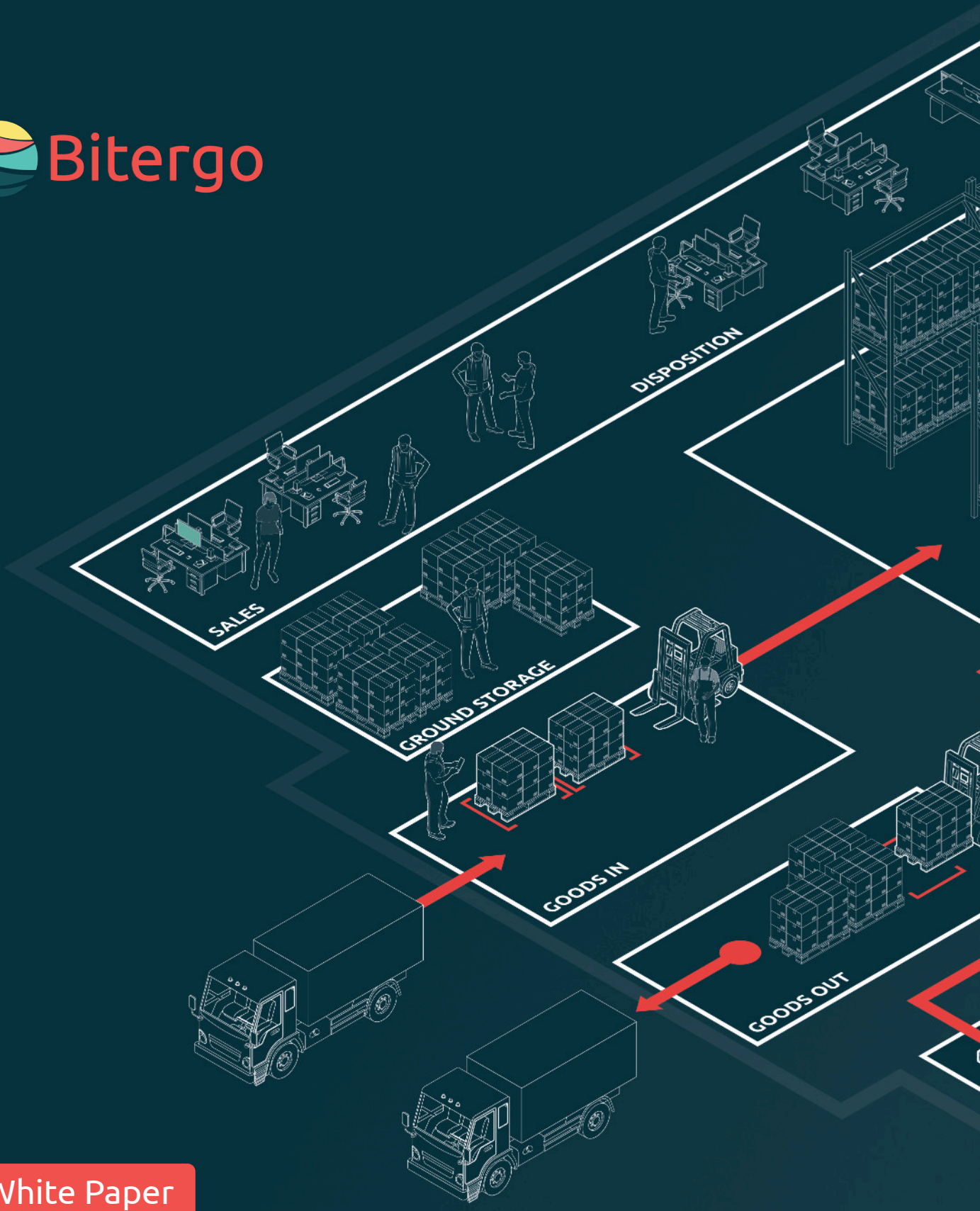
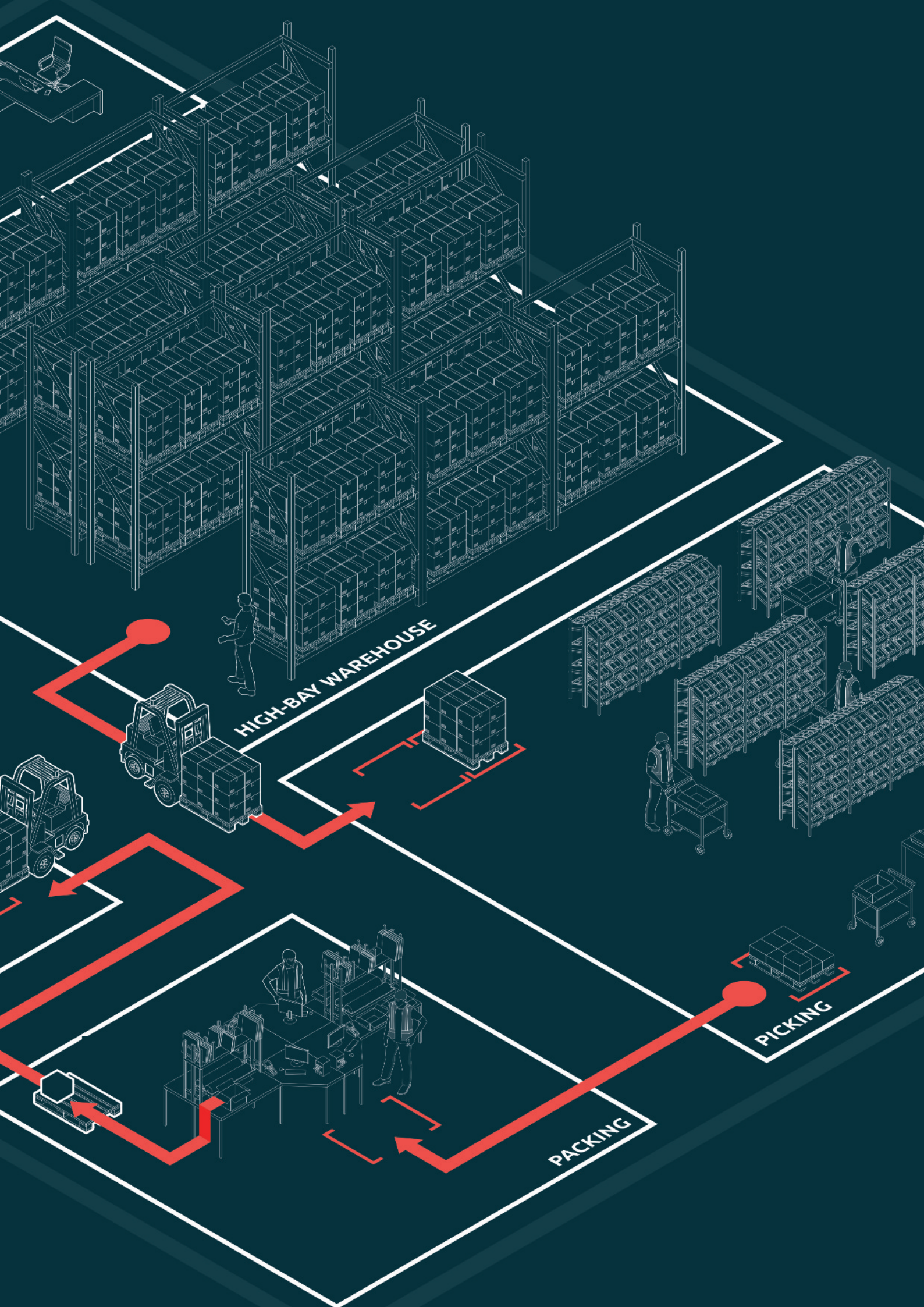
Bitergo




White Paper

# Digitalization in the warehouse

## Inventory management in the supply chain


HIGH-BAY WAREHOUSE
PICKING
PACKING

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# 1. Preface

Dear Reader,

we would like to give you a complete picture as possible of the digitalization of inventory and warehouse management for supply chain management. To this end, we have written this white paper.

With modern cloud solutions and mobile apps, complex solutions can be implemented easily, reliably and with little effort compared to classic projects.

Nevertheless, there are important aspects to consider to ensure a smooth implementation. Unlike other software packages, warehouse management always also requires the introduction of suitable mobile devices, barcode identification and printers.

We will show how quickly such a solution can be implemented, for example, for the management of an eCommerce or production warehouse, and what needs to be taken into account, using the example of the Warehouse Star business apps from Logistics Mall.

The savings potential offered by modern WMS systems should not go unmentioned. Compare Figure 1: Savings potential over time.

## Savings potential over time

Based on10-30 user licenses – Connection to ERP-System – Support during normal business hours

**56%**

Savings in the first year

Hardware ..... 65%

Software ..... 50%

Launch costs ..... 32%

**48%**

Savings in following years

Staff ..... 50%

Maintenance ..... 100%

Figure 1: Savings potential over time // Source: Fraunhofer Gesellschaft

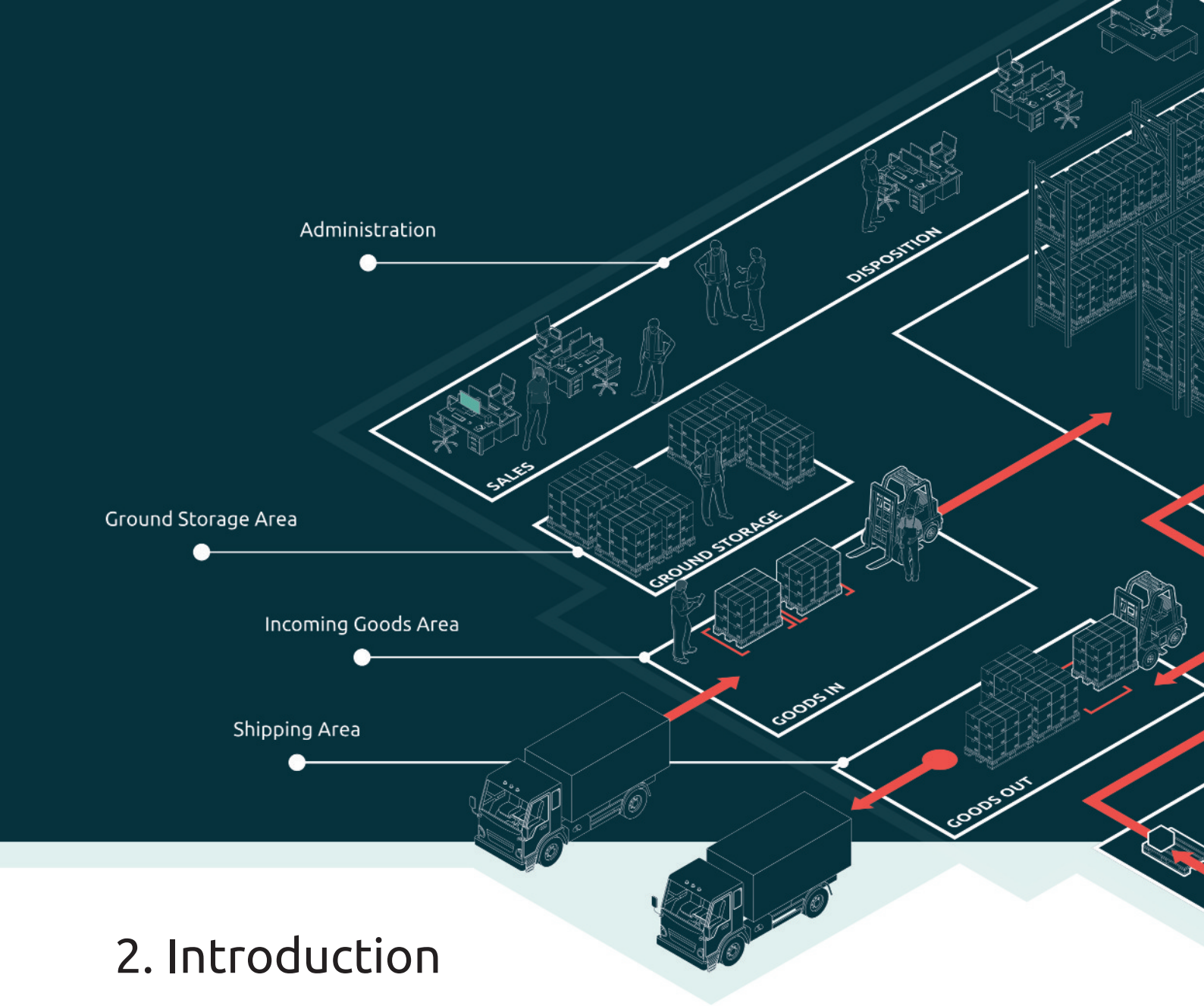
In the introduction, we first clarify general terms and give you a brief overview of different warehouse topologies.

In the following, we will present the individual apps, modules and connectivity features in detail, using Warehouse Star as an example.

If you have any questions or would like to give us feedback on our project, please do not hesitate to contact us. We are looking forward to an exchange with you!

Now we wish you a lot of fun reading.

Yours, Bitergo-Team




# 2. Introduction

## 2.1. Clarification of terms: warehouse management and warehouse administration

In common parlance, there is often talk of warehouse management. However, this term does not do justice to a warehouse management system or warehouse management software. The range of functions, the control and optimization functions go far beyond the definition of a warehouse management system. The scope of services often includes extensive possibilities for controlling system states, as well as a large number of operating and optimization strategies..[1]

## 2.2. Storage type

There are different warehouse types and topologies, such as manually operated block storage, pallet racks, racks for item picking and many more.

The warehouse types considered here are operated by logistics employees with the help of forklifts, hand pallet trucks or picking carts. Almost without exception, mobile barcode scanners are used for identification and automatic posting.

A very common warehouse layout is shown in ***Figure 2: Standard warehouse topology***.

[1] cf.: Michael ten Hompel, Thorsten Schmidt (2010): Warehouse Management

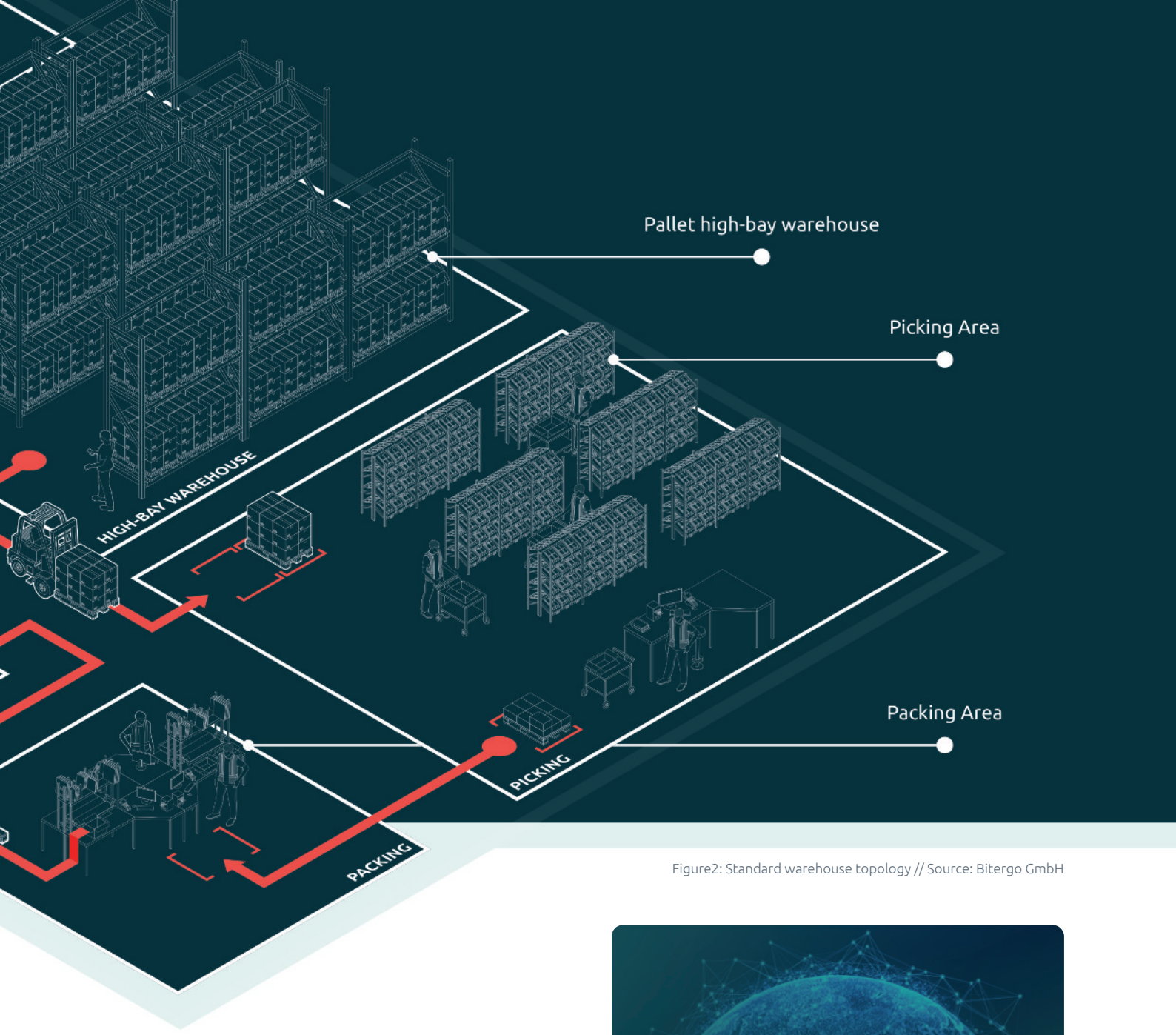



Figure2: Standard warehouse topology // Source: Bitergo GmbH

Such a warehouse includes :

- a receiving area for goods
- various racks and floor storage areas for load units with load carriers (such as Euro pallets)
- racks for picking items (often in cartons, mini-loads or without any load support)
- workstations for packing goods for parcel services such as UPS, DHL,…
- a shipping area for outgoing goods to forwarders and freight carriers

## Supply Chain Management

Supply chain management (SCM) means taking a holistic view of the logistics chain and optimizing it, i.e. creating highly productive logistics structures in procurement, production and distribution.

Automatic inventory management provides the basis for a holistic approach and supports the creation of highly productive logistics structures.[2]

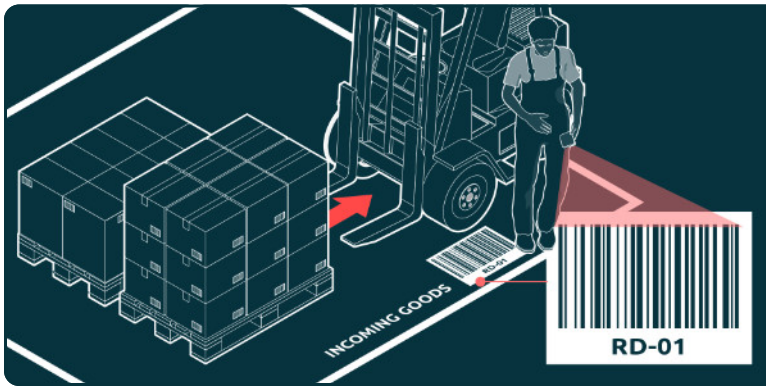
[2] cf.: Axel Kuhn, Bernd Hellingrath (2002): Optimierte Zusammenarbeit in der Wertschöpfungskette, Seite 13

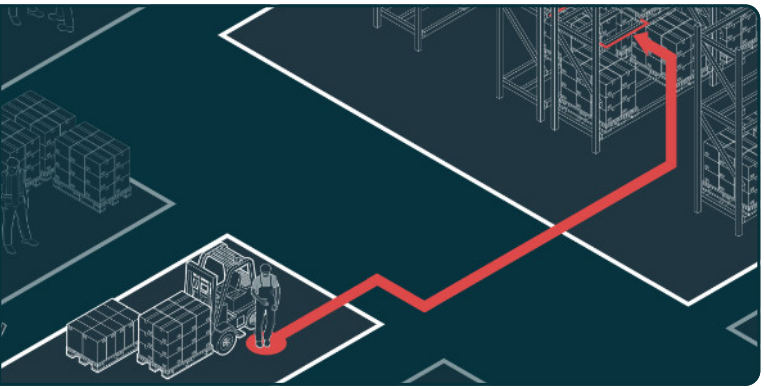
## 2.3. Which processes are typically supported?

Despite all the differences between warehouses for different areas of application, the main processes can still be generalized well:

### Goods receipt

Goods receipt is recorded on the move or in the office, against advice or spontaneously. Barcode scanning, label printing and generation of pallet labels are common. The advices are transferred via interface from an enterprise resource planning system or imported as Excel/csv file.



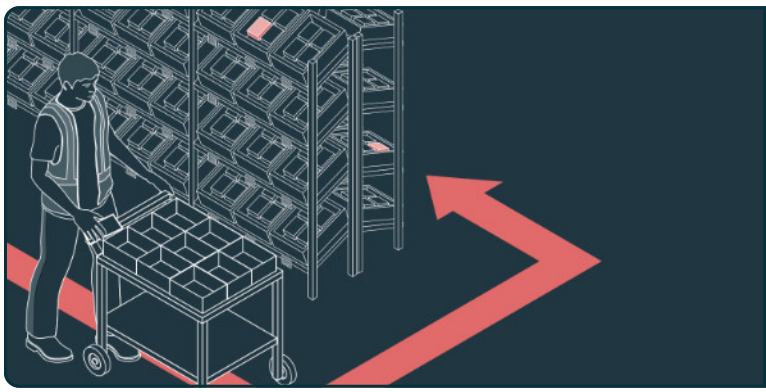



### Storage

Storage strategies for a wide variety of storage types, including block storage, shelving or high-bay racking. In addition, a wide range of restrictions such as pallet dimensions, weight, fixed bin assignments and/or freely definable classifications (e.g. ABC) must be supported. The booking of goods to space is carried out to the second via a mobile terminal.

### Picking

Shipping orders are transmitted via a standard interface and displayed in the warehouse. The warehouse supervisor then prepares the picking orders and triggers the picking release. Typical picking strategies take into account batch FIFO, expiration date and blocked stock.

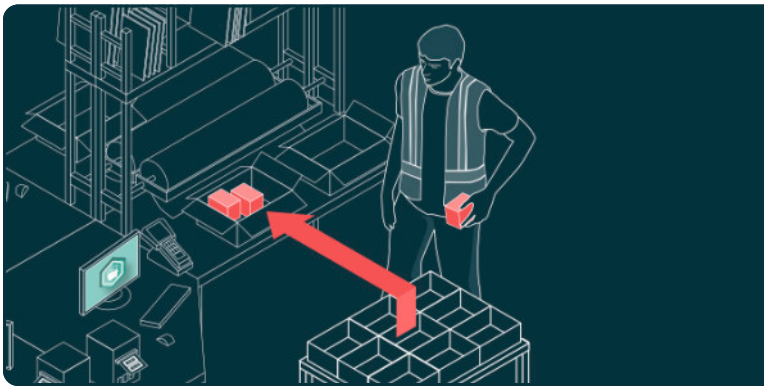


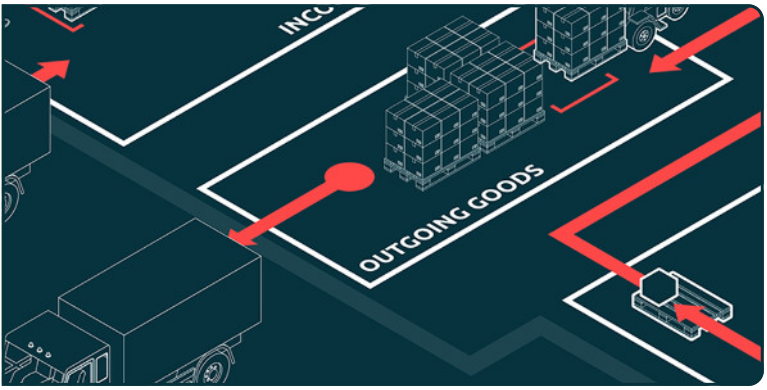

### Real time extraction

Mobile devices direct warehouse employees to the storage location and record the withdrawal in real time. Single-step single-order and multi-order picks are supported. Item swaps, empty notifications, and consideration of locks enable accurate inventory management. Picking ends at a packing or shipping location.

## Pick & Pack

Packing of a commission takes place in one or more shipping units. Goods are packed from the picking container or by Pick & Pack. For professional applications, the workstation is equipped with a printer and scales.



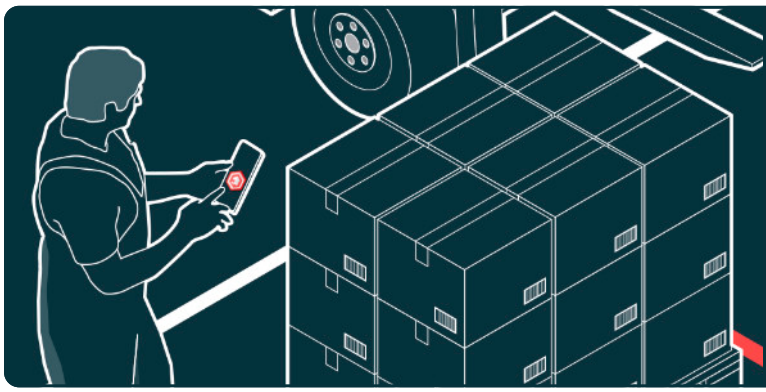



## Goods out

The shipping order is completed here. Package labels can be printed and optionally the dispatch can be ordered via a shipping service provider (e.g. DHL). Finally, delivery bills are printed and the goods are booked out.

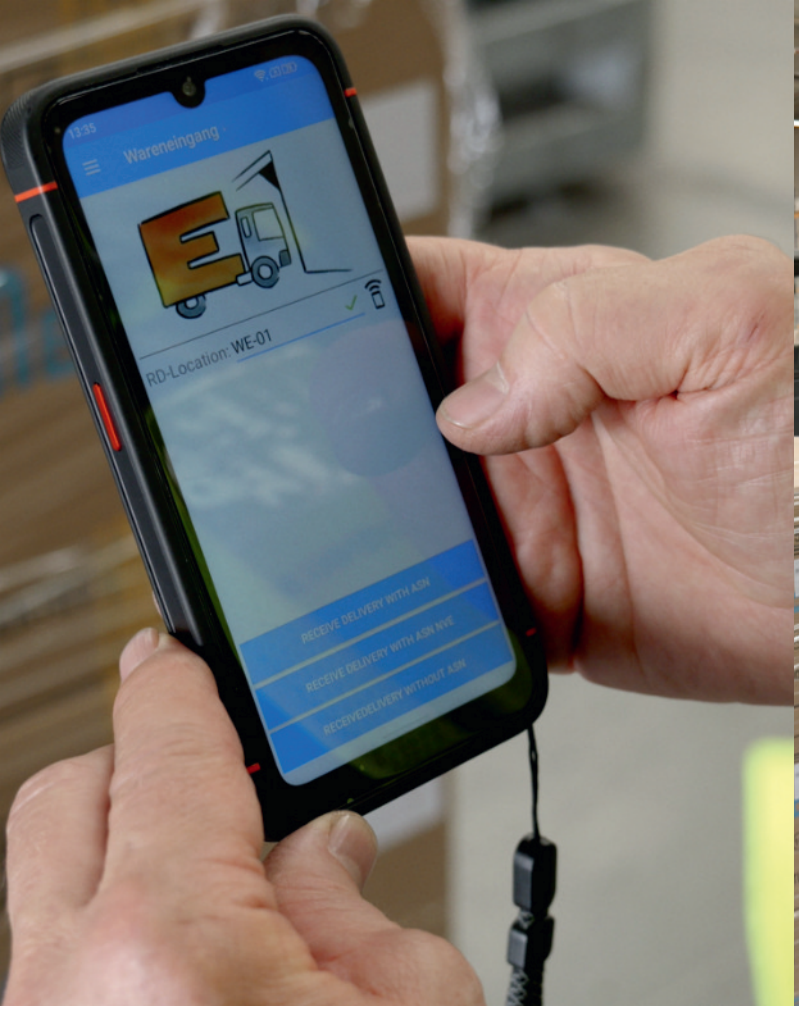
## Inventory

The electronic cut-off date inventory enables electronic counting. This makes inventory processes lean and transparent.



## Inventory Management

Inventory management consistently takes into account serial numbers, batches and expiration dates. Master data and blocked stock types must be flexibly definable.





# 3. Feature Set

## 3.1. Which functionalitites are needed?

The following functionalities are required in small and medium-sized warehouses, by logistics service providers, online retailers and manufacturing companies:

- Processing of incoming goods notifications (ASN) in the goods receipt area
- Support of any type of load carrier
- Batch and serial number management for storage units.
- Configurable storage strategies with regard to restrictions, physical (height, weight, ...) or logical (item value-based, dangerous goods classification, ABC)
- Storage of articles in a bonded warehouse, cross-dock or storage in the warehouse
- Efficient picking (single order, multi order, batch) in terms of FIFO or take-the-wholepallet, scanning of HU labels, EAN or location barcode
- Pick & pack, packing to shipping unit, printing of carrier labels
- Scan transport units for completion, measure weight, print delivery bill
- Permanent inventory count and electronic stocktaking

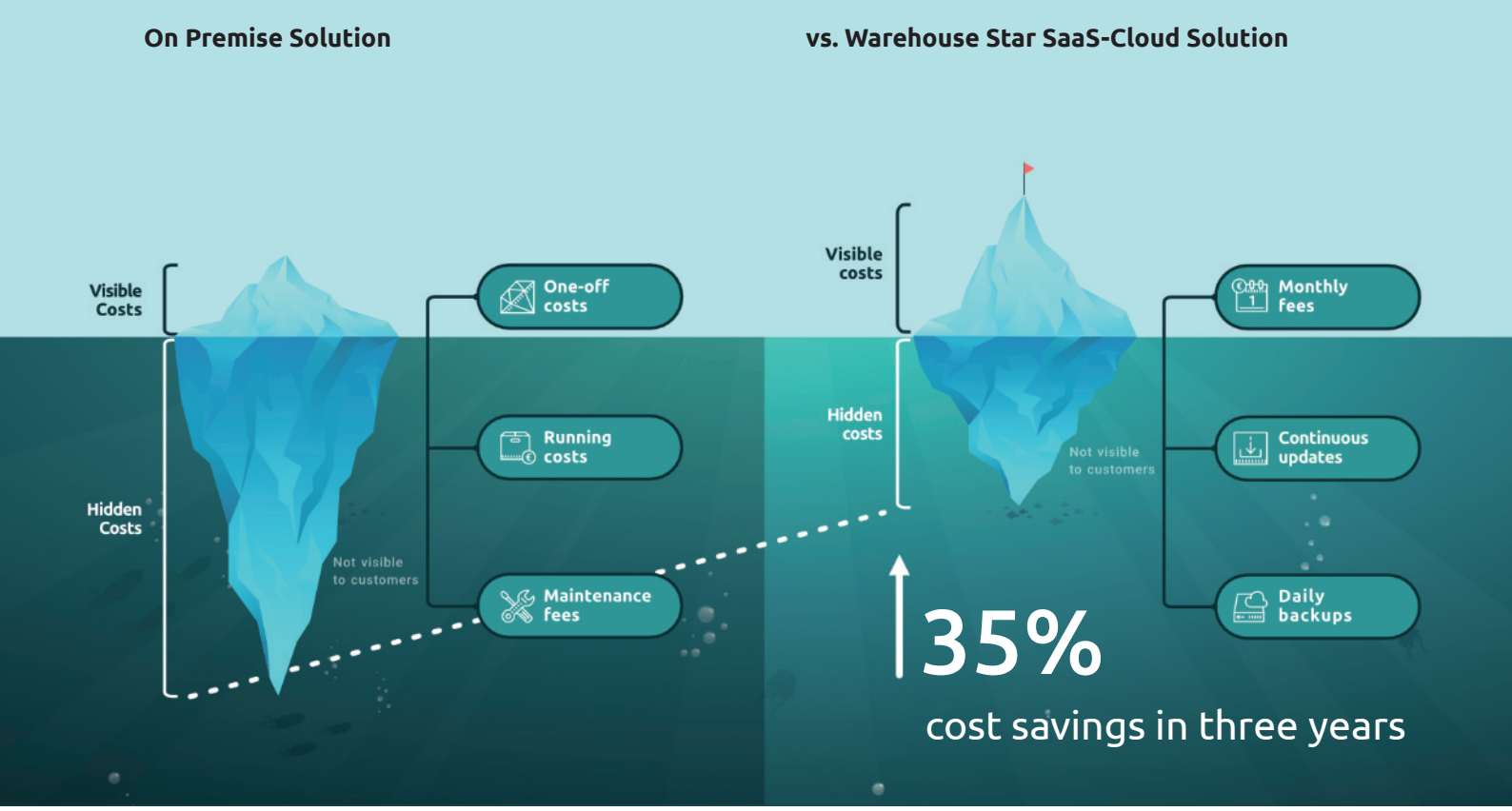



Figure 3: Comparison On Premise Solution / SaaS-Cloud Solution

## 3.2. What distinguishes a cloud solution from classic warehouse management systems?

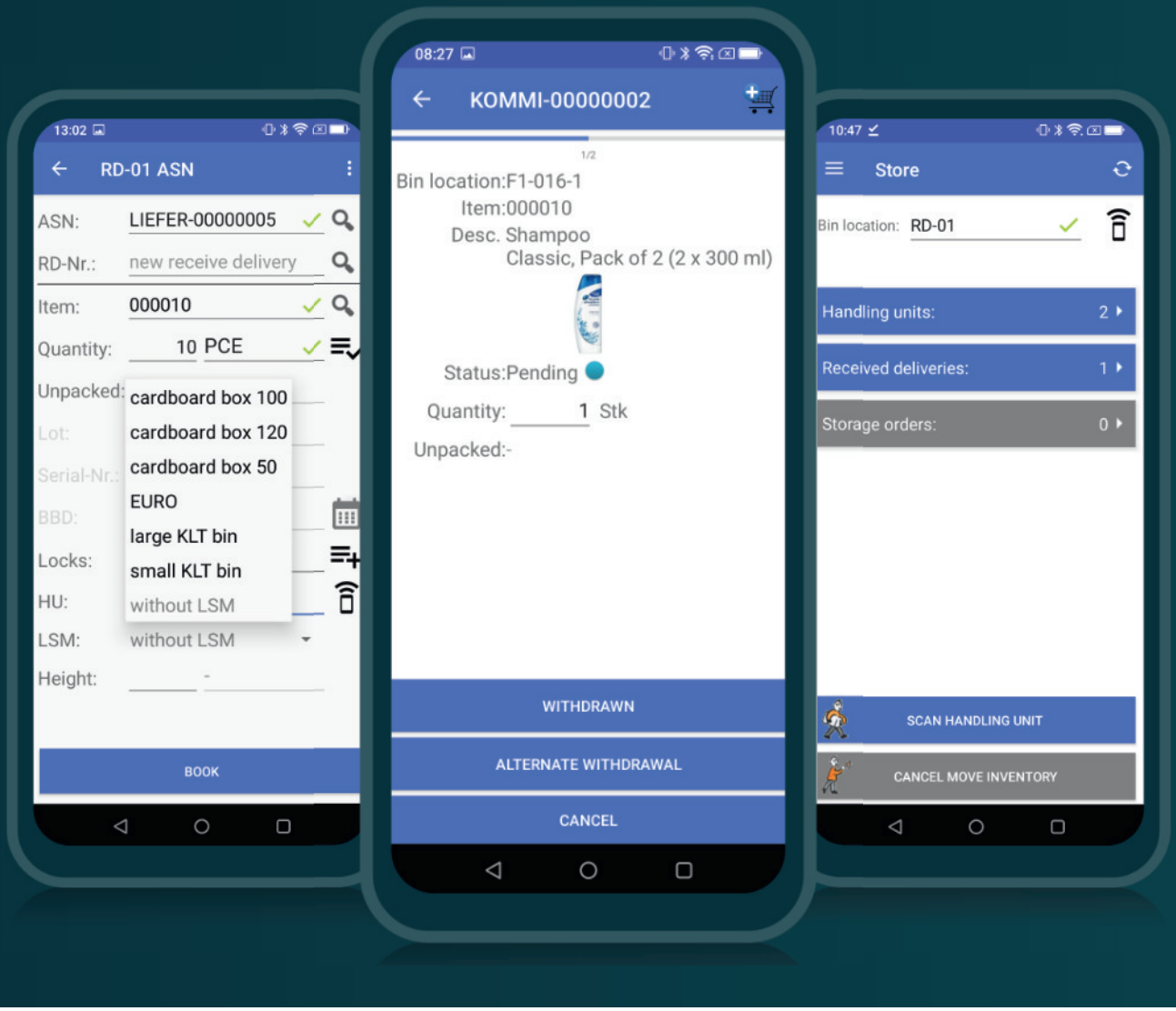
Cloud solutions are operated as-a-service. All that is needed for access is an Internet connection or a mobile data connection. Instead of a central system, modern solutions consist of interlinked apps. These run in the web browser or on mobile devices and smartphones (predominantly Android in the warehouse sector) often with integrated barcode scanners.

Compared to a conventional warehouse management system, these offer great advantages: Apps generate a high degree of standardization with simultaneous high flexibility, in that the user simply selects the right app for each use case that fits the respective workflow.

## 3.3. What is Warehouse Star?

Specifically, it is a collection of more than two dozen applications - web apps, as well as apps for Android smartphones, which are compatible with each other and in their composition cover almost all requirements for inventory management in the logistics supply chain.

**Warehouse Star** is based on the digital platform **www.logistics-mall.com** for optimal warehouse management and paperless processes and is a brand of Bitergo GmbH.



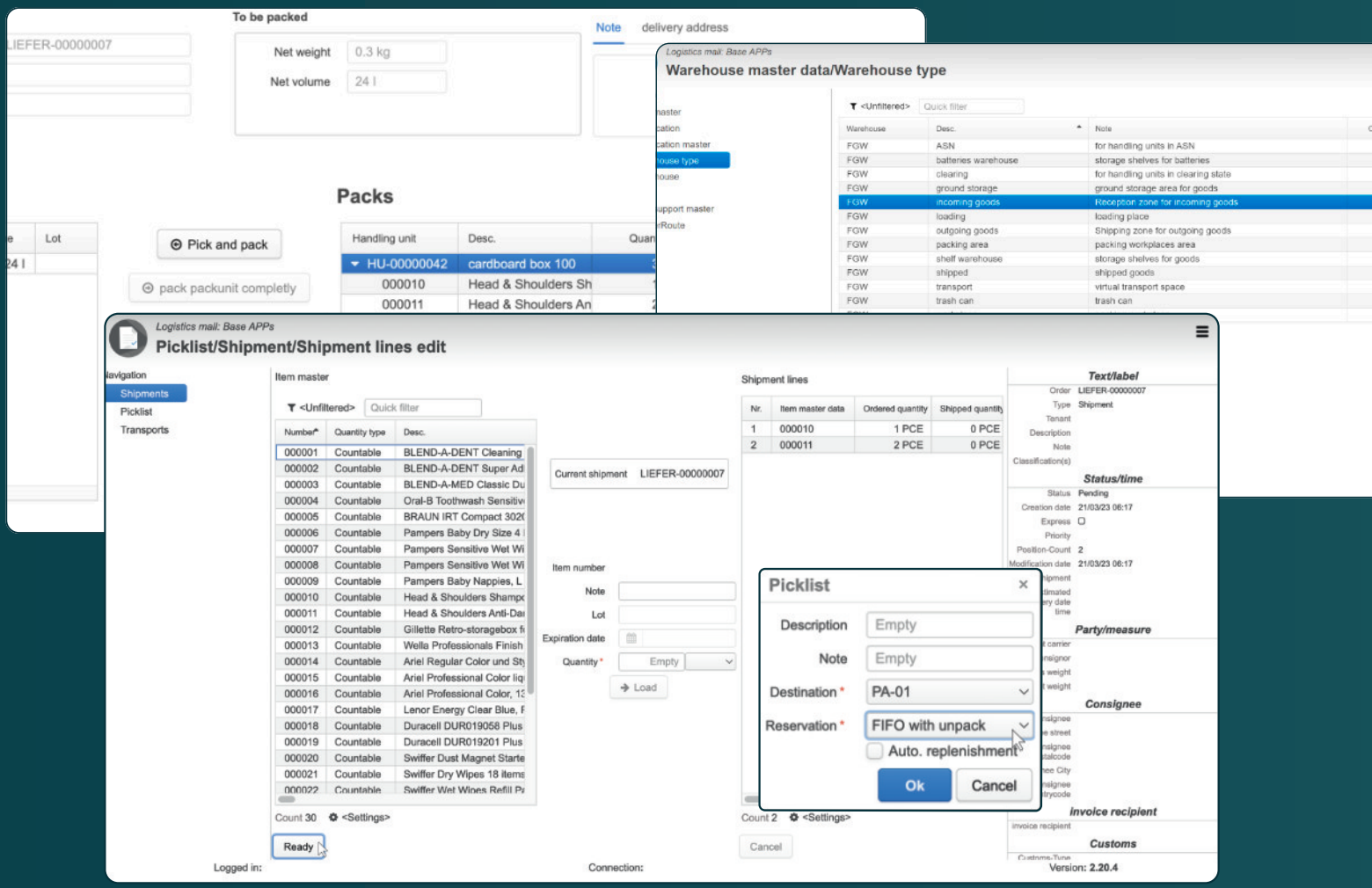

## 3.4. Which Apps are available?

With the web app and Android app **Incoming Goods**, you receive and process incoming goods. Handling units (HUs) can be created against an extended shipping notification or spontaneously. Barcodes, label printing and pallet label generation are supported. An advice note can be received via BOD interface (BOD stands for: Business Object Document) from the ERP system or imported as Excel/ cvs file.

The Android app **storage** offers storage strategies for a wide variety of storage types, such as block storage, shelf storage or high-bay storage. In addition, specific restrictions are supported, such as pallet size, weight, fixed space allocations and/ or freely definable classifications (e.g. ABC). To-the-second storage is performed using a mobile barcode scanner. Shipping orders are received via a standard interface and displayed in the **Picking** web app. The warehouse manager then activates a batch of orders and creates pick lists for them. The app supports different strategies for this task, e.g. FIFO, expiry date, full pallet, multi-order, single-order, single-stage or two-stage, and offers high flexibility in controlling the picking process.

The **Picking** Android app guides warehouse workers along the shortest path to the bin location and records item picks in real time by scanning bin and/or item barcode labels. Item changes, replenishment, and consideration of unexpectedly empty bin locations allow for the most accurate inventory management possible. Picking ends at a packing or shipping station.

The **Packing** web app supports packing picked items into one or more shipping units. For packing, the app offers




pick & pack capabilities and supports various configurations of workstations with connected printer and scale. The Shipping web app completes the shipping order. Package bills and delivery bills can be printed. Optionally, shipping service providers (e.g. DHL, UPS, Parcel Int. et.al.) can be connected.

The **Shipping** web app completes the shipping order. Package bills and delivery bills can be printed. Optionally, shipping service providers (e.g. DHL, UPS, Parcel Int. et.al.) can be connected.

Finally, the shipping units are booked out of the system with the Android or web app **Goods Out**.

The **Inventory** web app and the **Inventory** Android app enable electronic inventory and counting. This makes the inventory process simple, fast and error-free.

Inventory management consistently accounts for clients, serial numbers, batches, and expiration dates and provides real-time inventory reports.

All master data can be defined in the **Master Data** web app.

Additional apps, such as the **Correction**, **Information** and **Label Printing** apps, are suitable for efficiently handling daily problems and make users' lives much easier.

## 3.5. Warehouse Star can be tested immediately

On the website **www.warehouse-star.com** there is the possibility to create an account in three simple steps. After registration and entering a confirmation code, a test environment is created for the user at the push of a button. This process is completed in just a few minutes. After that, all apps - the Android apps as well as the web apps - can be tested to the full extent for 30 days. At the end of the test period, the user can transfer the data he has already entered into the productive Warehouse Star environment.

## 3.6. Connection to other systems

For optimal integration, Warehouse Star can be connected to your own or third-party systems, e.g. an enterprise resource planning system or an ERP. The ERP system is the leading system for the management of article master data, customer orders and orders with suppliers. Warehouse Star is responsible for the management of physical handling units and warehouse master data (e.g. shelf locations).

For synchronization, the following message types are transferred between the two systems:

- Item master data from ERP to be imported into Warehouse Star. This is the basis for all operations!
- Advanced Shipping Notifications (ASN) from the ERP to indicate an expected goods receipt. After the goods receipt, Warehouse Star sends a confirmation.
- Sales order from ERP, Warehouse Star creates pick lists from it and confirms the order after picking or shipping.
- Stock level from Warehouse Star to tell ERP the correct quantity of items available, reserved and blocked so that stock can be synchronized.
- Optionally, the blocking status of individual HUs can be transmitted bidirectionally.

## 3.7. The Warehouse Star REST-API

Warehouse Star provides a ready-to-use REST API for receiving all these message types. This is often the most cost-effective integration path for common systems. However, it requires the implementation of the Warehouse Star API on the ERP side.

## 3.8. Available Connectors

### SAP-Connektor

Connectors are available to SAP WMS, eWM and Hana Cloud. SAP configuration is performed on the customer side by an SAP department or an SAP partner.

### WeClapp-Connektor

WeClapp is a modern SaaS ERP system. A connector to connect to the WeClapp REST API is available.

### eCommerce-Cnnektor

Warehouse Star integrates seamlessly with many webshops. The eCommerce connector establishes the connection for example to Shopware 5+6, Shopify and Magento 1+2.

### Shipping and parcel service provider integration

During packing and before shipping, parcel service providers of choice can be integrated to create shipping labels and report shipping units to the service provider. Warehouse Star offers connectors for UPS, DHL and Parcel International, for example.


.. and many more incl. an open API

**30 Day Free Trial**

Test all features of the warehouse management apps for 30 days. Get started right away without having to enter your bank or credit card details. After the expiry of the test period, simply transfer your warehouse data into the system.

# 4. 4. What hardware is needed?

## 4.1. Handhelds

Android apps are run on the handhelds. They support the scanning of barcodes, e.g. handling unit labels, delivery bills or container locations. Different models are available, all from well-known brands and suitable for different requirements. All devices run the Android operating system and can be bundled with an accessory package (see *Figure 4*).

## 4.2. Vehicle Mounted Terminals (VMT) + Barcode Scanner

Vehicle mounted terminals are designed to be mounted on forklifts. Therefore, these devices are characterized by high robustness and shock absorption. Combined, these VMTs are equipped with long range barcode scanners (either wired or wireless).

## 4.3. Label printers

Label printers are necessary to print labels in the required quality depending on the application - for example, labels for handling units and shipping units. The size of the label determines the size of the printer. The labels are generated in Warehouse Star and sent to the printer (server-side printing). A VPN connection is required for server-side printing.

## 4.4. Desktop printers

Desktop printers are used for printing delivery bills and packing slips. Print jobs can be triggered locally (client-side printing). A PDF file is created in an app and printed on the local PC using an available printer. Server-side printing is also possible. A VPN connection is required for server-side printing.

## 4.5. Workstations

Smart mobile workstations are equipped with a touch computer, as well as a barcode scanner and a smart surface that functions as a scale.

## 4.6. Wearable Scanner

Partners offer innovative wearable scanners with Warehouse Star connection. As a unique selling point, the wearable has a touch display for user interaction. This allows employees to proceed much faster compared to interaction with a handheld, as their hands are free (*Cf. Figure 5*).

## 4.7. What network infrastructure is required?

The apps require an existing Internet connection. For connecting mobile devices, the Internet connection is usually provided via WLAN. But mobile data is also an option. At least 2Mbit (upload and download) is required. Either the network infrastructure is provided by the customer, or the following solutions can be offered:

**Internet connection**

An Internet connection (fiber optic or ADSL) can be provided as an independent Internet provider (only in Germany).

**VPN**

A site-to-site virtual private network that ensures the connection between the customer network and the data center where Warehouse Star is hosted. This is required for the connection of workshop label printers and scales.

**Wi-Fi installation**

Planning and implementation of industrial Wi-Fi infrastructure is done at the customer's own warehouse location. The cost of this is highly dependent on the layout of the building and its height, installations such as shelving, and the type of goods stored in the warehouse (e.g. stacks of pallets full of liquids are a challenge).

| | Premium | Standard | Low-cost / smartphone |
|---|---|---|---|
| Operating System (OS) | Android 8.1 +<br>Update until Android 11 | Android 10 +<br>Update until Android 11 | Pure Android 9.0 Pie; Upgrade until Android 10 (GSM + AER) ! |
| Speed | Qualcomm Snapdragon 660<br>Octa-Core; 2,2 GHz | Qualcomm Snapdragon 660<br>Octa-Core; 2,2 GHz | P23 Octa-Core MT6763 /<br>Bis zu 2,0 Ghz 4G LTE bis<br>zu Cat-6 (MediaTek Helio) ! |
| Drop | 2,4 m | 1,8 m (with bumper) | 1,2 m ! |
| Environmental Sealing | IP67, IP65 | IP68, IP65 | IP68, MIL-STD-810G2 |
| WLAN/WWAN/GPD/NFC | WLAN; GPD; NFC | WLAN; GPD; NFC | ALL |
| Roaming | ++++ | ++++ | ++ ! |
| Battery & Duration | 7000 mAh | 4050 mAh | 6200 mAh (several days) |
| Weight | 765 g ! | 249 g | 279 g |
| Dimensions & Usability | 240 mm x 88 mm x 189 mm ! | 155 mm x 75,5 mm x 18,6 mm | 162,4 mm x 79 mm x 15,3 mm |
| Display & Display Technology | 4,3“ (800x480) | 5,0“ 1280x720) | 6,1“ 19,5:9 HD+ V-Notch |
| Scanner | Yes | Yes | no dedicated scan-engine (de-coding via camera & scan App) ✕ |
| Decoding Performance | ++++ | ++++ | ++ ! |
| Camera Specification | Rear 13 MP, Front 5 MP | Rear 13 MP, Front 5 MP | Rear 13 MP, Front 8 MP ! |
| Use Cases | Vehicle,<br>Long-distance scanning,<br>extrem rugged | Mobile Users on the shopfloor,<br>Pickinng,<br>Goods In & Goods Out,<br>Shipping | a ruggedized smartphone, 1D and 2D barcodes are read via camera and a specialized app. Perfect for multi-pur-pose use - as communication device, app platform. Con: picture quality, roaming within Wi-Fi networks. |

Figure 4: Selection of compatible devices for warehouse-star.com | Source: Bitergo GmbH


Figure 5: Nimmsta wearable scanner | Source: Nimmsta GmbH

# 5. References


**Andreas Trautmann, Damian Daniluk, Oliver Wolf, Michael ten Hompel (2020):** Industrie-4.0-fähige Software-Dienste auf Basis von Cloud Computing

**Axel Kuhn, Bernd Hellingrath (2002):** Optimierte Zusammenarbeit in der Wertschöpfungskette, Seite 3 ff

**Michael ten Hompel, Maren-Bianca Meinhardt, Torben Lippmann (2011):** Cloud Computing für Logistik, Seite 125

**Michael ten Hompel, Thorsten Schmidt (2010):** Warehouse Management - Organisation und Steuerung von Lager- und Kommissioniersystemen, Seite 8 ff

**Kira Schmeltzpfenning, Theresa Fohrmann, Detlef Spee (2020):** Wege in das digitalisierte Lager - Mit Warehouse IT die digitale Transformation des Lagers erfolgreich gestalten