Studio®
- built-in connection to source control systems
- expandable with add-ons for features such as data connectivity
- right engineering software version always available for any given machine



Software quality and APIs

Standard tools to support software quality assurance, unit testing and automatic code generation with APIs.

Visual Studio®

Use of a long-established standard programming environment for high-level languages.

Analytics and diagnostics

Powerful analytic and diagnostic capabilities for optimizing automation projects.

TwinCAT Cloud Engineering for new TwinCAT users

The TwinCAT Cloud Engineering architecture provides a familiar automation environment in which professionals such as machine builders and plant operators will instantly feel at home. Users who are new to TwinCAT automation software, in particular, will find that a TwinCAT Cloud Engineering instance offers an ideal and comprehensive platform on which to begin exploring the TwinCAT capabilities. Providing extensive sample code and in-depth video tutorials, it offers new users the guidance and information they need to get up to speed with TwinCAT and quickly begin creating their first automation projects. The tutorials are organized according to skill levels so that more

advanced and experienced newcomers, too, can easily find the information they need. To give new users the opportunity to get to know TwinCAT, they can work with a TwinCAT Cloud Engineering instance free of charge for a limited period.

Visual Studio®

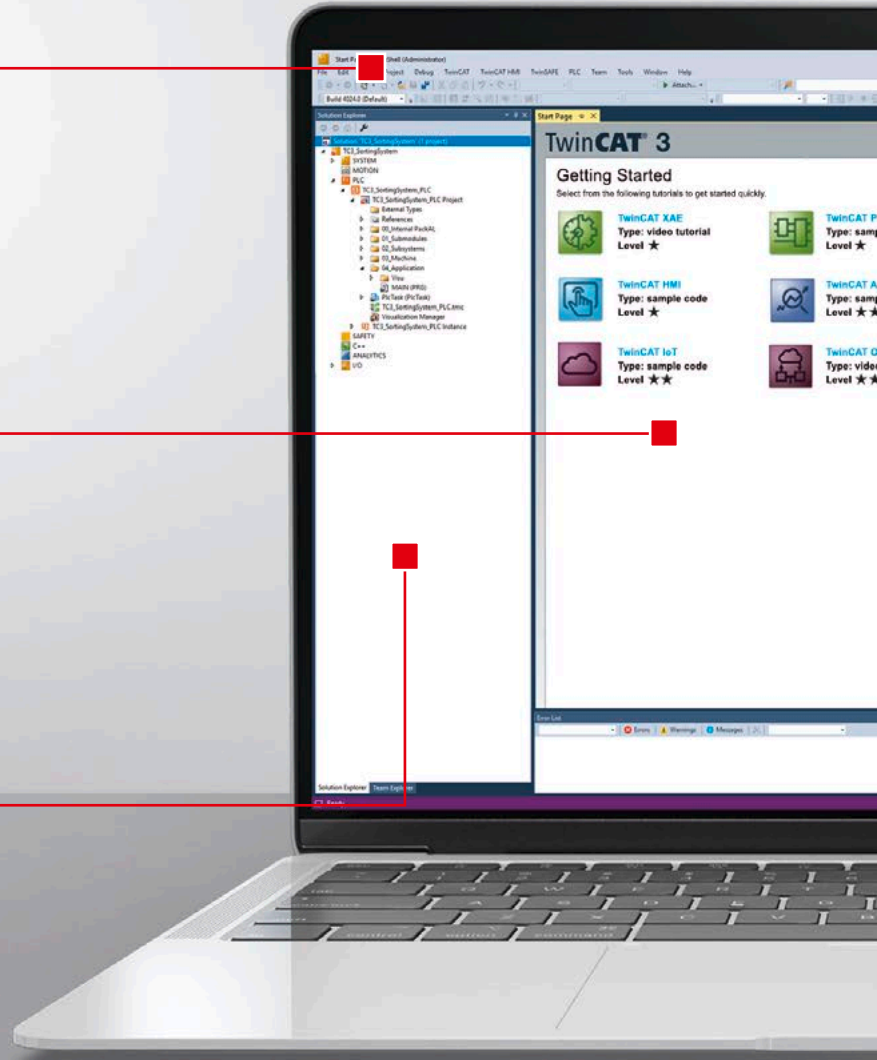
Use of a well-established standard programming environment for high-level languages, widely used in degree courses.

Tutorials and samples

Includes sample code and tutorials on all aspects of TwinCAT. Content is organized by skill levels to help beginners and advanced users easily find the resources they need.

All-in-one engineering

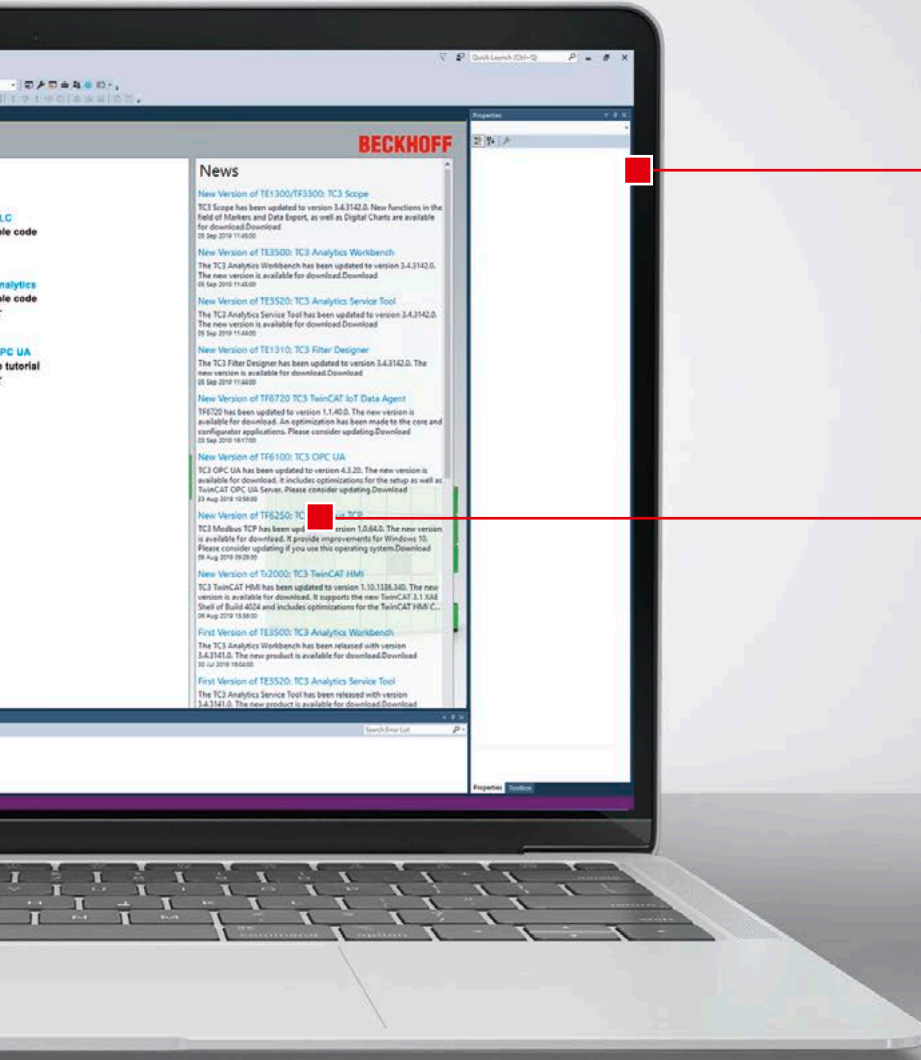
Seamless integration of TwinCAT tools in Visual Studio® eliminates the need to learn separate tools, making it much easier to get started.





Benefits

- to help new TwinCAT users getting started, the engineering system includes tutorials and samples that are instantly available on start-up
- tutorials are organized according to levels of difficulty
- TwinCAT software and tools available are quick and easy to learn
- an all-in-one engineering system with a full suite of tools integrated into Visual Studio®



Free trial period

Beginners can use TwinCAT Cloud Engineering free of charge for a limited trial period.

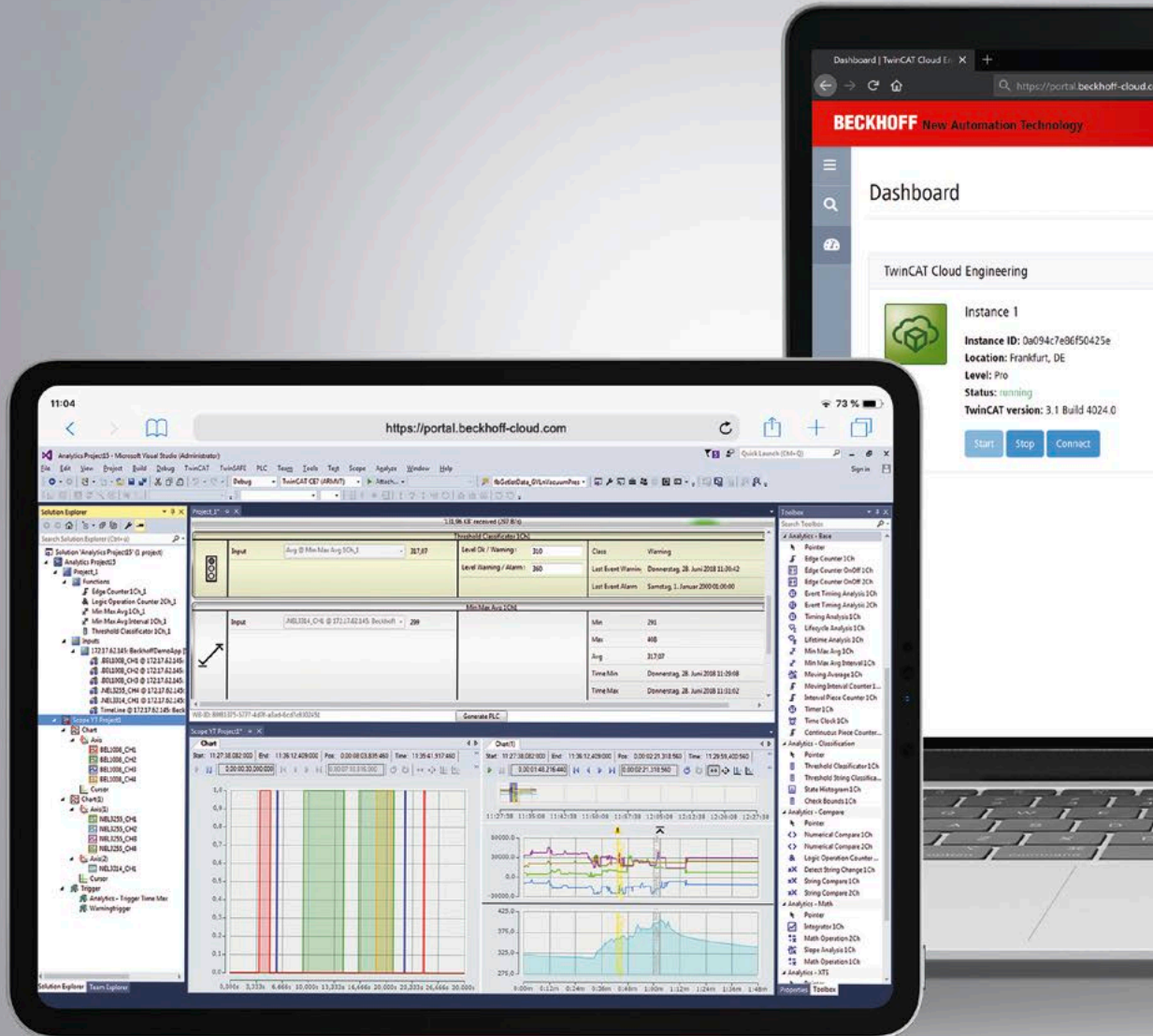
Always up-to-date

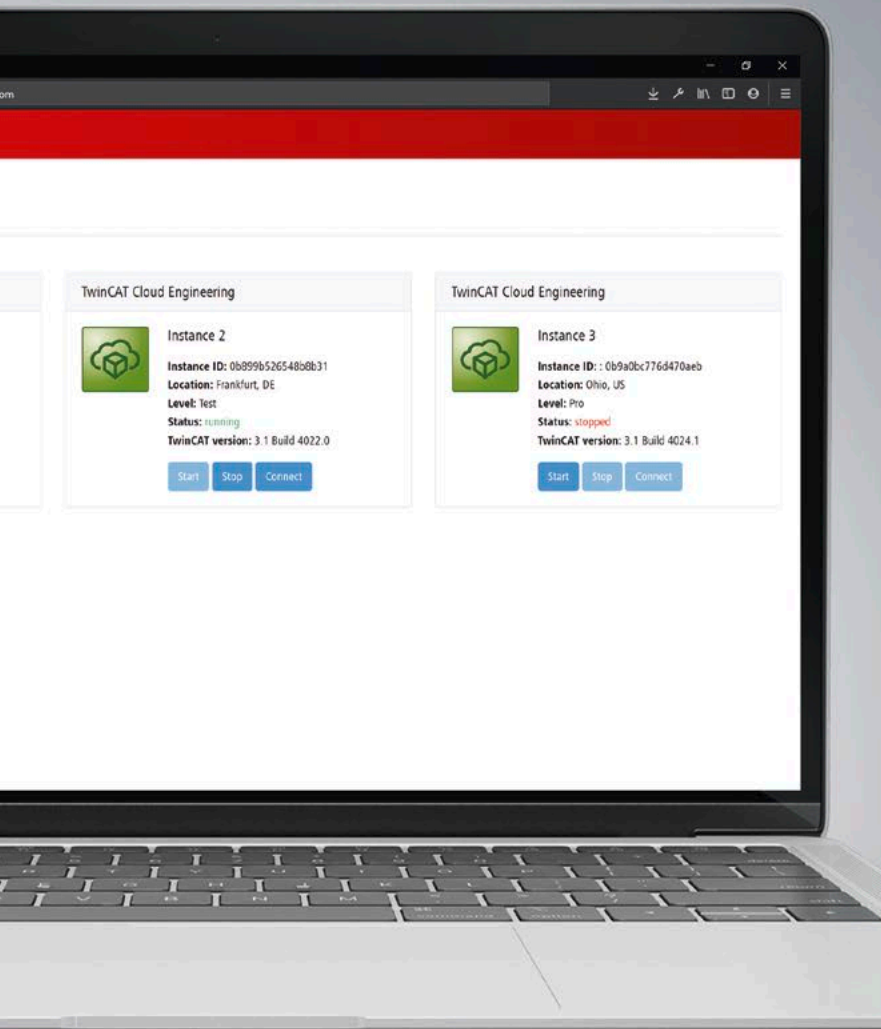
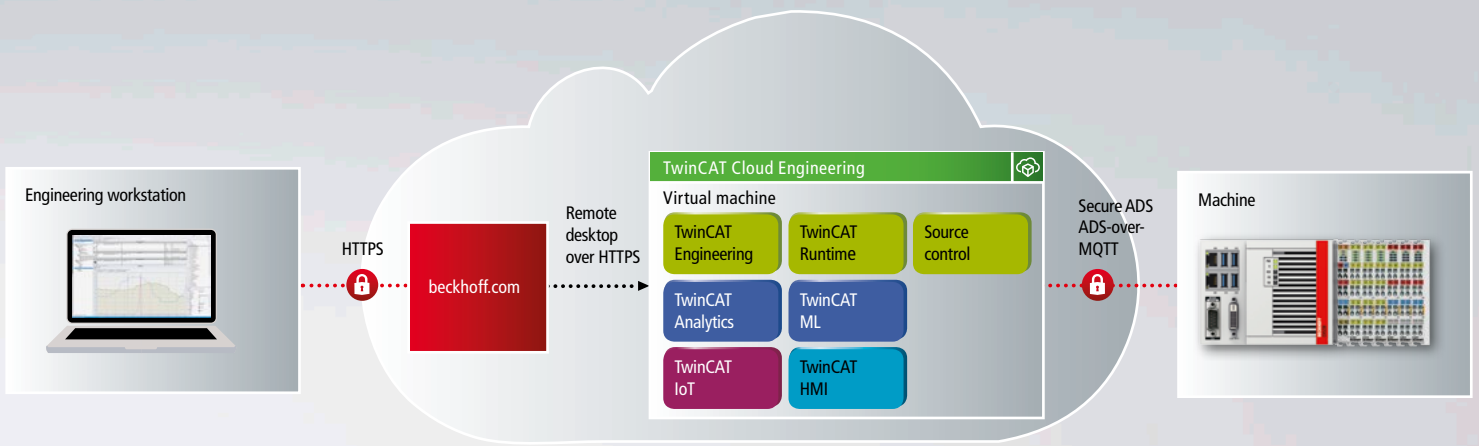
Built-in news feed keeps TwinCAT beginners informed about latest TwinCAT versions.

Smart engineering directly in the cloud at beckhoff.com

Users access the TwinCAT Cloud Engineering environment through the Beckhoff website. Working in a freely configurable dashboard, they can view any instances they create, and can start and stop these instances as needed, which helps keep provisioning costs down. They can also initiate a web-based remote desktop connection to an instance from the dashboard. All that they need in order to establish an HTTPS connection is a web browser. No special software or changes to corporate firewall settings are required. Users can simply access a project from within an instance using the familiar TwinCAT XAE toolchain and add it to the source code management system, either

through a collaborative Git-based tool or as a backup. Communication between the virtual space and the physical space with the actual control hardware can take place either on Secure ADS or on ADS-over-MQTT, with data connections protected by standard security mechanisms such as TLS and specific certificates. Control connections are handled fully transparent for users, in the same way as they have been in the past.

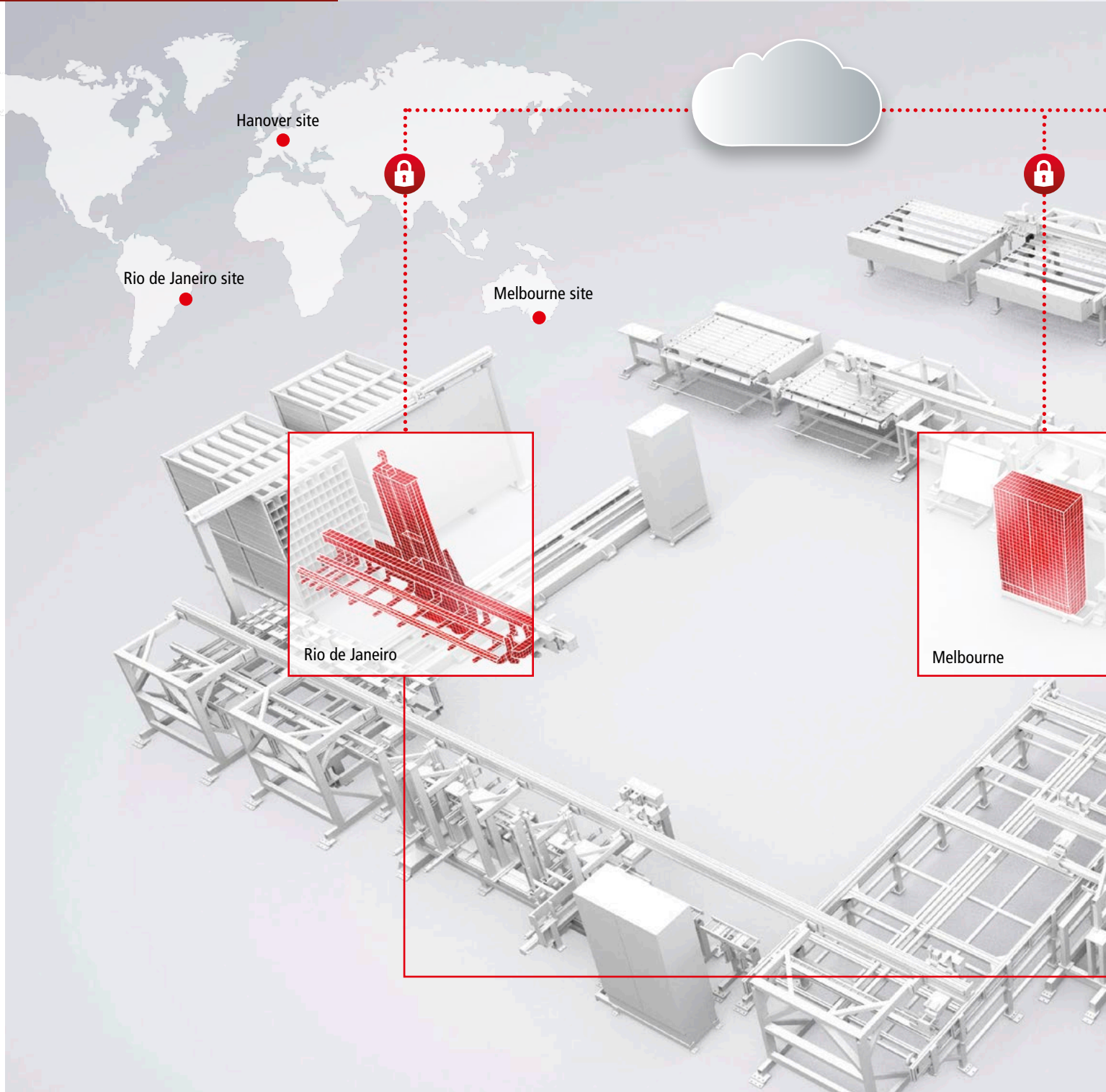


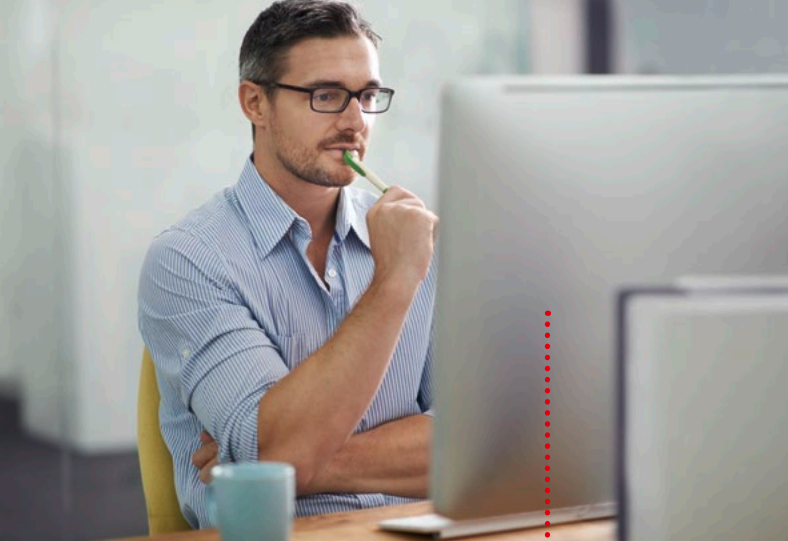


Easier all round: IT integration, initial setup and control

Setting up a TwinCAT Cloud Engineering instance takes just a few minutes using a special, automated process. When this is complete, users can begin to work with the instance right away. The user interface runs in a web browser. This means there is no need to install and operate any other software, and the user interface will work on any operating system or end device. Connecting an instance to actual physical control hardware is just as easy, because all components use the same communication port; this makes integration with existing IT infrastructure even simpler. In addition, a single instance can connect to multiple controllers, allowing, among other things, remote

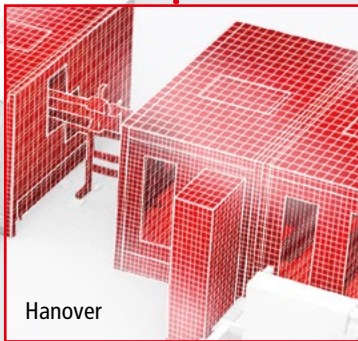
machine diagnostics and remote debugging of PLC programs. Setting up a visualization and enabling global remote access are both straightforward, too, because the visualization runs in the cloud. Through the source code management system, projects can be shared seamlessly. Plus, local TwinCAT installations can be connected, which means projects outside the TwinCAT Cloud Engineering environment can continue to be used and kept in synch.





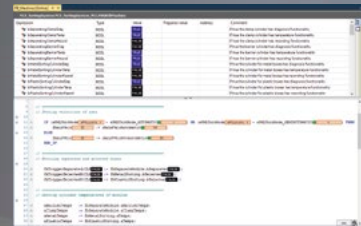
Benefits of IT integration

- platform and operating system independence
- no additional software required
- capable of connecting local TwinCAT installations and physical control systems
- communication over standard protocols and ports

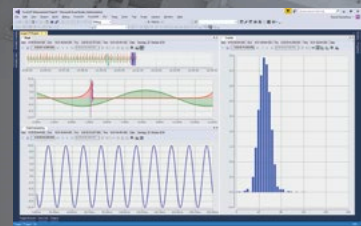


Hanover

Remote PLC debugging



Graphical remote diagnostics and condition monitoring



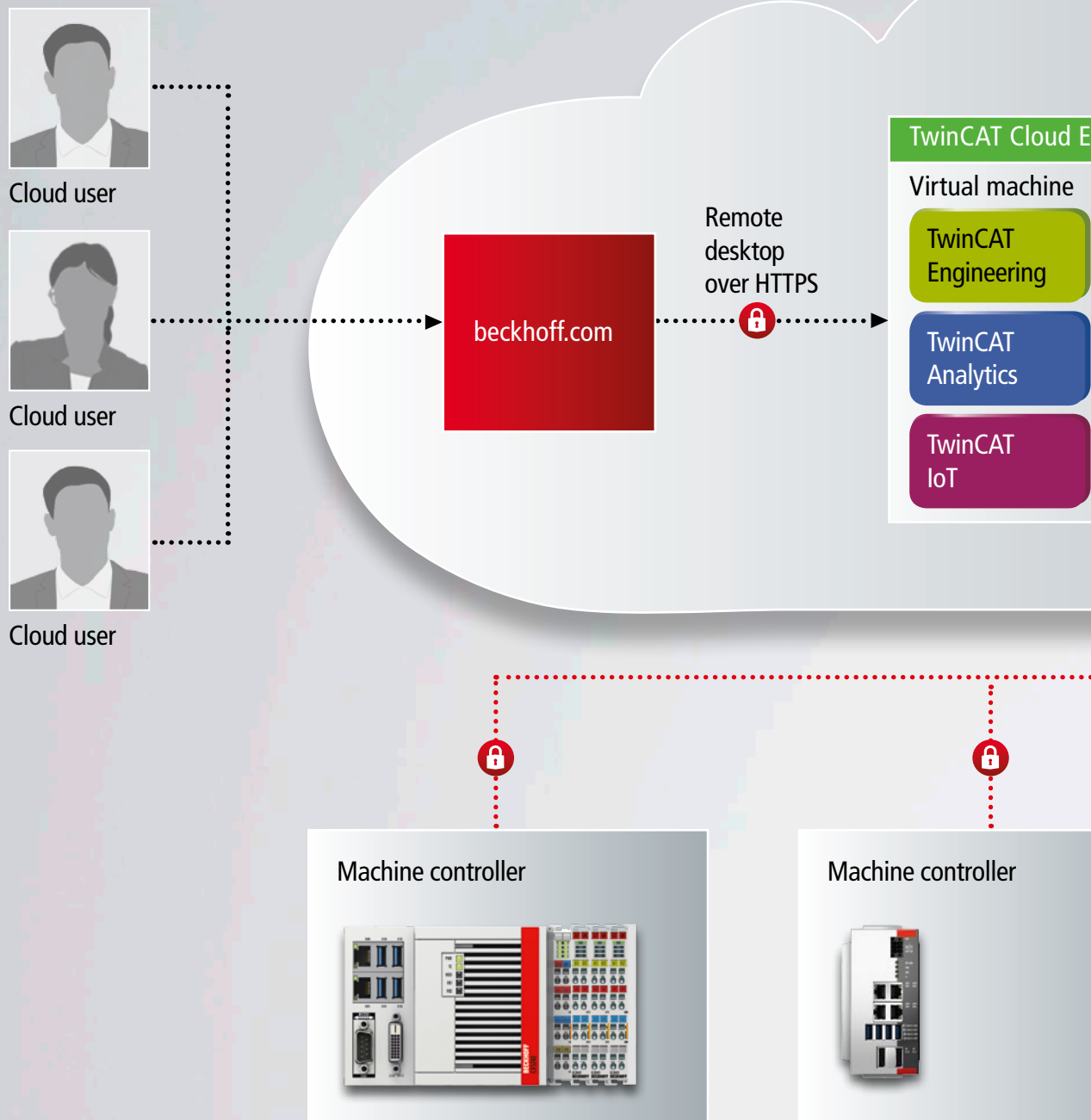
Remote visualization



Optimized team-work: global collaboration with source control

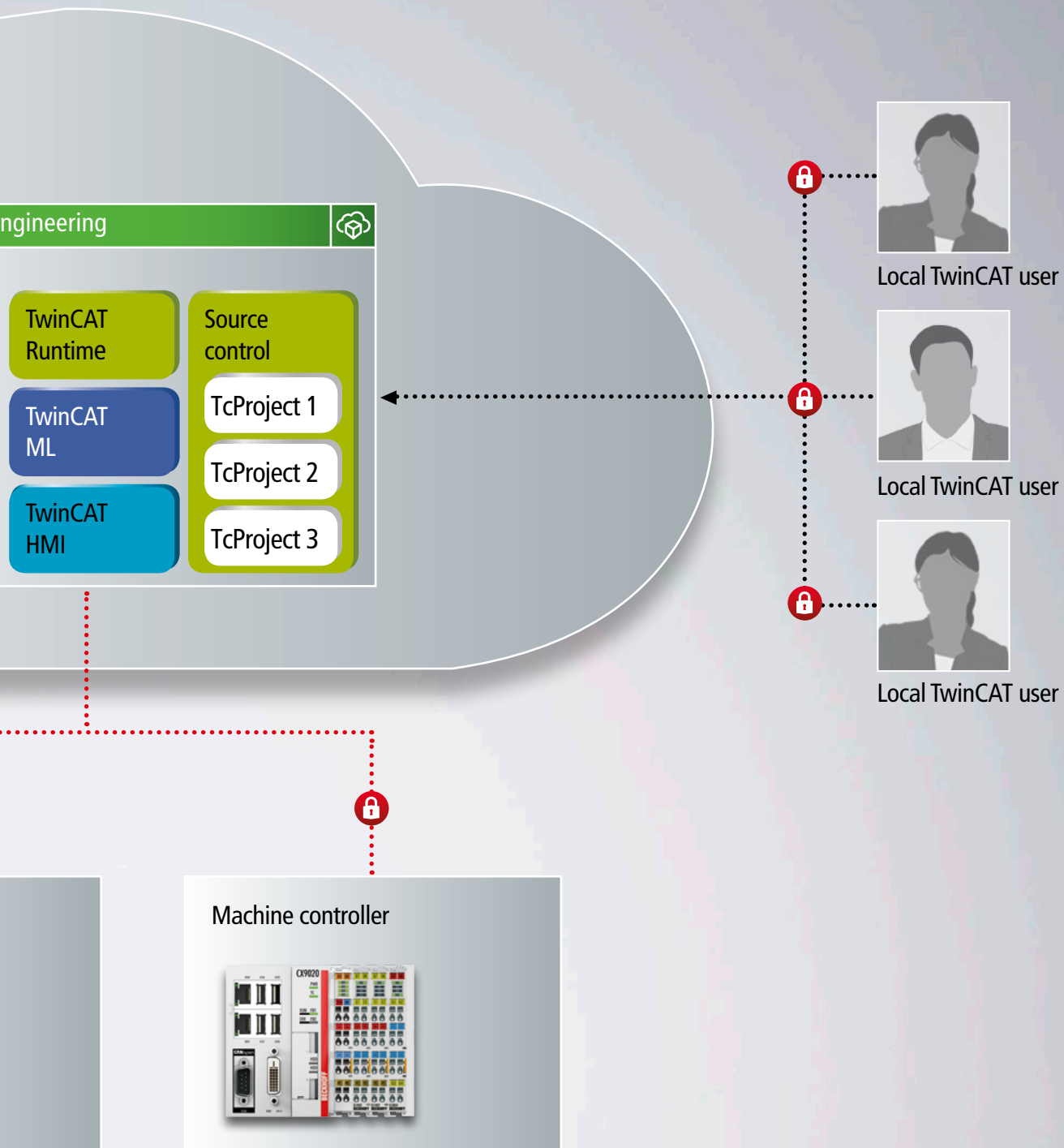
TwinCAT streamlines teamwork: With its advanced source control capabilities, it can connect easily to Git-based systems to manage automation projects. TwinCAT Multi-User supports simple, seamless user access to the source control repository without the need for special skills or in-depth knowledge. When enabling a TwinCAT configuration, the necessary check-in procedures are conducted and commented automatically in the repository and the relevant branches created. This makes working collaboratively on automation projects much easier. TwinCAT Cloud Engineering provides the same kind of functionality: By integrating a Git server into the instance or using

a Git-based cloud service, multiple users can work together on a number of instances at the same time, and they do not even have to be actual TwinCAT Cloud Engineering users in order to do so. Local users can be granted access to the source control system to work on projects posted there too.



Benefits

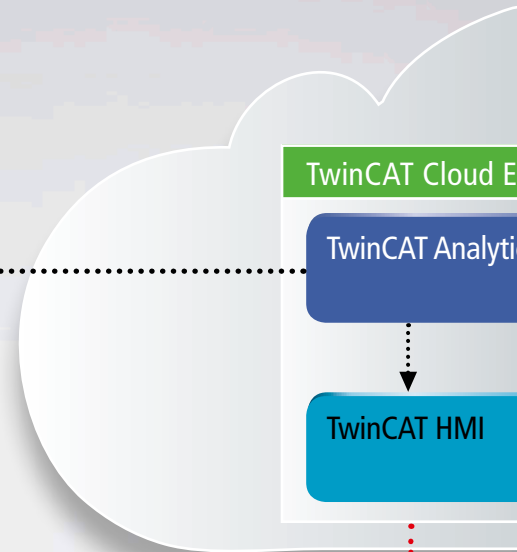
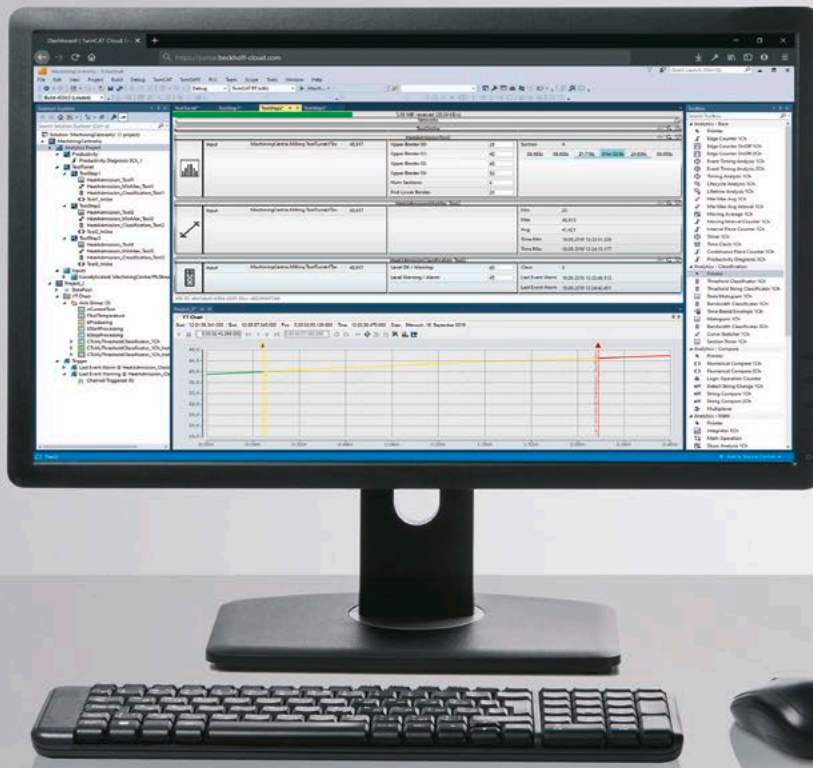
- integrated source control system
- enables local TwinCAT users to collaborate on joint projects
- simple, seamless access to the source control system through TwinCAT Multi-User



Direct integration: machine opti- mization with cloud-based data analysis

TwinCAT Analytics from Beckhoff supports both selective and continuous data analysis. It offers a range of software tools and mechanisms covering a variety of use cases, designed to help users get up to speed with machine analysis quickly. With built-in code generation capabilities, TwinCAT Analytics can automatically convert analysis configurations into IEC 61131-compliant PLC code to incorporate into PLC runtime systems, a feature that enables 24/7 analysis of connected machines. Parallel to generating the code, TwinCAT Analytics also automatically creates an analysis dashboard. Based on TwinCAT 3 HMI, the dashboard is written in HTML5 for platform-independence, while the

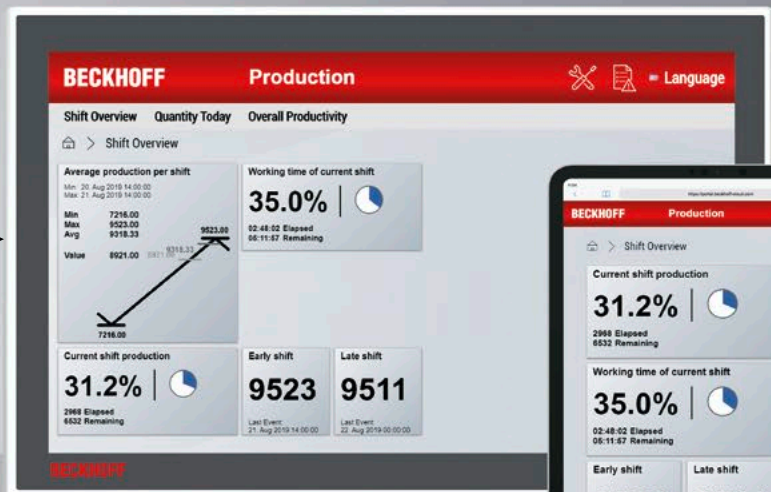
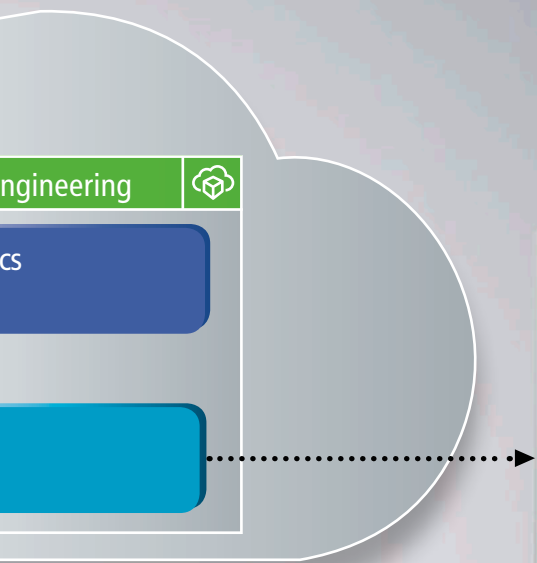
dashboard web pages are delivered by TwinCAT HMI Server. TwinCAT Analytics and the One-Click Dashboard can both be used from within the TwinCAT Cloud Engineering environment. And because the TwinCAT Cloud Engineering instance can be accessed from any geographic location, authorized users have anytime, anywhere access to the analytics dashboard as well.



Machine 1

Benefits of integrated analytics functions:

- easy analysis of machine data
- automatic PLC code generation using analytics configurations
- One-Click Dashboard: automatic analytics dashboard generation, with web-based visualization
- Analytics dashboard can be accessed using a standard web browser



Machine 2

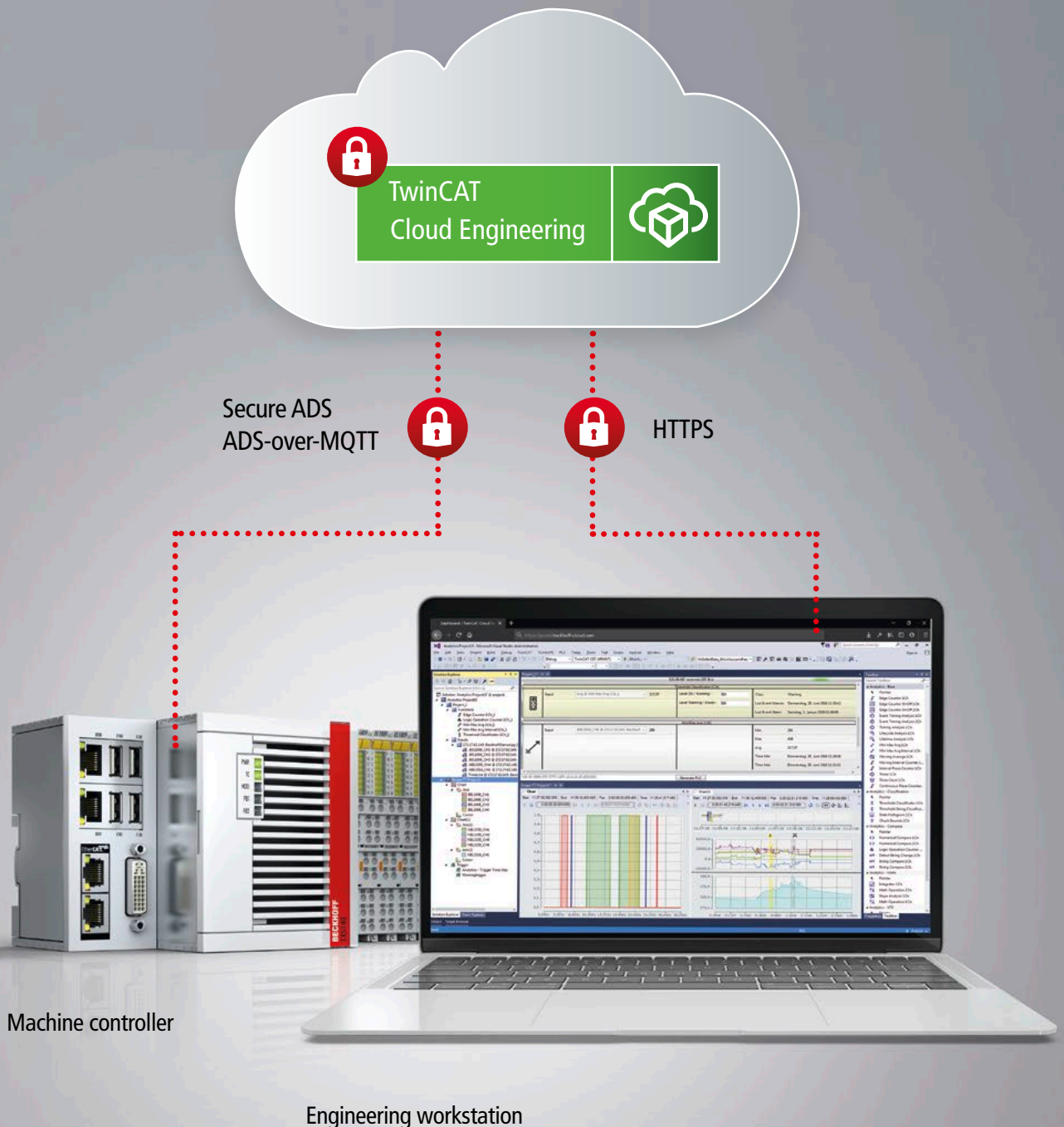


Machine n

Twice the security: risk-free cloud integration plus full IP protection

With any kind of cloud-based infrastructure or data communication, the security of company data always comes first, and TwinCAT Cloud Engineering is no exception: It uses proven standard mechanisms to secure data connections and ensure that only properly authenticated users and devices can access online instances. Physical devices accessing instances must also authenticate themselves by means of specially issued certificates, and data connections between controllers and instances are encrypted. Redundant cloud infrastructures and robust security mechanisms ensure that data is guarded against unauthorized access at all times. In addition, organizations' intellectual property –

their proprietary data and know-how – is protected against loss or damage, even in the event of a data center failure. And when users work with the integrated source control system, project data is encrypted, both during transmission and while in repository storage.



Cost-attractive: different usage models for TwinCAT Cloud Engineering

TwinCAT Cloud Engineering has different pricing models and feature sets intended for two specific user types: beginners and professionals. Beginners are allocated a time quota in which they can work with an instance to try out all the functionality. This time quota only applies when the instance is actually running, with usage recorded to the nearest hour. Users can start and stop the instance themselves, allowing them to manage their quota efficiently. Professional users can opt at the end of their trial period to continue using their instance for a monthly fee that includes all the TwinCAT licenses needed to run the instance. In addition, professional users get access to a central source

control repository. No matter which pricing model you choose, your contract is always with Beckhoff Automation.

TwinCAT Cloud Engineering usage models

	Beginner	Professional
Instance provisioned as a virtual machine	•	•
Creation of multiple virtual machines	–	•
TwinCAT installation customizable during initial setup	–	•
Installation of own software on virtual machine	–	•
Easy access to engineering through Beckhoff website	•	•
Connection of physical control hardware	•	•
Source code management within the instance	•	•
Source code management as a cloud service	–	•
TwinCAT licenses	time-limited	no time limit
Video tutorials and samples	•	•
Free access	•	–

If you would like to find out more about the control tasks that TwinCAT Cloud Engineering is designed to handle, talk to us!
► www.beckhoff.com/twincat-cloud-engineering

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