Synchronisation of material and information flow

How trucks and IT systems communicate in the warehouse

Expert article on the Jungheinrich Logistics Interface

Modern trucks dispose of more and more sensors and increasing intelligence. Material flow processes become considerably more efficient, process reliable and ergonomic by connecting these trucks with the variant-rich IT structure of the warehouse. For this purpose, Jungheinrich AG – forklift producer and logistic systems supplier – relies on the standardized middleware software Logistics Interface.

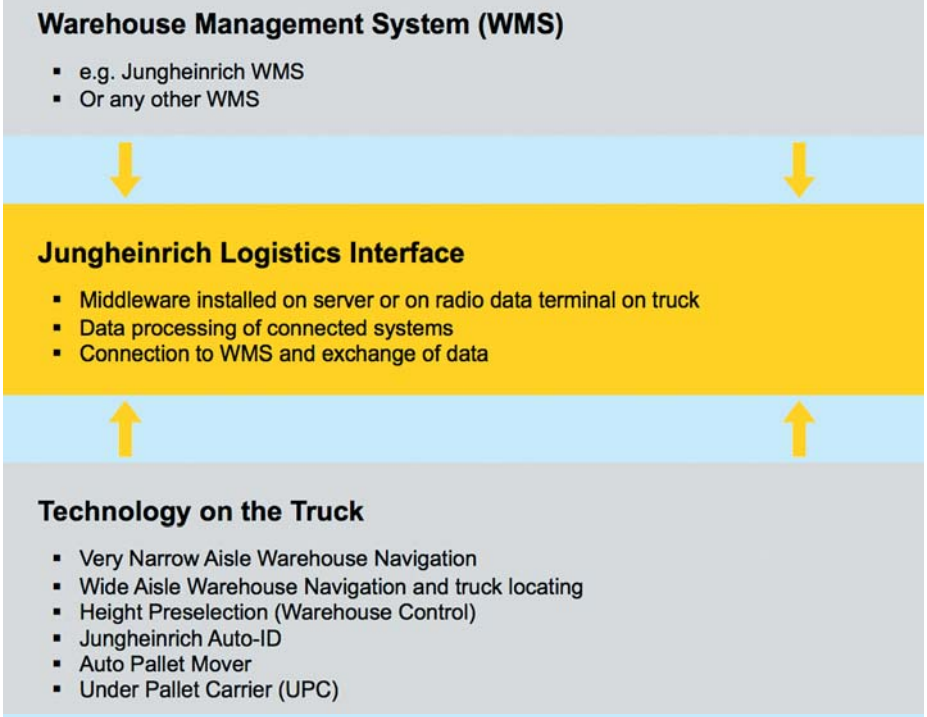
Dr. Kai Beckhaus
Jungheinrich AG

Initial situation

Intralogistics processes are subject to increasing time and performance pressure. Against that background, warehouses grow larger, are heavily technologized and continuously optimised. Warehouse Management Systems (WMS) and other IT systems are used to control and monitor these intralogistics processes.

Warehouse Management Systems show goods in stock and the flow of materials in the warehouse. The flow of information in a WMS and the actual physical handling of materials must be continuously synchronised. For instance, a physical stock level is reported to the WMS by scanning pallets in goods inward. Or the other way around, the planned actual handling of materials in the system is initiated by the WMS displaying a corresponding order on the truck terminal and the truck driver completing the order.

In both of these examples, synchronising materials handling and the flow of information requires a human interface between the physical warehouse and the WMS. The employee is responsible for the transfer of information and actual execution of the order. This entails various risks: misidentification, driving to the wrong destination, driving around to find something and time spent to name a few.



Jungheinrich Logistics Interface as connector between truck and WMS

In fact these processes can be partially automated and even eliminated by automatic data transfer between the truck and WMS.

Existing truck technology is confronted with this situation. Trucks may be equipped with many different types of automatic identification technology. Identification processes can be initiated manually or automatically. Some modern trucks also have vehicle interfaces with information about fork height, truck position and other truck data. Innovative trucks are able to perform transport orders semi-automatically or even fully automatically.

The challenge

Synchronisation between material and information flow can thus be significantly improved in terms of reliability, efficiency, ergonomics and real-time capability if the technology and information of the trucks is successfully connected with the Warehouse Management System.

A wide variety of intralogistics IT landscapes can be found in practice. The Fraunhofer Institute for Materials Handling and Logistics alone lists over 100 validated providers in its WMS database. These different Warehouse Management Systems have widely differing structures in both hardware and software, especially as they are implemented by individual customers. Despite efforts in recent years, no industry-wide standard interface to trucks has taken hold, and none is likely in the foreseeable future.

The practical challenge is thus to create an interface between the truck and Warehouse Management System, taking into account the wide diversity of warehouse IT systems, intralogistics processes and applications. On the one hand, this interface must be adequate for the performance requirements of the intralogistics application and technical limiting conditions. On the other hand, the interface must be universally compatible, future-proof, modular and easy to configure.

Solutions

The search for a suitable interface to connect trucks to the warehouse IT system must take into account limiting conditions and given systems.

Different trucks have different proprietary vehicle interfaces. Typically a serial interface with a defined communication protocol is used. In addition to a sensor system, identification, locating and further technologies can be used on the truck. Different types of interfaces must also be taken into account here, including serial, USB and Ethernet with different communication protocols.

On the other hand, the Warehouse Management System may be implemented in any of numerous ways. The shared feature is usually a central warehouse management server, which can be connected with different end-user devices. Modern systems support warehouse processes in real-time with information about clients on truck terminals, hand-held terminals and other end-user devices. In most cases the vehicle therefore has a truck terminal together with the installed WMS client.

A computer with the appropriate interface and data processing capability is required to make the physical connection with the serial interfaces of the truck and other equipment on the vehicle. Different hardware platforms are conceivable for this purpose, but an obvious choice is to use the truck terminal that is already the most common and which is equipped with a serial interface.

On the software side, the interface must process the data for communication with the truck. Moreover, it must record the communication with the Warehouse Management System. Communication may be directly with the server or with the WMS client on the truck terminal.

The Jungheinrich Logistics Interface

Several years ago, Jungheinrich as a manufacturer of materials handling equipment and intralogistics service and solution provider became aware of the potential for optimisation by connecting its trucks to the IT landscape of its customers. The initial situation as analysed above led to the development of a universal interface between trucks and Warehouse Management Systems, the Jungheinrich Logistics Interface.

The Jungheinrich Logistics Interface is an interface software (also called middleware) installed on the truck terminal or a warehouse server. From there, it communicates on the one hand with the truck or other fitted sensors. On the other hand, the standard Logistics Interface software also has a range of standard connection paths, enabling connection to any Warehouse Management System.

A number of factors may complicate the connection to the customer's Warehouse Management Systems: First, the structure of Warehouse Management Systems varies greatly in terms of both hardware and software. The same applies to terminal hardware and client architecture as well. Second, restrictive IT departments or limiting company requirements for hardware and software systems are encountered, especially in large companies. Third, integration into the Warehouse Management System requires two-way communication. Changes may need to be made to the Warehouse Management System or WMS clients on the terminal to achieve this.

The Jungheinrich Logistics Interface's standard connection paths permit a simple connection to any Warehouse Management System. One of the most important technical connection paths is file transfer: Both the Warehouse Management System and the

Jungheinrich Logistics Interface write simple text files on the data radio terminal or WMS server, which are loaded by the respective other device. The standard software is just configured for the specific case, without having to programme new software. In practice, communication is entirely possible in around half of all cases without making any changes to the WMS. Since the Jungheinrich Logistics Interface is available for different operating systems found in the warehouse, terminal independence will be ensured.

Even if the trucks are to be connected to a Jungheinrich WMS, the Logistics Interface is applied. In this case, the integration is already implemented without the need of further configuration. In combination with the Jungheinrich WMS, the Logistics Interface further enables some special functions.

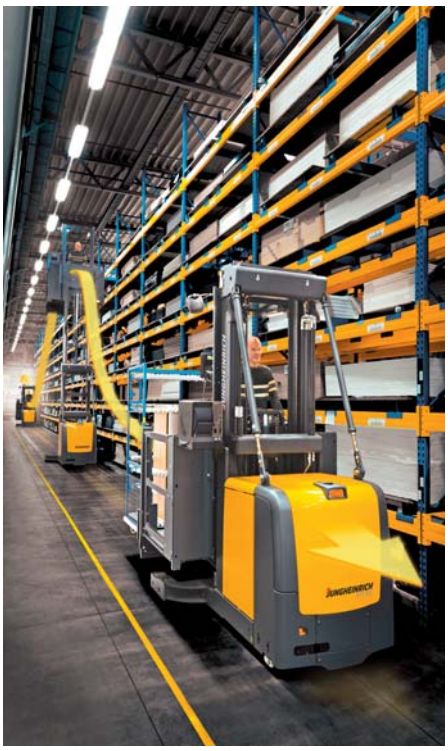
Applications

The connection between the truck and Warehouse Management System has different practical applications with potential for process optimisation.

Currently the most important application at Jungheinrich is semi-automatic and fully automatic trucks. The Logistics Interface communicates transport orders from the WMS to the truck and reports back to the Warehouse Management System after the transport orders are complete. Providing the necessary data allows for semi or fully automatic operation and the associated enhanced productivity. This is used especially for driverless Auto Pallet Mover, semi-automatic narrow aisle trucks with warehouse navigation and rack height select in reach trucks.

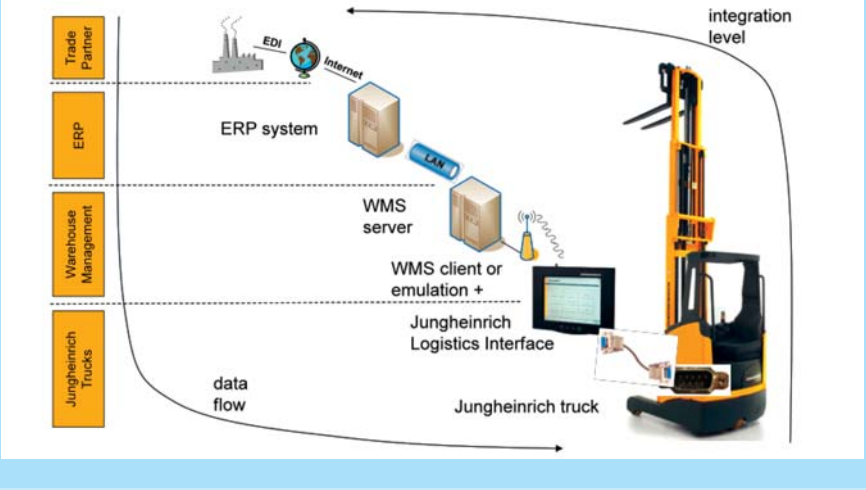
Other applications of the Logistics Interface include Auto-ID solutions. Automatic identification sensors installed on the truck send information obtained about identified goods, load carriers or storage spaces via the Logistics Interface to the Warehouse Management System. This also applies to information from a truck locating technology that may be present. Eliminating manual scanning into the masks of the Warehouse Management System by the truck driver makes the process more ergonomic and saves valuable time.

Beyond these two examples of applications, it is safe to assume that this system integration will include more and more trucks and applications. An example of a new application is the integration of Under Pallet Carrier (UPC) compact storage systems. Other trucks from the Jungheinrich product range will follow.



Synchronized material and information flow in the narrow aisle: Semi-automatic approach to order-picking positions with an EKS vertical order picker and warehouse navigation

(picture Jungheinrich)



System integration of Jungheinrich trucks with Logistics Interface

Practical example

The Jungheinrich Logistics Interface already connects trucks with Warehouse Management Systems in over 100 systems worldwide. An example of the versatile way in which this interface can be used may be seen in a large North German freight forwarder and logistics service supplier. In 2012, Jungheinrich set up a new high-bay warehouse here, acting as general contractor.

The Logistics Interface connects the narrow aisle trucks already present there to the existing Warehouse Management System. Transport orders are sent directly to the truck's Warehouse Navigation. This allows for semi-automatic operation. After the transport order is received, the operator simply presses and holds the drive or lift lever until the truck reaches the target position by itself and loads the pallet automatically. In this way warehouse navigation increases productivity by up to 25 %.

Reach trucks operating in wide aisles are also connected in a similar manner: The Warehouse Management System transfers a transport order with destination to the truck terminal. The Logistics Interface derives the lift height information of the destination from the transport order. Activated rack height select then makes it possible to reach the correct lift height semi-automatically. The destination is reached faster, more reliably and more ergonomically.

Transport orders are transferred to the truck interface of both connected vehicles automatically. This is done with a single WMS interface to the Logistics Interface. The interplay of reach trucks and narrow aisle trucks supports the entire material handling process from pallet pick-up with a conveyor system to stacking by the narrow aisle truck supported by operator assistance systems and synchronised with the flow of information. This increases productivity, ergonomics and process reliability considerably. □

Dr.-Ing. Kai Beckhaus
Head of Interfaces at Jungheinrich AG in Moosburg