

Manufacturing Integration Platform



Creating a digital image

Headlines like Industry 4.0, Smart Factory and Industrial Internet of Things (IIoT) embrace a series of new technologies and approaches dealing with production in the future. All these new technologies try to map the real physical world in a digital form. Powerful control loops can thus be established that guarantee an increased efficiency in production despite the growing complexity. The innovative MPDV concept of the Manufacturing Integration Platform (MIP) regards the digital transformation in a holistic manner. MIP offers the possibility to link systems, to model objects and to illustrate and integrate the respective processes with high flexibility. The objective is to ensure an overall interoperability of all processes and systems.

The factory of the future will face great challenges. One of these challenges is to record all data necessary to create a data model of the production. Unlike the Internet of Things (IoT), the Industrial Internet of Things (IIoT) is focused on manufacturing. It aims at representing conditions of the real world in digital form using different types of sensors. In addition, machine and line control systems provide multiple data. However, this data does not cover all information requirements existing today and arising from human activities as well as from software systems (e.g. ERP) in the future. All things considered, information from existing software systems and manually recorded data are needed to answer important questions like: What is the available capacity of a machine or machine group or what is the current scrap rate? In any case, pre-processed and evaluated information is required that sensors and machines cannot easily provide to a sufficient extent. We could also say that sensors provide data and humans want answers. In order to be able to convert digital mass data into useful results, you need appropriate methods.

If you want to meet the increasing information requirements, you need not only raw data, but applications that compress, aggregate and accumulate data. This is the only way for the user to obtain valuable information. That is the task of today's Manufacturing Execution Systems (MES). The challenges for such systems are now becoming more and more complex. The production-oriented departments need applications that include a growing variety of functions. As a consequence, the systems must offer a higher modularity and flexibility. The task to realize a standard solution that can cope with all these demands is challenging. Especially the rapidly rising number of participants (sensors, data providers and applications) depend on a new architecture that must be open in all directions.



The solution is an open integration platform that links MES applications and other production-related systems in a standardized manner. Such a platform fulfills many of the above-mentioned conditions and enables the general use of applications. In addition, a completely new cooperation between development or implementation partners could be the result.

Manufacturing Integration Platform

The Manufacturing Integration Platform (MIP) of MPDV represents such an open platform that can integrate all kinds of production-oriented applications.

This platform

- integrates standard applications of different suppliers
- creates the basic premise for the seamless embedding of specific applications and in-house developments
- supplies a digital host/harbor/home for all objects in a production environment

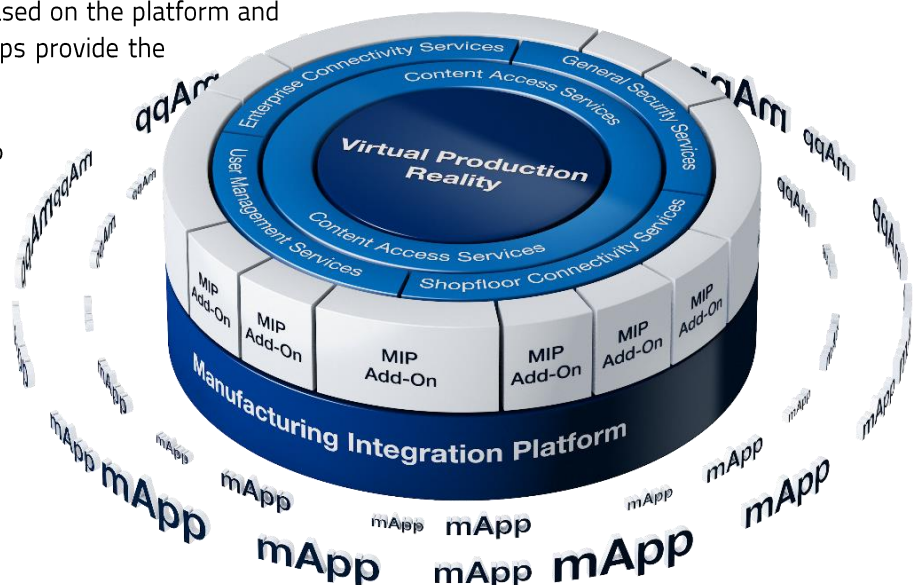
In summary, with this platform the user can combine in-house software developments including individual solutions and the available standard applications out-of-the-box. The user can decide at any time on the ratio of in-house development and external solution. At the same time, the platform ensures access to local resources and the ones linked via the Internet of Things.

The Manufacturing Integration Platform includes the following core components):

- Virtual Production Reality (ViPR): contains the digital shop floor image in the form of objects detached from today's categories like production, quality and HR.
- Content Access Services (CAS): enable easy access to the objects of the ViPR.
- Shopfloor Connectivity Services (SCS): contain methods to collect relevant events in production and support the connection of machines, equipment and data collection systems.
- Enterprise Connectivity Services (ECS): offer methods for connecting business IT systems (e.g. ERP, PLM,...).
- User Management Services (UMS): provide user administration and rights management
- General Security Services (GSS): offer security mechanisms and logging methods to ensure (among others) auditability
- MIP Add-ons: extend the platform by optional general functions

The added manufacturing apps (mApps) are based on the platform and contain the complete business logic. These apps provide the user with the required functions.

In addition to the actual platform, the MIP Software Development Kit (SDK) allows for an individual customization of different components and the creation of custom mApps and MIP Add-ons.



MIP structur in detail

Each of the above-mentioned components offers important features to ensure the functioning of the Manufacturing Integration Platform as a whole. The interaction between the components is very flexible and yet standardized. A look at the individual components reveals the interrelations and benefits of the MIP:

Virtual Production Reality (ViPR)

The Virtual Production Reality provides the living space for the digital twin of the production and is thus the core of the platform. The included Manufacturing Business Objects (MBO) integrate the real objects required to digitally map the production (the so-called model world). The MBOs also use the actual data and events recorded in the production (the so-called state world). Data referring to the past is stored in the so-called archive world that is also part of the ViPR.

The MBOs are described semantically. Based on these open objects, the production and its processes can be integrated and modeled in detail. You consider machines, equipment and resources as well as staff, orders and other relevant artifacts of production – irrespective of today's categories like production, quality and HR.

Content Access Services (CAS)

Content Access Services enable easy access to the objects and data of the ViPR. For each type of MBO, the services offer basic methods to enable read and write access to the data of these objects. If required, the provided standard objects can be extended by additional objects using the MIP SDK.

Shop Floor Connectivity Services (SCS)

The Shopfloor Connectivity Services include functionalities to connect machines and equipment as well as methods to collect relevant events of the production process. Another task of this component is to accept data from the shop floor applications (e.g. shop floor terminals). The so-called adapters take charge of the heterogeneity of the shop floor connection protocols and formats (like OPC UA or Euromap).

Enterprise Connectivity Services (ECS)

The Enterprise Connectivity Services (ECS) connect business IT systems (e.g. ERP, PLM...) to MIP. Different possibilities to exchange data are available. The ECS offer functionalities to integrate external data into the structures of the CAS. The services also support the deployment of data from the platform to enterprise applications.

User Management Services (UMS)

The platform includes a user administration. Each user can be authorized individually or via profiles. You can control access to functions, but also access to data. The platform offers the possibility to specify authorizations for each user or user group. Password policies define specifications for safe passwords.

General Security Services (GSS)

Security is a central topic for network applications in the age of Industry 4.0 and IIoT. The MIP provides numerous mechanisms to protect applications and data. On the one hand, communication with the platform can be realized via HTTPs/ SSL, which is authorized by certificates. On the other hand, the platform supports the integration of the four eyes principle if you enter or correct data, and offers the possibility to log all changes to the MBOs.

MIP Add-Ons

MIP Add-ons extend the platform by additional general functions. The mApp developers can decide if they use these functions or not. For example, an MIP Add-on could extend the UMS by an Active Directory Integration or implement a general escalation management.

MIP Software Development Kit (MIP SDK)

The MIP SDK supports the users in the needs-based individualization of the platform and the generation of new applications (so-called mApps). The MIP SDK offers functions, templates and tutorials that can be used in standard development environments (e.g. .NET). The core element of the MIP SDKs is a repository for the available ViPR objects, their data structure and the available methods.

Manufacturing Apps (mApps)

Manufacturing apps of different suppliers use the functions, services and objects offered by the platform to generate valuable information in a practice-oriented form for the user or other IT systems. The platform thus ensures a horizontal integration of all mApps.



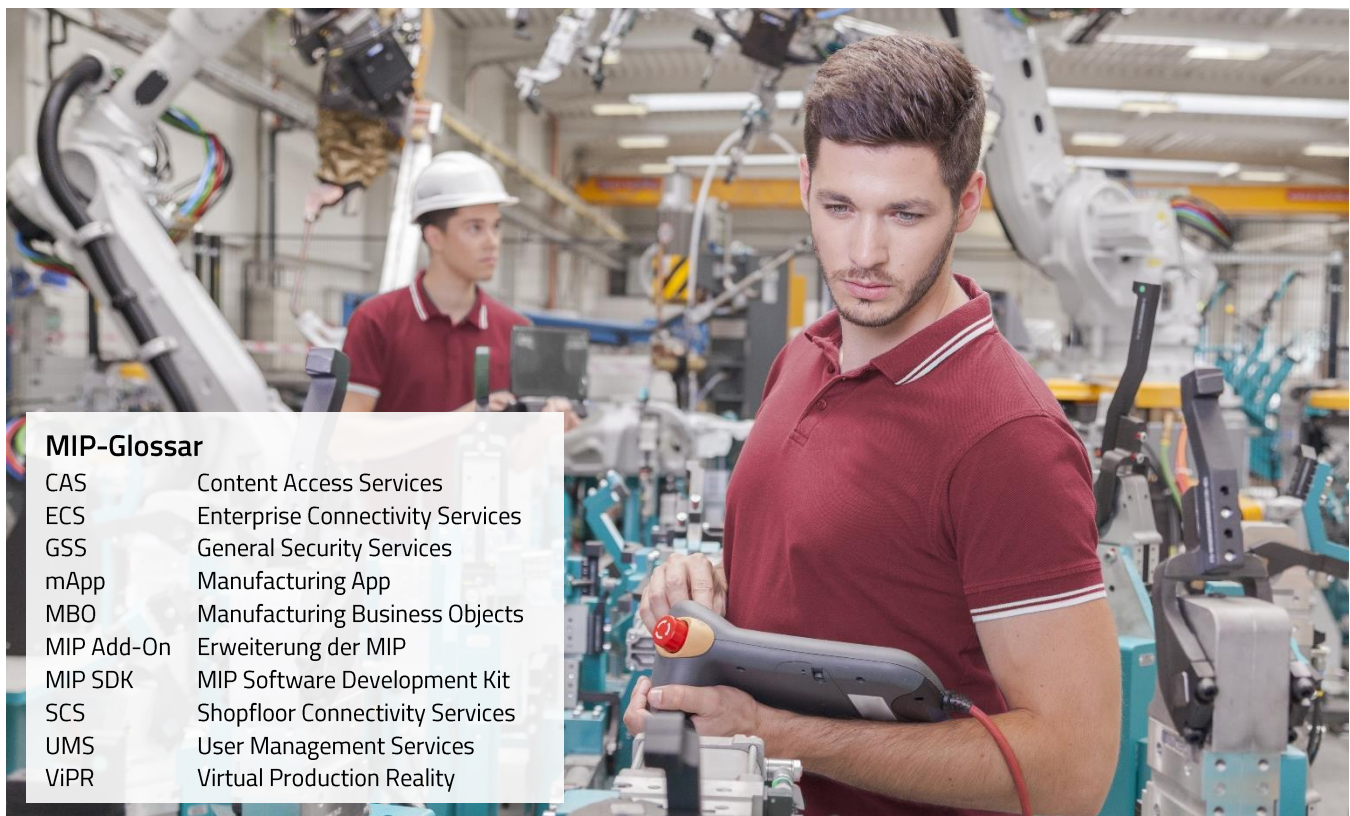
Example from working life

An example may illustrate the functioning of the Manufacturing Integration Platform: A manufacturing company has several machines. The machines and their master data, the description of the produced articles and all work plans are stored as objects in the ViPR (model world). The real machines are connected to the corresponding MBOs via SCS. Events in the shop floor are collected for the machines and stored in the ViPR. These events (e.g. machine failure) trigger a status change of the objects and an update of the production's digital image (state world). The storage of events and the derivation of results take place in the archive world.

If you create orders in the ERP system, the orders are transferred via ECS functions to the ViPR. The application developer can use the CAS to easily access the MBOs in the ViPR. Using an mApp, the production planner can now specify production time and sequence of the orders and the machines used for the individual orders. The resulting assignment is stored in the ViPR and other shop floor mApps can display the orders to be produced at the corresponding machine.

If you want to log an order on, you call the mApp in the shop floor via SCS. From now on, all recorded real time data are assigned to the corresponding machine and the logged-on order. An evaluation mApp can directly access the order data and events. Another mApp may be charged to first compress the data and then calculate suitable KPIs.

The above-mentioned procedure would also be possible using an MES, but only if all components derived from one source or if the components were integrated in one system. However, the increasing complexity of today's production asks for a more flexible solution. A solution that can combine components and applications of different origin – e.g. an mApp of the machine manufacturer to collect machine data or a self-developed app to evaluate production data. An open and documented system architecture is needed and such an open architecture is provided by the Manufacturing Integration Platform.



MIP-Glossar

CAS	Content Access Services
ECS	Enterprise Connectivity Services
GSS	General Security Services
mApp	Manufacturing App
MBO	Manufacturing Business Objects
MIP Add-On	Erweiterung der MIP
MIP SDK	MIP Software Development Kit
SCS	Shopfloor Connectivity Services
UMS	User Management Services
ViPR	Virtual Production Reality

Maximum flexibility

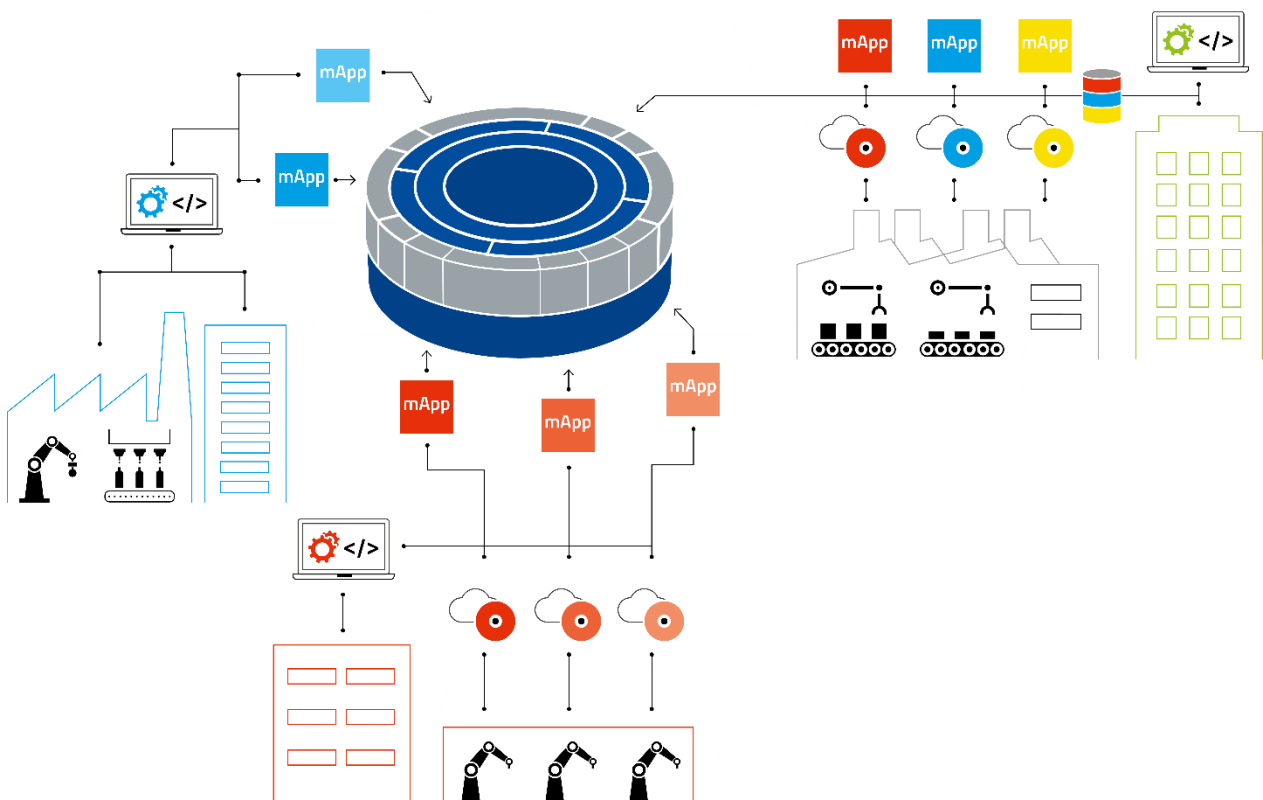
Using the MIP, any recorded and calculated data are available for any authorized mApp at any time. As a result, you can extend or customize the application environment at all times irrespective of the origin of an mApp or its purpose. For example, a manufacturing company could combine components to collect data from the machine supplier with a manufacturing control system of another supplier. At the same time, the company could realize the visualization of the KPIs on its own. For this purpose, the strict technical separation of data, access methods and applications is crucial to the integrated concept of the Manufacturing Integration Platform: The UMS and GSS services ensure that only authorized users and mApps have access to the objects in the ViPR.

The infrastructure is generally open in all directions, but at the same time it is protected against unauthorized access. Properties like the highly acclaimed horizontal integration can achieve a high performance with the MIP. Data that is today assigned to categories like production, quality and HR might be evaluated in a completely independent manner and across all sectors in the future. Due to these properties, the Manufacturing Integration Platform is not only innovative, but also future-proof.

MIP or MES – always the suitable solution!

The MIP extends the features of today's Manufacturing Execution Systems and provides the possibility to integrate applications of different suppliers and custom mApps. A functional separation of production, quality and HR is overruled.

Up to now, MES systems have been the preferred option for many companies as the provided features are largely sufficient and an additional flexibility is not yet required. In the meantime, an open world of mApps, MIP add-ons and service providers is developing in parallel and gradually establishing itself on the market - as a new variant, so to speak, for the realization of today's tasks of an MES and future new requirements. This means that the right software architecture for implementing manufacturing IT is already available today for every user and every scenario.



3 questions to our company founder Prof. Dr.-Ing. Jürgen Kletti

Prof. Kletti, can you tell us why the MES experts from MPDV have been working on a new platform approach since 2017? Isn't the MES HYDRA well positioned on the market?

Kletti: This is in principle correct, however, we are increasingly observing that production companies want to integrate their own applications or to connect third-party systems - setting aside the customary ERP connection. Business-wide integration of production and IT systems is also on the rise. From this, we derive the need for a new, open platform architecture for MES tasks. In the future, we will also offer an open approach for production-oriented IT systems, in addition to the classic MES systems.



What is the difference between an open platform and an MES system like HYDRA?

Kletti: With an MES like HYDRA, companies can capture data both today and tomorrow, thereby controlling and optimizing their own production. With the new Manufacturing Integration Platform (MIP), all objects relevant to production are kept together with their data in a common data base. Apps of all kinds can access these objects and their data flexibly through standardized methods and functions. The possible spectrum of functions far exceeds the extent of today's MES. In particular, the underlying interoperability allows the user to integrate any application packages and systems via the platform. This is exactly what is meant by "open in all directions". Ultimately, the MIP is an innovative alternative to realize an MES.

What benefits does your Manufacturing Integration Platform offer against other platforms that have been springing up like mushrooms since some time?

Kletti: Correct, you can spot platforms everywhere. The MIP stands out, as the platform is not all about availability and distribution of data, but is rather a digital image of production and all related data. At the core of the MIP, all objects are represented in a standardized manner, which allows a large number of apps to work with them independently of each other. Most other platforms only offer the option to exchange data. Knowing the meaning of the data is not imperative. The MIP is based on a semantic understanding of the data. If an app speaks of an order or a machine, it is clearly defined what is meant. This is an important requirement for the success of such a platform, especially for the integration of applications from different providers. Most other platforms can be either located in the automation or in the management environment. There is currently no platform for the intermediate level on which MES operates today. This is precisely why we are pushing ahead with the development of the MIP.

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Manufacturing Integration Platform (MIP)

Horizontal integration

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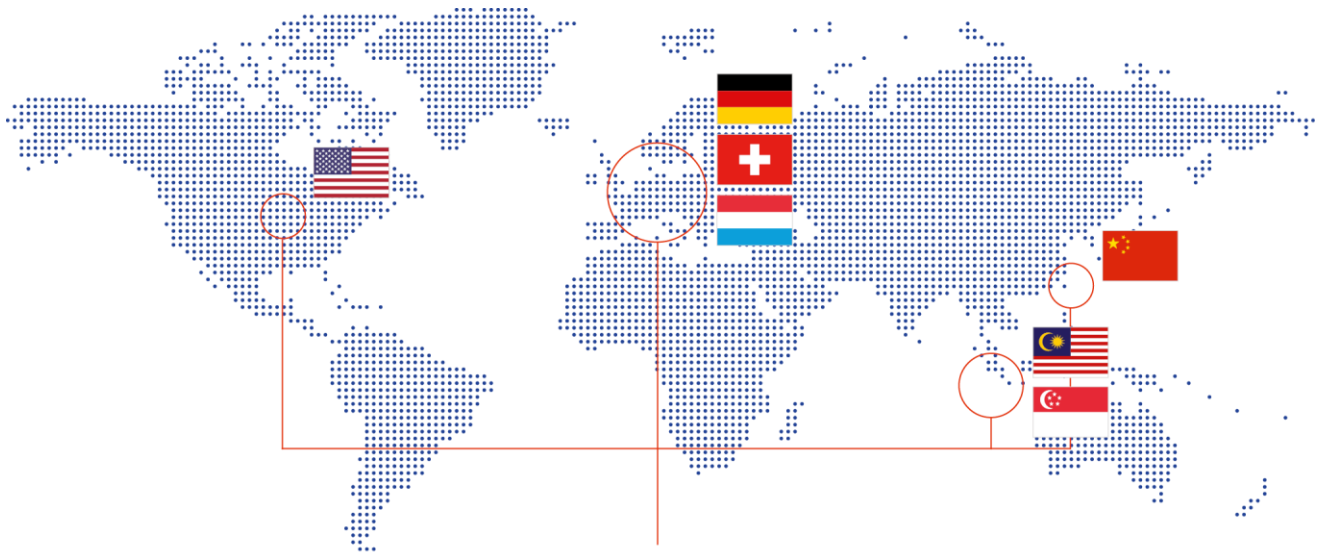


MPDV Mikrolab GmbH

headquartered in Mosbach/Germany, is the market leader for IT solutions in the manufacturing sector. With more than 45 years of project experience in the manufacturing environment, MPDV has extensive expertise and supports companies of all sizes on their way to the Smart Factory.

MPDV products such as the Manufacturing Execution System (MES) HYDRA, the Advanced Planning and Scheduling System (APS) FEDRA or the Manufacturing Integration Platform (MIP) enable manufacturing companies to streamline their production processes and stay one step ahead of the competition. The systems can be used to collect and evaluate production-related data along the entire value chain in real time. If the production process is delayed, employees detect it immediately and can initiate targeted measures.

More than 1,000,000 people in over 1,500 manufacturing companies worldwide use MPDV's innovative software solutions every day. This includes well-known companies from all sectors. The MPDV group employs around 500 people at 13 locations in China, Germany, Luxembourg, Malaysia, Singapore, Switzerland and the USA.



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