OVERVIEW OF THE SOFTWARE MODULES AND STRUCTURE

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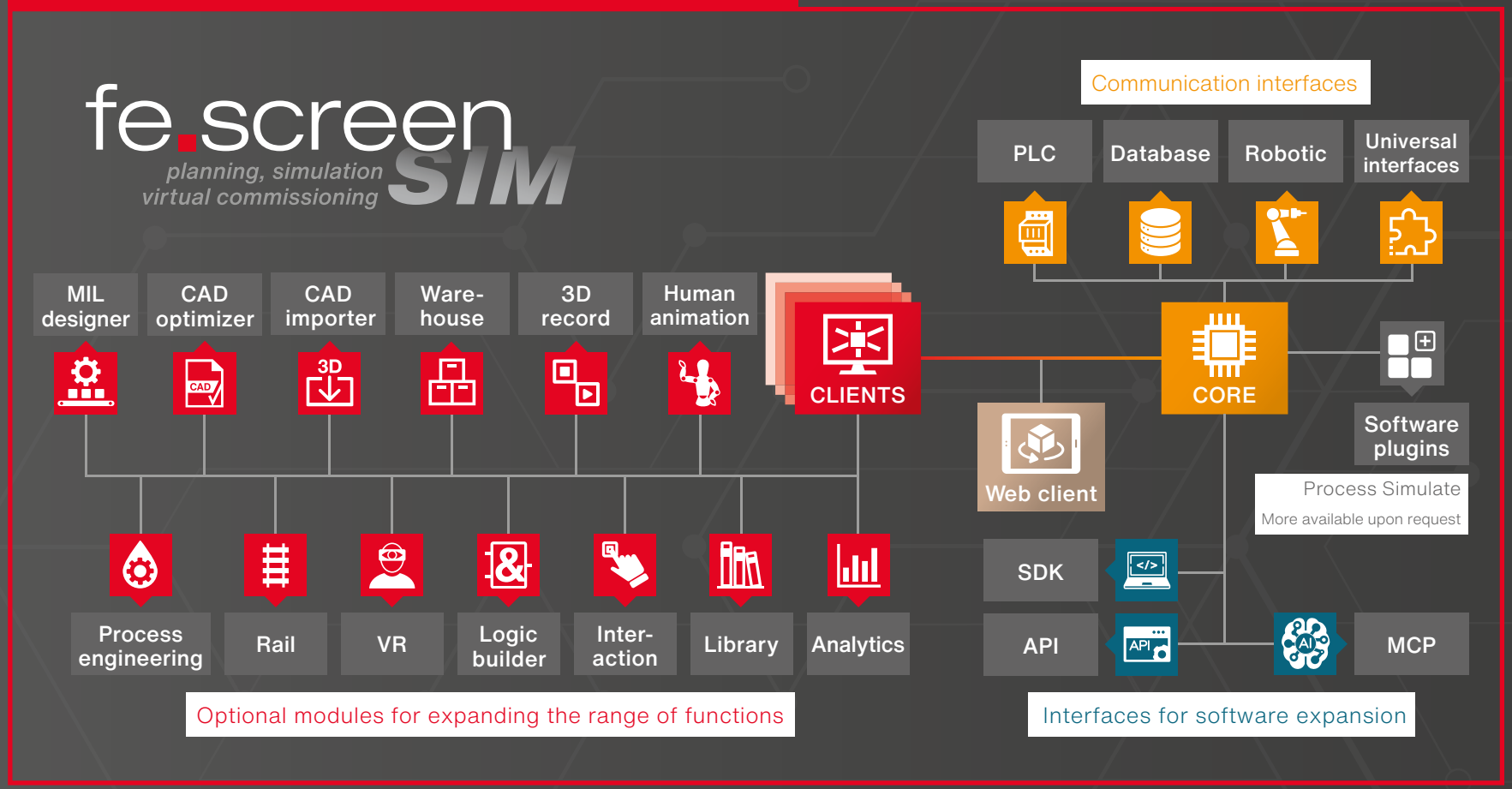

F.EE software for INDUSTRY

You can also find detailed and up-to-date information at:
www.fescreen-sim.de/en/softwarestructure

CLIENTS

OPTIONAL MODULES

WEB CLIENT

CORE

COMMUNICATION INTERFACES
PLC

COMMUNICATION INTERFACES
DATABASE | UNIVERSAL INTERFACES

COMMUNICATION INTERFACES
ROBOTIC

INTERFACES FOR SOFTWARE EXPANSION

SOFTWARE PLUGINS

// Client

The fe.screen-sim architecture essentially consists of a **multi-user Core Client application.** The **client acts as the user interface** and connects to the Core via a network. This gives users direct access to the executed model, enabling them to work in an interactive 3D environment and control the simulation via a **clearly structured, intuitive user interface.**
This enables multiple users to collaborate efficiently on a project simultaneously, **transparently and synchronously in real time.** This structure forms the basis for the **efficient creation and editing of simulation projects,** offering comprehensive modelling and configuration functions.

// Client runtime module

Just like in the full **Client, all relevant project data and functions** are available in the client's **runtime module.** However, it is not possible to make any changes to the models, logic or configuration. It is not possible to edit simulation objects, customise interfaces or move elements. The module is exclusively for **executing the project** and **utilising the existing PLC communication.** It can only be used in combination with the Core runtime module.

// 3D record

The **3D record module** allows you to record an ongoing simulation in its entirety and then view it as an interactive 3D playback. Users can **move freely around the room,** change perspectives, and analyze processes from any desired angle—regardless of the original camera path.

The recorded records can be viewed **without an additional fe.screen-sim license** – ideal for training courses, presentations, or sharing with external partners.

// Analytics

The **Analytics module** enables precise recording and evaluation of **signals and data points** – known as KPIs (Key Performance Indicators) – directly from the running simulation. A **wide range of chart types** is available for this purpose, from classic time series to complex comparison and analysis charts.

All **charts can be customized in detail** via a clearly structured **user menu:** colors, axes, legends, display types, and other visualization options can be configured individually. This provides users with meaningful key figures in real time directly on the digital twin. Thanks to the latest developments in cycle time analysis, production cycles can be **precisely simulated** and **optimized in a targeted manner** – directly in the simulation tool.

// CAD importer

The **CAD importer** allows **the import of construction data** from various formats, such as **SolidWorks, STEP, JT, OBJ,** or **FBX,** to be imported directly into the simulation model.

fe.screen-sim imports the **entire tree structure** from the CAD model, including existing kinematics.

// CAD optimizer

The **CAD optimizer** allows **CAD models to be quickly prepared** for optimal use in fe.screen-sim. The module optimizes complex CAD files by **selectively simplifying them and reducing** unnecessary detail. The result is a significantly lower computing load and noticeably **improved rendering performance.**

Simply load your CAD data into the CAD optimizer and **optimize it to the desired level of detail.** Your graphics card will thank you!

// Human animation

The **Human animation** module allows **human interactions** to be mapped and analyzed directly in the 3D environment – either along defined paths or using user-defined movement patterns.

This includes **assembly and transport activities, walking routes** or **manual workflows** – the speed can be adjusted variably. The module thus enables the realistic representation of processes that have not yet been automated – including the insertion or removal of components by people. This allows various workflows in the plant to be **accurately simulated** and **analyzed.**

// Interaction

The **Interaction module** is used to **integrate control and safety elements** such as switches, buttons, fuses, or emergency stop systems. It supports **realistic simulation of user interactions,** thereby facilitating virtual commissioning of the plant.

// Library

The **Library** allows you to build your own object library for reuse in projects — ideal for standardization and increased efficiency.

// Logic

In fe.screen-sim, you can create **user-defined process Logics** to control behaviour models. Implementation can be carried out in either the **function plan (FUP)** for users with a PLC background, or in C# for complex or bespoke control requirements. The system also supports the **FMI (Functional Mock-up Interface)** and associated **FMU (Functional Mock-up Unit)** simulation model containers.
Logic is defined via an **intuitive graphical user interface** that supports users in complex processes with predefined standard modules. Interfaces to the simulation can be flexibly defined using predefined data types, including the assignment of simulation object properties and **PLC variables.** Logic blocks can be used to create **processes** or replicate existing plant processes.

// MIL designer

With **MIL designer, conveyor systems** can be quickly **designed and optimized** using library models – without any PLC coupling or complex definition of sequence controls. The tool **analyzes material flows,** determines **optimal transport routes** and **simulates processes,** even faster than in real time if desired. The module thus supports the early **design and functional configuration** of a system using the **model-in-the-loop method.**

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// Process engineering

The **Process engineering module** allows you to **build and test process engineering and HVAC systems** such as heating, ventilation, and air conditioning schemes in 2D. This enables complex control schemes, process flows, and system behavior to be realistically mapped and simulated directly in fe.screen-sim.

// Rail

The **Rail add-on module** enables the simulation of **electronic overhead conveyors (EOC)** and **power and free systems.** The characteristic functions of both conveyor technologies, such as individual travel behavior, coupling and decoupling processes, congestion and buffer behavior, and flexible routing, are realistically represented. The module is suitable for the **planning, validation, design, and simulation of complex conveyor systems** in production and logistics environments.

// VR

The **VR module** uses **virtual reality headsets** (all SteamVR-compatible headsets are supported, such as Oculus Rift, Quest, HTC Vive, and Vive Pro) to enable immersion

in the simulation, thus opening up a completely new form of presentation. Sizes and distances can be better assessed compared to viewing on a monitor.

The viewer offers **navigation options** via VR-compatible controllers. **Any number of viewers** can thus view the simulation at any time – with their own viewing angle and choice of position. **Interactions** with conveyed material or 3D buttons are also possible, making the viewer the ideal solution for control tests.

// Warehouse

The **Warehouse module** enables the simulation of even very large **warehouses and logistics facilities** and supports the **analysis and optimization of material flows, facility capacities, and storage strategies.** This makes the module particularly suitable for **extensive or complex** intralogistics systems.

// Web client

The **Web client** allows simulations to be viewed and easily operated directly in the browser — **without local installation.**

Rendering takes place on the server side, so that the simulation is displayed smoothly **across platforms and independently of the user's hardware performance** — even on less powerful PCs or mobile devices. Simple interactions, such as moving the camera or triggering actions (e.g., buttons), are also possible directly in the browser.

In combination with **multi-user capability,** which allows multiple users to work on a digital twin in parallel without switching between editing and simulation modes, fe.screen-sim becomes even more versatile and flexible in its application.

// Core

The **Core** is the central component responsible for calculations and communication. This background module ensures seamless simulations and its high performance enables the implementation of large, complex projects. It provides **the technical foundation for physics and process calculations** while facilitating communication with controllers, robot interfaces, and other connected subsystems. Multiple clients can connect to the Core simultaneously, allowing for unrestricted parallel workflows.

// Core runtime module

The **Core runtime module** provides access to all **relevant project data and functions.** This is a limited version of the Core, which is ideal for presentations of concepts or studies. The complete fe.screen-sim Core is required for editing project components, such as objects and their positions. The same applies to PLC tests requiring project-specific adjustments.

// Rockwell driver (real PLC)

It provides a communication interface for connecting to genuine **Rockwell controllers.**

// Rockwell Logix Echo Network Interface

It enables communication with **Logix Echo,** a virtual environment for Rockwell controllers. It is ideal for simulation-based testing without physical hardware.

// Siemens (real PLC) and PLCSim Advanced

It provides an interface for connecting to **real Siemens controllers** and **PLCSim Advanced.**

// Siemens SINUMERIK ONE

This is a communication interface for connecting to the **Siemens SINUMERIK ONE Create MyVirtual Machine.**

// Beckhoff

It provides a communication interface for connection to **Beckhoff TwinCAT.** It supports both real and virtual controllers.

// Bosch Rexroth ctrlX

It provides an interface for connecting to **Bosch ctrlX controllers.**

// B&R

Provides an interface for communication with **B&R controllers.**

// CODESYS Simulation Interface (add-on, preview)

It offers a particularly fast connection option for **CODESYS-based controllers.**

// Fanuc

It enables the connection of **Fanuc CNC controls.** It is ideal for simulating manufacturing processes in combination with Fanuc controls.

// Mitsubishi

It establishes a connection to **Mitsubishi controllers.**

// Modbus

This interface can be used to set up a **Modbus master** and connect it to a **Modbus slave.**

// MQTT (Client)

You can use this interface to establish an **MQTT client** and then connect it to an **MQTT broker.**

// OPC UA (Client)

This interface can be used to create an **OPC UA client** and connect it to an **OPC UA server.** This allows you to search the server‘s nodes and automatically generate variables in fe.screen-sim.

// RFC 1006

This module can be used to set up **RFC 1006 (ISO-on-TCP)** server and client connections. These connections can then be configured for data exchange with other **RFC 1006 endpoints.**

// SQL connection (Microsoft)

This module establishes a connection to **Microsoft SQL Server** and provides comprehensive database access for simulation and virtual commissioning. SQL queries and data manipulation can be performed directly from the fe.screen-sim environment.

// SQL connection (Oracle)

This module provides an interface to the **Oracle database** for integrating data from Oracle databases into the simulation. It allows communication with Oracle systems via SQL and PL/SQL for data querying and processing.

// ABB (ABB RobotStudio)

It connects to the **ABB RobotStudio** suite and allows data exchange.

// ESTUN

It facilitates the connection of **ESTUN robots** and supports the bidirectional exchange of data for the control of robots in simulations.

// Epson

It provides a communication interface to **Epson** robots via **RC+ software,** enabling the exchange of relevant control data for realistic simulation.

// FANUC (FANUC ROBOGUIDE)

The integration of the system with the **FANUC ROBOGUIDE** is facilitated by an integrated communication interface.

// Interface zur RoboDK

It provides an interface for integrating **RoboDK** into the simulation environment.

// isel

Connection to the **isel robot simulator** is supported, as is data exchange with the **isel Robotics.**

// KUKA (KUKA.OfficeLite)

It enables communication with **KUKA.OfficeLite** via a dedicated interface.

// Mitsubishi (RT ToolBox3)

Connection to **Mitsubishi RT ToolBox3** is enabled for data exchange.

// NACHI

It connects **NACHI** robots via the **FD on Desk III** programming software and allows direct data exchange for precise mapping of robot functions in the simulation.

// Stäubli (Robotics Suite)

A communication interface for connecting to the **Stäubli Robotics Suite.**

// Universal Robots (UR Sim)

It supports connection to the **UR Sim from Universal Robots** for simulation and control.

// Yaskawa (MotoSim)

A specialized interface allows direct communication with **Yaskawa MotoSim EC-VRC.**

INTERFACES FOR SOFTWARE EXPANSION

// Back to the software structure

// API

fe.screen-sim provides **two powerful programming interfaces** (APIs – Application Programming Interfaces), a **.NET API** as a DLL and a **gRPC API,** which external applications can use to communicate directly with the core across networks.

This enables the **development of custom plugins, tools** and **integrations in a wide variety of software environments.** On this basis, for example, standalone **generation or automation tools can be developed** that create simulation models, exchange data, or trigger specific actions in fe.screen-sim. Recurring processes can thus be automated and **development processes** significantly **accelerated.**

// SDK

The **Software Development Kit (SDK)** is fully included in the fe.screen-sim license and enables the **development of custom extensions** directly based on fe.screen-sim. The SDK can be used to **implement custom interfaces, additional functions, and new simulation objects.** In addition, it can be used to implement custom **interfaces to third-party systems** such as PLC, robot, or ERP systems. The SDK thus offers **maximum flexibility** for the functional expansion of the simulation environment. The fe.screen-sim development team also uses the same SDK basis for software extensions, ensuring a consistently consistent and powerful extension architecture.

// MCP

With the **MCP (Model Context Protocol) interface,** fe.screen-sim is one of the first virtual commissioning tools to enable **direct connection to AI systems** such as ChatGPT, Claude, n8n or Cursor. This allows simulations to be not only **generated automatically,** but also **intelligently controlled, analyzed** and **optimized.**

The MCP interface also facilitates **troubleshooting** and enables an **extended help function.** All features of fe.screen-sim V5 are available via MCP, making the simulation tool a true part of the AI-supported engineering environment and significantly **increasing efficiency** in digital engineering.

// Software plugins

The **fe.screen-sim Process Simulate plugin** enables convenient **data export from Tecnomatix Process Simulate** for **further processing in fe.screen-sim.** The exported data can be imported directly using the dedicated import button – whereby not only the **joint relationships** but also the **complete kinematics, including all designations and defined attributes, are automatically transferred.**

On request, **additional software plugins** for connecting additional systems can also be **implemented individually.**