

S4TM1

Business Processes in embedded TM in SAP S/4HANA

PARTICIPANT HANDBOOK INSTRUCTOR-LED TRAINING

Course Version: 23

Course Duration: 4 Day(s)

Material Number: 50162867

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Course Overview

TARGET AUDIENCE

This course is intended for the following audiences:

- Business Analyst
- Business Process Owner/Team Lead/Power User
- User

UNIT 1

Transportation Management as Part of SAP S/4HANA Enterprise Management

Lesson 1

Describing SAP S/4HANA Enterprise Management: Motivation and Overview

3

Lesson 2

Evaluating Transportation Management

11

Lesson 3

Explaining Basic and Advanced Transportation Management (TM)

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UNIT OBJECTIVES

- Explain the motivation behind SAP S/4HANA Enterprise Management
- Describe the main components of SAP S/4HANA Enterprise Management
- Describe the capabilities of SAP Transportation Management
- Describe the end-to-end transportation processes
- Explain how LE-TRA relates to basic shipping
- Describe the differences between basic shipping and advanced transportation management

Unit 1

Lesson 1

Describing SAP S/4HANA Enterprise Management: Motivation and Overview



LESSON OBJECTIVES

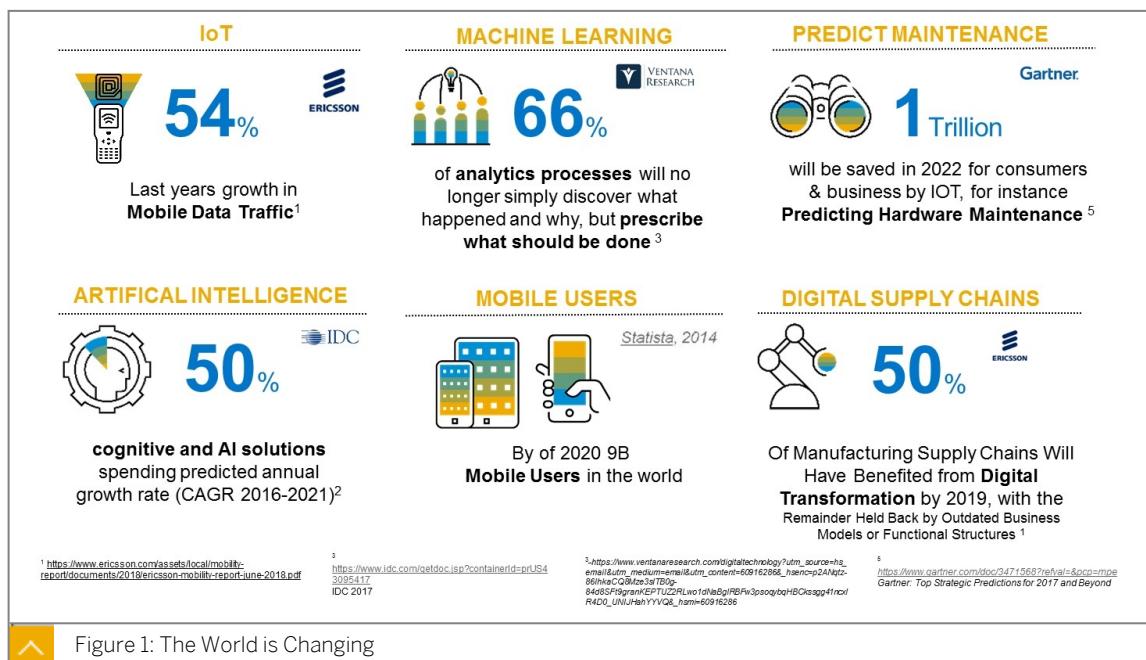
After completing this lesson, you will be able to:

- Explain the motivation behind SAP S/4HANA Enterprise Management
- Describe the main components of SAP S/4HANA Enterprise Management

Motivation Behind SAP S/4HANA

As your enterprise plans to implement SAP S/4HANA, you want to get some insights into the new SAP S/4HANA Enterprise Management logistic solution.

The World is Changing



The figure, The World is Changing, shows that the world around us is becoming more complex. There has been an exponential growth of digital information (social, mobile, and big data), an increase of globalization and the spread of business networks, and the Internet of Things (IoT). These changes have resulted in more complex business processes, more complex organizations, and more complex software solutions.

At the end of 2009, 5% of the world's population owned smart phones. Four years later, that figure jumped to 22%. Currently, 1.7 billion people are on social networks. Over the next three years, that audience will surpass 2.55 billion. By 2020, 5 billion people will enter the middle

class and come online. 50 billion devices will be connected to the Internet of Things, creating a digital network of virtually everything. And cloud computing, a \$41 billion business in 2011, will grow to a \$241 billion business in the same time frame.

The exponential proliferation of mobile devices, social media, cloud technologies, and the staggering amounts of data they generate, have transformed the way we live and work. 61% of companies report that most of their people use smart devices for everything, from e-mail to project management to content creation.

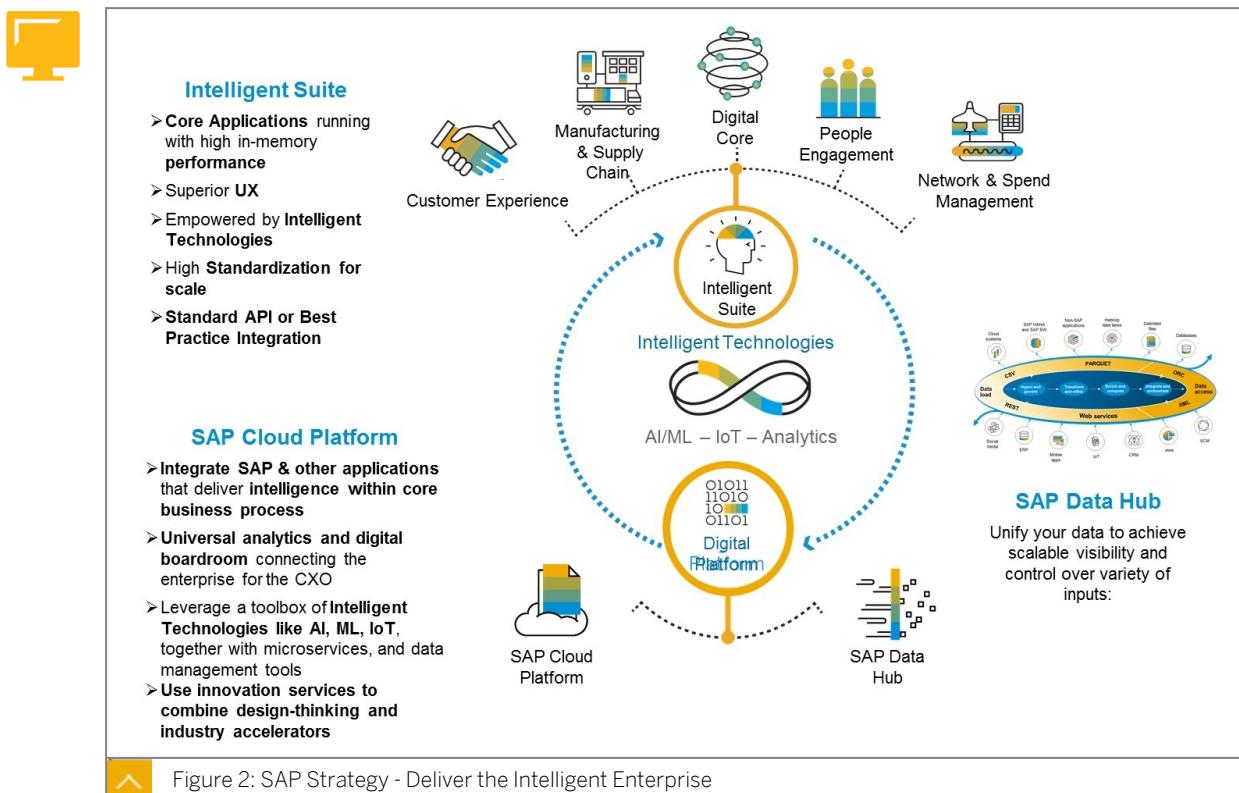
Machine learning (ML) is the study of algorithms and statistical models that computer systems use to progressively improve their performance on a specific task. Machine learning algorithms build a mathematical model of sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to perform the task.

Artificial intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that work and react like humans. Some examples of the activities that computers with artificial intelligence are designed for include the following:

- Speech recognition
- Learning
- Planning
- Problem solving

These advancements have improved our lives and provided us with greater opportunities for innovation than ever before. The world may be getting smarter, but it is not getting any easier.

SAP Strategy - Deliver the Intelligent Enterprise



As the figure, SAP Strategy – Deliver the Intelligent Enterprise, shows, the digital value network starts with a digital core, which interconnects all aspects of the value network in real

time to drive business outcomes. The digital core gives companies a new platform for core business processes and brings together business processes with analytics in real time. This enables a smarter, faster, and simpler enterprise, which includes connecting every aspect of internal operations. It also enables real-time processes.

SAP is heading in the direction of Machine Learning and the Intelligent Enterprise. Machine learning technologies are critical to empowering this vision of the Intelligent Enterprise. By embedding algorithms directly into multiple SAP systems, we can continuously learn and adapt to new data as it comes in, without a user having to be involved.

The information is presented to knowledge workers in the transaction screens they are familiar with, but are enhanced with new information to make them more effective at their job. Not only is SAP delivering these types of embedded self-adapting algorithms into all our core applications, we are making it possible for our customers to customize these models or deliver entirely new models of their own with SAP Predictive Analytics, application edition.

This entire value chain, including the core, is digitized, and serves as the platform for innovation and business process automation.

Evolution of SAP S/4HANA

The Next Generation Business Suite

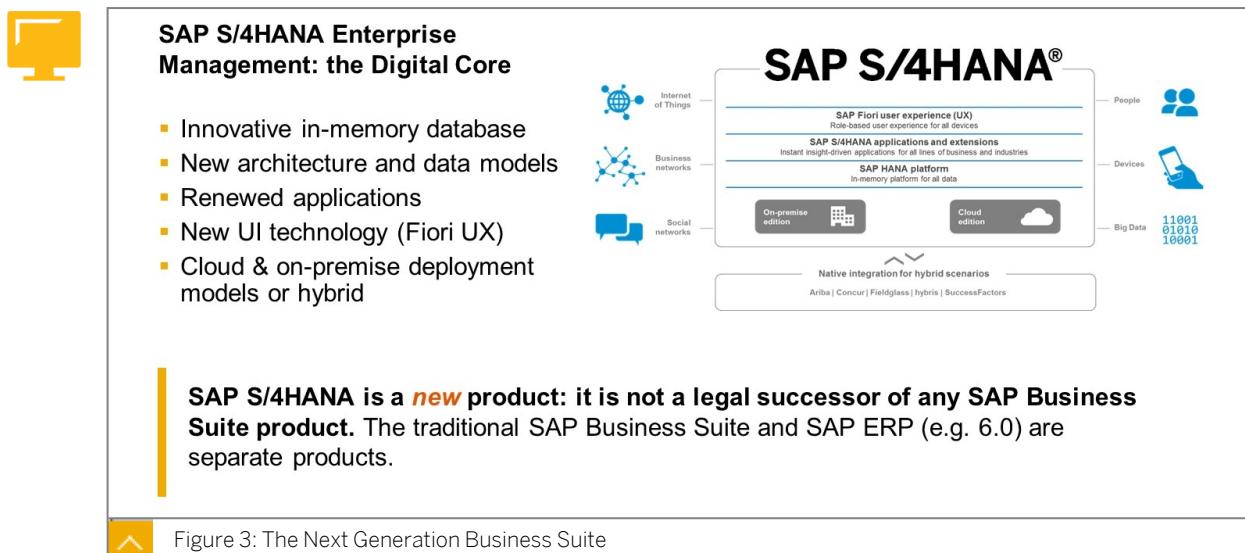


Figure 3: The Next Generation Business Suite

SAP S/4HANA is a new product. With SAP S/4HANA, we are building on the success of the SAP Business Suite, powered by SAP HANA, with a completely new and reimaged suite.

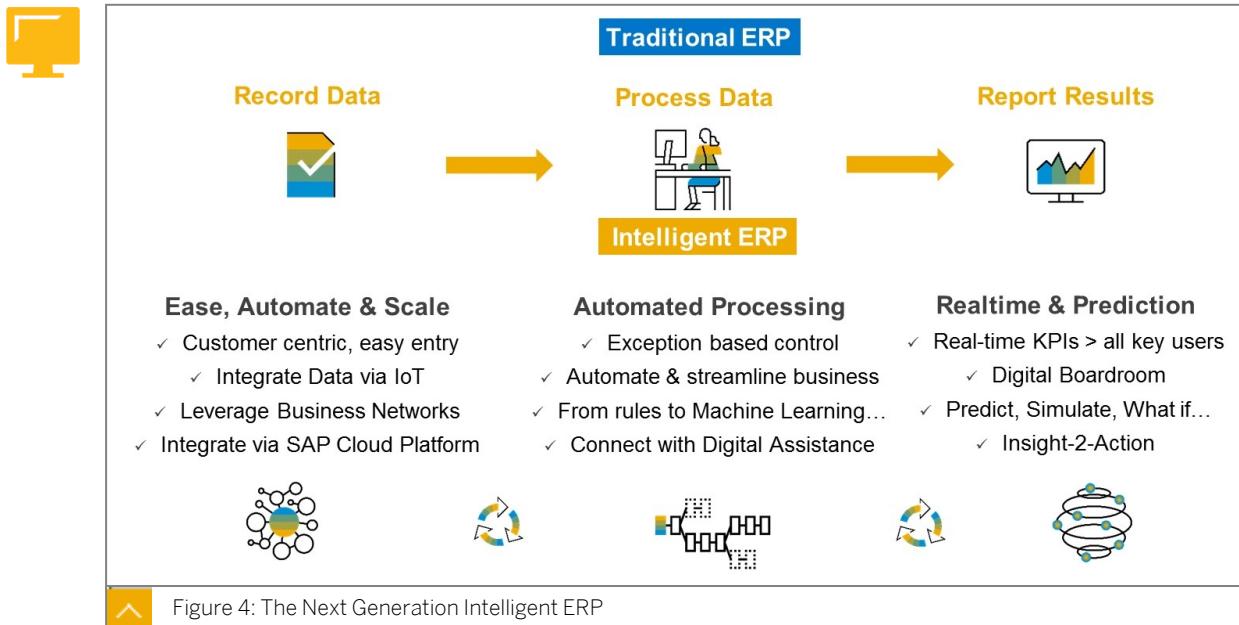
SAP S/4HANA runs on SAP HANA and provides simplicity. For example, a simplified data model with no indexes, no aggregates, no redundancies. It also promotes innovations. For example, open in-memory platform for advanced applications predicting, recommending, and simulating.

SAP S/4HANA is natively designed with SAP Fiori UX, and offers an integrated user experience with modern usability and instant insight on any device (role-based, a maximum of three steps to complete a job, mobile-first, consistent experience across lines of business (LoB)).

SAP S/4HANA is natively connected to the Internet of Things and business networks for real-time collaboration in the networked economy. It is natively engineered, providing a choice of deployment options (on-premise, cloud, and hybrid). It is also natively born for easy adoption.

For example, guided configuration and easy on-boarding, from the discovery of the solution through cloud trials to deployment with preconfigured best practices.

The Next Generation Intelligent ERP

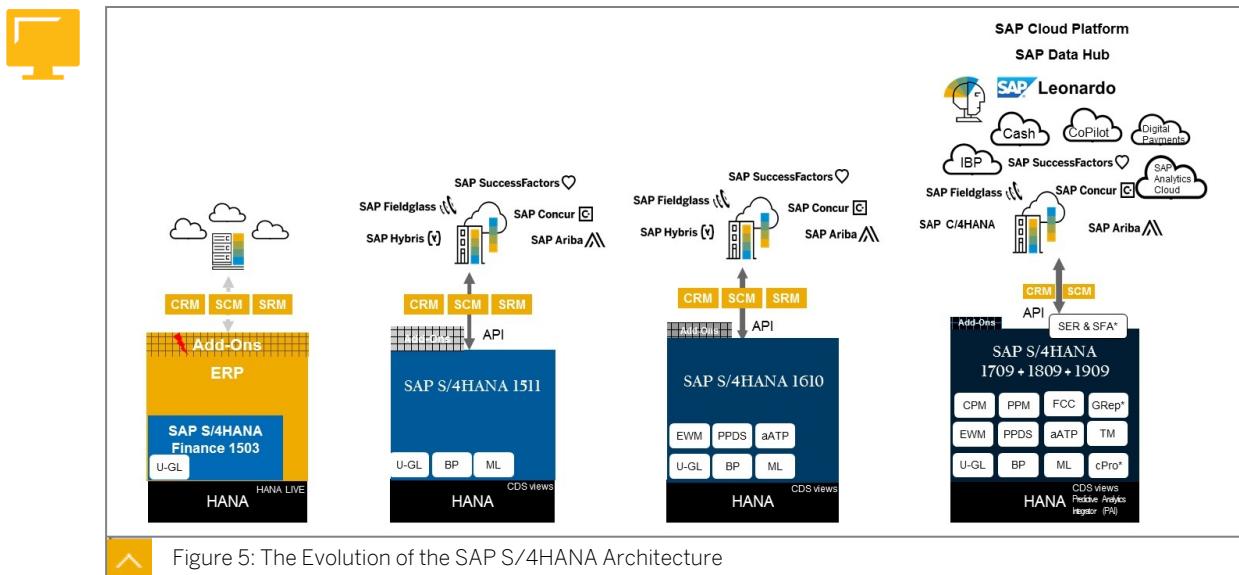


SAP S/4HANA improves the order and data records entry management. Orders can come in via business networks or via cloud systems. IoT data is easily imported.

Execution of data is improved by heuristics, machine learning, and fast batch processing. The user just has to react if an exception is raised.

Real time analytics and transactional data are brought together to support fast and suitable decisions.

The Evolution of the SAP S/4HANA Architecture



In SAP S/4HANA Finance 1503, the Unified General Ledger (U-GL) was introduced. It brings together the once-separate components Financial Accounting (FI) and Controlling (CO) into

one pool of relevant business data. This single source of truth collects all accounting-relevant transactions and makes them available to all relevant application components: Financial Accounting (General Ledger), Controlling, Asset Accounting, and Material Ledger.

With SAP S/4HANA 1511, the optimized data model for logistics with Business Partners (BP) and Material Ledger (ML) was introduced.

With SAP S/4HANA 1610, Extended Warehouse Management (EWM), Production Planning and Detailed Scheduling (PP/DS) where embedded and advanced ATP (aATP) was developed.

With SAP S/4HANA 1709, Transportation Management (TM) was embedded and Commercial Project Management (CPM), Portfolio and Project Management (PPM) and the Financial Closing Cockpit (FCC) were added.

With SAP S/4HANA 1809, Group Reporting (GRep), Sales Force Automation, Central Procurement (CPro) (central requisitioning was available as of 1709; 1809 adds central contract and central purchasing) were added.

SAP S/4HANA Enterprise Management Lines of Business

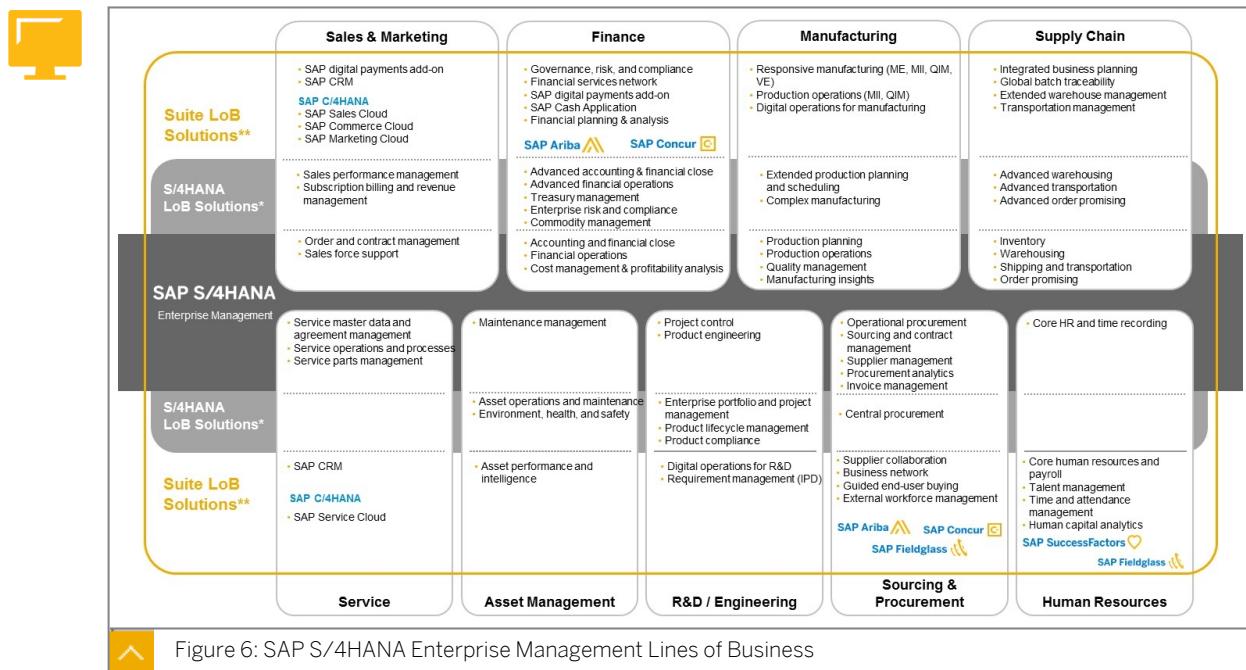


Figure 6: SAP S/4HANA Enterprise Management Lines of Business

At the center of SAP S/4HANA Suite is SAP S/4HANA Enterprise Management, which has been built by simplifying the SAP ERP solution and reintegrating and simplifying portions of the SAP Business Suite products, such as SAP SRM, SAP CRM, and SAP SCM into this core. SAP S/4HANA Enterprise Management is available on premise and in the cloud, with different licensing and subscription models.

The SAP S/4HANA Suite is completed by the integration of dedicated lines of business (LoB) and industry solutions natively into SAP S/4HANA Enterprise Management. These solutions can be cloud-based, like SAP SuccessFactors, or delivered on-premise as well (for example, SAP Transportation Management), depending on the market need.

SAP S/4HANA Deployment Options



	 SAP S/4HANA Cloud, essentials edition	 SAP S/4HANA Cloud, extended edition	 SAP S/4HANA*
Business Process	Standardized, core ERP	Flexible, ext. ERP	Customizable, ext. ERP
Innovation Lifecycle	Quarterly	Semi-annual	Annual, customer-led
TCO	Lowest	Lower	Higher
System Governance	SAP-led	Customer-influenced	Customer-led
IT Infrastructure	SAP, public	SAP, dedicated	Customer-managed
Customization	With standard APIs	With SPRO	SPRO and modifications
Extension	PaaS, SCP	PaaS, SCP	Open, SCP
System Delivery	New implementation	New implementation	New or ECC conversion
Licensing	Subscription	Subscription	Classic

*Private cloud managed by SAP & On-premise managed by cloud providers or customers

Figure 7: SAP S/4HANA Deployment Options

SAP S/4HANA is available as an on-premise edition and as a cloud edition. This training focuses on the SAP S/4HANA on-premise edition.

Although the SAP S/4HANA on-premise edition and the SAP S/4HANA Cloud (extended edition) have the same code line, there are important differences, as follows:

- SAP S/4HANA Cloud, extended edition; you do not buy the software, but you rent it.
- The cloud provider is responsible for sizing, upgrades, and so on.
- Modifications are not allowed in a cloud environment.

To set up the SAP S/4HANA Cloud, essentials edition:

- You get one company code with one plant per country as a template.
- You can use the migration workbench to import master data.
- You can use the Adobe Designer to change or create forms.

You can extend your system using Platform as a Service (PaaS) using the build in services in SAP HANA or the SAP Cloud Platform (SCP) environment.

Innovations - Embedded EWM



Business Challenges

- » Strategic warehouse management solution for enhanced visibility, flexibility and optimization required
- » Different Interfaces and tables leading to redundant data and replication requirements (decentralized EWM)
- » Classical WM is no strategic product of SAP anymore (⇒ simplification list)

Business Benefits

- » Reduce costs through better warehouse efficiency, increased labor productivity, and better space utilization
- » Full process transparency, flexible automated processes
- » Strong direct integration and interaction with other SAP solutions
- » High-performance, high-volume warehouse operations with direct support of automated storage and retrieval

Capabilities

- » SAP EWM embedded in SAP S/4 HANA: run all warehouse-related processes in a single SAP solution
- » Eliminate redundant customizing tables and warehouse request objects
- » Eliminate master data interface between materials management and warehouse management
- » Direct read of actual data (material values, accounting objects)
- » Increase transparency in stock and processes and flexibility in warehouse process modeling
- » Implement optimized customer specific put-away and retrieval strategies
- » Integrated Material Flow System (MFS) for automated storage and retrieval



^ Figure 8: Innovations - Embedded EWM

The figure, Innovations: Embedded EWM, shows an overview of the innovations both in the area of general advantages of EWM compared to WM and in the area of embedded EWM compared to a decentralized EWM in terms of business challenges, business benefits, and capabilities.

Innovations - Embedded TM



Business Challenges

- » High freight costs and poor customer service
- » Bad resource utilization and complex carrier selection
- » Poor accuracy and transparency of transportation cost calculation

Business Benefits

- » Minimize freight costs and enhance customer service
- » Better resource utilization and carrier selection to reduce transportation costs
- » Achieve faster, more dynamic, and responsive logistics execution
- » Better accuracy and transparency with automatic transportation cost calculation

Capabilities

- » Vehicle Scheduling Routing Optimization
- » Automated Carrier Selection
- » Driver Management
- » Package Building and Load Planning / Load Optimization
- » Incorporated Tendering Management

^ Figure 9: Innovations - Embedded TM

SAP S/4HANA Supply Chain for transportation management (SAP TM) supports you in all activities connected with the physical transportation of goods from one location to another. You can use SAP TM to perform the following activities, for example: create transportation requirements from your ERP documents (sales orders, purchase orders), plan the transportation and select carriers, tender transportation services, dispatch and monitor the transportation, calculate the transportation charges for both the ordering party and the supplier side, consider foreign trade and dangerous goods regulations.



LESSON SUMMARY

You should now be able to:

- Explain the motivation behind SAP S/4HANA Enterprise Management
- Describe the main components of SAP S/4HANA Enterprise Management

Evaluating Transportation Management



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe the capabilities of SAP Transportation Management
- Describe the end-to-end transportation processes

Capabilities of SAP Transportation Management

Companies have been shipping products across countries and continents for centuries. The concept of managing the transportation of products is not new. However, using new methodologies and technology can make a difference in an industry. Today, most economies are wholly reliant on efficient transportation logistics.

With the shift in recent years towards a global economy, crossing borders has become commonplace. Reaching customers in more remote locations and sourcing the procurement of product from multiple vendors or locations has increased the cost of transporting products. As the world becomes smaller, the team tasked with maintaining logistics needs to respond faster and more cost-effectively.

Global natural disasters and other dangers show the vulnerability of the global supply chain. Despite these challenges, the transportation part of the supply chain, in particular, has to solve the problems that arise in order to keep factories running and customers supplied.

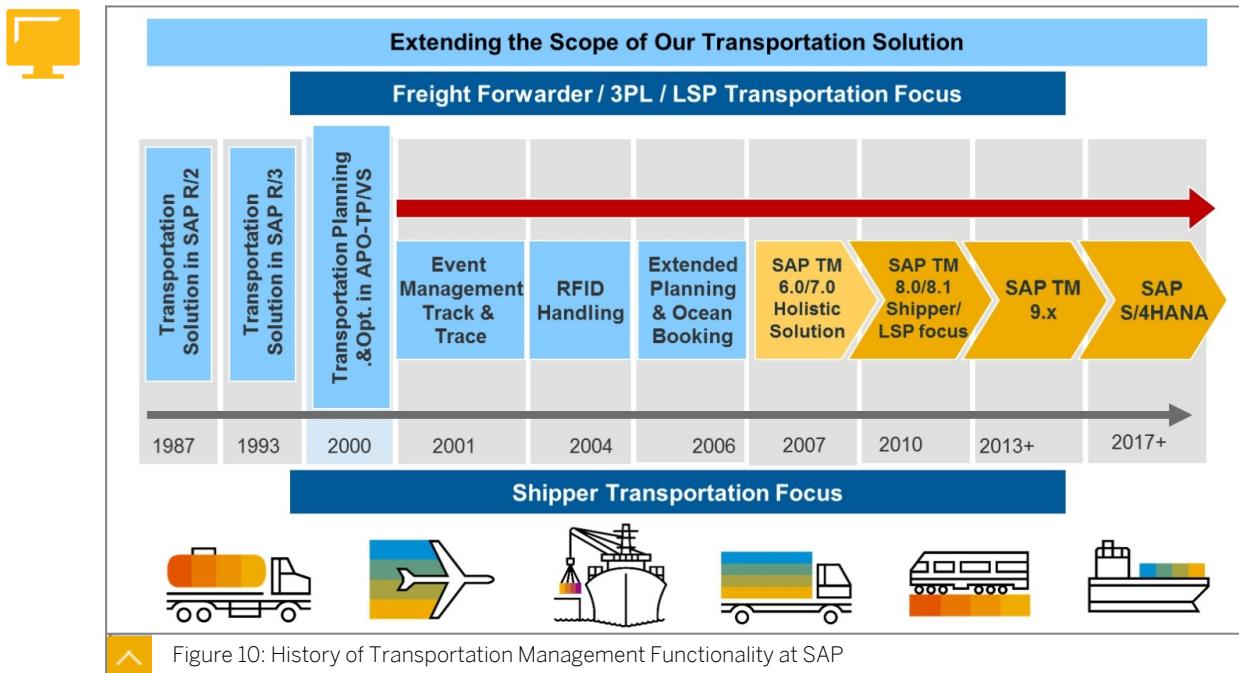
Executive Decisions

The following examples are issues that key executives face:

- How can I manage my logistics network in a holistic fashion?
- How can I minimize the risk factors throughout my supply chain?
- How can I reduce my operational costs and better understand transportation costs at the customer level?
- How can I ensure the best possible usage of my assets? How do I ensure high customer service levels and responsiveness to unexpected supply chain events?
- How do I ensure I am compliant with all of the varying regulations and compliance policies?

Transportation management is never an isolated process. Rather, it is always integrated into other business processes. If transportation management is poorly organized, this may have a negative impact on related business processes, for example, manufacturing or distribution.

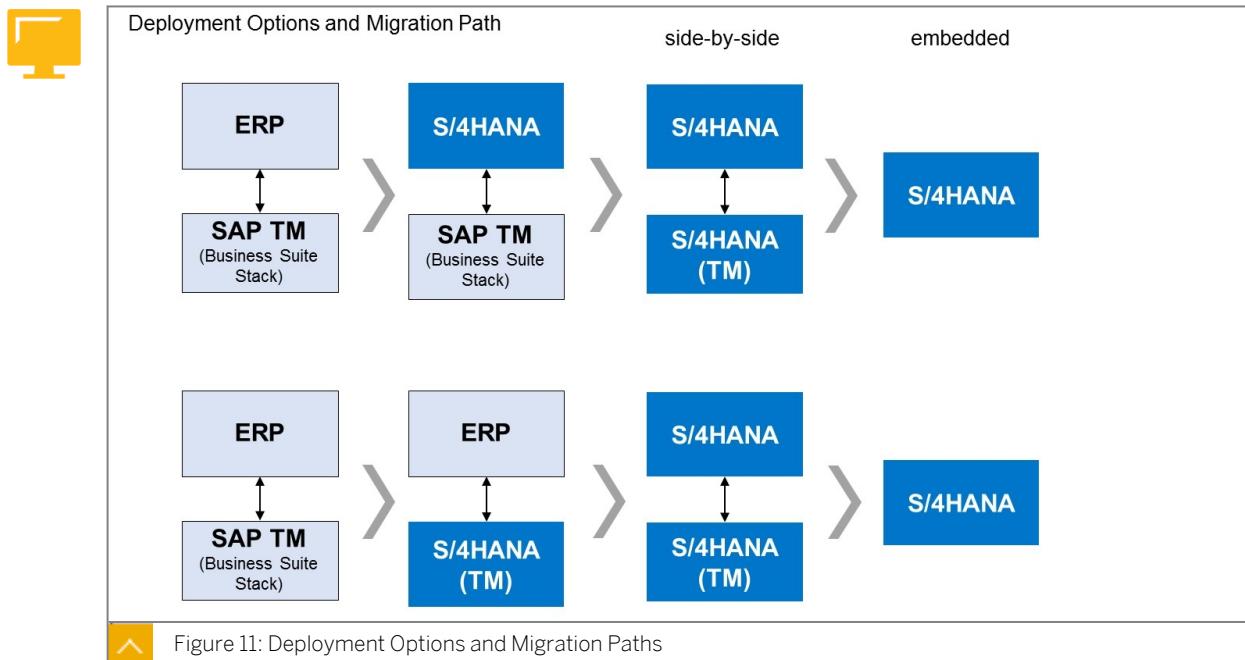
Evolution of Transportation Management at SAP



SAP TM 6.0 and 7.0 evolved from the SAP Transportation Planning/Vehicle Scheduling (TPVS) solution. With SAP TM 8.0, the architecture was redesigned and the execution was improved.

As time went on, customer feedback and lessons learned from the early implementations were used as a basis for improving the solution further. As society and business make the move to mobile, SAP TM is evolving accordingly and now includes several mobile-friendly elements. For example, drivers can input updates using mobile devices and this information can be used to update customers of possible delays. While previous iterations included integration with Global Trade Services (GTS) and facilitated compliance, the focus more recently has been on improving the shipper and freight forwarder elements of SAP TM.

Deployment Options and Migration Paths



SAP Transportation Management as part of SAP S/4HANA is optimized for the processing of system internal transportation demand, with regards to data footprint and TCO:

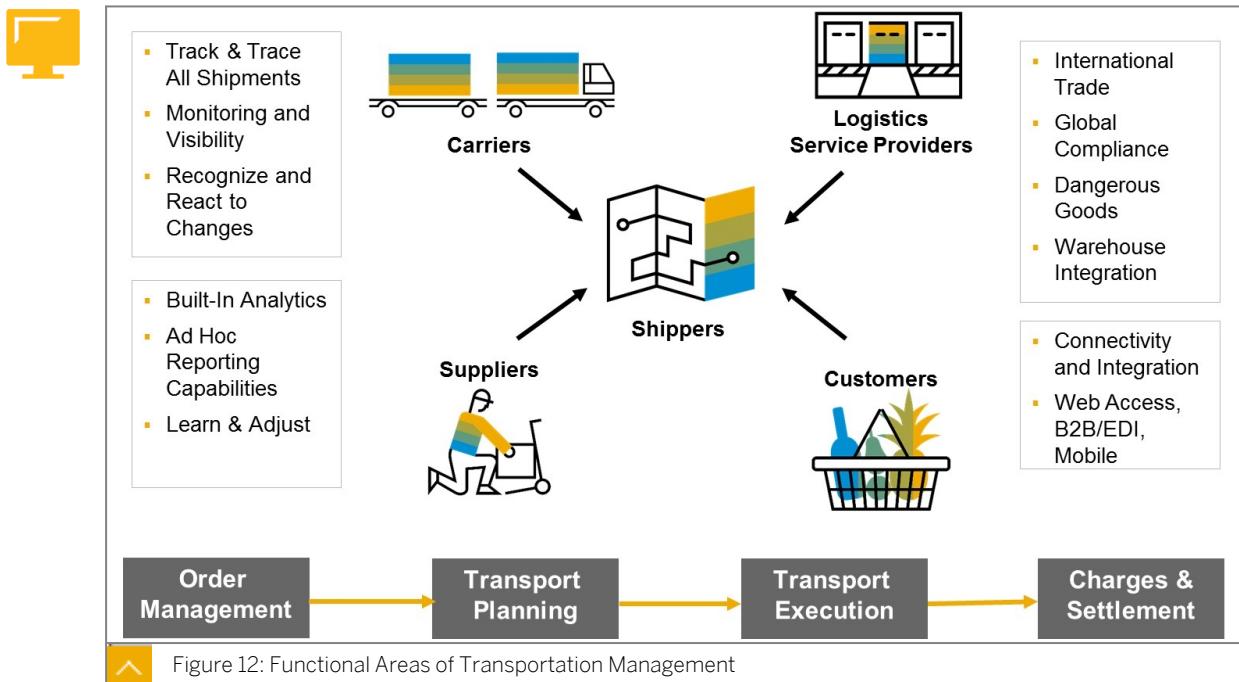
- No replication of master data and customizing
- No replication of transactional data (for example, the freight unit is directly integrated in system internal predecessor documents without the need of the TM business object TRQ in between, which stores replicated order data)
- Direct integration of predecessor and successor documents without web service messages and monitoring of corresponding queues

As of SAP S/4HANA 1709, SAP Transportation Management as part of SAP S/4HANA also supports side-by-side scenarios, which means that transportation demand can also be received from other SAP ERP or SAP S/4HANA instances in order to process the necessary steps for planning and execution and send back the needed information to the source system of the demand. In this case, replication of data is needed and the mentioned advantages for system internal processing do not apply.

From a system perspective, an SAP S/4HANA system has to be installed and Transportation Management capabilities can be used for the following different scenarios:

1. System internal integration of SAP Transportation Management with SAP S/4HANA Enterprise Management applications in the same system instance ("Embedded")
2. System external integration of SAP Transportation Management with SAP S/4HANA Enterprise Management or ERP applications in other system instances ("Side-by-Side")

Benefits of SAP Transportation Management



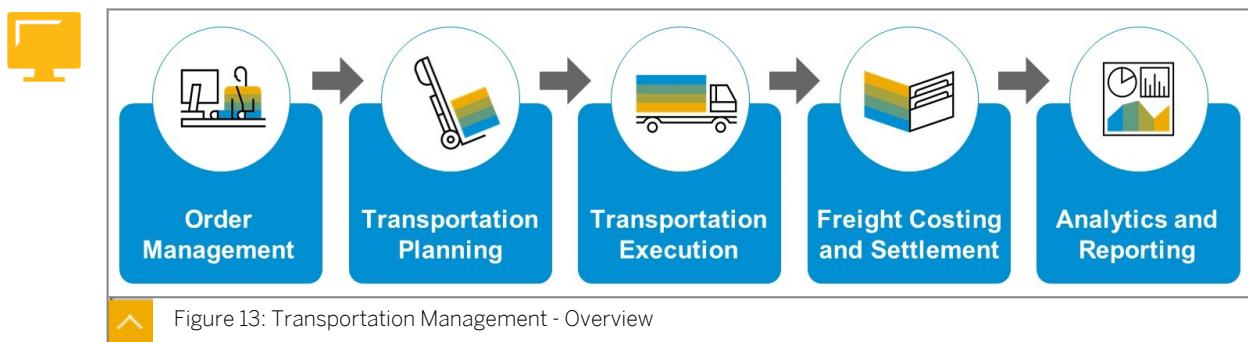
The benefits derived from using SAP TM include the following:

- Reduced costs and improved operational performance
- Improved carrier collaboration and resource utilization
- Efficient end-to-end order and process management
- Efficient logistics and fulfillment processes
- Improved execution visibility and responsiveness

In many cases, responsibility does not end by executing the shipment. Often, strategic contracts require that the shipments are traced, to provide visibility so that you can recognize and react to potential delays that could jeopardize customer service. This information is not often made available to ERP systems, whose concern is more finance-driven than service-driven. Depending upon the type of products that are being transported to different countries, compliance with regional regulations regarding dangerous goods needs to be reviewed and adhered to.

With SAP TM, existing SAP ERP customers can achieve integrated order processing and management. SAP TM is delivered with out-of-the-box integration, with order-to-cash and procure-to-pay scenarios to support timely execution updates. In addition, integrated freight settlement with SAP ERP billing and invoicing is available for customers who want to increase the speed at which business process cycles are executed. Additional planning features are available to support comprehensive order management. This includes forwarding, freight (land), and booking (sea and air) order and intermodal scenarios. This integrated environment provides full document flow and order lifecycle management, as well as a centralized order data management tool for planning, tendering, and so on.

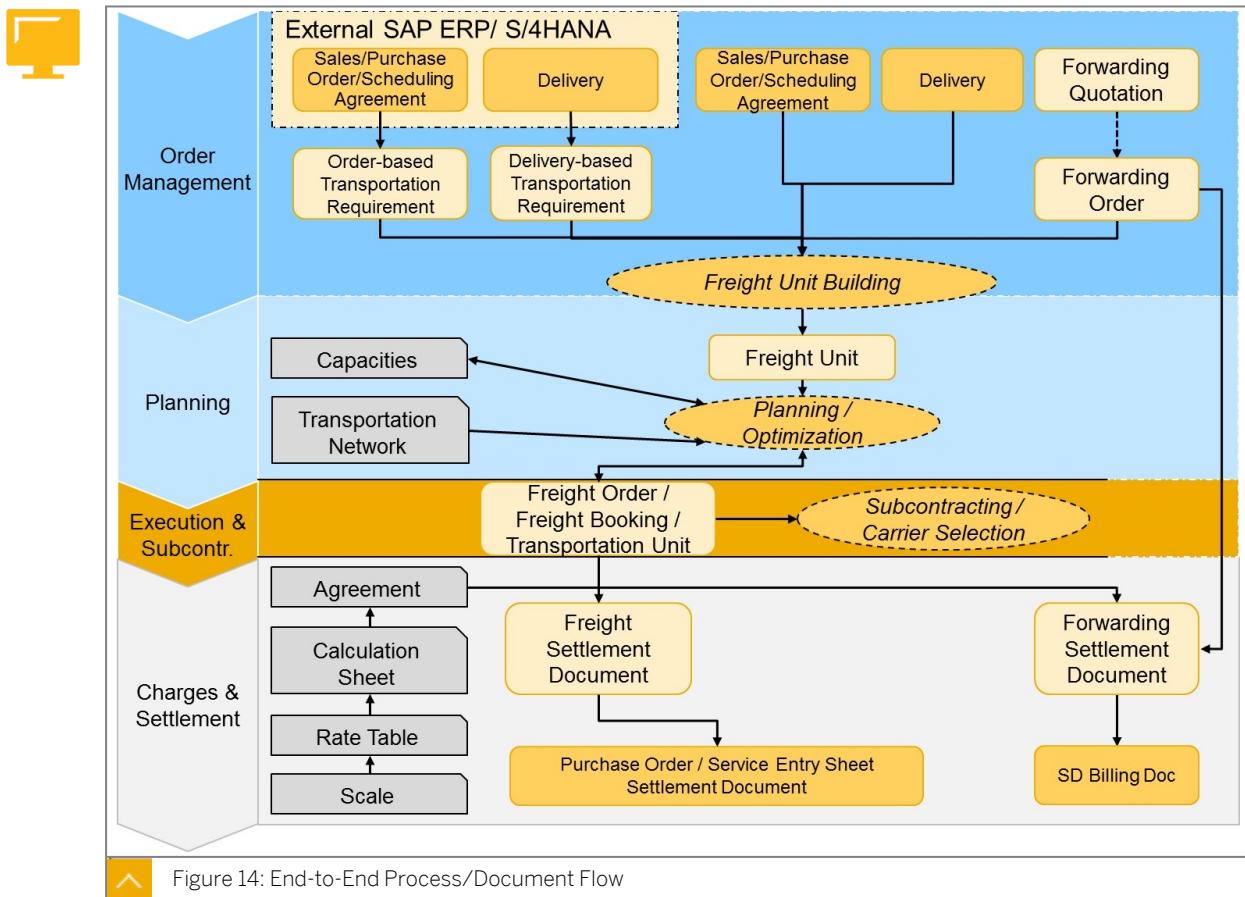
Transportation Management - Overview



A typical transportation process starts with order management. Order management is the process of creating a transportation requirement. Transportation requirements can be sales orders, purchase orders, deliveries, and so on. In a second step, these transportation requirements are planned. SAP TM offers manual planning functions, optimizer planning, and semi-automated processes (transportation proposal creation). Different aspects of planning supported by SAP TM are means-of-transport selection (for example, rail versus road), carrier selection based on real carrier rates, load optimization (3D-planning of container/truck utilization). Once the planning process is finished, SAP TM also supports the execution of transports. Execution includes delivery creation, document creation (print or electronic, like waybills), event management integration (track and trace), as well as warehouse integration (EWM integration). If you do not operate your own fleet, you need to make sure that the external carrier is paid for their services. SAP TM allows you to maintain freight agreements, calculation sheets, and rate tables to accurately define real carrier costs, which can be used for charge calculation (already in the planning phase, carrier selection), but also for settlement processes after the transport has been executed. Analytics and reporting functionalities complete the available functions of SAP TM.

End-to-End Transportation Processes

Transportation Management - Object Overview



The figure, End-to-End Process/Document Flow, gives an overview of the SAP TM document model. Depending upon the extent of your integration and business requirements, different objects, documents and statuses are available. Different types of transportation requests can be created in SAP TM by the execution or order management system. The documents that are the basis for freight unit creation depend on your business scenario and deployment of SAP TM, as follows:

- If you are a shipper and you have deployed SAP TM in a side-by-side scenario, (sales/purchase) orders from your SAP ERP or SAP S/4HANA system are the basis for order-based transportation requirement creation in SAP TM.
- If you are a shipper and you have deployed SAP TM in a side-by-side scenario, (outbound/inbound) deliveries from your SAP ERP or SAP S/4HANA system are the basis for delivery-based transportation requirement creation in SAP TM.
- If you are a shipper and you have deployed SAP TM in an embedded scenario, (sales/purchase) orders from your SAP S/4HANA system are directly the basis for freight unit creation in SAP TM (no replication of data required).
- If you are a shipper and you have deployed SAP TM in an embedded scenario, (outbound/inbound) deliveries from your SAP S/4HANA system are directly the basis for freight unit creation in SAP TM (no replication of data required).

- If you are a logistics service provider/forwarder, you create forwarding orders in SAP TM directly (or based on forwarding quotations).

Upon receiving transportation requirements, freight units are created and become the basic element for planning the movement of goods through the network. The freight unit is a transport unit used in planning. It could be a pallet or container, but it could also be two pallets that need to be transported together, for example, for customs reasons.

Freight orders will record the manual or system-generated transportation planning (intermodal) activities. These freight orders are the result of planning, consolidation of freight units on a vehicle, booked capacity, or scheduled means of transport. Once freight orders are created, carriers are assigned. Once this has been completed, transport order execution can be triggered and follow-on settlement processing can begin.

Order Management

The business purpose of order management is providing the ability to handle transportation requests, which are designated as requirements or demands from an ordering system.

One of the major benefits of SAP TM is the ability to use the system integrated to SAP ERP or SAP S/4HANA as the source demand system ("side-by-side") or as a component within SAP S/4HANA ("embedded"). So you can see the flexibility with SAP TM from an order management standpoint. If you choose to integrate with an SAP ERP or SAP S/4HANA system, SAP TM would be integrated by means of Process Integration (PI) interfaces. Orders and deliveries from SAP ERP or SAP S/4HANA can be converted into SAP TM transportation requirements automatically. LSP forwarding order creation is either done by manual entry in the SAP TM UI, or integrated from a customer's system via EDI.

You can use the Forwarding Order Management component in SAP TM to create, edit, and confirm the forwarding orders from your ordering parties. In addition to creating the forwarding order, you can also enter the data as a forwarding quotation and send it to the ordering party. You can then create a forwarding order based on the forwarding quotation.

Transportation Planning

You can use the Freight Order Management component in SAP Transportation Management to create and edit freight orders and freight bookings. You use freight orders for land transportation and you use freight bookings for sea and air transportation.

Freight orders and bookings are the result of transportation planning.

One of the major benefits of SAP TM is the ability to perform advanced planning activities. SAP TM has been developed as a planning and execution system desired to support transportation-related activities for several different industries. Some of the planning processes delivered with SAP TM are as follows:

- Vehicle Scheduling and Route Optimization
- Load Consolidation
- Load Planning
- Carrier Selection
- Freight Tendering

Transportation Execution

In addition to advanced planning capabilities in SAP TM, your organization can also gain the added benefit of integration execution activities in SAP TM.

These integration tasks include the following:

- Integration with SAP Event Management (EM) for alerts and transportation tracking
- Trigger generation of delivery documents
- Integration with dangerous goods management
- Document printing
- Integration with SAP Extended Warehouse Management (EWM)
- Realtime analytics

Charges and Settlement

When working with customers or subcontractors, it may be necessary to collect or pay fees in relation to the movement of products. With SAP TM, it is possible to introduce a settlement process in addition to planning and execution activities. The settlement process supports the following tasks:

- Ability to define transportation charges
- Definition of freight or forwarding agreements
- Generation of settlement documents
- Posting of settlement documents and purchase order / service-entry-sheet generation
- Cost distribution
- Customer billing



LESSON SUMMARY

You should now be able to:

- Describe the capabilities of SAP Transportation Management
- Describe the end-to-end transportation processes

Explaining Basic and Advanced Transportation Management (TM)



LESSON OBJECTIVES

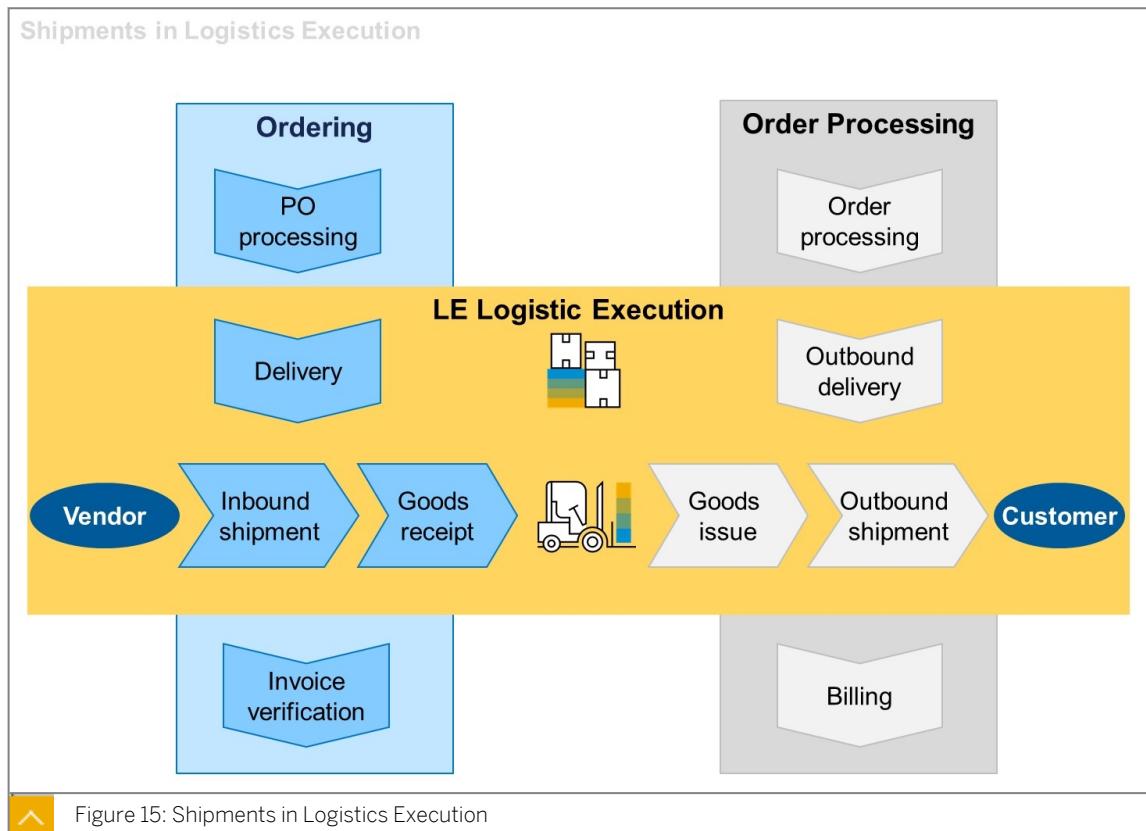
After completing this lesson, you will be able to:

- Explain how LE-TRA relates to basic shipping
- Describe the differences between basic shipping and advanced transportation management

How LE-TRA Relates to TM

Logistics Execution provided you with functions for the entire logistic processing (warehouse management, shipping processes, and transportation processes), available to you as part of SAP Enterprise Resource Planning (SAP ERP).

Shipments in Logistics Execution



Transportation (or shipment) is an essential element in the logistics chain. It affects both incoming and outgoing goods. Effective transportation planning and processing ensure that

shipments are dispatched without delay and arrive on schedule. Transportation costs play an essential role in the calculation of the price of a product. It is important to keep these transportation costs to a minimum so that the price of a product remains competitive. Efficient transportation planning and processing helps to keep these costs down.

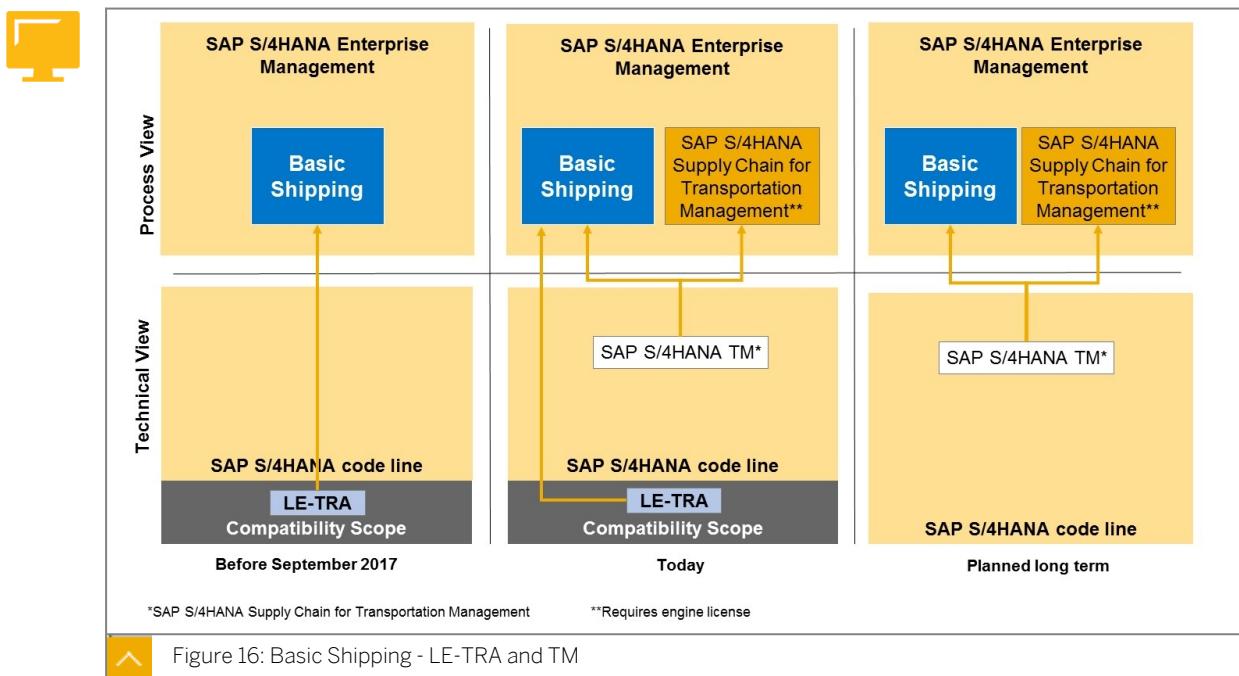
Effective transportation processing is required so that deliveries are shipped on time and are received on schedule at the customer's site. SAP ECC provides essential functions for transportation and shipment cost processing for goods issues and goods receipts.

Inbound shipments are an integral part of the process chain in procurement and are processed based on inbound deliveries.

The basis of the procurement process is the purchase order. This is followed by confirmation of the delivery by the vendor. The inbound delivery is created with reference to the purchase order. The inbound delivery is the basis for creating the inbound shipment, that is, the shipment of the ordered goods from the vendor to the company's plant. Goods receipt is then posted. Invoice verification completes the purchasing process.

Outbound shipments are part of the Sales and Distribution (SD) process and are processed based on outbound deliveries. The basis of the Sales and Distribution process is the sales order. The subsequent document is the outbound delivery, which documents the shipping of the goods. The outbound delivery is the basis for creating the outbound shipment, that is, the shipment of the goods from the company's plant to the customer. The goods issue is then posted and the invoice is created.

Basic Shipping - LE-TRA and TM



The software component LE-TRA that provided transportation-related content in SAP ECC is part of the compatibility scope (SAP Note 2269324 – Compatibility Scope Matrix for SAP S/4HANA on-premise). That means, its code line is kept within SAP S/4HANA Enterprise Management until the end of 2025. The functionality offered from this component is called basic shipping.

Basic shipping is a defined collection of business processes relevant for shipping within SAP S/4HANA Enterprise Management. The processes can be implemented with SAP S/4HANA release 1511 with LE-TRA and used until end of life of the compatibility scope. The main

functions of LE-TRA will eventually be replaced with the Transportation Management functions within SAP S/4HANA Enterprise Management. Due to the development of the freight processes in Transportation Management, the functions might have been realized differently than they did in LE-TRA. It is planned that the processes can be implemented with selected functions of SAP S/4HANA TM.

From SAP S/4HANA 1709, Transportation Management becomes part of S/4HANA Enterprise Management. It offers a much more comprehensive and sophisticated functionality in the domain of transportation. Use of its advanced functions require an additional license. However, it can also be used with limited scope, that is, offering the same capabilities that have been offered by LE-TRA. Use within this limited scope does not require a specific license.

Both technical applications are independent of each other and can then be used next to each other on the same SAP S/4HANA database instance. They have no data exchange/integration within the shipping process. Long term, the collection of basic shipping processes will only be realized by using selected functions of SAP S/4 HANA TM. The shipment from LE-TRA will be replaced by the freight order from SAP TM.

This course will focus primarily on advanced transportation functionality. A separate course dealing with basic shipping scope is available with course code S4611.

Differences Between Basic Shipping and Advanced Transportation

Comparison of Basic Shipping and Advanced Transportation



Advanced TM addresses not only the shipping industries, but also freight forwarders. It allows early planning based on orders (sales orders, purchase orders, MM scheduling agreements) in addition to planning based on deliveries (outbound and inbound), which is the only option in basic shipping. Combined planning of inbound and outbound deliveries within one freight order is allowed in the advanced transportation option. Sophisticated planning and optimization options in the domain of vehicle scheduling and routing, carrier selection, load consolidation and load planning are key differentiators between advanced transportation and basic shipping.

Detailed Description of Functional Difference

Sources of information, whether specific functionality relates to basic shipping or advanced transportation scope, is defined in the SAP S/4HANA 1909 Feature Scope Description document.

Basic shipping is defined as follows:

Transportation Management in SAP S/4HANA supports the entire transportation chain. You can manage the transportation demands by planning, tendering, and settlement of freight processes. Also, you can book carriers in accordance with the requirements of hazardous goods. Transportation Management supports the following end-to-end processes:

- Domestic and international transportation for the shipper industry
- Inbound and outbound freight management

Advanced Transportation Management is defined as follows:

Advanced Transportation Management (TM) in SAP S/4HANA supports the entire transportation chain. You can manage the transportation demands by planning, optimizing, tendering, subcontracting, and settlement of freight processes. Also, you can book carriers in accordance with the requirements of international trade and hazardous goods. TM supports the following end-to-end processes:

- Domestic and international transportation
- Inbound and outbound freight management based on sales orders, purchase orders, deliveries, stock transport orders, and returns
- Embedded analytics and key performance indicators for real-time performance visibility

Furthermore, SAP note [2868497](#) provides a detailed overview and comparison between LE-TRA, basic shipping TM and advanced transportation management scope.

Best Practice Scenarios

Best practices have been defined for the implementation of basic shipping scenarios. The following notes describe the details:

- [2563537](#) - SAP Best Practices for S/4HANA Supply Chain for Transportation Management – Outbound Transportation (Basic Shipping Scenario) 1709
- [2563425](#) - SAP Best Practices for S/4HANA Supply Chain for Transportation Management – Stock Transport Orders (Basic Shipping Scenario) 1709
- [2606349](#) - SAP Best Practices for S/4HANA Supply Chain for Transportation Management – Inbound Transportation (Basic Shipping Scenario) 1709
- [2632695](#) - SAP Best Practices for S/4HANA Supply Chain for Transportation Management – Combination of Inbound and Outbound Transportation (Integrated Transportation Management) 1709
- [2849562](#) - SAP Best Practices for S/4HANA Supply Chain for Transportation Management – Outbound Transportation (Basic Shipping Scenario) 1809
- [2849539](#) - SAP Best Practices for S/4HANA Supply Chain for Transportation Management – Inbound Transportation (Basic Shipping Scenario) 1809

- [2849584](#) - SAP Best Practices for S/4HANA Supply Chain for Transportation Management – Combination of Inbound and Outbound Transportation (Integrated Transportation Management) 1809



LESSON SUMMARY

You should now be able to:

- Explain how LE-TRA relates to basic shipping
- Describe the differences between basic shipping and advanced transportation management

Learning Assessment

1. What is included in SAP S/4HANA Enterprise Management?

Choose the correct answers.

- A A new ERP system
- B An SAP HANA database
- C Embedded SAP SuccessFactors
- D Embedded SAP APO

2. What are the deployment options of SAP S/4HANA?

Choose the correct answers.

- A On premise
- B SAP S/4HANA Cloud, extended edition
- C SAP S/4HANA Cloud, essentials edition
- D On desk

3. Which of the following are the main functional areas of SAP Transportation Management?

Choose the correct answers.

- A Order Management
- B Transportation Planning
- C Transportation Execution
- D Charges and Settlement

4. Which of the following are valid deployment options for SAP TM?

Choose the correct answers.

- A SAP ERP to SAP TM ("side-by-side")
- B SAP ERP to SAP S/4HANA TM ("side-by-side")
- C SAP S/4HANA to SAP S/4HANA TM ("side-by-side")
- D SAP S/4HANA to SAP TM ("side-by-side")
- E SAP S/4HANA ("embedded")

5. Which functions are part of the basic shipping scope?

Choose the correct answers.

- A Delivery-based planning
- B Order-based planning
- C Manual carrier selection
- D Automatic carrier selection using the optimizer

6. Which documents are relevant for the basic shipping scope using SAP S/4HANA Supply Chain for Transportation Management?

Choose the correct answers.

- A Shipment
- B Sales Order
- C Outbound Delivery
- D Freight Order

Learning Assessment - Answers

1. What is included in SAP S/4HANA Enterprise Management?

Choose the correct answers.

- A A new ERP system
- B An SAP HANA database
- C Embedded SAP SuccessFactors
- D Embedded SAP APO

Correct. There is no embedded SAP Success Factors or SAP APO (although there is embedded PP/DS from SAP APO). Yet, it provides a new ERP system based on an SAP HANA database.

2. What are the deployment options of SAP S/4HANA?

Choose the correct answers.

- A On premise
- B SAP S/4HANA Cloud, extended edition
- C SAP S/4HANA Cloud, essentials edition
- D On desk

Correct. There is no "on desk" version of SAP S/4HANA. It can be deployed on premise or via cloud (extended or essentials edition).

3. Which of the following are the main functional areas of SAP Transportation Management?

Choose the correct answers.

- A Order Management
- B Transportation Planning
- C Transportation Execution
- D Charges and Settlement

Correct. The four main functional areas of SAP Transportation Management are: Order Management, Transportation Planning, Transportation Execution, and Charges and Settlement.

4. Which of the following are valid deployment options for SAP TM?

Choose the correct answers.

- A SAP ERP to SAP TM ("side-by-side")
- B SAP ERP to SAP S/4HANA TM ("side-by-side")
- C SAP S/4HANA to SAP S/4HANA TM ("side-by-side")
- D SAP S/4HANA to SAP TM ("side-by-side")
- E SAP S/4HANA ("embedded")

Correct. You can deploy SAP TM either embedded or side-by-side. For side-by-side deployments all combinations of SAP ERP / SAP S/4 HANA to SAP TM / SAP S/4HANA TM are allowed.

5. Which functions are part of the basic shipping scope?

Choose the correct answers.

- A Delivery-based planning
- B Order-based planning
- C Manual carrier selection
- D Automatic carrier selection using the optimizer

Correct. Delivery-based planning and manual carrier selection are part of the basic shipping scope. Order-based planning and automatic carrier selection using the optimizer are part of advanced transportation management.

6. Which documents are relevant for the basic shipping scope using SAP S/4HANA Supply Chain for Transportation Management?

Choose the correct answers.

- A Shipment
- B Sales Order
- C Outbound Delivery
- D Freight Order

Correct. Outbound deliveries and freight orders are documents required for the basic shipping process in SAP S/4HANA Supply Chain for Transportation Management. Sales orders are not relevant, because the basic shipping process covers only delivery-based planning and the shipment is an object used within LE-TRA, but not within SAP S/4HANA Supply Chain for Transportation Management.

UNIT 2

New User Experience - Working with SAP TM

Lesson 1

Describing the SAP Fiori UX Strategy

31

Lesson 2

Using Worklists in SAP TM

37

UNIT OBJECTIVES

- Describe the SAP UX strategy based on SAP Fiori
- Explain the elements of personalization within SAP Fiori
- Describe the screen layout of worklists
- Create a query to filter transportation requirements

Unit 2

Lesson 1

Describing the SAP Fiori UX Strategy



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe the SAP UX strategy based on SAP Fiori
- Explain the elements of personalization within SAP Fiori

SAP Fiori UX

SAP Fiori provides a consistent and holistic user experience for SAP software. By creating visually pleasing designs with a strong focus on ease of use, the experience is intuitive and simple, across all devices. With effortless interaction patterns, the SAP Fiori UX is designed for a powerful impact across your enterprise.

SAP S/4HANA Will Run Your Business Different than Before



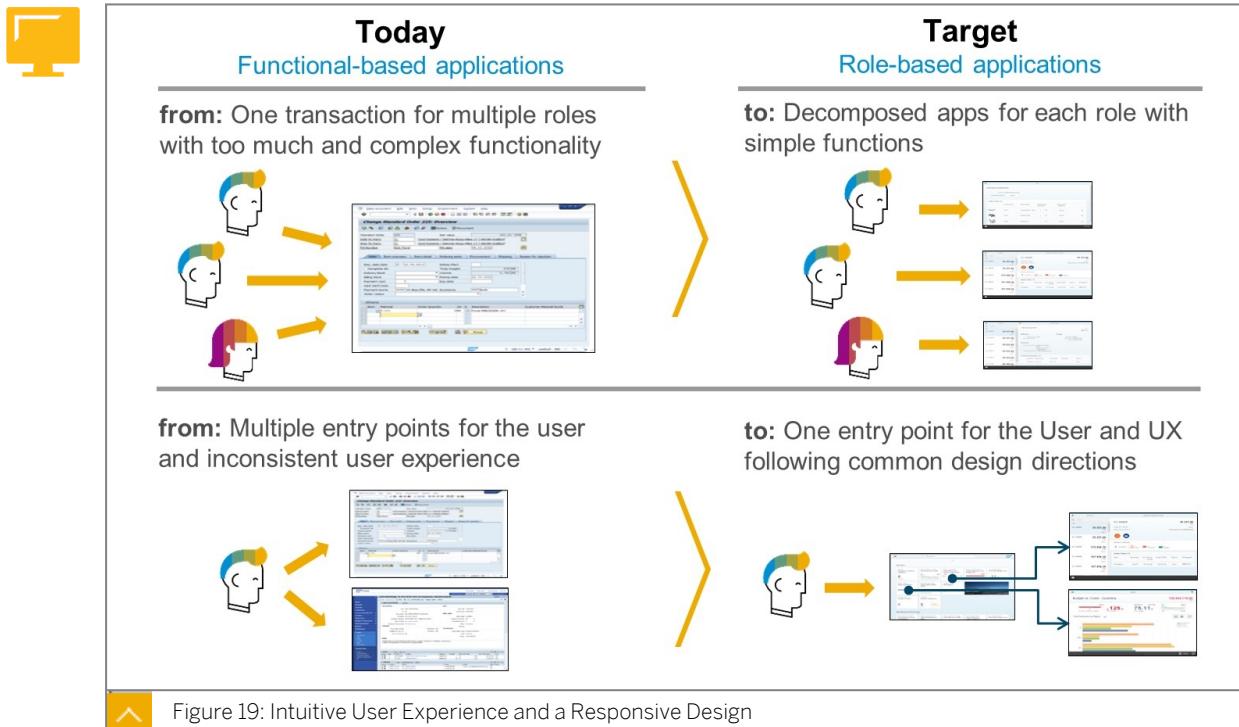
Figure 18: SAP S/4HANA Will Run Your Business Different than Before

Based on SAPUI5 technology, SAP Fiori focuses strongly on users and the way they work. It allows users to concentrate on core tasks while still keeping track of activities in other areas. Improvements to the existing SAP Fiori launchpad allow the user a higher degree of flexibility and guidance supported by machine learning and artificial intelligence.

These improvements include the enhanced discovery and navigation features, the opening up of surface interaction via the viewport, access to action-oriented personal notifications, improved collaboration using the SAP CoPilot, and much more.

SAP CoPilot is your digital assistant and bot-integration hub for the enterprise. Interact with your business apps through one single interface by talking or typing. Get your work done quickly on mobile, desktop, iOS, and external channels.

Intuitive User Experience and a Responsive Design



SAP Fiori offers a state-of-the-art web UI, based on HTML5 and UI5 (SAP technology) and provides capabilities to personalize the screen. SAP Fiori provides technology that creates the right screens for the new end users. SAP Fiori design principles make it possible to adjust the screens to every front-end device and adopt it automatically to future design principles. This ensures that screens are always state of the art.

SAP Fiori is also a development and design principle for SAP. For example, the screens are role-based, and will be designed and adapted to the needs of the end user of this particular role. This capability puts the user at the center of the business process. With this principle, we ensure that the software is not targeting a "neutral individual" that enters all information into one screen, but that the software is aware of the business context - that is, the tasks and the exceptional situation the user is working in. As a result, it provides all the relevant information that the user needs to perform the tasks.

The terms user interface (UI) and user experience (UX) stand for two different ways of thinking.

UI, from a software perspective, describes the interaction between humans and devices, and aims at maximum efficiency during use.

UX takes on the perspective of the end user, and aims at motivation and emotion, not only during use, but also before and after. UX tries to achieve a sustainably positive attitude for the user. It also tries to create a motivating experience.

Target - Unified UX Direction for All SAP Software

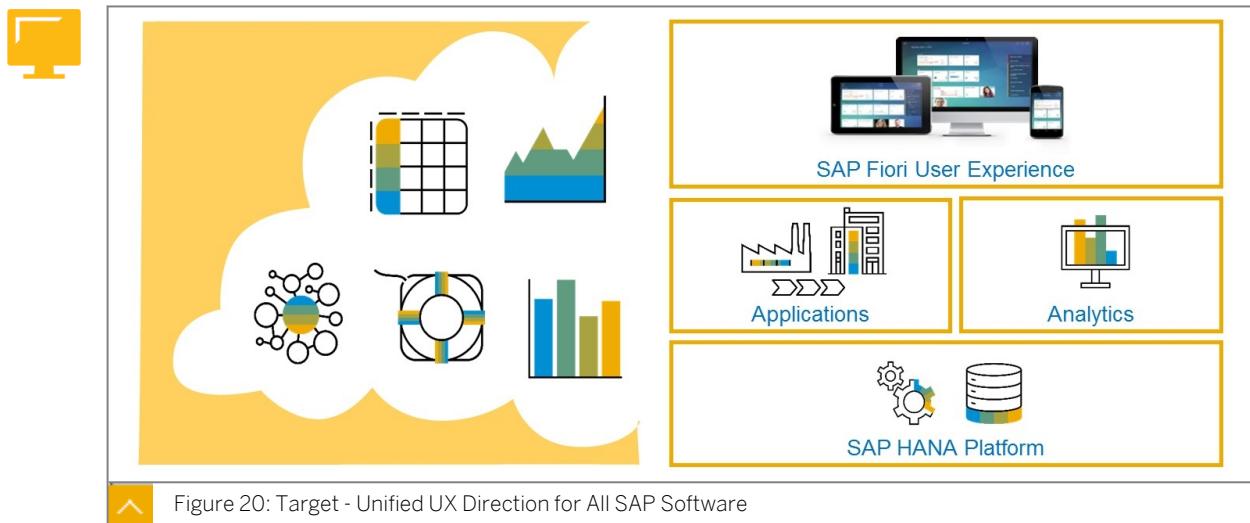


Figure 20: Target - Unified UX Direction for All SAP Software

The long-term goal of the SAP UX strategy is to offer all business and all analytic applications on SAP HANA with SAP Fiori as the unified UI.

SAP Fiori Dimensions

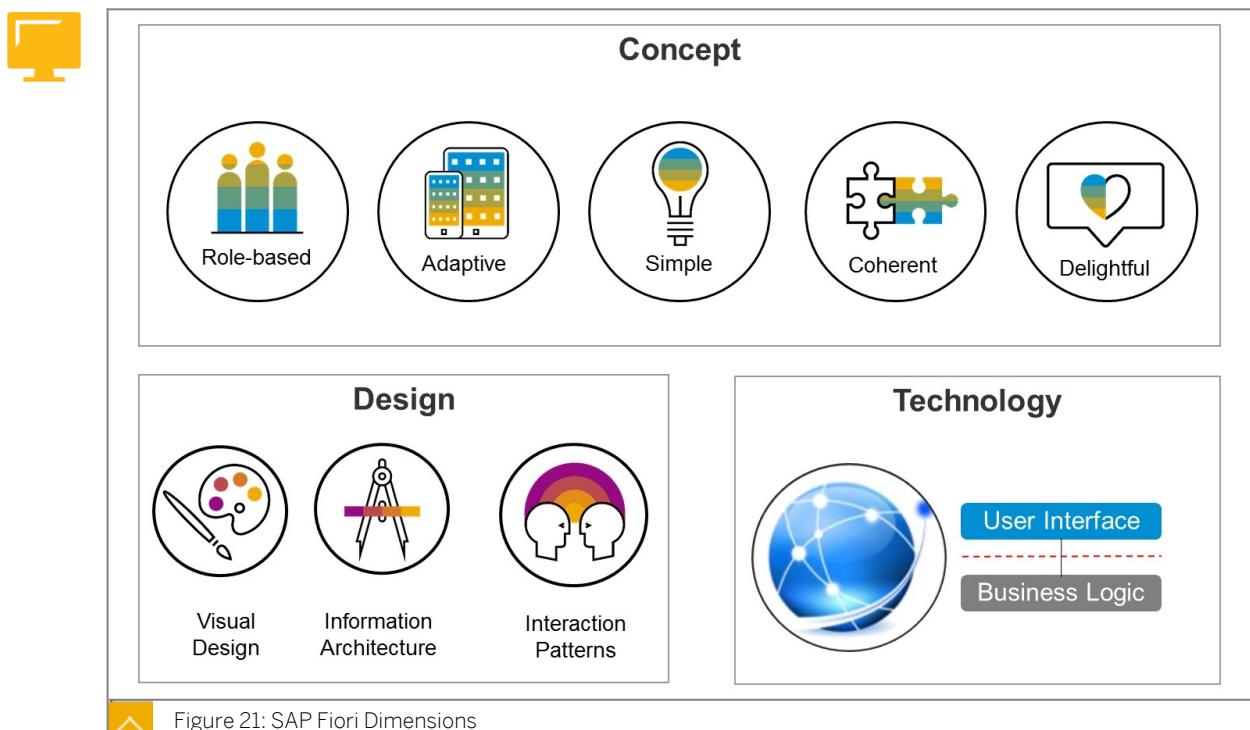
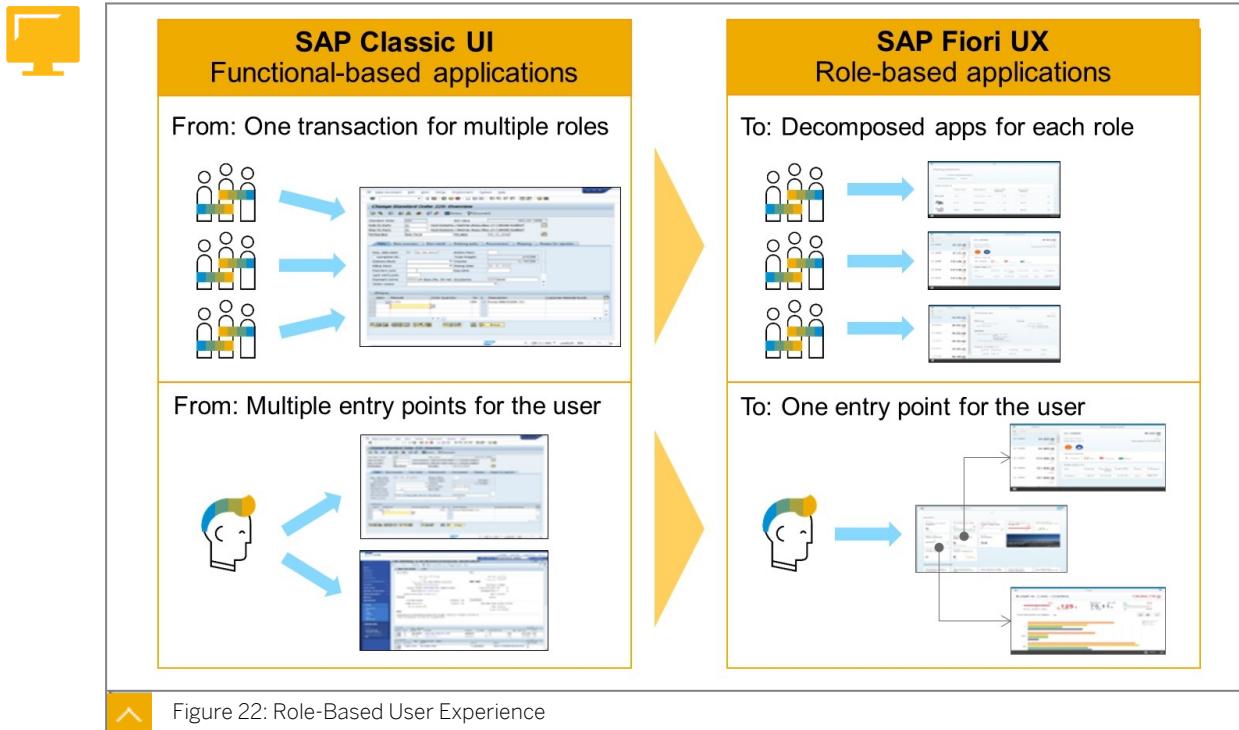


Figure 21: SAP Fiori Dimensions

The three dimensions that define SAP Fiori are Design, Concept, and Technology. In each dimension, rules and guidelines starting with optics, handling, interactions, and architectures up to technologies in development and system landscape are in place to set the definition of SAP Fiori.

Personalization in SAP Fiori

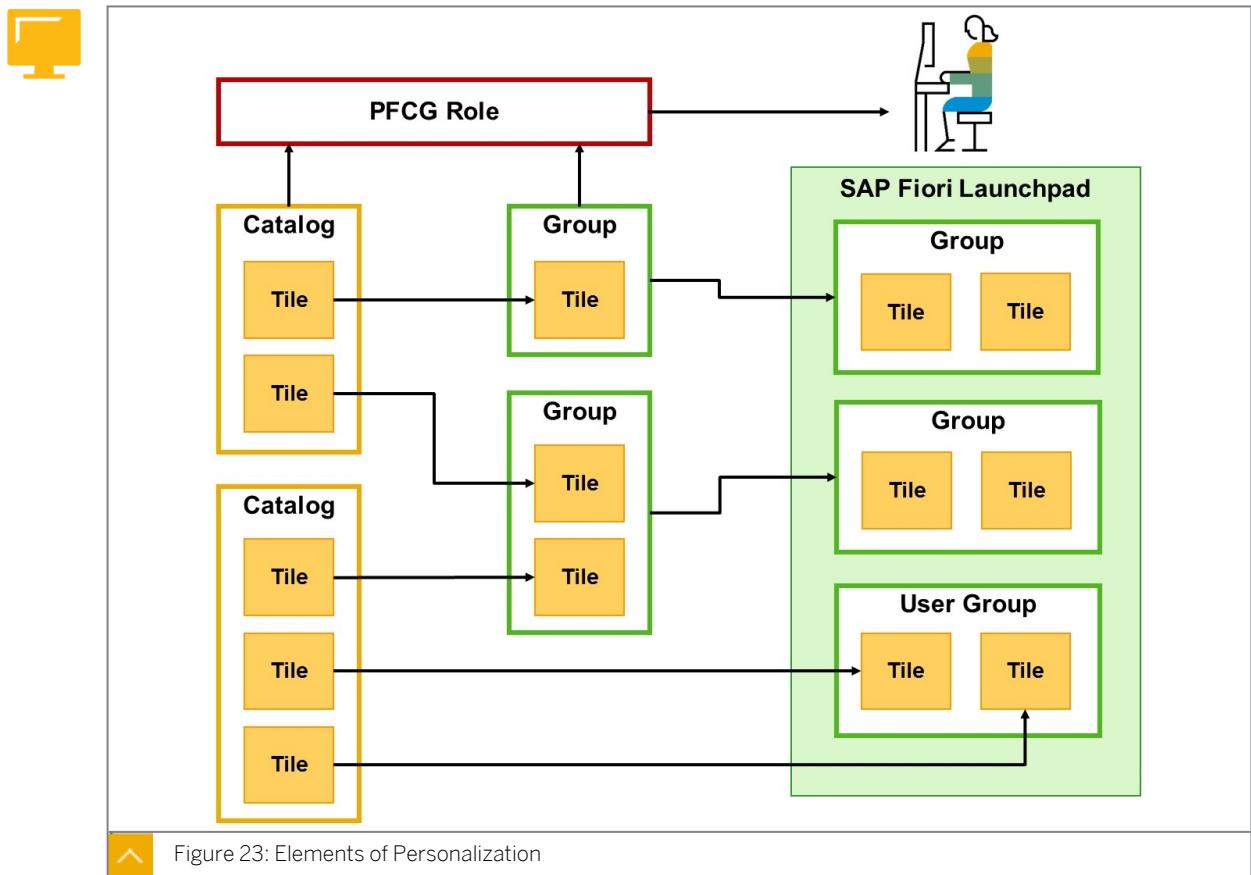
Role Based User Experience



A role-based user experience means that end users only get all the information and functions they need for their daily work. They do not receive unnecessary information. The classic SAP user interface (UI) offers a single complex transaction for many user roles. The tasks of a single user then make it necessary to use multiples of these transactions, or additional applications.

SAP Fiori decomposes these big transactions in several discrete apps suiting the user roles. All apps are connected to each other, so all tasks of the transaction are still possible but are only performed if the user really wants. The SAP Fiori launchpad then serves as the central entry point for all apps of a user.

Elements of Personalization



The end users can personalize their own variant of the SAP Fiori launchpad. Besides general settings like language, they can rearrange groups and tiles, create new groups, and add or delete tiles to or from an existing group.

Tiles are organized in catalogs in the system. These catalogs hold all technical information to start an application. To show a tile in the SAP Fiori launchpad, it must be embedded in a group. Groups can be created centrally in the system and then added to the launchpad, or the user creates his or her own group and adds tiles from catalogs.

All SAP Fiori apps utilize the SAPUI5 and SAP Gateway technologies. The three types of SAP Fiori apps differentiate in the following ways (in terms of usage of additional technologies):

- Transactional Apps
 - Use of ABAP to provide the classic approach for functions of a business system.
 - Available for SAP S/4HANA and SAP Business Suite on any DB.
- Analytical Apps
 - Use of analytical capabilities of SAP HANA to provide insights in business data.
 - Available for SAP S/4HANA and Business Suite on SAP HANA.
- Fact Sheet Apps
 - Use of Enterprise Search capabilities of SAP HANA to provide search results.

- Available for SAP S/4HANA and Business Suite on SAP HANA.

SAP Fiori - Useful Transactions and Links



SAP Fiori: Useful Transactions and Links

- Fiori Launchpad (FLP):
 - Link: <https://<host>:<port>/sap/bc/ui2/fip>
 - Front End Server Transaction: /UI2/FLP
- Fiori Launchpad Designer (FLPD):
 - Front End Server Transaction: /UI2/FLPD_CUST (per client)
 - Front End Server Transaction: /UI2/FLPD_CONF (system wide)
- Development Environment SAP Web IDE: <http://<system>:<port>/sap/hana/ide>
- SAP Fiori apps reference library: <http://www.sap.com/fiori-apps-library>
- SAP Fiori Demo Cloud Edition: <https://www.sapfioritrial.com>
- SAP Fiori Design: <https://experience.sap.com/fiori-design/>
- Theme designer on SAP HANA Cloud Platform (Trial):
<https://themedesigner-themedesigner.dispatcher.hanatrial.ondemand.com/>
(Prerequisites, installation, and configuration is available in the SAP Note 1852400)



Figure 24: SAP Fiori - Useful Transactions and Links

This figure, SAP Fiori - Useful Transactions and Links, gives you an overview of valuable transactions in terms of SAP Fiori, and links to further information.



LESSON SUMMARY

You should now be able to:

- Describe the SAP UX strategy based on SAP Fiori
- Explain the elements of personalization within SAP Fiori

Unit 2

Lesson 2

Using Worklists in SAP TM



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe the screen layout of worklists
- Create a query to filter transportation requirements

Worklists in SAP TM

SAP Fiori Apps in Transportation Management



Figure 25: SAP Fiori Apps in Transportation Management

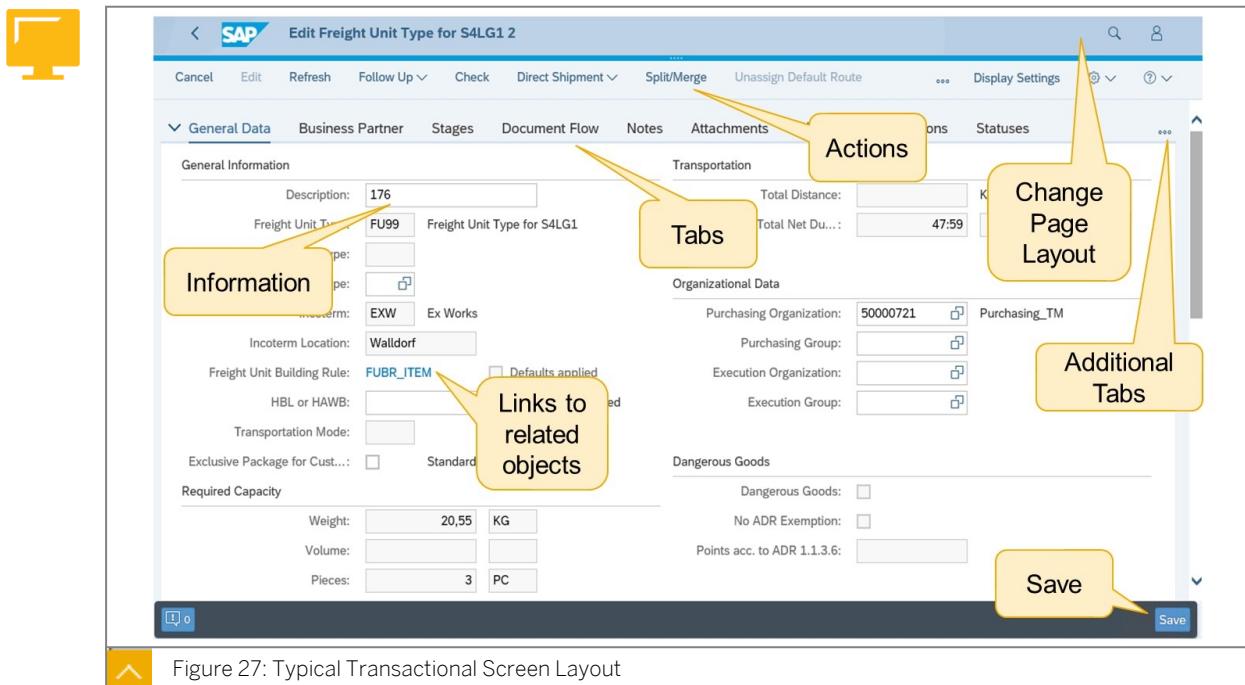
User interaction in SAP TM is based on SAP Fiori apps. SAP Fiori apps can be grouped and triggered via a tile or link, or (when not displayed in your menu structure), via the search function. There are several apps relating to worklists for the various documents/objects available in SAP TM. User interaction via worklists is a central use case.

Personal Object Worklists



One of the more flexible tools available to users in SAP TM is the personal object worklist. The personal object worklist provides central, personalized access to document lists. It gives users a portal-based interface that they can use to define (and optionally store) queries in a similar way they are used to from SAP ERP selection screen variants. This tool allows users to easily access queries, and create, change, delete, or categorize queries. Application-related buttons provide object-based functions. The data table can be filtered and other settings applied. Users can personalize the data table and refresh a single query or all queries. The user sees the very latest information thanks to a high performance refreshing and caching mechanism. Updates run asynchronously and worklists remain available until the results are refreshed.

Screen Layout in SAP TM



In a typical transactional screen layout, the main part of the page is dedicated to information. The information is organized into different tabs, which the user can choose from. The actions allowed for a specific document with a certain status are displayed as buttons on top of the tabs. Additional tabs or additional actions are hidden underneath the three dots in the actions/tab row respectively. Like in all SAP Fiori applications, the action to finish/complete a transaction (typically this is save) can be found in the lower-right corner of the screen.



LESSON SUMMARY

You should now be able to:

- Describe the screen layout of worklists
- Create a query to filter transportation requirements

Learning Assessment

1. Which of the following characteristics apply to SAP Fiori launchpad?

Choose the correct answers.

- A It requires Google Chrome as a browser.
- B It can be used side-by-side with other UIs.
- C It can be personalized.
- D It is role-based.

2. Which of the following are options within worklists in SAP TM?

Choose the correct answers.

- A Filtering and sorting.
- B Creation and change of existing queries.
- C Switch between different views.
- D Quick criteria maintenance.

Learning Assessment - Answers

1. Which of the following characteristics apply to SAP Fiori launchpad?

Choose the correct answers.

- A It requires Google Chrome as a browser.
- B It can be used side-by-side with other UIs.
- C It can be personalized.
- D It is role-based.

Correct. Google Chrome is not mandatory. But you can personalize it and use it with other UIs. Moreover, of course, it is role-based.

2. Which of the following are options within worklists in SAP TM?

Choose the correct answers.

- A Filtering and sorting.
- B Creation and change of existing queries.
- C Switch between different views.
- D Quick criteria maintenance.

Correct. You can create new queries and change existing queries. You can use filtering and sorting within a query and switch between different views. Furthermore, you can use the quick criteria maintenance to refine your selection.

UNIT 3

Transportation Management Master Data and Configuration

Lesson 1

Creating Business Partners

45

Lesson 2

Creating the Transportation Network

49

Lesson 3

Evaluating the Organizational Structures Used in SAP TM

67

Lesson 4

Defining Conditions and Freight Incompatibilities

75

UNIT OBJECTIVES

- Explain the role of business partners
- Create business partners for customers and carriers
- List the master data elements that define the transportation network
- Create locations, transportation zones, and transportation lanes
- Explain the concept of the scenario builder
- Explain the purpose of organizational structures
- Control outbound freight using organizational structures
- Control Forwarding Orders (FWOs) using organizational structures
- Evaluate an organization for planning and execution structures
- Maintain the link between MM/SD organizations and SAP TM organizations
- Determine the conditions used to customize a business process
- Display a condition or restriction
- Examine how incompatibilities can be used to control the outcome of business processes
- Dangerous goods restrictions modeled as incompatibilities

Creating Business Partners



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Explain the role of business partners
- Create business partners for customers and carriers

Business Partners

SAP TM can be integrated into SD and MM processes and use corresponding master data (customer, vendor, material). Some examples of business scenarios where SAP TM is integrated with these components are as follows:

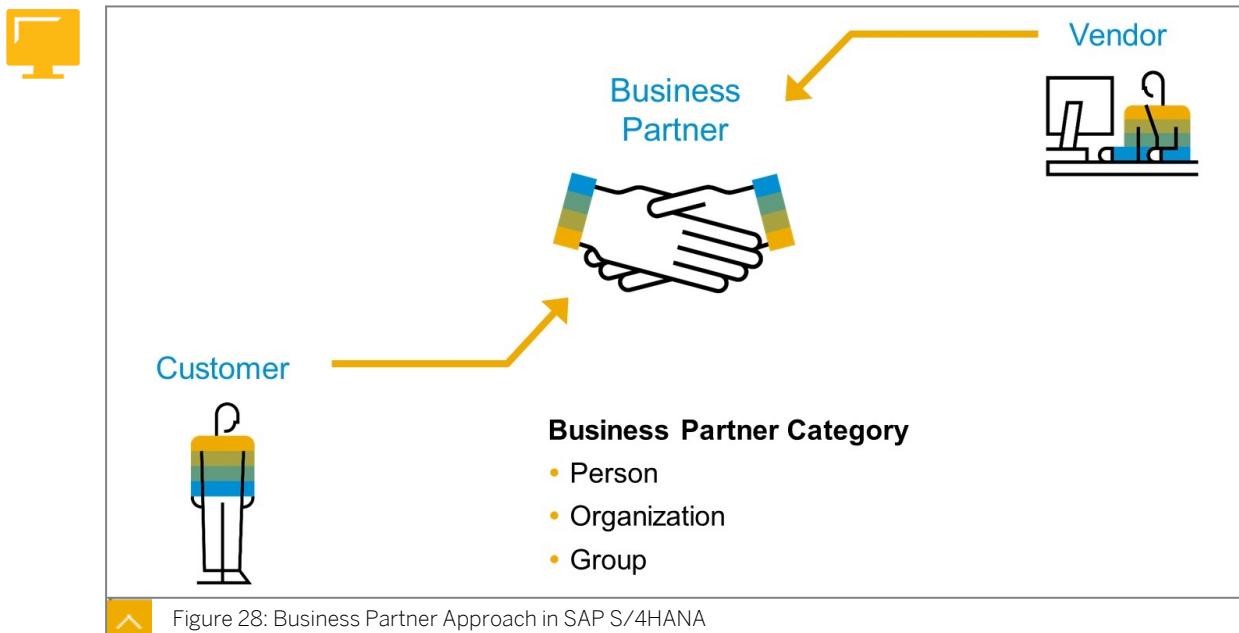
- Domestic/international outbound transportation:

In these scenarios, outbound delivery integration is initiated from SD, as a shipper needs to perform transportation activities with SAP TM. Delivery integration is the key to this process. Thus, master data for customers, plants, shipping points, and material master data has to be available to SAP TM to support consistency between planning and execution.

- Domestic/international inbound transportation:

In this scenario, SAP TM is integrated with MM and the process is triggered by inbound delivery integration. Consequently, master data like vendors, plants, shipping points, and material master data needs to be available to plan and execute the SAP TM processes.

Business Partner Approach in SAP S/4HANA



There are redundant object models in the traditional SAP ERP system where the vendor master and customer master are used. The (mandatory) target approach in SAP S/4HANA is the business partner approach. Using this approach, it is possible to centrally manage master data for customers and vendors. Business partners can be categorized as a person, group, or organization (legal person or part of a legal entity, for example, department). An organization represents units such as a company, a department of a company, or an association. Organization is an umbrella term to map every kind of situation in the day-to-day business activities. A group represents a shared living arrangement, a married couple, or an executive board.

Business partners represent a person, organization, group of persons, or group of organizations in which a company has a business interest. This business object is used for a variety of business transactions. You create and manage your business partners (BPs) and the roles they assume for your company centrally. You define the general business partner data once and assign business partner roles (BP roles) to the business partner. Specific data is stored for each business partner role. In this way, you do not store redundant data, since the general data is independent of a business partner's function or application-specific extensions. When you first create a business partner in the system, the BP role General Business Partner is automatically assigned to the business partner.

Assigning partner functions in the SAP system determines the functions of particular partners in the process. One partner may have several functions. For example, when all the partner functions within the customer partner type are assigned to one business partner, the same customer is the sold-to party, ship-to party, payer, and bill-to party.

Business Partner Creation

Relevant Business Partner Roles

(in the context of a basic shipping process)

- Business Partner (general) (000000)

- Customer (FLCU01)
- FI customer (FLCU00)
- Vendor (FLVN01)
- FI vendor (FLVN00)
- Carrier (CRM010)
- Invoicing Party (BBP006)

A customer is defined as a business partner with whom a business relationship involving the issue of goods or services exists. For SAP TM, customers represent a destination location in the case of a sales order, or a source location in the case of a returns order.

A vendor is defined as a business partner from whom materials or services are procured. The vendor master is master data, whether it is created for a one-time purchase or as a partner with whom your organization engages continuously. Carriers are vendors from whom (transportation) services are procured.

Business Partner Determination

You can enable the system to determine the business partners that you use in different business document types. This allows you to easily and efficiently enter business partners in a business document. It cuts down on the chance of manual errors, and reduces the need to enter a business partner for each partner function.

In the Define Partner Determination Profiles Customizing activity, you can create a partner determination profile that the system uses to automatically determine the following features:

- The partner functions available in a business document:

You specify the list of partner functions that the system makes available in a business document.

- The level of control the user has in entering the partner function:

Depending on the settings you define in Customizing, you change or delete a partner function, or add a partner function from a list of available partner functions. You can also specify settings so that you cannot change or delete specific partner functions.

- How the system determines business partners for the partner functions



LESSON SUMMARY

You should now be able to:

- Explain the role of business partners
- Create business partners for customers and carriers

Creating the Transportation Network



LESSON OBJECTIVES

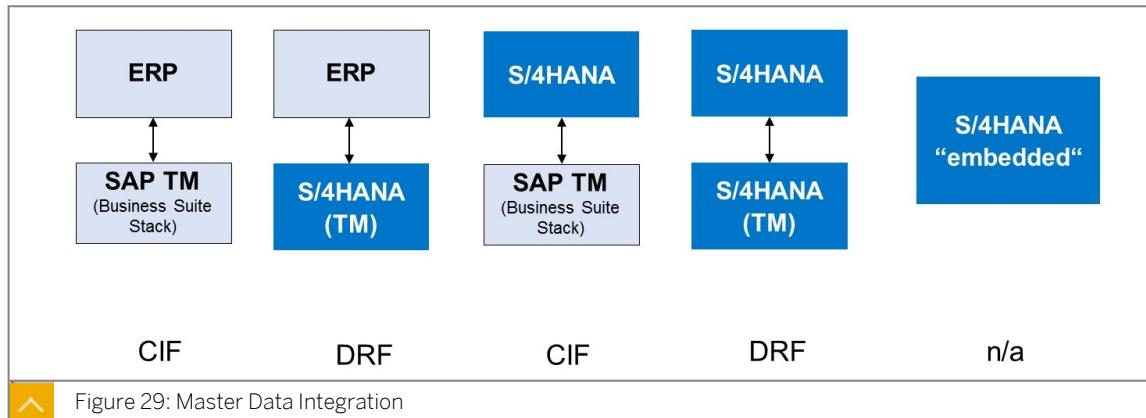
After completing this lesson, you will be able to:

- List the master data elements that define the transportation network
- Create locations, transportation zones, and transportation lanes
- Explain the concept of the scenario builder

Master Data in SAP TM

The SAP TM system can perform its functions, to some extent, independently of the existing product, location, and partner master data. The transactional data in SAP TM can be created without existing master data in the case of third-party logistics providers (3PLs). Planning and execution can be performed in SAP TM with only a minimal master data set that can be created and maintained exclusively in SAP TM. As an additional scenario, SAP TM can work with master data, customer, materials, in order to support an end-to-end scenario for a manufacturer or distributor.

Master Data Integration



Master data relevant to SAP TM can be distinguished into those master data elements that are exclusively used by SAP TM, like the elements of the transportation networks (for example, locations, transportation zones, transportation lanes), and those that are re-used by SAP TM, but defined in other software modules, like SD or MM. Material master data or business partners fall into this category. While the master data used exclusively in SAP TM is obviously defined locally in SAP TM, master data that is also used in other modules and defined there must be made available to SAP TM. How this is done and which interface technology is used for this purpose depends on the deployment option in which SAP TM is used.

No interface is obviously required if SAP TM is used "embedded", because in this case, all relevant master data objects are available in SAP S/4HANA, and following the "principle of one", no replication is required. If SAP TM is used in a "side-by-side" deployment, the interface used to transfer master data from an SAP ERP or SAP S/4HANA system to SAP TM or SAP S/4HANA TM depends on the destination system. If the receiving system is an SAP TM 9.x (Business Stack), then CIF (core interface) is used. If the receiving system is an SAP S/4HANA system, then DRF (data replication framework) is used.

In certain business environments, SAP TM can be implemented as a standalone system. In this case, transportation demands can be created directly within the SAP TM system. Consequently, master data can be created directly in the SAP TM system and executed in the SAP TM system.

The DRF is used to replicate master data such as business partners, products, and locations between source systems and target systems. The DRF uses a Key Mapping Framework to map the IDs of the corresponding objects in the source and the target system when replicating master data. This allows the target system to determine the IDs of local master data entities based on the IDs of the master data objects in the source system. This is to ensure that an object in the target system can be assigned the same value as the corresponding object in the source system, even if the object IDs in the two systems are not identical. Key mapping is essential if a target system receives data from several source systems which may contain the same objects with different IDs, or where the usage of the same key for different entities in different source systems might occur.

SAP TM Additional Master Data

To support advanced planning features and to ensure consistency with the execution process, SAP TM requires additional master data to support its own internal processes. The master data elements or features that support master data in SAP TM are as follows:

- Carrier Profiles:

A carrier profile identifies the transportation capabilities of a carrier. Carriers are business partners with the role "Carrier". Within the carrier's profile, you can define characteristics like freight code sets, transportation lane, and carrier-specific parameters, product freight groups, transportation groups, equipment groups, equipment types, and so on.

- Trade Lanes:

A trade lane is a classification of any transport-related activities representing a combination of zones or locations combined with a transportation mode or means of transport and providing an orientation between the source and destination. Trade lanes are not a substitute for transportation lanes. Trade lanes may overlap. Examples of trade lanes include the following:

- All transports from Hamburg to New York
- All transports within Germany
- All transports that leave Bavaria

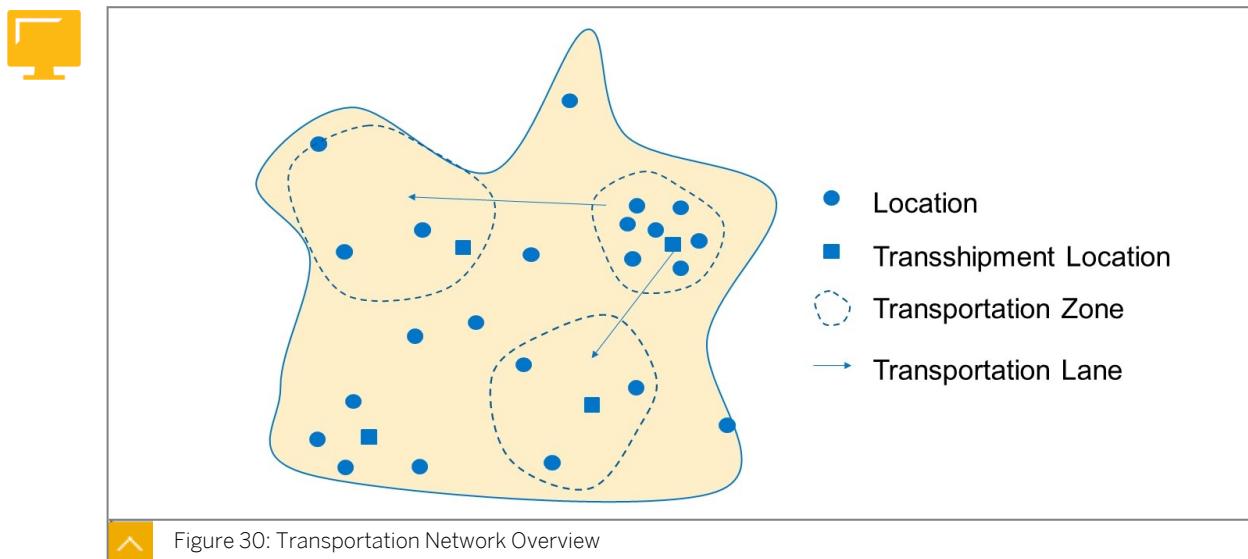
Mass Maintenance

Mass maintenance allows your company to maintain the following objects en masse: transportation lanes, locations, products, and resources. Where-used features allow your company to find these objects and see where they are used.

The Transportation Network and its Creation

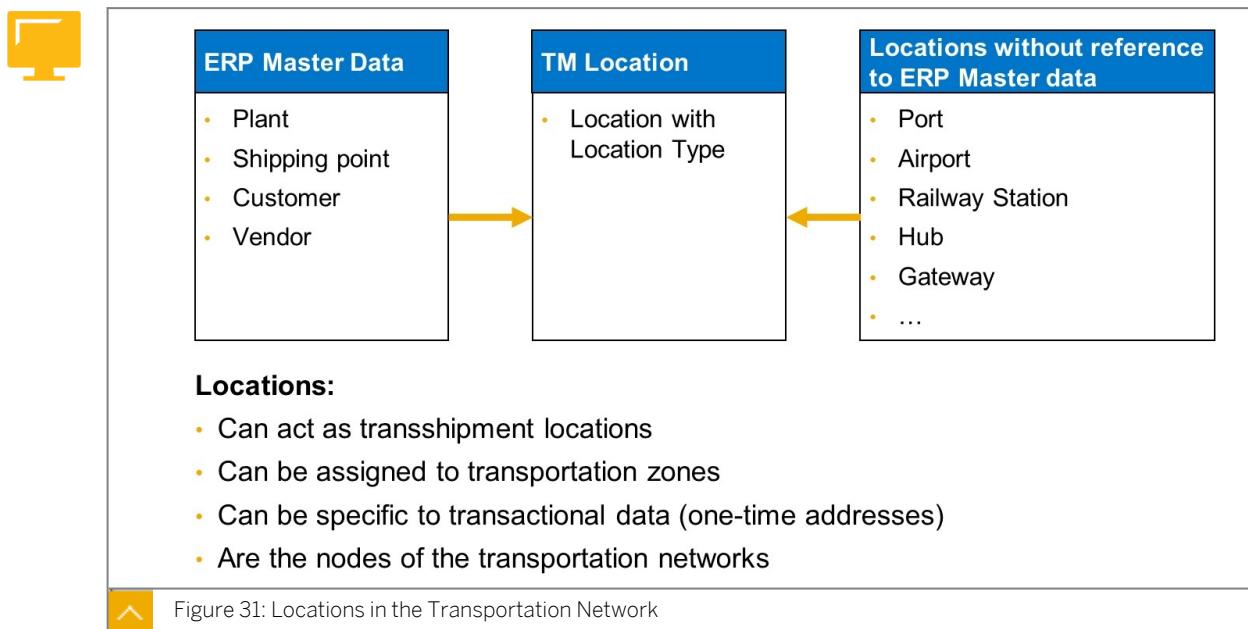
Master data is an integral part of any system. You create and maintain master data over the course of an object's lifecycle. It offers companies consistency when executing their various business processes. In this lesson, you will learn what master data is relevant for SAP Transportation Management. SAP TM can work with master data, customer, and materials, in order to support an end-to-end scenario for a manufacturer or distributor.

Transportation Network Overview



In the SAP ERP system, each inventory-relevant location can be assigned one or more shipping points. A shipping point is an independent organizational unit at a fixed location that processes and monitors inbound and outbound deliveries. The physical address of a shipping point is represented as a location in master data.

Locations in the Transportation Network



The following are a number of the purposes of locations:

- Freight is moved between locations
- A freight unit always has both a source location and a destination location
- A freight unit may travel through a number of locations

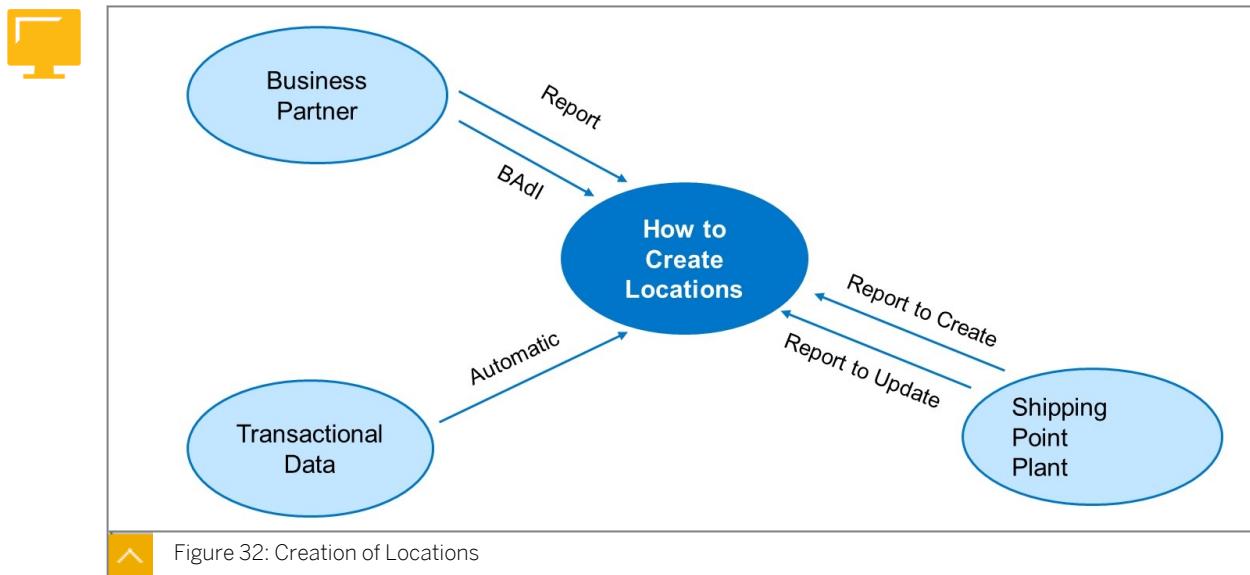
Locations are the most granular objects in the transportation network. They are used for further definitions, such as transportation lanes, and so on. They are classified using a location type. The following location types exist:

ID	Location Type
1001	Production Plant
1002	Distribution Center
1003	Shipping Point
1010	Customer
1011	Vendor
1021	Business Partner
1030	Terminal
1040	Store
1100	Port
1110	Airport
1120	Railway Station
1130	Container Freight Station
1140	Hub
1150	Gateway
1160	Container Yard
1170	Warehouse
1180	Carrier Warehouse
1190	Rail Junction
1191	Border Crossing Point

Transshipment locations are used for unloading goods from one freight order and loading them onto another freight order during the transportation process. This function is necessary when different means of transport or different transportation service providers (carriers) have to be used to execute a transportation process, for example, truck-ocean-truck; truck-rail-truck.

Transshipment locations may also be used when consolidating or de-consolidating goods to be transported.

Creation of Locations



Creating Locations Using a Report

You can use report /SAPAPO/CREATE_LOCATION to create new locations for plants, shipping points, and business partners. This is useful if you have a lot of entities for which you require locations.

The following steps are performed when executing the report:

- Creates a location using the existing address of the entity
- Creates a transportation zone for the location if needed
- Updates the location to transportation zone assignment

Creating Locations out of Business Documents

If you create or update a document that is relevant for Transportation Management (TM), the system checks that all necessary locations needed to represent plants, shipping points, and business partners in SAP TM are present in the system. If a location has not already been created, the system creates it. You can create locations, on demand, from the following TM-relevant business document categories:

- SD Documents:
 - Sales Order (SO) (not within basic shipping)
- MM Documents:
 - Purchase Order (PO) (not within basic shipping)
 - Stock Transfer Order (STO) (not within basic shipping)
- Deliveries:
 - Outbound Deliveries
 - Inbound Deliveries

Creating Locations out of Business Partner Master

For business partners, the system can be configured to immediately create locations when you create and save a business partner. To do so, you need to implement BAdI /SAPAPO/ LOC_CREATE which allows you to specify the conditions for creating or updating a location when a business partner is saved. Once you create a location, the system triggers any updates as you make a change to the business partner address.

Updating Locations Using a Report

You can use the report /SAPAPO/UPD_LOC_SP_PL to update locations for plants and shipping points. You can trigger this report as follows:

- After making changes in the address data that is relevant for the geocodes of plants and shipping points
- On a scheduled basis to capture any changes made during a specific period

If a location name already exists when creating a location, a number suffix (for example, '_01') is added to the location name.

Transportation Zones



- Transportation zones can dramatically reduce the effort needed to model your geographic network. Grouping locations into zones effectively reduces master data volume in the system.
- Zone assignment types
 - Direct
 - Postal Code
 - Region

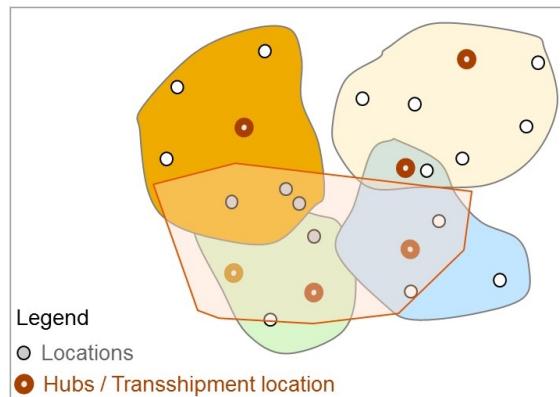


Figure 33: Transportation Zones

Transportation zones and zone hierarchies are used to group together a number of locations, as required by transportation and logistics processes. Again, transportation zones are in turn used to define other objects such as transportation lanes that define legitimate supply routes. To improve master data maintenance, the zones are also part of a zone hierarchy. The zone hierarchy is used in functions like transshipment locations and transportation lane definitions.

You can group locations into transportation zones. The system can partly transfer the properties that you assign to a transportation zone to all its locations. This function reduces the volume of master data stored in the system.

Transportation zones can group locations (customers, vendors) as well as other zones. One-time locations are also included in transportation zones.

The following assignment types of locations to transportation zones are possible:

- Direct Assignment – locations are assigned directly to a zone
- Postal Code (Range) Assignment – specified by a postal code or postal code range

- Region Assignment – specified by a country or region, for example, the state of Florida in the US

You can mix different assignment types within one transportation zone definition.

Transportation Zone Hierarchies

You can define the transportation zone hierarchies. Choose *Transportation Management* → *Transportation Network* → *Define Transportation Zone Hierarchy*.

The following conditions apply when you define a transportation zone hierarchy:

- You cannot assign a transportation zone to itself.
- You cannot assign a transportation zone A to another zone B, if B already contains A.

Transportation Lanes



Transportation Lanes

- Represent a direct connection between two locations or transportation zones to transport freight from one location to another.
- Are typically maintained on transportation zone level
- Are Defined by:
 - Source and Destination
 - Direction
 - Available MTr
 - (Optional: Carrier per MTr)
- Maintenance:
 - Individual
 - Mass maintenance

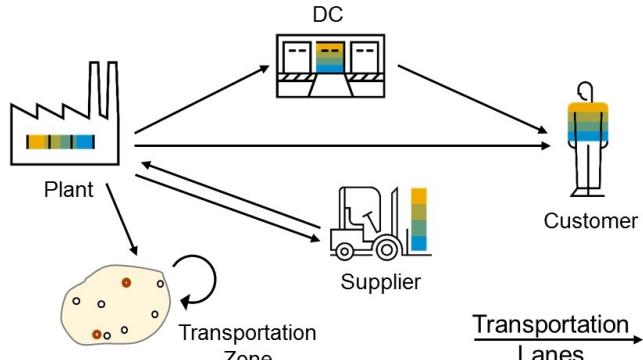


Figure 34: Transportation Lanes

Transportation lanes represent the relationship between two locations, two transportation zones, or a combination of locations and transportation zones that expresses the direct reachability of the locations, or of all locations, within the transportation zones for a specific means of transport (MTr).

Using transportation zones as the source, destination, or both, considerably reduces the amount of transportation lanes to maintain.

A transportation lane points only in one direction. To model the reverse direction, you need to create another transportation lane.

Transshipment Locations and Default Routes

Transshipment locations are used for unloading goods from one vehicle resource and loading them onto another vehicle resource during the transportation process. This function is necessary when different means of transport or different transportation service providers (carriers) have to be used to execute a transportation process, for example, truck-ocean-truck, truck-rail-truck.

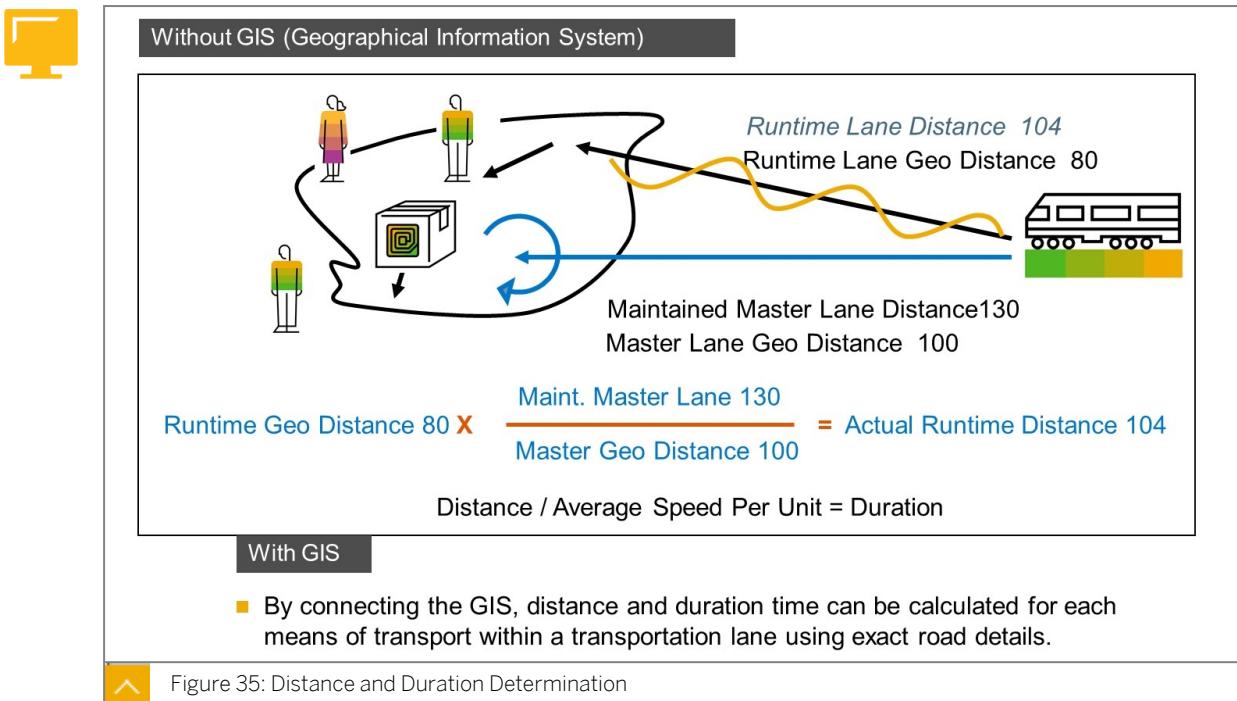
Transshipment locations may also be used when consolidating or de-consolidating goods to be transported.

Default Routes

A default route defines the sequence of stops for a given source/destination location combination. Default routes can be used in place of transshipment chains with sales orders and deliveries, forwarding orders, and forwarding quotations. Default routes can be modified manually where the desired route is different to that proposed by the system.

Where no default route exists between two locations, it is possible to specify a default route. The default route determines the sequence of transshipment locations for a given pair of locations or, in an LCL ocean freight scenario, identifies the route for a forwarding order. You can also assign a transportation mode to your default route type to specify, for example, whether freight is to be transported by road or sea. In the default route type you can also define whether the optimizer is allowed to use it for freight units, trailer units, railcar units, container units or package units.

Distance and Duration Calculation



SAP TM computes the runtime lanes during scheduling/optimization. Corresponding transportation lanes are generated between all locations assigned to the transportation zones. The distance/duration is calculated according to the settings or taken from the transportation lane maintained.

The maintained distance in the master lane includes a factor for road/street map variability. The factor is obtained from the means of transport. This factor establishes the proportion between the linear distance between two locations and the actual distance covered by the vehicle transporting goods between them. Included in the means of transport is the average speed. The runtime distance is divided by the average speed to calculate the estimated duration. You determine whether the means of transport distance is calculated by a geographical information system (GIS) by setting the corresponding indicator in the means of transport. If the indicator is not set, the aerial distance is used.

If the GIS indicator is set then the low, medium, or high average speed is used. GIS systems typically categorize streets by “slow”, “medium”, or “fast”.

Use Cases for GIS

There are different use cases for GIS, as follows:

- Geocoding (determine coordinates from an address for a location): This can be performed automatically when changing the address data of a location, or in the background with a report.
- Distance and duration determination between two locations: For performance reasons, distances and durations are stored in a buffer table in SAP TM. This buffer table can be filled in batch mode with a pre-calculation report. If a distance and duration is not in the buffer table when required, it is determined via GIS integration and stored in the buffer. This could be the case with one-time locations, for example.
- Route determination.
- Map display.

The integration with GIS providers is a project activity that SAP supports with cookbooks and examples.

Transportation Resources and Schedules

Mode of Transport, Means of Transport, Transportation Resources

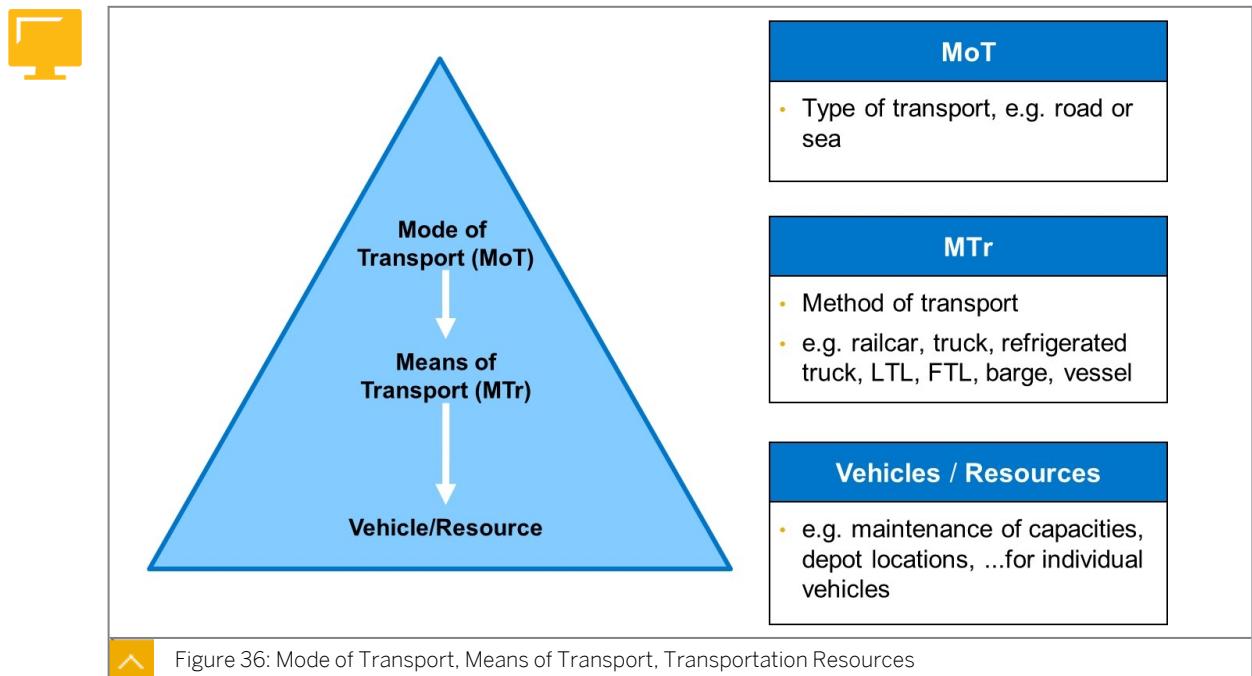
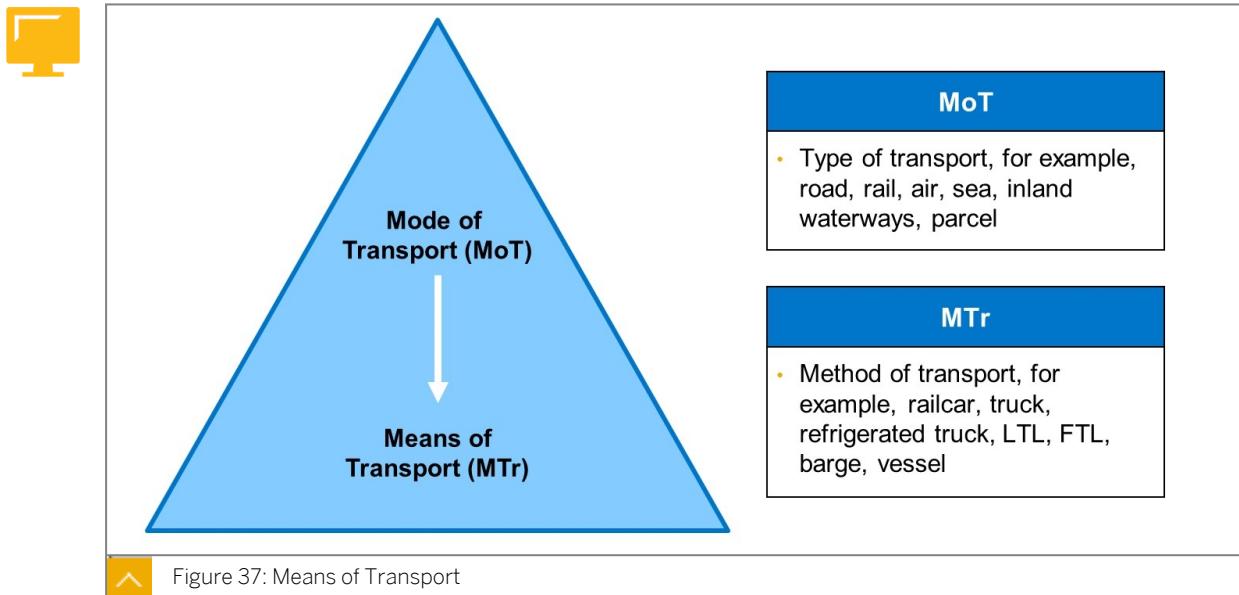


Figure 36: Mode of Transport, Means of Transport, Transportation Resources

The mode of transport is the highest element of a hierarchy defining how goods can be transported. The following transportation modes are defined in standard:

- 01 - Road
- 02 - Rail
- 03 - Sea
- 04 - Inland Waterway
- 05 - Air
- 06 - Postal Service

Means of Transport



Means of transport are classes of (similar) resources, for example, a container ship or a cargo ship.

The means of transport is used to represent a “method” of transportation such as a truck with full truck load capacity or a refrigerated truck. The means of transport are assigned to transportation lanes according to their (geographical) availability. Examples of means of transports include the following: ship, aircraft, truck (15 to), truck (25 to). A means of transport could also represent refrigerated trucks with a specific cost structure and geographic availability.

Own Means of Transport

Vehicles belonging to an MTr that are flagged as “Own means of transport” have specific attributes, as follows:

- Vehicles belonging to an MTr that have the *own means of transport* indicator set can have a depot location. Depending on the Customizing settings, the optimizer makes sure the resource starts and ends at this depot location within one optimization run.
- To use the *own means of transport* function, you have to set the indicator in the means of transport and assign a location to the resource master data.
- In relation to planning, on completion of the freight order planned by the optimizer, the vehicle must always return to the depot location (if the indicator on the MTr is set).

Transportation Resources

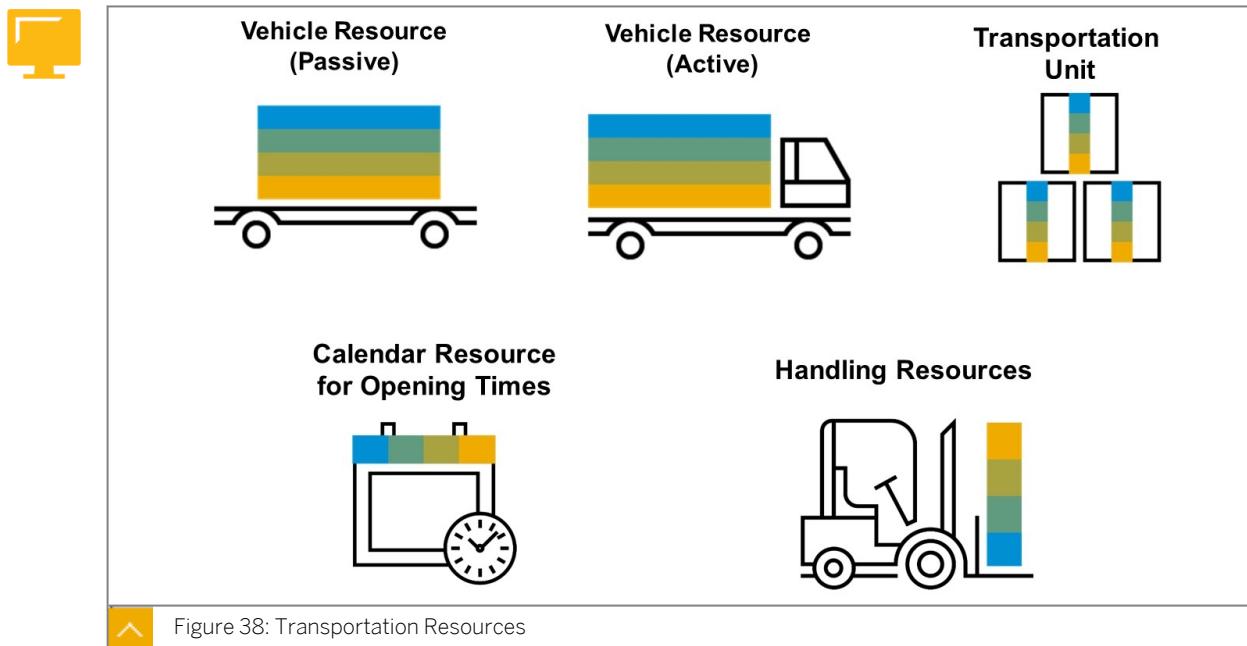


Figure 38: Transportation Resources

Transportation resources are instances of means of transport that allow detailed planning to take place, taking availability, suitability, or various restrictions into account. Resources can have different capacity dimensions, can contain shifts, and are always assigned to a means of transport.

A vehicle resource always represents a specific vehicle, for example:

- Double-axis truck with maximum number of 20 pallets, 12 tons weight capacity, 37 m³.
- Double-deck trailer.

Calendar resources are used to model when a location is available for loading/unloading. They are assigned to a location and represent opening hours.

Handling resources specify the available capacity and the hours in which they can be operated.

Transportation units are used to model cargo units that have to be moved by a vehicle resource. They include containers - flatbed or chassis. They can only be configured/loaded manually.

Transportation Resource Capacities

A vehicle resource is an instance of a particular means of transport, or a group of identical instances of means of transport, that can provide transportation services.

You use the vehicle resource to map the capacity and availability of vehicles that you want to use for transportation. You can choose up to eight dimensions and units of measurement to describe the capacity (mass and volume are predefined by default). Planning can only take the vehicle capacity into account if these correspond to the dimensions and units of measurement that you have defined in a freight unit building rule.

Depending on the MTr, a vehicle resource can be modeled with or without capacity and may be 'active' or 'passive', as follows:

- Active - can move by itself.

- Passive - must be pulled by another resource.

MTr combinations can be used to model truck and trailer combinations. Multiresources can be used to model an external fleet in one step.

Compartments

Compartments can be used to indicate a division of the vehicle resource (truck) and also the trailer into smaller units. Capacity constraints can be specified for compartments. Furthermore, they offer the following benefits:

- Flexible and fixed compartments
- Incompatibilities can be used to restrict certain freight units from being transported in certain compartments, for example, because of temperature restrictions

The use of compartments allows you to assign dangerous goods to certain areas of the truck. In addition, the use of compartments improves transportation planning for oil and gas, chemical, retail, and consumer products.

Means of Transport Combinations

A means of transport combination is an instance of a particular means of transport, or a group of identical instances of means of transport, that can provide transportation services. You use this business object to map the capacity and availability of vehicles that you want to use for transportation.

MTr combinations have the following attributes:

- They can be used to model a truck and trailer combination.
- You specify the number of the objects of each MTr within the combination, for example, 1 truck and 2 trailers.
- You specify capacities (several UoM): Maximum capacities of the combination.
- Additional (freely definable) attributes can be used for compatibilities and incompatibilities; based on a customizable attribute definition (code + text).
- Coupling/un-coupling durations are defined per passive MTr.

Integration of Resources into the Transportation Network

Vehicle resources are used to represent a unit of transportation as well as its capacity and planning parameters. A vehicle resource is independent of a particular carrier, but a means of transport is assigned to the resource master data to represent the means by which the transportation between locations is executed.

Schedules

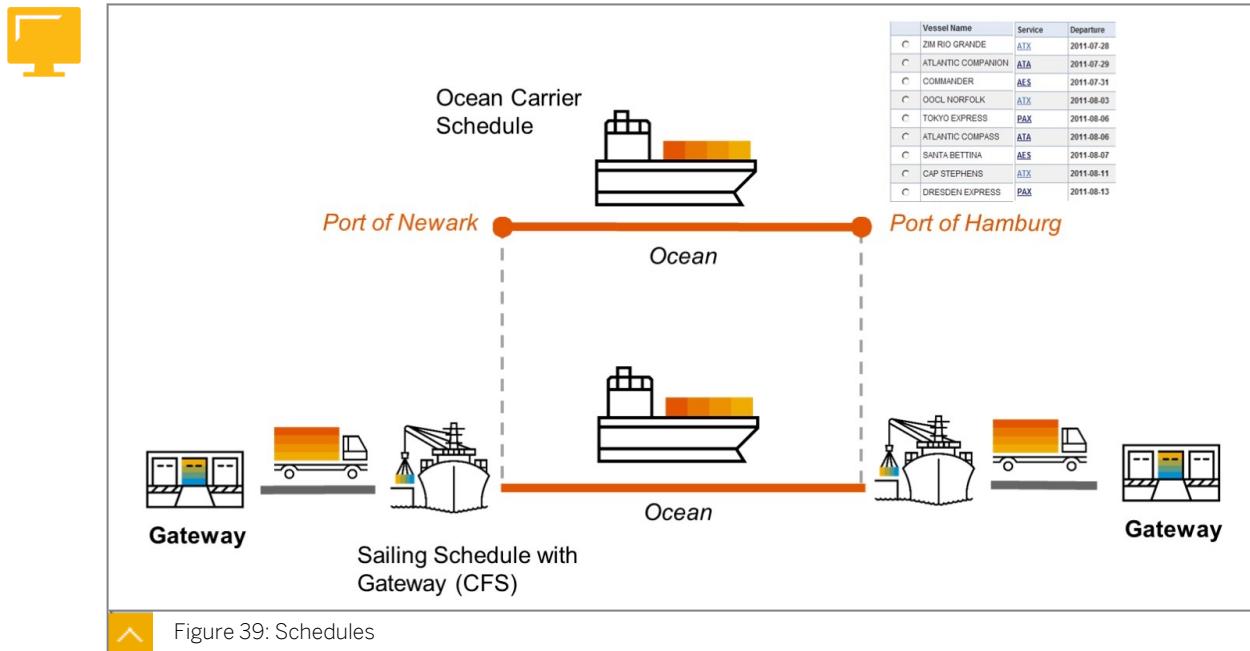


Figure 39: Schedules

When transporting goods from one location to another, firms do not always have the luxury of moving the product whenever they choose. In many cases, certain partners have strict schedules they must adhere to in order to make efficient use of resources, and some of these resources may be rented. In this section, we examine how SAP TM can make use of schedules in order to deal with means of transport that operate on a strict schedule.

Schedules can be created to define fixed times of departure or arrival schedules for certain means of transport, such as vessel sailing schedules, or airline flight schedules where, due to the immense infrastructure requirements, capacity is limited.

Schedules define a sequence of transportation stops such as ports, airports, or gateways, that is valid for a specific period of time. Ships, trucks, or airplanes can move goods at recurring times along the whole sequence or any part of it. The movement of goods depends on the transportation duration between each of the stops as well as the cut-off times and the length of stay at each stop.

As part of the schedule concept, you can use different carrier schedules and gateway schedules to define information about your stop sequence. Schedules are supported by the optimizer. A means of transport can be assigned to a schedule.

Application of Schedules

Intensive planning is required when exporting goods to other countries using ocean or air freight. In such instances, a shipper will have to make use of a freight forwarder, or contact a shipping line directly to reserve capacity on a container ship. Unlike a road-based scenario in which business partners are typically plentiful, fewer potential partners are likely to be available for ocean voyages.

When shipping product via air or ocean, you must take into account that your partners are typically renting space at a port facility. This facility is being used by many parties and options for moving product may be limited.

While the road-based scenario can make use of a variety of transportation lanes due to the flexibility of the carriers, ocean and air carriers often face more competition on the one hand,

and more regulation on the other. This limits the flexibility for departures and arrivals. When looking at this from a transportation planning perspective, the implication is that you may need something more structured and predictable for scheduling purposes.

With SAP TM, your organization can take advantage of different types of schedules to model specific departure and arrival rules suited to air and ocean shipping.

Schedule Types

SAP TM allows businesses to create different schedule types to handle the multiple shipping scenarios they may encounter. Schedules can be maintained for each business partner or carrier, and can identify different loading and unloading points, such as ports and airports.

Carrier Schedules

Carrier schedules describe a sequence of transportation stops where the start stop and the target stop are not gateways. A gateway is a transportation hub where freight is consolidated and deconsolidated.

By specifying departure rules in carrier schedules, you can generate voyages, flights, and departures automatically. The system calculates the arrival and departure dates and times at each transportation stop in the sequence, taking into account the transit duration, cut-off times, and availability of the goods for each stop. You can then modify each generated voyage individually.

In the standard SAP TM delivery, the following carrier schedules are supplied:

- Ocean Carrier Schedule: Use the ocean carrier schedule to define a standard sequence of transportation stops that are served by a ship. By specifying departure rules, you can generate voyages automatically.
- Carrier Flight Schedule: Use the carrier flight schedule to define a standard sequence of transportation stops that are served by a plane. By specifying departure rules, you can generate flights automatically.
- Road Schedule: Use the road schedule to define a standard sequence of transportation stops that are served by a truck.

Gateway Schedules

Gateway schedules are schedules whose start stops and destination stops are transportation hubs (gateways), such as container freight stations (CFS). When you create a gateway schedule, you can enter a reference to a carrier schedule and transfer departure rules and voyages from the carrier schedule to the gateway schedule. (This function is based on the transportation mode and is available for the sea and air modes only.)

Creation of Schedules

When creating schedules, you first enter general data, such as the carrier, transportation mode, and the transportation group for your schedule. When creating a gateway schedule, you must enter a reference to an existing ocean carrier schedule. If you create a master flight schedule, you can define an air cargo security status for this schedule.

You enter the standard sequence of transportation stops together with the transit duration, the cutoff times, the length of stay, and so on. You can also enter a start location and end location. You enter departure rules to specify the frequency of trips from a transportation stop. You also define a time period during which the departure rule is valid. For example, you can specify that a ship sails from the port of Newark every Thursday at 3:00 pm between January 1 and June 30. If you are working with a sailing schedule and have referenced an ocean carrier schedule, you can copy the departure rules from the ocean carrier schedule.

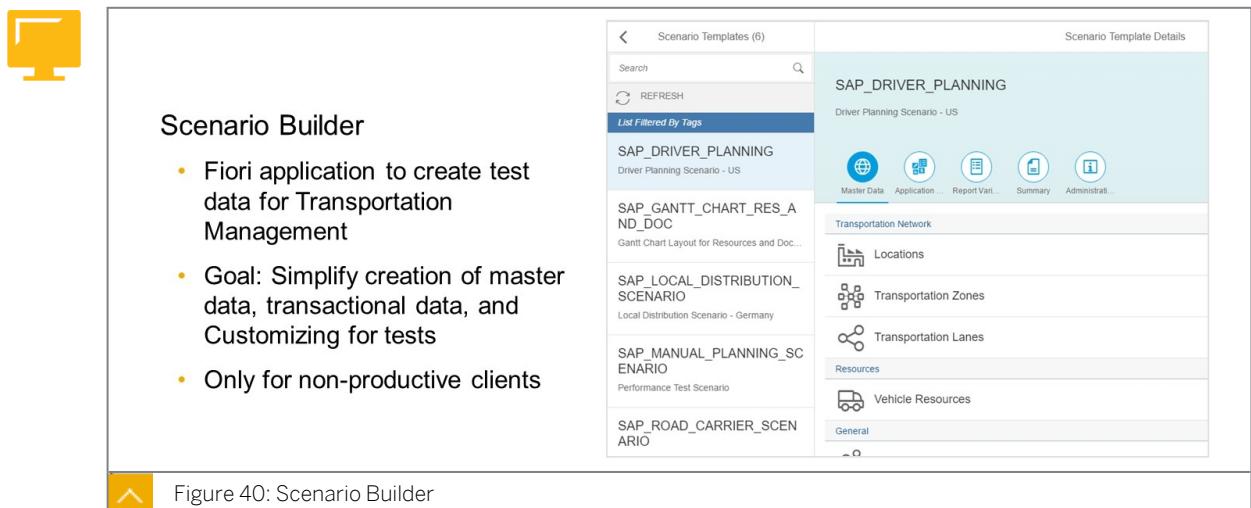
After you have created your departure rules, you can have the system automatically calculate the trips (that is, the actual departure dates/times). If you are working with a sailing schedule and have referenced an ocean carrier schedule, you can copy the trips from the ocean carrier schedule. This is valid even if you have referenced a carrier flight plan from a master flight plan.

Schedules can be created in the following ways:

- manually
- via import from Microsoft Excel using the report /SCMTMS/SCH_UPLOAD
- from an external data source using BAPI /SCMTMS/BAPI_SCHEDULE_SAVMULT

Scenario Builder

The scenario builder lets you quickly create data for testing, demos, and training. With the scenario builder, administrators can create scenario templates that include all the scenario data (system objects and Customizing data) required for running a scenario in SAP Transportation Management. Testers, for example, can then browse the scenario templates and use them to quickly create their own copy of the scenario data in the system.



The screenshot shows the SAP Fiori Launchpad. On the left, there is a yellow square icon with a white computer monitor symbol. To its right, the title "Scenario Builder" is displayed above a bulleted list of features. To the right of the list is a detailed view of a scenario template named "SAP_DRIVER_PLANNING". This view includes sections for "Transportation Network" (with icons for Locations, Transportation Zones, Transportation Lanes, Resources, and Vehicle Resources), "Master Data" (with icons for Application..., Report Vari., Summary, and Administrat...), and a "General" section. At the bottom of the main view, there is a horizontal navigation bar with icons for Home, Search, Refresh, and List Filtered By Tags.

Scenario Builder

- Fiori application to create test data for Transportation Management
- Goal: Simplify creation of master data, transactional data, and Customizing for tests
- Only for non-productive clients

SAP_DRIVER_PLANNING

Driver Planning Scenario - US

Transportation Network

- Locations
- Transportation Zones
- Transportation Lanes
- Resources
- Vehicle Resources

Master Data

- Application...
- Report Vari...
- Summary
- Administrat...

General

Figure 40: Scenario Builder

You have two options for creating scenarios; either by a system-driven approach, or using a file-oriented approach.

If you want to use data that already exists in the system for your new scenario template, you can proceed as follows:

1. In SAP Transportation Management (TM), create and prepare the scenario data (system objects and Customizing data) that you want to add to a scenario template. Proceed as follows:
 - For each system object that you want to add, include your three-character personal prefix in its name.
 - If you want to add Customizing data to a scenario template, add the Customizing data to a Business Configuration (BC) set.
2. On the launchpad, open the *Scenario Builder* app and add a new scenario template.
3. Add the prepared scenario data to the scenario template. You have the following options:

- If you add a BC set or forwarding order, for example, then in the displayed dialog box, enter the personal prefix used in the BC set or forwarding order.
- If users of the scenario template must select system objects or specify settings in the system because they are not included in the scenario template, enter a comment on the *Info* tab.

The scenario template can now be used by testers, for example, to create their own copy of the scenario data in the SAP TM system.

If you do not want to use existing system data as a basis for your scenario template, but want to create the scenario template from scratch, you can proceed as follows:

1. On the launchpad, open the *Scenario Builder* app and add a new scenario template.
2. In the *New Scenario Template* dialog box, enter a name and description for your template and, if required, select the *Sample Data* checkbox. You have the following options:
 - If you select this checkbox, the system creates sample data for your scenario template. When you download the template in the next step, the system enters this sample data in the Excel files that have been created automatically. The sample data shows the data format that is used in the scenario builder.
 - If you do not select the checkbox, the system does not create any sample data for your scenario template. It creates empty Excel files that you can fill with your own data.
3. Download your scenario template.
4. Add or change the data in the Excel files that the system has created automatically. The column titles already contain information about the number of characters that you are allowed to enter (for example, 20 characters for the location ID).
5. Upload the modified scenario template into the scenario builder.

You can now use the scenario template to create your scenario data in the SAP TM system.

The following master data and configuration objects are supported by the scenario builder:

- Master Data:
 - Locations
 - Transportation Zones
 - Transshipment Location Assignments
 - Schedules
 - Transportation Lanes
 - Vehicle Resources
 - Default Routes
 - Business Partners (TM-specific data only)
 - Materials (TM-specific data only)
- Configuration Objects:
 - Freight Unit Building Rules

- Selection Profiles
- Scheduling Settings
- Optimizer Settings
- Planning Profiles
- Capacity Selection Settings
- Customizing (BC Sets)
- Report Variants



LESSON SUMMARY

You should now be able to:

- List the master data elements that define the transportation network
- Create locations, transportation zones, and transportation lanes
- Explain the concept of the scenario builder

Evaluating the Organizational Structures Used in SAP TM

LESSON OVERVIEW

In this lesson we examine the units in the SAP TM organizational structure, and learn about the interactions and relationships between units.

At the end of this lesson, you can determine the structures of the purchasing and sales organizations, and account for the role of both in freight and forwarding orders.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Explain the purpose of organizational structures
- Control outbound freight using organizational structures
- Control Forwarding Orders (FWOs) using organizational structures
- Evaluate an organization for planning and execution structures
- Maintain the link between MM/SD organizations and SAP TM organizations

Organizational Structures in SAP ERP / SAP S/4HANA

The foundation of the SAP ERP / SAP S/4HANA system is the organizational structure that is configured in the early stages of your company's implementation of the software. All other configuration or master data is built on top of the organizational structures.

Client

To understand the enterprise structure in the SAP system, familiarize yourself with the following definition.

The client is a unit within an SAP ERP or SAP S/4HANA system. It is self-contained in legal and organizational terms. In terms of data, it has separate master records and an independent set of tables. From a business viewpoint, the client represents a corporate group, for example.

The client is the highest hierarchical level in the SAP S/4HANA system. Specifications you make or data you enter at this level apply to all company codes and all other organizational units. Therefore, you do not have to enter the specifications and data in the system at client level more than once. This ensures a uniform data status.

Access authorization is assigned on a client-specific basis. A user master record must be created for every user in the client in which they wish to work. If the *Client* field has not been pre-populated, each user must specify a client key when logging on to an SAP S/4HANA client. The client key is uniquely defined in the system and is a three-digit number. In this way, the user specifies the client in which he or she wishes to work. All user input is stored and separated by client.

The processing and evaluation of data is carried out on a client-specific basis.

Company Code

A company code is the smallest organizational unit of external accounting for which a complete and self-contained bookkeeping system can be replicated. This includes the entry of all events that require posting to the accounts and the creation of a complete audit trail for balance sheets and profit-and-loss statements. A company code represents an independent unit producing its own balance sheet, for example, a company within a client.

You can set up several company codes in one client to keep separate sets of financial books. You can use a special Customizing function to copy a company code. In the process, company-code-dependent specifications are adopted for your new company code.

A company code is defined in the system by a four-character alphanumeric key that is unique in the client.

Organizational units are tightly linked to each other to process the relevant data for a business area. For example, plant 3100 is assigned to company code 3000. Company code 3000 is assigned to controlling area 3000.

Therefore, whenever a transaction involving cost occurs in plant 3100, the relevant records in controlling area 3000 are automatically updated.

Valuation Areas

The valuation area is the organizational level at which material quantities and values are managed. It is essential for product costing that a valuation area exists for each plant.

Within each valuation level, you can differentiate between values and quantities for valuation (in-house production and external procurement) by using different valuation types. In Customizing for materials management, balance sheet valuation is set up at company code or valuation area level.

The selection of a valuation area level automatically causes the creation of a valuation area for each plant. To use product costing and order costing, inventory must be valued at plant level.

Organizational Data In SAP TM

Organizational Management is a means for creating and managing the organizational and staffing structures in your company that use an organizational model as its basis.

In SAP Transportation Management (TM), the organizational structure consists of the following organizational units:

- Corporate organization:

This organization unit is optional and serves as a single entry point into the organizations structure in SAP TM.

- Company organization:

This organization unit corresponds to the ERP company code containing the local currency. The company organization unit is used by transportation charge management (TCM) for invoicing and charging.

- Sales organization, office, and group (not relevant for basic shipping)
- Purchase organization and group
- Planning and execution organization and group

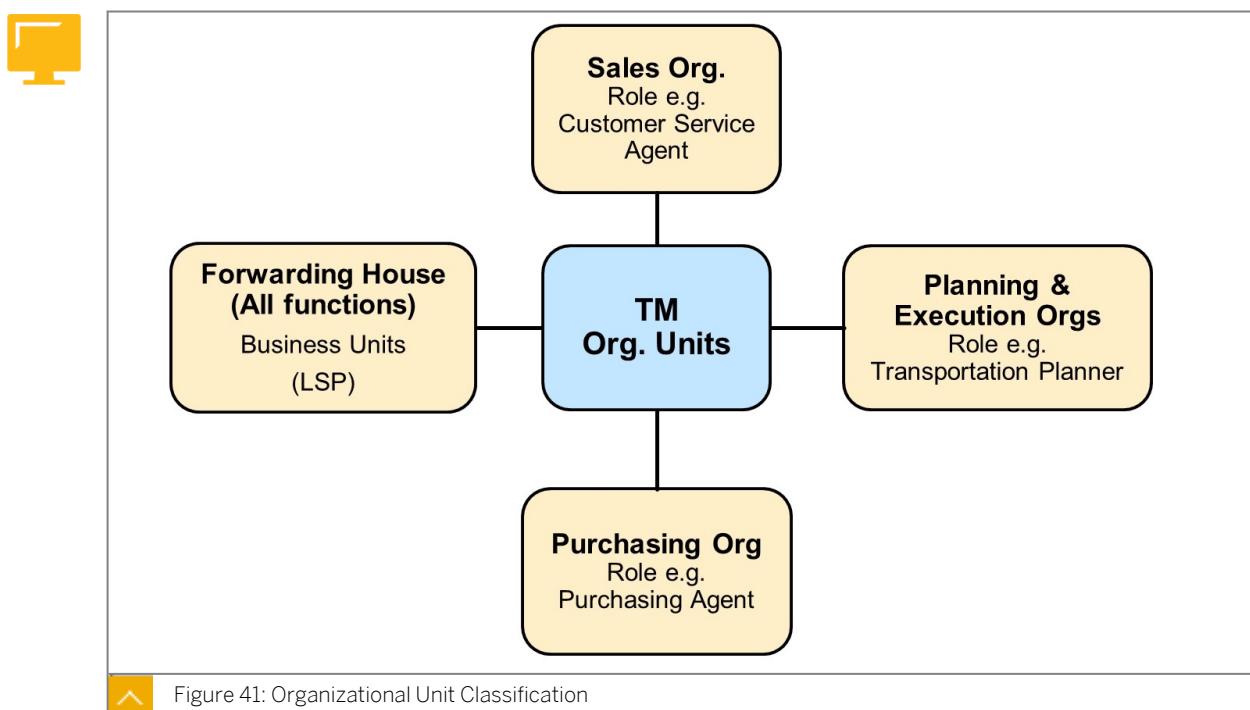
A variety of transportation tasks are assigned to different people in an organization. SAP TM enables you to structure these staffing concepts with the help of organizational models. Other SAP TM concepts, such as the use of workflow mechanisms, rely on these models to assign tasks to individuals who participate in these workflows.

SAP TM is a system especially designed for transportation. Due to the particularities of the business, SAP TM offers a modified organizational model that is easy to maintain.

The following are characteristics of organizational units in SAP TM:

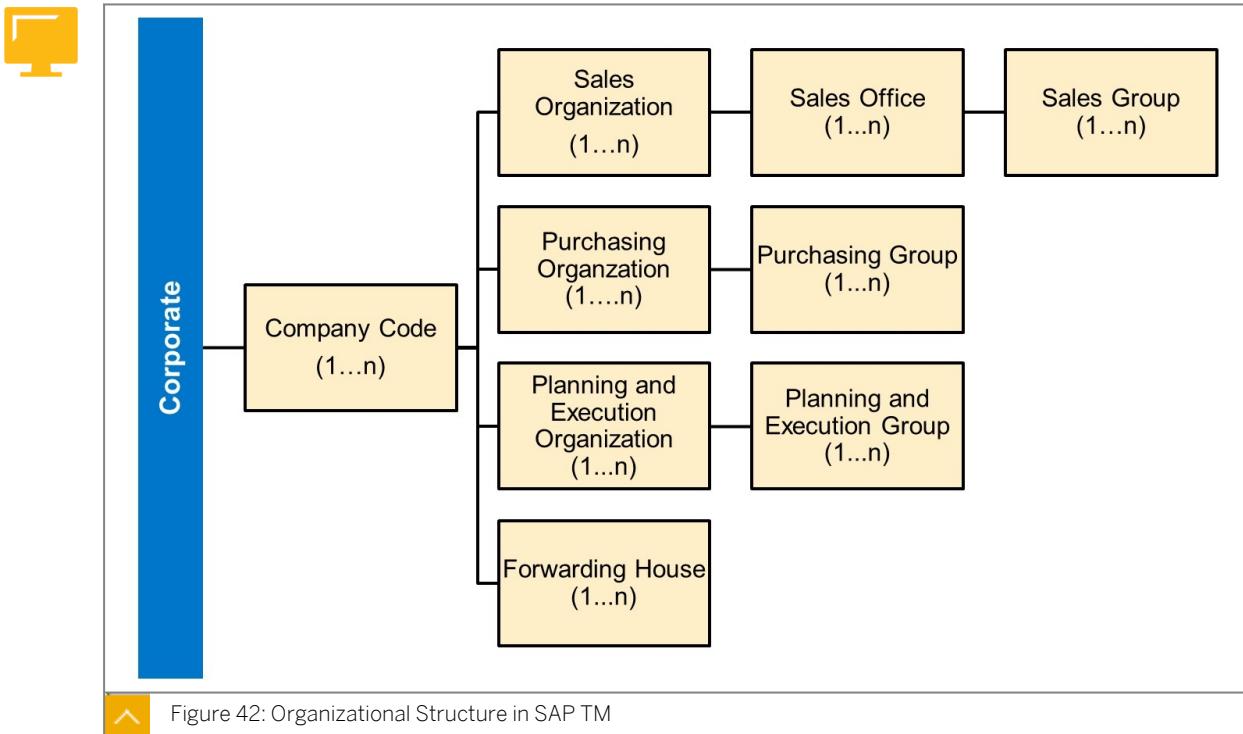
- Organizational units are used to represent the organizational structure of a company. A company may be structured based on different points of view, such as sales, planning and execution, or purchasing of freight services.
- These units also build a framework in which all relevant business processes can be processed.
- Organizational units are used to determine responsibilities, for example, for approval processes.
- Organizational units are used to allocate revenue and costs to different groups within a company, such as profit or cost centers.
- Organizational units in SAP TM can be maintained independently of SD and MM. The organizational structure in SD, MM, and SAP TM can be different.
- Organizational units define the responsible persons who are allowed to see the data or to perform certain actions (authorization).
- Organizational units can be determined automatically based on predefined conditions.

Organizational Units



SAP TM is a system especially designed for transportation. Due to the particularities of the business, SAP TM offers a modified organizational model that is easy to maintain.

Structure of Organizational Units



The organizational units in SAP TM can be divided into organizational units for sales and purchase, and organizational units for planning and execution.

Forwarding houses can be used to represent business units (LSP) and perform all functions including sales, purchasing, planning, and execution.

The hierarchical relationship of organizational units is fixed. For organizational units with a sales unit function, you can define the unit roles Organization, Office, and Group.

Organizational units with the Group unit role can be assigned to organizational units with an Office or Organization unit role, and organizational units with an Office unit role to organizational units with an Organization unit role.

For organizational units with a Purchasing or Planning and Execution unit function, you can only assign organizational units with a Group unit role to organizational units with an Organization unit role.

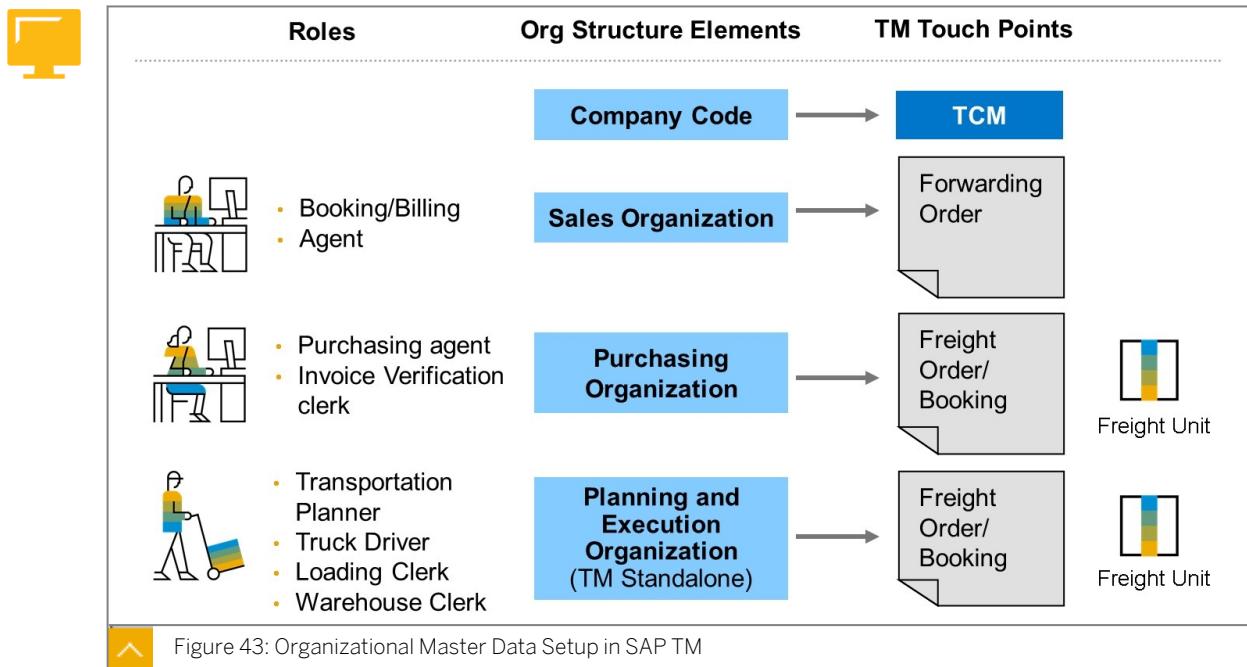
Organizations and Business Documents

The selling side is responsible for the sale of services, such as organizing the necessary activities for shipment transportation. For this reason, the sales organization is indicated in the business documents forwarding documents, order-based transportation requirements, delivery-based transport requirements, and forwarding settlement documents.

The purchasing side is responsible for procuring the necessary services from vendors (for example, carriers). For this reason, the purchasing organization is indicated in the business documents freight orders, freight bookings, service orders, and freight settlement documents.

The sales organization would interact with the purchasing organization for executing the transportation of the undertaken shipment. This shipment is later settled using intracompany/intercompany settlements. Thus, the information regarding the relevant sales or purchasing organization will also be contained in the necessary documents.

Organizational Master Data



The organizational master data setup in SAP TM is divided into a number of elements.

The company code corresponds to the SAP S/4HANA company code containing currency. The company code in SAP TM is used in transportation charge management for invoicing and charging.

The sales organization is a part of the organizational structure in SAP TM. The sales organization is used in the creation of forwarding order types, forwarding quotation types, order based and delivery based transportation requirements.

The purchasing organization and planning and execution organizations are used for freight order types, freight booking types, and freight unit types.

Organizational Relationships in SAP TM

In SAP TM, organizational units are used to represent the organizational structure of a company. Organizational structures in SAP TM are flexible. An organizational unit can have the following organizational functions in SAP TM:

- Purchasing
- Sales
- Planning and Execution
- Company
- Corporate
- Forwarding House (representing purchasing, sales, and planning and execution)

Organization Structures

Depending on the implementation scenario, shipper or freight forwarder, a company may be structured from different points of view such as sales, planning and execution, or purchasing of freight services. These units also build a framework in which all relevant business

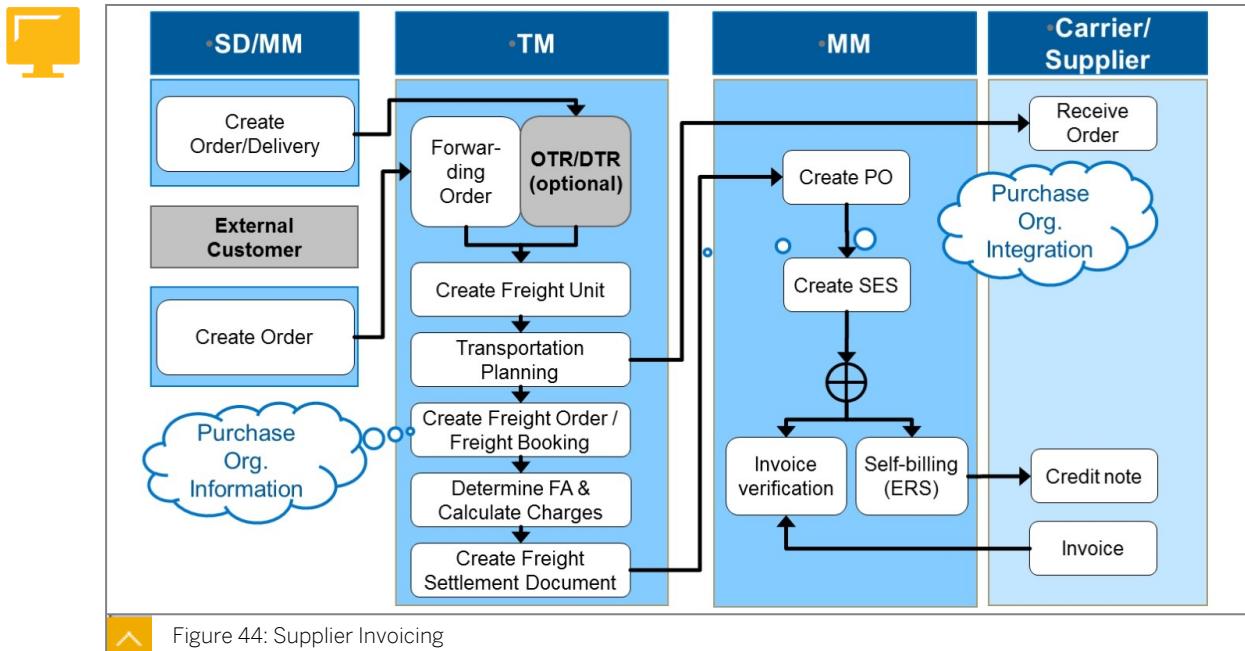
processes are processed. Organizational units are used to determine responsibilities, for example, for approval processes. Organizational units are also used to allocate revenue and costs to different groups within a company, for example, profit or cost centers.

In SAP TM, multiple sales organizations can be attached to one company code. Multiple sales offices can be attached to one sales organization, and multiple sales groups can be attached to a single sales office.

SAP TM can support multiple purchasing organizations tied to one company code. Multiple purchasing groups can be attached to one purchasing organization.

Multiple planning and execution groups can be attached to one planning and execution organization in SAP TM.

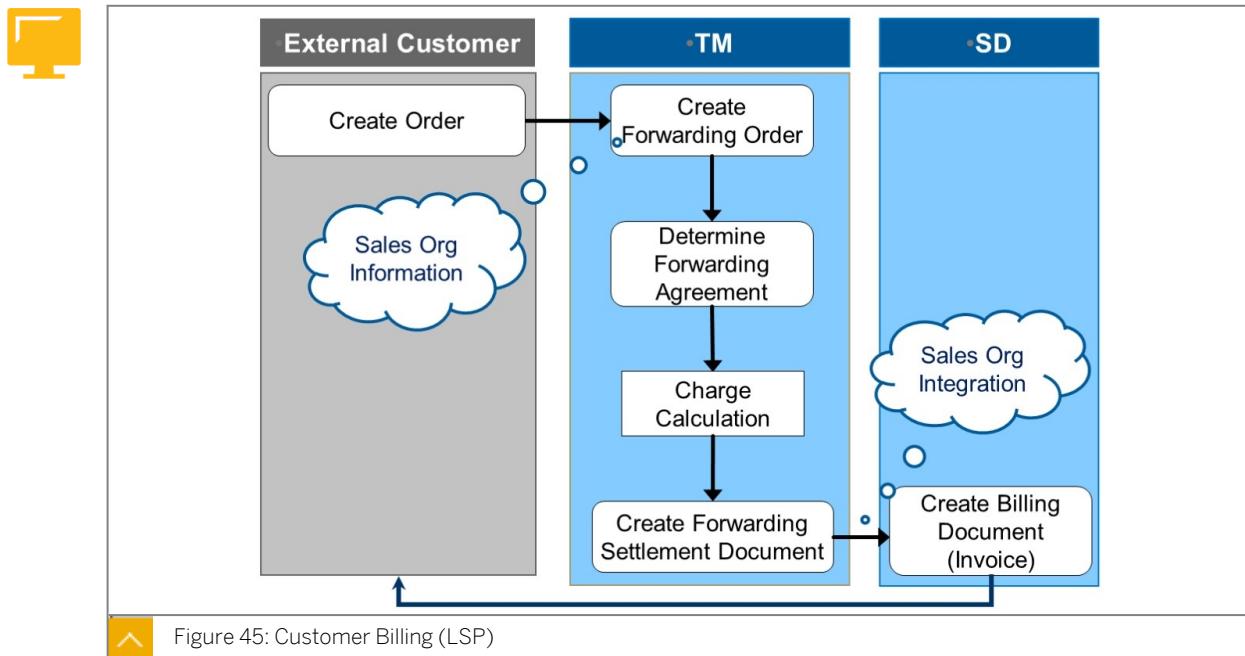
Supplier Invoicing



Mapping of the purchasing organization is required for a shipper using both SAP TM and SD/MM that purchases transportation services from third parties. The same is relevant for logistic service providers that are subcontracting freight to external carriers. The initial determination point is during the creation of the freight order/booking. The same purchasing organization needs to be defined in the freight agreement, which is a long-term contract that represents the contractual relationship with a carrier from whom you are buying transportation services.

SAP TM generates a freight settlement document (FSD) when a freight order is settled. The FSD is posted to MM. When the invoice is received, the invoice verification process from MM is used. If you perform evaluated receipt settlement, the automatically generated invoice is based on the data from the FSD.

Customer Billing (LSP)



As part of the supported integration with SAP TM, the integration of the sales organization is essential if an SAP S/4HANA back end is present. In the case of an LSP using both SAP TM and SAP S/4HANA, the sales organization is integrated at two points. The first integration point is the Forwarding Order in SAP TM. To calculate charges and settle the forwarding order, a forwarding agreement for the same sales organization is required. A forwarding agreement is a long-term contract that represents the contractual relationship with a customer to whom you are selling transportation services.

In SAP TM, you can perform forwarding settlement with your ordering parties by creating a forwarding settlement document (FWSD) and sending it to SD for billing and subsequent posting to financials.

Organizational Planning and Execution Structures

Planning and execution organizational structures are responsible for the planning and execution of freight orders. They play an important role in LSP scenarios in which different organizational units have to work together. You use the *Interaction Between Organizational Units* function to model how organizational units interact with each other. For example, you can model how a sales organization interacts with a planning and execution organization.

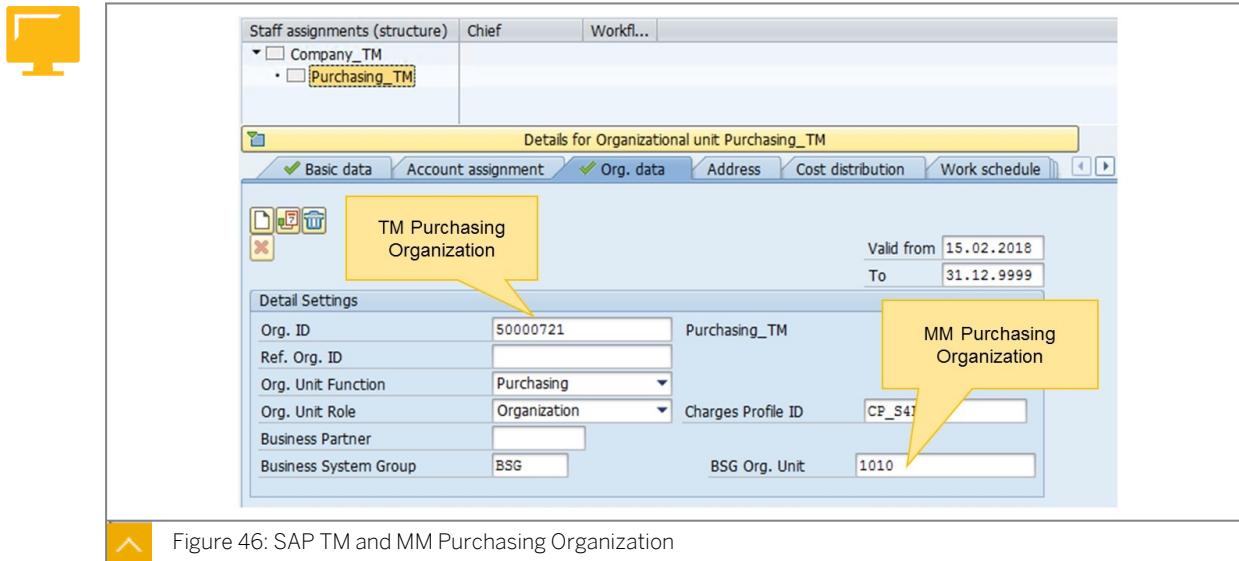
Planning and Execution Group

Planning and execution groups are used to define responsibilities among a planning and execution organization.

Multiple groups can be assigned to a planning and execution organization. However, each planning and execution group is assigned to only one planning and execution organization.

Organizational Units

SAP TM and MM/SD Organizations



The MM Purchasing Organization is assigned to the corresponding TM Purchasing Organization in transaction PPOME, which is used to maintain the organizational structure for SAP TM. In the same way, the mapping between purchasing groups is maintained. Sales organizations, sales offices, and sales groups from SD are mapped in a similar fashion.



LESSON SUMMARY

You should now be able to:

- Explain the purpose of organizational structures
- Control outbound freight using organizational structures
- Control Forwarding Orders (FWOs) using organizational structures
- Evaluate an organization for planning and execution structures
- Maintain the link between MM/SD organizations and SAP TM organizations

Defining Conditions and Freight Incompatibilities

LESSON OVERVIEW

In this lesson, we examine how conditions are used in SAP TM. Conditions provide a means (of configuration) to flexibly maintain customer-specific decisions. For example, conditions can be used in the determination of business document types, the determination of a freight unit building rule, or the determination of organizational units.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Determine the conditions used to customize a business process
- Display a condition or restriction
- Examine how incompatibilities can be used to control the outcome of business processes
- Dangerous goods restrictions modeled as incompatibilities

Conditions

In this lesson, we examine how conditions are used in SAP TM. Conditions provide a means (of configuration) to flexibly maintain project-specific requirements. For example, conditions can be used in the determination of business document types, the determination of a freight unit building rule, or the determination of organizational units.

Conditions Can Determine Dependent Values:



- Determine freight unit building rules (FUB rules)
- Determine organizational units
- Define Incompatibilities
- Determine change controller strategies
- Determine pickup and delivery time windows
- Determining transportation charge rate tables using a charge calculation rule

Conditions can be used throughout SAP TM to represent project/customer-specific rule-based decisions. They are based on field content which is stored in business documents. The system uses standard operators (that is, greater than, less than, equal to, and so on) to compare field values with the customer conditions in a true/false decision-making process. The values can be defined in the decision table. Using the *Data Access Definition* tab, you define the criteria for which you want to determine different parameters.

Let's say that you want to define the freight unit building rules that the system uses when dealing with dangerous goods and with goods that are not dangerous. Basically, there are three things to consider, as follows:

- An input
- A decision (based on the input and a condition that you have specified)
- An output

In this example, the input value is important for the decision to take into account is whether or not the goods comprising the delivery are dangerous. You can define this using a data access definition.

The decision itself is based on the input value and a condition. The condition is based on a condition type, and specifies what should happen in response to a specified input value.

The output value is the result of the decision. In this example, it will be a specific freight unit building rule.

Conditions, Input Values, and Output Values



- Origin of Condition:
 - Direct Business Object Access
 - BRF+ Decision Table
 - BRF+ Expression
- Input Value, determined by the following factors:
 - Direct Business Object Access
 - Data Crawler
 - Determination Class
- Output Values:
 - Depending on Condition Type (field or structure)

Conditions can have different origins. They can be as simple as direct business object access conditions that simply read a value from a predefined field, or as complex as business rules framework plus (BRF+) decision tables or expressions.

Define input values for each condition by defining business object fields including user-specific fields, or values determined in external determination classes. The available input values depend on the condition type chosen. The condition type defines the area in which the system is to take the condition into account. SAP delivers a number of condition types in the standard system.

The output values are determined by the condition type. For example, the FUB rule is a result of FUB rule determination.

The system generates a Business Rule Framework plus (BRFplus) decision table from input and output values. The system processes this table from top to bottom during determination. When the system finds a row in the BRFplus decision table whose input values match the current input values, it copies the corresponding output values and processes them in the area that made the call.

Condition Type Definition

If you need additional fields for the condition types to be delivered as standard, or if you want to use customer condition types, create new data access definitions and extend the assignments in Customizing. You can also change or add to the data access definitions used by default. The condition type must be identified when defining a condition in SAP TM. A condition type is a configurable object that is based on field contents stored in various business object nodes. Each condition type is assigned to a business object (structure) and the node name.

When defining a condition type, you can identify when a result is found, if it is stored in a structure, and whether one or more conditions may exist for this condition type. Condition types are then assigned to data access definitions.

In SAP TM, there are the following three different origins:

- The Direct Business Object Access condition returns directly the value determined by the data access definition. There is no evaluation of the data.
- The BRFplus Decision Table condition takes the input of the data access definition(s) and evaluates it in a table. This condition table can be maintained from the condition user interface.
- The BRFplus Expression can be maintained in the form of nested if/then statements.

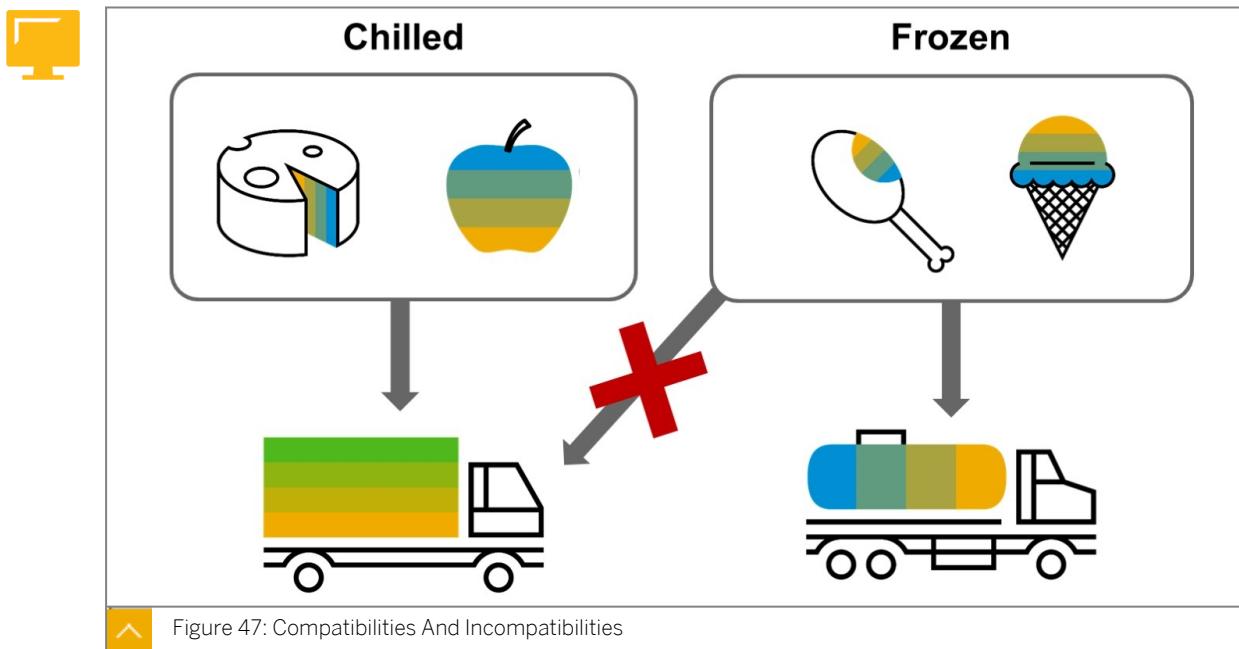
Incompatibilities

Compatibilities And Incompatibilities

Shippers are often presented with challenges when shipping multiple products. One of these is the need to take into consideration what materials can be shipped together and what materials cannot.

You use incompatibilities to define the compatibility of planning data that the system is to take into account during transportation planning, for example:

- Freight units with different incoterms must not be transported together.
- Refrigerated goods must only be transported in appropriate means of transport (refrigerated trucks).
- A certain means of transport cannot be unloaded at a location, since the location does not have a suitable loading ramp.
- A certain carrier should not be assigned to freight orders for a certain customer (blacklist).



Incompatibility Validity

When creating an incompatibility definition, you must specify a validity area. Validity areas are comprised of an incompatibility area and an incompatibility type. Incompatibility areas define where an incompatibility can be used. Four incompatibility areas exist in SAP TM, as follows:

- Vehicle Scheduling and Routing (Optimizer and Manual Planning, Transportation Proposal)
- Freight unit building
- Carrier selection
- Delivery proposals



04 – Freight Unit Building	01 – Transportation Planning	05 – Carrier Selection	07 – Delivery Proposal
52 – Transportation Request Item	01 – Freight Unit - Freight Unit (Vehicle Level)	81 – Carrier – Transportation Order	51 – Transportation Request Header - Transportation Request Root
	02 – Freight Unit - Freight Unit (Compartment Level)	82 – Transportation Order - Transportation Order	52 – Transportation Request Item - Transportation Request Item
	03 – Freight Unit - Freight Unit (Means of Transp. Combination)		53 – Freight Unit - Freight Unit
	04 – Freight Unit - Vehicle Resource		
	05 – Freight Unit - Transshipment Location		
	06 – Freight Unit - Vehicle Compartment		
	09 – Vehicle Resource - Location (Loading/Unloading Level)		
	10 – Vehicle MTR Combination – Location		
	11 – Freight Unit – Freight Booking		
	...		

Figure 48: Incompatibility Validity

Incompatibility Types

The incompatibility type defines between which two objects the incompatibility is set up. Depending on the incompatibility area, different incompatibility types are supported. Examples for incompatibility types are as follows (this list is not exhaustive):

- FU – FU (vehicle level)
- FU – FU (compartment level)
- FU – FU (MTr combination level)
- FU – Vehicle resource
- FU – Transshipment location
- FU – Compartment
- Vehicle resource – Vehicle resource
- Vehicle resource – Location (stay)
- Vehicle resource – Location (loading/unloading)
- Vehicle MTr combination – Location
- FU – Booking

Dangerous Goods



Goods that carry a risk of being a danger to the following:

- the environment
- other goods
- infrastructure
- people



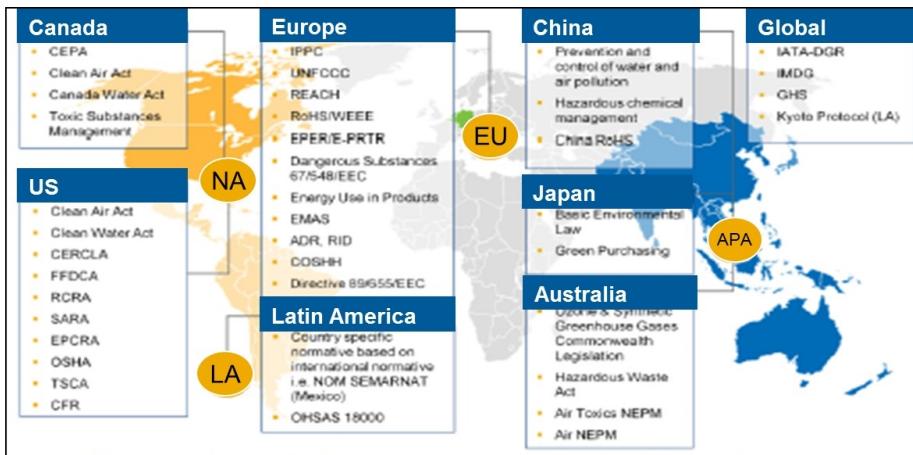
Figure 49: What Are Dangerous Goods?

Dangerous goods, also called hazardous materials or hazmat, are solids, liquids, or gases that can harm people, other living organisms, property, or the environment. They are often subject to chemical regulations that can differ from country to country. Dangerous goods include materials that are radioactive, flammable, explosive, corrosive, oxidizing, asphyxiating, biohazardous, toxic, pathogenic, or allergenic. Also included are physical conditions such as compressed gases and liquids or hot materials. This includes all goods containing such materials or chemicals, or that may have other characteristics that render them hazardous in specific circumstances.

Dangerous Goods Regulations and Compliance



Companies are required to comply with multitude of EHS regulations.



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Figure 50: Regulations and Compliance

Mitigating the risks associated with hazardous materials may require the application of safety precautions during their transport, use, storage, and disposal. Most countries regulate hazardous materials by law, and they are subject to several international treaties as well. Laws and regulations on the use and handling of hazardous materials may differ depending on the activity and status of the material. For example, one set of requirements may apply to their use in the workplace while a different set of requirements may apply to spill response, sale for consumer use, or transportation. Most countries regulate some aspect of hazardous materials. Dangerous goods are divided into classes on the basis of the specific chemical characteristics producing the risk.

Consideration of Dangerous Goods

The dangerous goods functions in SAP Transportation Management (TM) enable you to transport dangerous goods (DG) in compliance with international regulations.

When you perform dangerous goods checks for your business documents, the system bases the checks on the relevant dangerous goods data. This data is created as follows:

- Dangerous goods master data (created by shippers):

When a shipper enters a product in the product master data in SAP TM and the product is classified as dangerous goods, the shipper also creates a dangerous goods master data for the product.

- Document-based dangerous goods records (created by logistics service providers):

When a logistics service provider (LSP) receives dangerous goods data from a shipper, the LSP enters the dangerous goods data in the relevant business document by creating a document-based dangerous goods record at item level.

You can perform dangerous goods checks for business documents created in SAP TM. The system bases the checks on the available dangerous goods data, that is, dangerous goods master data, or document-based dangerous goods records created for forwarding orders, freight orders, or freight bookings.

You can perform dangerous goods (DG) checks for forwarding orders, forwarding quotations, freight orders, and freight bookings. The system can perform checks automatically when you save your business documents, and you can trigger the checks manually. Due to different risks involved in transporting DG, the system carries out checks in different ways and at different process steps to ensure safety precautions are observed during transportation. For example, the system can perform checks during freight unit (FU) building and vehicle scheduling and routing (VSR) optimization. This ensures the compliance of the resulting successor documents such as FUs and freight orders (FOs).

The system can check DG during freight unit building, for example, by using the mixed loading check. The system analyzes the items with respect to their possible combination during transportation. The system considers incompatibilities for the affected items. If the DG check returns errors, the system prevents these items from being transported in the same freight unit.

During VSR optimization, the system assigns FUs to vehicle resources and creates freight documents. When creating the transportation proposals, the system carries out the DG check and offers an alternative transportation proposal. In batch processing, the system selects the first solution that does not contain DG errors.

With the mixed-loading check, you can check incompatible FUs that should not be transported together. By setting up a freight unit vehicle check, you avoid planned freight documents that contain freight units with DG that are incompatible with certain resources. The system incorporates incompatibilities into the VSR optimization run.



LESSON SUMMARY

You should now be able to:

- Determine the conditions used to customize a business process
- Display a condition or restriction
- Examine how incompatibilities can be used to control the outcome of business processes
- Dangerous goods restrictions modeled as incompatibilities

Learning Assessment

1. Which of the following are business partner roles relevant to a basic shipping process?

Choose the correct answers.

- A Customer (FLCU01)
- B Carrier (CRM010)
- C Invoicing Party (BBP006)
- D Driver (TM0001)

2. Which of the following are location types?

Choose the correct answers.

- A Shipping Point
- B Transshipment Location
- C Incoterm Location
- D Customer
- E Business Partner

3. Which master data object defines connectivity in the transportation network?

Choose the correct answer.

- A Location
- B Transportation Zone
- C Transportation Lane

4. How can you create locations from business partners?

Choose the correct answers.

- A Using a BAdI implementation
- B Using Output Management
- C Using the CIF Interface
- D Using a report

5. For which purpose can you use the scenario builder?

Choose the correct answer.

- A You can simulate freight charges.
- B You can implement best practices.
- C You can create test data.

6. Master data can only be created directly in SAP TM.

Determine whether this statement is true or false.

- True
- False

7. Which of the following elements are part of the transportation network?

Choose the correct answers.

- A Location
- B Transportation Zone
- C Business Partner
- D Transportation Lane

8. The purchasing organization can be entered on which business documents?

Choose the correct answers.

- A Forwarding Order
- B Freight Unit
- C Freight Order
- D Freight Booking

9. The sales organization can be entered on which business documents?

Choose the correct answer.

- A Forwarding Order
- B Freight Unit
- C Freight Order
- D Freight Booking

10. Only one planning and execution group can be assigned to any planning and execution organization.

Determine whether this statement is true or false.

- True
- False

11. Which of the following organizational unit functions are available and relevant to SAP TM?

Choose the correct answers.

- A Purchasing
- B Production
- C Planning and Execution
- D Forwarding

12. How are input values for a condition determined?

Choose the correct answers.

- A Using direct business object access
- B Using the data crawler
- C Using a determination class
- D Using a process controller strategy

13. Which of the following best describes the use of conditions in SAP TM?

Choose the correct answer.

- A Conditions are a way of setting up rules that the system takes into account when planning.
- B Conditions refer to specific, one-time customer requirements in relation to how an individual delivery is handled.
- C Conditions refer to the handling requirements of specific materials.
- D Conditions refer to the guidelines that operators (drivers) must adhere to when delivering in particular transportation zones.

14. The following is a possible scenario for the use of incompatibilities in SAP TM: A driver for carrier A is careless in his delivery of goods to customer B. The customer makes a complaint to the shipper and says carrier A should not be used for future deliveries. The shipper or freight forwarder sets up an incompatibility in SAP TM that automatically prevents the carrier being assigned future deliveries to this customer.

Determine whether this statement is true or false.

- True
- False

15. The regulations pertaining to any hazardous material are consistent across locations, activities, and lifespan.

Determine whether this statement is true or false.

- True
- False

Learning Assessment - Answers

1. Which of the following are business partner roles relevant to a basic shipping process?

Choose the correct answers.

- A Customer (FLCU01)
- B Carrier (CRM010)
- C Invoicing Party (BBP006)
- D Driver (TM0001)

Correct. Customer, Carrier, and Invoicing Party are relevant business partner roles for the basic shipping process. The Driver business partner role is a relevant role for the advanced transportation management process.

2. Which of the following are location types?

Choose the correct answers.

- A Shipping Point
- B Transshipment Location
- C Incoterm Location
- D Customer
- E Business Partner

Correct. Shipping Point, Business Partner and Customer are location types.

Transshipment location is not a location type, but more of an attribute of a location to model transshipments. Incoterm locations are used as special freight terms together with certain incoterms.

3. Which master data object defines connectivity in the transportation network?

Choose the correct answer.

- A Location
- B Transportation Zone
- C Transportation Lane

Correct. Transportation lanes define connectivity in the transportation network.

4. How can you create locations from business partners?

Choose the correct answers.

- A Using a BAdI implementation
- B Using Output Management
- C Using the CIF Interface
- D Using a report

Correct. You can create locations from business partners using a report or via a BAdI implementation.

5. For which purpose can you use the scenario builder?

Choose the correct answer.

- A You can simulate freight charges.
- B You can implement best practices.
- C You can create test data.

Correct. The scenario builder allows you to create test data in SAP TM. It is not used to implement best practices or simulate freight charges.

6. Master data can only be created directly in SAP TM.

Determine whether this statement is true or false.

- True
- False

Correct. Master data can also be transferred from SAP ERP or SAP S/4HANA. How master data gets created depends on the deployment scenario.

7. Which of the following elements are part of the transportation network?

Choose the correct answers.

- A Location
- B Transportation Zone
- C Business Partner
- D Transportation Lane

Correct. Locations, transportation zones, and transportation lanes form the transportation network. Business partner master data is not relevant in the transportation network. Business partners can be used to create locations, though.

8. The purchasing organization can be entered on which business documents?

Choose the correct answers.

- A Forwarding Order
- B Freight Unit
- C Freight Order
- D Freight Booking

Correct. The purchasing organization is relevant to freight unit, freight order, and freight booking.

9. The sales organization can be entered on which business documents?

Choose the correct answer.

- A Forwarding Order
- B Freight Unit
- C Freight Order
- D Freight Booking

Correct. A sales organization is only relevant in the forwarding order.

10. Only one planning and execution group can be assigned to any planning and execution organization.

Determine whether this statement is true or false.

- True
- False

Correct. Many planning and execution groups can be assigned to any planning and execution organization.

11. Which of the following organizational unit functions are available and relevant to SAP TM?

Choose the correct answers.

- A Purchasing
- B Production
- C Planning and Execution
- D Forwarding

Correct. Purchasing and Planning and Execution are available and relevant organizational unit functions in SAP TM.

12. How are input values for a condition determined?

Choose the correct answers.

- A Using direct business object access
- B Using the data crawler
- C Using a determination class
- D Using a process controller strategy

Correct. Input values for a condition are determined by data access definitions based on either direct business object access, the data crawler, or a determination class.

13. Which of the following best describes the use of conditions in SAP TM?

Choose the correct answer.

- A Conditions are a way of setting up rules that the system takes into account when planning.
- B Conditions refer to specific, one-time customer requirements in relation to how an individual delivery is handled.
- C Conditions refer to the handling requirements of specific materials.
- D Conditions refer to the guidelines that operators (drivers) must adhere to when delivering in particular transportation zones.

Correct. Conditions are a way of setting up rules that the system takes into account when planning.

14. The following is a possible scenario for the use of incompatibilities in SAP TM: A driver for carrier A is careless in his delivery of goods to customer B. The customer makes a complaint to the shipper and says carrier A should not be used for future deliveries. The shipper or freight forwarder sets up an incompatibility in SAP TM that automatically prevents the carrier being assigned future deliveries to this customer.

Determine whether this statement is true or false.

- True
- False

Correct. This is a possible scenario in which the use of incompatibilities may be useful.

15. The regulations pertaining to any hazardous material are consistent across locations, activities, and lifespan.

Determine whether this statement is true or false.

True

False

Correct. In reality, regulations may differ according to jurisdiction concerned, the status of the material, for example, whether it is being transported or stored, and numerous other factors.

UNIT 4

Creation of Transportation Requirements

Lesson 1

Triggering the Transportation Management Process

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Lesson 2

Explaining Logistics Integration

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Lesson 3

Creating Freight Units

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Lesson 4

Building a Package

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Lesson 5

Managing the Freight Forwarding Process

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UNIT OBJECTIVES

- Describe the creation of transportation requirements
- Define transportation relevance of documents
- Determine routing based on Incoterms
- Create a SD sales order
- Describe the integration of MM purchase orders
- Describe the Integration of MM scheduling agreements
- Create freight units and freight unit building rules
- View a freight unit
- Explain the representation of handling units
- Describe package building
- Explain the concept of normalized load quantity

- Describe the freight forwarding process

Triggering the Transportation Management Process

LESSON OVERVIEW

In this lesson, you will briefly examine transportation processes and scenarios, and how transportation requirements result from the creation of specific document types in SAP ERP – sales orders, purchase orders and forwarding orders.



LESSON OBJECTIVES

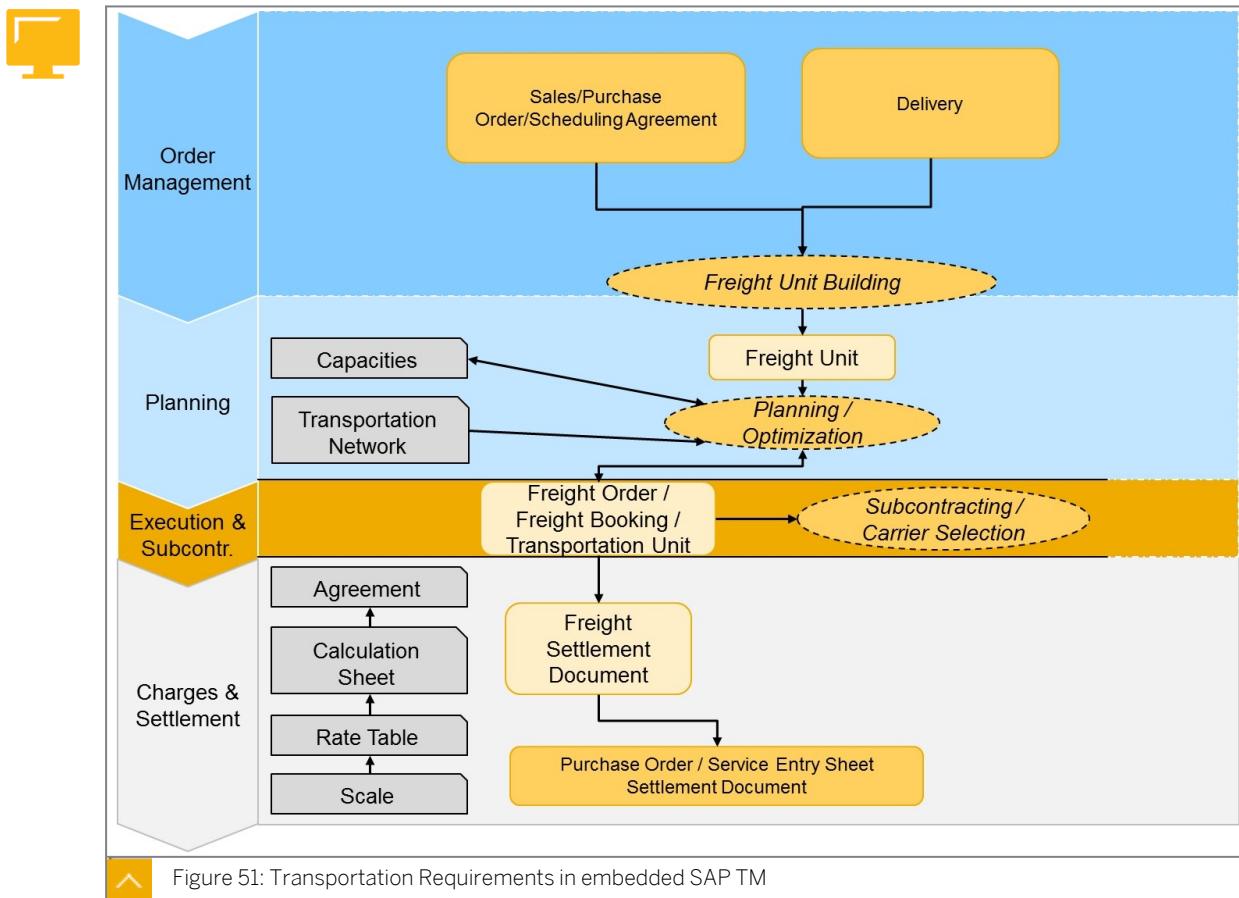
After completing this lesson, you will be able to:

- Describe the creation of transportation requirements

Transportation Requirements

The initial event that triggers the transportation management process is a transportation requirement. Based on the deployment option used for SAP TM, the transportation requirement can come in different formats.

Transportation Requirements in embedded SAP TM



In the embedded deployment scenario, a separate document representing a transportation requirement is not required, since the original object causing the transportation demand is already present in the SAP S/4HANA system itself. This can be order documents like sales orders, purchase orders, stock transport orders, scheduling agreements, or delivery documents like inbound or outbound deliveries. In this deployment scenario, the freight unit is the starting object for SAP TM and the freight unit is created directly from the original object causing the transportation demand.

The embedded scenario is the primary focus of this overview training.



Note:

The embedded deployment option is also referred to as **internal TM component integration**.

Transportation Requirements in side-by-side SAP TM

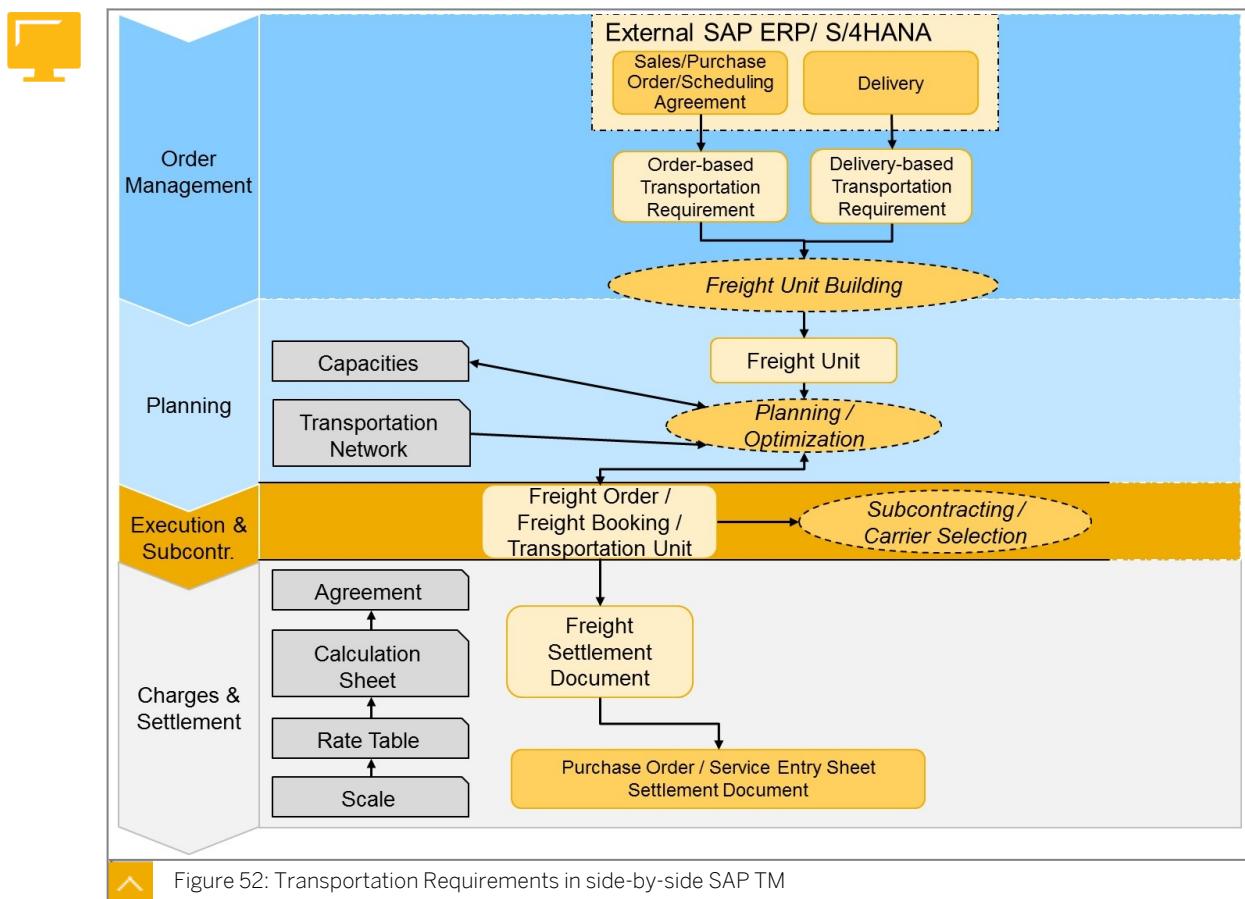


Figure 52: Transportation Requirements in side-by-side SAP TM

In side-by-side deployment scenarios, SAP TM is installed as a separate system and the original document causing the transportation demand is not present in SAP TM. Therefore, a replication of this information to the SAP TM system must take place. This replication can either create order-based transportation requirements or delivery-based transportation requirements. Order-based transportation requirements may be created from a sales order, a purchase order, a stock transport order (STO), or a scheduling agreement. Delivery-based transportation requirements may be created from an outbound or inbound delivery. Integration between SAP TM and the source system (SAP ERP or SAP S/4HANA) is accomplished using XML messages via SAP Process Integration, or a point-to-point communication.



Note:

The side-by-side deployment option is also referred to as external TM system integration.

Transportation Requirements for LSPs

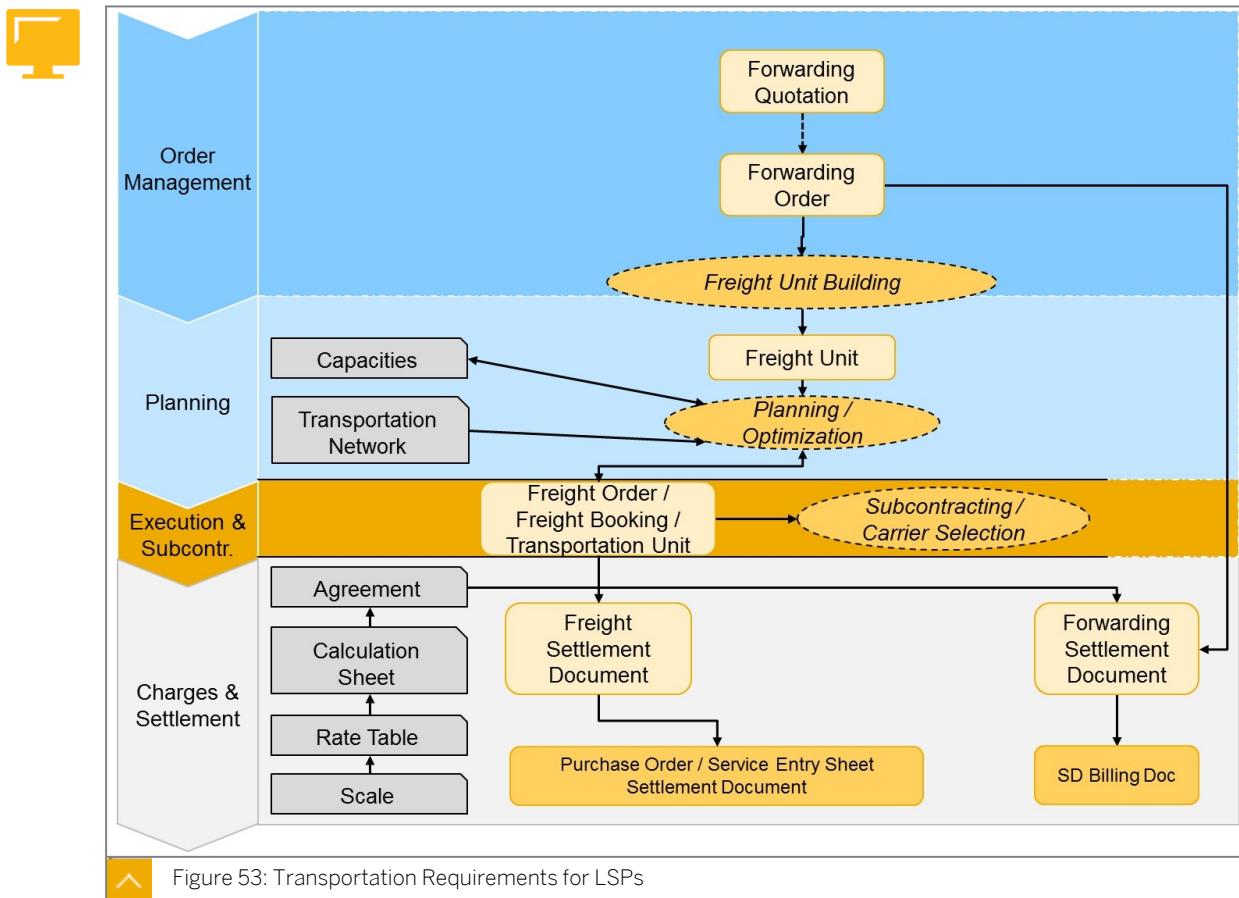


Figure 53: Transportation Requirements for LSPs

Logistics service providers (LSPs or 3PLs) can also receive transportation requirements. For LSPs, forwarding orders are created in one of two ways - manually, using the SAP TM UI, or through integration with an external system via electronic data interchange (EDI).

Transportation Demands

The following documents can trigger an SAP TM process, either through internal SAP TM component integration or via external SAP TM system integration:

- Sales orders
- Customer returns
- Purchase orders
- Returns purchase order
- Stock transport order
- Returns stock transport order
- Sales scheduling agreements (only external system integration)
- MM scheduling agreements
- Outbound deliveries
- Inbound deliveries

In an LSP process, the following documents act as transportation requirements:

- Forwarding orders
- Forwarding quotations

Process examples are as follows:

Transportation Requirement: Sales Order

Selected SAP ERP sales orders create outbound messages in SAP ERP that are sent to SAP TM, where an order-based transportation requirement (OTR) is created. The necessary data for the transportation of goods, such as the customer of the sales order, shipping point, material and quantities, delivery date, and several other requirements for the transport are taken over into the OTR.

Transportation Requirement: Purchase Order

Selected purchase orders, using standard purchase order workflow configuration, initiate the process of sending the purchase order data to SAP TM. In SAP TM, an OTR is created. SAP TM does not differentiate between inbound and outbound transportation. Therefore, the OTR is used for both sales orders and purchase orders.

Transportation Requirement: Scheduling Agreement

Selected MM scheduling agreements and sales scheduling agreements can be integrated to create OTRs in SAP TM also. The integration is based on delivery schedules. The relevant data, including dates and quantities, are incorporated into the OTR.

Transportation Requirement: Delivery

Deliveries can also initiate the transportation process in SAP TM. Instead of integrating the created sales order or purchase order, only the outbound or inbound delivery is sent to SAP TM. For deliveries, a delivery-based transportation requirement (DTR) is created.

Transportation Requirement: Forwarding Order

Forwarding orders can be sent to SAP TM from an external system or can be entered manually. Forwarding orders require that all data is specifically entered into the forwarding order document, as no preceding document exists from where necessary information could be taken.



LESSON SUMMARY

You should now be able to:

- Describe the creation of transportation requirements

Explaining Logistics Integration



LESSON OBJECTIVES

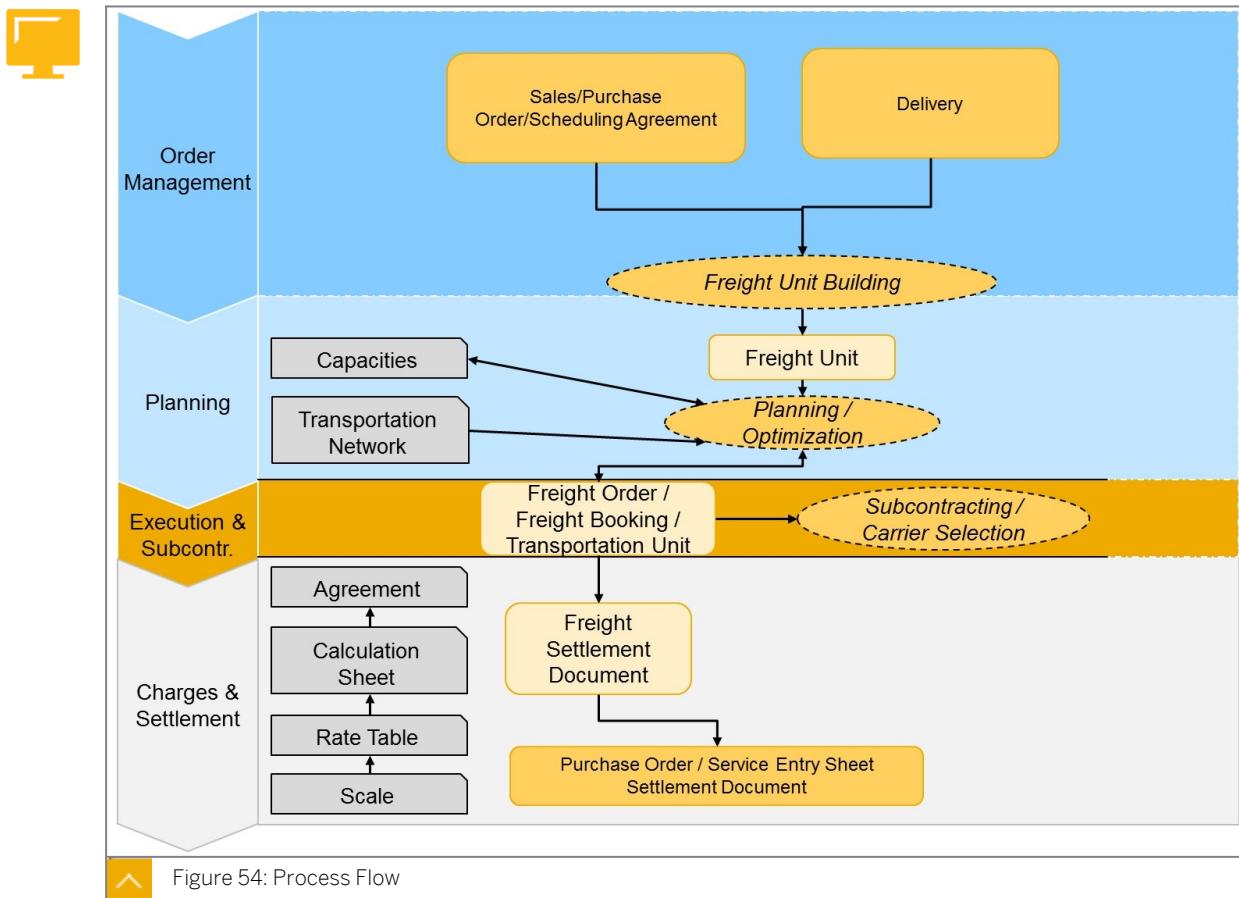
After completing this lesson, you will be able to:

- Define transportation relevance of documents
- Determine routing based on Incoterms
- Create a SD sales order
- Describe the integration of MM purchase orders
- Describe the Integration of MM scheduling agreements

The Transportation Management Process

The initial event that triggers the transportation management process is a transportation demand. In the basic shipping scenario, an outbound or inbound delivery can act as a transportation demand. In advanced transportation scenarios, order-based planning is also possible, that is, sales orders, purchase orders, stock transfer orders, or MM-scheduling agreements can act as transportation requirements.

Process Flow



The figure, Process Flow, shows the overall process flow. The starting point is the order (sales order, purchase order, stock transport order, scheduling agreement). Based on the order, a freight unit will be created, which is the basis of a planning process, if several freight units are to be consolidated into one transport. In another process variant, the freight order can be created directly from the delivery. This is called "short-cut" process. In the normal (consolidation) process, freight units are grouped into a freight order. The freight order is used for subcontracting processes and execution. Prior to execution, delivery creation can be triggered from SAP TM, to insert the delivery in the document flow between the order and the freight unit. In subcontracting processes, the freight charges need to be settled. For this purpose, a freight settlement document can be created. The freight settlement document can be posted to a service purchase order and service entry sheet. To allow cost distribution of freight, a settlement document can also be created. The process may ultimately conclude with an invoice verification.

The Logistics Integration Profile

The logistics integration profile determines the basic settings for transportation management.

Settings Defined in the Logistics Integration Profile



- Freight Unit Building Rule / Condition
- Stage Profile / Condition
- Incoterm Location Stage Building

Freight unit building rules: If freight units are to be built, you can identify a rule directly or a condition to determine the freight unit building rule.

Integration of Text Types

Texts are stored in various objects. You can define different text types for each of these areas. A sales note, a marketing note, and a shipping specification are examples of sales-specific text types.

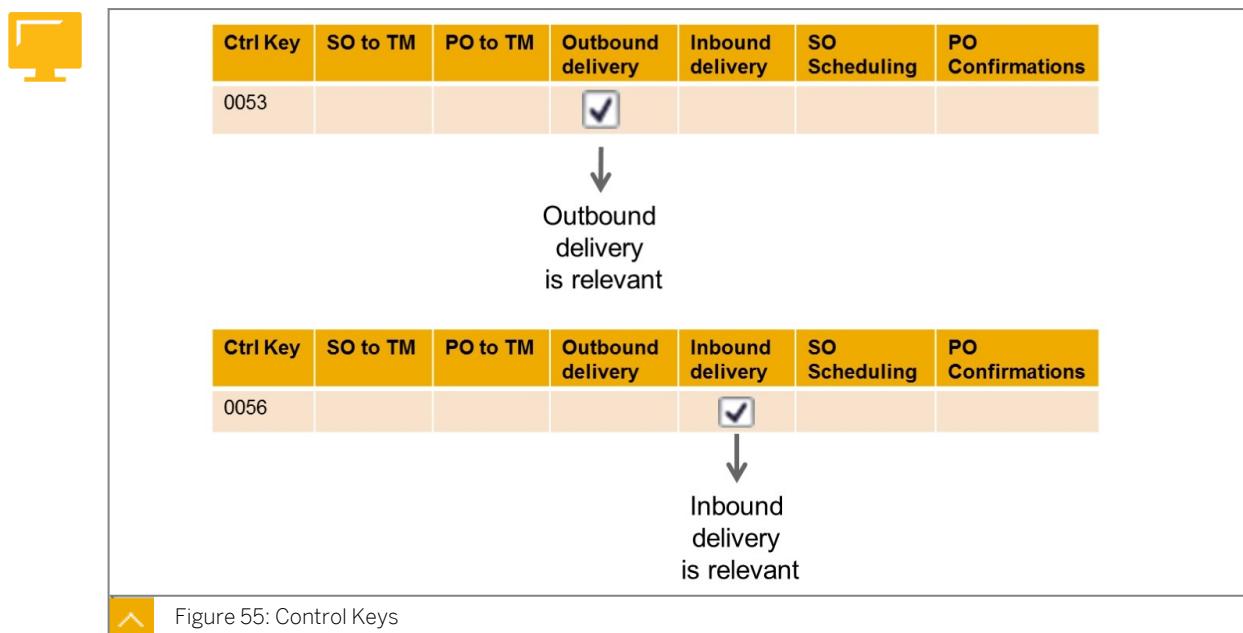
Documents contain texts at header and item level. You can enter texts in several different languages.

You can store texts in the master data and then copy them into sales and distribution documents. You can also copy texts from a reference document to another sales and distribution document, for example, from a quotation to an order, or from an order to a delivery document. Texts can be copied in a specific language.

Text control is used to determine texts automatically when you create a text object. Texts on LE documents can be integrated to SAP TM. In SAP TM, you need to define text types and map LE text types to SAP TM text types. A set of text types is defined as a text schema.

Control Keys

In SAP S/4HANA, you can display the available control keys for document integration with the internal SAP TM component.

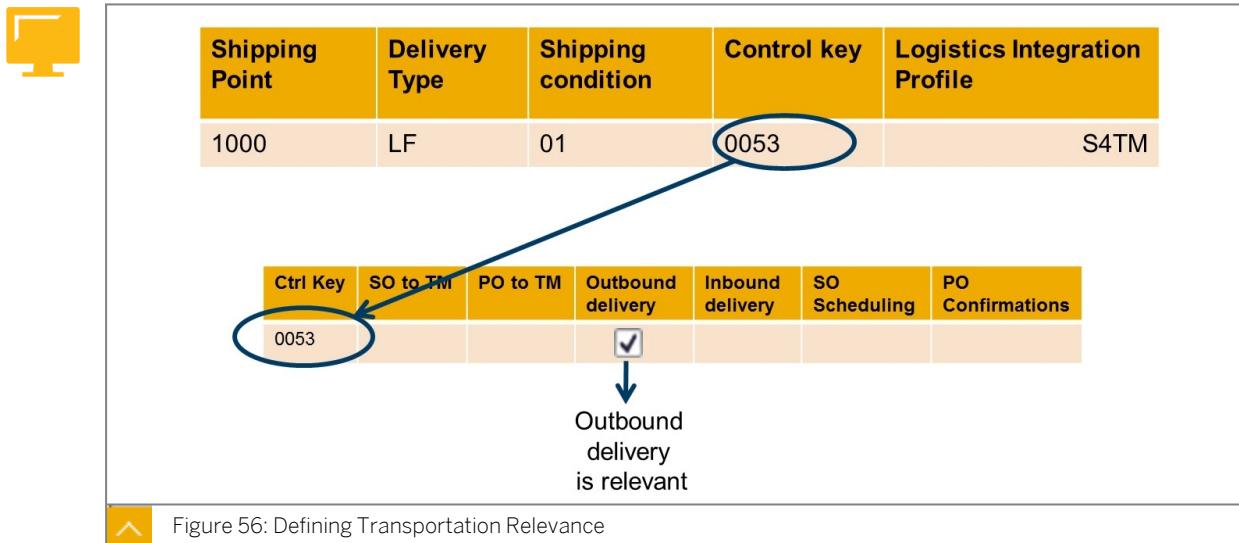


Control keys are configured in Customizing, under *Transportation Management* → *Integration* → *Logistics Integration* → *Internal TM Component Integration* → *Define Control Keys for Document Integration*.

In the Define Transportation-Relevance of Delivery Documents customizing activity, assign a control key to your delivery document types to integrate corresponding deliveries. The control key that you assign must have the *Outbound Deliveries* checkbox selected, if you want to transfer outbound deliveries. If you want to transfer inbound deliveries, the *Inbound Deliveries* checkbox must be selected in the control key.

Transportation Relevancy for document integration into SAP TM is configured in Customizing for Transportation Management, *Integration* → *Logistics Integration* → *Internal TM Component Integration* → *Define Control Keys for Document Integration*.

Defining Transportation Relevance



When you define your different document integration scenarios, you then assign the control key to a shipping point, delivery type, and shipping condition. You also assign it to the logistics integration profile which you will be using.

When the delivery is relevant for document integration, the control key is copied to the delivery document. The logistics integration profile can be used to differentiate the freight unit building logic, if multiple logistics integration profiles are used.

The following Business Add-In (BAPI) is available to control the transportation relevance for document integration to SAP TM:

- **CHANGE_TM_CTRL_KEY:** You can use this BAPI method to change the control key assigned to the delivery from the control key that was determined using the maintained Customizing.

Route Determination with Incoterms

Incoterms

Integrating routing information based on Incoterms:

Incoterms are intended to clearly communicate the tasks, costs, and risks associated with the transportation and delivery of goods. They define a contractual agreement between shipper and consignee to determine who is responsible for which stage of the transport, and where and when the responsibilities of each partner start and end.

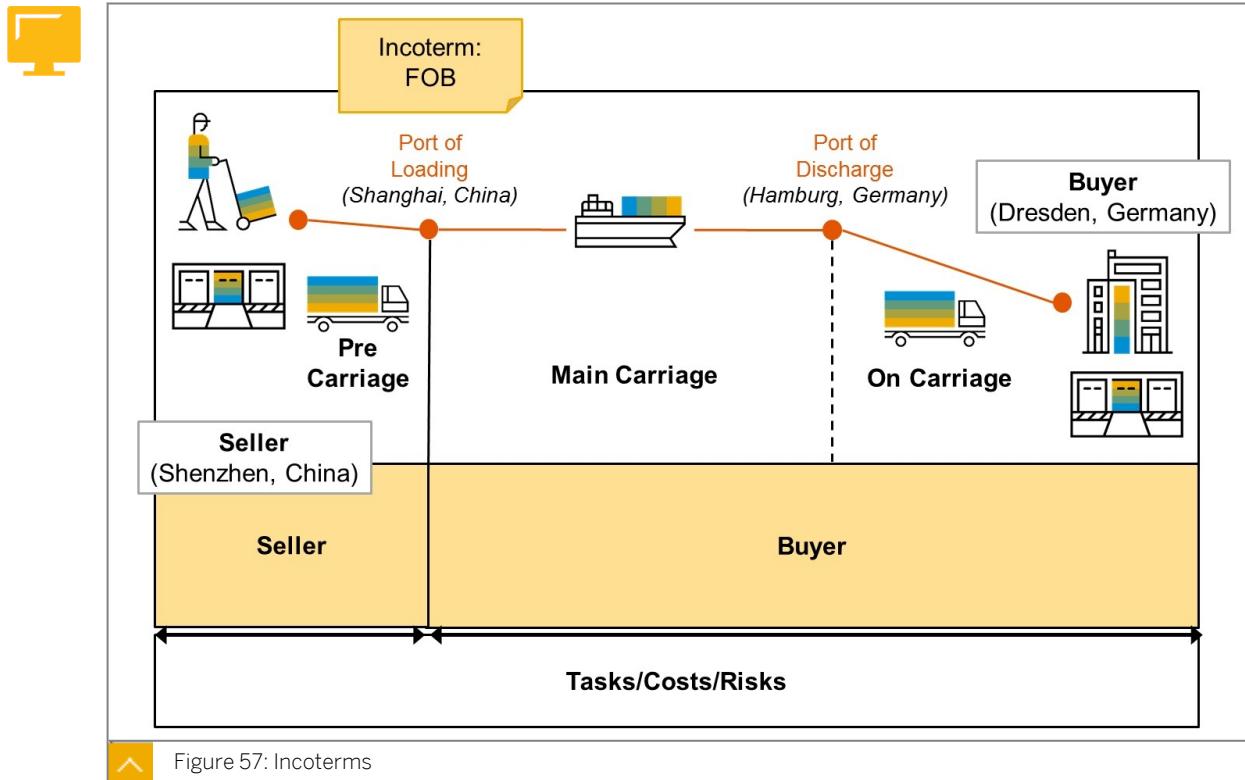


Figure 57: Incoterms

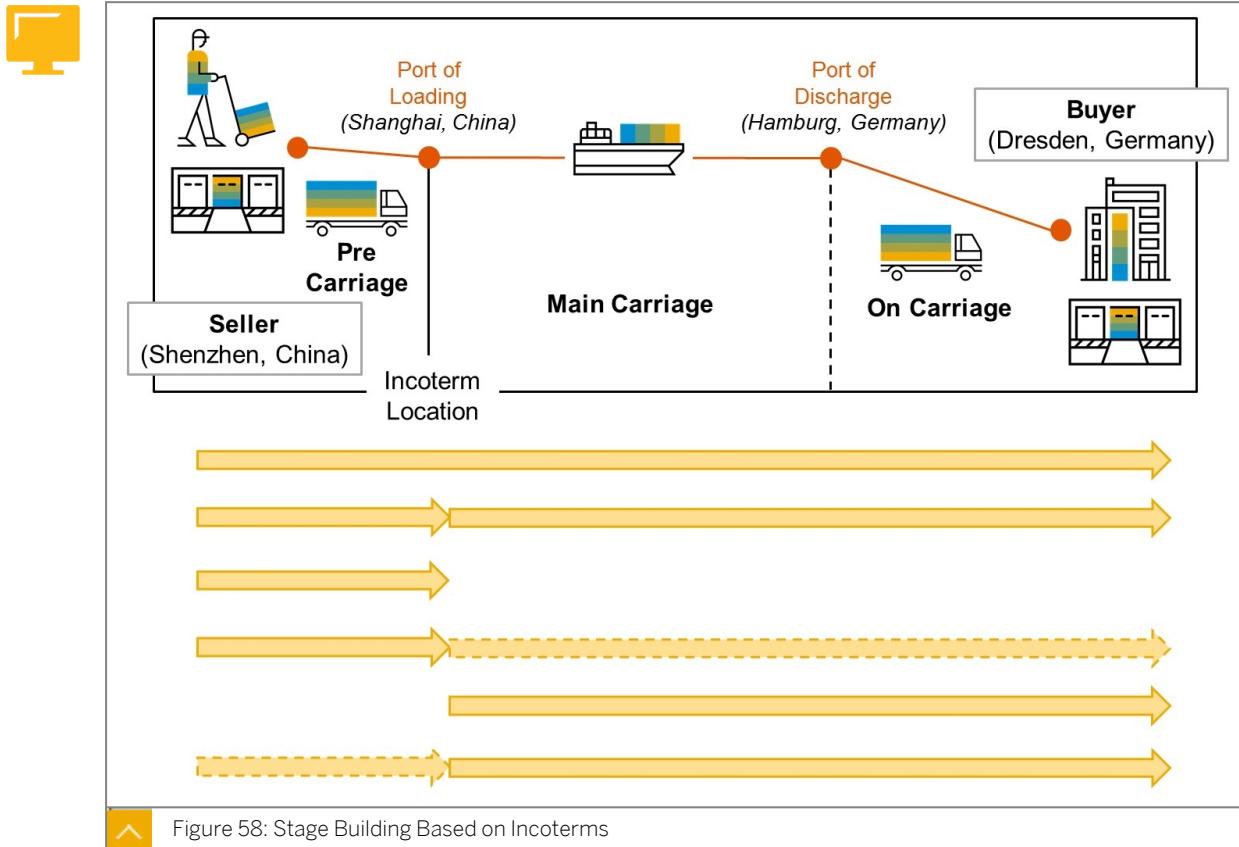
Frequently used incoterms are described in the following table:

Incoterm	Description
EXW	Ex Works
FAS	Free Alongside Ship
FOB	Free On Board
CFR	Cost and Freight
CIF	Cost, Insurance, and Freight
CPT	Carriage paid To
DES	Delivered Ex Ship
DEQ	Delivered Ex Quay
DAF	Delivered At Frontier
DDP	Delivered Duty Paid
DDU	Delivered Duty Unpaid
FCA	Free Carrier
CIP	Carriage and Insurance Paid To

Some of these incoterms require a location, at which tasks, costs, and risks are transferred from the shipper to the consignee. The incoterm location is the place where the goods are physically handed over and where the responsibilities for the goods change. The incoterm location is a master data location in SAP TM and can be used for routing purposes.

In case of delivery integration with SAP TM, the Incoterms (Part 2) field can be used to define the incoterm location. You can map Incoterms (Part 2) to an SAP TM master data location with the app *Assign Location to Incoterm Location*. You can use this information for stage building.

Stage Building Based on Incoterms



In SAP TM, you can build stages based on the incoterm location. The *Incoterm Location Stage Building* field in the logistics integration profile customizing defines how stages are built based on source location, incoterm location, and destination location. The system uses the incoterm location for stage building if the incoterm has set the *Incoterm Location* flag (a flag that indicates that you must enter a location with this incoterm). If no incoterm is specified, the system does not use the incoterm location for stage building and the system creates only one stage from the source to the destination location. If an incoterm is specified but this incoterm has not set the *Incoterm Location* flag, the system does not use the incoterm location for stage building. Instead, the system creates only one stage from the source to the destination location.

The following stage building rules are possible:

- Initial Value - Two Active Stages:

This setting is set as default. Two planning-relevant stages are created.

- 01 Source Location to Incoterm Location - Type 1:

One stage from the source to the incoterm location is created.

- 02 Source Location to Incoterm Location - Type 2:

Two stages are created:

- An active stage from the source location to the Incoterm location
- An additional stage from the Incoterm location to the destination location which is not relevant for planning
- 03 Incoterm Location to Destination - Type 1:
One stage from the Incoterm location to the destination. This is relevant, for example, for the consignee who plans only the route from Incoterm location to the goods receipt.
- 04 Incoterm Location to Destination - Type 2:
Two stages are created:
 - An active stage from the Incoterm location to the destination location
 - An additional stage which is not relevant for planning from the source location to the Incoterm location
- 05 Two Active Stages:
Two planning-relevant stages are created.

If you have defined a handover location in a purchase order, the handover location takes precedence over the Incoterm location.

Block Handling

You can define how shipment planning blocks of outbound and inbound deliveries are handled in SAP TM, specifying whether a shipment planning block is creating a planning block, an execution block, or both.

Therefore, shipment planning blocks can prevent further planning or execution in SAP TM.

You can define a block in customizing by selecting a shipment blocking reason, a document type, and either the flag for planning block, execution block, or both. The shipment planning block description is entered automatically according to the block reason.

Sales Orders

When integrating SD sales orders with SAP TM, the SD process flow is not altered (compared to an SAP ERP or SAP S/4HANA system not integrated/using SAP TM). The sales order is created in the usual way and saved. Upon saving, the control key determination identifies SAP TM relevance or not for the sales order. Based on the SAP TM relevance, the freight unit gets created, containing all necessary information from the sales order that is relevant for the transportation process.

When creating sales orders, we usually talk about outbound transportation. However (as noted in earlier lessons), SAP TM does not differentiate between outbound and inbound transportation. Therefore, the freight unit does not state any information about outbound or inbound scenarios, but is a generic object. The ship-to party is taken over into the freight unit as the destination location. The shipping point determined in SD is used as the source location of the freight unit.

You activate the integration of sales documents into SAP TM by assigning a control key to a combination of the required sales document types, sales area (sales organization, distribution channel, division), and shipping condition. The sales documents can be sales orders, or customer returns. The control key determines whether a sales document and the corresponding outbound delivery are to be integrated into SAP TM.



Note:

For external TM system integration, the configuration of SD output management is required in addition.

The freight unit lists all necessary information concerning the transportation of the corresponding SD order, such as products, schedule lines, delivery dates, locations, and quantities. Freight units and freight unit creation is covered in a later lesson.

Purchase Order

Like SD sales orders, MM purchase orders can also be integrated into SAP TM.

You activate the integration of purchasing documents into SAP TM by assigning a control key to a combination of the required document types, purchasing order, purchasing organization, and purchasing group. The purchasing documents can be purchasing orders, stock transport orders, returns, or scheduling agreements. The control key determines whether a purchasing document and the corresponding inbound delivery or outbound delivery are to be integrated into SAP TM.



Note:

For external TM system integration, the configuration of workflow technology is required to send messages.

Freight unit building runs in exactly the same way as for sales orders. With purchase orders, you can decide whether you want to plan based on the ordered quantities of the purchase orders, or with quantities confirmed by the vendor. However, if planning should only happen based on confirmed quantities, the freight unit is not created until the vendor's confirmation has been posted.

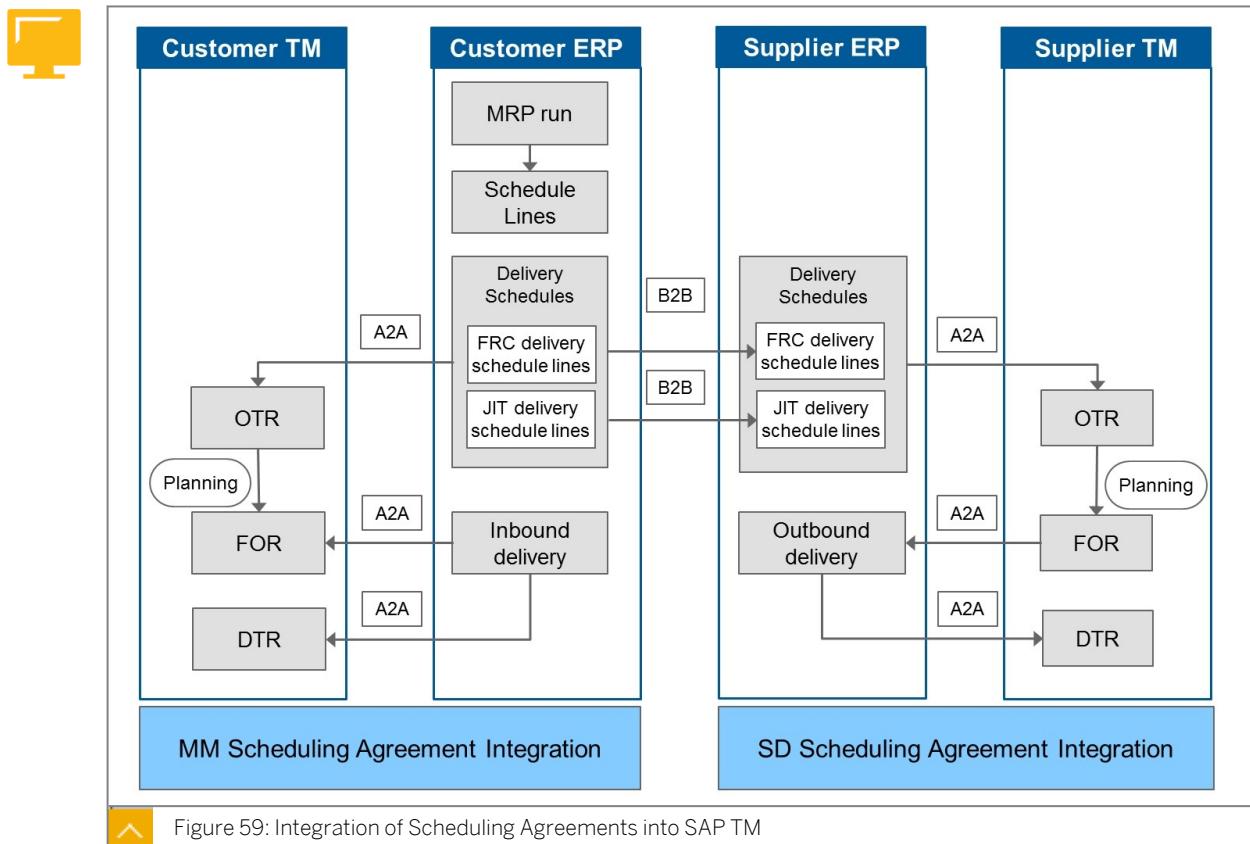
Integration of MM Scheduling Agreements

A scheduling agreement is a framework purchase agreement or sales agreement under which materials are procured (on the buying side). Products are delivered (on the selling sides) on predetermined dates within a certain time period. The future delivery quantities and dates are entered as schedule lines in a delivery schedule.

To reflect forecasted quantities and dates along with the more detailed requirements, two different types of scheduling agreement delivery schedules can be used. These are the following schedules:

- Forecast delivery schedules (FRC schedules)
- Just-in-time delivery schedules (JIT schedules)

Using SAP TM Planning and Execution Capabilities



The figure shows the integration of SD/MM Scheduling Agreements in a side-by-side deployment scenario. In general, both SD and MM scheduling agreements can be transferred to SAP TM to create order-based transportation requirements. The relevant schedule lines are typically transmitted using Business-to-Business (B2B) communication. Both the customer and the supplier can make use of SAP TM planning and execution capabilities in the following context:

- A customer can manage their inbound deliveries (purchasing) by creating corresponding transportation requirements in SAP TM. This is an MM Scheduling Agreement scenario.
- A supplier can manage their outbound deliveries (sales) by creating corresponding transportation requirements in SAP TM. This is a Sales Scheduling Agreement scenario.

In both cases, the transportation planning is done based on the planned quantities and dates that are reflected by the FRC and JIT delivery schedules. Therefore, the line items of these FRC and JIT delivery schedules are transferred from SAP ERP (or SAP S/4HANA) to SAP TM (or SAP S/4HANA TM) and stored as Order-Based Transportation Requirements (OTR).

The subsequent planning activities result in Freight Orders (FOR) created in SAP TM (or SAP S/4HANA TM). These are used to define the schedule of the deliveries that shall be created in SAP ERP (or SAP S/4HANA). To do so, a delivery proposal for the Freight Order is created in SAP TM (or SAP S/4HANA TM) and sent to SAP ERP (or SAP S/4HANA). Based on this, an inbound or outbound delivery for the scheduling agreement is created on the SAP ERP (or SAP S/4HANA) side, which in turn triggers the creation of a Delivery-Based Transportation Requirement (DTR) in SAP TM (or SAP S/4HANA TM).



Note:

Please note that for scheduling agreement integration, not all possible scenarios have been released for all deployment scenarios. Please check the documentation or release notes for the current status. Some scenarios that are explicitly not released as of SAP S/4HANA 1909 are the following:

- Use of SD scheduling agreements in internal TM component integration



LESSON SUMMARY

You should now be able to:

- Define transportation relevance of documents
- Determine routing based on Incoterms
- Create a SD sales order
- Describe the integration of MM purchase orders
- Describe the Integration of MM scheduling agreements

Unit 4

Lesson 3

Creating Freight Units



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Create freight units and freight unit building rules
- View a freight unit

Concept of Freight Unit

This lesson examines the freight planning process in SAP TM, including freight unit building rules, the definition of freight unit types, and strategies for freight unit building.

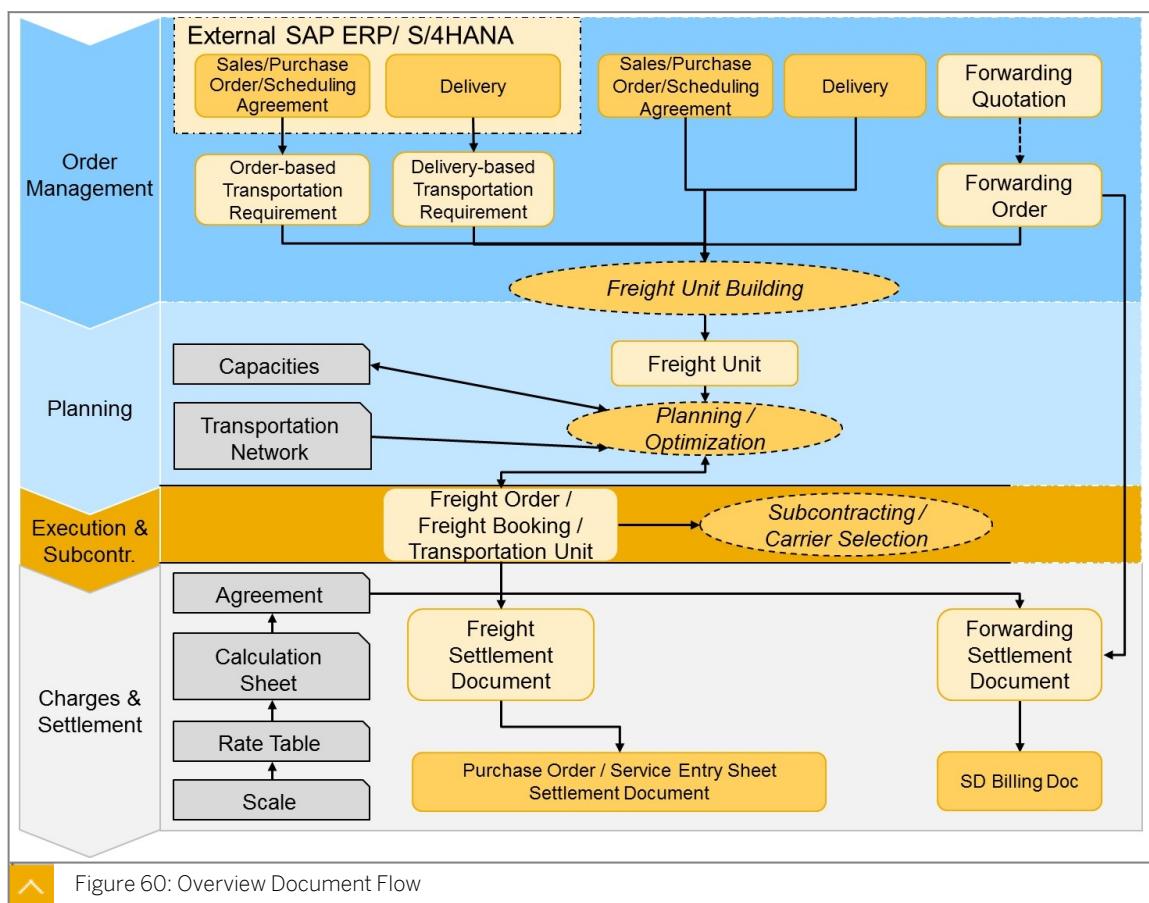


Figure 60: Overview Document Flow

Freight units are created from preceding business documents such as deliveries.

The system uses either the freight unit type from the freight unit building rule, or the default freight unit type defined in customizing.

Freight Units



Freight units are:

- A set of goods that can be transported together
- Used to merge items that can be transported together
- The smallest unit of freight
- Used in the planning of freight

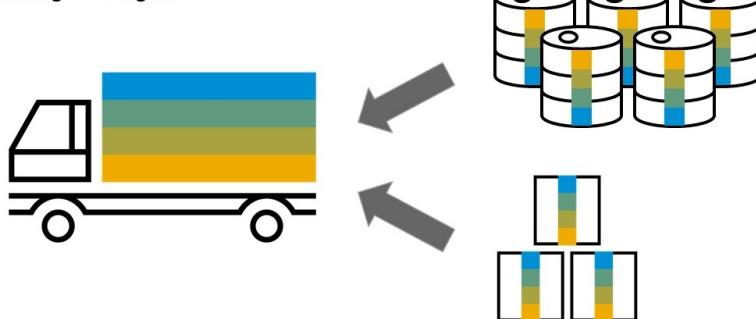


Figure 61: Freight Units



Note:

The freight unit type consists of a four-character identifier. The freight order type, freight booking type, transportation unit type, and freight unit types must be unique across these four business document types.

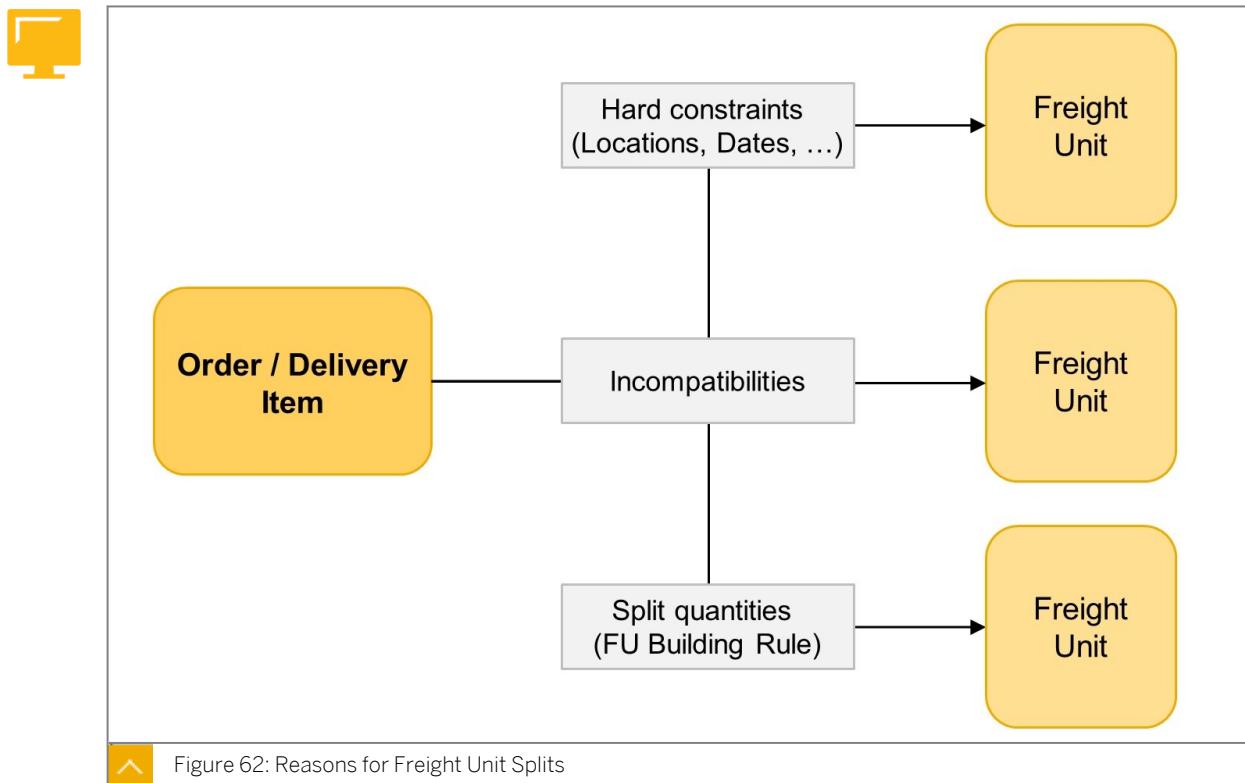
Freight Unit Building Rules

Freight unit building rules are required to plan freight in SAP TM and define how freight units are built. The system determines which freight unit building rule will be taken into account for the business document during planning.

There are three freight unit building rule determination options, as follows:

1. The system checks the condition defined in the logistics integration profile. If there is no condition or the condition cannot determine a result, the system moves to the second option.
2. The system checks if a freight unit building rule has been maintained in the logistics integration profile. If no freight unit building rule is maintained, the system moves to the third option.
3. The system applies standard settings.

Reasons for Freight Unit Splits



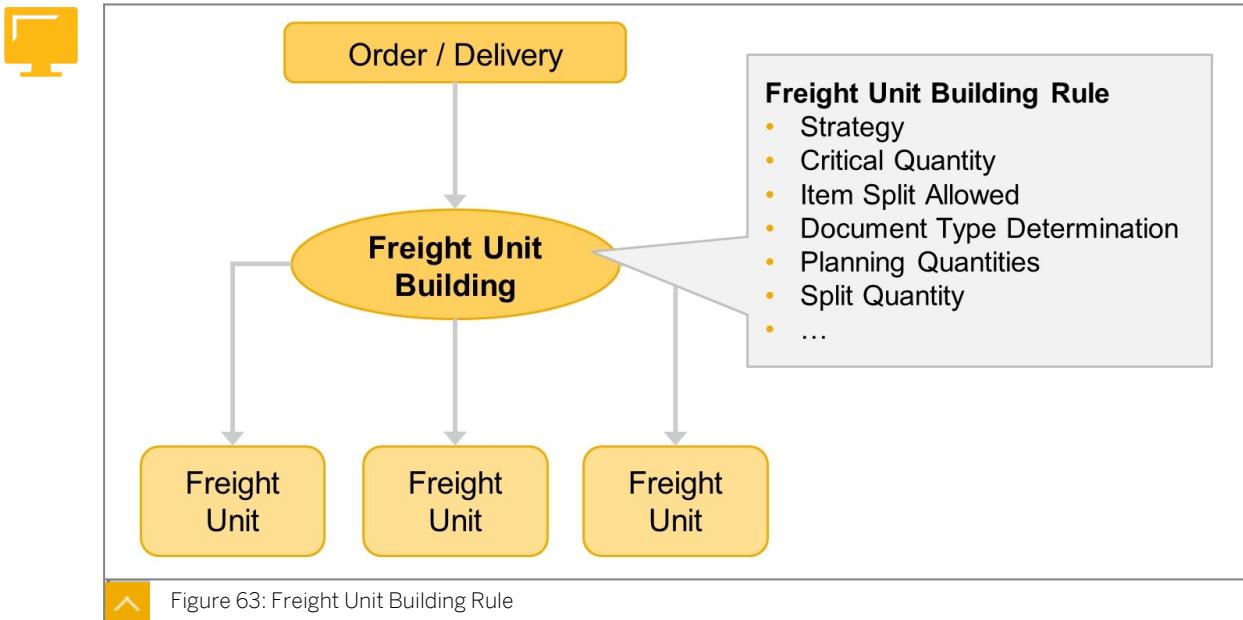
When creating freight units, the system first groups all delivery items within the following parameters:

- Hard constraints: These include source and destination location, and pick-up and delivery dates
- Business document attributes and packaging information
- Incompatibilities

Freight units are created automatically if transportation-relevance is determined for the transportation demand (sales order, purchase order, delivery, forwarding order, OTR, DTR).

The system considers freight units that already exist for the transportation demand. It creates freight units depending on the split quantity and the checkbox for the item split allowed. The system considers these entries when creating multiple freight units. You can use strategies to create freight units in accordance with your own requirements. SAP delivers the standard strategy **FUB_AUTO** for freight unit building.

Freight Unit Building Rule



Within the freight unit building rule, you must specify the critical quantity. This parameter defines the primary unit of measure that allows a line item on a transport requirement to be split into multiple freight units. Besides that, several planning quantities can be defined, for example, weight and volume. Every planning quantity is considered for capacity checks of resources during transportation planning, and every planning quantity is copied to the freight unit.

The split quantities define the maximum capacity of a freight unit. The system calculates the freight unit as a multiple of the rounding quantity. If *Item Split Allowed* is selected, the freight unit splits the item while it is being built, if it is over the split quantity. The process controller strategy allows you to use strategies to define the way in which freight units are created, in accordance with your requirements. If you maintain an equipment type in the freight unit building rule, the capacity of the equipment is considered during freight unit building and the items consolidated into one freight unit are loaded into the equipment.

If necessary, companies can define that the freight units are split if certain constraints are present. For example, you define the maximum capacity of a freight unit using the split quantity. Let's say you have to transport 5 tons of cement, but you can only transport it in batches of 500 kg. In this case, you define a split quantity of 500 kg and the system generates 10 freight units.



Note:

Using the process controller, freight unit building can be adjusted to customer-specific requirements using ABAP coding.

Based on the definition of freight units, all items included in a freight order are transported together from their source to their final destination. However, in multi-modal scenarios, different planners may be involved in scheduling the different stages of the transport. For this reason, stage information can be added to the freight unit. This allows a degree of independence when scheduling the stages.

Freight Units in Planning

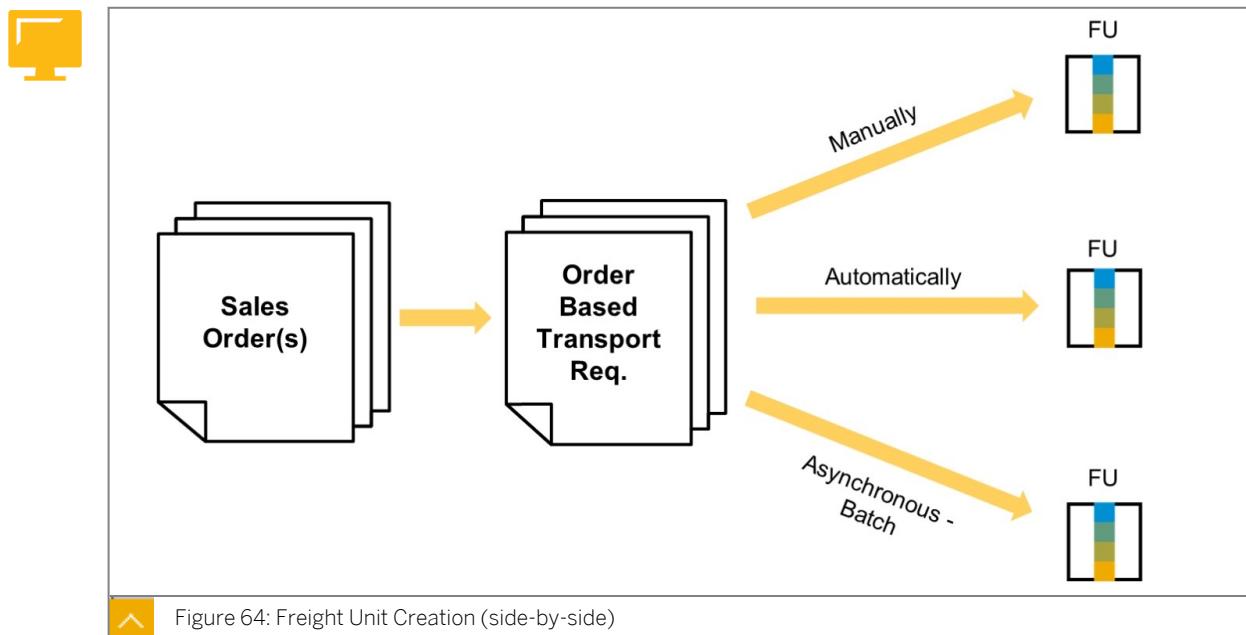


Figure 64: Freight Unit Creation (side-by-side)

The most convenient way of creating freight units is to create them automatically, based on their predecessor document (sales order, delivery, FWO, OTR, DTR). This option is the only option in an embedded deployment scenario.

In a side-by-side deployment scenario, freight units can additionally be created using a background report, and the creation of freight units can be manually triggered from worklists. If it arises during planning that a freight unit has to be adapted (split or merged, for example), this can be done manually, for example, in the transportation cockpit.

The creation of freight units based on forwarding orders in an LSP scenario can be done automatically, manually, or using the background report.



LESSON SUMMARY

You should now be able to:

- Create freight units and freight unit building rules
- View a freight unit

Unit 4

Lesson 4

Building a Package

LESSON OVERVIEW

In this lesson, we look at package building.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Explain the representation of handling units
- Describe package building
- Explain the concept of normalized load quantity

Handling Units

A handling unit (HU) is a logistic unit consisting of packaging materials and goods (materials). Typically, a company does not move individual pieces of different materials, rather quantities of materials grouped together as packages. You can depict this situation using Handling Unit Management.

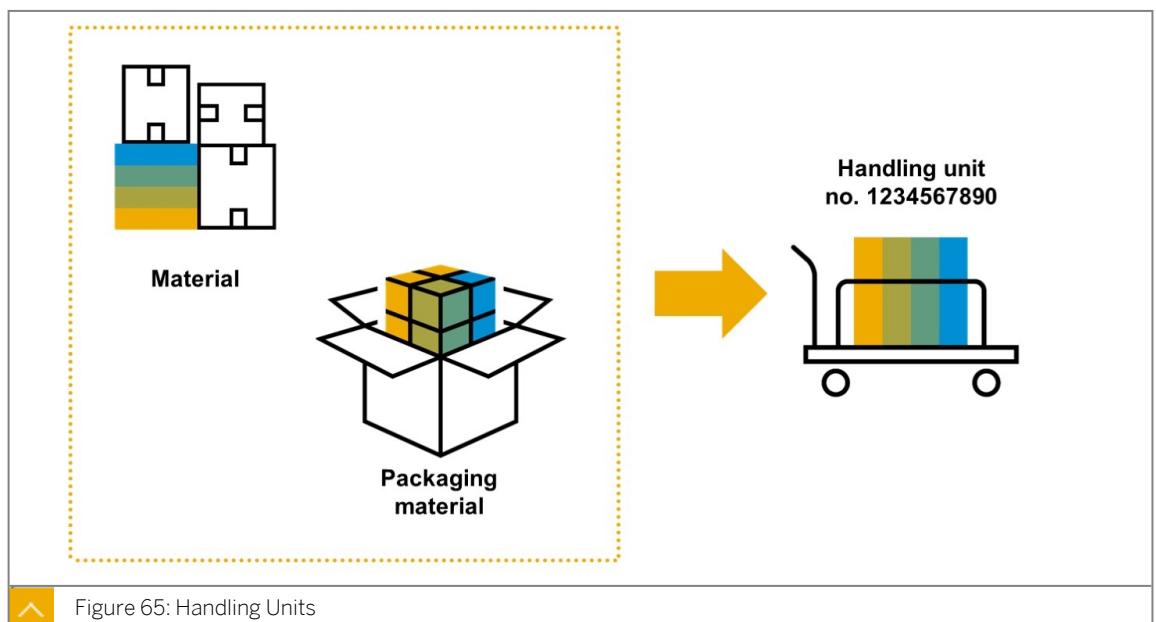


Figure 65: Handling Units

When you use Handling Unit Management, the system tracks the entire HU rather than individual materials. The HU is the common unit for material and information flow. A business transaction for a HU implies corresponding business transactions in the background for the materials and packaging materials it contains. In this way, one business transaction entry takes the place of several individual material-movement entries.

You can use handling units and can pass them to partners throughout the supply chain. Handling units have a single identification number that uniquely identifies the handling unit

across the various processes through which it moves. Using handling units in a cross-system logistics chain usually requires an identification number that is unique worldwide. You therefore have the option of assigning a Serial Shipping Container Code (SSCC) number to each handling unit.

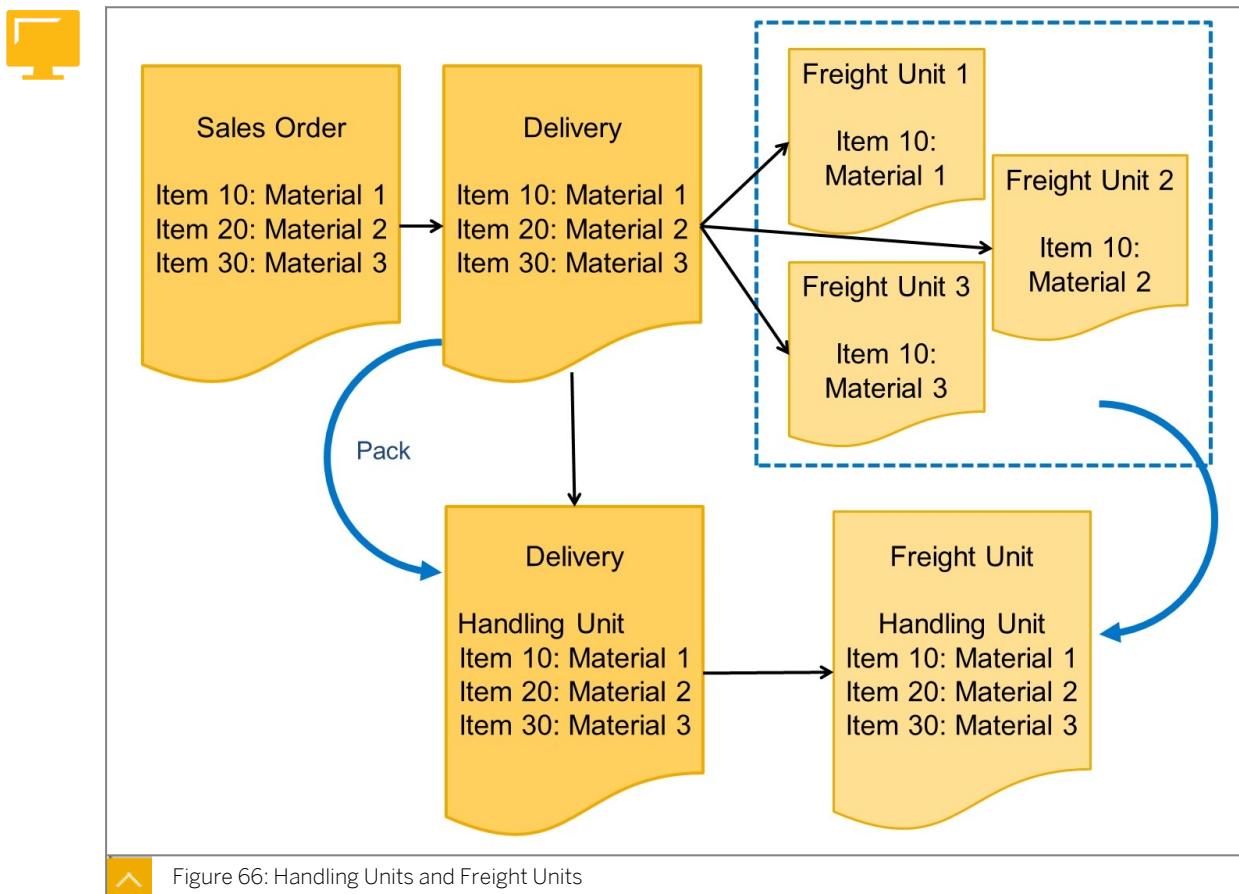
Packaging Materials

Packaging materials are intended to enclose or hold together the materials that are to be transported. The packaging materials and the goods material together comprise the handling unit, as we have seen.

The material that is to be packed can be packed into or onto the packaging material. The packaging material can also be a load carrier, such as a pallet. The most important packaging materials include crates, boxes, containers, wire baskets, and pallets.

You have to maintain the material master data for each packaging material you want to use. When creating material master records for packaging materials, enter either material type, VERP (packaging) or a customer-specific material type that you have already defined in Customizing.

Handling Units and Freight Units



When a delivery includes handling unit items, the freight units are adjusted accordingly. All product items that have been packaged into one handling unit are included in one freight unit; they are not split across several freight units. In this way, it is ensured that parts of a handling unit are not assigned to different freight orders during transportation planning.

If, for example, separate freight units were built per product initially, and these products are consolidated into one handling unit, the separate freight units are merged into one freight unit.

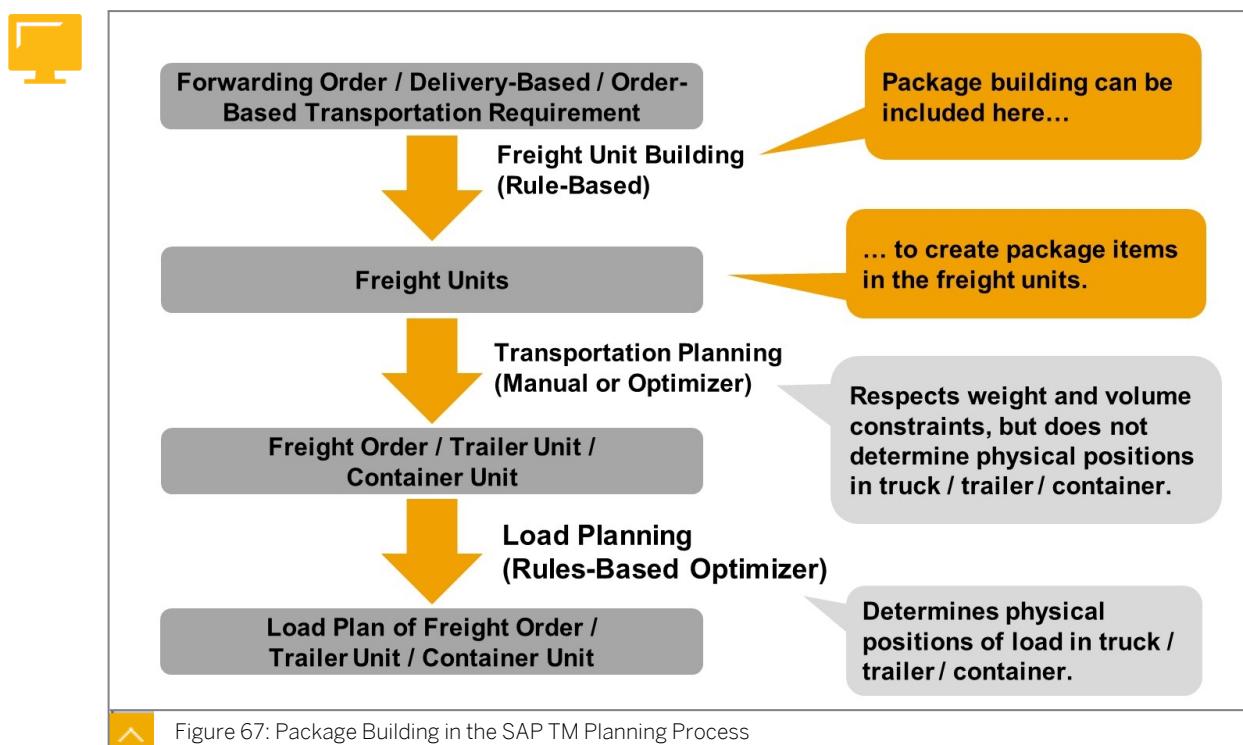
There is not necessarily a one-to-one relationship between handling units and freight units. One freight unit can contain several handling units. If desired, freight unit building can be set up to create one freight unit per handling unit.

Package Building

Orders are placed on products which, during the real process, are packaged to create packages and pallets (HUs, TUs, main cargo items, and so on). Packaging is a warehouse process. Warehouse-specific information can influence the result (for example, pick sequence). For the end-to-end process, the package information is required long before the warehouse is reached.

The goal for SAP TM is to close the gap between orders based on products and the load planning happening for packages and pallets, as well as to enable a package building function that considers warehouse information. Therefore, readily available packaging components and product master data packaging-specific definitions are reused.

Package Building in the SAP Transport Management (TM) Planning Process



Package building can be inserted into the overall planning process at the freight unit building step. It allows products to be combined into packages. These packages (within freight units) are later used in subsequent planning steps (manual and optimizer planning (VSR) to create freight orders and subsequent load planning).



"Early" Package Building Process

- Package building (PB) is used in freight unit building (FUB) and stores the created packaging hierarchy in the document created by FUB.
- Each package contains goods from one freight unit (i.e. only one customer).
- Vehicle scheduling and routing (VSR) and load planning (LP) operate on these freight units.
- In this process, package building cannot consolidate goods from different original demands (e.g. deliveries or forwarding orders) or customers into one package.

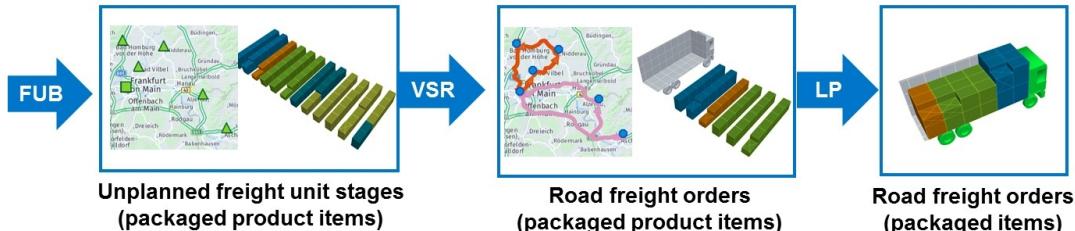


Figure 68: "Early" Package Building

Package Building Selected Features

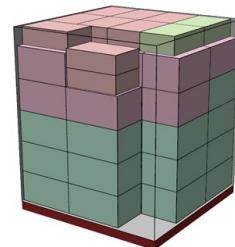
During package building, the system bundles products into packages based on specific constraints, while also keeping the total number of packages to a minimum. The system can also specify the exact position and orientation of each product item. You can define these constraints for different combinations of product, business partner, equipment, and location. If several constraints apply, the system always uses the most specific constraint.

Mixed Package Building



Mixed Package Building – Overview

- Consolidate multiple products for the same customer into one mixed carton
- Package building optimizer ("detailed package building") determines positions (x/y/z) and orientations of cartonized and non-cartonized products on mixed pallet, considering various constraints, e.g.
 - Stackability matrix (allow to stack product A on product B), stacking factor (A can be stacked n times within a stack), stack by decreasing weight / density
 - Incompatibilities (between products in mixed carton and in mixed pallet)
 - Height, volume and weight constraints
 - Orientation constraints of the products



Business value:

- ➔ Minimize number of pallets
- ➔ Maximize truck utilization
- ➔ Minimize number of trucks
- ➔ Reduce transportation costs

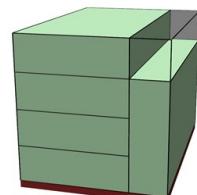


Figure 69: Mixed Package Building

The system creates mixed packages based on one of the following consolidation types:

- Volume
- Layer definitions

- Incompatibilities, stacking rules, and product orientations (based on these values, the system determines the exact positions of each product item in the package (detailed mixed package building))

Furthermore, the definition allows specific limits to be set regarding the weight and height that the package builder will consider when packing the product. It is possible to set generally valid limits on the package material (that is, product master data). For example, you can only stack an EU pallet up to 1.8 meters and put 900 kg on it. In the product and package type assignment, you can lower the specific product, customer, and location limits.

Package Building - Options

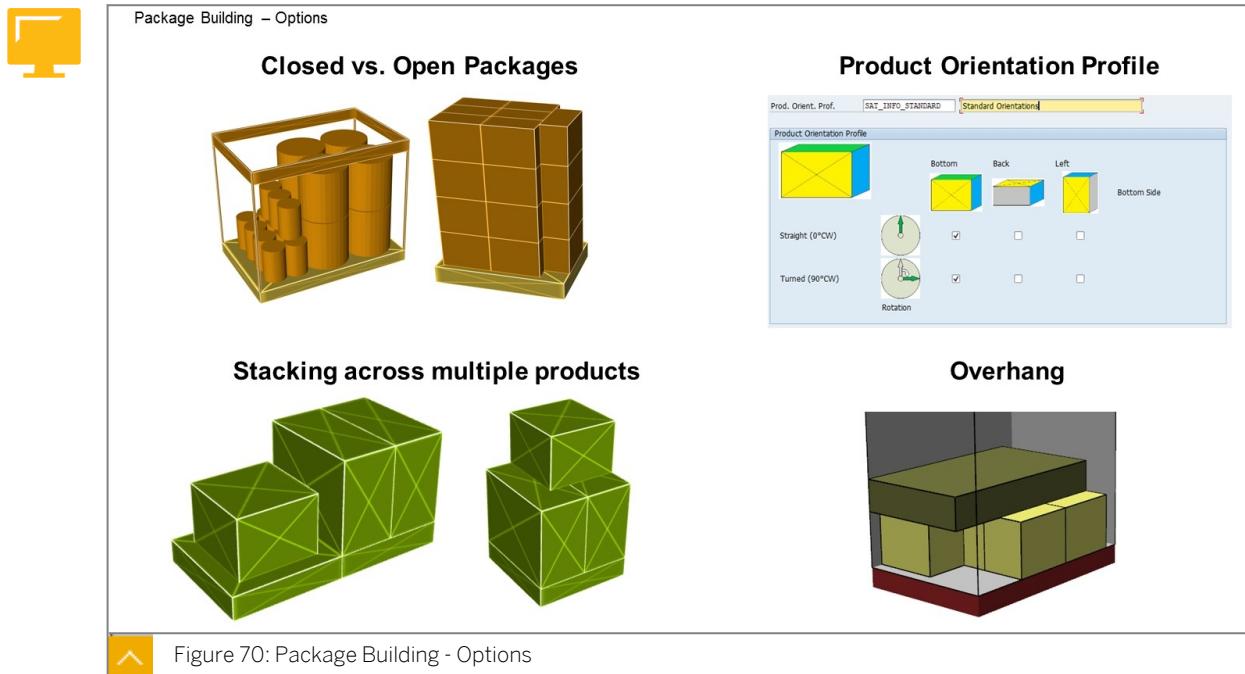


Figure 70: Package Building - Options

When creating packages, the system can split the quantity of a product using the following criteria:

- Quantity per package
- Maximum height of the package
- Maximum weight of the package

If different products are to be packaged, the system considers the lowest maximum height and the lowest maximum weight for a product or a packaging material. For example, if each product has a different maximum height, the system uses the lowest maximum height.

The result of package building is different types of packages, as follows:

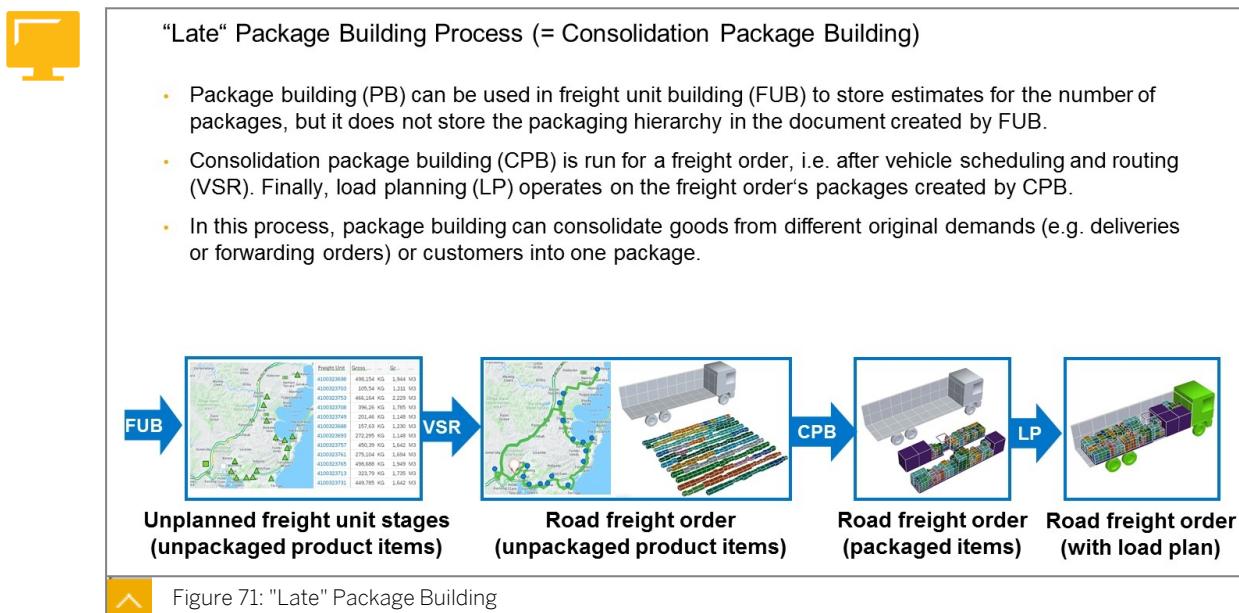
- Packages that contain only a single type of product
- Mixed packages that contain several different products
- Packages that consist of several layers:
The layers within a package can also contain different products, which results in mixed layers.
- Nested packages, that is, a package in another package:

For example, you can plan 24 cans in one box and 100 boxes in ten layers on one pallet.

- Full packages or incomplete packages:
Incomplete packages provide room for further consolidation.
- Flat or uneven packages:
Flat packages are a prerequisite for stackability.

"Late" Package Building

The "late" or "consolidation" package building process defers the package building process until the vehicle scheduling and routing process has created freight orders for the individual tours. This allows to add additional information into the package building process, that is, which products are to be delivered with the same truck/tour/freight order. Consequently, this information can be utilized to build packages/pallets across freight units/deliveries.



Package Units

The **Package Unit (PU)** is an additional business document: It represents one or multiple packages to be transported together across multiple stages (capacity documents). The PU is not needed if there is only one stage. It can have a deep packaging hierarchy, for example, pallet – carton – product. It is (technically) a transportation unit (like container units, trailer units, and railcar units). It can represent both capacity document and demand document. That means, package units can be assigned to freight orders / bookings and container / trailer / railcar units, but at the same time freight units can be assigned to a package unit. Typical examples for package units are pallet, pallet cage, box, carton.

The package unit provides additional functionality to enable an integrated delivery and line haul planning process:

- Linear with distribution stage type
- Multi-assignment



Integrated Delivery and Line-Haul Planning Process

- Business Process: Serve customers from regional hub by delivery tours with mixed pallets, which are built in warehouse and transported to hub by line haul tours. No re-building of pallets in hub.
- Planning process:
 - Plan delivery tours, build (mixed) pallets for delivery tours, create load plan for delivery tours
 - Plan line-haul tours based on mixed pallets from delivery tours, create load plan for line-haul tours
- New business document „package unit“ to represent transportation of mixed pallet by line-haul & delivery trucks
- Default route applied during freight unit building to define its regional hub
- Business value:** Avoid re-packing of pallets in hubs

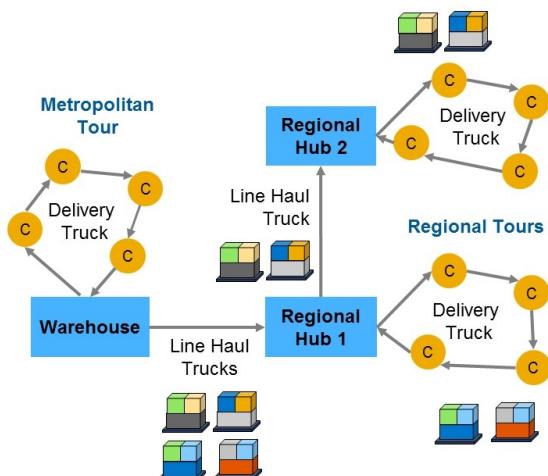


Figure 72: Integrated Delivery and Line-Haul Planning Process

The PU type allows defining the flexibility of assigning predecessor documents to the PU:

- Completely:** A freight unit is completely assigned to the PU. This is the standard approach of assigning freight units.
- Partially:** A freight unit can be distributed among multiple PUs (multi-assignment), but the PUs are assigned to one single capacity document. This is a new approach, which helps to avoid freight unit splits and an increasing number of documents in scenarios with freight units' items distributed across multiple package units (for example, pallets).



Note:

If PUs containing the same freight unit get assigned to different capacity documents, the freight unit gets split to ensure the fundamental freight unit consistency principle (it represents the goods transported together across the whole transportation chain).



FU1

FU2

FU3

PU1

PU2

FO1

Figure 73: Package Unit - Multi Assignment

Normalized Load Quantity

Many customers have the demand to get normalized quantities shown and used in different parts of SAP TM. Some examples for normalization are as follows:

- Central conversion of all transportation demands into Europallet / EuroPallet footprint
- Central conversion of all transportation demands into Colli / Rollbehälter
- Central conversion of all transportation demands into Loading Meters

For this purpose, the following two fields are available in various business objects:

- NLQ = Normalized Load Quantity
- ALQ = Additional Load Quantity



Normalized Load Quantity

Many customers have the demand to get normalized quantities shown and used in different parts of SAP TM.

Some examples for normalization are:

- Central conversion of all transportation demands into Europallet / EuroPallet footprint
- Central conversion of all transportation demands into Colli / Rollbehälter
- Central conversion of all transportation demands into LoadingMeters

For this purpose two fields are available in various business objects:

- NLQ = Normalized Load Quantity
→ available on header and item level of FU / TU / FO
- ALQ = Additional Load Quantity
→ available on header level of FU / TU / FO



Figure 74: Normalized Load Quantity

The normalized load quantity is available on header and item level of freight units, transportation units, and freight orders. The additional load quantity is available only on header level of the freight unit, transportation unit, and freight order.

Example for normalized load quantity (NLQ): Two different packaging materials are used in a road scenario. The first packaging material is, for example, europallet (UoM is EPL). The second packaging material is defined as Düsseldorfer Pallet (UoM is DPL), which is half of the size of EPL. You can now specify the normalized UoM EPL in the master data of the packaging material as follows:

- EPL = EPL * 1
- DPL = EPL * 0.5

If a resource, for example, has a capacity of 33 EPL (as the normalized quantity), different combinations of EPL and DPL can be evaluated so that the total capacity is not exceeded. For example, 23 EPL and 20 DPL would fit, but also 33 EPL or 66 DPL fits on the truck.

Example for additional load quantity (ALQ): A freight order has a total aggregated NLQ of 6 europallets. For the ALQ, a default UoM of loading meters has been defined in customizing. For the conversion between europallets and loading meters, the factor 0.4 has been specified.

In this case, the ALQ would be 2,4. This additional information can be used for charge calculation and subcontracting because many contracts are based on UoM, like loading meters specially in Europe. The ALQ is calculated based on the aggregated value of the NLQ for a requirement or capacity document. For calculation, the system uses the factor that has been defined in the customizing activity for the conversion between the NLQ UoM and the ALQ UoM.

Determination of Normalized Load Consumption Quantities

During package building, the system determines normalized load consumption quantities (normalized quantities, NLQ) to get accurate values regarding the load consumption of products. Based on these values, vehicle scheduling and routing optimization is able to choose the most suitable resources later in the process.

To determine the normalized quantity for each product, the system does the following steps:

1. The system first checks if values are available in the *Normalized Quantity* field of the package type assignment transaction (on the *Normalized Quantity Definition* tab page). These values can have the following source:
 - You have entered the values manually.
 - You have executed the NLQ determination report. The results are copied in this field automatically.
 - You have uploaded a Microsoft Excel file that contains the values.
2. If the system finds values in this field, it multiplies for each product the corresponding value with the planned quantity indicated in the freight unit item.
The system saves the results in the freight unit items. In addition, it displays the sum of the normalized quantities of all items on header level of the freight unit.
3. If the system does not find values in this field, it checks the product master data. If it finds a conversion factor between the base unit of measure and the unit of measure for normalized quantity for a product, it uses this conversion factor to determine the normalized quantity for this product.
4. If you have not defined conversion factors in the product master data, the system does not determine normalized quantities during package building.



Note:

The system only determines normalized quantities if you have defined a unit of measure for normalized quantity in your package building profile.



LESSON SUMMARY

You should now be able to:

- Explain the representation of handling units
- Describe package building
- Explain the concept of normalized load quantity

Unit 4

Lesson 5

Managing the Freight Forwarding Process

LESSON OVERVIEW

You can use the Forwarding Order Management component in SAP TM to create, edit, and confirm the forwarding orders from your ordering parties. In doing so, you can have the system determine the route and calculate the transportation charges. The orders then form the basis for transportation planning.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe the freight forwarding process

Freight Forwarding Process

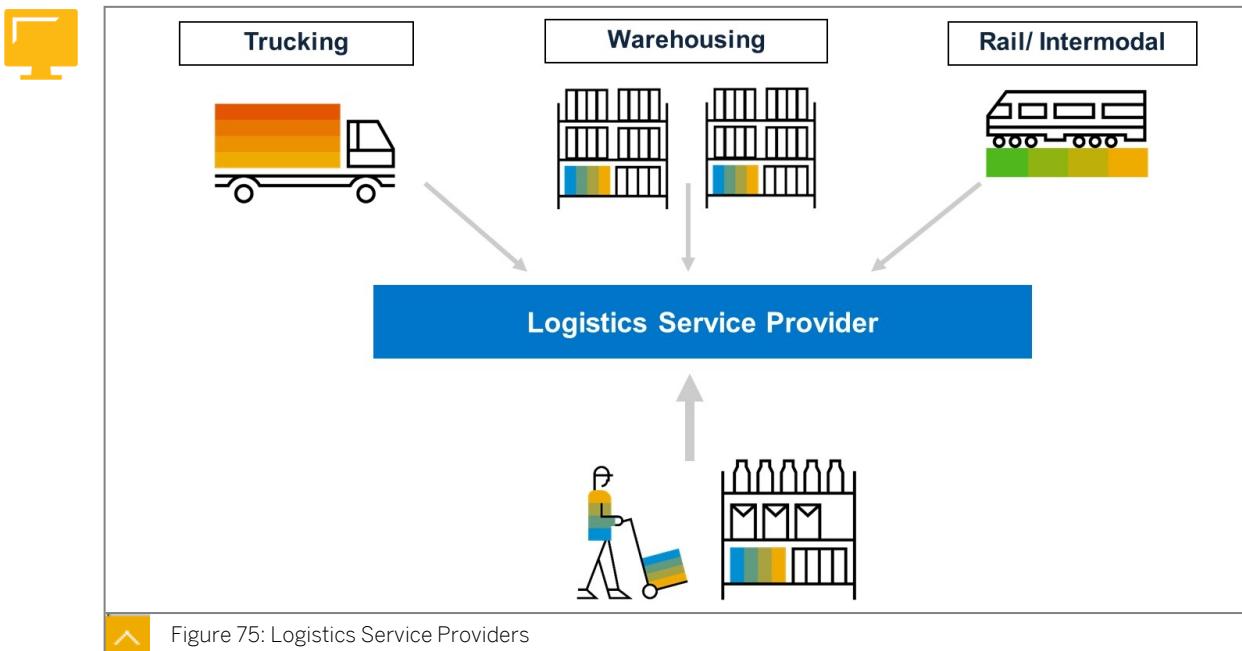


Figure 75: Logistics Service Providers

Outsourcing refers to the process whereby the transportation services are performed by an external party, often referred to as the logistics service provider (LSP), freight forwarder, or third-party logistics provider.

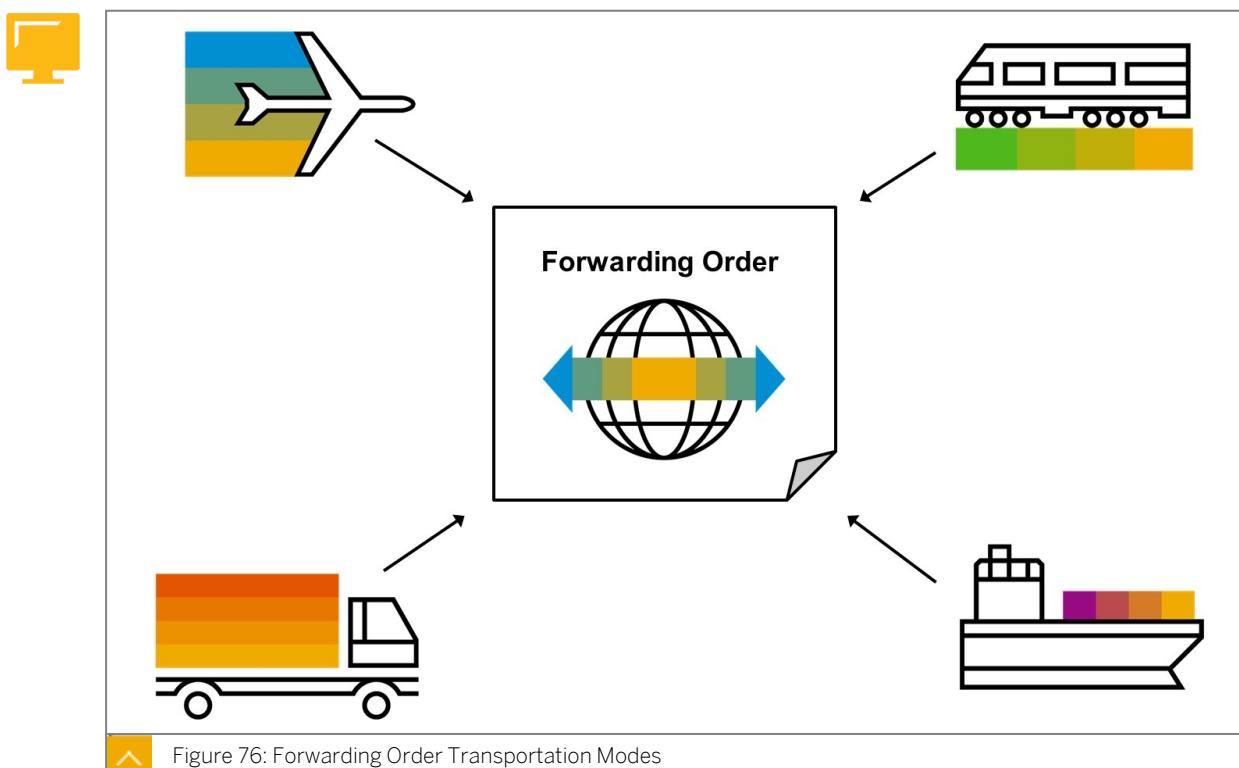
A freight forwarder, forwarder, or forwarding agent is a person or company that organizes shipments for individuals or other companies and may also act as a carrier. A forwarder is often not active as a carrier and acts only as an agent, in other words, as a third-party (non-asset-based) logistics provider. The agent dispatches shipments via asset-based carriers and books or otherwise arranges space for these shipments. Carrier types include ships, airplanes, trucks, and trains. Freight forwarders typically arrange cargo movements to an international destination. Also referred to as international freight forwarders, they have the

expertise that allows them to prepare and process the documentation and perform related activities pertaining to international shipments. Some of the typical information reviewed by a freight forwarder is the commercial invoice, shipper's export declaration, bill of lading, and other documents required by the carrier or country of export, import, or transshipment. Much of this information is now processed in a paperless environment.

The third-party logistics provider (abbreviated as 3PL, or sometimes TPL) is a firm that provides a one stop shop service to its customers of outsourced (or "third-party") logistics services for part, or all of, their supply chain management functions. Third-party logistics providers typically specialize in integrated operation, warehousing, and transportation services that can be scaled and adapted to the customer's needs based on market conditions and the demands and delivery service requirements for their products and materials.

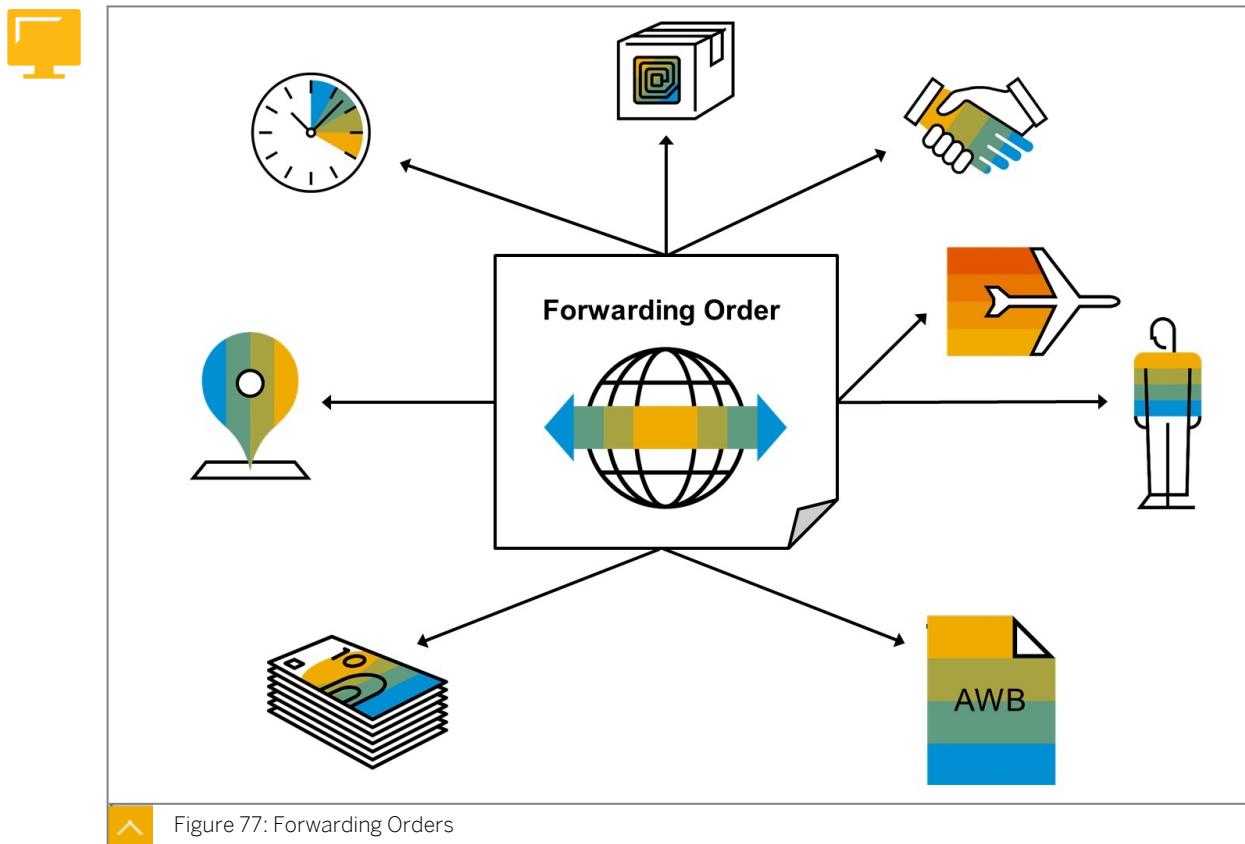
Forwarding Orders in SAP TM

Forwarding Order Transportation Modes



Logistics service providers operate globally. Therefore, they also operate multiple transportation modes, as shown in figure Forwarding Order Transportation Modes. Each transportation mode has its own specific information requirements, which are entered into the forwarding order. In most cases, the mode of transportation is already predefined by the customer based on the locations involved in the transportation. The method of processing forwarding orders can also vary from customer to customer, region to region, or product to product. The general forwarding order process normally starts with the receipt of customer requirements, either as an e-mail, phone call, or through direct bookings on the forwarding company's portal. A dispatcher or forwarding agent may only have 3-5 minutes to dispatch a customer requirement. Therefore, it is extremely important that this customer requirement can be processed quickly. SAP TM achieves this through the use of fast-entry screens and templates.

Information and Functionality in Forwarding Orders



As already mentioned, the necessary level of information in a forwarding order is different for each transportation mode. The example in the figure, Forwarding Orders, shows a forwarding order designed for air transportation processes. The forwarding order comprises the following information and functionality:

- Locations:

As with OTRs and DTRs, locations are one of the major elements of a transportation requirement. The locations define from where and to where the transport is supposed to run.

- Dates/Times:

For transportation requirements, 'when' is almost as important as 'where'. Therefore, dates and times are another major element of the forwarding order.

- ULD (Unit Load Device):

The ULD is specific to air transportation and, when required, the forwarding order also carries the relevant information pertaining to the air container types supposed to be used in the transportation.

- Business Partners:

The business partners details lists all parties involved in the transportation process. For LSP driven processes, the number of involved parties can be much higher than in shipper processes, including additional parties such as preferred carrier, notify parties, payer different to ordering party, and so on. On forwarding orders, charges can be calculated for

the transportation requirement. The charges calculated can be settled to create an invoice that is sent to the LSP's customer.

- Airports:

In air transportation, the LSP usually predefines which airports are included in the transportation. This is based on a certain rule set (called Default Route in SAP TM). In this way, the LSP defines how the goods are supposed to be routed in the transportation requirement.

- Planning and Execution Organizations:

For each defined stage of the transportation requirement, the LSP can maintain which planning and execution organization within the LSP company should be concerned with the follow-up activities for this transportation requirement, such as planning, subcontracting, or execution.

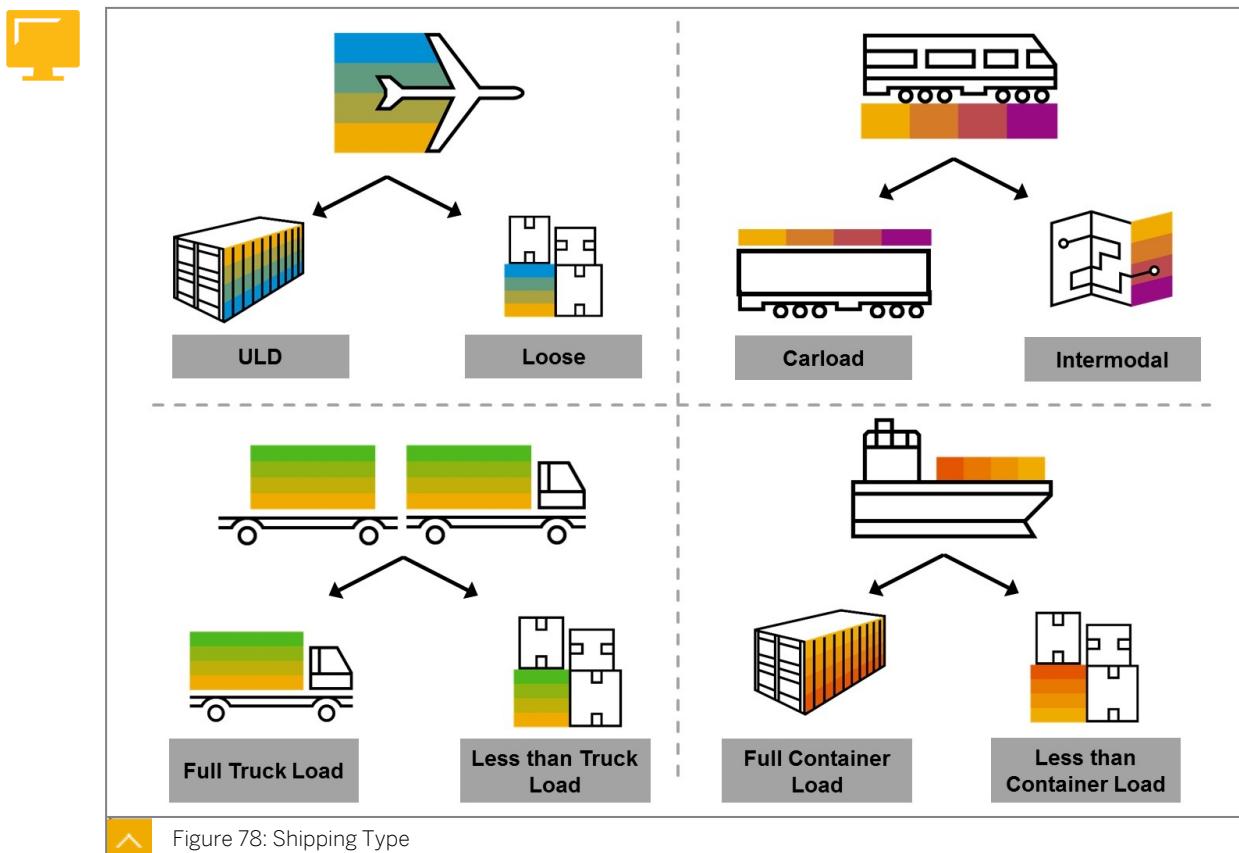
- Output:

The LSP can issue documents such as a House Air Waybill (used in air transportation) directly from the transportation requirement.

- Items:

The forwarding order contains information about what goods are to be transported.

Shipping Type



Shipping types define how the cargo is given to the LSP or carrier for transportation. In general, we can differentiate between the following two transportation scenarios:

- Consolidation is needed:

If consolidation is required, the customer only provides pallets to the LSP. The LSP finds other customer orders during planning in order to consolidate these orders into one container to reduce costs.

- Consolidation is not needed:

If consolidation is not needed, the customer provides the LSP with a full container which can be transported individually as it is.

Stage Definition

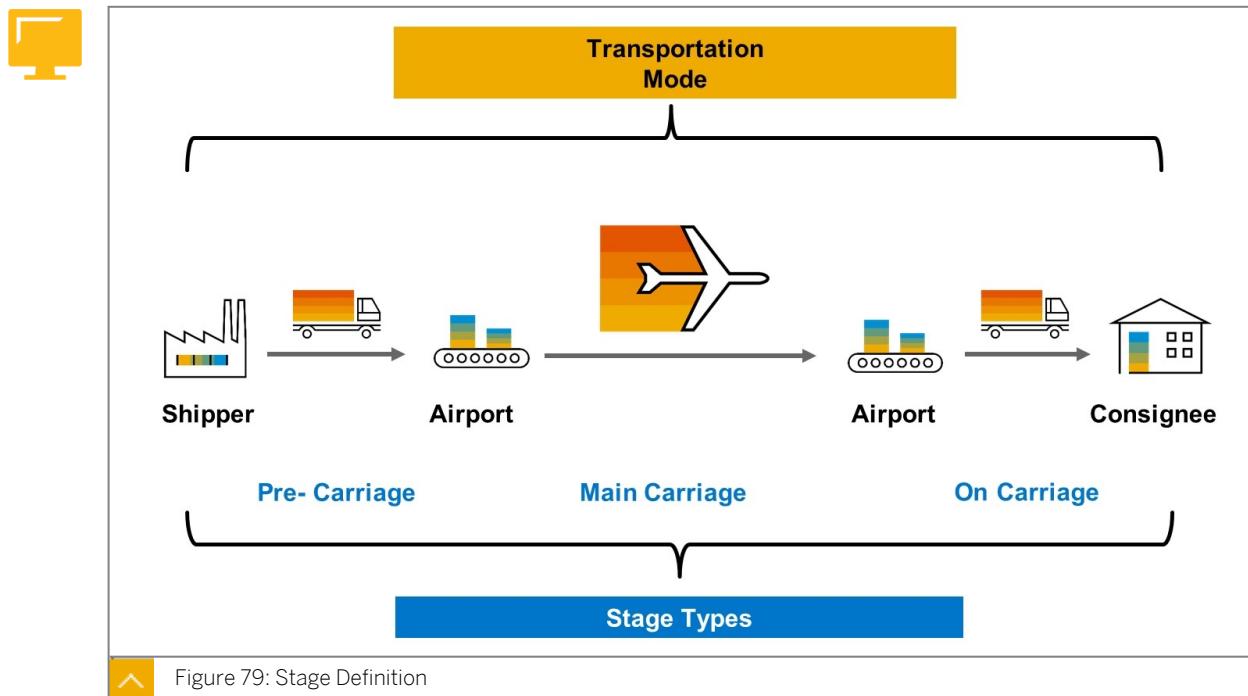


Figure 79: Stage Definition

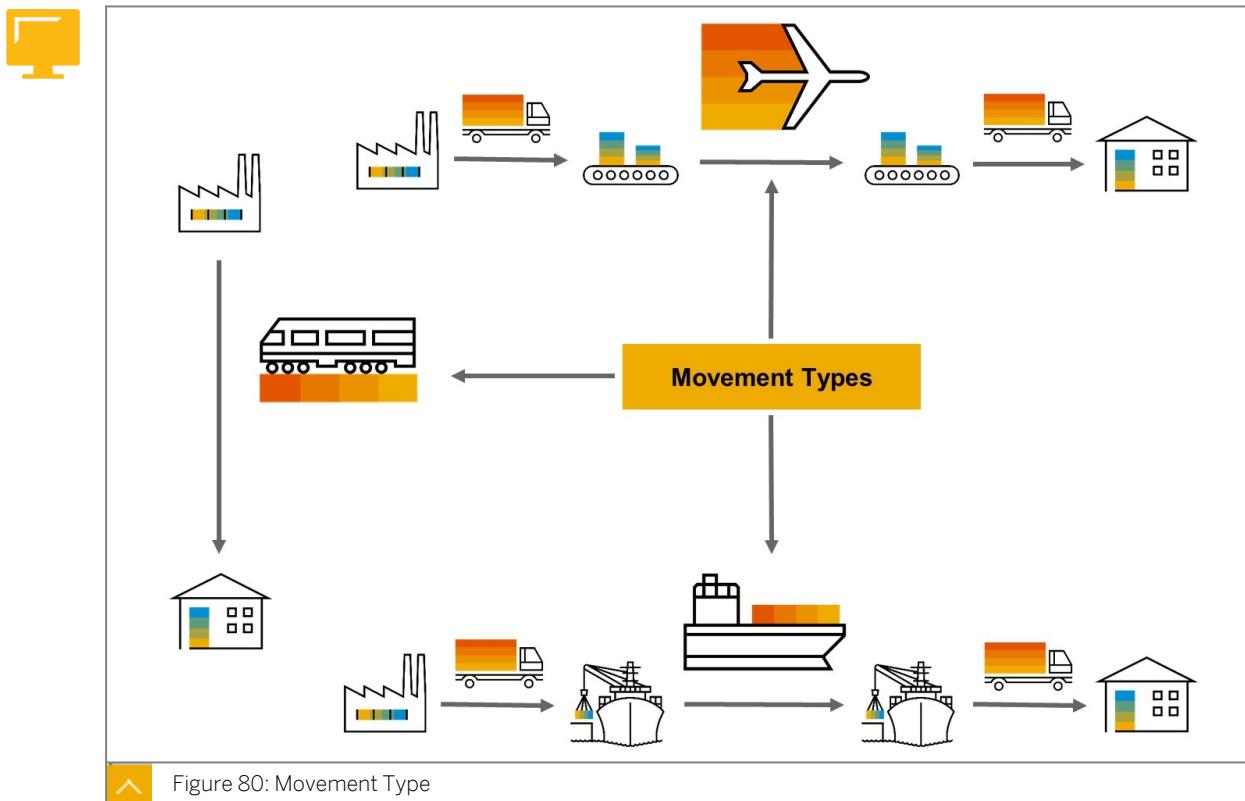
In most international transports, the LSP does a routing of the entire transportation prior to the planning itself. Initially, when only source and destination locations are entered, there is only one stage in the forwarding order. However, the LSP can split this stage and enter intermediate stops as well as planned arrival and departure dates for each intermediate stop.

These stages are propagated into the freight unit and the planning complies with it. The stages can be maintained manually or automatically, running a transportation proposal. As different items of the forwarding order may have different destination locations, the routing can also be defined for each item individually. This is done on the *Ordered Route* and *Actual Route* tabs.

For each stage, you can maintain the required transportation mode. The definition of the transportation mode per stage is optional but if a transportation mode is defined for a stage, the corresponding freight units stage may only be planned on freight documents and resources of this transportation mode.

Furthermore, stages can be classified with so called stage types. There are predefined stage types such as pre-carriage, main carriage, and on-carriage as shown in the figure, Stage Definition. The transportation modes used in the stages do not have to match the transportation mode defined for the forwarding order, however, the transportation mode of the stage representing the main carriage should always match the transportation mode for the entire forwarding order.

Movement Type



The movement type describes the geographical nature of the entire transportation process, as shown in the figure, Movement Type. While the shipping type describes the nature of what is going to be transported, the movement type describes the way it is going to be transported. Common examples for movement types are door-to-door or port-to-port.

When defining a movement type, the business partner entered as the shipper of the forwarding order can be used as the source location of the forwarding order (that is, the location that has the business partner defined as shipper assigned). The same can be done for the destination location which is derived from the consignee of the forwarding order.

Processing Forwarding Orders

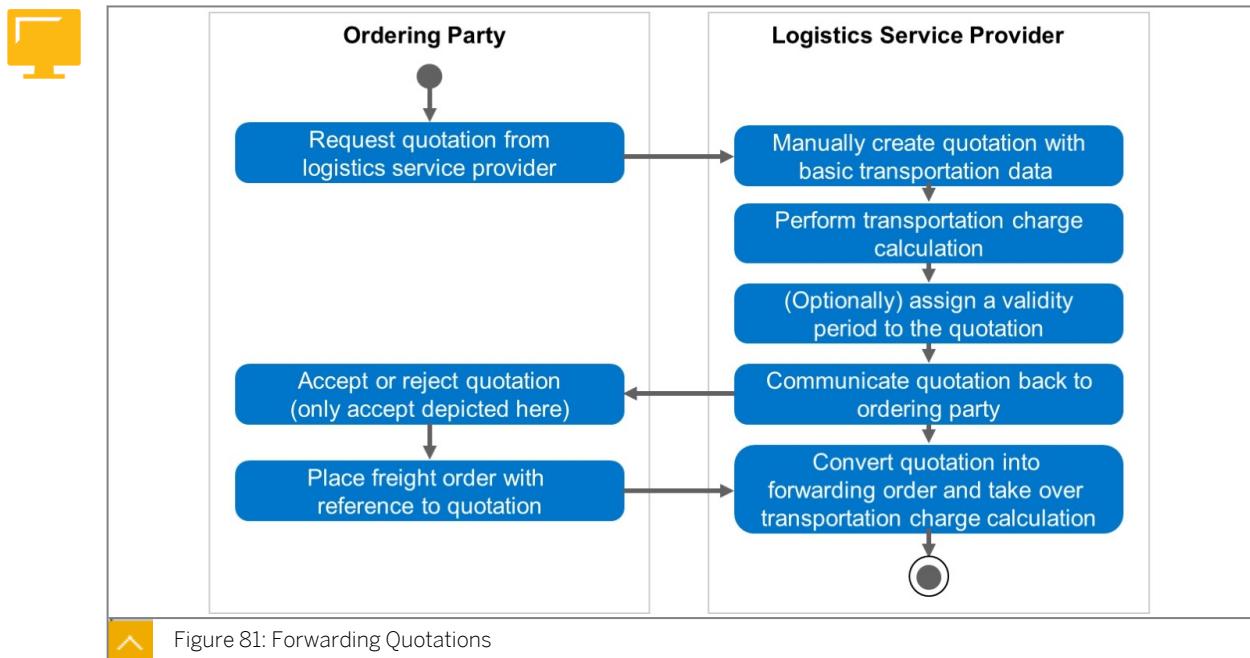


Figure 81: Forwarding Quotations

An offer (that is, a quote) is made by a logistics service provider to a customer for the transportation of goods. The offer binds the logistics service provider for a certain period of time to execute a subsequent forwarding order for a certain amount of money. The quotation process in forwarding order management is seamlessly integrated with the tendering process in freight order management. Forwarding order management is comprised of functions such as creation, update, and confirmation of forwarding orders. Forwarding orders can be received electronically via EDI or can be entered through the user interface.

Profitability Concept in Forwarding Orders



Revenue			Cost		
Planned	Expected	Invoiced/Paid*	Planned	Expected	Invoiced/Paid*
Charges in FWO	Charges in FWSD	Charges finally paid in ERP	Costs flow from freight documents (executed stages)	Charges from cost distribution from FO/FB	Charges from cost distribution is FSD related to FO/FB executing the FWO
			Internal costs in FWO in case internal settlement has been enabled	Charges from ISD related to the FWO	Amounts finally paid from ERP
Calculated Profit = Total Revenue – Total Cost			* tbd, planned functionality		

Figure 82: Profitability Concept in Forwarding Orders

A profitability analysis can be done in the forwarding order. The system takes into account all the costs and revenues associated with the execution of a forwarding order. The system displays the revenues, costs, and profits for the planned profitability and estimated profitability. The sources of costs are freight orders, freight bookings, and freight settlement documents. The sources of revenue are forwarding orders and the corresponding forwarding settlement documents. Internal settlement documents are costs for the company receiving the settlement and revenue for the company sending the settlement.

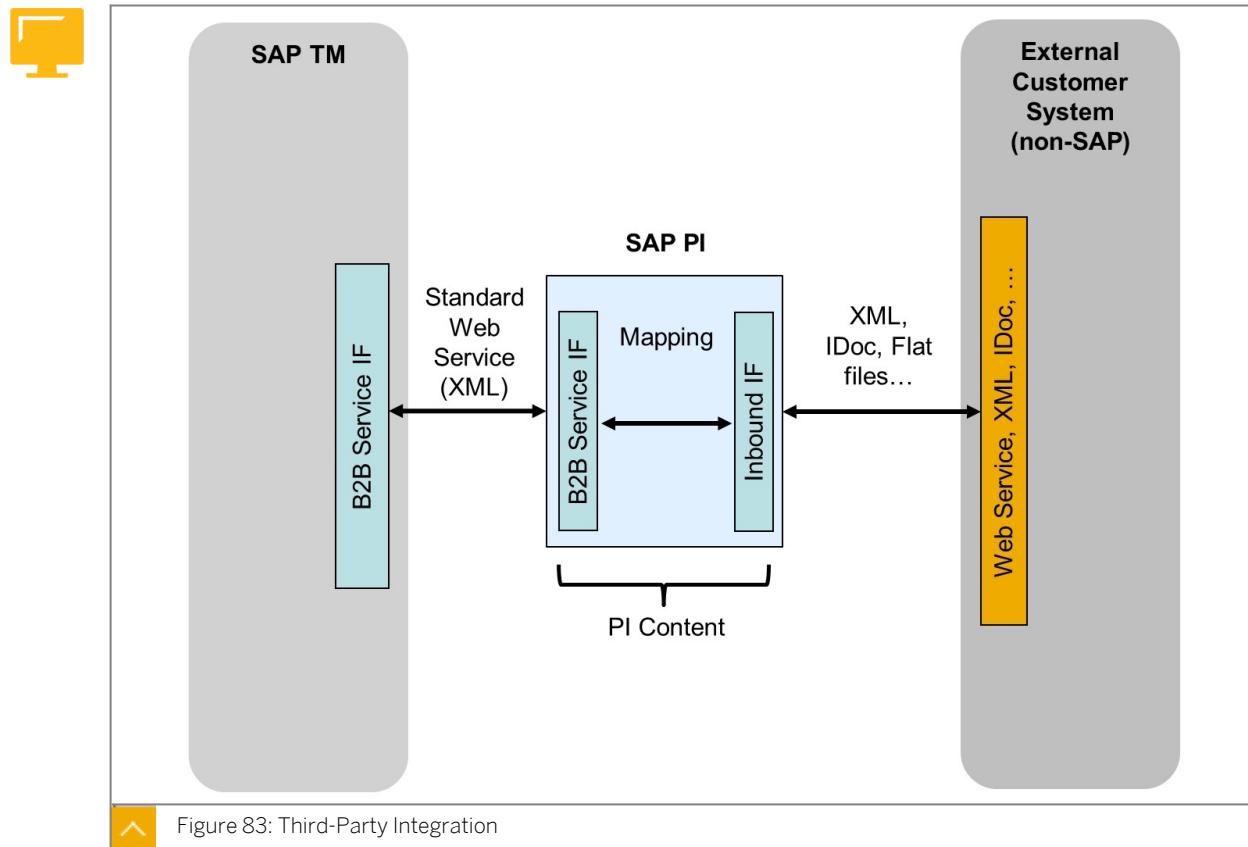
Planned profitability: The system calculates the revenue and cost charges from forwarding orders. It retrieves the planned cost from the following sources:

- Cost distribution done in a freight order or freight booking
- Internal charge calculation done on a forwarding order

Expected profitability: The system calculates the revenue and cost charges from settlement documents. It retrieves the expected cost from the cost distribution done on freight settlement documents and internal settlement documents.

Third-Party Integration with Forwarding Orders

Forwarding orders can be received electronically and created automatically, based on the information of a B2B message. SAP TM offers a predefined interface for B2B communication between the LSP and the customer. The customer can therefore send a B2B message to the LSP's SAP TM system, in which a forwarding order is automatically created. The B2B message contains all the fields of a forwarding order, which means that compared to the manual entry of the forwarding order document, there is no loss of information. If messages are received in a different format, they can be mapped to the standard interface using SAP PI.



LESSON SUMMARY

You should now be able to:

- Describe the freight forwarding process

Learning Assessment

1. Which business documents can be created and changed manually in SAP TM?

Choose the correct answer.

- A Forwarding Order
- B Order-Based Transportation Requirements
- C Delivery-Based Transportation Requirements

2. How can you trigger a process in SAP TM?

Choose the correct answers.

- A By creating order-based transportation requirements from sales order integration
- B By creating business partners
- C By creating freight units
- D By creating delivery-based transportation requirements from inbound delivery integration
- E By creating forwarding orders

3. What can you influence with the control key?

Choose the correct answers.

- A Whether sales order are relevant for SAP TM
- B How freight units are created
- C Whether the incoterm location is used for stage building
- D Whether outbound deliveries are relevant for SAP TM
- E Whether sales orders and outbound deliveries are both relevant for SAP TM

4. Which business document is created in SAP TM based on an SAP ERP sales order in a side-by-side deployment scenario?

Choose the correct answer.

- A None
- B Delivery-Based Transportation Requirement
- C Order-Based Transportation Requirement

5. Which of the following business documents can serve as input for freight unit building?

Choose the correct answers.

- A Forwarding Orders
- B Order-Based Transportation Requirements
- C Deliveries
- D Freight Orders
- E Freight Bookings

6. A freight unit can only be assigned to a single freight order or freight booking.

Determine whether this statement is true or false.

- True
- False

7. A handling unit can be represented by several freight units in SAP TM.

Determine whether this statement is true or false.

- True
- False

8. What are the allowed relationships between freight units and handling units?

Choose the correct answers.

- A 1:1
- B 1:n
- C n:1

9. Provide an overview of package building in the SAP TM planning process.

10. What is the purpose of package building?

Choose the correct answers.

- A To get an overview about the dimensions relevant for transportation
- B To create an item hierarchy involving all transported goods
- C To receive many presents for your birthday
- D To support the warehouse in cartonization

11. Which transportation modes are supported using forwarding orders in an LSP scenario?

Choose the correct answers.

- A Road
- B Rail
- C Ocean
- D Air

12. How can you create a forwarding order?

Choose the correct answers.

- A You create it manually by typing in the data.
- B You receive it via a B2B interface.
- C You create it based on deliveries.
- D You receive it as an order-based transportation requirement.

Learning Assessment - Answers

1. Which business documents can be created and changed manually in SAP TM?

Choose the correct answer.

- A Forwarding Order
- B Order-Based Transportation Requirements
- C Delivery-Based Transportation Requirements

Correct. Forwarding Orders can be created and changed manually in SAP TM.

2. How can you trigger a process in SAP TM?

Choose the correct answers.

- A By creating order-based transportation requirements from sales order integration
- B By creating business partners
- C By creating freight units
- D By creating delivery-based transportation requirements from inbound delivery integration
- E By creating forwarding orders

Correct. A transportation process may be initiated by an order-based transportation requirement, by a delivery-based transportation requirement, or by a forwarding order. Freight units cannot be created directly and business partners are master data, but not transactional data.

3. What can you influence with the control key?

Choose the correct answers.

- A Whether sales order are relevant for SAP TM
- B How freight units are created
- C Whether the incoterm location is used for stage building
- D Whether outbound deliveries are relevant for SAP TM
- E Whether sales orders and outbound deliveries are both relevant for SAP TM

Correct. The selection of the control key controls whether sales orders, outbound deliveries, or both are relevant for SAP TM. How freight units are created and whether the incoterm location is used for stage building is defined in the logistics integration profile.

4. Which business document is created in SAP TM based on an SAP ERP sales order in a side-by-side deployment scenario?

Choose the correct answer.

- A None
- B Delivery-Based Transportation Requirement
- C Order-Based Transportation Requirement

Correct. An order-based transportation requirement is created in this scenario.

5. Which of the following business documents can serve as input for freight unit building?

Choose the correct answers.

- A Forwarding Orders
- B Order-Based Transportation Requirements
- C Deliveries
- D Freight Orders
- E Freight Bookings

Correct. Forwarding orders, order-based transportation requirements and deliveries can serve as an input to freight unit building.

6. A freight unit can only be assigned to a single freight order or freight booking.

Determine whether this statement is true or false.

True

False

Correct. The same freight unit could be assigned to a freight order for pre-carriage and a freight booking for main carriage, for example.

7. A handling unit can be represented by several freight units in SAP TM.

Determine whether this statement is true or false.

True

False

Correct. A handling unit is always completely contained in one freight unit.

8. What are the allowed relationships between freight units and handling units?

Choose the correct answers.

A 1:1

B 1:n

C n:1

Correct. On freight unit can contain 1 or more (n) handling units, but a handling unit cannot be split across freight units.

9. Provide an overview of package building in the SAP TM planning process.

Package building allows products to be combined into packages. These packages (within freight units) are later used in subsequent planning steps (manual and optimizer planning (VSR) to create freight orders and subsequent load planning).

10. What is the purpose of package building?

Choose the correct answers.

- A To get an overview about the dimensions relevant for transportation
- B To create an item hierarchy involving all transported goods
- C To receive many presents for your birthday
- D To support the warehouse in cartonization

Correct. The purpose of package building is to get an overview about the dimensions relevant for transportation and to create an item hierarchy representing the packaging of all transported goods. Cartonization is a process in warehousing and not in SAP TM.

11. Which transportation modes are supported using forwarding orders in an LSP scenario?

Choose the correct answers.

- A Road
- B Rail
- C Ocean
- D Air

Correct. All transportation modes (road, rail, air, ocean) are supported using forwarding orders in an LSP scenario.

12. How can you create a forwarding order?

Choose the correct answers.

- A You create it manually by typing in the data.
- B You receive it via a B2B interface.
- C You create it based on deliveries.
- D You receive it as an order-based transportation requirement.

Correct. You can create it manually by typing in the data or receive it via a B2B interface.

UNIT 5

Transportation Planning

Lesson 1

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Lesson 8

Performing Carrier Selection

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Lesson 9

Tendering a Freight Order

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UNIT OBJECTIVES

- Describe the business process and documentation required for transportation planning
- Define freight order types

- Define the requirements for a selection profile
- Display a selection profile
- Describe the parameters used to support planning in SAP TM
- Display a planning profile
- Describe the concept of profile and layout sets
- Access the transportation cockpit
- Describe visual planning
- Create freight orders for road transportation
- Explain the scheduling logic
- Understand the Logic of VSR Optimization
- Execute the VSR optimizer
- Describe transportation units
- Generate a transportation proposal
- Describe load planning
- Describe the ocean freight booking process
- Create an ocean freight booking
- Define the carrier selection process and parameters
- Assign carriers to freight orders
- Describe the tendering process
- Tender a freight order

Unit 5

Lesson 1

Defining the Transportation Planning Process

LESSON OVERVIEW

Your business receives orders for the products it manufactures and must then ship these products to the end customer. SAP TM has the capability to perform advance planning in order to increase your company's service level and increase profitability. In this lesson, you will gain a high-level overview of the planning capabilities of SAP TM.

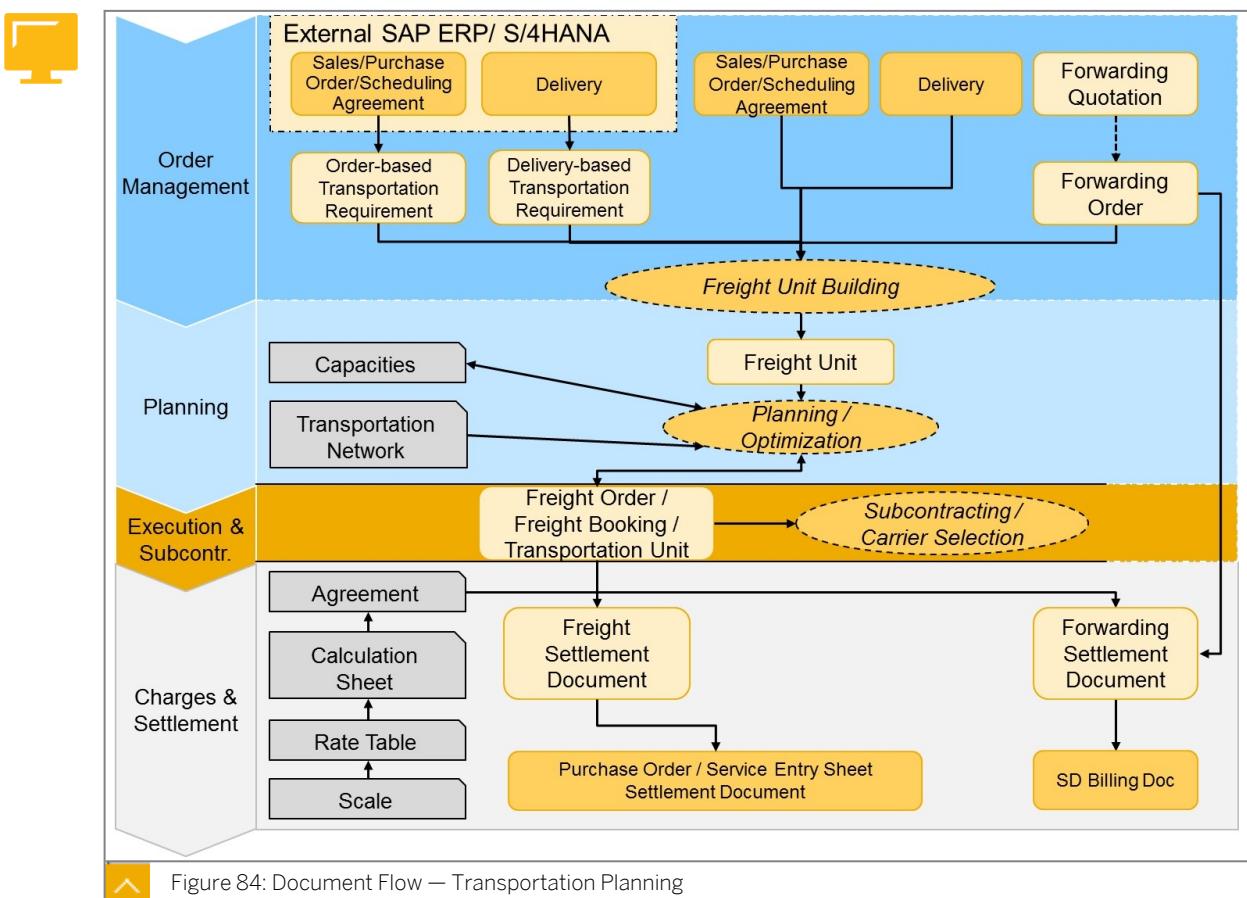


LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe the business process and documentation required for transportation planning
- Define freight order types

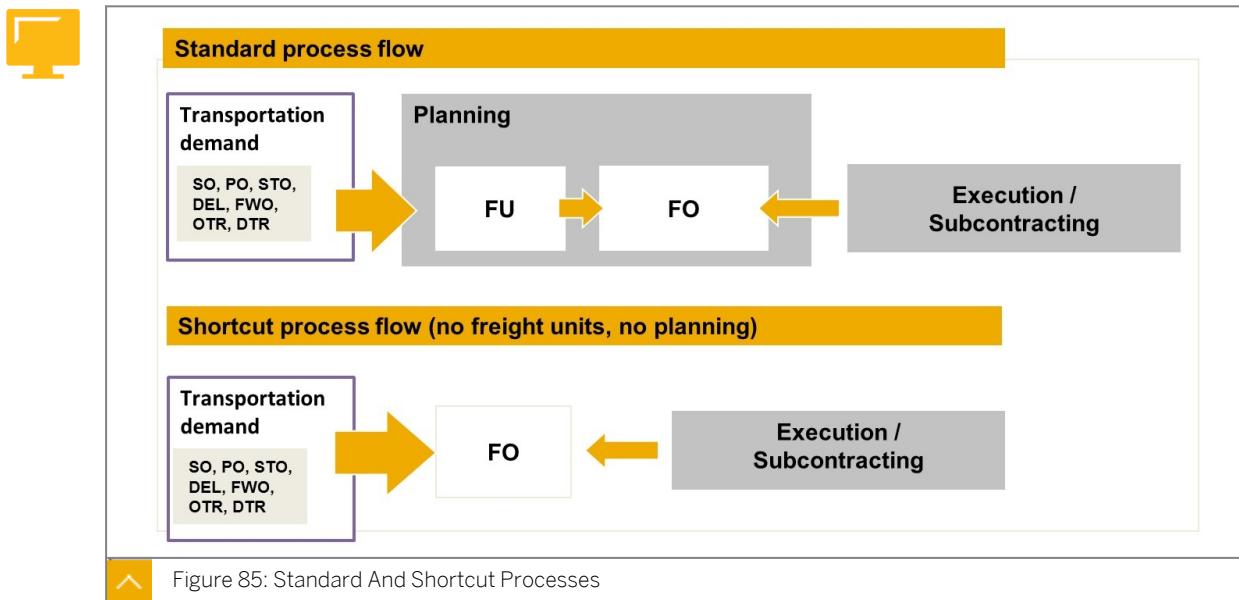
Transportation Planning Document Flow



The standard planning process begins with creating freight units.

Purpose of the Short-Cut Process

Once created, freight units are used by manual or automatic planning activities to build freight orders, which can subsequently be used for carrier selection and/or tendering processes. The purpose of the short-cut process is to skip any planning activities, because these may not be required in certain scenarios. For example, if the sales orders that are received by a company already state the required truck size, the freight order could be created directly from the transportation demand (in this example, a sale order). Technically, this is done during freight unit building by selecting a freight order type instead of a freight unit type.



Reasons for Transportation Planning

The goal of SAP TM is to provide customers with the ability to either manually or automatically plan and optimize their transportation requests. This includes the ability to perform order consolidation, where a company can group orders with the same ship-from and ship-to locations for more efficient transportation quantities. If multiple orders are being shipped within a predefined transportation zone, your company can try to efficiently schedule and route the multiple orders, and choose the appropriate carrier. The planning and selection can be determined using the most cost effective and timely route from source to destination while considering real-world constraints, costs, and penalties. The optimizer is capable of making multi-modal decisions such as sea, air, truck, train, and any combination thereof. The SAP TM planning function can also perform multi-pickup and stop options.

Within the optimization algorithm is the ability to use the appropriate resources in terms of availability and capacity. The optimizer can consider incompatibility rules to restrict how freight orders are built, for example, modeling material-specific transport requirements (for example, cooled products). In addition, carrier selection allows your company to determine the right combination of carrier assignments based on cost, equipment availability, priority, and business share goals.

Transportation Planning Scenarios

In SAP TM, transportation planning supports multiple variants. There are several scenarios that can be used, depending upon shipping requirements, as follows:

- Truckload shipments (FTL or LTL)

- Intermodal (IM)
- Direct shipments
- Multi-stop shipments
- Pooled distribution

Truckload Shipments (FTL or LTL)

Truckload shipments tend to be the simplest of the outbound planning scenarios. The transportation order received by the shipper is in a full truck load quantity, typically \geq 35,000 lb, or 3,660 cubic feet, or 28 - 32 pallets. The shipment is from one source to one destination, so very little route planning is necessary, with the exception of carrier selection. The ideal situation would be one product, but multiple line items can be supported. In SAP TM, when orders are entered with a weight greater than 35,000 lb, the system can be set up to automatically plan, tender, and cost the freight order without additional user intervention. This is considered a one-step process.

Full Truck Load

In some industries, goods are ordered and delivered based on full truck load (FTL), because that is an inexpensive option. Typically, this is used for cheap products where the transport costs are high compared to the value of the goods. This FTL scenario is also used extensively in bulk transport. If the order is for multi-line items, SAP TM can perform truck load optimization planning for freight units. During planning, companies can perform carrier restriction (a carrier is not permitted). Additionally, if a default carrier is not maintained, companies can perform carrier selection based on lowest costs. Once planning is done, the transportation order is ready for tendering. Finally, bills of lading can be created with driver notes when the shipment is picked up.

Intermodal Shipment

Intermodal freight transport involves the transportation of freight in a container or vehicle that can use multiple modes of transportation (rail, ship, and truck), without any handling of the freight itself when changing modes. This method reduces cargo handling, and so improves security, reduces damages and losses, and allows freight to be transported faster. This method reduces costs compared with road transport, and is the key advantage when deployed for intracontinental use. The cost savings may be offset by reduced timing for road transport over shorter distances, however.

Intermodal transport is generally used for two purposes. One is to move goods relatively cheaply over long distances using ocean and rail transport. The second is to move goods over long distances very quickly, for example with air freight. Based on the requested delivery date, the carrier selection process determines whether to use intermodal or truck load as the means of transport. This is based on the transit time for each means of transport; intermodal container on flat car (COFC) with a 4 day transit period or TL with a 3 day transit period.

Multi-Stop Shipments

Multi-stop or pool shipment is the consolidation of two or more orders into one or more shipments. Instead of making several (say 5) shipments, sending a separate vehicle to each customer, your company plans to have only one vehicle visit each customer. This is a truck load (TL) process, where some planning is required to ensure no constraints are violated. Be aware that in-transit stops are limited, usually 3 or less. As transportation volumes increase, optimized multi-stop planning improves operational efficiencies. Routes can be determined by pick-up and delivery windows at both shipping and receiving locations.

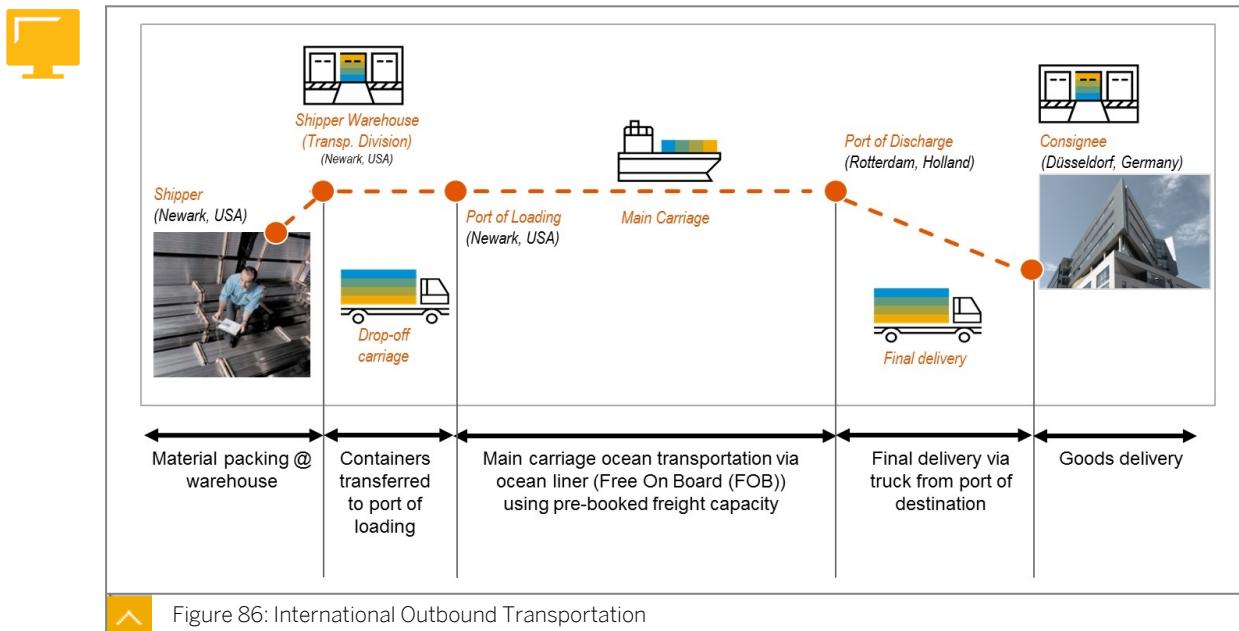
Pooled Shipment

Pooled distribution is prevalent in delivery/distribution scenarios, from distribution centers to customers. In the postal industry, it is also used to deliver mail to post offices or large customers and institutions. In general, this scenario also includes the collection of empty returnable packaging from customer sites.

International Transportation

When companies begin to transport goods across borders, the complexity of the logistics increases. Depending upon how the product gets to its destination, multiple modes of transportation may be needed. In addition, you have to consider the legal requirements necessary to import and export products to other countries.

In SAP TM, you can perform container transportation from forwarding order processing, ocean carrier booking, freight planning, execution and tracking, to order settlement.



With international transportation, more planning segments may need to be considered. In the figure, International Outbound Transportation, time is allotted for the material to be packaged into 3 20-foot standard dry containers at the manufacturing location. These containers are then affixed to a trailer chassis. Then, time must be factored in to deliver the three containers to the transportation division's warehouse in the port of loading. At the port, they will be loaded on to the ocean liner and delivered to the port of discharge. At this time, incoterms need to be considered. In this case, Free On Board (FOB) would be applied where you need to pre-book freight capacity. Once the freight arrives at the port of discharge, the containers are either warehoused or picked up for final delivery to the consignee. Finally, the containers are delivered to the consignee with proof of delivery.

Routing, Scheduling, and Carrier Selection

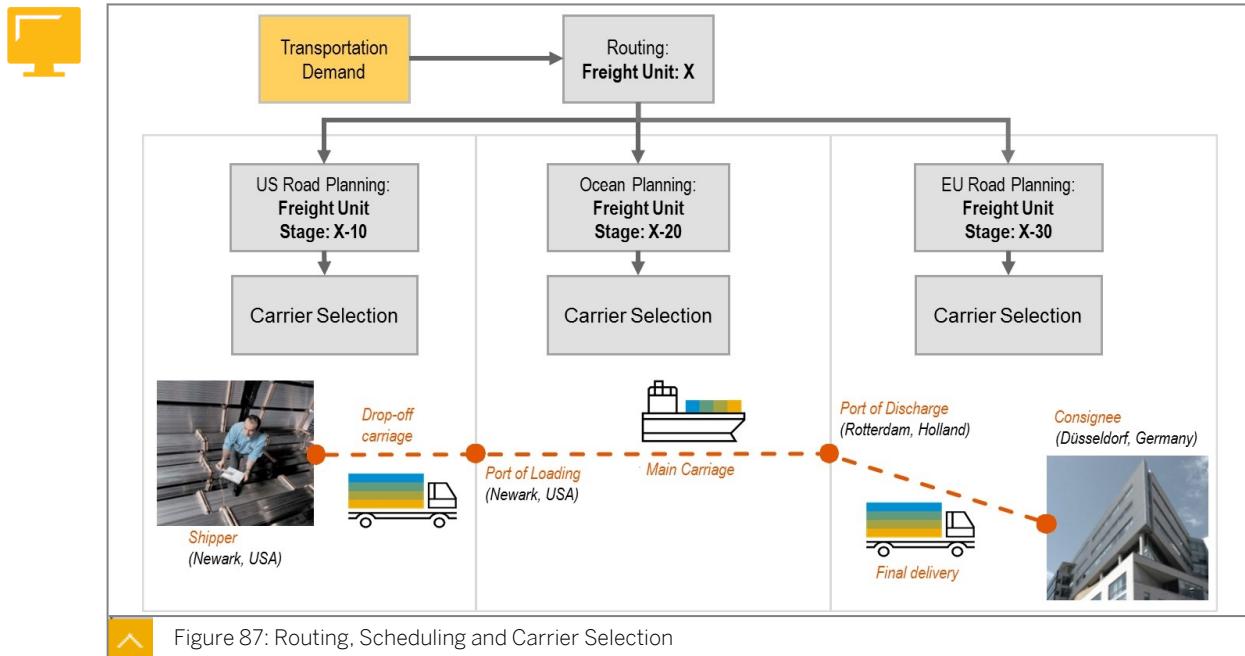


Figure 87: Routing, Scheduling and Carrier Selection

The figure, Routing, Scheduling and Carrier Selection, outlines this process in the following way: a freight unit X is first routed using the transportation planning function, for example, a transportation proposal. Based on this routing, three stages are created for freight unit X, as follows:

- 10 - A stage for US road pick-up transport
- 20 - A stage for the ocean voyage
- 30 - A stage for EU road delivery transport

Up to a certain point, these stages are planned independently of each other because different (local) planners may be responsible for scheduling each of the three stages. A freight order is created as a result of this stage. Finally, carriers are selected based on specific criteria. This is described as a three-step process but a planner can decide whether to perform planning and carrier selection in two steps or three. It is also possible for the SAP TM optimization function to plan all three steps in one run - this planning strategy is called one step optimization.

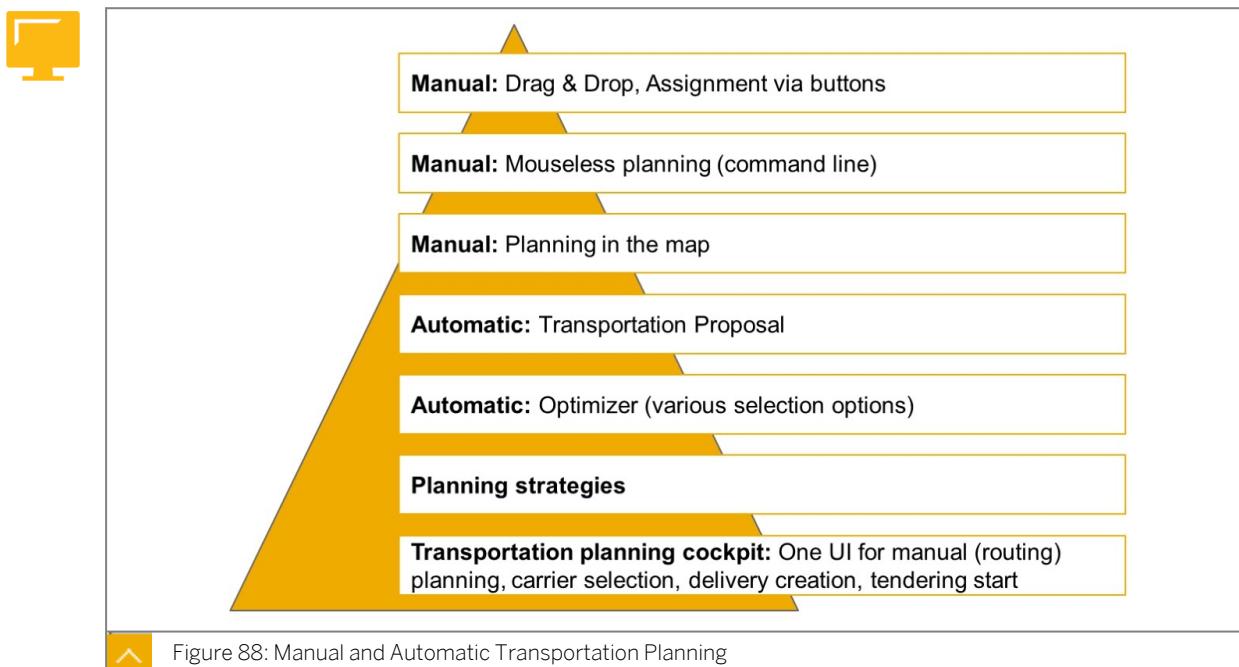
Process Steps

The steps involved in the process, whether one, two, or three step can be described as follows:

- Three step
 1. Determine routing (for example, via transportation proposal)
 2. Vehicle scheduling and routing to create (a) freight order(s)
 3. Carrier selection
- Two step

1. Vehicle scheduling and routing to create a freight order
2. Carrier selection
- One step
 1. One-step optimization determines the route and plan, creates a freight order, and selects a carrier

Manual and Automatic Transportation Planning



Transportation planning activities in SAP TM can be performed manually and automatically as well as interactively and in the background. For interactive planning, the central planning UI is the transportation cockpit. Both manual and automatic planning activities are performed there based on planning strategies (for example, one-step optimization).

Transportation Planning Document Structure

Planning relies on three distinct pillars, as follows:

- Master Data

Master data objects such as the transportation network (locations, transshipment hierarchies, transportation zones, and transportation zone hierarchies and transportation lanes) and resources are the basis for any planning activities in SAP TM.

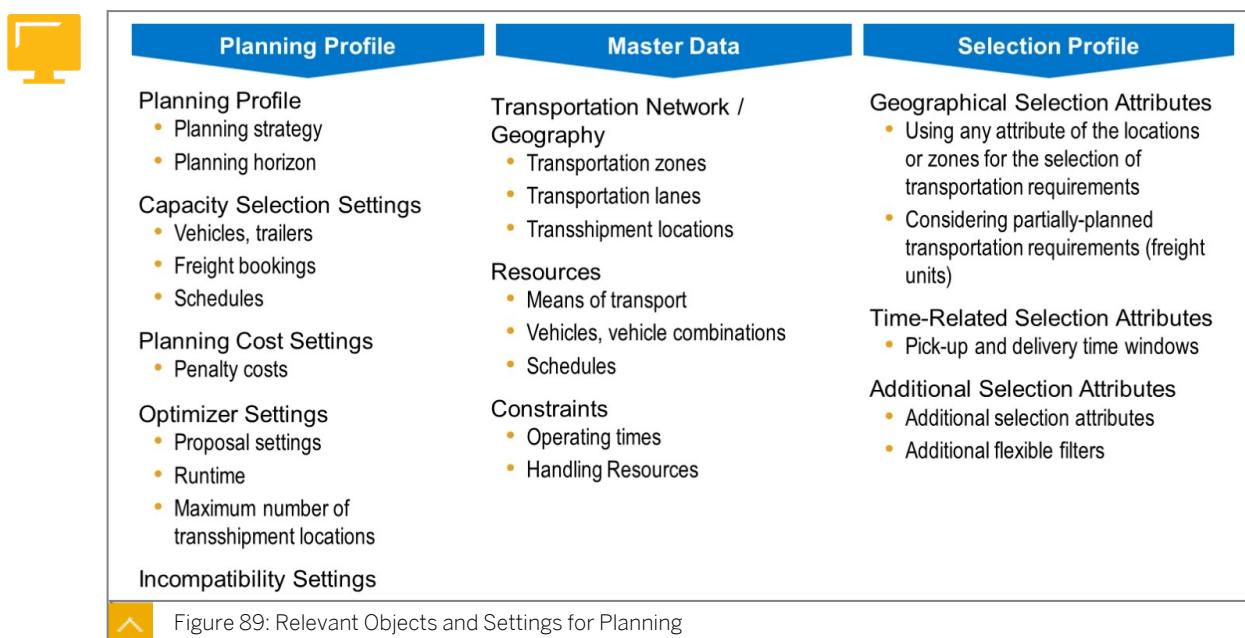
- Selection Profiles

Selection profiles specify what should be planned in a certain scenario. For example, selection settings specify the geography for which a transportation plan shall be created. This could be, for example, all freight units to be transported within California.

- Planning Profiles

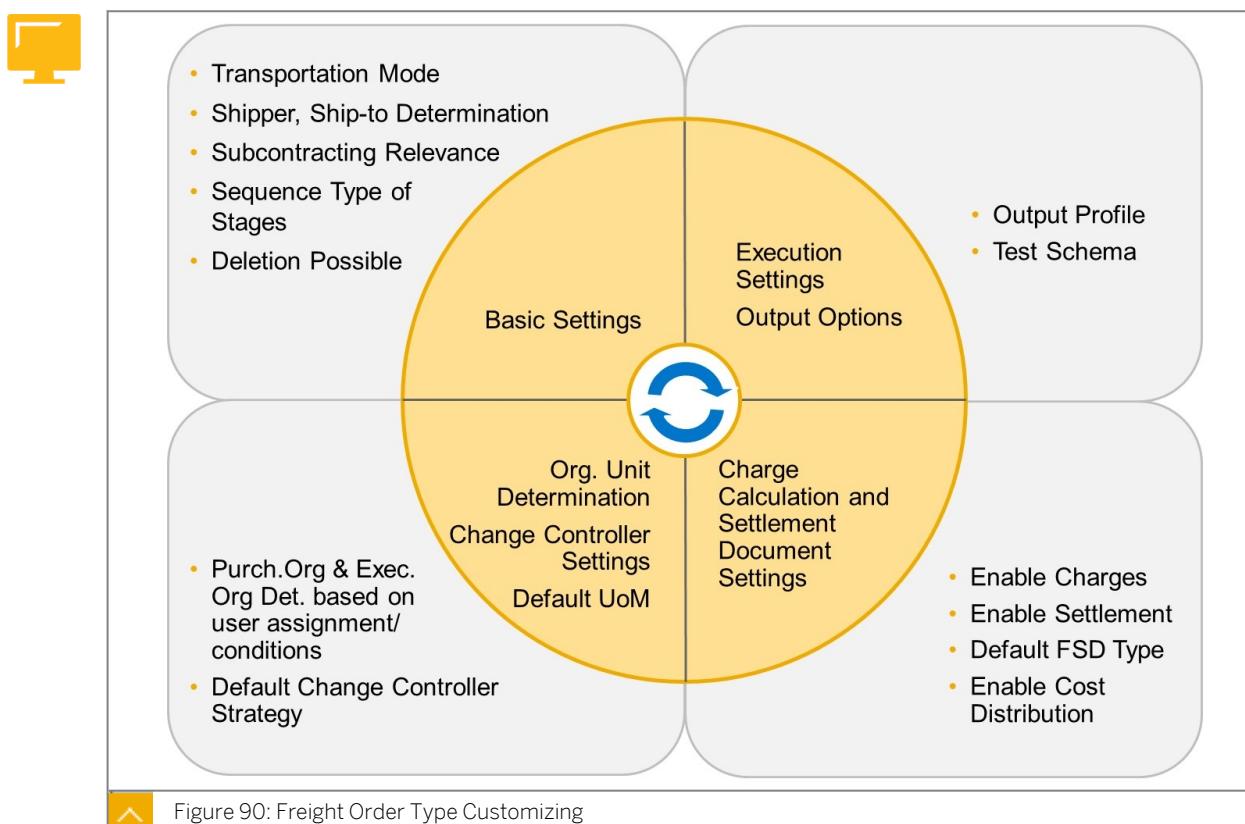
Planning profiles specify the "how" of the process. For example, a planner may only be allowed to schedule standard trucks and not a helicopter for emergency transports. This

information dictates how the actual transportation is to be carried out. Which resources can be used and at what cost is specified in the planning settings.



Freight Order Types

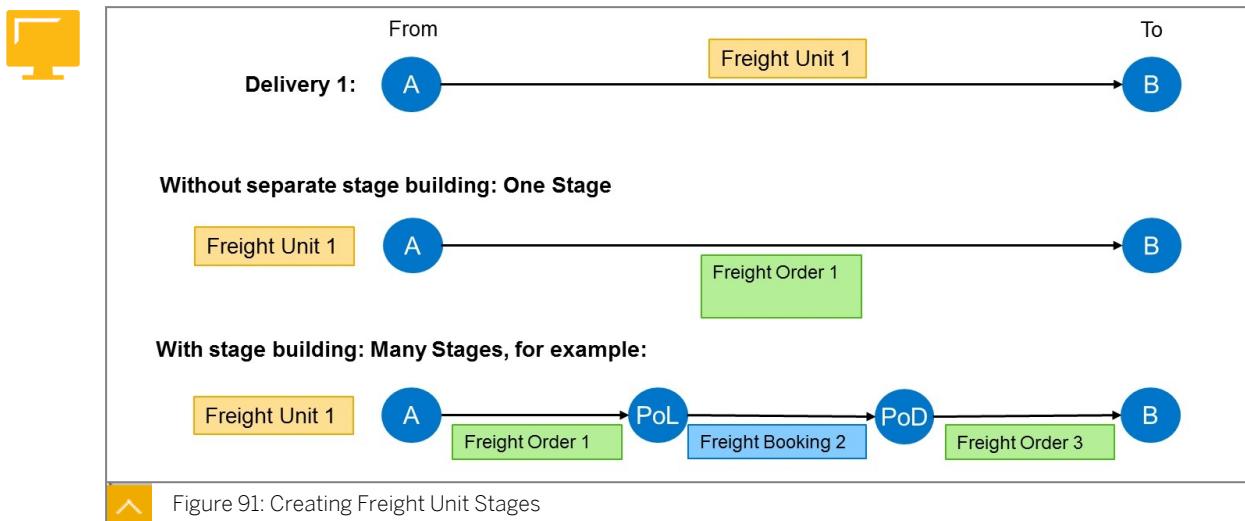
A freight order type defines parameters that influence how the system processes the freight order. When manually creating a freight order, the user has to select a freight order type.



The following are some of the settings that can be configured in the freight order type:

- Basic Settings:
 - Determining shipper and ship-to-party
 - Specifying if a freight order can be subcontracted
 - Defining whether a freight order is to be deleted or only canceled
- Charge Calculation and Settlement Document Settings:
 - Enabling charges and settlement
 - Enable cost distribution
- Execution Settings
- Organizational Unit Determination:
You can define how the system determines the purchasing organization and the execution organization.
- Change Controller Settings:
You can define settings for the change controller, for example, a default change strategy and a condition for change strategy determination.
- Output Options:
You can define an output profile and a text schema, for example.

Freight Order Creation



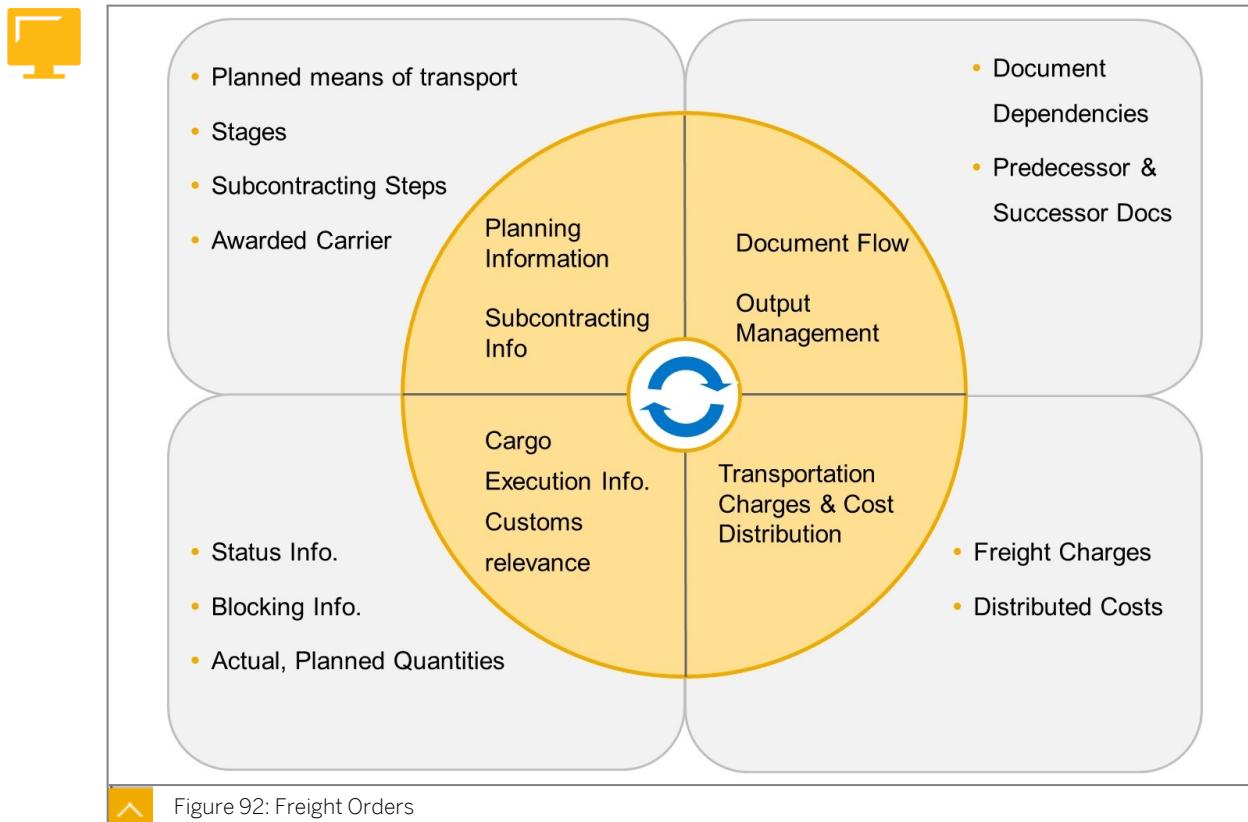
Freight units can have one or more stages. Stages can be created in the freight unit to split the overall transportation chain, for example, based on the mode of transportation. A freight unit with a source in Germany and destination in the US may be split into three stages to reflect the following:

- Pre-carriage from source to port-of-loading
- Main-carriage from port of loading to port of discharges
- On-carriage from port of discharge to destination

In this way, the individual stages may be used to create separate freight orders/freight bookings for each stage to subcontract these different stages to three different business partners/carriers.

Freight orders are the result of planning and the consolidation of freight units on a vehicle-booked capacity or scheduled means of transport. Once this has been completed, transport order execution can be triggered and follow-on settlement processing can begin.

Freight Orders



Freight orders/bookings contain the following information:

- Planning information, for example, planned means of transport and stages, routing, planned pickup and delivery dates, durations, and distances
- Document dependencies, as well as predecessor and successor documents
- Transportation charges and cost distribution
- Cargo information: quantities and weights, goods information
- Execution information
- Business partner information
- Output management
- Status information and blocking information
- Subcontracting information

Creating Freight Orders

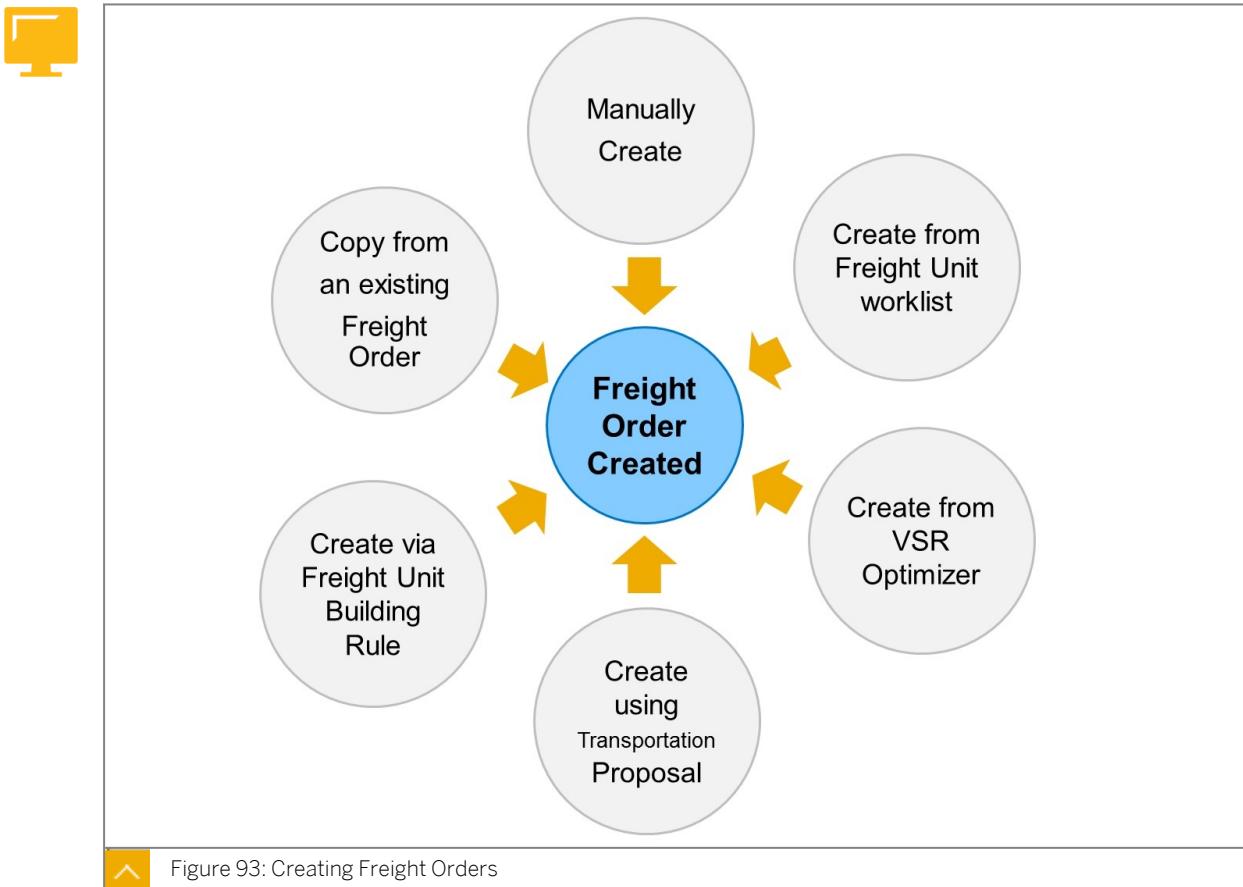


Figure 93: Creating Freight Orders

Manual creation is generally used when you already know the most important transportation data, such as source location, destination location, and business partner, because you regularly transport goods for a certain customer using a certain carrier.

To manually create a freight order, you require the following information: general data for the freight order (shipper, consignee, carrier, resource, locations, dates and times, and terms of payment), information about any additional intermediate stops, the items involved (add freight units to the freight order or enter the items directly on the freight order), and information about the charges involved (as calculated, or configure the system to calculate charges).

Once the required information has been entered, you can check the consistency and save the freight order. The freight order can then be sent over to the carrier and confirmed or rejected on behalf of the carrier. Necessary documents can be printed, and a freight settlement document is created after the execution.

Some of the information, like source and destination location, are automatically populated in the freight order if you create the freight order from the freight unit worklist.

You can create a freight order by copying an existing one (a reference document). The system copies the header data and the logistical data. However, it does not copy references to freight units and execution information.

Finally, you can create freight orders via the short-cut process on the basis of a freight unit building rule, which will be explained in more detail later in this lesson.

The more advanced features of creating freight orders are their interactive creation in the transportation cockpit, VSR optimization, and the use of transportation proposal functionality. These topics will be covered once we have finished the relevant configuration.



LESSON SUMMARY

You should now be able to:

- Describe the business process and documentation required for transportation planning
- Define freight order types

Defining Selection and Planning Profiles

LESSON OVERVIEW

Your SAP TM system is full of data. In order to maintain a workspace that is not overloaded and yet provides easy access to necessary information, you need a way of selecting what it is you want to work on using specific criteria. Selection profiles are the way you achieve this, helping to provide a clear and relevant workspace.

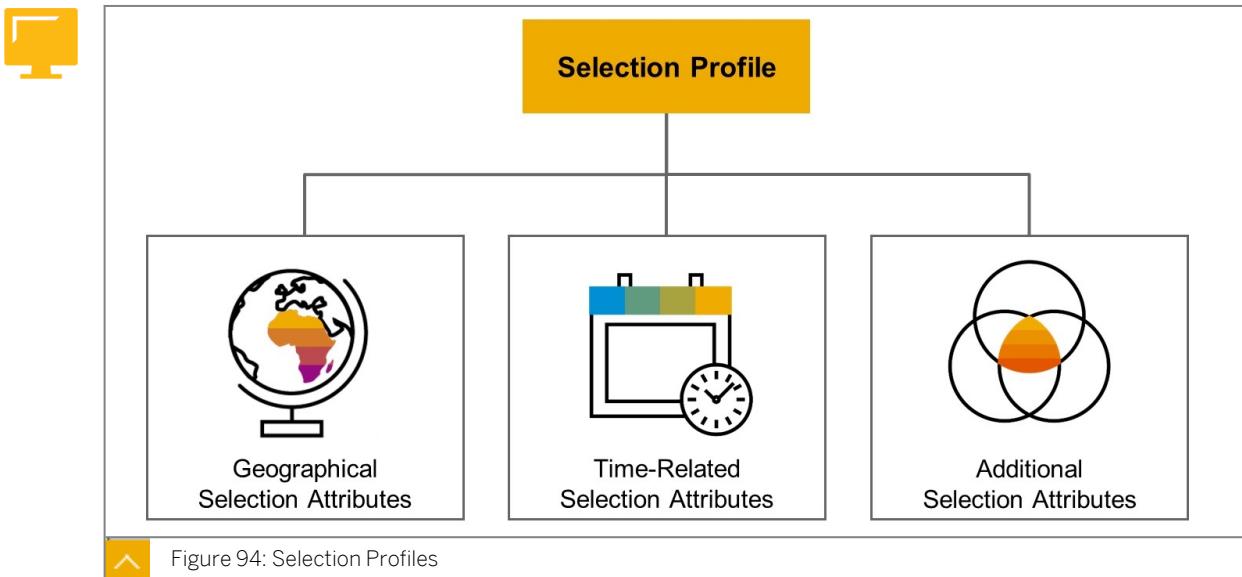


LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Define the requirements for a selection profile
- Display a selection profile
- Describe the parameters used to support planning in SAP TM
- Display a planning profile
- Describe the concept of profile and layout sets

Selection Profile



Selection profiles define what is called up for planning in the transportation cockpit.

Selection Objects

Selections can be made on a number of objects, including those outlined in the following list:



- Freight Units
- Transportation Units
- Freight Orders
- Freight Bookings

Selection attributes include geographical selection (using any location or zone attribute), and time-related selection attributes, such as pickup and delivery windows.

Additional selection attributes can be taken into account – such as statuses (for example, planned or unplanned freight units). An example of an additional selection attribute might be the nature of the product being selected, such as freight unit type or dangerous goods.

Selection Profile Attributes

Geographical Selection Attributes

In a company's planning department, geography is often used as a way to allocate planning responsibility. For example, an individual or team might be responsible for a specific plant, distribution center or group of customers in a geographical area. The geographical selection attributes in the selection profile allow the team to limit their view in such a way that they only see FUs or FOs for which they have responsibility.

Time-Related Selection Attributes

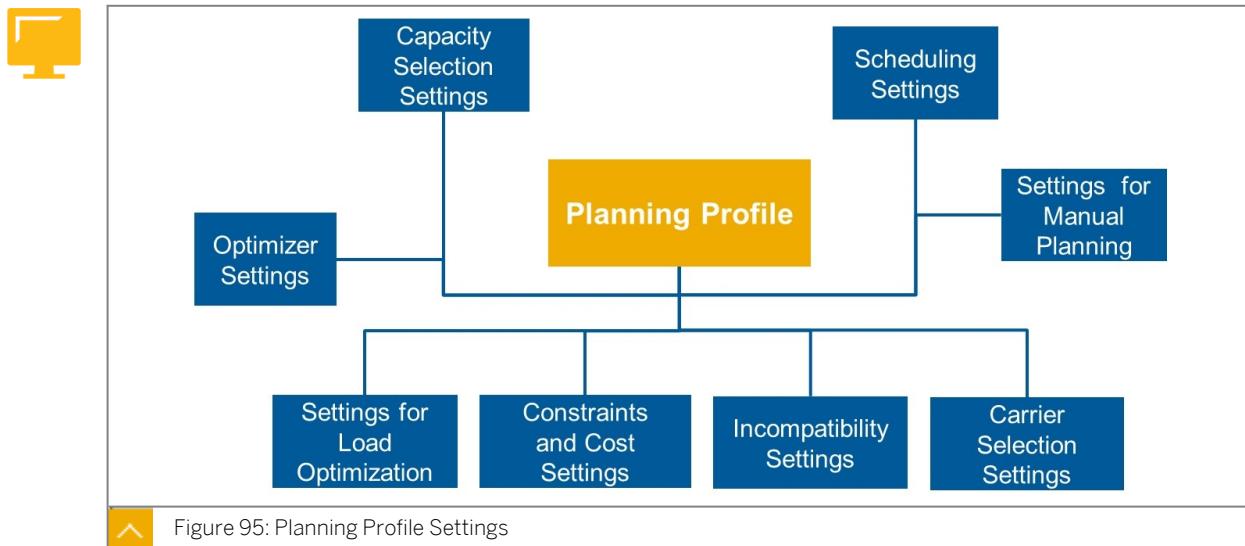
You define the demand horizon in the time-related selection attributes that you assign to your selection profile. You can define a demand horizon for pickup and a demand horizon for delivery. The system chooses all freight units and freight orders whose pick-up date/time or delivery date/time lies within the relevant demand horizon.

Planning Profiles

Planning profiles are used to influence and control the outcome of the planning process. A planning profile must be specified for a background optimizer run as well as for interactive planning in the transportation cockpit. A planning profile is even relevant for scheduling actions performed in the freight order itself. There are several settings which can/must be created for use in the planning profile.

The planning profile includes settings to control the different steps of the optimization. These steps are controlled by strategies set up in Customizing. Standard strategies are delivered by SAP – but unique strategies can be created. The strategies are made up of various programs. If you wish to perform manual planning or a scheduled planning run, there is a standard strategy for each. You also specify in the planning profile which type of checks will take place in relation to incompatibilities, dangerous goods, and so on.

Planning Profile Settings



You can also assign the following settings and profiles to a planning profile:

- Capacity selection settings:

Here, you choose the required capacities, such as resources. If you use resources for which you have defined an ADR limit, VSR optimization takes into account the number of ADR points for this resource during the optimization run. Moreover, you can specify that resources for which you have set a planning block are not displayed in the resource lists of the transportation cockpit.

- Optimizer settings:

Here, you can define the optimizer runtime, the maximum number of transshipment locations and processes, and the freight order building rule, for example. You also specify whether you require rough or detailed information for your planning activities, define the required process controller strategy, and configure the settings for generating transportation proposals.

In the advanced settings, you can also specify whether the main aim in your transportation proposals is to ensure the lowest transportation costs possible or the shortest transportation duration possible, based on the planned delivery date/time. You can also define preferences in relation to your relative weighting of the variance of carriers, routes, and departure dates, or activate or deactivate capacity constraints at transportation mode level. You can also specify whether the system is to ignore certain settings such as the capacity or ADR limit of a resource during VSR optimization.

- Settings for load optimization:

Here, you can define the optimizer runtime, the planning strategy, and various rules for load planning. For example, you can define the maximum height difference between stacks in a row.

- Constraints and costs settings:

Here, you define costs related to freight units and means of transport. In most cases, these costs are not actual costs. They simply offer a means of controlling the result of the optimization run (for example, earliness costs and lateness costs).

- Incompatibility settings:
Here, you define settings for your incompatibilities.
- Carrier selection settings:
Here, you specify whether the system is to use transportation allocations or business shares, for example.
- Settings for manual planning:
Here, you specify how you want the system to behave when it assigns documents and resources:
 - Assignment of documents:
You use these settings to control how the system is to assign one or more requirement documents to a capacity document.
 - Removal of the assignment of documents:
You use this setting to control how the system is to remove the assignment of requirement documents to capacity documents.
 - Assignment of resources and creation of documents:
You use these settings to control how the system is to assign resources to documents and how it is to create and assign reference documents.
- Scheduling settings:
Here, you define loading and unloading durations for scheduling, for example.

Profile and Layout Sets



- Profile and layout sets are used in
 - Transportation Cockpit
 - Carrier Selection
 - Delivery Builder
- Profile and layout sets define
 - Data to read (for example, freight units)
 - Settings (for example, planning profiles)
 - Page layouts

Content and Use of Profile and Layout Sets

The profile and layout set (PLS) management applications enable an administrator to centrally create and manage PLSs for a team or organization and assign users to them. This approach simplifies the process of working with PLSs by removing the need for individual users to create and maintain their own. When an administrator creates a PLS and assigns a user to it, the PLS is available for the user to select on the relevant application start screen.

When creating a PLS, the following recommendations should be considered:

- Transportation cockpit:

You are recommended to enter a selection profile for freight units as well as a planning profile to which you have already assigned a selection profile for freight orders and freight bookings.

Optionally, you can also specify incompatibility settings and settings for capacity selection. If you have already assigned incompatibility settings or settings for capacity selection to the specified planning profile, the system overwrites these settings with the settings that you specified here.

The system considers the profiles that you specify in your PLS for all planning options available in the transportation cockpit.



Note:

In the transportation cockpit, the user can use the Change Planning Settings function to temporarily change the planning settings and load planning settings in the selection profiles. The system discards these changes when you leave the transportation cockpit or change the profile selection.

- Carrier selection:

You are recommended to enter a selection profile for freight orders and freight bookings as well as carrier selection settings.

- Creating delivery proposals:

You are recommended to enter a selection profile for freight units, freight orders and freight bookings as well as a delivery profile.



LESSON SUMMARY

You should now be able to:

- Define the requirements for a selection profile
- Display a selection profile
- Describe the parameters used to support planning in SAP TM
- Display a planning profile
- Describe the concept of profile and layout sets

Accessing the Transportation Cockpit for Interactive Planning

LESSON OVERVIEW

Companies responsible for shipping large volumes of products require a tool that allows planners to get a high-level perspective of their transportation demands, while allowing planning activities to be carried out in a quick and targeted manner. In this lesson, you learn about SAP TM's transportation cockpit, a central element in the transportation planning process.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

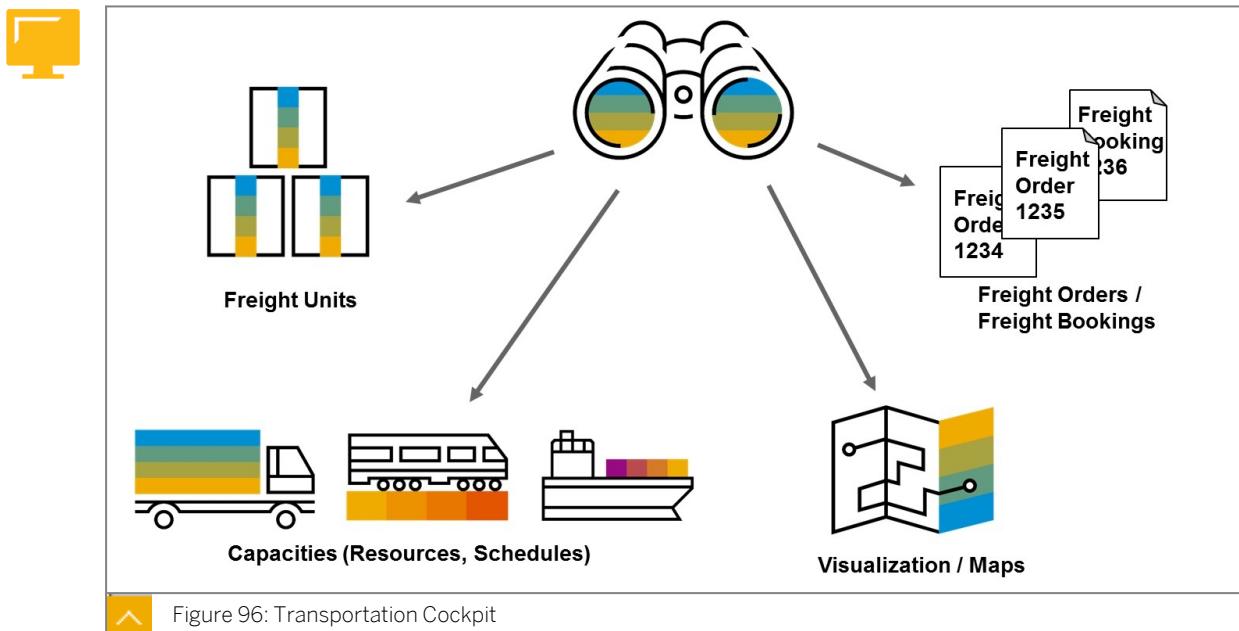
- Access the transportation cockpit
- Describe visual planning
- Create freight orders for road transportation
- Explain the scheduling logic

Interactive Planning

Business Example

John is a logistics coordinator at a shipping company, and needs software that will manage his company's shipments. He needs the ability to view all of his customer's domestic and international export orders, and consolidate them to ship as efficiently as possible. To accomplish this, he needs an easily managed dashboard from which he can plan his orders. For some shipments, John is using automatic planning, but he still needs to verify the result of the optimizations. For other shipments, he needs to manually plan the transport requirements. Depending on the scenario, therefore, he requires different information and different functions to be available at different times. The specific and differentiated presentation of information possible in SAP TM allows him to plan efficiently.

Transportation Cockpit



Amongst others, the transportation cockpit includes the following elements:

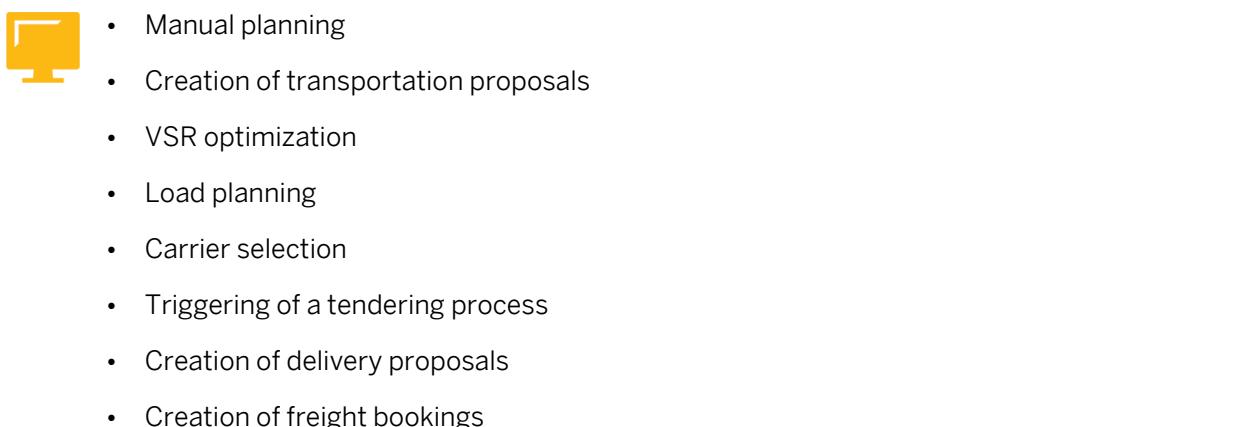
- Requirements list (freight units)
- Capacity lists (vehicle resources and schedules)
- Order list (freight orders, but may also contain freight bookings as transactional or agreed capacities)
- Order details

Tasks in the Transportation Cockpit

The transportation cockpit is a central element in the transportation planning process, and facilitates numerous tasks.

The transportation cockpit can be used for the following tasks:

Transportation Cockpit Tasks

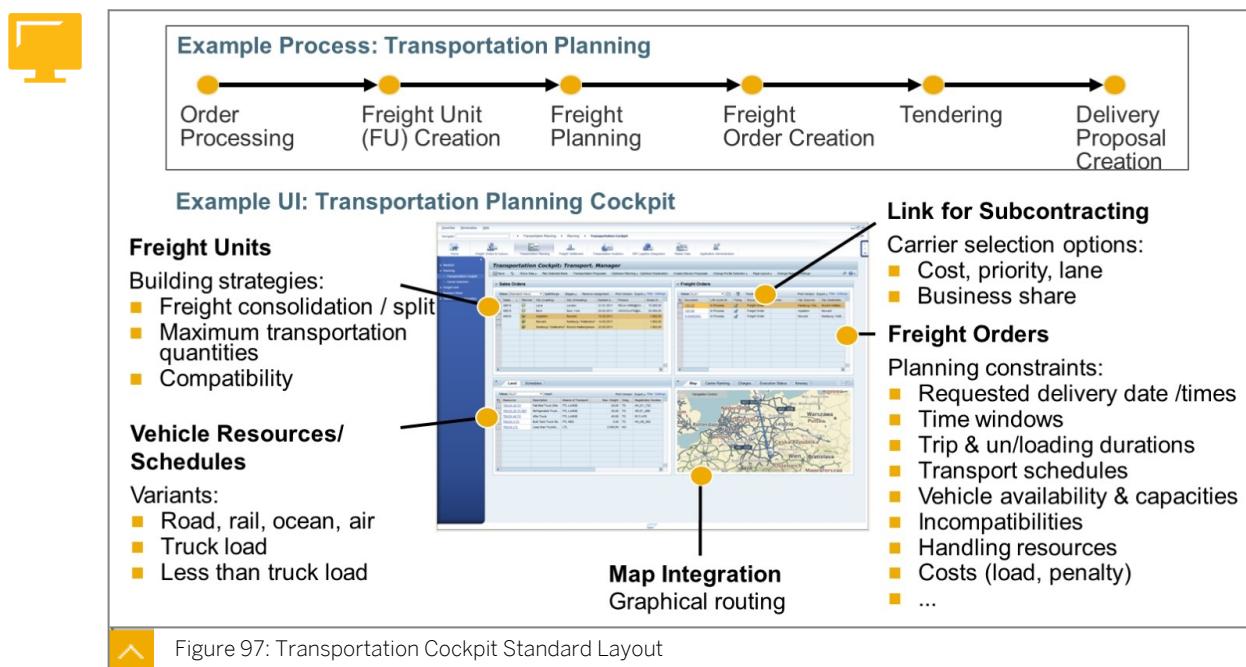


Profile and Layout Sets

The cockpit requires users to enter several profiles that govern the content of generated result lists. The selection profile determines what is to be planned. That is, what freight units or freight orders are pertinent for a particular objective. The planning profile determines how the selected freight units are planned. The capacity selection profile restricts the planning run in relation to the transportation resources that can be used.

Once the profiles have been determined, planners can use the cockpit to create freight bookings or manage existing freight orders. The transportation cockpit layout offers flexible settings to control what information is presented and the processing options available. A combination of selection and planning profile together with a layout can be assigned to a profile and layout set, such that this specific planning scenario is always shown in this layout, while another planning scenario requires another layout. Such a profile and layout set is based on the specific information requirements of a planner. For example, in one scenario, a planner has to plan liquids on tank trucks and must be able to see the volume of product, while in another scenario, the liquids are in barrels on pallets and the planner requires the pallet count to be displayed. It is possible to switch between different layouts on-the-fly, for example, if a multi-step planning process leads to different needs in each step.

Transportation Cockpit: Standard Layout



In the standard layout, the main screen is broken up into four quadrants (views). The maximum number of views in any layout is 6. The standard layout contains the following views:

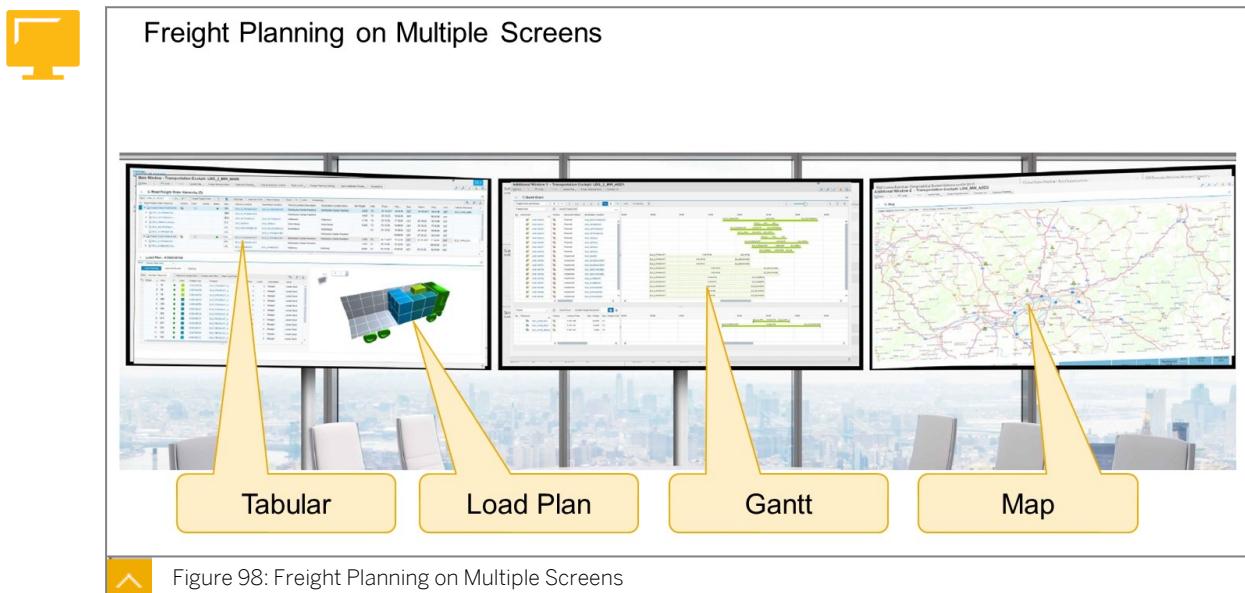
- Freight units to be planned
- Available capacities that can be used for planning
- Freight order / booking list
- Freight order / booking details

Each view is equipped with processing options using menus and buttons within the views. Processing options include the following actions:

- Merge / split freight units
- Apply default routes to freight units
- Remove resources from freight orders
- Cancel freight orders
- Schedule and check freight orders

Each of the available menus or buttons can be personalized in the planning layout definition.

Freight Planning on Multiple Screens



If a user works with several screens, they can choose a separate layout for each screen. The transportation cockpit can be deployed in multiple windows on up to three screens.

Planning from the Cockpit

Automatic Planning

Both manual and automatic planning are provided for in the cockpit. In relation to automatic planning, transportation proposals can be generated automatically and the optimizer allows planners to plan requirements onto resources and freight bookings or orders. Optimizer planning also creates detailed log information that can be analyzed using the explanation tool.

Manual Planning

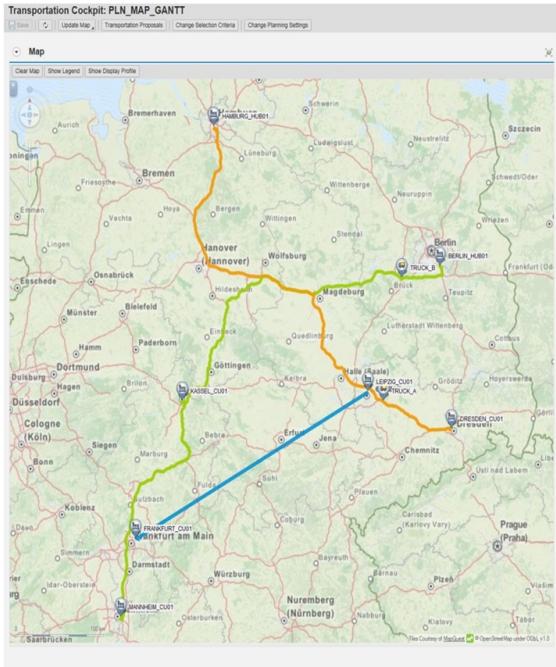
The following options exist for manual planning:

- Drag a freight unit onto a resource, thereby creating a new freight order. Add resources/ MTrs.
- Drag a freight unit onto a freight booking, thereby adding the freight unit to this freight booking.
- Drag a freight unit onto a freight order, thereby extending the freight order.
- Command line planning and buttons provide additional options on top of the drag and drop functionality.

Visual Planning

Interactive Planning on the Map





Features

- Assign freight units / freight orders to resources
- Add intermediate location to freight unit or freight order
- Proximity search
- Show related transshipment locations

Options

- Drag and drop
- Context menu

Figure 99: Interactive Planning on the Map

The map can be displayed as an own screen area in the transportation cockpit or in full screen. However, having the map displayed in an own screen area of the transportation cockpit enables the planner to directly see the selected freight units, freight orders/bookings, transportation units, and resources on the map.

Display Options

When you display the map, you can choose whether all of the planning objects or only selected planning objects are to be displayed. Furthermore, you can select which planning objects are to be displayed on the map, for example, just freight orders or just freight units, in a display profile. You can call up the display profile with the toolbar.

Planning Functions

You can carry out your planning on the map. If, for example, you select unplanned freight units and start planning from the context menu, the system shows the possible assignments of the freight units to the resources. Select the assignments that you require.

You can also assign unplanned freight units or multirelations that contain unplanned freight units to resources by using drag and drop. When you do so, you can either assign the freight units to the resource or the resource to the freight units. You can use the proximity search in the context menu to find unplanned freight units and transportation units that are within a specific radius of a resource or a location.

If you want to split a stage that is displayed on the map, you can assign an unplanned freight unit or multirelation to a location using drag and drop. Once you have selected the required planning option, the system adds the selected location to the freight unit stage and updates the map accordingly. This process also applies to freight orders. You can also display

transshipment locations that are not necessarily part of your planning activities. You display these locations by choosing *Show Related Transshipment Locations* from the context menu.

If a freight order does not have a vehicle assigned to it, you can also assign the vehicle by using drag and drop. To do so, you assign the freight order to a single vehicle resource or a multispot that contains at least one vehicle resource or passive vehicle resource and select the relevant planning option from the menu. You can use the proximity search in the context menu to find available resources that are within a specific radius. You can also specify the exact position of a resource at any time in the context menu of the map. The system displays all of your transportation planning activities on the map. When you leave the display of the map, your planning activities are also displayed in the table view of the transportation cockpit.

Context Menu Options

Address Search

You can use the context menu of the map to start the address search and display the search results on the map. The address search is based on the geocoding of the location. This allows you to perform several address searches and display the search results simultaneously on the map. You can use the context menu of the map to hide the search results individually or completely.

Route Display

You can use the context menu of a connection line to determine a route display along real street routes (georoutes). This function is dependent on the geographical information system available in the system. Alternatively, you can use the context menu of a resource to display the connection lines of all freight orders assigned to this resource.

Gantt Chart: Display of Resources and Documents



Visibility

- Usage of trucks and trailers
- Load utilization of trucks and trailers
- Downtimes and nonworking times
- Execution status and reported times for freight orders, trailer units and their activities
- Notifications for overload, empty movements, and time conflicts

Usability & Flexibility

- Time zoom in and out
- Aggregated and detailed view
- Hierarchical views
- Single and dual view (horizontal and vertical)

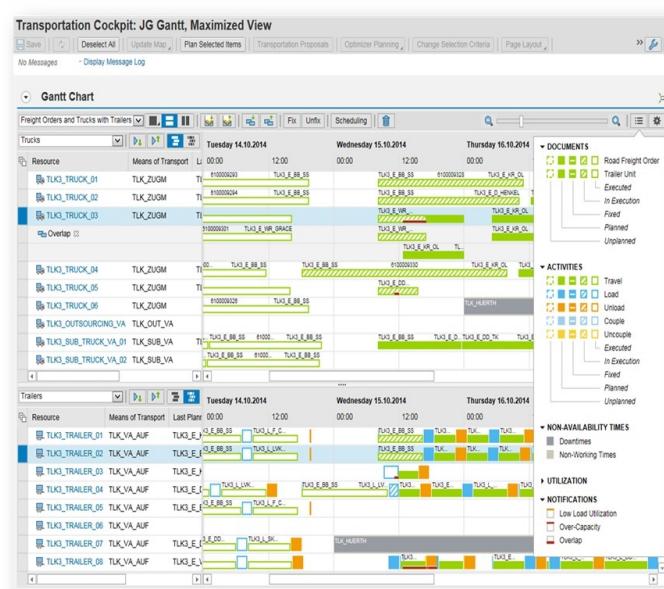


Figure 100: Gantt Chart: Display of Resources and Documents

Gantt Chart

When performing transportation planning, a planner usually considers two main aspects: availability of resources and utilization of the used resources. With the conventional use of the transportation cockpit, the sequential order of freight orders using a particular resource and

the availability of a resource for a certain timeframe is not (graphically) shown. Using a Gantt chart, which is often used in project planning as well, helps to visualize the availability of resources and the sequential order of transports. The Gantt chart is fully integrated into the transportation cockpit.

Transportation planning can now also be done using a Gantt chart. In the Gantt chart, freight orders and vehicle resources are displayed as a time bar and planners can manually plan transports by using drag and drop.

The Gantt chart provides a visual platform for performing transportation planning. With an intuitive and graphical user interface, the Gantt chart enables you to perform transportation planning visually, interactively, and more efficiently.

The Gantt chart is a screen area in the transportation cockpit, which can be enabled in a page layout of the transportation cockpit. All standard functionalities, such as, positioning the Gantt chart anywhere on the transportation cockpit as well as maximizing the screen area to full screen, are available in a Gantt chart.

The Gantt chart displays planned and unplanned freight orders and resources in a time bar. It is configurable; additional sets of information should be displayed next to the time bar. The time bar itself shows the activities planned for the document and resource. Depending on the layout chosen, the planner can use a single view, which only shows planned and unplanned freight orders or resources exclusively or a dual view (as shown in the figure, Gantt Chart: Display of Resources and Documents) that displays two entities next to each other. Similar to the dual view in the transportation cockpit, the dual view can be configured vertically or horizontally. The scrollbars of both screen areas can be synchronized.

A zoom bar on top of the screen area can zoom in and out to be able to see a more detailed view of a day or week or a more general view of the year.

An important factor for transportation planning is the utilization of a vehicle. The utilization of the vehicle can be displayed with the utilization view which can be enabled when needed. The utilization view shows the utilization of the vehicle over time in a graph. The graph is displayed in a detail line below the actual resource or document. In this case, the single-view is chosen, which enables the user to see all the execution information within one screen. Multiple loading acts are only displayed as one item in the Gantt chart. This keeps the chart clean and easy to understand.

Gantt Chart: Interactivity and Planning Scenarios



Interactivity

- Assign and schedule trucks and trailers by drag and drop
- Re-sequencing by drag and drop
- Fix and unfix freight orders, trailer units, and their activities
- Context menus and hyperlinks

Planning Scenarios

- Truck planning (freight orders and truck resources)
- Truck and trailer planning (trailer units and trailer resources)
- Re-planning based on events from execution

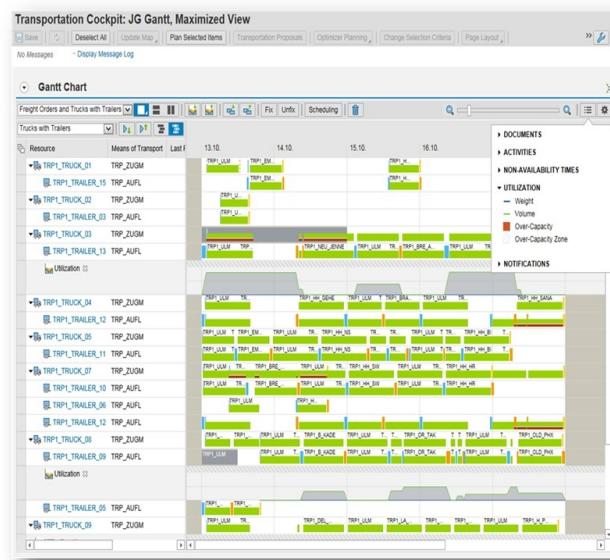


Figure 101: Gantt Chart: Interactivity and Planning Scenarios

The main benefit of this functionality is to have a good overview of the status of the trucks. Re-planning can be simply done by drag and drop. Freight orders can be fixed or unfixed by just clicking one button. Furthermore it is possible to navigate directly to the resources or trailer units.

The main focus is the planning of road transport. The truck and trailer planning can be done easily from this new feature in the cockpit. When execution events make a change to the planning necessary, this can be immediately done via this overview. Other mode of transports, such as air, sea or rail, are currently not supported in this cockpit.

Interactive planning can be performed in the Gantt chart using drag and drop. Unplanned freight orders can be assigned to resources. Likewise, resources can be assigned to freight orders. The freight order is dropped on the time bar of the resource. If the freight order is not dropped at the same date it was originally planned, the date where it was dropped is taken over into the freight order. Scheduling is only performed when requested using the *Scheduling* button on top of the Gantt chart. The dual-view can be selected to have the unplanned freight orders displayed on top and the available resources below. This enables the user to work with one window to plan freight orders. The dual-view can either be displayed horizontally or vertically. The size of each area can be changed by dragging with the mouse.

The Gantt chart enables the planning of unplanned freight orders by dragging on vehicle resources, as well as the creation of transportation units. When dragging and dropping the loading activity of one freight order into the time bar of another freight order, both freight orders are combined.

Overlap means that a resource has been planned multiple times and is therefore not executable, for example, if a trailer is already planned and newly planned during the next step, an overlap is caused, which is displayed as a red line to the user.

Similar to the utilization view, an overlap view shows if several documents on a resource overlap. This overlap can be overcome by scheduling the resource.

Manual Planning with Driver

Driver Management Overview

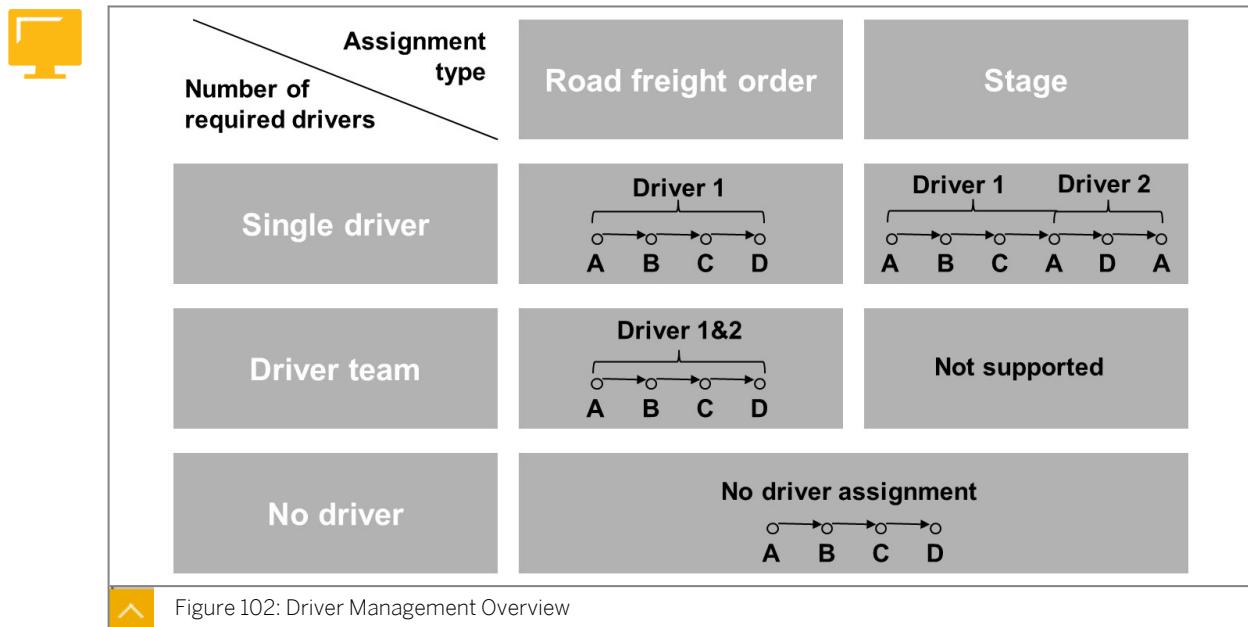


Figure 102: Driver Management Overview

Drivers can get assigned to existing freight orders and vehicle resources. It is also possible to create freight orders to which the system assigns drivers automatically as soon as they are created. This function is available only for road freight orders and trucks.

One or more drivers can be assigned to an existing freight order or to the individual transportation stages of an existing freight order. In a driver team, the individual drivers take turns to drive. The person who is not driving sleeps.

A prerequisite of this process is that drivers are created as business partners with business partner role TM Labor Resource. The properties of the driver are as follows:

- Home location
- Organizational Unit
- Validity Period
- Absences (for example, sickness, vacation)
- Non-working times (for example, shift sequences from Monday to Friday)
- Qualifications
- Last planned location and availability time

Automatic Assignment of Drivers

Automatic assignment of drivers to freight orders happens if the driver assignment is requested via the freight order type and the driver is assigned to the resource master data of the vehicle resource as default driver. Other than that, manual assignment of drivers is possible in the transportation cockpit as follows:

- Drag and drop:

It is possible to drag and drop drivers from the list of drivers in the transportation cockpit to the freight order being planned in the road freight order hierarchy, or in the road freight order list. If it has been specified in the freight order type that drivers have to be assigned per transportation stage, it is possible to drag and drop drivers in the road freight order hierarchy to the individual transportation stages.

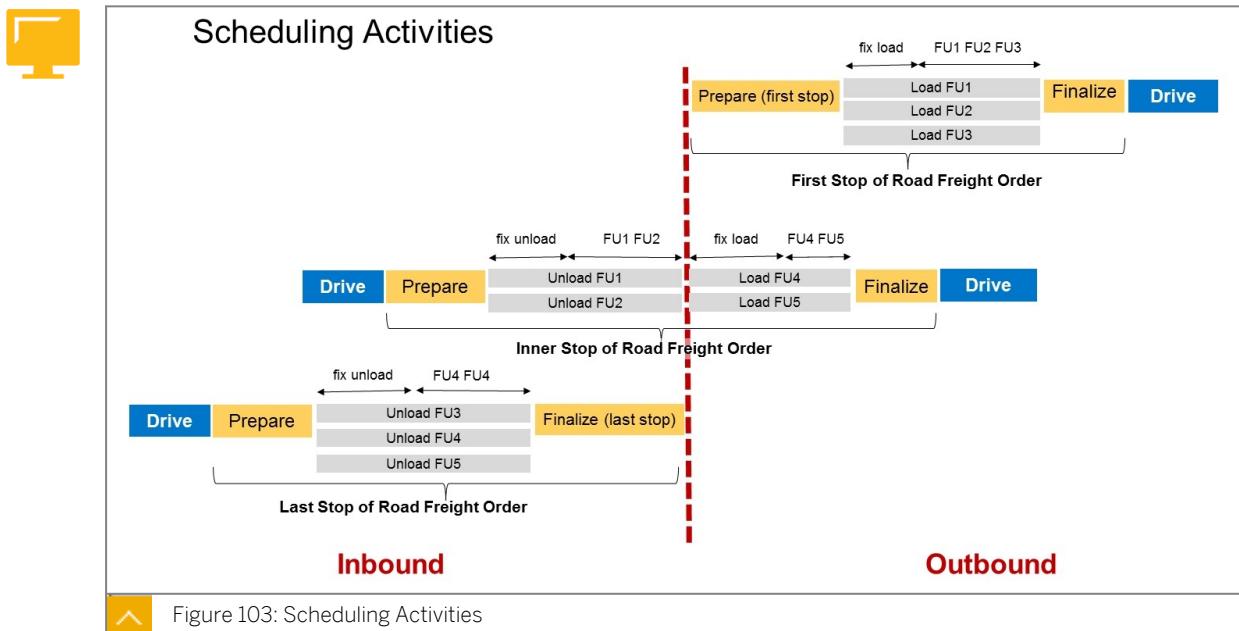
- Manual creation and change:

It is possible to enter or change drivers manually in the Driver column in the road freight order hierarchy or in the road freight order list. If specified in the freight order type that drivers have to be assigned per transportation stage, it is possible to enter or change drivers for individual transportation stages in the Driver column in the road freight order hierarchy. If driver assignment has been activated in the order details area in the layout for the transportation cockpit, it is possible to select a freight order in the road freight order hierarchy or in the road freight order list and manually enter or change a driver in the details for this freight order.

- Dialog box:

Finally, it is possible to select a freight order in the road freight order hierarchy or in the road freight order list and choose the *Assign Driver* button. A dialog box appears in which drivers can be entered. Then the user can decide in the dialog box whether to replace the currently assigned drivers with new drivers, or whether to add drivers to the existing drivers.

Scheduling Logic



Scheduling in SAP TM involves the following activities:

- Drive / Travel
- Load
- Unload
- Prepare

- Finalize
- Couple
- Uncouple

The duration of the individual activities is defined in the transportation network (travel), and in the scheduling settings of the planning profile (load, unload, prepare, finalize, couple, uncouple).

Scheduling in the transportation cockpit or freight order considers the following constraints:

- Time windows for loading and unloading activities for your freight units
- Loading and unloading durations of your freight units
- Appointments for the freight order your freight units are assigned to
- Location sequence of your freight order
- Existing freight orders on resources
- Coupling and uncoupling durations
- Absences and non-working times of the involved drivers
- Downtimes and non-working times of the involved vehicle resources
- Calendar resources as well as the calendars and capacities for the loading and unloading activities of handling resources
- Calendars of the involved vehicle resources and drivers for loading, unloading, transportation, coupling, and uncoupling activities
- Minimum and maximum goods wait times defined for transshipment locations



LESSON SUMMARY

You should now be able to:

- Access the transportation cockpit
- Describe visual planning
- Create freight orders for road transportation
- Explain the scheduling logic

Creating Freight Orders using Optimization

LESSON OVERVIEW

The focus of this lesson is the creation of freight orders, whether this is done manually (interactively) or automatically using the vehicle scheduling and routing (VSR) optimizer. Freight orders are a result of planning, and can have different properties based on their freight order type.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Understand the Logic of VSR Optimization
- Execute the VSR optimizer
- Describe transportation units

Freight Order

Business Example

In his role as an SAP transportation consultant, John has been requested to explain the benefits of freight orders and how they can get created using optimization criteria. John must describe the principles of vehicle scheduling and routing (VSR) optimization used in SAP TM as well as explain the difference of freight units, transportation units and freight orders.

Freight orders represent a single shipment or load departing from one of your facilities (outbound scenario) or arriving in one of your facilities (inbound scenario). The freight order can be created manually or automatically, for example, by using the vehicle scheduling and route optimizer. Freight orders are the basis for carrier selection, tendering, and freight settlement processes. These topics are covered in separate units.

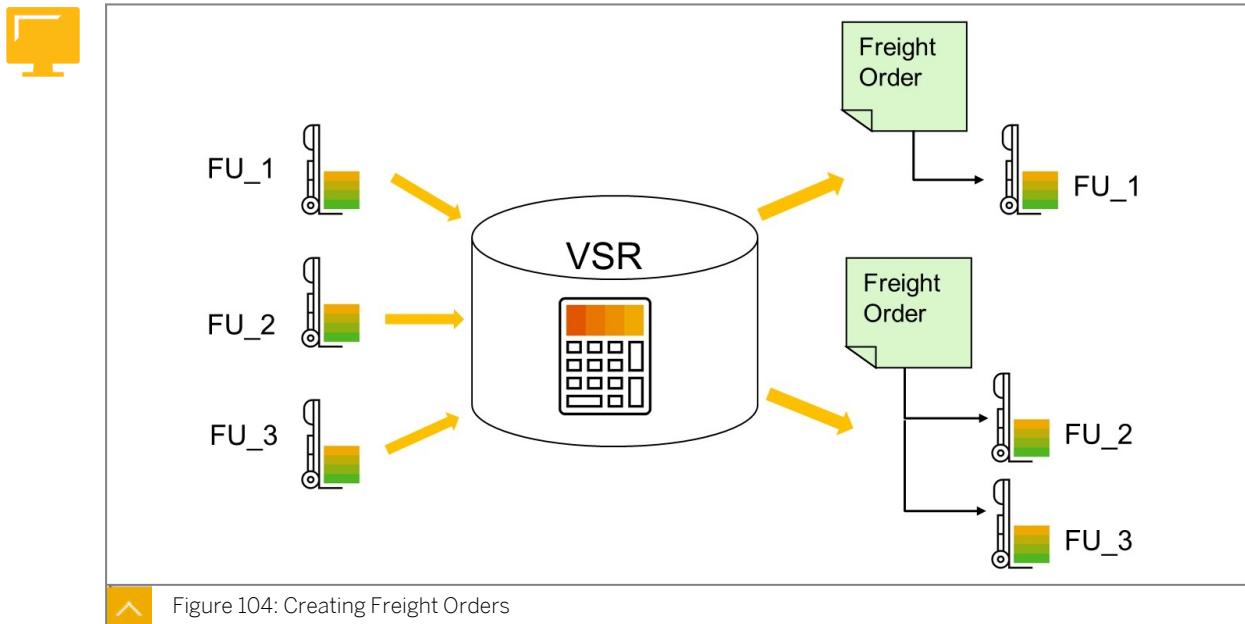


Note:

A freight booking can also be created as the result of transportation planning, similar to a freight order. For the sake of simplicity, the term freight order is used in the course book.

You can use the freight order management component in SAP TM to create and edit freight orders and freight bookings. You use freight orders above all for land transportation and you use freight bookings for sea and air transportation. You can use the business documents in freight order management to enter all the information required for transportation planning and execution, such as source and destination locations, dates/times, product information, and resources used. You can create freight orders directly, or in transportation planning. For example, you can assign freight units to the freight orders and have the system calculate the transportation charges. You can then perform carrier selection, assign the freight orders directly to a carrier as a suborder, or perform tendering.

Freight Orders in Transportation Planning



In a freight order, freight units from different transportation demands (SO/PO/DEL/OTR/DTR/FWO) can be consolidated. The VSR optimizer aims at finding the lowest cost solution based on the freight units to be planned, the transportation network (as defined in master data) and, for example, the costs defined in the relevant planning profile. If freight orders are created during planning and have the respective settings in the planning profile, the system determines the freight order type according to the Customizing settings.

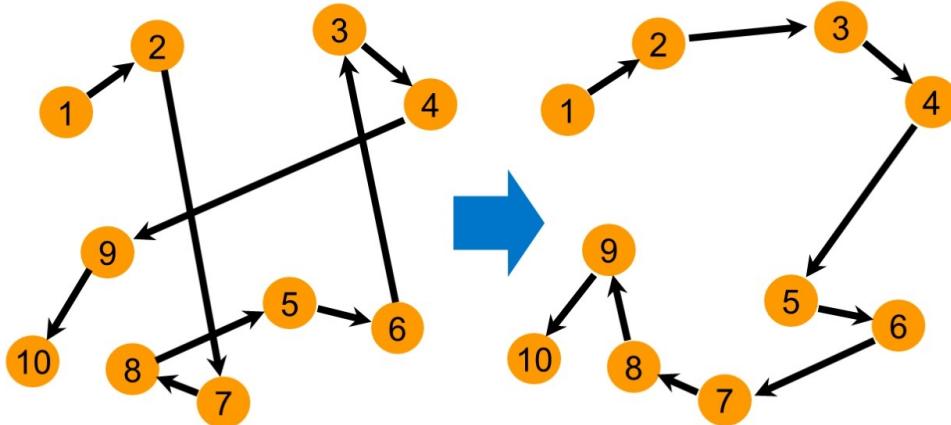
Route Optimization

As the name suggests, the vehicle scheduling and routing (VSR) optimizer considers routing, and the sequence in which resources arrive at certain locations (as well as the scheduling of tasks running in parallel). It evaluates potential changes to the routing and the effect such changes would have on scheduling, helping to avoid the possibility of delayed deliveries and follow-on costs.

Essentially, the goal of the optimizer is to assign freight units to vehicles/resources and determine the route and sequence of freight units per vehicle/resource such that all constraints are met and total costs are minimized. The optimizer achieves this goal by evolutionary local search, a population-based meta-heuristic that borrows selection principles from evolutionary algorithms and relies heavily on local optimization.



Transportation Planning



The optimizer creates a mathematical model out of a real world problem.

Figure 105: Mathematical Model

A more concrete example of the workings of the optimizer may be its handling of potential date changes, which it handles by applying each date change to all freight units on the affected vehicle/resource, or dependent freight units on any other resources, in order to derive the most appropriate choice. This consideration of several aspects in parallel is repeated for other variables such as transshipment locations, and is necessary to arrive at good plans or to make improvements on existing plans.

Costs and Constraints

The total cost, which the optimizer is designed to minimize, is a weighted sum of the following items:

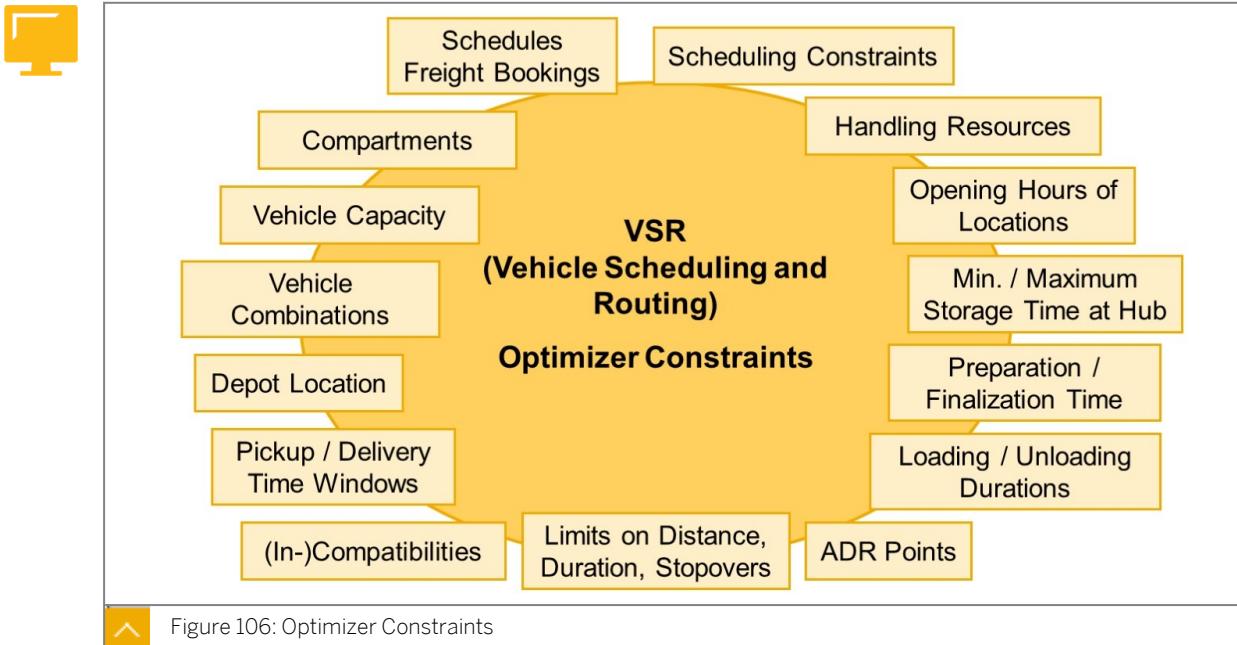
- Non-delivery/execution penalty (per FU)
- Earliness and lateness penalty (per FU)
- Fixed cost (per vehicle or tour)
- Travel-dependent costs (per vehicle), for example, distance, duration, etc.
- Load-dependent costs (per vehicle and tour)
- Sustainability costs such as CO₂ emissions (from SAP TM 8.0 by BAdI)

Optimizer Constraints

The optimizer can consider various additional constraints, as follows:

- At some locations, a handling resource for loading or unloading may be necessary, with attendant breaks or delays.
- The transshipment time of an order at a specific location can be restricted by a minimum and maximum duration.
- There may be incompatibilities between orders, vehicles, (transshipment) locations, and so on, which need to be considered.

- Driving times of vehicles may be restricted. For example, a planner can define that after 8 hours of travel, a driver needs a 2-hours break and that 10 hours is the maximum daily traveling time.



The VSR optimizer is mainly driven by freight units. As long as there are unplanned freight units, the VSR optimizer is searching for capacity to transport these. As a result, the optimizer is creating freight orders or freight bookings. If the VSR optimizer is to keep existing freight orders, but is allowed to change them, it is required to tell the optimizer how they can be changed. This is called incremental planning for freight orders.

Cost and Constraints Settings

The cost and constraint settings of the planning profile contain input for the optimization cost. The costs are internal costs and are not related to a particular currency. The following settings can be made:

- Non-delivery cost: This is (business-wise, not technical) a mandatory entry. The algorithm used in the optimization takes non-delivery into account. If there are no costs for non-delivery, the system will deliver nothing, since this is the cheapest solution. Therefore, a cost setting for non-delivery must be maintained.
- Earliness and lateness cost: Sometimes, it is more cost-effective to deliver early or late, if this means the route/trip can be completed. This setting controls the period for early or late pickup and delivery.
- Means of transport or resource specific cost: This setting controls the cost in relation to means of transport, and a break-even calculation can be made to determine the means of transport used. For instance, for very heavy goods in large volumes, rail is cheaper than road. These costs can be defined for individual resources (based on vehicle resource master data) or for groups of similar resources (based on means-of-transport level).
- In the Costs and Constraints Settings, it is allowed to define the minimum target utilization of a means-of-transport to be taken into account when road freight orders are created during VSR optimization. Furthermore, it can be specified whether this utilization is a hard or soft constraint. As a soft constraint, the target utilization may not be reached and a

warning is raised in this case. This setting controls whether freight documents which do not meet the desired target utilization are kept or deleted after the optimization run. As a hard constraint, the target utilization is always considered and as a result, freight units may remain unplanned.

Incremental Planning

In incremental planning, the following options are available:

- The optimizer keeps the resource (truck or trailer).
- The optimizer keeps all stops of an incremental freight order.
- The optimizer keeps all freight units of such an incremental freight order.
- It is possible to specify if additional new stops to an incremental freight order are allowed or not.

If more control about the incremental planning is required, there is a BAdI before the optimization call. Here, each freight order can be flagged for incremental planning separately. Additionally, there are the following options:

- Define time frames, how much change is allowed in rescheduling.
- Define if it is allowed to add stops as first or last stop or only between.
- Define which locations are potentially allowed to be inserted and which ones are not.

How incremental planning can be controlled is described in the note 1866364.

Transportation Unit

The transportation unit (TU) depicts transport requirements or capacity, for example:

- A trailer and its load
- The capacity of a railcar or several railcars that are transported together
- A container and its load
- A package, such as a pallet or a carton, and its load

You use the transportation unit to consolidate freight units. You can then plan the transportation unit as a unit for several transportation stages, in other words, you can assign it to one or more freight orders.

A transportation unit always represents a transportation requirement and is therefore a requirement document that you can assign to a capacity document. However, a transportation unit can also represent transportation capacity if it was not created during freight unit building. In this case, it is also a capacity document.

Within the transportation unit type, you configure the most important settings for the transportation unit. For example, you use the transportation unit category to indicate whether you want to create the transportation unit type for a trailer, a railcar, a container, or a package. When you then create the related business document (for example, a trailer unit), the system offers you only the relevant transportation units.



Feature	Freight Unit	Transportation Unit	Freight Order
Represents demand	+	+	-
Default route to define stages	+	+	-
Provides capacity	-	+	+
Different quantities per stage	-	+	+
Cargo management	-	+	+
Subcontracting	-	-	+

Figure 107: Transportation Unit, Freight Unit, Freight Order - Comparison



LESSON SUMMARY

You should now be able to:

- Understand the Logic of VSR Optimization
- Execute the VSR optimizer
- Describe transportation units

Generating a Transportation Proposal

LESSON OVERVIEW

This lesson shows you how to generate a transportation proposal.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

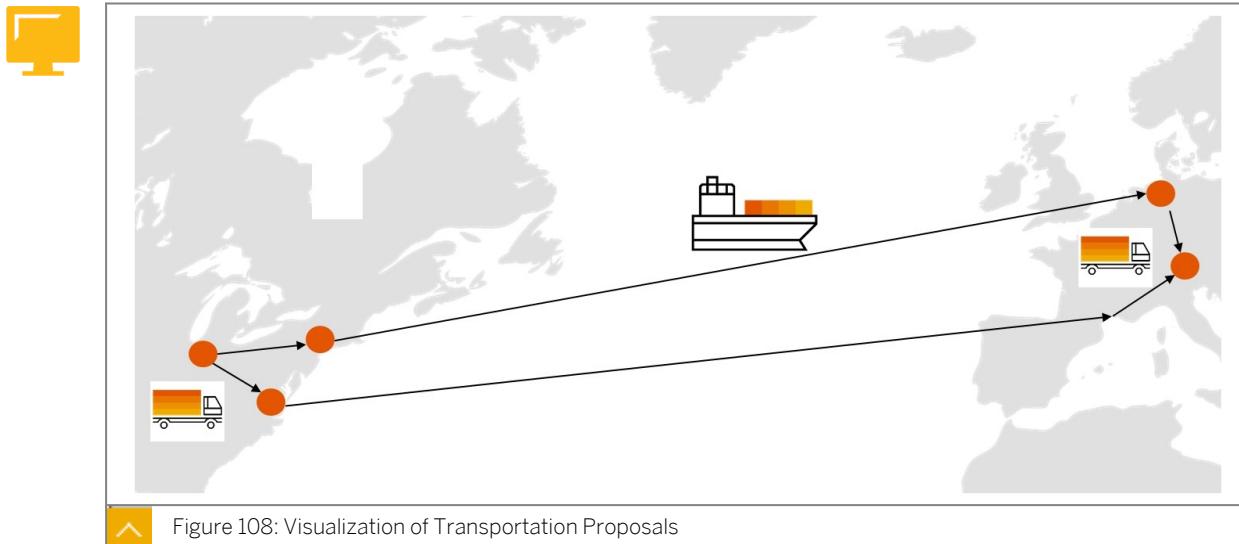
- Generate a transportation proposal

Transportation Proposal

A transportation proposal defines how a freight unit can be transported through a transportation network (which is defined by locations, transshipment locations, transportation zones, transportation lanes, vehicle resources, schedules and bookings). For a given transportation demand (freight unit), the system determines a set of alternative transportation proposals. Transportation proposal functionality serves two purposes.

The first and most obvious purpose is to help the user identify the different transportation options for a freight unit. In a complex network, in which end-to-end transportation requires several stages, transportation proposals are an easy way to make the different options transparent. Transportation proposals can differ in relation to routing, means of transport, time required. Each of these variables can increase or reduce costs, and the proposals thus provide the planner responsible with the necessary information to make an appropriate choice.

Secondly, transportation proposal functionality can be used from the forwarding order to create the stages upfront, for example, to choose the option of ocean transport, because the customer has placed their order well in advance and this is the cheapest choice. In this use case, no freight orders are created based on the proposal result, but only the stage information is stored. This allows the task of planning the different stages to be assigned to different planners and to be completed at different times.



Entry Points for Transportation Proposal Determination

Forwarding Order → Stages → Actual Route → Define Route

Transportation Cockpit → Select Freight Unit → Transportation Proposal

Layout of the Transportation Proposal Result

The layout of the transportation proposal result screen can be configured, similar to the transportation cockpit layout. The results can be displayed in a table format or visualized on a map. If the transportation proposal has been carried out for several freight units (because these compete for the same capacity, for example), the solution is always for a valid combination of assignments. In the table-based layout, each stage is shown in a separate line. In complex networks, there could be millions of routing options for a given transport, with only minor differences between them. Depending on the objective of the planner, results can be presented according to defined criteria, as follows:

- Lowest cost
- Shortest duration
- Carriers assigned
- Departure days
- Routes

Features of the Transportation Proposal

The features of the transportation proposal are as follows:

- Implicit definition of transshipment locations by schedules and freight bookings (simplified definition of transportation network)
- Mode of transport constraints on freight unit and freight unit stage level
- Fast determination of transportation proposals, yielding more alternatives according to predefined variation criteria (for example, route, carrier, departure date) and trade-off between time and cost (controlled variation according to pre-defined criteria)
- Consideration of preferences for locations, carrier, mode of transport, dates and times
- Display of multiple solutions on the result map

- Rough planning (detailed planning on the main leg and rough planning for pre leg and subsequent leg, based on rough definition of transportation durations)



LESSON SUMMARY

You should now be able to:

- Generate a transportation proposal

Optimizing a Load

LESSON OVERVIEW

In this lesson, you learn about the possibilities for load optimization in SAP TM. Load optimization allows a much finer view of how loads are put together than simply tare weight and volume, and facilitates planning down to the level of item position within a trailer, stackability, and axle weight distribution.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe load planning

Load Planning

You can plan the loading space of box trucks, trailers, semi-trailers, and containers in the transportation cockpit or directly in one of the following business documents:

- Road freight order
- Trailer unit
- Container unit

Planning is carried out at the level of business document items.



Note:

Load planning returns an approximate calculation of how the available loading space can be optimally used, taking into account the maximum axle loads and the maximum weight of a vehicle resource. The calculation is based on the master data that you enter for the resource. It is essential that you check the results calculated during load planning.



- Loading pallets into trucks, trailers, containers
- Rules-based load optimization, considering:
 - Dimensions
 - Axle weight constraints
 - Stacking rules
 - LIFO loading
 - Etc.
- 3D visualization of load plan

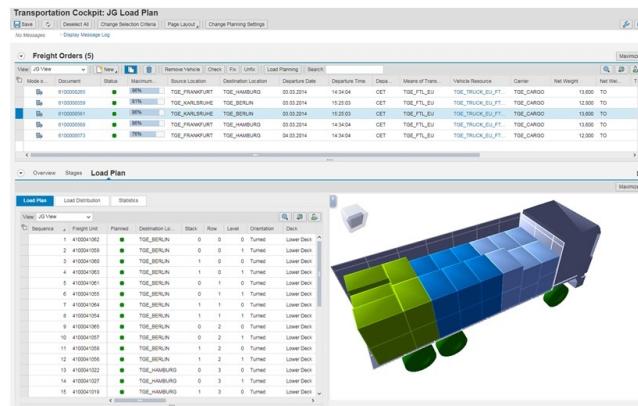
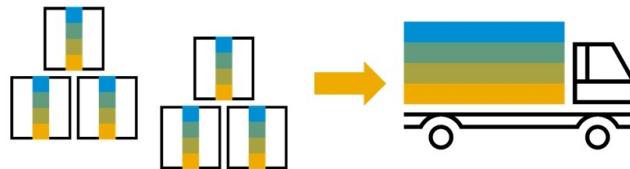


Figure 109: Load Planning

Take the following business scenario: Katie is working in the road department of a logistics service provider (ABC Company). She plans hundreds of road freight orders on trucks every day. Previously, the system has supported her by comparing the total weight and volume of the cargo and the truck. However, in some cases, cargo has been left at the warehouse because to carry it would contravene the guidelines of the truck (for example, axle weight distribution). Katie requires system support that optimizes the load plan regarding weight, dimensions, stackability, axle weight distribution, and further rules. This support would enable her to create a detailed load plan that could then be used in the warehouse to guide the loading of the truck. The load planning functionality of SAP TM provides this support.

Load Planning in the SAP TM Planning Process

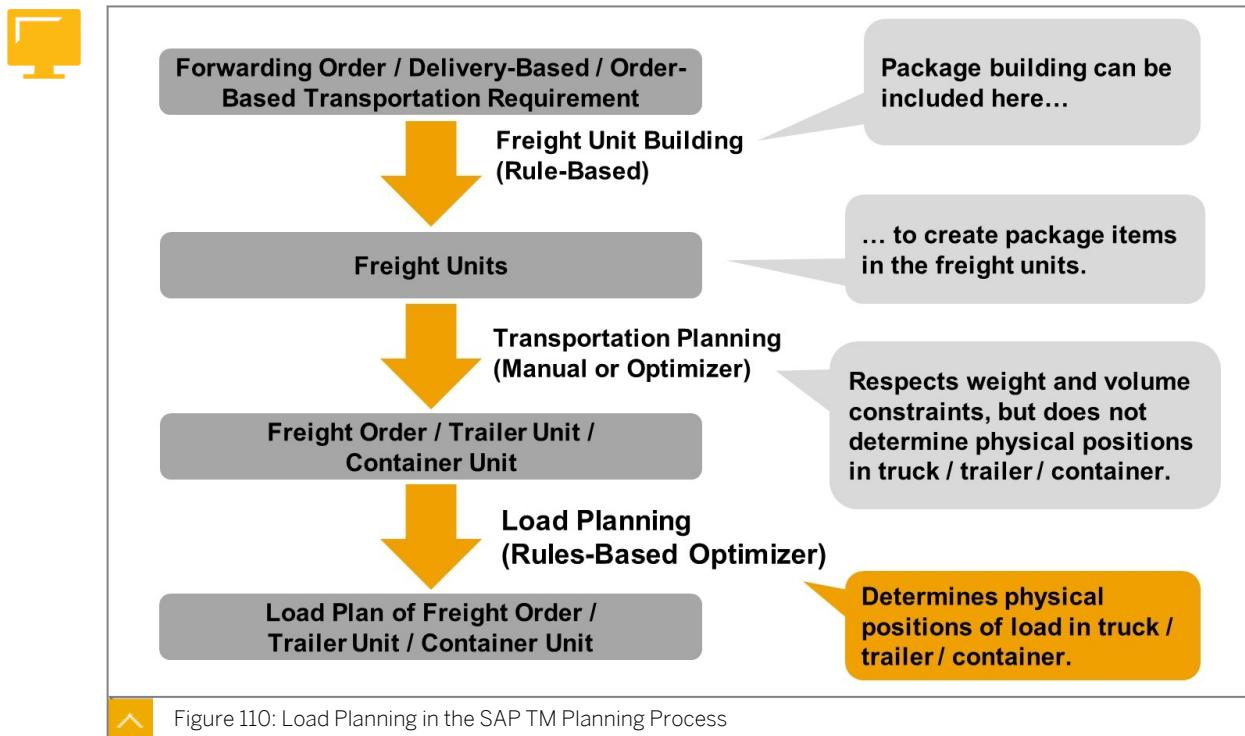


Figure 110: Load Planning in the SAP TM Planning Process

When you plan a road freight order on a box truck, trailer, or semi-trailer, the system takes into account capacity restrictions in terms of the height, width, length, and weight of the loading space. The same capacity restrictions also apply to the planning of a trailer unit on a trailer or semi-trailer. It also takes into account the maximum axle load of your box truck. Furthermore, in the system, you can add a split deck to your trailer or semi-trailer and consequently plan two decks. When you plan a container unit on a container, the system also takes into account capacity restrictions in terms of the height, width, and length of the loading space, as well as the total weight and the empty weight of the container. In both the transportation cockpit and in the freight order, you can check the results of load planning as a 3D load plan or a table load plan in the form of a list of business document items. In the 3D load plan, you can show or hide individual objects as well as entire rows, columns, or stacks. The systems also provides you with information about the current load distribution and utilization of the loading space.

Transportation Cockpit Load Plan

The screenshot shows the 'Transportation Cockpit: Torsten, Load Planning' interface. At the top, there are buttons for Save, Undo, Redo, Deselect All, Change Profile Selection, Page Layout, and Change Planning Settings. A message box indicates that 14 of 18 items of freight order 6100005032 can be loaded, while others are not considered due to measures maintained. Below this is a 'Display Message Log' section.

The main area has tabs for Freight Orders, Load Planning, and Search. Under Freight Orders, there is a table with columns: M., Document, S..., M..., Source..., Destin..., Departu..., De..., D..., Car..., Planne..., Pla..., A..., Tot..., D..., Net..., N..., Carrier, F..., D..., Mea..., Vehicle... . Three rows are listed: 6100005023 (33% loaded), 6100005025 (40% loaded), and 6100005032 (143% loaded).

The Load Planning tab is active, showing a table of items with columns: Item, Planned, Seq..., St..., Row, Le..., Orientation. The items listed are 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100. To the right of the table is a 3D visualization of a truck with blue and purple cargo boxes being loaded.

Figure 111: Transportation Cockpit Load Plan



Note:

The load planning functionality is useful for LSPs and shippers alike.

When entering the transportation cockpit, you select the appropriate Planning and Selection Profile. The example layout shown in the figure, *Transportation Cockpit Load Plan*, shows a list of all selected freight orders in the top area. In the lower area, you can see the *Load Plan* tab. Choosing this tab for a selected freight order shows a list with all the main cargo items along with the 3D visualization of the vehicle. Only the main cargo items of a freight order are relevant for load planning, so if you have a pallet where products are assigned as sub-items, those products are not shown in the list, only the pallets. In the case of multi-items (the item type can be defined in the freight order type), the level below the multi-item is used for load planning.

Choosing the *Load Planning* button (above the freight order list) runs the load planning optimization. The load optimizer fits the cargo items onto the vehicle, taking their dimensions into account and ensuring that no rules are broken.

Information about the planned load is displayed in the table to the left of the visualization image, and includes information on the following points:

- Position in which the item is loaded (loading sequence) on the truck
- The stack row and level on which the item is loaded
- Weight
- Dimension

Using the load planner, the planner can see immediately how much space for further items is left on the truck. If the planning of forwarding orders is carried out in the transportation

cockpit, the planner can now continue to load forwarding orders into the freight order and can then repeat the load planning.

3D Visualization

The visualization provides the planner with an enhanced overview of the loading of the truck. The planner can rotate the view, hover the mouse over particular items to see more information about the items, and they can hide or unhide special items to get a complete impression of the current loading.

Load Planning

- Optimizer ensures that freight order cargo fits onto a truck while taking dimensions, weight, and further rules (for example, reasonable load distribution) into account.
- A rotatable 3D visual load planning result per freight order is generated.
- Information on the exact position of each main cargo item is provided.
- Manipulation of the visualization to view the details of the load plan is possible.
- Load planning is available in the transportation cockpit and the freight order UI.
- Definition and prioritization of load planning settings is possible.
- Optimizer run data can be reviewed in the explanation tool.

Load Plan

The load plan is the result of load planning. It provides you with an overview of how the loading space available for transporting a business document is currently used. In both the transportation cockpit and in the business document, you can display the complete load plan as a 3D load plan or a table load plan of business document items. You can show and hide grid lines in your decks in the 3D load plan. You can also show and hide individual objects as well as entire rows, columns, or stacks and fill with different colors.

The load plan contains the following information about the business document item:

- Resource
- Item in the resource
- Loading sequence
- Row, stack, and level in the loading space
- Gross weight
- Height, width, and length
- Stackability

You also get information about the load distribution as well as additional statistical data about the current load on separate tab pages. This includes the following:

- Number of loaded business document items
- Used area on the lower deck of your double-deck trailer
- Utilization of the loading volume as a percentage
- Used area on the upper deck of your double-deck trailer

- Maximum weight for each axle group compared to the current weight for each axle group
- Maximum trailing load compared to the current trailing load

In the 3D load plan, you can adjust a load plan manually using buttons in the toolbar or keyboard shortcuts to move products and packages onto a truck. The status and the axle load are adjusted accordingly. You must have selected the *Activate Manual Load Planning* checkbox in Customizing for Transportation Management under Basic Functions Load Planning Define Layouts for 3D Load Plan. You can also define in this Customizing activity which combination of keys execute which command and how far an object should be moved (length of the movement increment).

Load Optimization Process



Common restrictions which are observed during load optimization:

- Weight
- Dimensions
- Stackability
- Axle weight distribution
- Further rules
- Priority of the rules
- Locations: which item is unloaded at which location (according to the *First In Last Out* principle)
- Which freight units belong together



Figure 112: Load Optimization Functionality

Load Planning Prerequisites

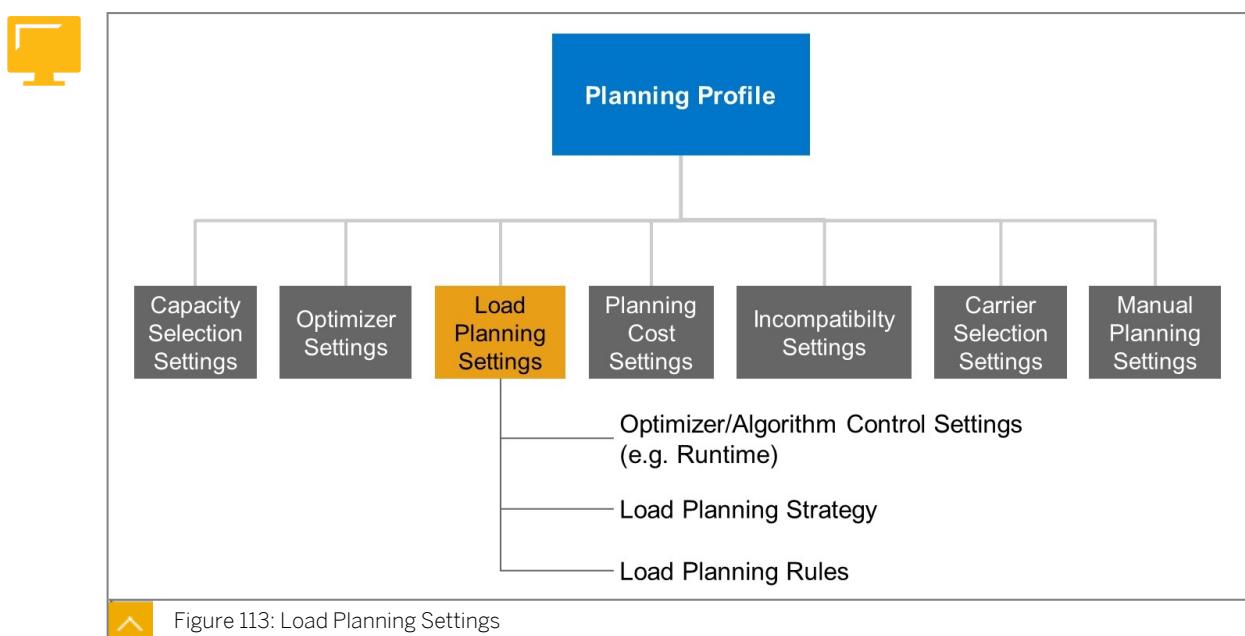
- The visualization is set up the layout of the transportation cockpit (in the Order area).
In the Order area, enable the *Road Freight Order Hierarchy* or *Freight Order* list. In the Details area, enable the *Load Planning* button. In the *Order Details* tab, enable a new detailed tab (Load Plan) for road freight orders.
- You have specified capacity details in the Resource Master Data for the truck on which planning is to take place. If the relevant dimensions are not maintained, the optimizer is not able to perform the load planning. The dimensions maintained here are used by the optimizer and the 3D-Visualization for the load planning.

In relation to the last point, the following data is critical:

- Capacity
 - Mass: Gross vehicle weight
 - Internal length: length of loading space
 - Internal width: width of loading space

- Internal height: height of loading space
- Physical Properties
 - Tare weight: empty vehicle weight
 - Cargo body distance: from the front of the truck to the beginning of the loading space
- Axle Group
 - Axle type: single, tandem, triple, and so on
 - Axle group distance: distance from front of truck to axle
 - Dist. between axles: relevant in case of more than one axle
 - Max weight on group: maximum weight on axle group
 - Emp. weight on group: weight of empty vehicle on axle group
- The load planning settings and rules. The planning profile contains a new field — *Load Planning Settings* — in which you enter the load plan. In the load planning settings, you can maintain certain rules that are considered by the optimizer during the load planning run, for example, height difference within a row: maximum deviation, and so on. You can set each rule as active or inactive, and you can prioritize the list of rules.

Load Planning Settings

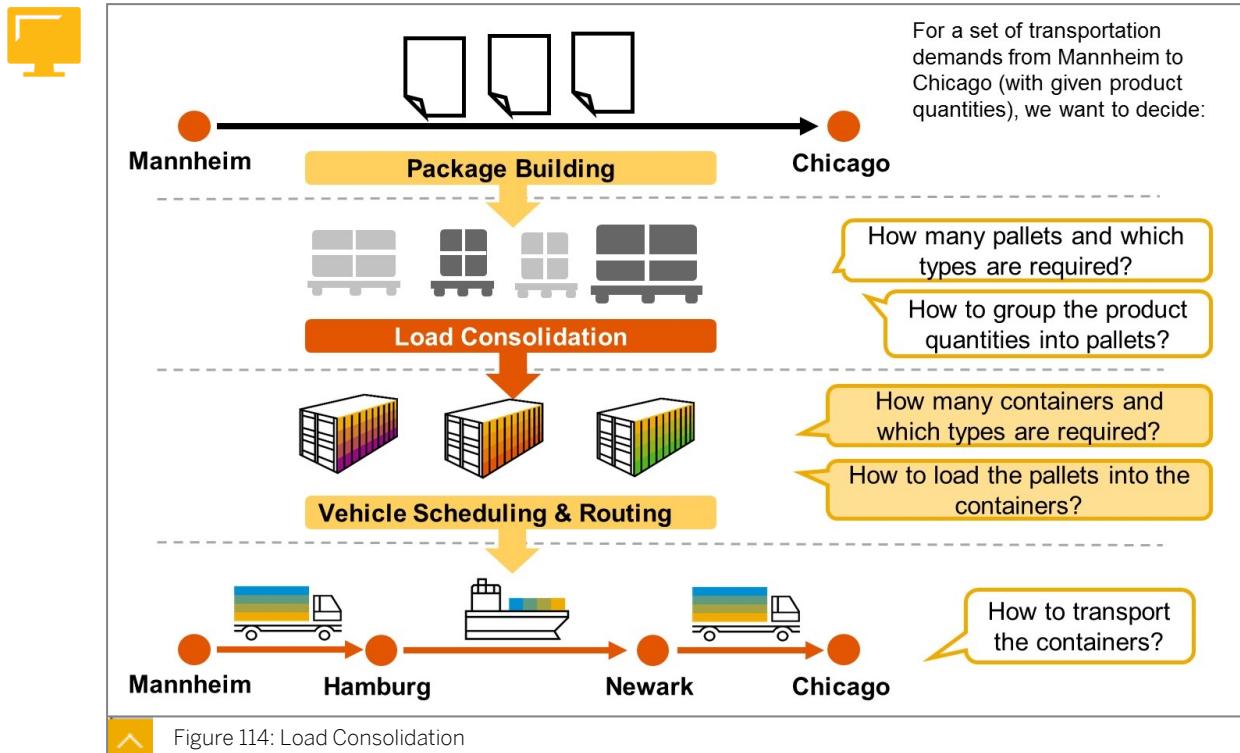


The rules that the load optimization algorithm should observe are defined in the load planning settings of the planning profile.

Load Consolidation

Load Consolidation is an extension of load planning. In load planning, the assignment of a set of packages to one truck, trailer, or container has already been decided before and the decision to be made is on how to place the packages within the one truck, trailer, or container. The planning problem for load planning can be described as follows:

- Given a set of packages and multiple trucks, trailers, and containers, how to assign the packages to the available trucks, trailers, and containers?
- How to place the packages in the assigned trucks, trailers, and containers?



Load Consolidation offers the following:

- Optimizer-based, automated assignment of a given set of freight units to resource types
- Determination of the number of resources to be ordered / to be used
- Focus on planning the main route where no routing decision has to be made

Load Consolidation supports the following:

- Alternative resource types (for example, 20 ft, 40 ft, 40 ft High Cube Container)
- Limitation of the maximal number of available instances possible
- Minimization of total costs
(based on defined fixed cost for usage of one resource type instance)
- Capacity Check based on given load dimensions (for example, weight and volume)
- Incompatibility between Freight Unit and Resource Type (for example, temperature condition)
- Incompatibility between Freight Unit and Freight Unit (for example, dangerous goods)
- Detailed Capacity Check
(considering detailed pallet dimensions and loading space and stackability of pallets)
- Providing an exact load plan (as in load planning)



LESSON SUMMARY

You should now be able to:

- Describe load planning

Creating Freight Bookings

LESSON OVERVIEW

In this lesson, you learn about how SAP TM can integrate your company's requirements for overseas shipping (by ocean or air) into your standard transportation management activities, particularly in relation to capacity booking.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe the ocean freight booking process
- Create an ocean freight booking

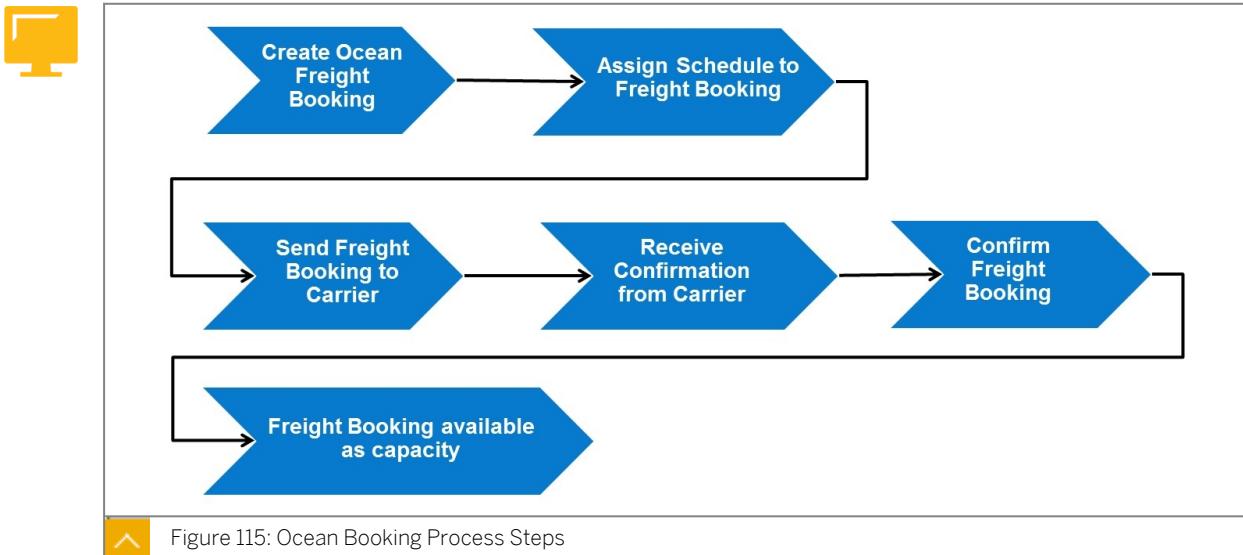
Ocean Freight Booking

Ocean transport has been the largest carrier of freight throughout recorded history. Although the importance of sea travel for passengers has decreased due to the rise of aviation (it is still popular for short trips and pleasure cruises), it remains hugely important for the transport of goods. Freight transport by water is cheaper than transport by air. Sea or ocean transport can be over any distance - by boat, ship, sailboat or barge, over oceans and lakes, through canals, or along rivers. Virtually any material that can be moved can be moved by water. Despite these benefits, ocean transport is less practical in situations where a speedy delivery is paramount.

When speaking of ocean transport, 'general cargo' refers to goods packaged in boxes, cases, pallets, and barrels. In the 1960s, a revolution called "containerization" altered the way that cargo was moved overseas. When a cargo is carried in more than one mode, it is said to be intermodal or co-modal.

Intermodal freight transport involves the transportation of freight in an intermodal container or vehicle, using multiple modes of transport (rail, ship, and truck), without any handling of the freight itself when changing modes. The method reduces cargo handling, and so improves security, reduces damages and losses, and allows freight to be transported faster. Reduced cost over road trucking is the key benefit for intracontinental use. This may be offset by quicker times for road transport over shorter distances.

Ocean Booking Process



Planning an ocean freight movement is different to planning a domestic freight movement insofar as the resources are often more scarce and they tend to operate on fixed schedules. Schedules in SAP TM can mimic the departure days, times, and frequency of ocean-going vessels or aircraft.

One step in the ocean-bound process that is different to the domestic scenario is the use of a booking. The freight booking is intended to reserve capacity on a vessel or aircraft. The difference between a (ocean) freight booking and a freight order is that a freight booking is equivalent to buying an airplane ticket, that is, you book capacity; a freight order is equivalent to checking in baggage and having it put aboard the plane.

Using Templates

If bookings for the same routes are required repeatedly, it is recommended to work with templates. Templates can be used to copy a new freight booking directly from the worklist for bookings.

Less Than Container Loads

One of the other scenarios that SAP TM considers is the 'Less than Container Load' (LCL). In this situation, a freight forwarder coordinates the ocean shipments for more than one customer simultaneously.

Prior to the receipt of export requirements, the freight forwarder may decide to book capacity on a vessel due to a forecast based on previous requirements. When requirements arrive they are often too small to warrant the use of a full container. In such situations, the freight forwarder ships the items to a facility where they consolidate the load into a single container.

SOLAS – Convention for the Safety of Life at Sea

Starting July, 1st 2016, the International Maritime Organization (IMO) will enforce the Safety of Life at Sea Convention (SOLAS) requirements regarding the verification of the gross mass of packed containers.

"A packed container will not be allowed to be loaded on board vessels to which the SOLAS Convention applies unless the Verified Gross Mass (VGM) of the container has been provided

to the ship's master or his representative and to the terminal or its representative sufficiently in advance to allow for the edition of the loading plan."

VGM must be auditable.

Definitions and Explanations:

VGM (Verified Gross Mass)= The total weight of a container including weight of goods, weight of packing material, and container tare.

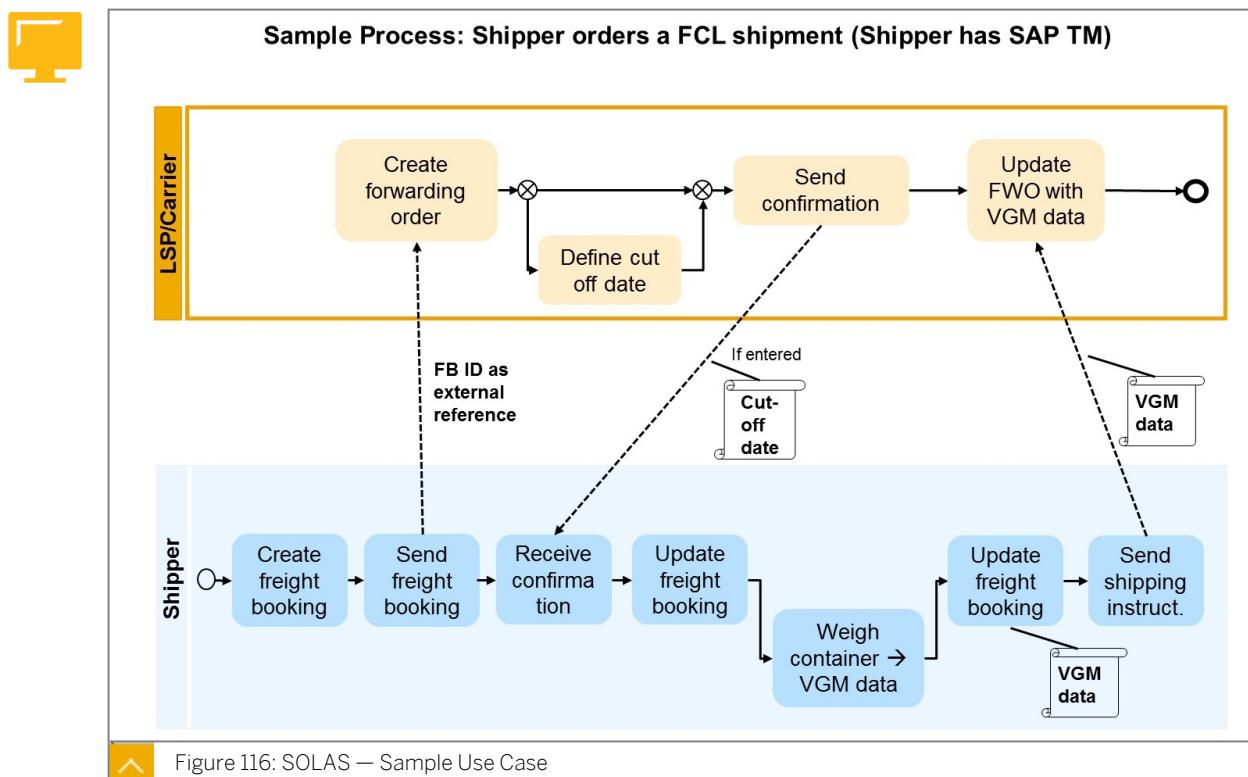
The following two methods are allowed to determine the VGM:

Weighing of the packed container

Sum of weighted packages and cargo items, (including the mass of pallets, dunnage, and other packing and securing material to be packed in the container) plus tare mass of the container

The VGM must be part of the shipping instructions. The company that has to report the VGM data to carrier/terminal depends on the scenario. The verified gross mass of a packed container should be provided to the next party taking custody of the container.

Several use cases/processes are supported in SAP TM.



Air Freight Booking

Like ocean freight bookings, air freight bookings can be created in SAP TM as capacity reservations with airline carriers. During transportation planning, they can be used as capacities. Before being shipped, air freight may be consolidated in one of two ways, namely gateway consolidation and business unit consolidation.

Gateway Consolidation

In the gateway consolidation scenario, the gateway (freight forwarder) receives freight from a number of different business units or stations. The gateway is responsible for flight planning, capacity management, (de)consolidation, MAWB (Master Air Waybill) creation and also for

communicating directly with the air carrier. The gateway is also responsible for transfers to/from the airport. The business units consume the booking capacity of the gateway. A business unit issues a HAWB (House Air Waybill) to the MAWB maintained at the gateway. As the gateway receives cargo from different business units, multiple HAWBs (forwarding orders) may be issued to one MAWB (air freight booking).

Business Unit Consolidation

With business unit consolidation, the business units have direct relationships with customers and are consolidating cargo from multiple shippers. This might also include cargo from other business units. The business unit is responsible for flight planning, capacity management, consolidation, MAWB creation and communicating directly with the air carrier. There is no gateway involved (for export or import) in this scenario. In SAP TM, the MAWB is the airfreight booking and the HAWB represents a forwarding order. In this scenario, both the HAWB and MAWB are issued by the business unit. In an internal co-load scenario, a booking (air or ocean) arranged by a certain business unit (BU1) is used by a separate, independent business unit (BU2) to ship their forwarding orders. The cargo (forwarding orders) of BU2 is co-loaded on the air freight booking of BU1.



LESSON SUMMARY

You should now be able to:

- Describe the ocean freight booking process
- Create an ocean freight booking

Unit 5

Lesson 8

Performing Carrier Selection

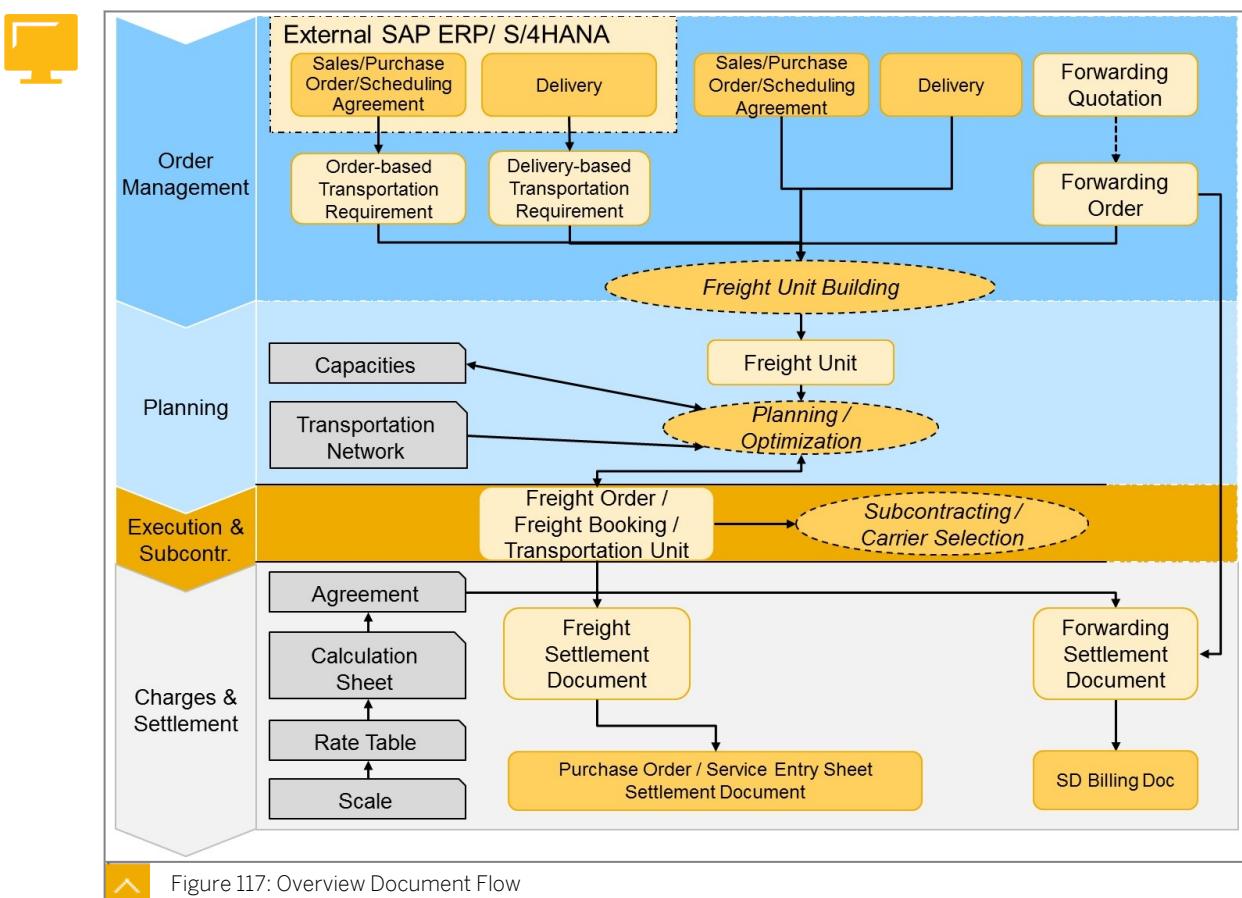


LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Define the carrier selection process and parameters
- Assign carriers to freight orders

Carrier Selection Process



Once a freight order has been built, a shipper needs to choose (and communicate with) the business partner responsible for moving the product. We will refer to this as carrier selection.

The carrier is the business partner that you subcontract the freight order to. The carrier can be different from the executing carrier, which is another business partner role that you can assign to your freight order, if the carrier itself subcontracts the execution of the freight order to a third party. That way, you have the option to differentiate between the party you contracted with and the party actually executing the freight move.

Carrier Selection

Carrier selection is used to assign a suitable carrier to your subcontractable business documents (for example, freight orders), either manually or automatically. The aim is to find a carrier with the lowest costs under consideration of the defined constraints.

In manual carrier selection, you manually assign the required carrier to your business documents. If you have configured a check against transportation allocations, the system takes this into account and checks transportation capacities (transportation allocations) that you have defined for the individual carriers. If, during the allocation, the system finds relevant transportation allocations without capacity or that certain rules are violated by the allocation, warning messages appear.

A separate optimization is available for automatic carrier selection. It takes selected optimization options into account when determining the most cost-effective carrier for all business documents that you have selected. If none of the carriers are available, the system does not assign any carrier to the relevant business documents.

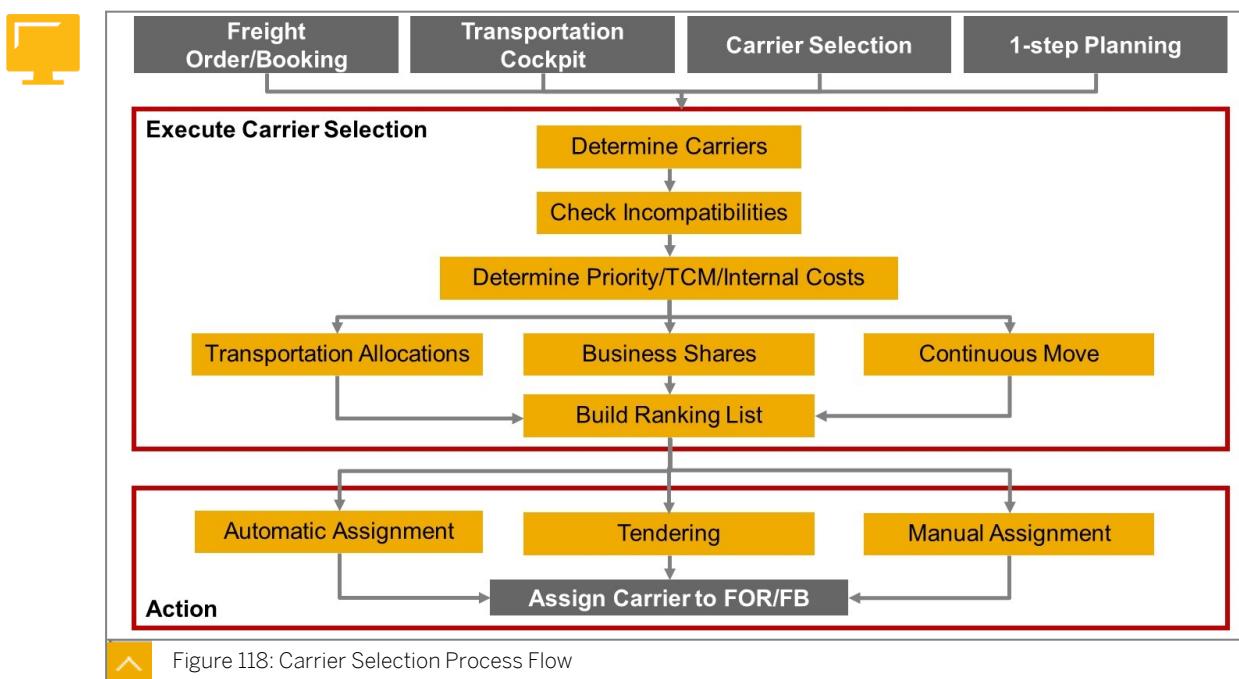
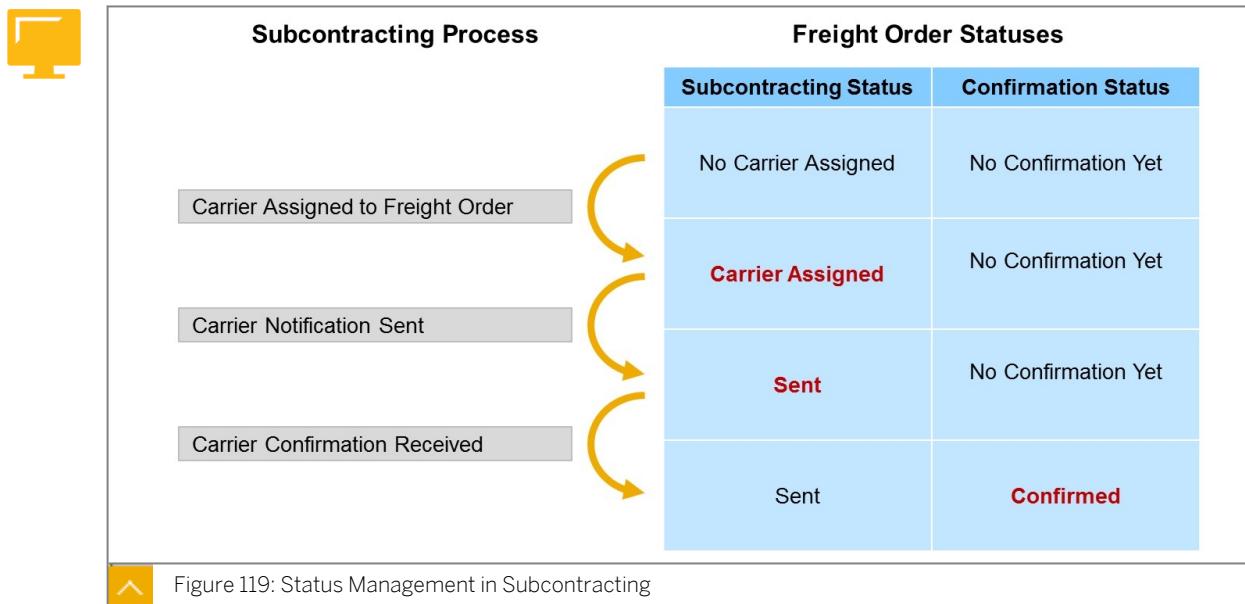


Figure 118: Carrier Selection Process Flow

Status Management in Subcontracting



The figure shows which statuses change during the subcontracting process.

Strategy Options

During planning in SAP TM, strategies are defined which are optimization options for carrier selection. The system takes these strategies into account during the automatic carrier selection process.

You define strategies either in the transportation lane or in carrier selection settings. Initially, the system considers the appropriate transportation lane for each freight order. This allows it to consider different settings in one run. Taking strategies and settings into consideration, the optimizer then creates a carrier ranking list containing the different carrier options. The strategy options supported are as follows:

- Cost and Priority
- Business Share
- Transportation Allocation
- Continuous Move

Costs and Priorities in Carrier Selection

In carrying out carrier selection, the system can put more weight on priorities or costs.

In terms of priority, the system can determine the most favorable carrier based on the priorities you have defined. In effect, this means that the system chooses the carrier with the highest priority, while taking into account the various restrictions that may be in place.

Alternatively, the system can determine the carrier on the basis of lowest total cost. Costs in this case can refer to internal costs or to charges calculated in charge management (we will look at this option in a separate lesson).

**Note:**

When we speak of internal costs here, we are not speaking of real-world costs. Internal costs are used for weighting only, as part of the carrier selection process.

Carrier Selection Settings



Figure 120: Carrier Selection Settings

The relevant constraints for the carrier selection process are defined in the carrier selection settings of the planning profile. Some of the decisions taken in the carrier selection settings can be delegated to the relevant transportation lanes, if decisions should not be taken globally, but different for certain geographical areas. The options selected here are on strategies such as lowest cost, business share, and priority. Carrier selection can consider continuous move options and equipment allocations and can tender automatically based on the tendering strategy.

Business Share

Formalized firm relationships often exist with carriers in the form of contracts. These contracts can guarantee an amount of business to be allocated to a carrier. If the required allocation is not met, penalties may result. SAP TM has the tools to track these relationships and to divide business appropriately between different carriers. This supports the negotiation of freight agreements, and avoids dependency on a single vendor. The idea is to use a fixed percentage to dictate the assignment of jobs to certain carriers. The system can also take the capacity of a carrier in relation to certain routes or geographical areas into account when generating assignments.

When defining the business share context, you create business share buckets. These define the actual business share a carrier is allowed to have. There are different types of buckets available for business share creation - yearly, quarterly, monthly, weekly, and daily.

Business Example

Carrier A has a weekly bucket equating to 75% of the business share on the lane between Hamburg and Frankfurt, between the validity period 03.01.2015 to 05.31.2015. In the same context, Carrier B can have a defined weekly bucket of 25%.

Penalties

You can define tolerances and penalty costs in relation to business share. As long as the business share for a specific carrier is within the tolerance limits, it does not affect the cost calculations during carrier ranking. Once the share allocation goes beyond a defined level, however, penalties start to apply. Tolerances are always defined in percentage terms. Penalties are maintained as numeric values. This number (the penalty) is multiplied by the deviation percentage (the amount outside the defined tolerance range) to arrive at the penalty cost.

Example

A penalty of 1,000 is defined. An excess tolerance of 10% is also defined. During business share calculation, if the excess is 12%, the excess liable for penalty is 2%. This 2 is multiplied by 1,000 to arrive at the total excess penalty cost of 2,000.

Currencies in Penalty Costs

When calculating the total costs for a carrier, if you are working with charge management costs, there will be a currency assigned to the charge management costs. To assign a currency to business share penalty costs, this has to be defined under *Carrier Selection Profile* → *Advanced Settings* → *Common Currency*.

If you are working with carriers from multiple geographic locations with multiple currencies, to arrive at the correct ranking, the system uses the internal common currency (maintained in the carrier selection profile) for its calculations. The currency displayed in the carrier ranking list is always the local currency of the carrier (the one maintained in the freight agreement). All freight orders in a business share context are selected for the business share penalty calculations, although these freight orders are not selected during the planning run.

Business Example

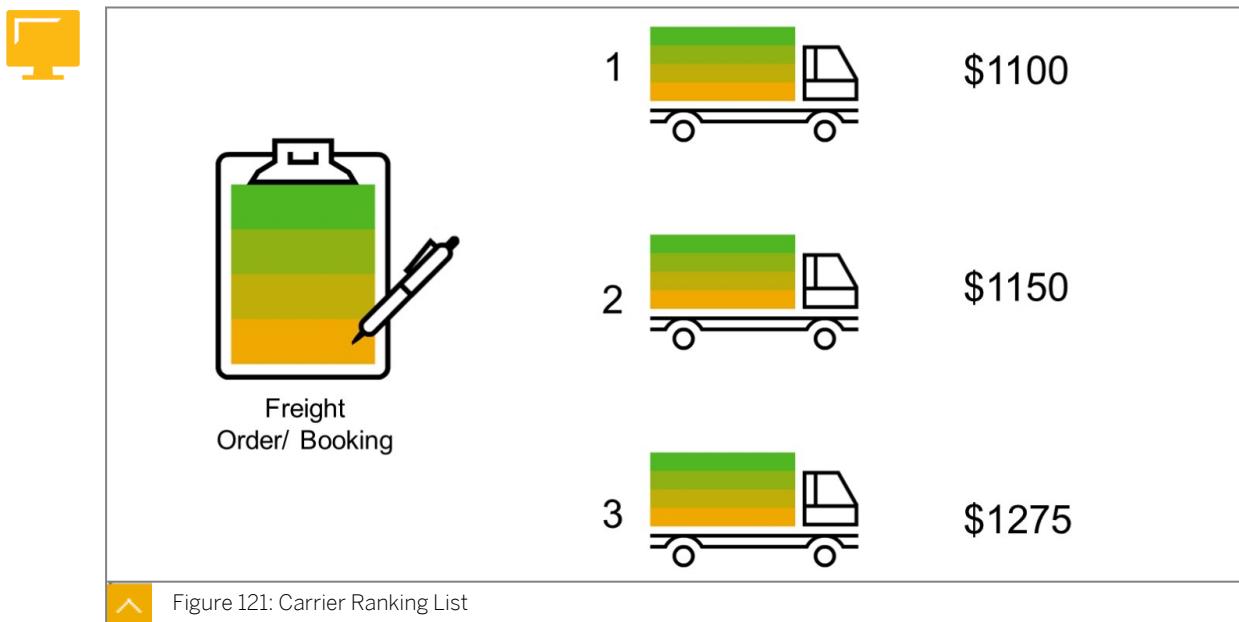
Assume that in a business share context, we have two carriers: A and B. No tolerances have been defined. Carrier A is awarded 60% and carrier B 40%. There are already 10 freight orders awarded, of which carrier A is assigned 6 and carrier B is assigned 4. Now let's perform carrier selection for an 11th freight order. If carrier B is assigned this FO, carrier A will have a shortfall of business share. If the freight order is assigned to carrier A, carrier B will have a shortfall of business shares. Both options are evaluated by the system and ranked according to their suitability.

Allocation

Transportation allocations allow companies to assign defined quantities of capacity to certain business partners. This includes set minimum or maximum capacity restrictions that regulate how much business is allowed with a certain carrier in a certain region for a certain means of transport. A separate business object is used to model these allocations.

Carrier Selection Ranking

When using automatic carrier selection, the system will create a carrier ranking list of the relevant carriers for a particular freight order/freight booking. For each relevant carrier, users can see a variety of information that influenced the selection process. This could include the means of transport cost, delivery performance ratings, and others. After automatic carrier selection has been performed, the ranking list will be visible in the freight order.



LESSON SUMMARY

You should now be able to:

- Define the carrier selection process and parameters
- Assign carriers to freight orders

Unit 5

Lesson 9

Tendering a Freight Order

LESSON OVERVIEW

Once a freight order has been built and a carrier selected, your business needs to let the appropriate parties know that they have been selected. In this lesson, you will investigate how SAP TM can support this process of order tendering.

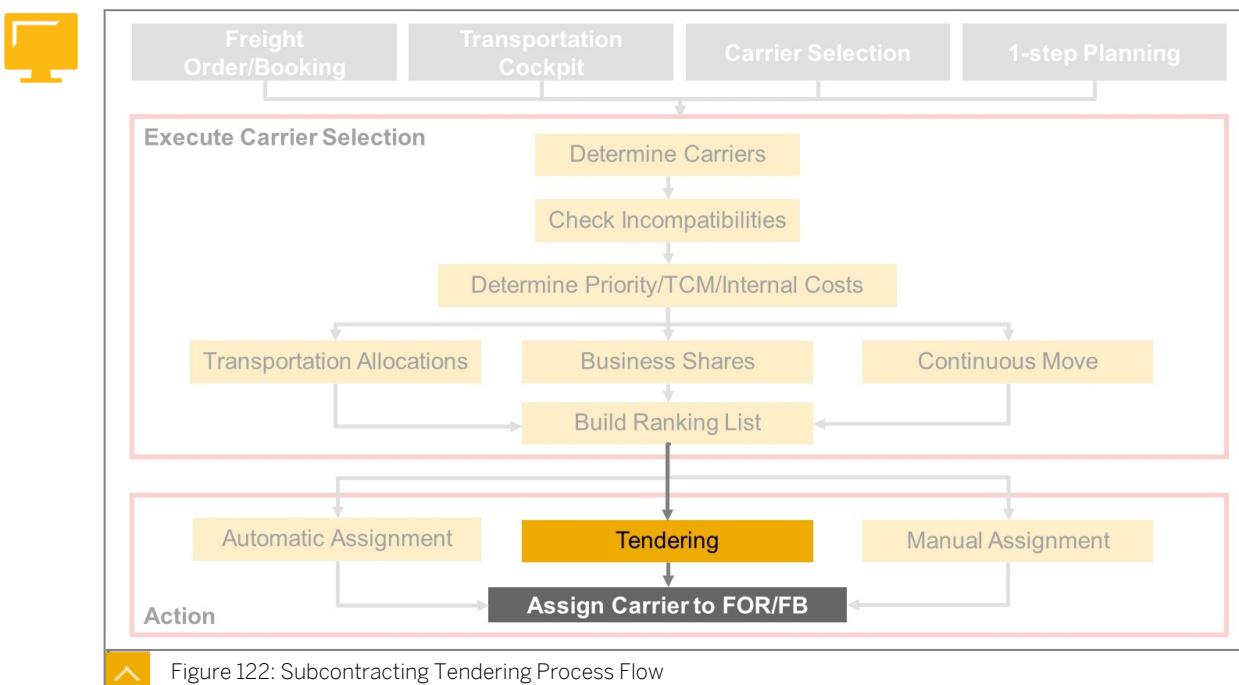


LESSON OBJECTIVES

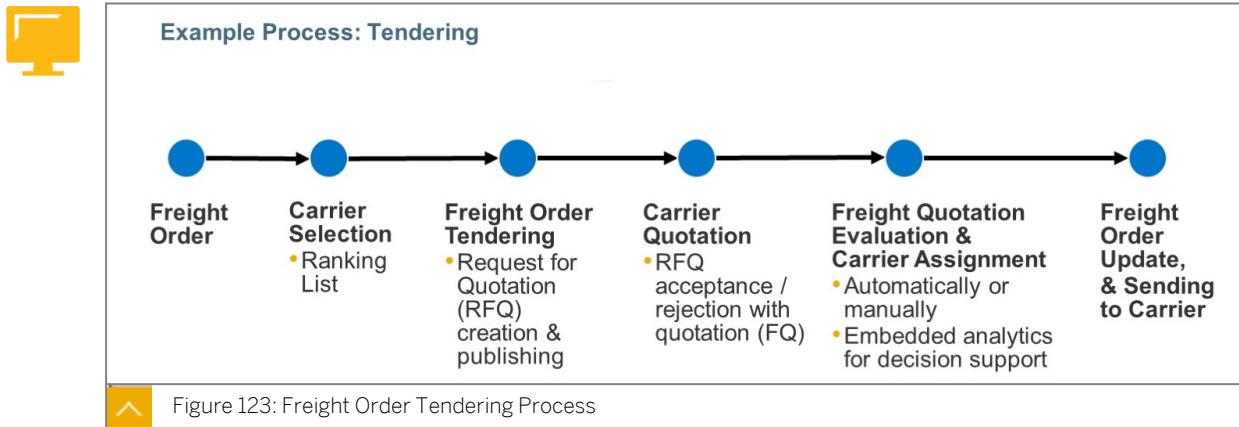
After completing this lesson, you will be able to:

- Describe the tendering process
- Tender a freight order

Freight Order Tendering Process



Once carrier selection has taken place, communication with the selected carrier needs to be initiated. This process is referred to as order tendering. Different tendering processes can be deployed depending upon the technology used by the carrier. You use this process to tender (offer) a freight order to one or more potential carriers. Tendering is a bidding process, in which you request one or multiple carriers to submit a quote for a transportation service that is defined in a freight order. You can select the carrier that you want to execute the transportation service by evaluating the quotes. The main characteristics of the tendering process are flexible configuration and the reduction of required manual interaction to support ease of use and lower total cost of ownership (TCO).



Tendering Types

In general, there are two types of tendering. Long-term tendering is where contracts are negotiated for a longer period, for example, a year. Long-term tendering is a process that is covered in Strategic Freight Management, which we will look at in the Managing Freight Contracts lesson. Short-term tendering is where tendering is executed based on specific orders. This is known as order tendering. SAP TM supports the following short-term tendering scenarios:

- Peer-to-Peer Tendering
- Broadcast Tendering

The strategies for each are determined in tendering profiles in SAP TM.

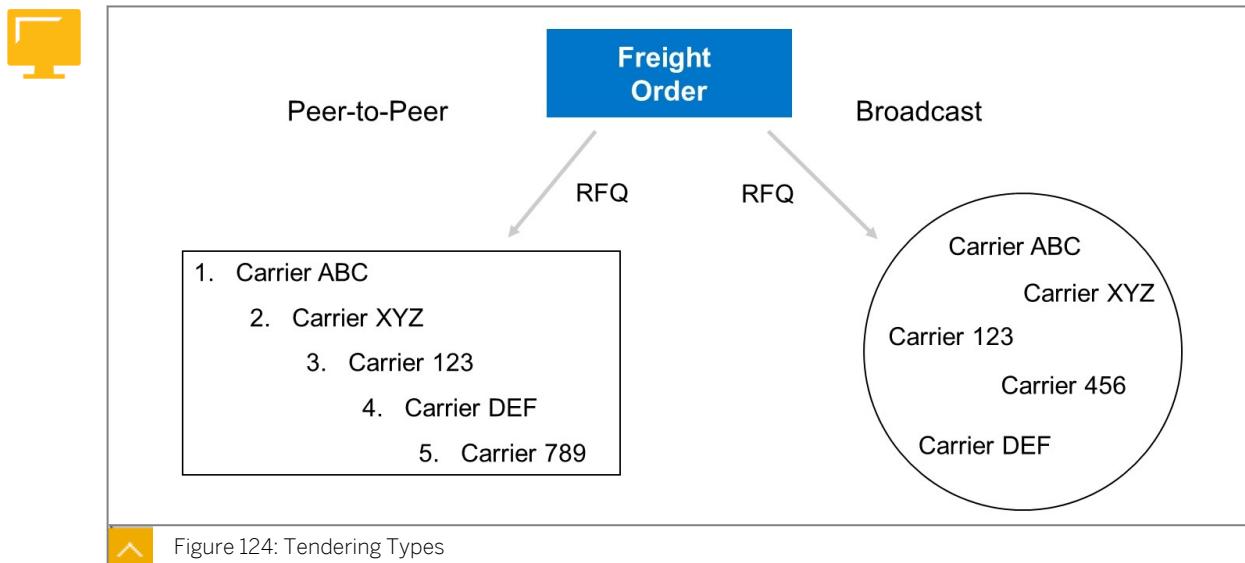
Parties and Roles in the Tendering Process

At least two parties are involved in the tendering process - a customer who wants to subcontract a transportation service that is defined in a freight order, and a supplier (subcontractor) or carrier, who potentially carries out the transportation service. There are two roles on the customer side of the tendering process. The first is a transportation dispatcher, who is responsible for the transportation service, that is, the freight order. The second is the tendering manager, who is responsible for configuring and executing the tendering process and acquiring an acceptable quote from a carrier to perform the transportation service.

Manual and Automatic Tendering

When a transportation dispatcher initiates the tendering process, they have two options: manual process configuration or automatic tendering. If they want to tender only a single freight order, the transportation dispatcher can choose between the two options. If they initiate a tendering process using manual configuration, the tendering manager must configure and start the tendering process manually. If the transportation dispatcher wants to tender more than one freight order, they must initiate automatic tendering and use the automatic tendering configuration in the system.

Peer-to-Peer Tendering



Peer-to-peer tendering is a process whereby freight orders are tendered sequentially or “offered” to preselected carriers. Peer-to-peer tendering involves the sequential sending of freight requests for quotation (freight RFQs) to each proposed carrier. The system waits until the carrier sends a freight quotation (FQ), or until the maximum response time has passed. If the carrier does not send a quote within the maximum response time, the peer-to-peer tendering process continues, and the system sends a request for quote to the next carrier. If peer-to-peer tendering ends without an acceptable quote, the tendering process continues with the next tendering process step that you have configured. If the carrier sends a quote before the maximum response time has elapsed, the system evaluates the quote and can either accept or reject it. In the case of rejection, a new RFQ is sent out. The process continues until at least one acceptable FQ has been received. The system awards this a Quotation Acceptable evaluation result and the process ends successfully. There are two types of peer-to-peer tendering: response required and no response required.

Broadcast Tendering

Broadcast tendering is a tender process whereby freight orders are simultaneously tendered (offered) to preselected carriers. All carriers have to respond within a given maximum response time. There are two types of broadcast tendering: best offer and first acceptable offer. Depending on which one of these is being used, either the first acceptable quote wins or, after the maximum response time, the system evaluates all the acceptable quotes and selects the carrier that has submitted the quote with the lowest price. If broadcast tendering ends without an acceptable quote, the tendering process continues with the next tendering process step that you have configured.

Tendering Communication Methods

Tendering Profiles

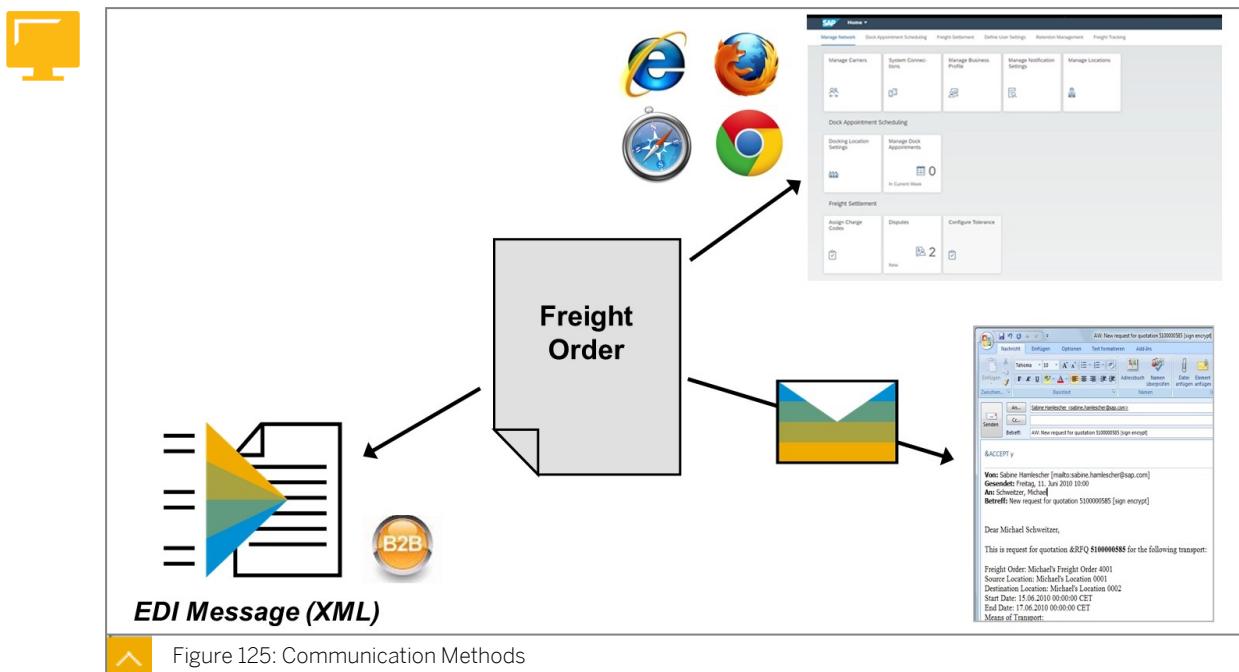
The tendering profile contains basic tendering data and is a prerequisite for automatic tendering. You can use a tendering profile when you manually create a tendering plan. Within the profile, you can define multi-step tendering. This allows a company to mix tendering types. For example, you can first use peer-to-peer tendering, and if this is unsuccessful you can use broadcast tendering. In a tendering profile, you can make settings in relation to the following options:

- Choose from tendering types — peer-to-peer, broadcasting (best offer, first acceptable offer)
- Choose from tendering processes — direct or RFQ-based
- Choose fully or semi-automatic rules-based tendering (response time and price limits, automatic re-tendering)
- Configure the tendering process and RFQ publishing
- Set up web-based, e-mail, B2B tendering communication
- Set up authorization-based RFQ processing and data visibility (carrier authorization to change the price and delivery dates, view tender price limit, stop date and rejection code reasons, support of free text and attachments)
- Make settings in relation to currency

Communication Methods

As part of the tendering process, it is important to review the communication methods that support the tendering scenarios. For carriers who may not be able to support EDI (electronic data interchange) scenarios, SAP offers the logistics business network (SAP LBN). This requires subcontractors to log on to SAP LBN using the Web in order to process a freight order. On a periodic basis, each subcontractor views their RFQs (modeled as tendering requests) and submits quotations (modeled as tendering responses). Each subcontractor is provided with their own user IDs and passwords, as well as the relevant authorization to restrict visibility to only the loads that have been tendered to them.

Additional methods are supported, such as receiving RFQs by e-mail and submitting quotations by e-mail without the need to access an SAP TM system at all. In this case, an RFQ is sent to a carrier by e-mail message. The carrier responds to the e-mail using a regular e-mail client on a PC or a mobile device. The e-mail is then converted (using PI) into a quotation. Carriers can accept RFQs directly, reject them with a specified reason, or accept them with changes.



If a subcontractor is more technically advanced, B2B communication can be used.

In this situation, a copy of the freight order is created for the carrier (the tendering manager or system administrator can control what is included in the copy that is visible to the carrier). The copy is persisted in the system to retain what was communicated to the carrier. A freight request for quotation (tendering request) is sent via PI and received as a forwarding quotation in the supplier's SAP TM system. The carrier can accept the order directly or, if the first carrier rejects the order, the freight order will be sent to the next carrier. Finally, a quotation confirmation is sent back to the customer and is converted into a quotation (tendering response) in the customer's SAP TM system. The Change Controller allows you to react to changes in the FO, for example, by stopping tendering when there are major changes in the FO.



LESSON SUMMARY

You should now be able to:

- Describe the tendering process
- Tender a freight order

Learning Assessment

1. Which of the following are options for transportation planning in SAP TM?

Choose the correct answers.

- A Manual planning using drag and drop
- B Optimizer planning
- C Transportation proposals
- D Map-based planning

2. How can you create freight orders?

Choose the correct answers.

- A Manual creation
- B Creation via Transportation Proposal
- C Creation using the VSR Optimizer
- D Creation by Copying
- E Creation via drag and drop in the Transportation Cockpit

3. Which profile can be used to select freight units for transportation planning?

Choose the correct answer.

- A Layout Profile
- B Selection Profile
- C Transportation Profile

4. What can be maintained within a planning profile?

Choose the correct answers.

- A Master data
- B Scheduling settings
- C Capacity selection settings

5. A profile and layout set can be chosen when entering the transportation cockpit. This defines what should be planned, how it should be planned, and how information should be arranged.

Determine whether this statement is true or false.

True

False

6. What visual elements support planning in the transportation cockpit?

Choose the correct answers.

A Analytics

B Map

C Gantt Chart

D Load Plan

7. What information can be displayed in the transportation cockpit?

Choose the correct answers.

A Transportation Lanes

B Business Partners

C Freight unit stages

D Resources

E Freight Bookings

8. What is the optimizer taking into account during vehicle scheduling and routing?

Choose the correct answers.

A Incompatibilities

B Internal costs

C Real costs from TCM

D Opening hours

9. Which of the following are criteria for transportation proposals?

Choose the correct answers.

- A Route variation
- B Used carriers
- C Number of transshipment locations
- D Driver availability
- E Real costs from TCM

10. The axle weight distribution can be considered during load optimization.

Determine whether this statement is true or false.

- True
- False

11. The load planning result of the load optimizer can be adjusted manually.

Determine whether this statement is true or false.

- True
- False

12. Which business document is used to reserve capacity in ocean freight scenarios?

Choose the correct answer.

- A Freight Order
- B OTR
- C Freight Booking
- D Ocean Schedule

13. Which business document is used to reserve capacity in an air freight scenario?

Choose the correct answer.

- A Air Waybill
- B Freight Booking
- C MAWB

14. For which of the following transportation modes does SAP TM create freight bookings?

Choose the correct answers.

- A Air
- B Road
- C Rail
- D Sea

15. Which of the following can be considered during carrier selection?

Choose the correct answers.

- A Internal costs
- B Real costs from TCM
- C Business shares
- D Incompatibilities

16. The carrier is the business partner that you subcontract the freight order to.

Determine whether this statement is true or false.

- True
- False

17. Broadcast tendering refers to a process whereby all quotations received (in response to an RFQ) are broadcast to all carriers in an effort to improve transparency.

Determine whether this statement is true or false.

- True
- False

18. There are different methods of communicating during tendering process, one of them being e-mail.

Determine whether this statement is true or false.

- True
- False

Learning Assessment - Answers

1. Which of the following are options for transportation planning in SAP TM?

Choose the correct answers.

- A Manual planning using drag and drop
- B Optimizer planning
- C Transportation proposals
- D Map-based planning

Correct. You can use the optimizer or transportation proposal for planning as well as drag and drop and interactive map-based planning.

2. How can you create freight orders?

Choose the correct answers.

- A Manual creation
- B Creation via Transportation Proposal
- C Creation using the VSR Optimizer
- D Creation by Copying
- E Creation via drag and drop in the Transportation Cockpit

Correct. There are many options for creating freight orders. These include manual creation, creation via transportation proposal or VSR optimizer, creation by copying or interactively in the transportation cockpit.

3. Which profile can be used to select freight units for transportation planning?

Choose the correct answer.

- A Layout Profile
- B Selection Profile
- C Transportation Profile

Correct. A selection profile is used to select freight units for transportation planning.

4. What can be maintained within a planning profile?

Choose the correct answers.

- A Master data
- B Scheduling settings
- C Capacity selection settings

Correct. Master data is not maintained in the planning profile. In the planning profile you can maintain scheduling settings and capacity selection settings.

5. A profile and layout set can be chosen when entering the transportation cockpit. This defines what should be planned, how it should be planned, and how information should be arranged.

Determine whether this statement is true or false.

- True
- False

Correct. A profile and layout set defines what should be planned, how it should be planned, and how information should be arranged.

6. What visual elements support planning in the transportation cockpit?

Choose the correct answers.

- A Analytics
- B Map
- C Gantt Chart
- D Load Plan

Correct. In the transportation cockpit you can activate a map, a gantt chart and the load plan as visual elements.

7. What information can be displayed in the transportation cockpit?

Choose the correct answers.

- A Transportation Lanes
- B Business Partners
- C Freight unit stages
- D Resources
- E Freight Bookings

Correct. You can display freight unit stages, freight bookings and resources in the transportation cockpit.

8. What is the optimizer taking into account during vehicle scheduling and routing?

Choose the correct answers.

- A Incompatibilities
- B Internal costs
- C Real costs from TCM
- D Opening hours

Correct. The VSR optimizer can take incompatibilities, internal costs and opening hours into account, but not real costs from TCM.

9. Which of the following are criteria for transportation proposals?

Choose the correct answers.

- A Route variation
- B Used carriers
- C Number of transshipment locations
- D Driver availability
- E Real costs from TCM

Correct. Criteria for transportation proposals are route variation, used carriers, and real costs from TCM.

10. The axle weight distribution can be considered during load optimization.

Determine whether this statement is true or false.

True

False

Correct. Axle weight distribution can be considered during load optimization.

11. The load planning result of the load optimizer can be adjusted manually.

Determine whether this statement is true or false.

True

False

Correct. The load planning result of the load optimizer can be adjusted manually.

12. Which business document is used to reserve capacity in ocean freight scenarios?

Choose the correct answer.

A Freight Order

B OTR

C Freight Booking

D Ocean Schedule

Correct. A freight booking can be used to reserve capacity in an ocean freight scenario.

13. Which business document is used to reserve capacity in an air freight scenario?

Choose the correct answer.

A Air Waybill

B Freight Booking

C MAWB

Correct. Freight Bookings are used to reserve capacity in an air freight scenario.

14. For which of the following transportation modes does SAP TM create freight bookings?

Choose the correct answers.

- A Air
- B Road
- C Rail
- D Sea

Correct. Freight bookings are created for air and sea transports.

15. Which of the following can be considered during carrier selection?

Choose the correct answers.

- A Internal costs
- B Real costs from TCM
- C Business shares
- D Incompatibilities

Correct. All of the above can be considered during carrier selection.

16. The carrier is the business partner that you subcontract the freight order to.

Determine whether this statement is true or false.

- True
- False

Correct. The carrier is the business partner that you subcontract the freight order to.

17. Broadcast tendering refers to a process whereby all quotations received (in response to an RFQ) are broadcast to all carriers in an effort to improve transparency.

Determine whether this statement is true or false.

- True
- False

Correct. Broadcast tendering refers to a scenario in which an RFQ is sent to multiple carriers at the same time and the responses are then evaluated. This is in contrast to peer-to-peer tendering, which is sequential.

18. There are different methods of communicating during tendering process, one of them being e-mail.

Determine whether this statement is true or false.

True

False

Correct. E-mail is a valid communication method in the tendering process.

UNIT 6

Transportation Execution

Lesson 1

Processing Deliveries

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Generating Outputs

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Lesson 6

Analyzing SAP Transportation Management Performance

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UNIT OBJECTIVES

- Describe delivery processing
- Create a delivery
- Describe the freight and transport execution process in transportation management
- Post goods issue for the deliveries
- Explain delivery-based integration to SAP EWM
- Integrate SAP EWM for transit warehousing
- Understand the Output Management in basic shipping
- Generate outputs for your freight order and preview the documents
- Describe visibility scenarios

- View events in freight units/orders
- Process an international shipment
- Explore analytics content
- Explain the concept of embedded analytics

Processing Deliveries

LESSON OVERVIEW

This lesson describes the delivery integration process and it shows you how to create a delivery.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe delivery processing
- Create a delivery
- Describe the freight and transport execution process in transportation management

Delivery Documents

The delivery document controls, supports, and monitors numerous sub-processes for shipment processing, such as picking, packing, loading, and posting the goods issue. In addition, the delivery document can be used as a reference document for the creation of other shipment documents, such as a bill of lading.

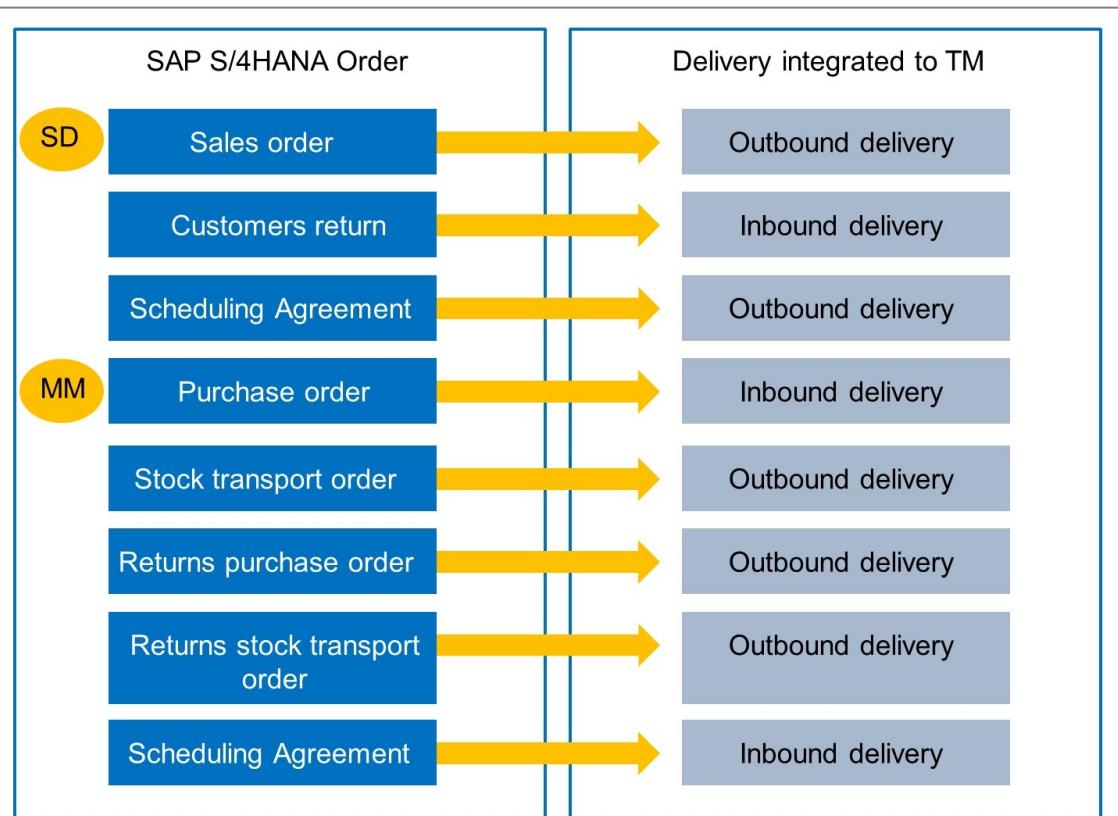


Figure 126: Deliveries relevant to TM

Outbound deliveries and inbound deliveries are created in SAP S/4HANA. In a side-by-side scenario, they are integrated to SAP TM, where they are stored as delivery-based transportation requirements. They can be a starting point for SAP TM processes, or they can be created during the course of a transportation process.

Delivery Creation from SAP TM

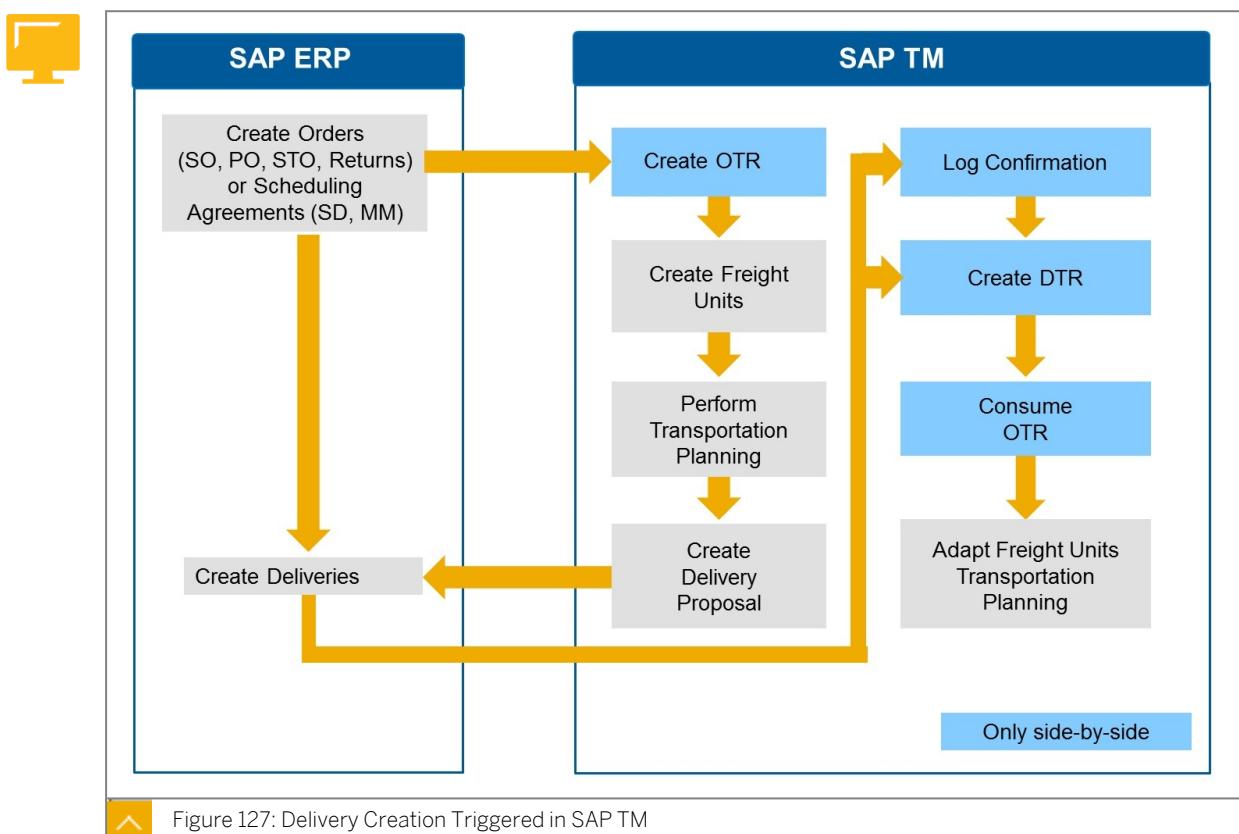
Creation of a delivery document can be triggered in either SAP ERP / SAP S/4HANA or SAP TM.

Triggered in SAP ERP / SAP S/4HANA

When the delivery is created, and considered relevant for SAP TM (see the logistics integration chapter), it triggers the creation of a freight unit. In a side-by-side scenario, the delivery is sent to SAP TM as a Delivery-Based Transportation Requirement (DTR). This is a specific instance of the Transportation Request Object (TRQ). Due to the fact that the source document (the delivery) originates in SAP ERP, not all functions and changes are possible (in comparison with a forwarding order created in SAP TM).

Triggered in SAP TM

The second scenario is one in which the creation of deliveries is triggered from SAP TM, for example, based on transportation planning performed in SAP TM. This solution offers the possibility of combining and planning multiple orders in SAP TM, and of creating a single delivery and transport. If handling unit management is being used in SAP ERP, these handling units are created as packages in SAP TM.



Delivery Creation Triggered in SAP TM

SAP TM can generate proposals for delivery creation in SAP ERP / SAP S/4HANA, based on dates and quantities according to transportation planning results, and taking into account transportation constraints such as resource availability and transportation durations. SAP TM

can also trigger the creation of deliveries prior to transportation planning. SAP TM can send these proposals to SAP ERP / SAP S/4HANA to trigger the creation of deliveries.

After the delivery proposals have been created and sent to SAP ERP / SAP S/4HANA, the system creates an entry in the application log. The application log entry includes the delivery proposals that were sent to SAP ERP / SAP S/4HANA (in side-by-side scenarios). Furthermore, the freight units for which a delivery proposal is sent to SAP ERP / SAP S/4HANA are marked with a send timestamp.

SAP ERP / SAP S/4HANA creates the deliveries when it receives the request to do so. SAP ERP / SAP S/4HANA may split the proposed deliveries further, for example, based on additional split criteria. However, SAP ERP / SAP S/4HANA will not change the dates that were proposed by SAP TM nor consolidate proposed deliveries. Once the deliveries have been created, SAP ERP / SAP S/4HANA sends a confirmation to SAP TM, together with a request to create a delivery-based transportation requirement in SAP TM.

SAP TM creates an entry in the application log. The application log entry includes the system messages that were created in SAP ERP / SAP S/4HANA during delivery creation, as well as the numbers and document IDs of deliveries created in SAP ERP / SAP S/4HANA. If an error occurs during delivery creation in SAP ERP / SAP S/4HANA, SAP TM generates an alert.

When a confirmation is received, SAP TM sets a confirmation timestamp in the relevant freight units. The timestamp is used to monitor whether SAP ERP / SAP S/4HANA has responded.



Note:

For error handling purposes, the following two additional worklists are available (in side-by-side scenarios):

- One for all OTRs for which delivery creation has been triggered but no response has arrived from SAP ERP / SAP S/4HANA
- One for all OTRs for which delivery creation has been triggered and the confirmation has arrived from SAP ERP / SAP S/4HANA, but for which an error occurred during delivery creation (and for which the delivery creation needs to be triggered again)

Methods for Delivery Creation

- Background Report
- Interactive Delivery Creation

Background Report

Delivery proposals can be created by using a background report (report /SCMTMS/ DLV_BATCH). The user can enter selection criteria or use a selection profile. In both cases, the user can also enter a delivery profile. Delivery profiles include settings for delivery creation and will be covered later. The system selects the documents, creates the delivery proposals, and sends them to SAP ERP (in a side-by-side scenario).

Interactive Delivery Creation

The following list shows the possible interactive delivery creation approaches:

- Input Selection with Profiles:

The user specifies one or more profiles according to which the system selects and displays a list of documents. The user can then select the relevant documents in the list and trigger delivery proposal creation. The user can review the delivery proposals before processing them.

- For Specific Documents:

The user can trigger delivery creation for specific business documents from worklists. The system automatically processes the proposals to create deliveries. It also displays the proposals before sending. The following are worklists from which delivery creation can be triggered:

- OTR Worklist
- Freight Unit Worklist
- Freight Order Worklist
- Ocean/Air Freight Booking Worklist

The user can also trigger the creation and sending of delivery proposals for a specific freight order in the freight order UI.

- After Planning:

The user can trigger delivery creation for specific documents after carrying out planning in the transportation cockpit. The system displays the delivery proposals, which the user can then review before processing them.

Data Sources

SAP TM considers data for delivery creation from the order / order-based transportation requirements and from the assigned freight units, freight orders, and freight bookings. Based on the chosen input, SAP TM creates delivery proposals. A proposal consists of groups of freight units that can be delivered together.

Data Collected by SAP TM

- Dates:

SAP TM uses dates from the freight order or freight booking. If the freight unit is not planned, that is no freight order or freight booking exists, then SAP TM uses dates from the freight units.

- Quantities:

SAP TM uses quantities from the freight units.

- SAP ERP Document References:

SAP TM retrieves document references (such as order document number) from the order / order-based transportation requirement.

Consolidation

If order-based freight units have been planned, and freight orders or freight bookings exist for the transportation demands, SAP TM uses only one freight order or one freight booking for each delivery proposal. That is, only freight units that belong to the same freight order or freight booking can be consolidated into a single delivery proposal. In this way, freight units from various order-based transportation demands can be consolidated into a single delivery proposal if they belong to the same freight order or freight booking. If, however, freight units from a single order-based transportation demand are distributed across multiple freight

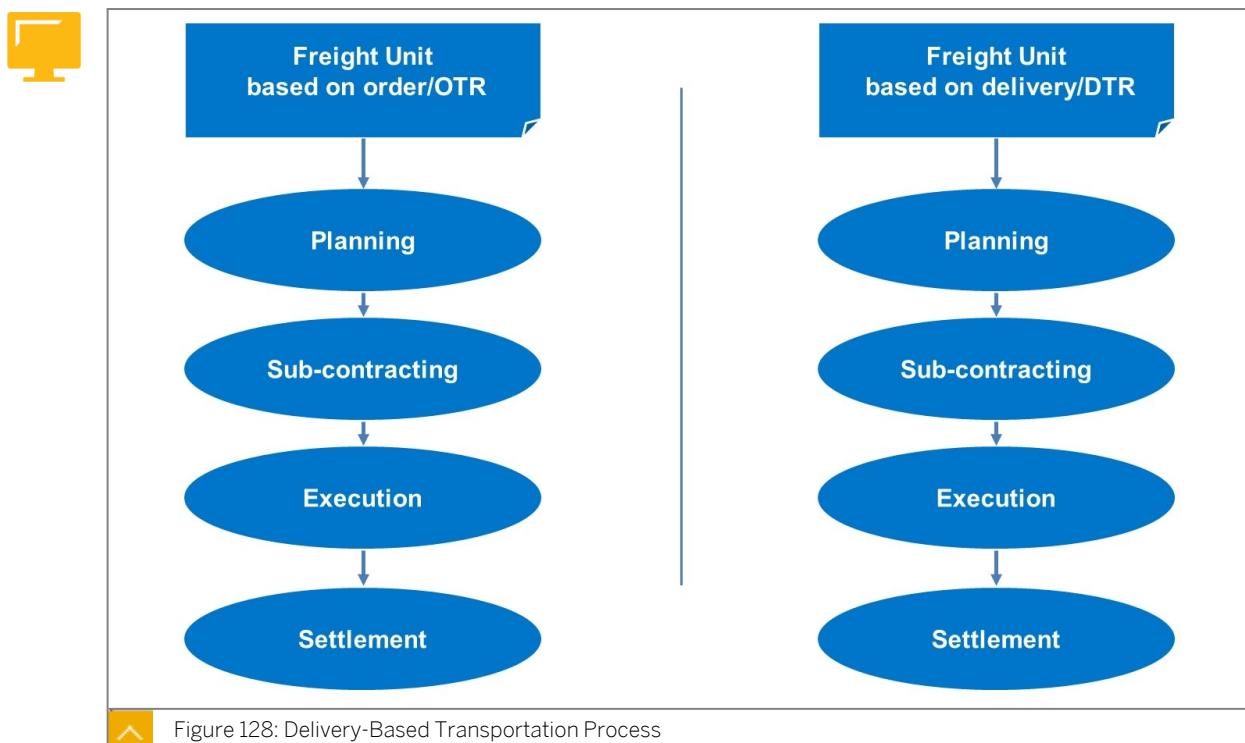
orders or freight bookings, then multiple deliveries are proposed for the freight units of this one order-based transportation demand.

If order combination is not allowed for an order-based transportation demand, SAP TM does not group freight units from this transportation demand together with freight units from other order-based transportation demands. If freight units for such order-based transportation demands have been consolidated into the same freight order or freight booking during planning, SAP TM does not include them in the same delivery proposal, but instead creates multiple delivery proposals.

In addition, freight units can only be consolidated into the same delivery proposal if the following data is the same:

- SAP ERP system from which the order was received (only in side-by-side scenarios)
- Source location
- Destination location
- Incoterms
- Shipping conditions
- SAP ERP document type, such as purchase order or sales order
- Start stop (if planning has already been done)
- Destination stop (if planning has already been done)

Delivery-Based Transportation Process



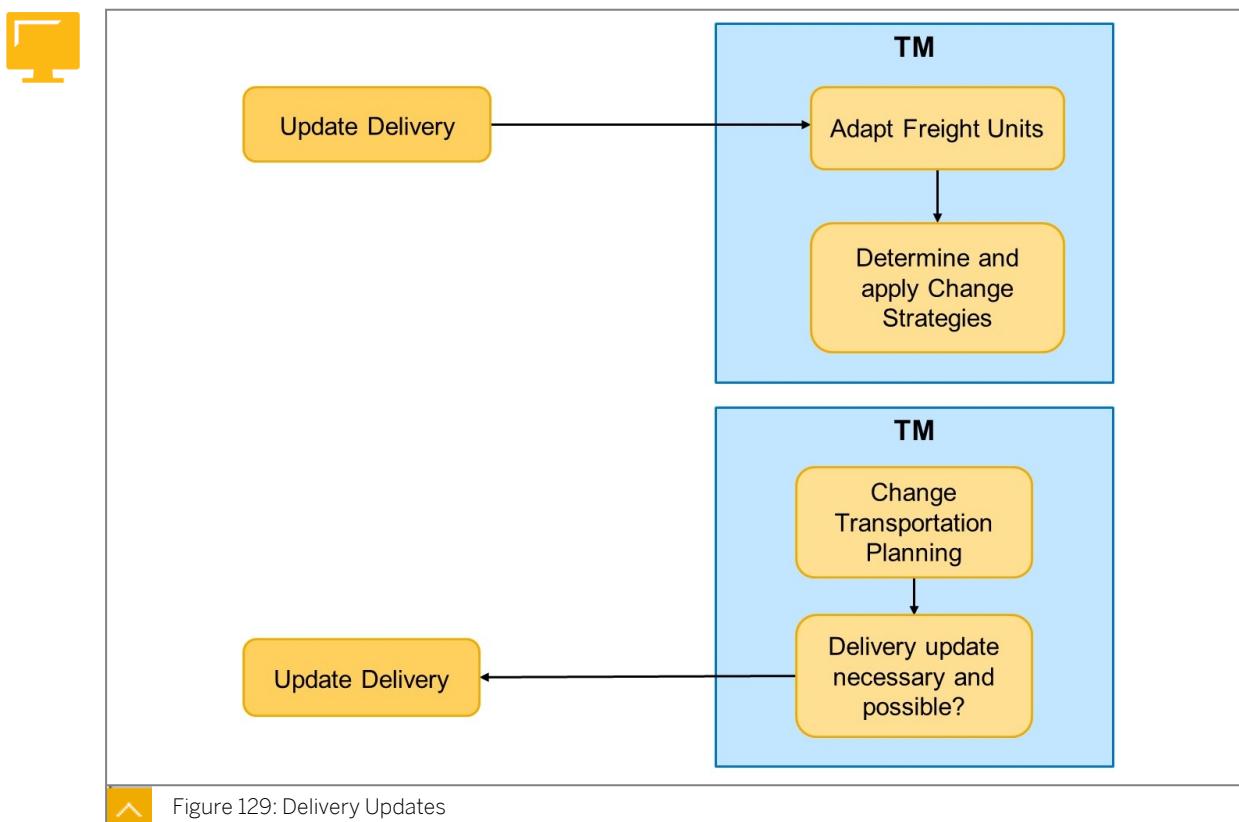
The decision about whether to start the process in SAP TM with either the ERP order or the ERP delivery depends on the customer requirements and guidelines concerning transportation planning and execution. If shipping activities other than transportation planning are involved prior to the transportation process, the process based on the ERP

delivery is more likely to be used. If goods are sold with all shipping activities considered, the ERP order will be the basis for transportation planning.

As depicted in figure, Delivery-Based Transportation Process, you can see that there is no significant difference to subsequent process steps on whether an OTR or DTR (in side-by-side scenarios) or order- or delivery-based freight units (in an embedded scenario) are used as a starting point. There is no difference in the continuation of the process between transportation requirements based on an ERP order and those based on ERP deliveries. As shown in the figure, Delivery-Based Transportation Process, both documents are capable of triggering the entire process.

Delivery Updates

Delivery updates can be triggered both from SAP ERP and from SAP TM. Updates from SAP TM are based on planning changes.



If a delivery is changed or deleted, this information is sent to SAP TM. The freight units are adjusted according to the changes. If the quantity of the delivery has changed, the freight units are adjusted.

You can also update the goods issue date, loading date, transportation start date, and delivery date in the outbound delivery based on changed planning dates in SAP TM.

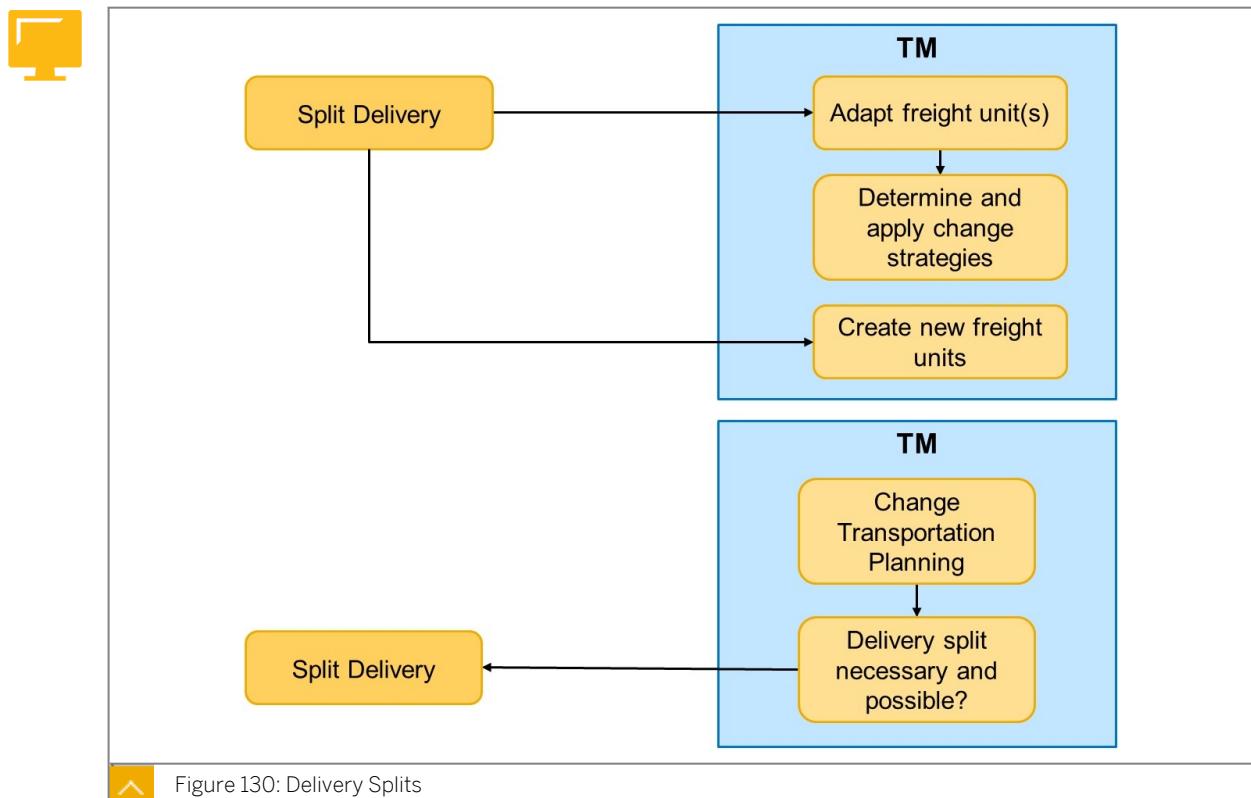
You perform planning or change the existing planning of freight units that are based on an outbound delivery. Dates are changed during planning. Alternatively, you change the dates of the relevant freight order. When you save the planning results or the changed freight order, SAP TM determines that the dates in the freight order no longer match the dates in the original delivery.

SAP TM determines whether the delivery can still be changed by checking the delivery status. If the delivery can be changed, SAP TM sends the changed dates and requests the update of the outbound delivery.

Note that SAP TM can trigger the update of outbound deliveries only. It cannot trigger the update of inbound deliveries.

Delivery Splits

Delivery splits can be triggered both from SAP S/4HANA and from SAP TM. Splits triggered from SAP TM are based on planning changes.



A delivery that has already been sent to SAP TM and created freight units can be split subsequently.

Afterwards, there are two deliveries: the changed original one, and the new one.

The changed original delivery updates its freight units.

The new delivery that has been created for the items split from the original delivery. For this new delivery, new freight unit(s) will be created.

Technically, SAP TM first creates the new freight unit(s) by reassigning the freight units from the original delivery to the new delivery. It then updates the freight units from the original delivery.

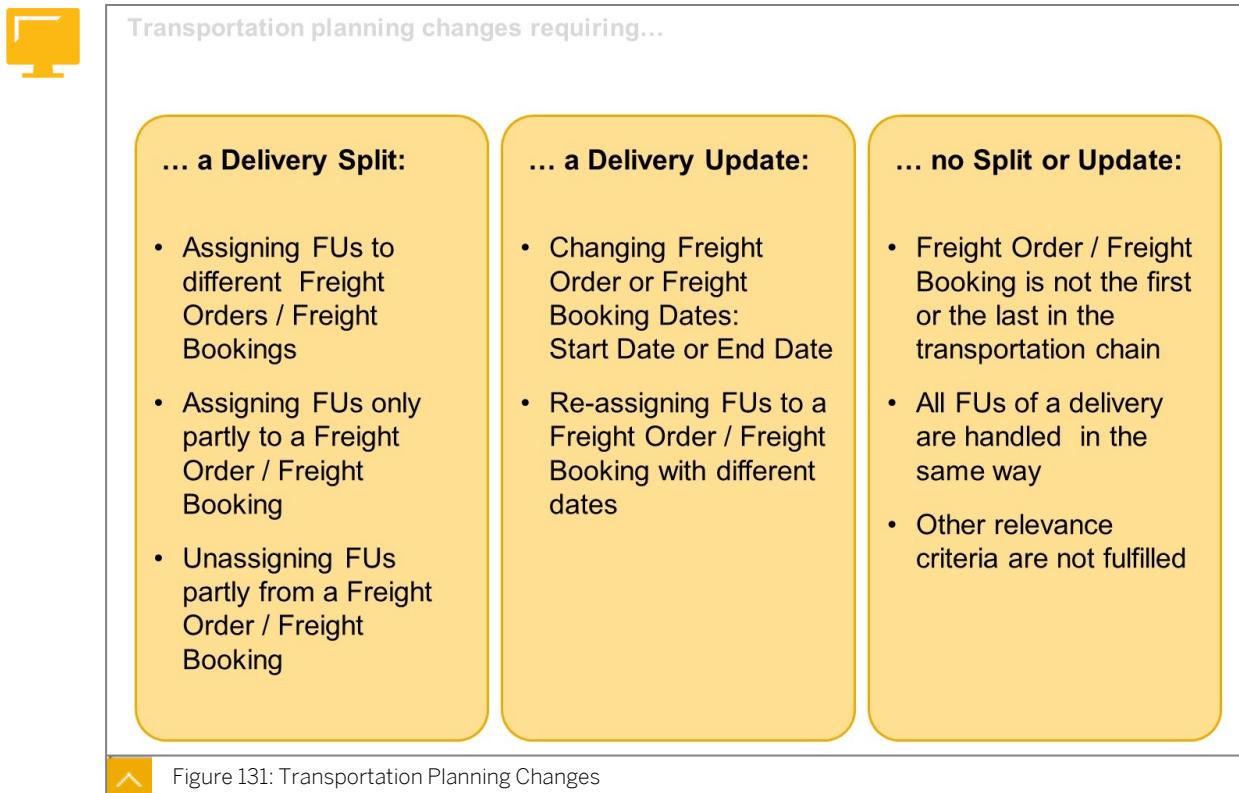
The system determines the required changes to freight unit planning for the freight units assigned to both deliveries. After reassigning the freight units, the system must determine whether the planning of the freight units in the new or the original delivery is to be discarded or kept.

You can split an outbound delivery based on planning changes in SAP TM. You perform planning or change the existing planning of freight units that are based on an outbound delivery. When you save the planning results, the system determines that a delivery split is

required. For example, freight units that belong to the same delivery have been assigned to different freight orders, or only some of the freight units that belong to a delivery have been assigned to freight orders, and the other freight units have not been assigned. Note that the split is required only if the first stage or the last stage of the transportation chain is affected.

SAP TM determines whether the delivery can still be changed by checking the delivery status. If the delivery can be changed, a new outbound delivery is created and the original outbound delivery is adapted (that is, it removes the relevant items from the original delivery and creates a new delivery for these items).

Transportation Planning Changes



Changes to transportation planning in SAP TM can result in several actions, as summarized in the figure, Transportation Planning Changes.



LESSON SUMMARY

You should now be able to:

- Describe delivery processing
- Create a delivery
- Describe the freight and transport execution process in transportation management

Exploring Integration with Warehousing



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Post goods issue for the deliveries
- Explain delivery-based integration to SAP EWM
- Integrate SAP EWM for transit warehousing

Warehouse Integration

With SAP S/4HANA, there are various ways to model the execution process. This depends on the complexity of your warehouse processes. SAP offers solutions for warehouse execution from simple (none) warehouse processes to full scale-out warehouse setups. All of them are integrated via the delivery to SAP Transportation Management.

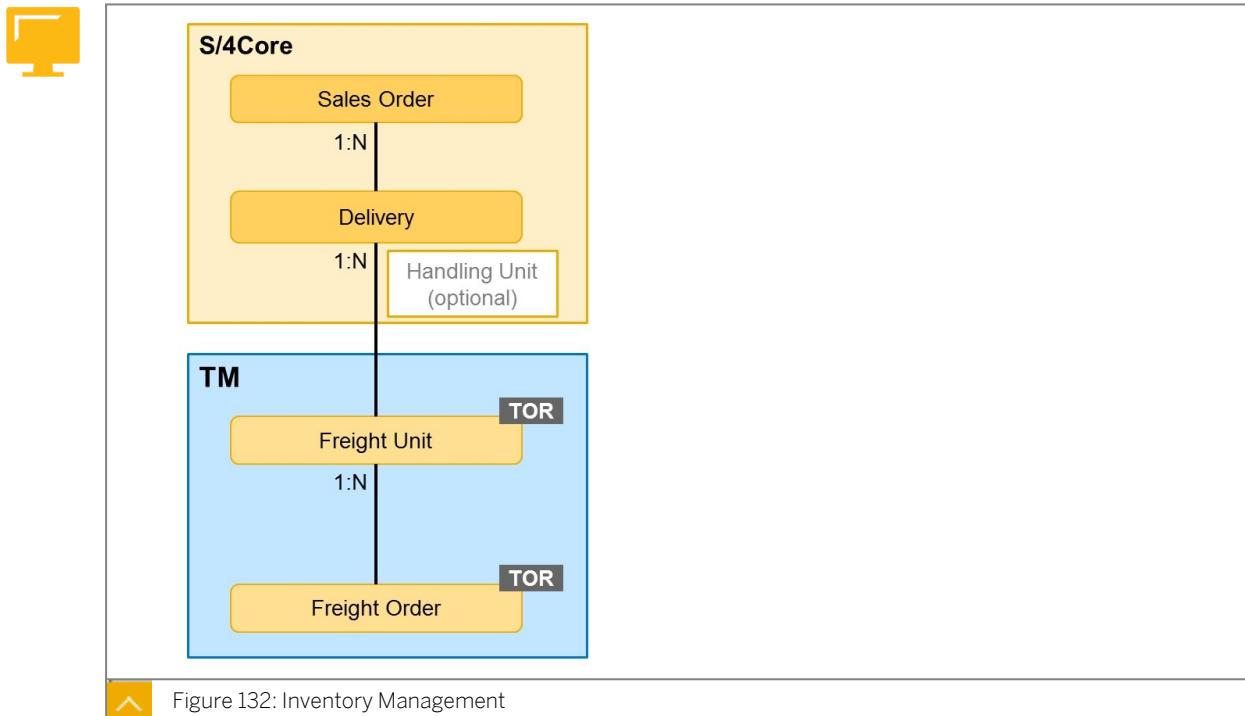
Ways to Handle Stock



- Inventory Management
- Inventory Management with Handling Unit Management
- Stockroom Management (former LE-WM)
- Extended Warehouse Management (SAP EWM)

The simplest way to model a process for transport execution is without a dedicated warehouse setup. Therefore, the transportation demand represents the delivery in logistics execution which will lead to a freight unit that can be planned on a freight order and the transportation execution can be started.

Inventory Management



Note that Handling Unit Management (HUM) is optional and could be used to create deliveries with handling units or just take care of the items itself, for example, if you want to model a very lean process and do not have to take care with which item is shipped on what load carrier system-wise.

Stockroom Management

For small to medium warehouse setups, there is an option available called Stockroom Management. Stockroom Management is integrated directly to the LE Delivery, and the warehouse transportation orders are triggered as a subsequent task to the LE predecessor documents.

Stockroom Management is a specific offering for installed base customers to continue running their light warehouse management implementation in the context of SAP S/4HANA. The license is included in the SAP S/4HANA Enterprise Management component.

The main reason for creating the Stockroom Management offering is to give existing customers of LE-WM an opportunity to keep these warehouses untouched that do not benefit immediately from moving to embedded EWM. Stock room management is basically the ECC warehouse management component (LE-WM) without capabilities supporting more complex warehouses. It is relevant for small warehouses with manual operations (that is, storage bin management).

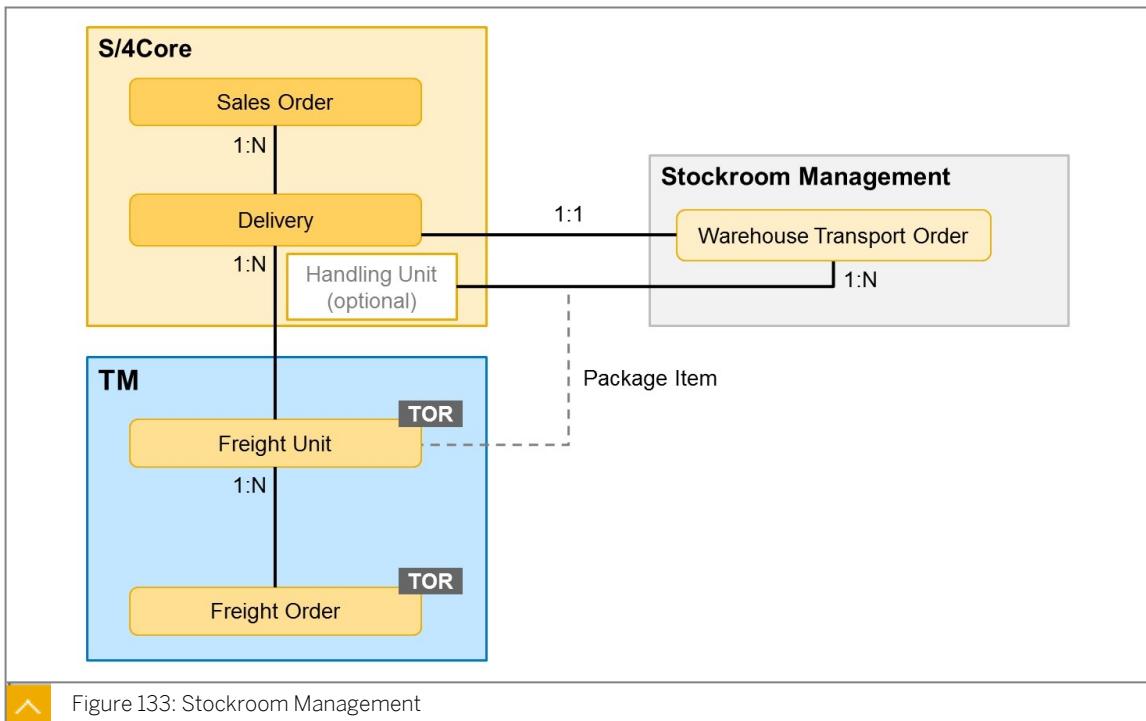


Figure 133: Stockroom Management

Stock Room Management Exclusion List

Functionalities of LE-WM that are **not part** of stock room management are as follows:

- Task & Resource Management (WM-TRM)
- Warehouse Control Unit interface (WM-LSR)
- Value Added Service (WM-VAS)
- Yard Management (WM-YM)
- Cross-Docking (WM-CD)
- Wave Management (WM-TFM-CP)
- Decentral WM (WM-DWM)

There are no innovations planned here and SAP EWM remains the strategic product.
Components are part of the compatibility scope (not Stockroom Management!)

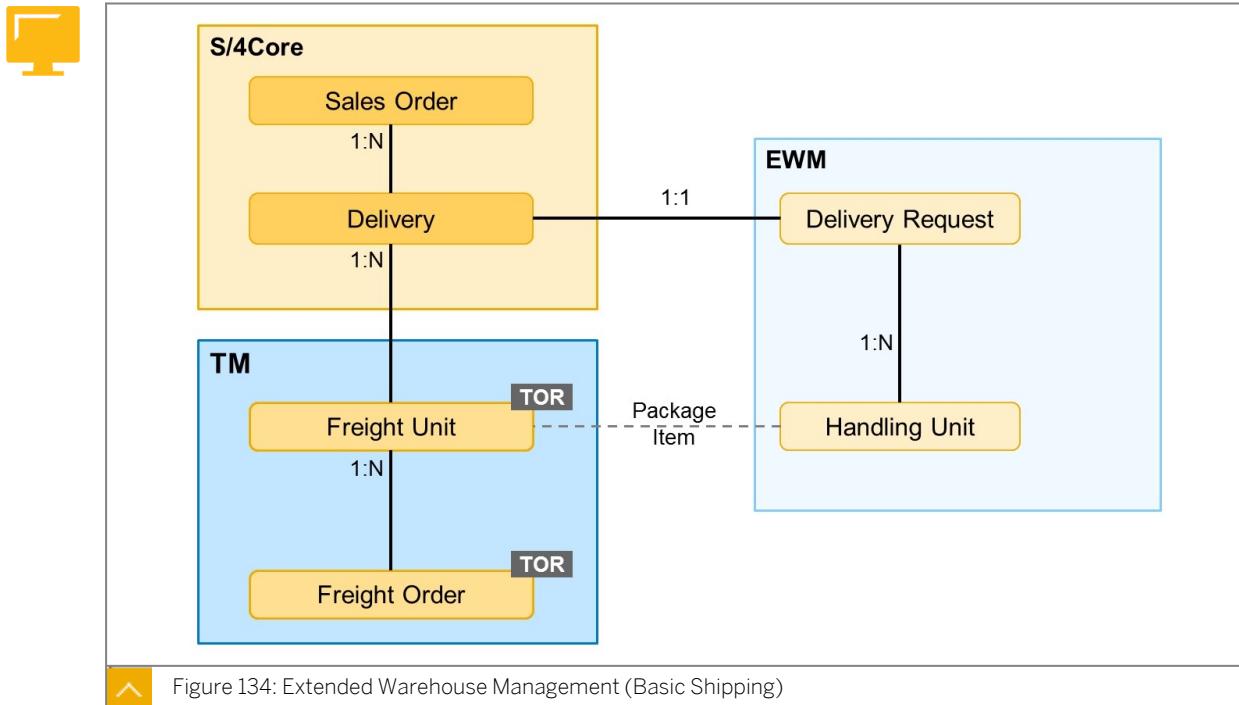


Hint:

For additional information, please also refer to the SAP Note 2577428.

SAP Extended Warehouse Management

For complex setups of your warehouse, maybe even with automated guided vehicles (AGV), complex conveyer techniques, and high frequent warehouses, the SAP Extended Warehouse Management solution is designed to fulfill these requirements. Even here, the integration is done towards Basic Shipping via the LE Delivery. The delivery in this case is also replicated to the SAP EWM solution and the warehouse tasks will be executed there according to the setup in SAP EWM. SAP EWM will update the LE Delivery and therefore the freight unit in basic shipping is also updated with the relevant information from the WMS system.



Note that there is also an advanced integration between SAP EWM and SAP TM that requires the advanced license. In the process described above, the integration from ECC/TM to SAP EWM is done only via the delivery, the so-called delivery-based integration. There is also the possibility to use more planning capabilities by creating deliveries already on a plan made based on sales orders in SAP TM, and hand over a load plan from your TMS system to the WMS system for execution. Therefore, in SAP EWM the transportation unit is needed. The transportation unit in this scenario is created based on the Freight Order in SAP TM that is created during SAP TM planning (for example, based on sales orders).



Hint:

For additional information about TM EWM integration with the advanced license, please refer to SAP Notes 1984252 and 2269324.

Extended Warehouse Management (Advanced)

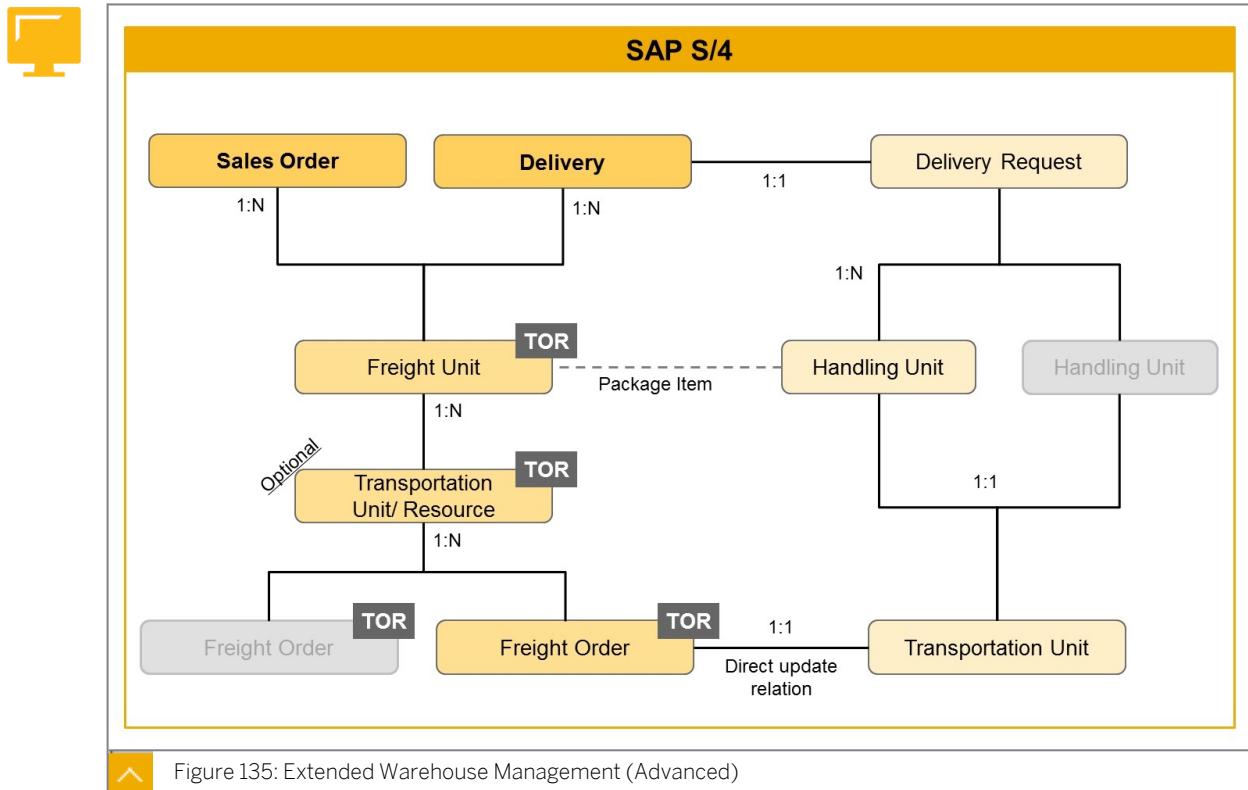


Figure 135: Extended Warehouse Management (Advanced)

Delivery-Based Integration to SAP EWM

In general, two integration scenarios between SAP TM and SAP EWM exist. The first one is relevant for shippers and supports order/delivery-based outbound processes, whereas the second one is relevant for LSP and allows integration of a transit warehouse. The first scenario includes the following steps:

- Goods are send from a warehouse to external customers
- Transportation is planned based on sales orders or deliveries
- SAP EWM informs SAP TM about activities (arrival at checkpoint, departure from checkpoint, and so on)

Integrate Best-in-Class Applications

The SAP EWM-SAP TM integration allows a tight integration of master data and Customizing between the two systems.

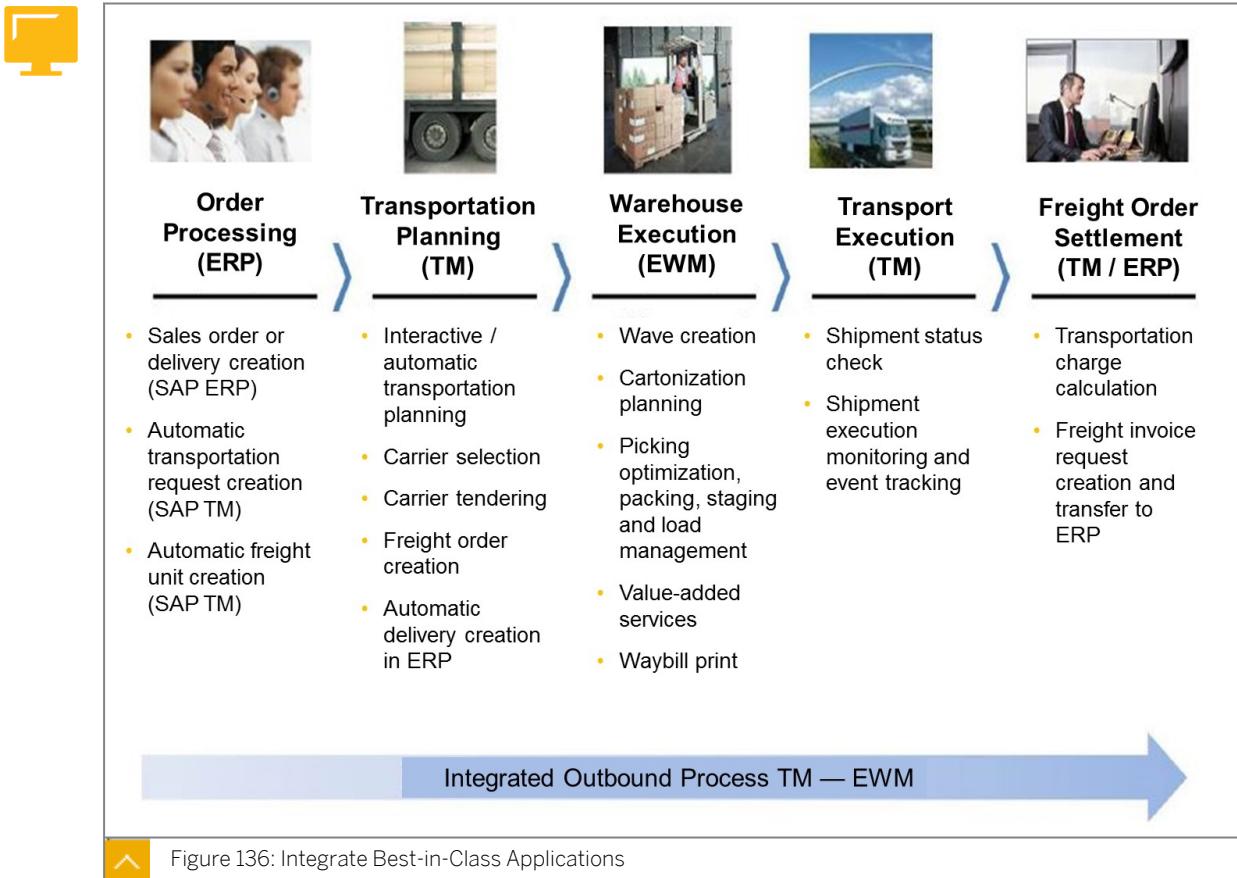


Figure 136: Integrate Best-in-Class Applications

When you plan to send goods from several outbound delivery documents with the same transport, transportation planning in SAP TM is based on SAP ERP sales orders or deliveries. SAP TM sends the transportation planning results to SAP EWM. The information from SAP TM is mapped into corresponding TU or vehicle activities. Building rules are not used in SAP EWM.

After the warehouse execution, the transport information is communicated from SAP EWM to SAP TM to carry out transport execution and freight settlement in SAP TM. The communication back to SAP TM is triggered on goods issue of the TU, and contains information about what is loaded on the TUs that are posted goods issue.

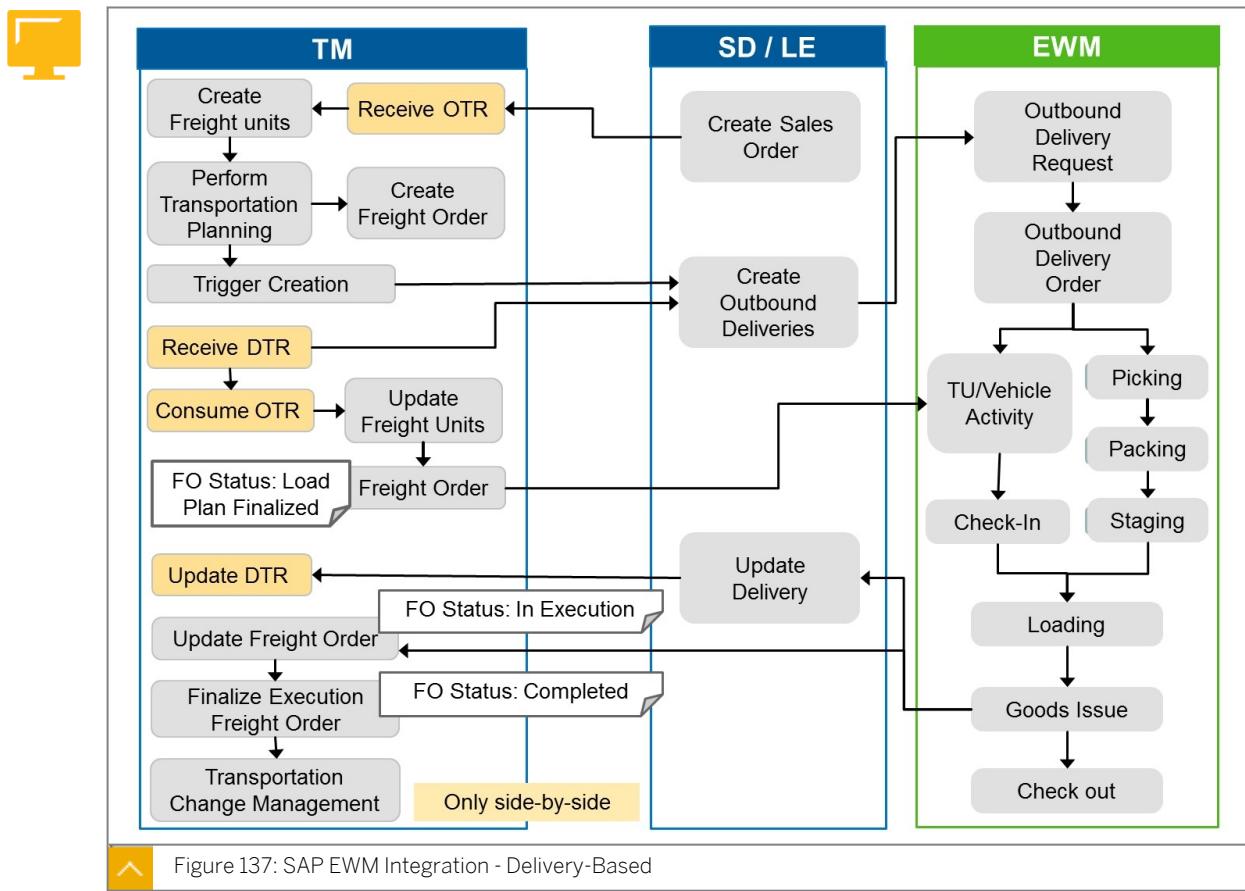


Note:

Delivery-based outbound transportation planning in SAP TM is also supported for outbound deliveries created in SAP EWM (DirODO). SAP EWM Customizing enables the setting of a TM-relevant transportation planning type and therefore the assignment of such deliveries to TUs created from SAP TM.

Main Process Steps of Outbound-Delivery-Based Transportation Planning

In SAP TM, you can plan your transportation activities based on an outbound delivery and send your freight orders to SAP EWM. In SAP EWM, you can carry out the steps relating to the warehouse, for example, loading. Because the two systems are directly integrated with one another, SAP TM informs you that the truck in SAP EWM has been loaded and whether there are any discrepancies, such as quantity deviations.



The main process steps of outbound-delivery-based transportation planning is described as follows. The description assumes that there is only one transportation stop. If your freight order comprises several transportation stops, the process is repeated for each stop if the stop contains loading locations relevant to SAP EWM. Note, however, that multiple pickup and multiple delivery scenarios are not supported:

1. You create a sales order in SD.
 2. Freight units get created, transportation is planned, and freight orders are created in SAP TM.
 3. When transportation planning is based on sales orders, you trigger delivery creation from SAP TM.
 4. You create outbound deliveries in SAP S/4HANA and send them to SAP TM and SAP EWM. In SAP TM, a delivery-based transportation requirement is automatically created along with the associated freight units. In SAP EWM, an outbound delivery request and an outbound delivery order are created automatically.
 5. You set the load plan status of the freight order to *Load Plan Finalized*. The system automatically sends a loading instruction to SAP EWM with the message *LoadingAppointmentRequest*.
 6. When the *LoadingAppointmentRequest* message is received from SAP TM, SAP EWM automatically creates a transportation unit, and the outbound delivery orders are assigned to the TU activity.

7. Perform the warehouse activities related to the outbound delivery orders such as picking, packing, staging, and loading the goods. The system can create handling units automatically. Note that all warehouse activities except loading can be performed before arrival of the TU to the door.
8. The warehouse workers post the goods issue (optional).
9. The warehouse workers post the departure of the truck. SAP EWM sends the LoadingAppointmentNotification message to SAP TM. At the same time, the outbound delivery is automatically updated in SAP ERP.
10. When the data is updated in SAP ERP, the delivery-based transportation requirement is automatically updated in SAP TM.
11. When the LoadingAppointmentNotification message is received, SAP TM updates the freight order and sets the execution status to *In Execution*. The cargo receipt status at item level is automatically set to *Shipped*. If the item in question is to be unloaded at the next transportation stop, the handling execution status is automatically set to *Not Unloaded*. The system also updates the associated freight units.
12. You complete freight order execution.

Transit Warehousing

The transit warehousing scenario allows you to integrate warehouse execution with freight forwarding operations. Transit warehousing enables you to seamlessly integrate the planned flow of goods in SAP Transportation Management (SAP TM) and the physical flow of goods in SAP Extended Warehouse Management (SAP EWM) over the entire transportation chain. The integration is based on execution documents resulting from forwarding orders.

With this process, you can store cargo temporarily in transit warehouses or gateways (air freight) or in container freight stations (ocean freight) until it is transported. You can also organize cargo over the entire transportation chain and get transparency over warehouse-specific data. The process of handling cargo at a location can be repeated for several locations.

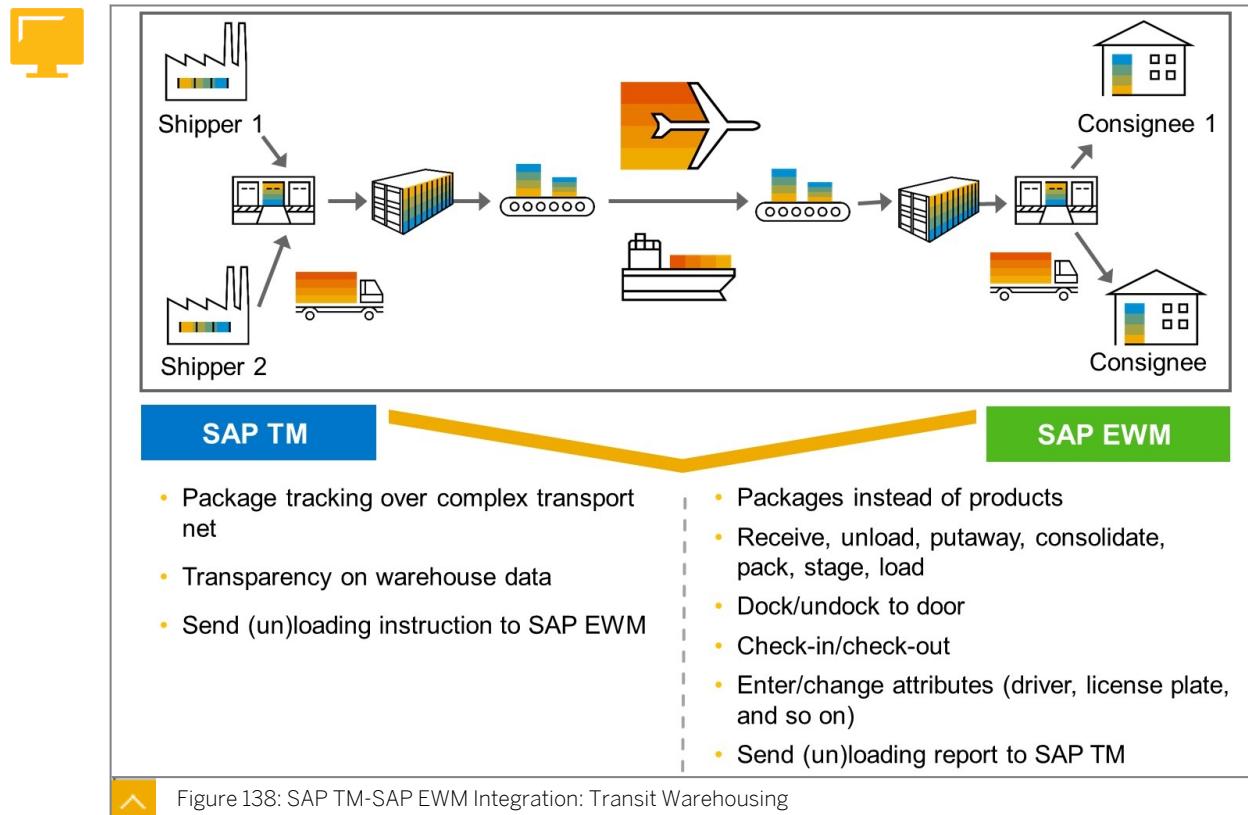
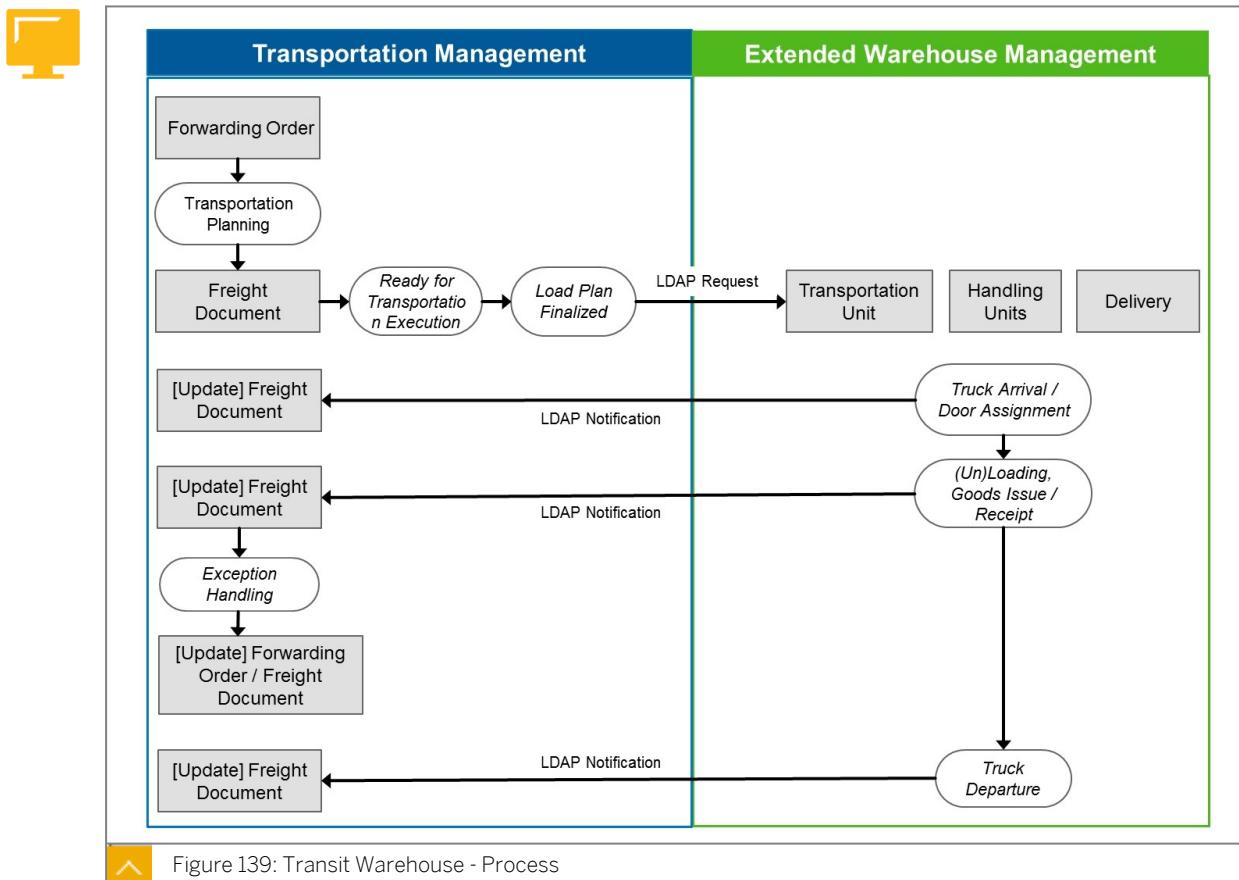


Figure 138: SAP TM-SAP EWM Integration: Transit Warehousing

In SAP EWM, the warehouse-specific processes are based on business documents that are sent from SAP TM using a loading or unloading instruction. You can also configure the warehouse layout according to the requirements of the transit warehousing process. For example, specific storage types are available and a product master is no longer necessary. The handling of cargo is based on package level and not on product level.

Transit Warehouse - Process



The customer service agent creates a forwarding order in SAP TM.

The transportation planner creates an actual route manually or has the system determine this route. The actual route contains one or more locations that are relevant for transit warehousing. A location is relevant for transit warehousing if you have entered a warehouse number and a logical system (SAP EWM system) in the location master data.

From the forwarding order, the transportation planner creates a freight order for picking up the goods at the shipper and transporting them to the transit warehouse. Afterwards, the transportation planner sets the execution status of the freight order to *Ready for Transportation Execution*, which means that the transportation activities can start. Finally, the transportation planner sets the load plan status of the freight order for the transit warehouse to *Load / Unload Plan Finalized*. The system sends an unloading instruction to SAP EWM.

On receipt of the message, SAP EWM generates a transportation unit and the corresponding handling units and an inbound delivery.

On arrival of the truck on the yard, the warehouse staff log the arrival of the truck and assign it to a door. SAP EWM sends a notification to SAP TM. On receiving the message, the freight document is updated with the information about the arrival of the truck.

The warehouse staff unload the truck and posts goods receipt. When the freight is fully received, SAP EWM sends an unloading report to SAP TM. On receiving the message, the freight order and the freight units are updated with the information about the received cargo.

In case of exceptions, exception handling is processed.

In SAP EWM, new UIs for inbound handling were implemented for *Freight Order Inbound*, *Unloading Preparation*, and *Stock List*. These new UIs display SAP EWM information for the underlying SAP TM freight documents. It is possible to navigate directly to the SAP TM documents.



LESSON SUMMARY

You should now be able to:

- Post goods issue for the deliveries
- Explain delivery-based integration to SAP EWM
- Integrate SAP EWM for transit warehousing

Generating Outputs

LESSON OVERVIEW

In this lesson, you learn about the control of output documents in SAP TM, which are essential to maintaining a smooth and transparent transportation process.



LESSON OBJECTIVES

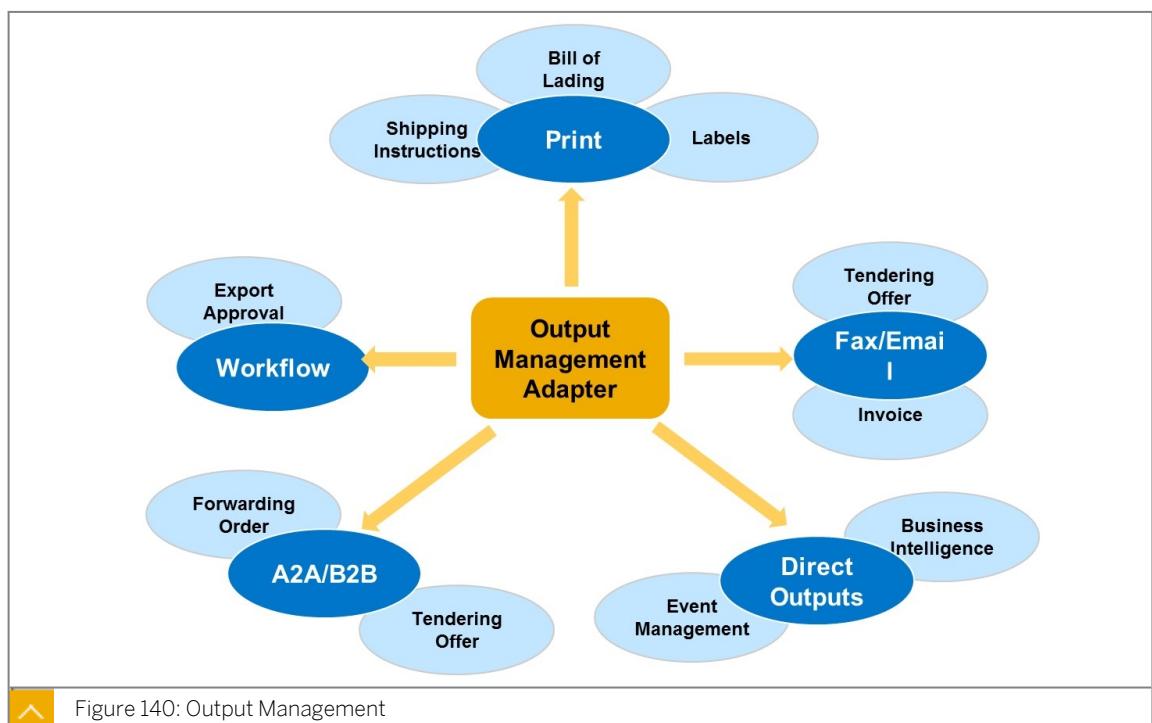
After completing this lesson, you will be able to:

- Understand the Output Management in basic shipping
- Generate outputs for your freight order and preview the documents

Output Management

In this lesson, you learn how to configure settings to enable the printing of documents in the freight order.

Output Management



Before, during, and after execution, each of the users and parties involved needs to be notified when a task is required to be executed, or a report on a recent activity is made. Users need to view the result of business process activities and generate output in response along the process. Output management automates the output of business documents, such as printouts, mail, or fax to certain events.

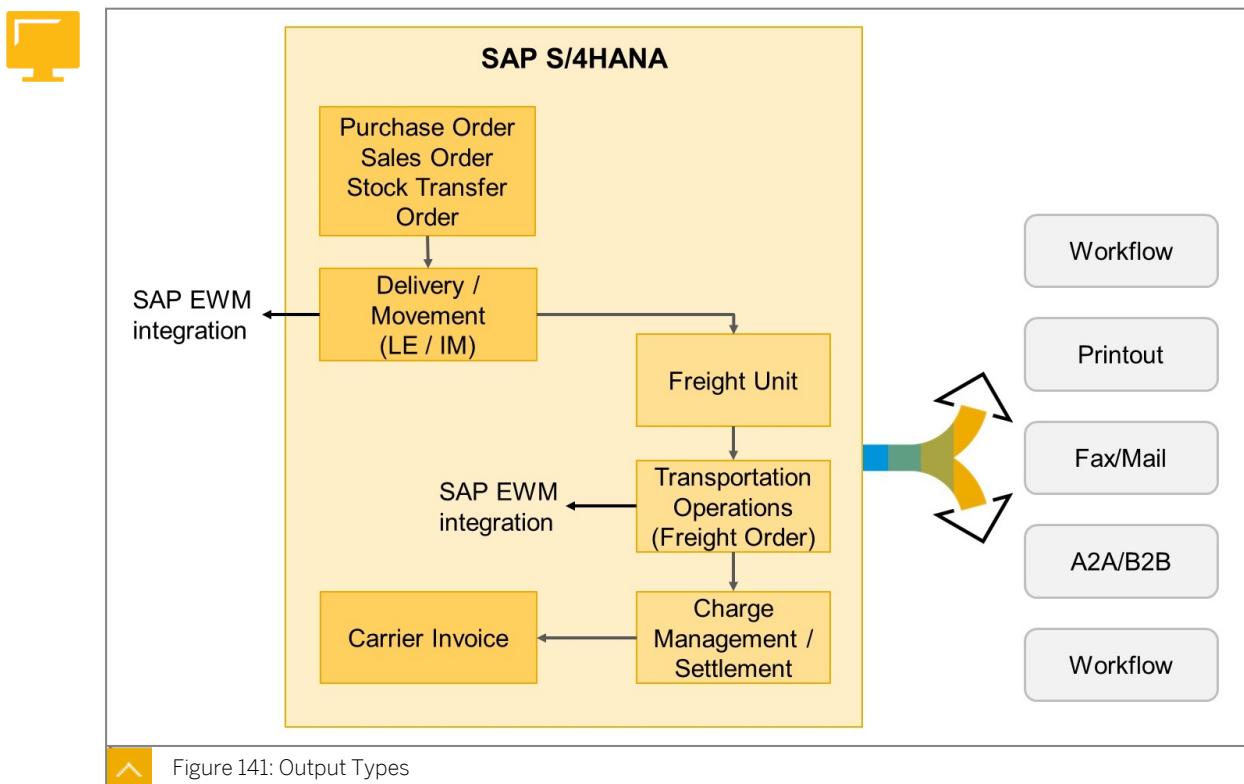
SAP TM is equipped with several standard output types, such as external communication and alert notification. Several other tools and methods may also be utilized.

For external communication, your business can use standard printing, fax, and e-mail with a document preview option. For internal communication, alert management options are available, and workflow can be used to pass requirements from one business process step to another. Communication with B2B systems is also available in situations such as tendering freight orders when a bidding or purchasing activity is present.

BI data uploads can be executed to provide management reporting on various documents like freight units, freight orders, and freight bookings.

Various order events can trigger communication to event management systems to make cross-system activities transparent. While SAP TM has its own internal status, when integrating with systems such as SAP ERP or SAP EWM, cross-system communication is necessary to gain visibility of the big picture.

Output Types



The Output Management in SAP TM is available for all documents.

To understand what happens when documents are printed, you need to understand the Post Processing Framework (PPF).

It is configured in the backend system, with the following customizing path:

Cross-Application Components → Process and Tools for Enterprise Applications → Reusable Objects and Functions for BOPF Environment → PPF Adapter for Output Management → Maintain PPF Settings.

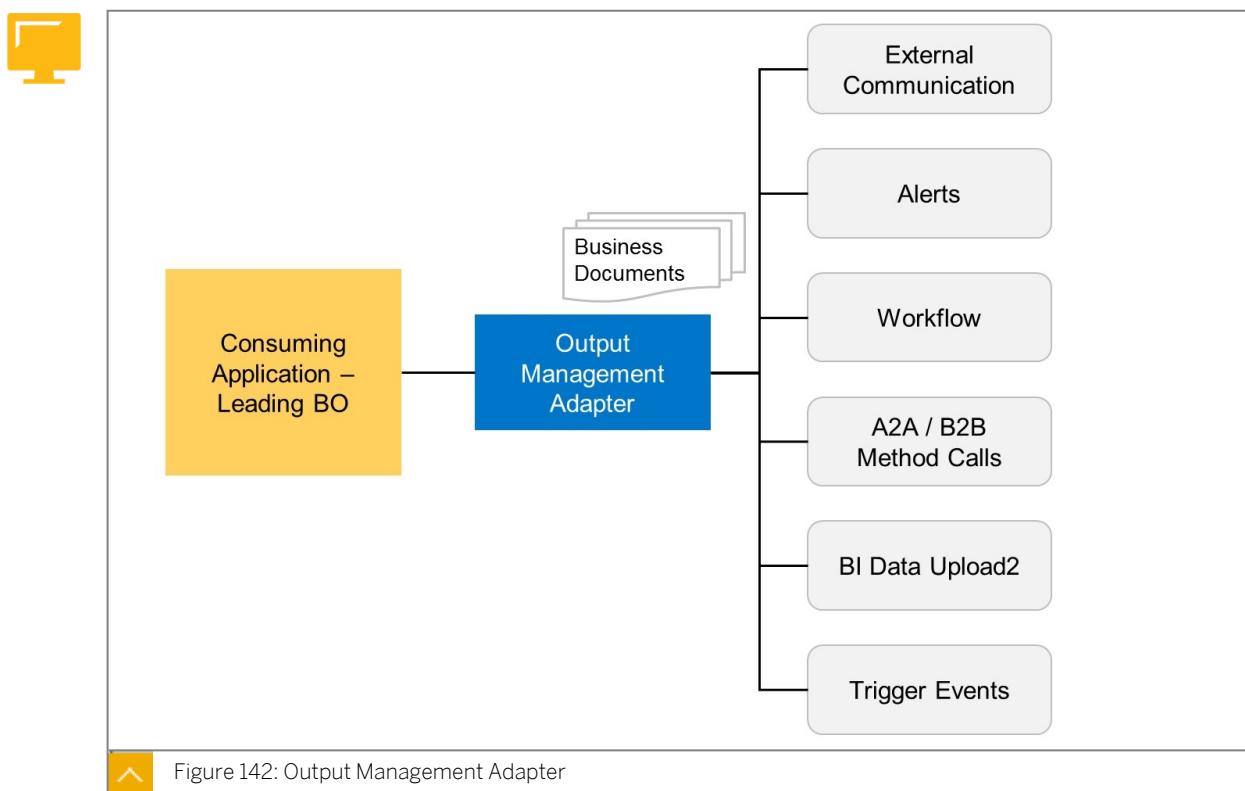
The Post-Processing Framework (PPF) is used in various SAP applications, therefore, you must specify the application /SCMTMS/TRANSPORTATION.

Here, you manage the action profiles. An action profile is the smallest set of action definitions that can be investigated during one call of the action determination of the PPF.

Output Management Adapter

PPF can perform the following processing types:

- Trigger alert
- Method Call
- Workflow
- Smart Form Actions
- External Communication (for example, Adobe Document Server Connection)
- BI Data Upload



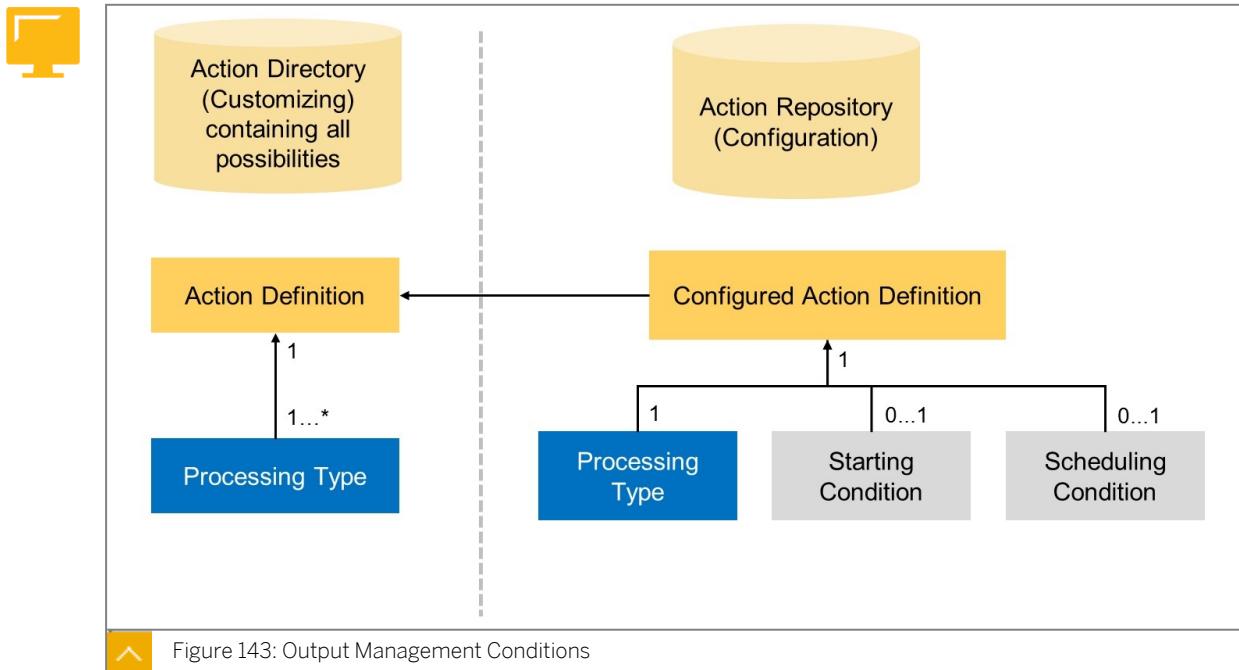
You can connect the PPF at the level of the individual BO nodes. You can also set up PPF triggers on a BO node specific (use case) basis and specify whether they are critical or non-critical.

When you select /SCMTMS/TRANSPORTATION, you can manage the action profiles assigned to this application. An action profile is the smallest set of action definitions that can be investigated during one call of the action determination of the PPF.

Each action profile contains a set of multiple action definitions (1:n). An action definition defines all possible realizations. The realizations are modeled in the so-called processing type. The processing type represents the technical realization of an action definition, for example, the start of a workflow, sending out a PDF form by fax or mail. The action definition determines whether business partner data is required for the execution, and the business partner which the data relates to. An action definition therefore has the character of an business task and defines the “what” should be done with this action (mail, fax, and so on).

If the system has identified the action, definitions from the action list the conditions that come into place. There are two important types of conditions for the PPF/Output Management.

Output Management Conditions



The first one is the scheduling condition. This condition is checked during the PPF action determination. It decides whether an action should be executed or not. The identification of the scheduling condition is done from the assignment to the configured action definition. The scheduling conditions define the “why”, for example, lifecycle of the predecessor document is X or document is canceled.

The second important condition is the starting condition. This condition is checked just before an execution of an action will be started. These conditions should only influence the point in time when an action will be executed. They define the “when”, for example, they define that the message is sent “on save”, or “one day before pickup”, and so on.

Creation of Print Documents

Post-Processing Framework (PPF)

As a summary, you can imagine the PPF as a way to answer the following three questions:

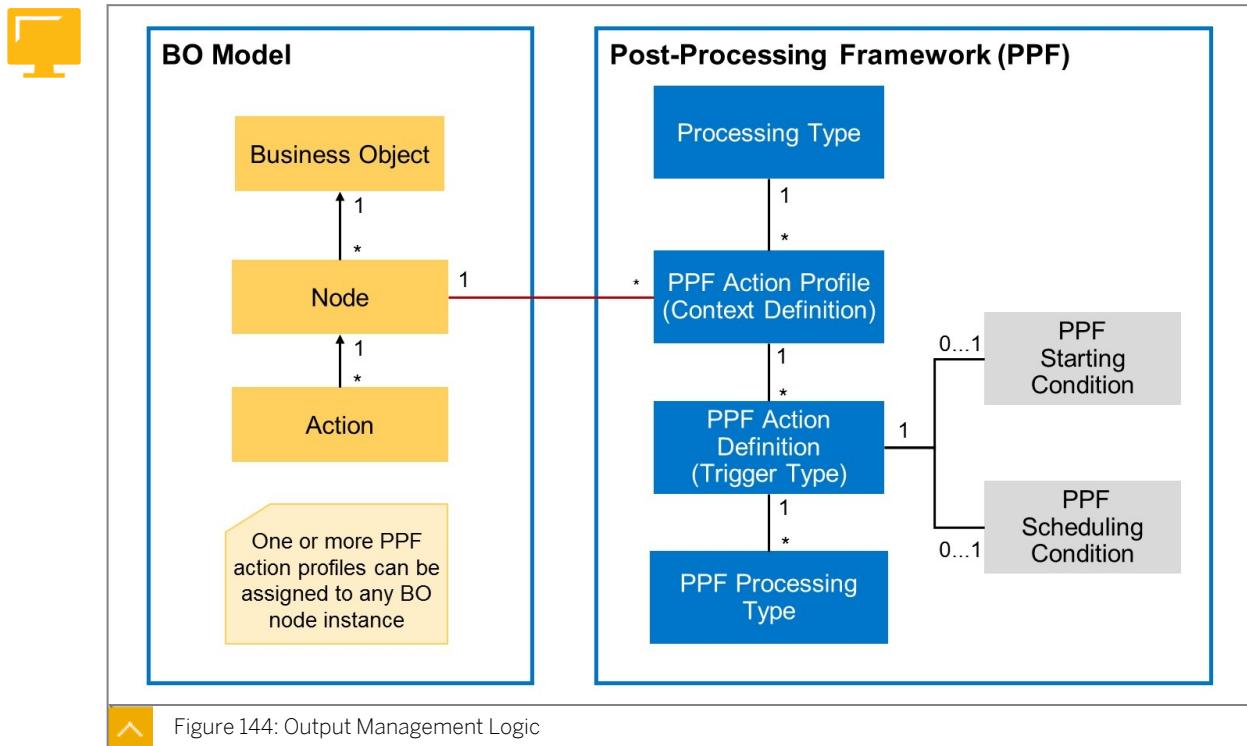
- What (should be done in the activity)?
- Why (is the activity done)?
- When (is the activity done)?

Table 1: Post-Processing Framework (PPF) Answers Three Questions

What	Why	When
Send whole shipping list via EDI	Shipping list has been created	Next batch job
Send whole shipping list via mail	Shipping list has been changed	When saving the document

What	Why	When
Send shipping list changes via fax	Business object is in the state <i>In Process</i>	When saving the document

Output Management Logic



In the /SCMTMS/TRANSPORTATION application, all relevant action profiles are configured. In the action profile /SCMTMS/TOR_PRINT_ROAD, the action definition shows all defined actions that are available for this action profile. In this example you see a lot of freight documents that are attached to this action profile to be triggered during the execution process (for example, CMR, Waybill, Packaging Labels). Here, you can find the processing type of the selected document.

Output Management Capabilities

Output Management provides the following capabilities based on the business document:

- Automated (backend), rule-based dispatching of outbound communications in response to business events, such as creation of an order, saving a document, and so on
- Preview of output and manual (front end) outputs in the user interface (UI)
- Archive output dispatched in relation to business documents
- Mass output from a worklist

If you want more insights for PPF settings within SAP S/4HANA, see the setup guides at SAP Business Suite → SAP Supply Chain Management → SAP SCM 7.0 → Processes and Tools for Enterprise Applications (CA-EPT) → Reusable Objects and Functions for BOPF Environment (CA-EPT-BRC).

Also, see SAP Note 489334.

In general, it is important to note that PPF actions can only process information that is already saved to the database. This prevents you from accidentally sending preliminary transportation labels to a spool in the warehouse, for example.



LESSON SUMMARY

You should now be able to:

- Understand the Output Management in basic shipping
- Generate outputs for your freight order and preview the documents

Monitoring Transportation Events

LESSON OVERVIEW

The shipping process involves activities and procedures spread across several distributed systems. From a monitoring perspective, this increases the challenge of successfully monitoring the progress of individual parts of the overall process. In this lesson, you will learn how your company can overcome these difficulties by using the SAP Event Manager tool.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe visibility scenarios
- View events in freight units/orders

SAP Event Management

Nowadays, supply chains are global and complex. End-to-end supply chain visibility is one of the key factors in efficient supply chain operation and control. SAP Event Management is the only application needed to provide this visibility, since it is available to all partners, including customers. SAP Event Management can also work with multiple SAP and non-SAP applications.

Visibility Across Business Partners And IT Environments

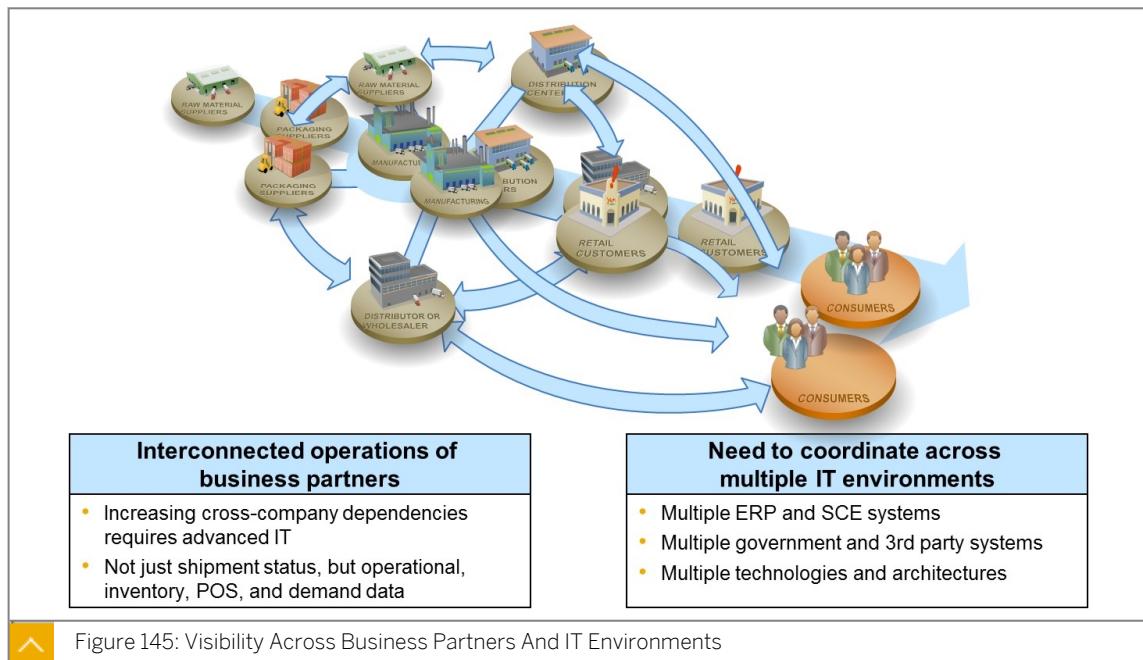


Figure 145: Visibility Across Business Partners And IT Environments

As companies expand their suite of IT products to handle more complex scenarios, they often have to add systems to their ERP environment. This makes it difficult for business users and

management to gain a complete view of end-to-end processes and monitor potential service issues. Therefore, it is imperative to have a tool that can incorporate information from several systems and provide insight into how order fulfillment is progressing.

SAP Event Management makes processes, assets, and performance visible across the entire supply chain. Extensive tracking and tracing functions allow process monitoring, automated exception resolution, proactive alerting, as well as extensive reporting in a single solution.

The event management system is designed to work with several SAP ERP instances, if necessary. It can communicate with SAP CRM, where sales orders may be received, and this communication is processed back to the customer to support order fulfillment. SAP Advanced Planning and Optimization (APO) may be responsible for creating the replenishment plan. SAP ERP or SAP Manufacturing Execution may be responsible for communication and tracking progress on the shop floor. SAP EWM (Extended Warehouse Management) may be responsible for the picking and packing as part of the logistics execution.

Event Management in SAP TM

SAP Event Management offers visibility processes to monitor transportation execution in connection with SAP TM. The transportation execution visibility processes enable users in roles such as transportation dispatcher, shipper, or ordering party, to track and monitor planned events or to report an actual event.

Tracking and tracing is provided for the following business document types in SAP TM:

- Freight unit
- Freight order
- Freight booking
- Transportation unit
- Resource
- Instruction execution for standard operating procedures

In each case, the goal is to manage by exception, reduce time to action, and spend less time fire-fighting.

SAP Event Management Process

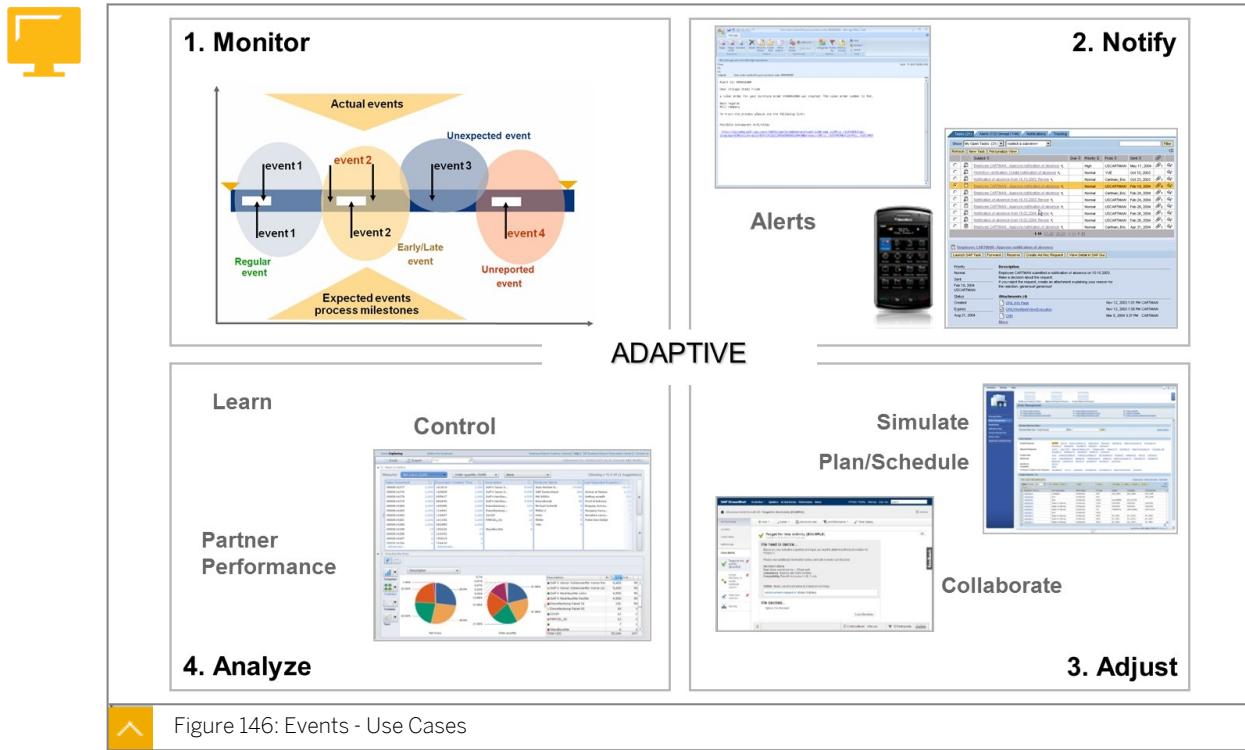


Figure 146: Events - Use Cases

Monitor, notify, analyze, and adjust - these are the four cornerstones of SAP Event Management, and they contribute in providing an adaptive solution. The monitoring process collects data from the various source systems. Notifications can be set up to be triggered, with alerts sent to the parties responsible if a process deviates from its anticipated course. Based on the alerts, the appropriate parties can then simulate adjustments and make any necessary changes. Finally, in relation to analytics, SAP Event Management can be tied into the SAP BW environment to support transportation management reviews.

Event Types

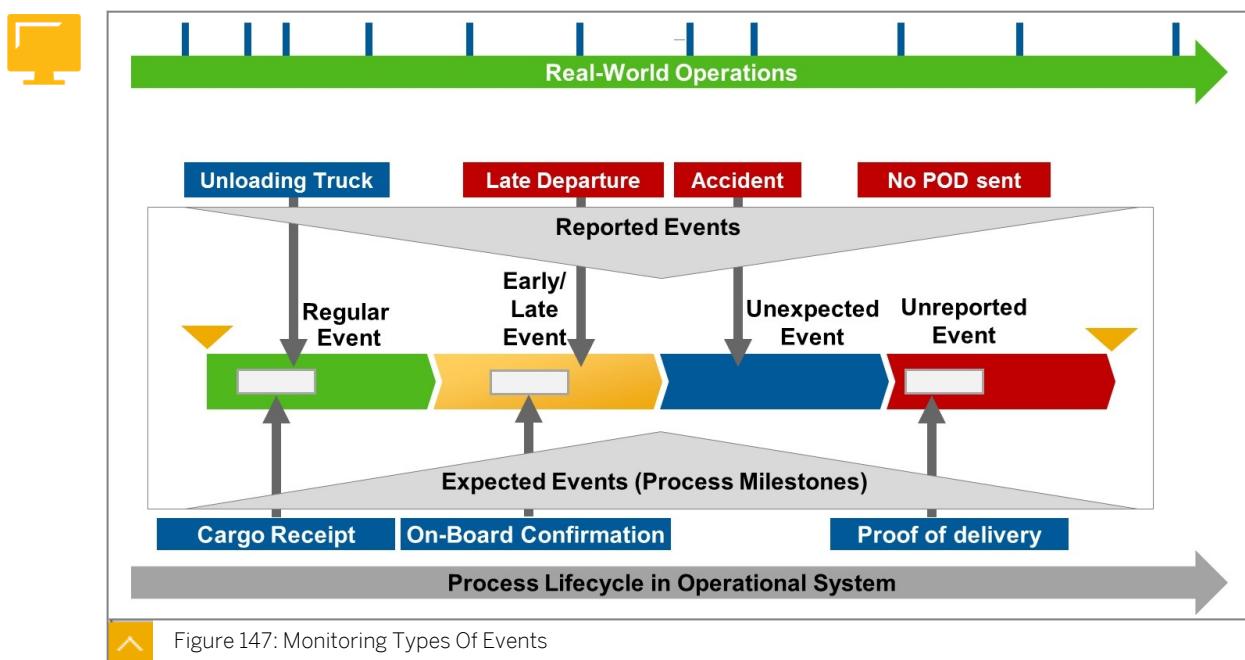


Figure 147: Monitoring Types Of Events

SAP Event Management is capable of processing several different types of events. Within a given process, you have events that you expect to happen, and events that actually happen. Typically, you want to compare the actual event against what you expected, as follows:

- Regular Event

The first type of event is an event that you expect to happen within a particular time frame, and it happens as expected. This is a regular event.

- Overdue Event

This is an event that you expect to happen within a particular time frame, and it happens outside the expected time frame. An overdue event can cause a subsequent event to be rescheduled, or it could just be recorded as an overdue event.

- Unexpected Event

The third type of event is one that is unexpected. This could be a truck breaking down or a malfunction in a piece of equipment; something that could potentially have an effect on subsequent events, causing something to be rescheduled or another action to be taken. An unexpected event could trigger an alert or another type of notification.

- Unreported Event

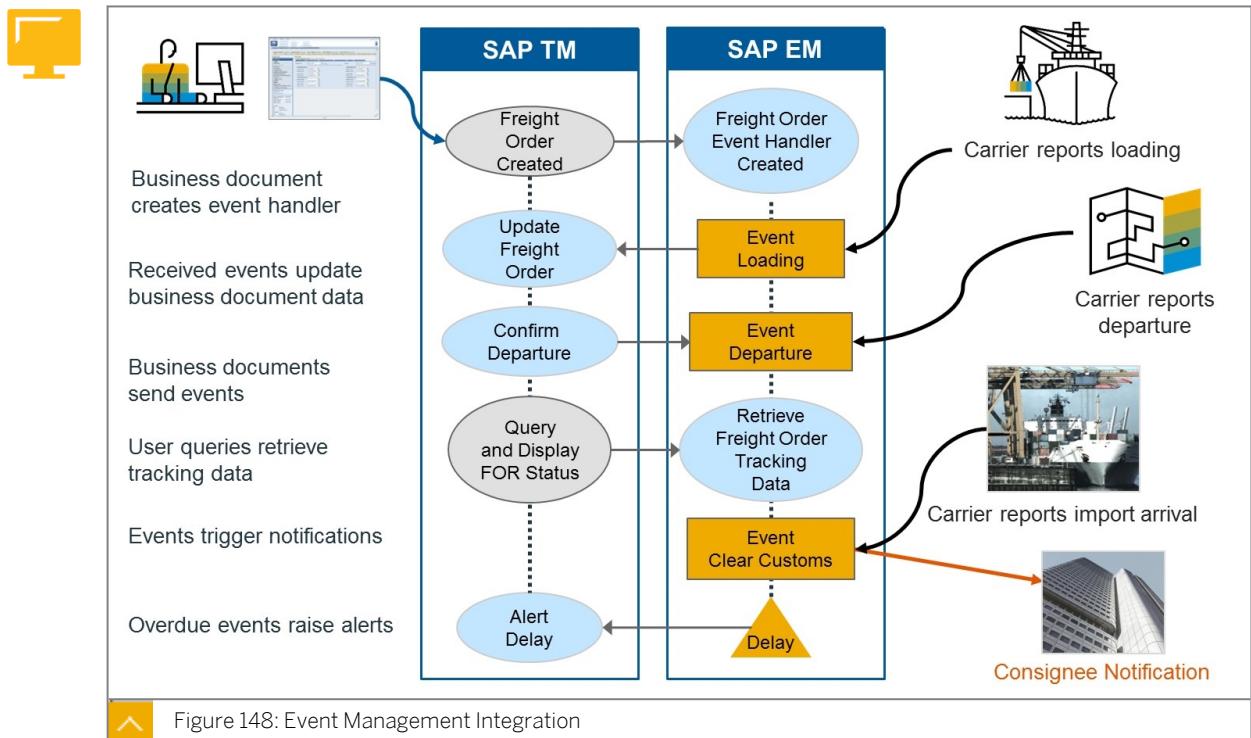
In this case, you expect an event to occur within a particular time frame, but for whatever reason, it is not reported. It is possible that something still needs to happen following this event, so you could set a time limit that sends a message or triggers something to happen when the event is unreported for a certain time period.

SAP TM Monitoring Scenarios

Transportation operations is an area in which transparency is crucial, especially in those cases where lengthy transportation times have to be considered, such as when shipping overseas. To ensure customer satisfaction, it is more important than ever to keep full control of what is going on, even if parts of the business process may run outside your company's sphere of influence.

Visibility processes for transportation management offer preconfigured, out-of-the box content for transportation operations, supporting you in tracking relevant activities within and beyond the confines of your company. You can monitor different processes and business documents, such as freight units, freight orders and freight bookings. Depending on your role, you can choose different layouts for the user interface, such as shipper and consignee, which result in a comprehensive and easy to understand view of transportation operations.

Event Management Integration



The figure, Event Management Integration, shows a typical scenario in which the SAP EM and SAP TM systems are updated to accurately reflect the real-world progress of a freight order.

Alerts

During the loading process, SAP ERP or SAP EWM may send a signal (notification) that there is a delay in the loading process. This can trigger an alert. The transportation planner may have to make adjustments to the schedule to ensure that the container makes it to the ship on time. Once the ship has left the departure port, GPS updates may indicate that the ship has not reached its midway point. This could be due to weather or mechanical issues. The customer service agent can be notified and can contact the customer to inform them of anticipated delays.

Due to the alert system, the planning team does not have to watch over every order. They can spend most of their time managing exceptions.

SAP Event Management UI

SAP Event Management is delivered with out-of-the-box content for transportation operations and global trade. Users can save their favorite searches on the Web UI. In addition, an archiving concept and logic tailored to high-volume processes are available. Archived data can now also be accessed from the Web UI.

The SAP Event Management Web front end can be configured easily, and includes the following elements:

- Selection screen
- Results list
- Details display

- Event details display
- Event messages that can be sent



LESSON SUMMARY

You should now be able to:

- Describe visibility scenarios
- View events in freight units/orders

Understand Customs Processing and Compliance

LESSON OVERVIEW

As global markets become more prevalent, the requirements for international shipping will increase. The number of government regulations increase when you cross international borders. The SAP Global Trade Services (GTS) system is designed to improve the process of international shipping with regards to your ERP system. In this lesson, we will discuss the integration between SAP TM and GTS.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Process an international shipment

International Shipment

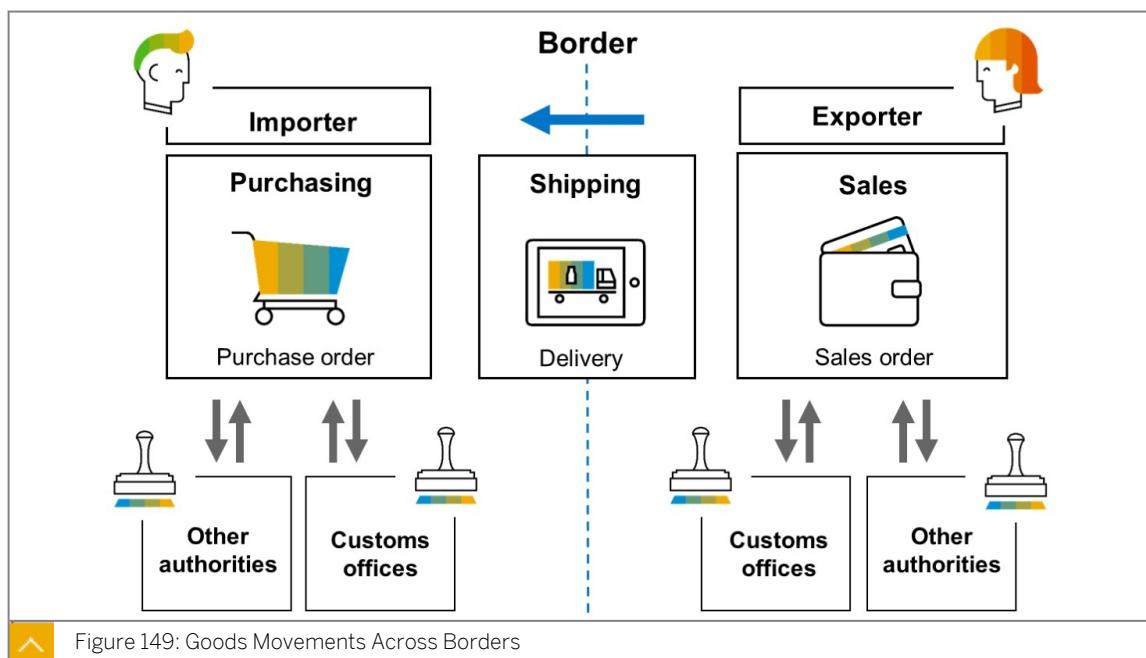


Figure 149: Goods Movements Across Borders

In contrast to domestic trade, foreign trade is monitored by governmental agencies. Regulatory agencies check whether imports and exports are permitted under foreign trade law and issue any licenses that are necessary. All international goods movements also have to be reported to the appropriate customs offices, either using manual or electronic means. When goods are imported, import duties are imposed in the form of duties or specific taxes.

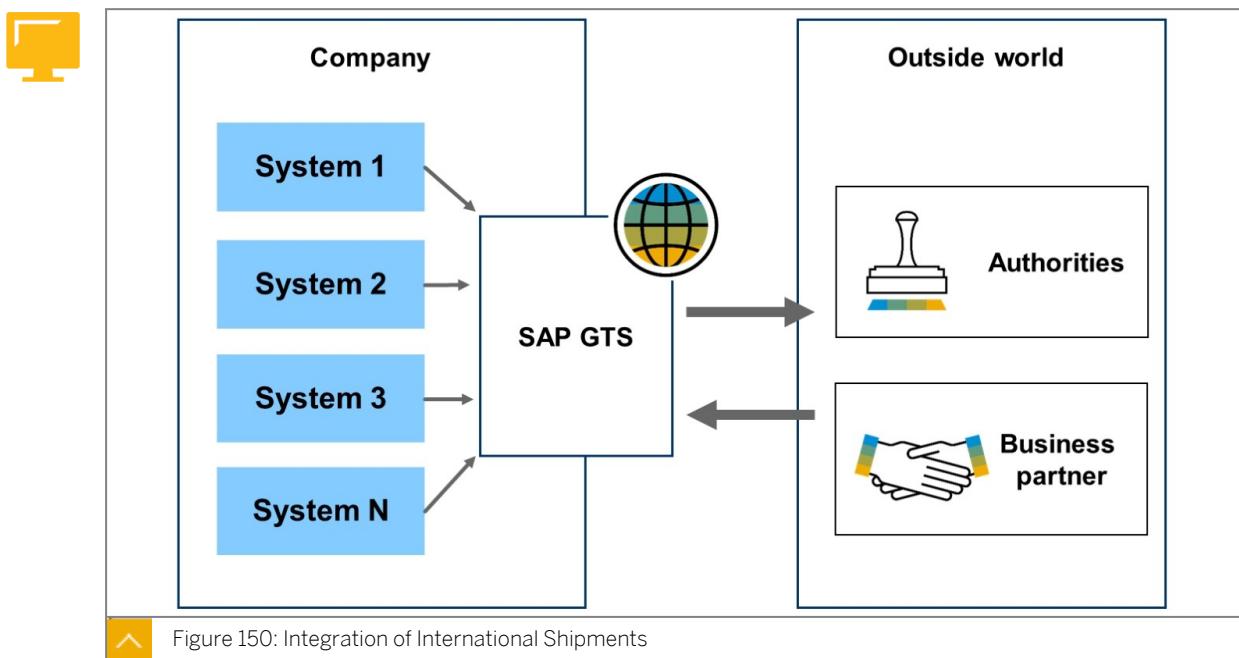
When you are performing international business transactions, you usually have to submit specific documents – in addition to the standard accompanying documents used in domestic

business transactions – such as commercial invoices, shipping documents, and packing lists. For example, the authorities in many destination countries require certificates of origin from authorized public institutions, such as chambers of industry and commerce. If you wish to claim preferential treatment when paying import duties (tariff preference), you have to present appropriate proof of origin (for example, a movement certificate) to the competent customs office.

SAP Global Trade Services (GTS)

For many companies, the import and export of goods is essential in numerous everyday business processes. The purchasing department orders goods for the company's warehouse, or for end customers, from vendors that are based abroad, and the sales department processes orders from foreign customers. These orders are subsequently delivered using transit procedures. However, it is necessary to consider international restrictions and requirements prior to the execution of transportation. This is where SAP GTS and SAP TM integration can be used.

Measures against international terrorism, and the decline in paper-based communication brought about by electronic procedures have had far-reaching effects on our requirements for systems that model foreign trade processes. Not only is SAP GTS able to fulfill the considerably stricter requirements of foreign trade law, it can also connect the processes in your system to electronic customs procedures.



SAP GTS serves as a central gateway to the world of foreign trade. While complex system landscapes often made data redundancy and manual processing unavoidable, SAP GTS unifies and centralizes import and export processes. All the data required for carrying out foreign trade transactions is contained in SAP GTS in bundled form. SAP GTS also takes care of communication with the authorities and, if necessary, with foreign trade partners.

Compliance

This unified procedure makes it significantly easier to achieve 100% compliance with legal requirements. It thus reduces the risk of a company incurring sanctions by inadvertently breaking the regulations; a major advantage, considering the often draconian nature of such sanctions.

The connection to electronic customs procedures greatly speeds up import and export processes. All the relevant documents can be systematically archived and retrieved for the purpose of external audits.

The Compliance Management, Customs Management, Risk Management, and Electronic Compliance Reporting solutions manage all cross-border goods receipt and goods issue processes, regardless of the type of feeder system.

You can use Compliance Management as early as the purchase order creation stage of the purchasing process in the feeder system to check whether the planned import is permitted and, if necessary, stop the order from being processed further. If the import is permitted, but requires a license from an authority, the license can be applied for in good time and stored in the system.

Sales staff can use Compliance Management when putting together a request for quotation or an order to determine whether they are permitted to make a delivery to a particular customer. If a license is required for an export, you can apply for the license from the authorities and manage it in the system, just as you do in the import process.

Compliance During Export and Import

When goods are being exported, staff in the export department can create the documents or messages required for carrying out the customs procedure (export procedure, transit procedure) directly from Customs Management and then send them to the authorities.

Depending on the country of destination, you should also execute a preference determination for the product to be exported in Risk Management: If you can export goods as originating products, the customer pays considerably less import duties due to tariff preferences. This strengthens your competitive position. You may want to use a letter of credit to guarantee payment by the customer. Risk Management supports the processing of payment transaction documents.

In the import process, Customs Management supports the technical department to communicate with the authorities while the goods are placed under a customs procedure. If you are a consignee in the electronic transit procedure, you can create the messages required to discharge the procedure in Customs Management. Customs values can also be calculated for every import consignment.

If you are located in the EU and have obtained goods from another EU member state, or have delivered goods to a customer in another EU member state, Electronic Compliance Reporting enables you to transfer the statistical data about these intra-community goods movements.

Customs Processing

Customs processing in SAP Transportation Management (TM) is controlled by customs activities that are defined in Customizing. Each customs activity contains a set of parameters that defines how customs processing is carried out for a specific process (for example, export or transit). The customs activities are assigned to the business documents via a customs profile.

When you save a business document, the system checks whether a customs profile is assigned to the business document type. You can assign a customs profile to freight order types, freight booking types, and freight unit types. The system then determines which customs activities are assigned to the customs profile. Further processing depends on the settings in the customs activities. For example, which customs relevance check is to be carried out and which grouping strategy is to be used to group items into customs groups.

The customs activity also controls which customs statuses are displayed on the UI for predefined steps of a customs process. You define the customs statuses according to your

requirements and assign them to the customs activity. You also define cumulated customs statuses that are displayed at header and item level in a business document.

You can create export declarations for customs-relevant freight documents that contain freight units. Note that export declarations are created at the pre-carriage stage of a freight document.

To communicate with the customs authorities, you can use an integrated customs management application, for example, SAP Global Trade Services. When you request an export declaration for a freight document, the customs management application automatically creates the export declaration and handles the customs processes.



LESSON SUMMARY

You should now be able to:

- Process an international shipment

Unit 6

Lesson 6

Analyzing SAP Transportation Management Performance

LESSON OVERVIEW

In order to manage any business, supervisors and managers rely heavily on reports, key performance indicators (KPIs), and metrics. These show how well or poorly business processes are performing, and give an indication where adjustments need to be made. In this lesson, you will review what options are available in SAP TM to provide the necessary tools to review business performance.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Explore analytics content
- Explain the concept of embedded analytics

Transportation Management Analytics

Analytics is the use of computer technology, operational research, and statistics to solve problems in business and industry. It is performed within an information system, and aids the process of making optimal or realistic decisions based on existing data.

Online transactional processing (OLTP) refers to the type of processing typically performed in an SAP ERP or SAP TM system. The reporting necessary in this type of system often refers to information requirements for day-to-day work. List displays enable you to request a listing of documents or master data, as well as combinations of these objects (characteristics). List displays are reports that access data that is generated directly from online transactions. From these lists, you can then access the source documents directly.

It is also possible to use information structures to aggregate data for simple operational analytics. This varies greatly from the reporting used in an online analytical processing (OLAP) environment. Analytical systems must provide information that the management of an enterprise needs to make business decisions.

Embedded Analytics Content

SAP Transportation Management analytics provide apps, called overview pages, that show the key performance indicators (KPIs) that you need to manage your operational business. At a glance, you can see all the vital data you need for your daily decision-making. Each overview page displays information from a different area of TM, for example, freight booking, freight ordering, tendering, and business share.

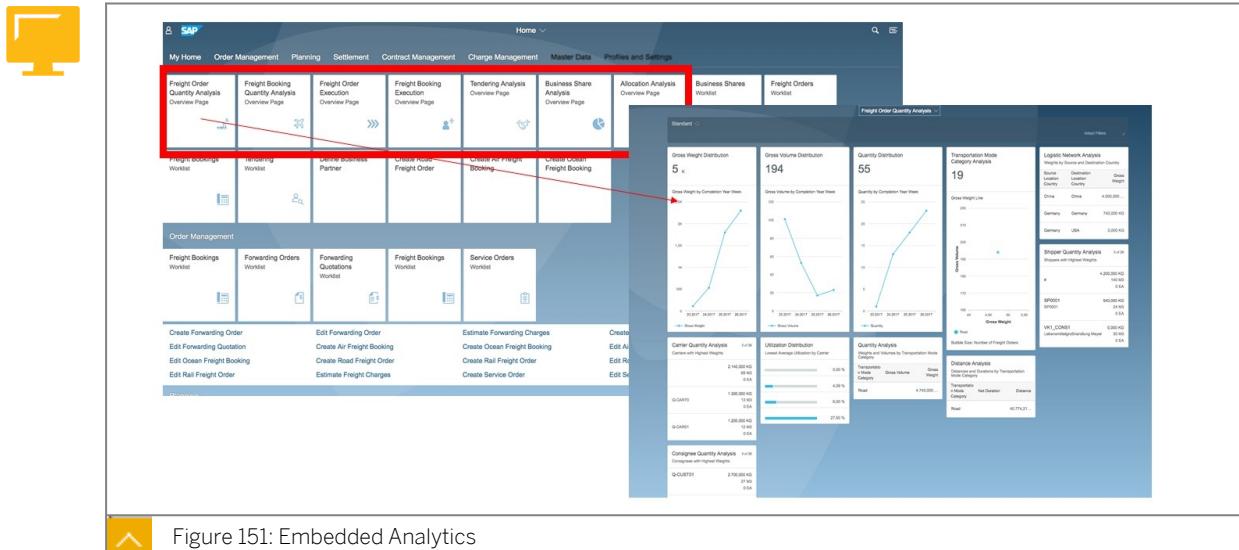


Figure 151: Embedded Analytics

Analytics Overview Pages

Each overview page consists of a number of cards (similar to tiles) that display information based on one or more KPIs. The cards are read-only; you cannot enter any information or perform queries or searches on them. The cards present data in different ways; some show lists, others display tables or charts. Some cards present summary information and you can drill down to see further details, such as individual transactions.

For cards displaying graphical charts (line, bubble), selecting the header takes you to a detailed view showing all the unfiltered information, while selecting a data point in a chart takes you to a detailed view, filtered to show only the information relevant to that data point. All the cards show information in real time, so that you always have the most up-to-date information. This can be invaluable in identifying problems such as delays or bottlenecks, and enables you to take swift action to remedy the situation. You can re-size the cards and change the order in which they are displayed to suit your own requirements.

Each overview page is based on one or more Core Data Services (CDS) views.

Detailed Views

You can use visual features to analyze the KPI information at a more detailed level. Selecting a card header or information line on the overview page takes you to the detailed view, which presents summary information graphically in the form of a combination of donut, bar, and line charts, and also in a table listing relevant Transportation Management documents. From the table, you can navigate directly to the relevant document, such as a freight order or a freight booking in the SAP Transportation Management system and change it if necessary.

Detailed views are also read-only; you cannot enter any information or perform queries or searches on them. Some overview pages have two detailed views, each containing information relevant to specific cards, while others only have one. For example, on the Cost Analysis overview page, selecting the Invoicing Block Analysis card takes you to the Transportation Invoice Blocked Detailed View, while selecting any other card takes you to the Transportation Costs Detailed View.

Embedded Analytics Overview Pages

- Allocation Analysis
- Business Share Analysis

- Freight Booking Execution Monitoring
- Freight Booking Quantity Analysis
- Freight Order Execution Monitoring
- Freight Order Quantity Analysis
- Tendering Analysis

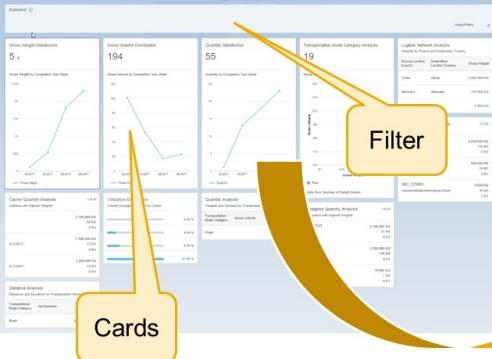
Example: Freight Order Quantity Analysis

You can use the Freight Order Quantity Analysis overview page to provide you with the KPIs that you need to manage your execution business. At a glance, you can see all the vital data you need for your daily decision-making. You can see KPIs for the current weight, volume, and numbers being transported on a weekly basis by each carrier, shipper, and ship-to party, as well as by transportation mode, and source and destination country. You can also view each carrier's utilization performance. The overview page provides you with KPIs for the current and previous month.

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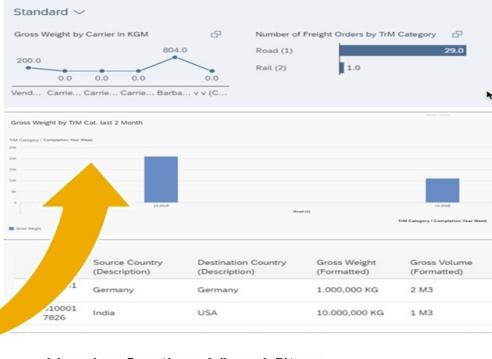
Example: Freight Order Quantity Analysis

Overview Page



A screenshot of the SAP Fiori Overview Page for Freight Order Quantity Analysis. It features several cards with KPIs and charts. A yellow callout labeled 'Cards' points to one of the cards. A yellow arrow labeled 'Filter' points to a filter icon in the top right corner of the page.

Analytical List Pages



A screenshot of the Analytical List Pages. It shows two charts: 'Gross Weight by Carrier in KGK' and 'Number of Freight Orders by TrM Category'. Below the charts is a table with data for Source Country (Germany), Destination Country (USA), Gross Weight (1,000,000 KG), and Gross Volume (2 M3). A yellow arrow points from the Overview Page towards this section.

- Header Section: Visual filters
- Middle Section: Smart Chart
- Bottom Section: Table with backend navigation

[] Figure 152: Example: Freight Order Quantity Analysis

The freight order quantity analysis comprises the following information.

- Gross Weight Distribution:

You can view a chart showing how gross weight distribution for completed freight orders (that is, with a freight order life cycle status of *Completed*) has increased or decreased in each completion week (current and previous month). The total gross weight distribution also appears at the top, for example, 5K.

- Gross Volume Distribution:

You can view a chart showing how gross volume distribution for completed freight orders has increased or decreased in each completion week (current and previous month). The total gross volume distribution also appears at the top, for example, 194K.

- Quantity Distribution:

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You can view a chart showing how quantity distribution for completed freight orders has increased or decreased in each completion week (current and previous month). The total gross quantity distribution also appears at the top, for example, 55K.

- Transportation Mode Category Analysis:

You can see a chart with gross weight and gross volume as axes, plus the total number of freight orders, for each transportation mode category for completed freight orders. This can help you identify the most effective method of transportation.

- Logistic Network Analysis:

You can review a table showing source and destination countries, and total gross weight for completed freight orders. This identifies where you have transported most goods in the current and previous months. The table is sorted in descending order of gross weight.

- Carrier Quantity Analysis:

You can view the total gross weight, gross volume, and container count per carrier for completed freight orders. This gives you information on which carriers you are using the most. The highest weight appears at the top.

- Shipper Quantity Analysis:

You can view the total gross weight, gross volume, and container count per shipper for completed freight orders. This gives you information on which shippers you are using the most. The highest gross weight appears at the top.

- Ship-To Party Quantity Analysis:

You can view the total gross weight, gross volume, and container count per ship-to parties for completed freight orders. The highest gross weight appears at the top.

- Utilization Distribution:

You can see the lowest average utilization per carrier (expressed as a percentage) for completed freight orders. The lowest utilization percentage appears at the top. This helps you assess carriers' performance and capacity.

- Quantity Analysis:

You can view a table showing the gross volume and gross weight transported for each transportation mode category (for example, road and air) for completed freight orders. You can use this information when deciding on the most efficient method of transportation. The table is sorted in descending order of gross weight.

- Distance Analysis:

You can see the total net duration and total distance for transported goods for each transportation mode category (for example, sea and air) for completed freight orders. You can use this information when deciding on the most efficient method of transportation. The greatest distance appears at the top.

You can use visual features to analyze the KPI information at a more detailed level. Selecting a card header or information line takes you to the detailed view, which presents summary information graphically and also in a table, from which you can navigate directly to the freight order in the SAP Transportation Management system and change it if necessary.



LESSON SUMMARY

You should now be able to:

- Explore analytics content
- Explain the concept of embedded analytics

Learning Assessment

1. What does a delivery document provide?

2. Which of the following methods are used for delivery creation?

Choose the correct answers.

- A Interactive Delivery Creation
- B Freight Unit Building
- C Background Report
- D Freight Order Creation

3. What are triggers for a delivery update by SAP TM?

Choose the correct answers.

- A Packing items into a handling unit
- B Changing the dates on a freight order
- C Re-assigning freight units to a freight order with different dates

4. What does the integration of SAP TM into the SAP EWM application enable?

5. Which of the following are options for warehouse integration with SAP TM?

Choose the correct answers.

- A Stockroom Management
- B Delivery-based Integration to SAP EWM
- C Order-based Integration to SAP EWM
- D Inventory Management

6. Which of the following business process are relevant for transit warehousing?

Choose the correct answer.

- A Warehouse operation of an LSP
- B Picking in a shipper's warehouse
- C Loading in a shipper's warehouse

7. Describe the integration of transit warehousing tasks between SAP TM and SAP EWM.

8. PPF used in output management is comparable to the SAP Workflow.

Determine whether this statement is true or false.

- True
- False

9. Which of the following are conditions necessary for PPF Output Management?

Choose the correct answers.

- A Scheduling Condition
- B Spool Condition
- C Starting Condition
- D Update Condition

10. Which of the following predecessor documents can be used for an integration in basic shipping and can trigger a freight unit creation?

Choose the correct answers.

- A Sales Order
- B Inbound Delivery
- C Stock Transfer Order
- D Outbound Delivery

11. Which of the following business documents can be used for Output Management in basic shipping?

Choose the correct answers.

- A Freight Units
- B Transportation Units
- C Freight Orders
- D Forwarding Orders

12. Print documents are available for which of the following?

Choose the correct answers.

- A Forwarding Orders
- B Sea Freight Bookings
- C Road Freight Orders
- D Air Freight Bookings
- E Freight Units

13. Which types of events are used when integrating with SAP Event Management?

Choose the correct answers.

- A Regular events
- B Overdue events
- C Unexpected events
- D Unreported events

14. Which of the following would not be reported by a carrier?

Choose the correct answer.

- A Freight order creation
- B Loading
- C Arrival
- D Departure

15. Tracking and tracing is supported for which business documents?

Choose the correct answers.

- A Freight orders
- B Freight units
- C Freight settlement documents

16. SAP GTS can be integrated with SAP TM for export declaration.

Determine whether this statement is true or false.

- True
- False

17. It is not possible to view analytics data directly in SAP S/4HANA.

Determine whether this statement is true or false.

- True
- False

18. Which of the following documents can be predecessor documents of a freight unit?

Choose the correct answers.

- A Sales Order
- B Order-based Transportation requirement
- C Forwarding Order
- D Delivery-based Transportation Requirement
- E Delivery

19. Which optimization algorithms are part of advanced transportation?

Choose the correct answers.

- A DS – Detailed Scheduling Optimizer
- B VSO – Vehicle Space Optimization
- C CS – Carrier Selection
- D VSR – Vehicle Scheduling and Routing
- E SEQ – Sequencing Optimizer

20. Package building allows to consolidate materials from different customers onto one pallet.

Determine whether this statement is true or false.

- True
- False

Learning Assessment - Answers

1. What does a delivery document provide?

A delivery document controls, supports, and monitors numerous subprocesses for shipment processing, such as picking, packing, loading, and posting the goods issue. In addition, the delivery document can be used as a reference document for the creation of other shipment documents, such as a bill of lading.

2. Which of the following methods are used for delivery creation?

Choose the correct answers.

- A Interactive Delivery Creation
- B Freight Unit Building
- C Background Report
- D Freight Order Creation

Correct. You can create deliveries interactively or by using a background report.

3. What are triggers for a delivery update by SAP TM?

Choose the correct answers.

- A Packing items into a handling unit
- B Changing the dates on a freight order
- C Re-assigning freight units to a freight order with different dates

Correct. Changing the dates on a freight order or re-assigning freight units to a freight order with different dates will cause a delivery update.

4. What does the integration of SAP TM into the SAP EWM application enable?

The integration of SAP TM into the SAP EWM application enables you to integrate SAP TM transportation planning with SAP ERP delivery processing and SAP EWM warehouse planning and execution.

5. Which of the following are options for warehouse integration with SAP TM?

Choose the correct answers.

- A Stockroom Management
- B Delivery-based Integration to SAP EWM
- C Order-based Integration to SAP EWM
- D Inventory Management

Correct. You can integrate warehouse processes with SAP TM via inventory management, stockroom management, or extended warehouse management (EWM). Integration to SAP EWM is only possible for deliveries, but not for orders.

6. Which of the following business process are relevant for transit warehousing?

Choose the correct answer.

- A Warehouse operation of an LSP
- B Picking in a shipper's warehouse
- C Loading in a shipper's warehouse

Correct. The transit warehouse process is available only for LSP scenarios, but not for shipper's scenarios

7. Describe the integration of transit warehousing tasks between SAP TM and SAP EWM.

You perform transportation planning in SAP TM, and then send your freight documents and transportation units to SAP EWM. In SAP EWM, you then execute the warehouse tasks, such as picking, packing, staging, and loading or unloading. You execute the settlement in SAP TM.

8. PPF used in output management is comparable to the SAP Workflow.

Determine whether this statement is true or false.

- True
- False

Correct. Workflow is a type of processing for an PPF Action.

9. Which of the following are conditions necessary for PPF Output Management?

Choose the correct answers.

- A Scheduling Condition
- B Spool Condition
- C Starting Condition
- D Update Condition

Correct. A scheduling condition defines the "why" for processing an action, while the starting condition defines the "when" for the processing.

10. Which of the following predecessor documents can be used for an integration in basic shipping and can trigger a freight unit creation?

Choose the correct answers.

- A Sales Order
- B Inbound Delivery
- C Stock Transfer Order
- D Outbound Delivery

Correct. With basic shipping, the customer can use the delivery integration to trigger freight unit creation in SAP TM. Sales Order and Stock Transfer Order can be used in SAP TM, but require the advanced license.

11. Which of the following business documents can be used for Output Management in basic shipping?

Choose the correct answers.

- A Freight Units
- B Transportation Units
- C Freight Orders
- D Forwarding Orders

Correct. The transportation unit and forwarding orders are used in advanced Transportation Management to model complex planning scenarios / forwarding processes for carriers.

12. Print documents are available for which of the following?

Choose the correct answers.

- A Forwarding Orders
- B Sea Freight Bookings
- C Road Freight Orders
- D Air Freight Bookings
- E Freight Units

Correct. Print documents are available for all listed documents.

13. Which types of events are used when integrating with SAP Event Management?

Choose the correct answers.

- A Regular events
- B Overdue events
- C Unexpected events
- D Unreported events

Correct. All listed events are integrated with SAP Event Management.

14. Which of the following would not be reported by a carrier?

Choose the correct answer.

- A Freight order creation
- B Loading
- C Arrival
- D Departure

Correct. Other than freight order creation the mentioned events may be reported by the carrier.

15. Tracking and tracing is supported for which business documents?

Choose the correct answers.

- A Freight orders
- B Freight units
- C Freight settlement documents

Correct. You can track and trace freight units and freight orders.

16. SAP GTS can be integrated with SAP TM for export declaration.

Determine whether this statement is true or false.

True

False

Correct. SAP GTS can be integrated with SAP TM for export declaration.

17. It is not possible to view analytics data directly in SAP S/4HANA.

Determine whether this statement is true or false.

True

False

Correct. You can view analytics data directly in SAP S/4HANA.

18. Which of the following documents can be predecessor documents of a freight unit?

Choose the correct answers.

A Sales Order

B Order-based Transportation requirement

C Forwarding Order

D Delivery-based Transportation Requirement

E Delivery

Correct. All of these documents can be predecessor documents of a freight unit.

19. Which optimization algorithms are part of advanced transportation?

Choose the correct answers.

A DS – Detailed Scheduling Optimizer

B VSO – Vehicle Space Optimization

C CS – Carrier Selection

D VSR – Vehicle Scheduling and Routing

E SEQ – Sequencing Optimizer

Correct. Advanced transportation scope includes optimization algorithms for vehicle scheduling and routing, vehicle space optimization and carrier selection.

20. Package building allows to consolidate materials from different customers onto one pallet.

Determine whether this statement is true or false.

True

False

Correct. The statement is true.

UNIT 7

Financial Processes in Transportation

Lesson 1

Managing Charge Calculation Master Data

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Lesson 2

Calculate Charges in a Freight Order

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Lesson 3

Settling Freight Charges

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Lesson 4

Distributing Costs

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Lesson 5

Calculating and Settling Charges in Forwarding Orders

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Lesson 6

Settling Freight Charges in a Group Logistics Scenario

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Lesson 7

Managing Freight and Forwarding Agreements

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UNIT OBJECTIVES

- Describe a freight agreement and its content
- Display the elements of a charge calculation sheet
- Describe rate tables in charge management
- Display a scale
- Calculate transportation charges
- Generate a freight settlement document
- Post freight charges to MM

- Verify freight invoices
- Distribute freight costs
- Include freight costs into the SD billing document
- Identify how charges are calculated for a FWO
- Generate a forwarding settlement document
- Settle an internal charge
- Describe a group logistics scenario
- Describe the process of strategic freight management

Unit 7

Lesson 1

Managing Charge Calculation Master Data

LESSON OVERVIEW

In this lesson we will look at the master data (agreements, calculation sheets, rate tables, and scales) that governs how transportation charges are calculated for customers or suppliers. This is an integral step and must occur before the process of charge calculation and settlement is triggered.

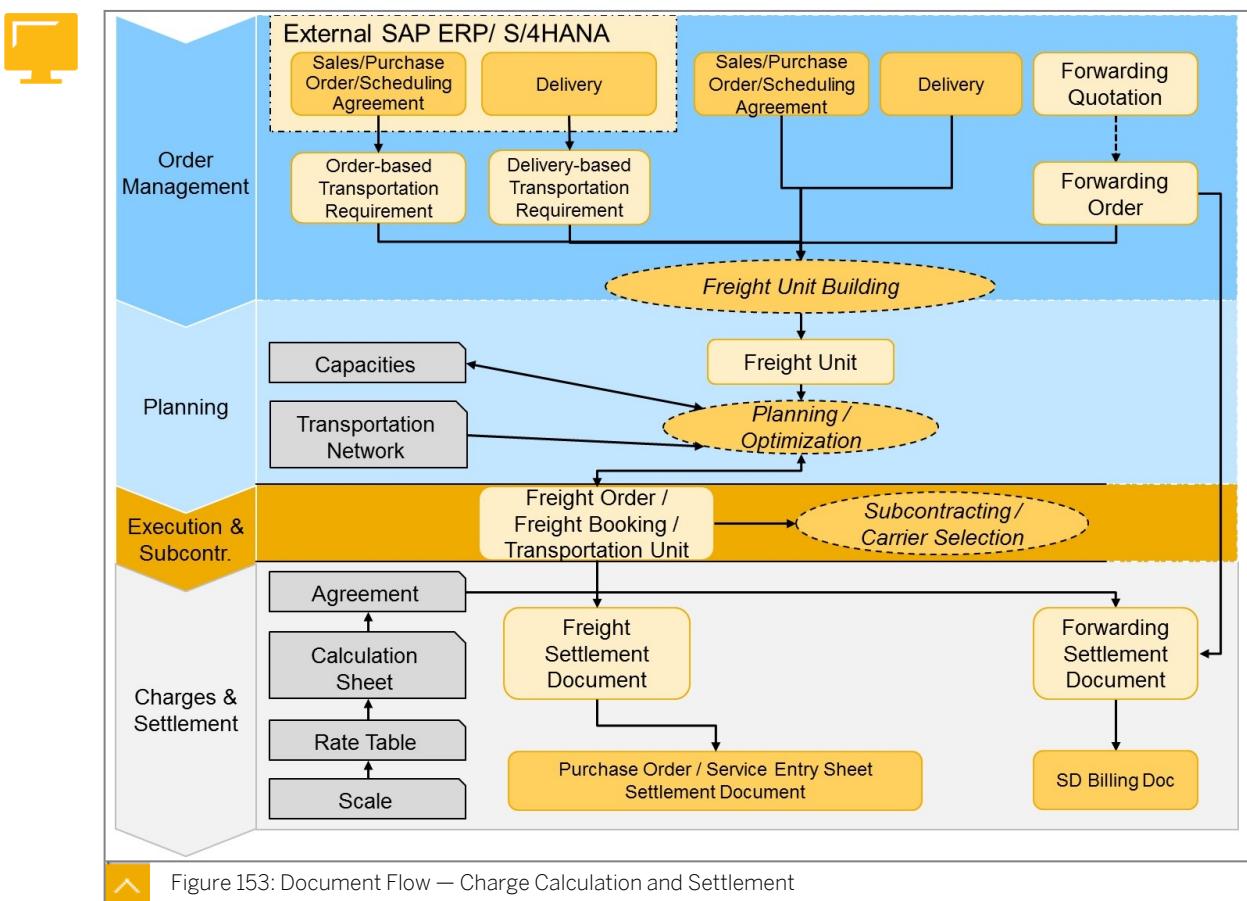


LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe a freight agreement and its content
- Display the elements of a charge calculation sheet
- Describe rate tables in charge management
- Display a scale

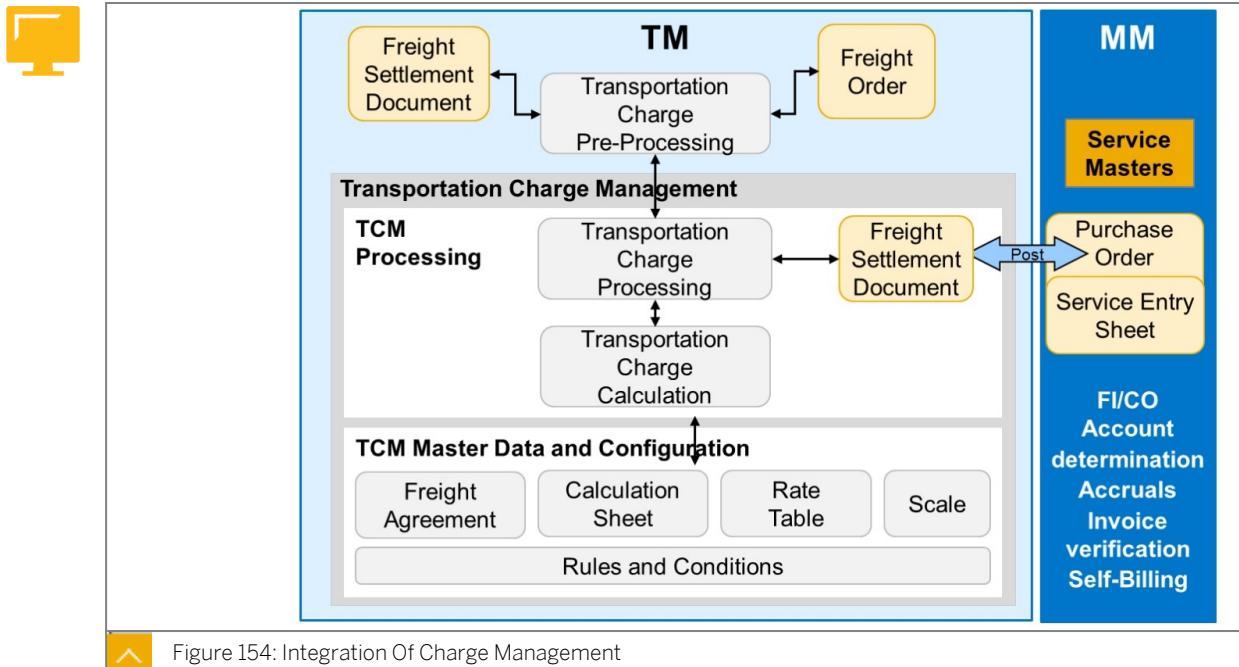
Transportation Charge Management



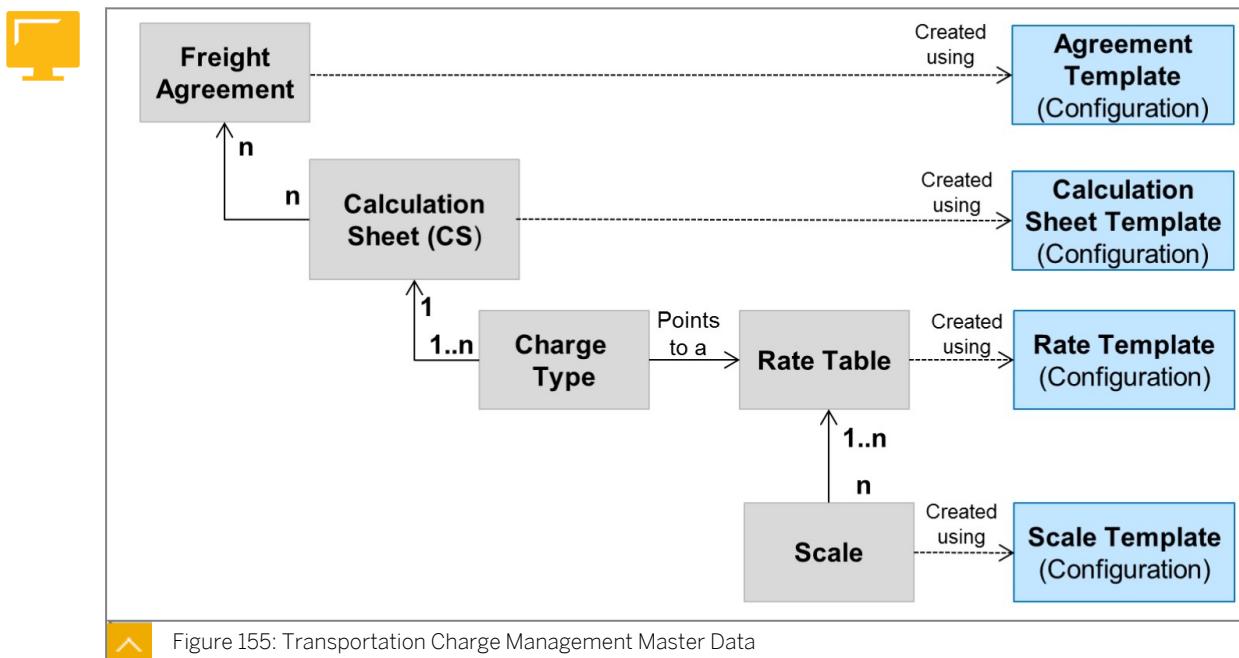
The figure, Document Flow — Charge Calculation and Settlement, shows the content of this lesson in terms of the overall document flow.

Integration of Charge Management

When shipping products to customers via a third party, an organization needs to account for and recognize the costs involved in moving goods. SAP TM provides a broad and flexible calculation process. With the integration of MM, integration to the Financial Accounting (FI) and Controlling (CO) applications allows an organization to perform payment and execute billing transactions, as well as trigger the settlement process to accrue the proper transportation charges to financial accounts.



Transportation Charge Management Master Data



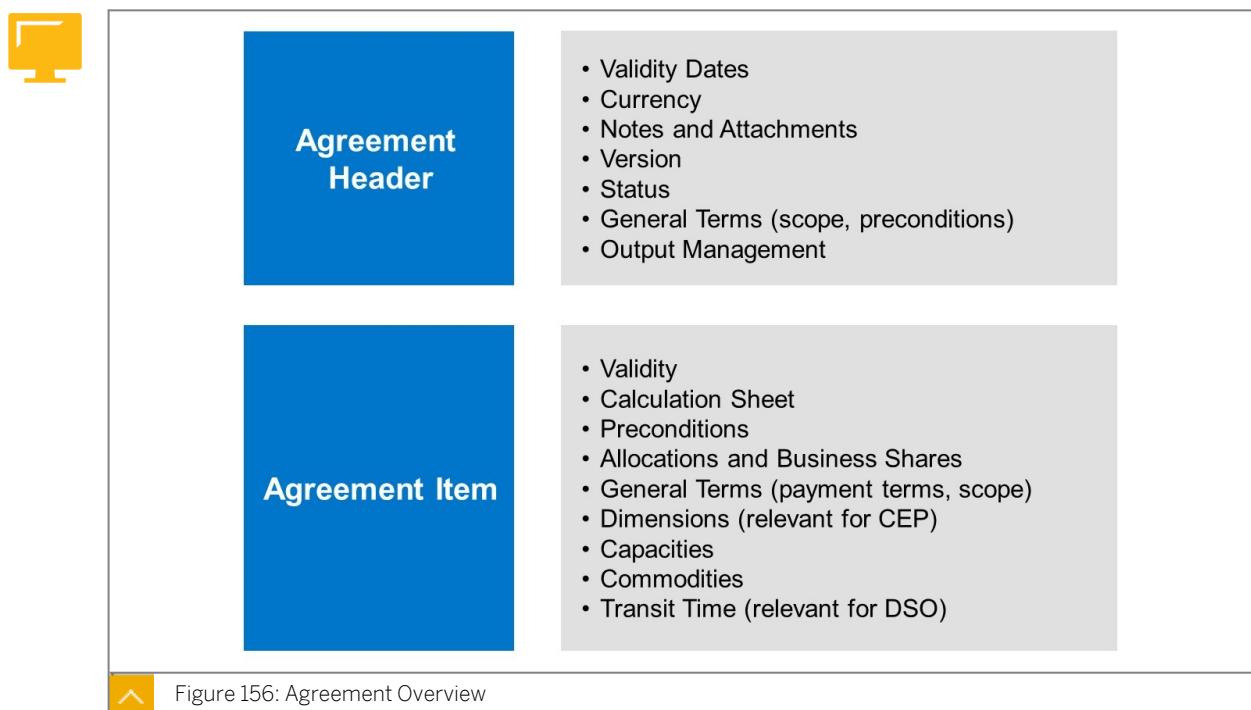
Freight Agreements

Freight agreements represent a long-term contract between a shipper or LSP and a carrier or supplier. Freight agreements can be determined based on purchasing organization and carrier. (Additional preconditions can also be defined, if required). Each agreement can point to one or more calculation sheets (CS). The freight agreement is connected to a CS and the costs (freight charges and advice fees) used in the assigned CS are visible in the FA.

Freight agreements (FAs) are the basis for calculating transportation charges. You use FAs to calculate transportation charges billable to you by your carrier.

Freight Agreement Structure

The system determines the agreement based on organization, business partner, validity period, and preconditions. An agreement is most commonly determined by the purchasing organization and business partner (Carrier for Freight Agreements). In the Freight Agreement Type Customizing activity, you can configure whether one or multiple partners can be entered in the agreement. That is, if you have one freight agreement with a carrier valid for multiple purchasing organizations.



Charge Calculation Sheet

Depending on how a shipment will be transported, various charges may be incurred for different means of transport. In SAP TM, companies can create calculation sheets that reflect all possible charge elements for a given carrier. These charges essentially mimic the terms of the freight contract.

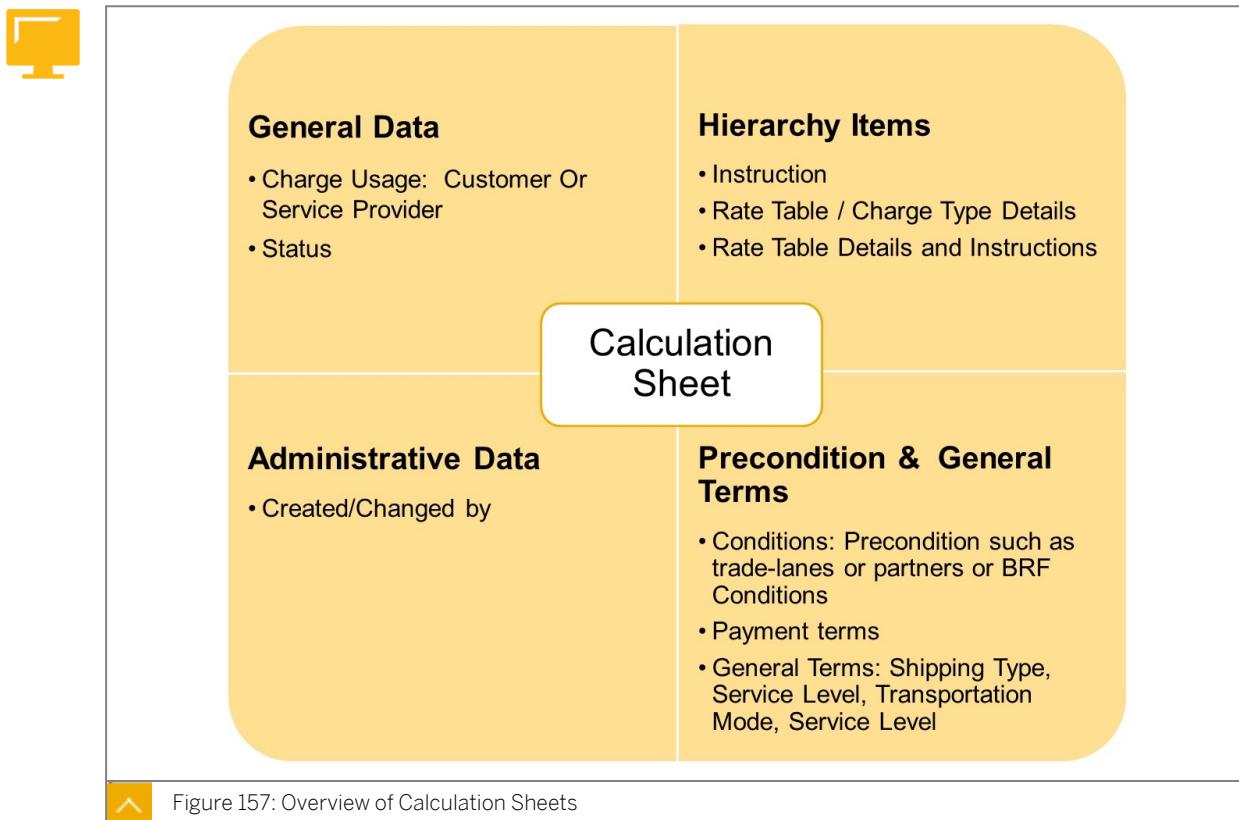
The calculation sheet (CS) is a hierarchical table used to calculate transportation charges. The calculation sheet combines the charge types permitted for a document and the sequence in which the system takes these charge types into account during the calculation. The system uses the calculation sheet to specify which transportation charges to calculate and how to calculate them. This helps to pay suppliers or carriers for subcontracted transportation services. The calculation sheet points to charge items and each charge item can result in a calculated amount.

Calculation Sheet Maintenance

Calculation sheet maintenance is a step in the process of setting up master data in the Charge Management and Service Product Catalogs component and is integrated with agreements, rate tables, and scales. You can use the master data cockpit to access an overview of the charge management master data per organizational unit, business partner, and charge type. The system also shows the relationship between the different types of charge management master data.

You can use a template to create a calculation sheet and calculation sheet line items.

The calculation sheet includes transportation charge elements, subtotals, and totals.



It provides for a calculation schema showing the steps and the specifications for the charges. Based on the calculation sheet, the resulting charges, sub-totals, and totals can then be displayed in the documents.

Calculation Sheet Items

The calculation sheet items have the following attributes:



- Charge Type
- Rate
- Dimensional Weight Profile
- Calculation Resolution Base (for example, root, container, product, and stage)
- Resolution Base Grouping Rule (for example, destination location, weight, volume)
- Calculation Method (for example standard, breakweight)

In more detail, the items above refer to the following:

Rate:

Rates contain details of the rate table for each standard charge item. It is also possible to enter fixed rates or percentages of other lines in the calculation sheet.

Dimensional Weight Profile:

The dimensional weight profile the system uses to calculate the transportation charges for the line item. The system uses the dimensional weight factor in the dimensional weight profile to convert a product's gross volume into dimensional weight. The system then uses the dimensional weight to apply the correct rate. Note that a dimensional weight profile at the line item level of a calculation sheet has priority over a dimensional weight profile in an agreement.

Calculation Resolution Base:

During charge calculation, the system determines the calculation resolution base by the origin of the data upon which the charge aspect is based. You can define the charge aspect in the resolution base objects, for example, container, product, and stage.

- Root: This is the header of the document such as freight order, or freight booking.
- Stage: To utilize stage attributes such as distance between the shipper location and the port of loading.
- Container: When gross weight of the container will be used for the calculation.
- Product: When product attributes like product quantity, weight, or volume need to be used.

For example, you want to determine the freight rate based upon the gross weight of the order. To do this, you will need to use the calculation resolution base of root. If, however, you want to calculate the freight on a per package basis, the calculation resolution base should be package.

Resolution Base Grouping Rule:

The rule the system uses to group selected input data, for example, destination location, weight, and volume. You use the grouping rule together with the resolution base to group charge lines by the calculation base specified in the *Group By* field of the grouping rule.

Calculation Method:

The calculation method defines how the rates determined from the rate table are to be interpreted. The break weight calculation method compares and selects the lower rate from either the actual rate range or the lower end of the next rate range. It assumes that one of the scales in the rate is the weight. With clipping, the system works through the pricing scale level by level. The calculation results from each scale level are then added up to produce the overall result.

Charge Type

A charge type is the classification of a charge line that plays an important role in how the system calculates the transportation charges for the charge line, for example, a base rate, surcharge, or discount. A charge type can result in a positive or negative value for a charge line. You can also specify whether a charge type can be an amount or a percentage value. The figure, Charge Types, shows where the charge type resides in the TCM master data structure.



Charge Category

Category	Description
004	Basic Freight
011	Accessorial Charges

Charge Subcategory

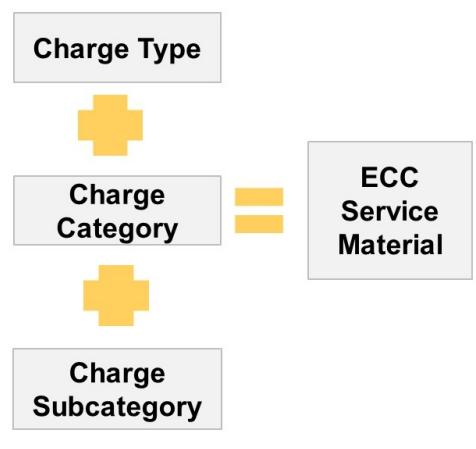
Subcategory	Description	Category
100000	BAF	011
101021	Sea Freight	004

Charge Types

Charge Type	Category	Subcategory
HAUL	004	101021
ZS01	011	100000

Usage of Charge Categories and Subcategories

Charge Type



```

graph TD
    CT[Charge Type] == CC[Charge Category]
    CC == CS[Charge Subcategory]
    
```

ECC Service Material

Figure 158: Charge Types

Charge types can be grouped into charge categories. A useful code list is the UN/EDIFACT codelist 5237. All three entities are freely definable in Customizing. You can use the charge subcategories of charge types to group and categorize charge types in a more granular way than charge categories. A suitable example is the code list resulting from UN/EDIFACT Recommendation 23: "FREIGHT COST CODE # FCC Harmonization of the Description of Freight Costs and Other Charges".

Charge categories and subcategories can be assigned in the charge type Customizing activity, and can be used to determine the service material during settlement.

When defining charge types, you can use the following settings:

- Specify whether a charge type can result in a positive or negative value.
- Specify whether a charge type can be an absolute value or a percentage value.
- Specify whether you want to set the charge type as an absolute value or a percentage value each time you assign the charge type.
- Assign a charge type to a charge category and charge subcategory.
- Indicate if the charge is a tax.
- Specify if and how the system rounds a value.
- Assign a default calculation base to the charge type so you do not need to assign a calculation base each time you create a calculation sheet line item.

Rate Table

A rate is a price for a certain transportation service that applies only during its validity period. In SAP TM, rates are listed in a rate table.



		Validity Period: 01.01.2021 to 31.12.2021					Status: Released	
Dest Zone		Origin = Plant Chicago						
		<=100 kg	<=500 kg	<=1000 kg	<=5000 kg	<=20000 kg		
TX	\$ 60.00	\$ 51.00	\$ 45.90	\$ 43.61	\$ 30.52			
IN	\$ 30.68	\$ 26.08	\$ 23.47	\$ 22.30	\$ 15.61			
KY	\$ 35.68	\$ 30.33	\$ 27.30	\$ 25.93	\$ 18.15			
CA	\$ 85.00	\$ 72.25	\$ 65.03	\$ 61.77	\$ 43.24			
FL	\$ 55.90	\$ 47.52	\$ 42.76	\$ 40.63	\$ 28.44			
LA	\$ 57.00	\$ 48.45	\$ 43.61	\$ 41.42	\$ 29.00			
CO	\$ 45.00	\$ 38.25	\$ 34.43	\$ 32.70	\$ 22.89			
GA	\$ 55.90	\$ 47.52	\$ 42.76	\$ 40.63	\$ 28.44			
WA	\$ 55.90	\$ 47.52	\$ 42.76	\$ 40.63	\$ 28.44			

Figure 159: Rate Table Overview

Rate Table Elements

You can define the following elements in the rate table:



- Charge Usage
- Charge Type
- Dimensions
- Calculation Base (for each scale)
- Relevance for Calculation Method

Additional information on elements you can define in the rate table are as follows:

- Charge Usage: You can define the charge usage as relevant for paying your carrier.
- Charge Type: The system only assigns rate tables to a charge item in a calculation sheet if the charge types match. You can use this field to search for a rate table.
- Dimensions: You add each dimension on which you want your rate to be defined and looked up. For example, if you want the rate to be defined based on destination location and weight, add a dimension for destination location and for weight.
- Calculation Base: You can define the calculation base for the scale. The calculation base is the actual base or the factor on which the rate retrieval is performed.
- Rel. Calc. Method (Relevant for Calculation Method): If you select this checkbox, you define whether you want the system to apply a special calculation method, such as break weight or clipping, to the rate table on the level of a charge item.

Rate tables also contain the freight rates for transportation services and allow you to maintain rates for certain validity periods. A rate table can contain up to 14 dimensions for rate maintenance. The rates are reusable and can be referred to in multiple calculation sheets. The rates can be imported or exported using Microsoft Excel.

Calculation Method

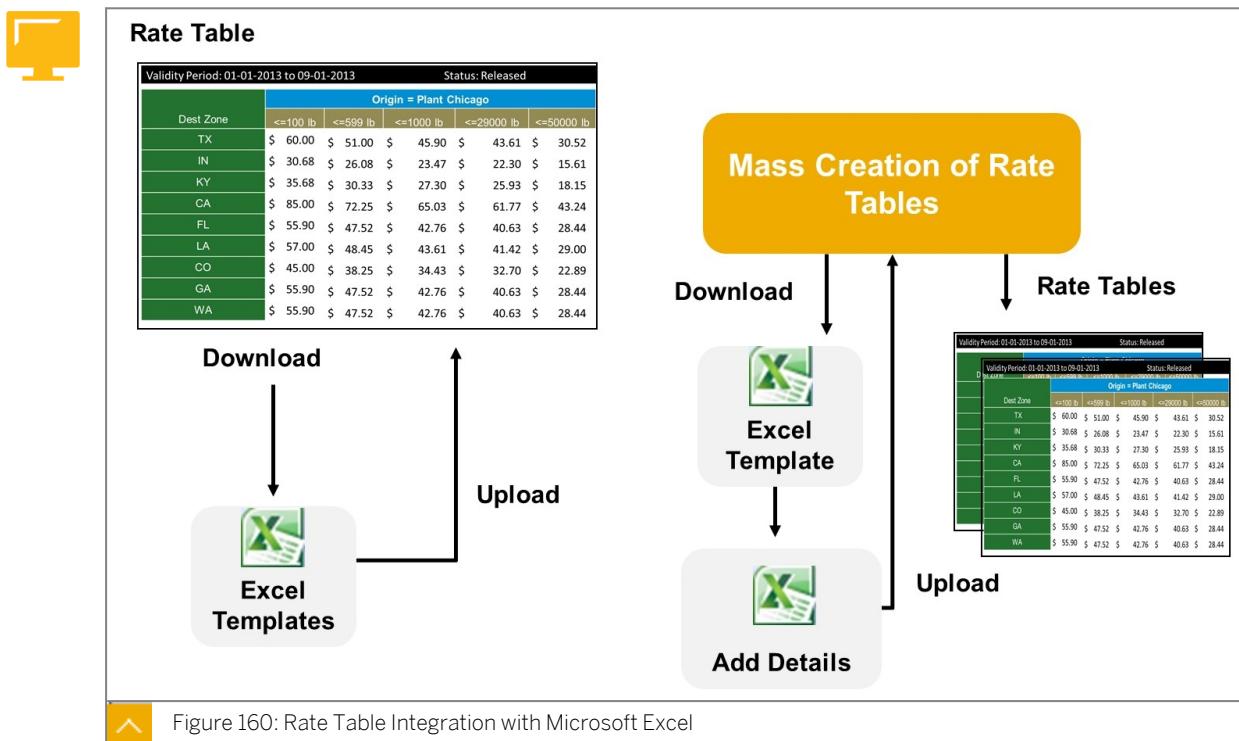
You can use the standard, break weight, or clipping calculation method for a rate.

The break weight calculation method compares and selects the lower rate from either the actual rate range or the lower end of the next rate range. It assumes that one of the scales in the rate is the weight. With clipping, the system works through the pricing scale level by level. The calculation results from each scale level are then added up to produce the overall result.

Example of rates include the following:

- Weight / volume rates
- Volumetric rate calculation (bulkiness factors)
- Distance rates
- Freight of all kind and commodity rates
- Various origin and destination point classifications such as point-to-point, point-to-zip, point-to-state, zip-to-zip, and state-to-state
- Rates based on equipment (container type or size) or packaging class
- Handling charges: Terminal handling, cross docking costs, loading and unloading, empty handling, document handling, AMS filing, canal due, security surcharge, and so on

Rate Table Integration with Microsoft Excel



You can maintain a large rate table, with or without scale items, using Microsoft Excel. You can enter the rates and scales into a Microsoft Excel file and upload the file to your SAP TM system.

Alternatively, you can define an empty reference rate table with validity periods in SAP TM and download it to Microsoft Excel. You can then maintain the rate table in the Microsoft Excel file and upload it to your SAP TM system.

Scales

If a rate is a price for a certain transportation service that applies only during its validity period, a scale represents a dimension of the rate. In effect, a scale is used to define a parameter that then defines a rate. For example, if a rate depends upon distance and weight, you must define a separate scale for distance and for weight. The distance and weight scales are then used to define the rate.



Scale: Dest Zone	Scale: Weight	Scale: Location			
<ul style="list-style-type: none"> • Scale Base: TRZONE • Scale Type: Same Scale • Calculation Type: Absolute 	<ul style="list-style-type: none"> • Scale Base: WEIGHT • Scale Type: To Scale • Scale Unit of Measure: Kg • Rounding Profile: 0005 • Calculation Type: Relative 	<ul style="list-style-type: none"> • Scale Base: LOC • Scale Type: Same Scale • Calculation Type: Absolute 			
Dest Zone	Origin = Plant Chicago				
	<=100 kg	<=500 kg	<=1000 kg	<=5000 kg	<=20000 kg
TX	\$ 60.00	\$ 51.00	\$ 45.90	\$ 43.61	\$ 30.52
IN	\$ 30.68	\$ 26.08	\$ 23.47	\$ 22.30	\$ 15.61
KY	\$ 35.68	\$ 30.33	\$ 27.30	\$ 25.93	\$ 18.15
CA	\$ 85.00	\$ 72.25	\$ 65.03	\$ 61.77	\$ 43.24
FL	\$ 55.90	\$ 47.52	\$ 42.76	\$ 40.63	\$ 28.44
LA	\$ 57.00	\$ 48.45	\$ 43.61	\$ 41.42	\$ 29.00



Figure 161: Scale Overview

Scale maintenance is a prerequisite for the maintenance of rates, as scales are the dimensions of rate tables. You maintain scales independently of the agreement and the rates, and can reuse them in multiple rate tables. A scale has a scale base, which is essentially a database field tied to an attribute of the freight order. The scale base defines how the system interprets the scale. For example, a rate based on distance has to have the distance calculated.

Possible scale bases include the following:

- Product quantity
- Package type
- Weight
- Volume
- Means of transport
- Location
- Distance

- Business partner

Each scale is based on a scale type. The scale type controls how the scale levels are defined. It indicates whether the scale values that were specified represent the upper or lower boundaries for the scale levels.

Depending upon the scale base, a scale unit of measure can be defined. This is a mandatory field if the unit of measure is relevant for the scale base. Weight, for example, requires a unit of measure.

In relation to calculation type, you can choose between absolute and relative. For non-numeric scales, you can only choose absolute. The system uses the calculation type on scale level as the proposed value for rate table maintenance.

You can also assign rounding profiles. Before the system accesses the scale to look up a rate in a rate table, it rounds the input value based on the rounding profile to determine the right scale level.

Calculation Base

A calculation base identifies the actual base or factor with which the system calculates the charges for the scale.



- The calculation base defines how the system will determine the actual value of the scale during charge calculation

Calculation Base “DESTLOC”

If the calculation will be based upon the destination location of the stage of the freight order/booking

Helper Assignment

BAF/ Container dry

	Newark	Portland	Miami
up to 5 tons	42,000 USD	48,000 USD	54,000 USD
up to 10 tons	36,000 USD	39,600 USD	48,000 USD
up to 20 tons	30,000 USD	33,600 USD	42,000 USD



Calculation Base “GROSSWT”

If the calculation will be based upon the total weight of the freight order



Figure 162: Calculation Base

There can be various scenarios in which the system must calculate a charge for different forms of weights, for example, gross weight and net weight.

In this case, both gross weight and net weight correspond to the scale base Weight (W), whose dimension is mass. However, by definition, gross weight and net weight are two entirely different charge aspects. Therefore, they have two different calculation bases, such as "W1" for gross weight and "W2" for net weight.

To follow the scenario given here, you define a calculation base for every scale base. This calculation base is the final element in the charge determination. This means that the calculation base is used to determine the charges.

In the figure, Calculation Base, the charges are dependent on weight and the destination location. The scale has the scale base Location. This scale base defines that the scale uses locations only. The scale base can be used for both the source and destination location. The calculation base DESTLOC determines that the destination location of the freight order is used. Technically, in the customizing of the calculation base, you define which field is to be used and which program or class the system will call to determine the field value.

If the resolution base in the calculation sheet points to the freight order stage, the system will derive the values from the specific stage and use it in the calculation.



LESSON SUMMARY

You should now be able to:

- Describe a freight agreement and its content
- Display the elements of a charge calculation sheet
- Describe rate tables in charge management
- Display a scale

Calculate Charges in a Freight Order

LESSON OVERVIEW

In this lesson, you learn how to calculate supplier charges for freight orders.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Calculate transportation charges

Agreement Determination

Freight Agreements (FAs) are the basis for calculating transportation charges. In this section, we look at how agreements are determined.

The system determines the agreement based on organization, business partner, validity period, and preconditions.

If there are several matching agreements which can be determined on the data from freight order/booking, it is possible to have a leading charge type (defined in charge type Customizing), and the first agreement where the defined leading charge type can be calculated is picked. Besides using leading charge types, it is possible to maintain priorities.

If the system finds multiple matching agreements during agreement determination, the agreement priority defines the sequence in which the subsequent determination is executed.

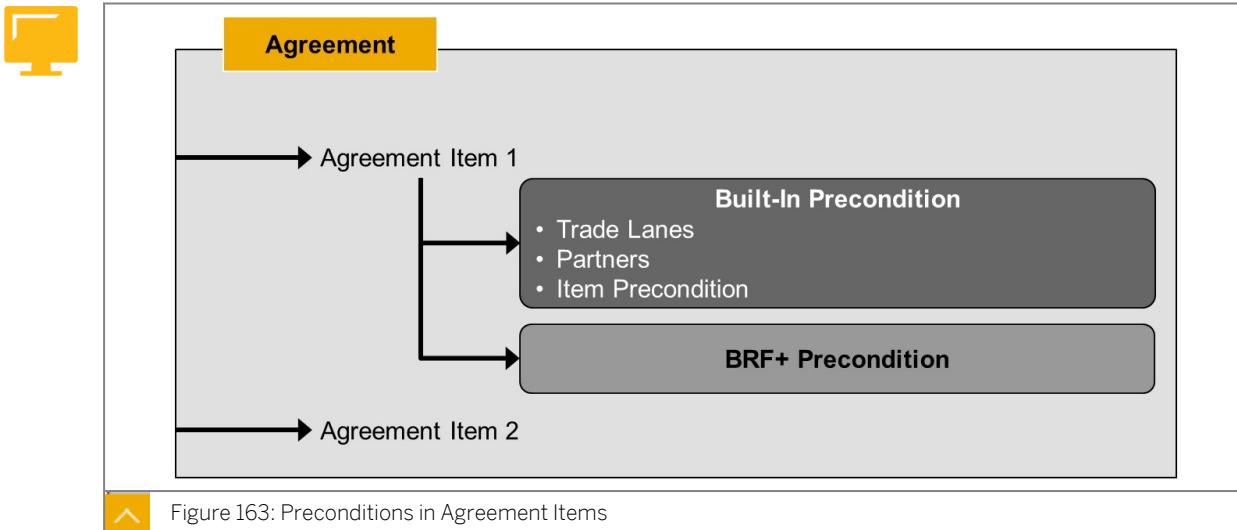
The agreement priority can be maintained on the *General Data* tab in the details section.

Built-in Preconditions in Agreement Items

In an agreement, there are two ways of using preconditions for the agreement items (calculation sheets):

- Built-in preconditions
- BRFplus preconditions

It is possible to define a BRFplus condition or a BAdl to check if a certain calculation sheet is to be processed in a certain business context. The result of this rule is a true or false decision. If the response from BRFplus or the BAdl is true, the calculation sheet is considered for charge calculation. Some built-in preconditions are available on agreement item level.



Manual Agreement Selection

Often, logistics service providers (LSPs) have multiple FAs with the same carriers and purchasing organizations. This is due to the fact that an LSP may strike deals with carriers at various levels, for example, on a country, regional, and global basis.

Normally, the larger the contract, the better the rates. However, if a country business partner (BP) is pushing a lane to increase market share, then the LSP could potentially get better rates. Therefore, it makes sense to have a different contract with the country BP, or even multiple contracts.

Similar scenarios can exist on the customer side. Therefore, the ability to choose a particular context in a given scenario is a critical business requirement on both the buying and selling side.

Manual Agreement Selection: Functions



- An enhancement to the standard agreement selection, which is an automated process.
- Provides the capability to select an agreement or agreement item for charge calculation.
- Offers additional capability for automatic selection of minimum or maximum agreement items through calculation profile control setting.

Charge Calculation Customizing and Assignment

The calculation profile provides a central location to define the settings that you want the system to use when calculating transportation charges.

The following are examples of settings you can define in a calculation profile:

- Specify the date type that the system uses as the basis for the rate, exchange rate, and agreement validity, and ultimately the charge calculation. (For example, the order date, the invoice date, or the expected end date of the main carriage.)
- Specify the level at which the system calculates the charges, for example, at header level, item level, or stage level.
- Specify the determination rule that the system uses to determine the agreement and the calculation sheet.

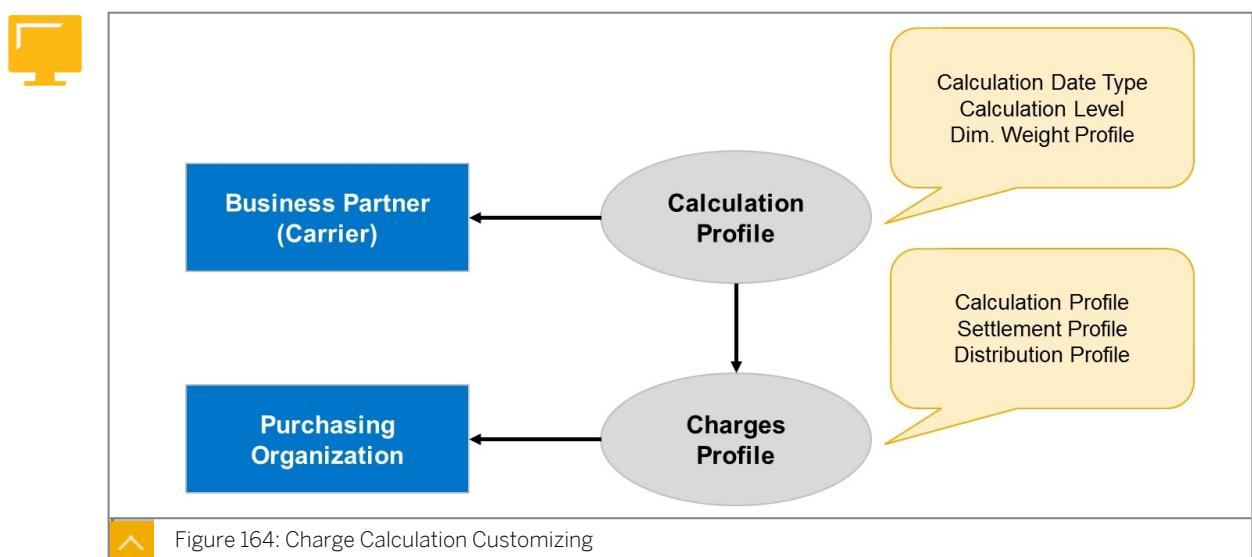
- Specify the default dimensional weight profile for the organizational unit and the condition that the system uses to determine the dimensional weight profile.

In the Define Calculation Profile Customizing activity, you define the settings that you want the system to use when calculating transportation charges. You find it in Customizing at *Transportation Management → Basic Functions → Charge Calculation → Basic Settings for Charge Calculation → Define Calculation Profiles*.

Charges Profile

You can enable charge calculation for a purchasing organization by assigning a charges profile to the purchasing organization (see the PPOCE transaction). The charges profile groups together the general settings for charge calculation, such as the calculation profile you want the system to use when calculating transportation charges.

Charge Calculation Customizing

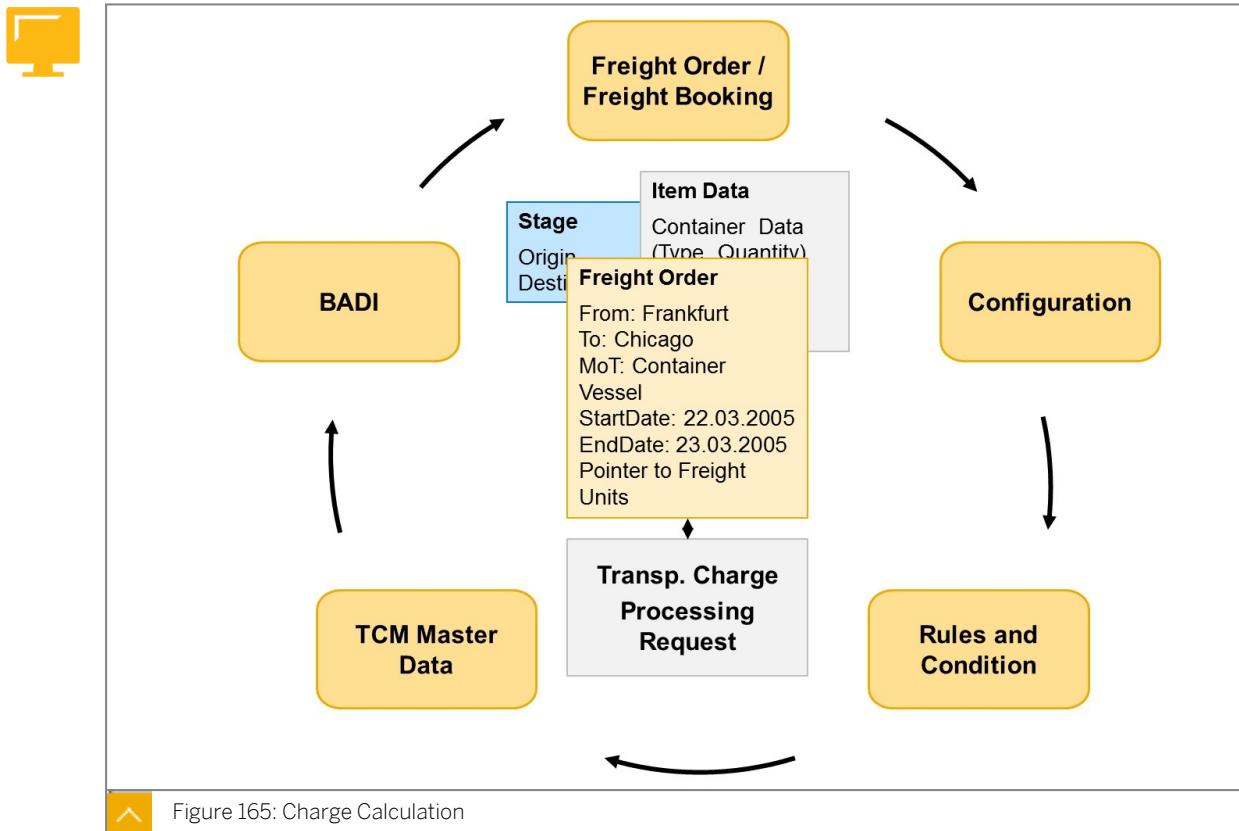


In the Customizing activity Define Freight Order Types, the following settings influence charge calculation:

- Enable Charge Calculation: This must be selected to enable the system to calculate the charges. This setting does not influence manual freight charges, as they can be entered even when this setting is not selected.
- Save Strategy: Calculate Charge After Each Save: When this save strategy is selected, the system performs charge calculation after each save. If a mandatory charge type cannot be determined or is missing, the freight order cannot be saved.

To define freight order types, in Customizing, choose *Transportation Management → Freight Order Management → Freight Orders → Define Freight Order Type*.

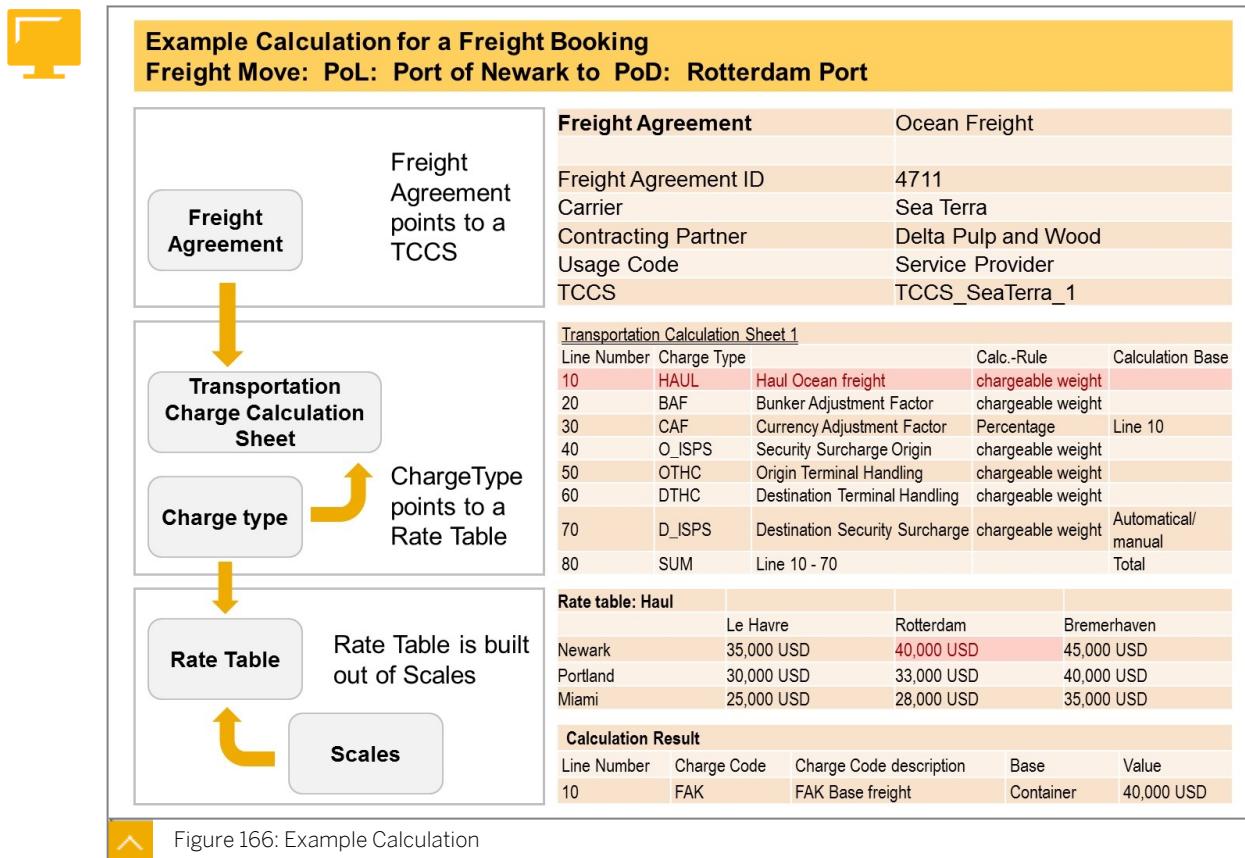
Freight Order Charge Calculation



During freight charge calculation in the freight order, the following steps occur:

1. Collect the data from the following SAP TM core objects:
 - Transaction business object: freight order, freight booking, stage, item, container
 - Configuration objects
 - Charge Calculation Rules (BRF+ conditions)
 - Relevant master data
 - Any BAdI implementation
2. Determine the freight agreement.
3. Calculate the values of each charge type in the calculation sheet.
4. Show the calculated results in the freight order.

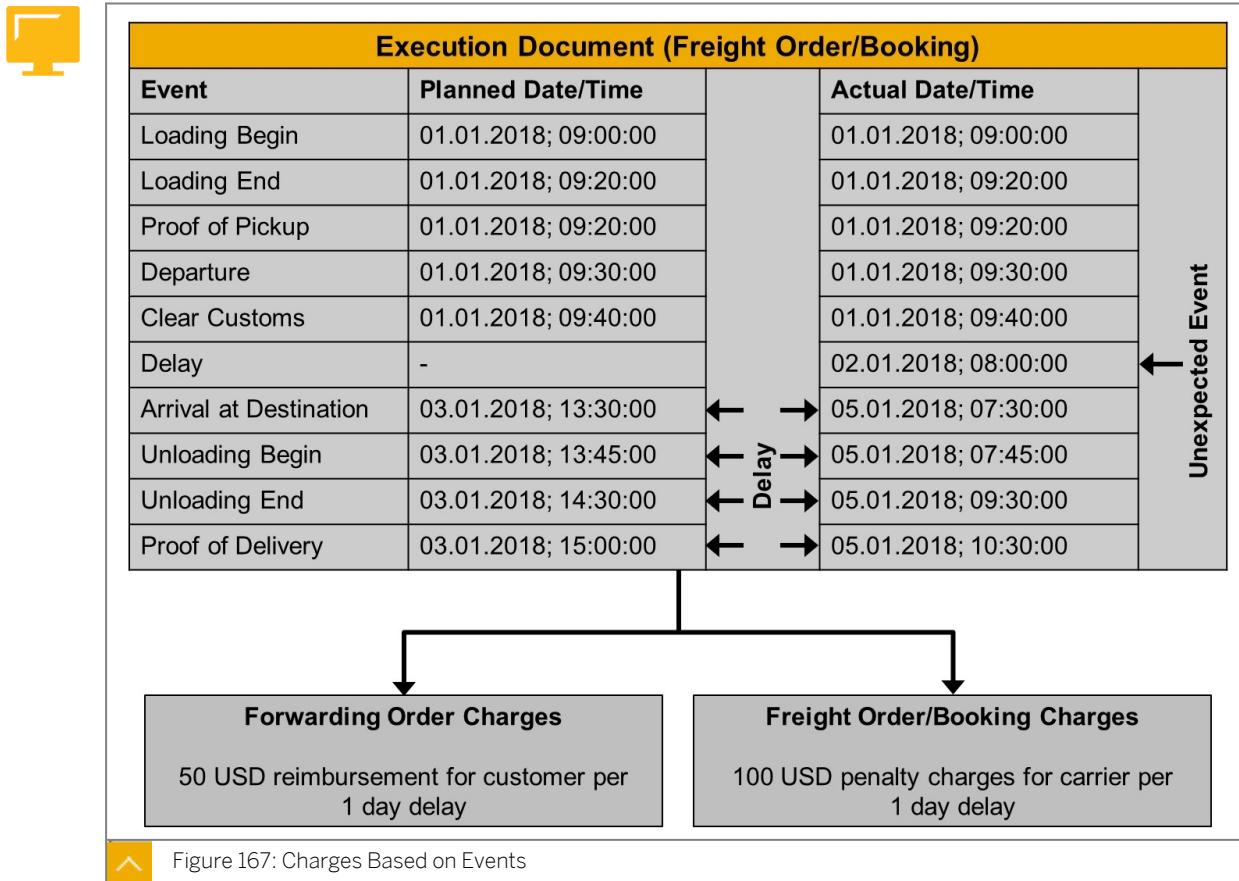
Example Calculation



The example demonstrates how the system calculates the charge for a container ocean freight booking from Newark to Rotterdam based on TCM master data.

Event-Based Charges

Events can influence how the customer is charged (via the forwarding order) and how the carrier is charged (via the freight order and freight booking).



LESSON SUMMARY

You should now be able to:

- Calculate transportation charges

Settling Freight Charges

LESSON OVERVIEW

After services have been rendered for the freight order, the settlement process must be initiated. In this lesson you will examine the steps SAP TM performs to assist in the process of settling transportation costs with your carriers.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Generate a freight settlement document
- Post freight charges to MM
- Verify freight invoices

Freight Settlement Processing

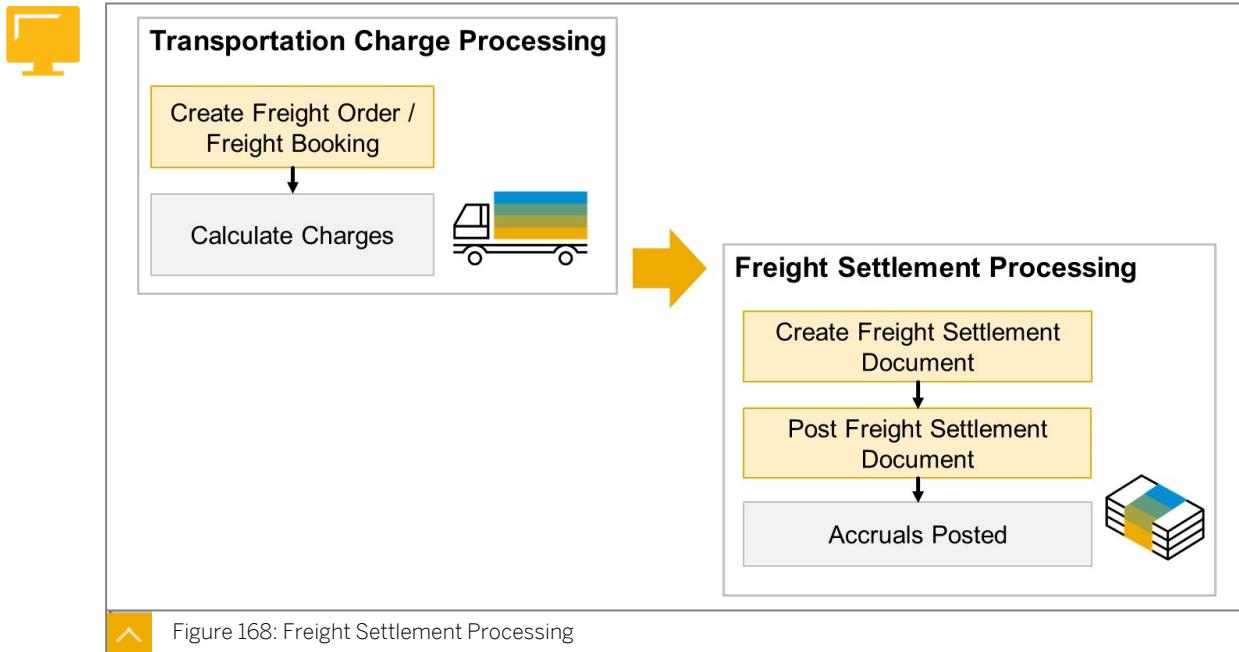
After services have been rendered for the freight order, the settlement process must be initiated. In this lesson you will examine the steps SAP TM performs to assist in the process of settling transportation costs with your carriers.

What is Freight Settlement?

When an organization ships via a third party to a customer, costs may be incurred that have to be charged back to this shipper. After services have been rendered, the following activities should take place:

- Accruals are posted
- Invoices are verified
- Vendors are paid

To manage this process properly in an integrated environment, a freight settlement document is created and posted to MM.



Freight charges are settled with the carrier (supplier).

Settlement includes the following:

- Assigning and transferring shipment costs to Financial Accounting to generate accruals, and assigning costs to a CO object.
- Settlement of costs with the carrier: posting payables by canceling the accruals.

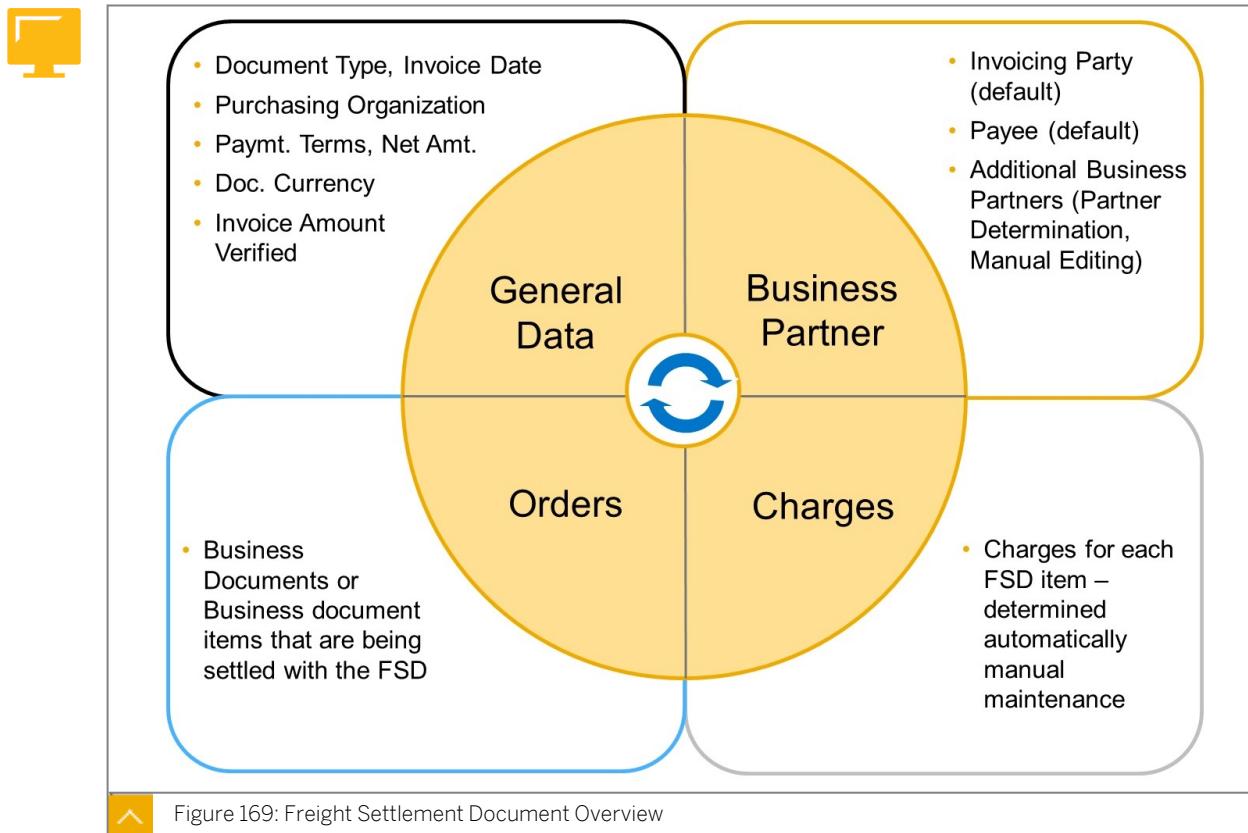
You need to have entered and accepted the services provided before you can transfer costs to Financial Accounting. The system automatically creates the service entry sheet based on a purchase order for external services.

Before you can settle costs with the carrier, you need to create an invoice using manual invoice verification, or create a credit memo using the credit memo procedure.

Freight Settlement Document

A freight settlement document (FSD) is a business document that is posted to MM to create a purchase order and service entry sheet in order to verify an invoice received from a supplier or carrier. When the invoice is received, it should be checked against the data from the freight settlement document. If performing an evaluated receipt settlement, the automatically generated invoice is based on the data from the freight settlement document.

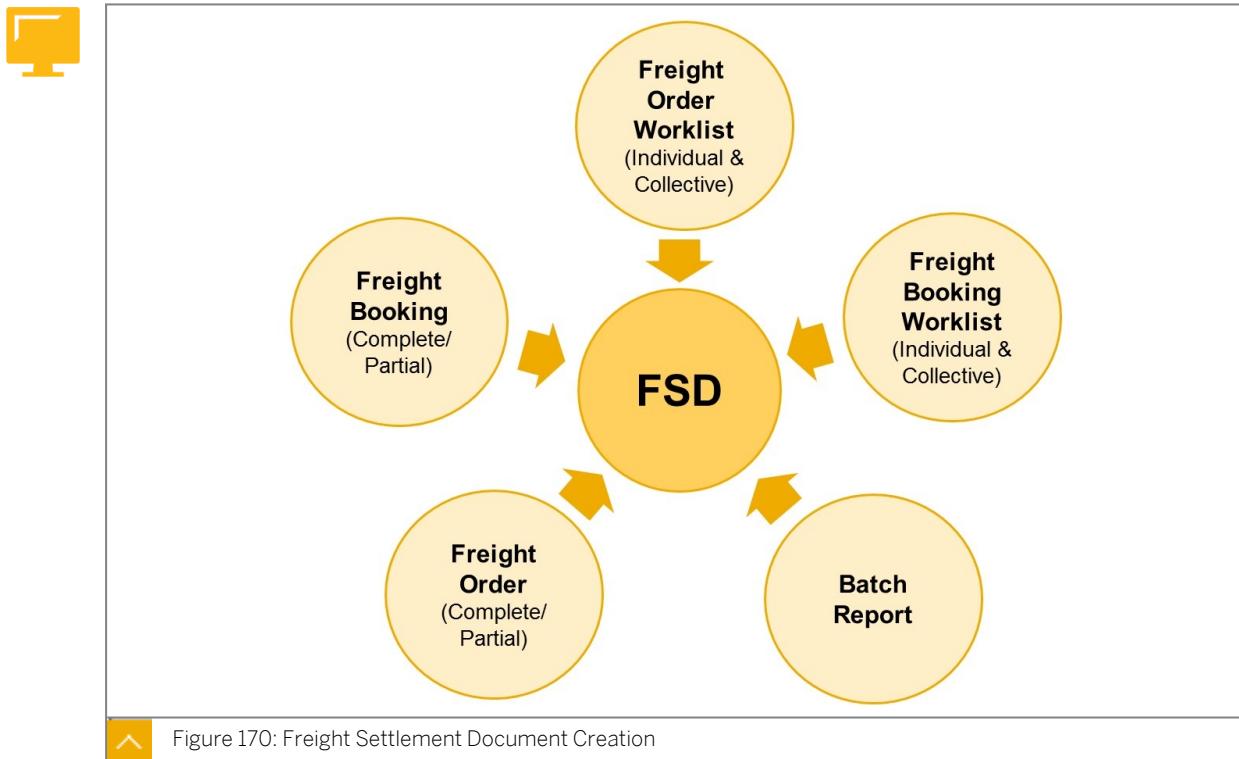
The transportation charges are calculated in SAP TM based on a freight order, or freight booking. The actual invoice verification takes place in MM. You can create an individual FSD for one freight order, or freight booking. You can create a collective FSD for multiple freight orders or freight bookings. You can also create multiple FSDs at the same time.



An FSD contains the following information:

- General data: Document type, the purchasing organization, payment terms, document currency, and so on.
- Business partner information: Invoicing party, payee, additional business partners, which can be entered manually or automatically determined by the system.
- Orders: The business documents or the business document items that are being settled using the FSD.
- Charges: For each FSD item, the *Charges* tab page has the charges relevant for settlement with the carrier.

Freight Settlement Document Creation



The FSD can be created in the following ways:

- You can create an individual FSD for one freight order, or freight booking, or a collective FSD for multiple freight orders, or freight bookings. To do this access freight orders, or freight bookings from the worklist, in the relevant document overview, or in the freight settlement overview. The system automatically creates the FSD based on the data in the freight orders, or freight bookings and calculates the transportation charges.
- You can create FSDs directly out of the freight booking or freight order apps.
- You can create partial FSDs for previously invoiced freight documents.
- You can create multiple freight settlement documents using the mass creation of FSD report.

Freight Settlement Document Creation 2

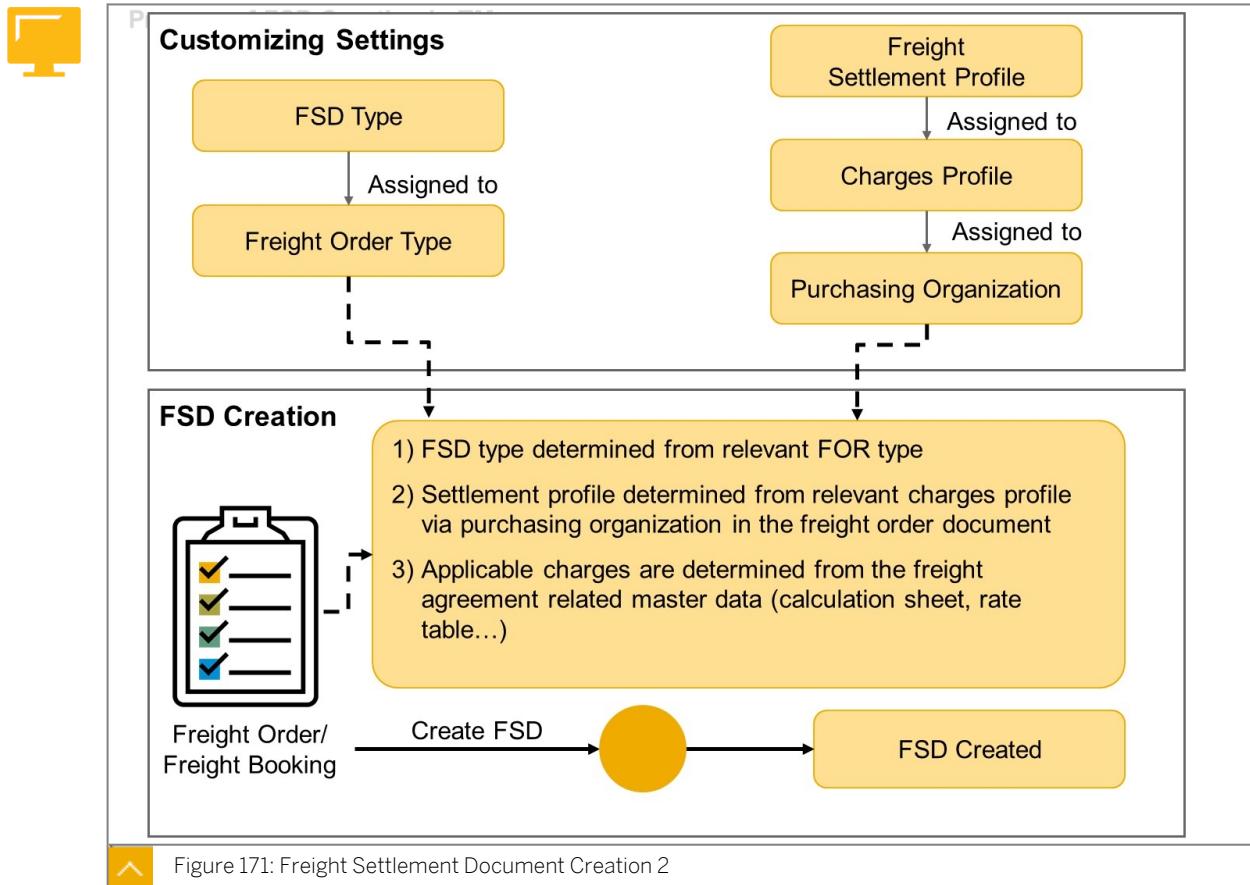


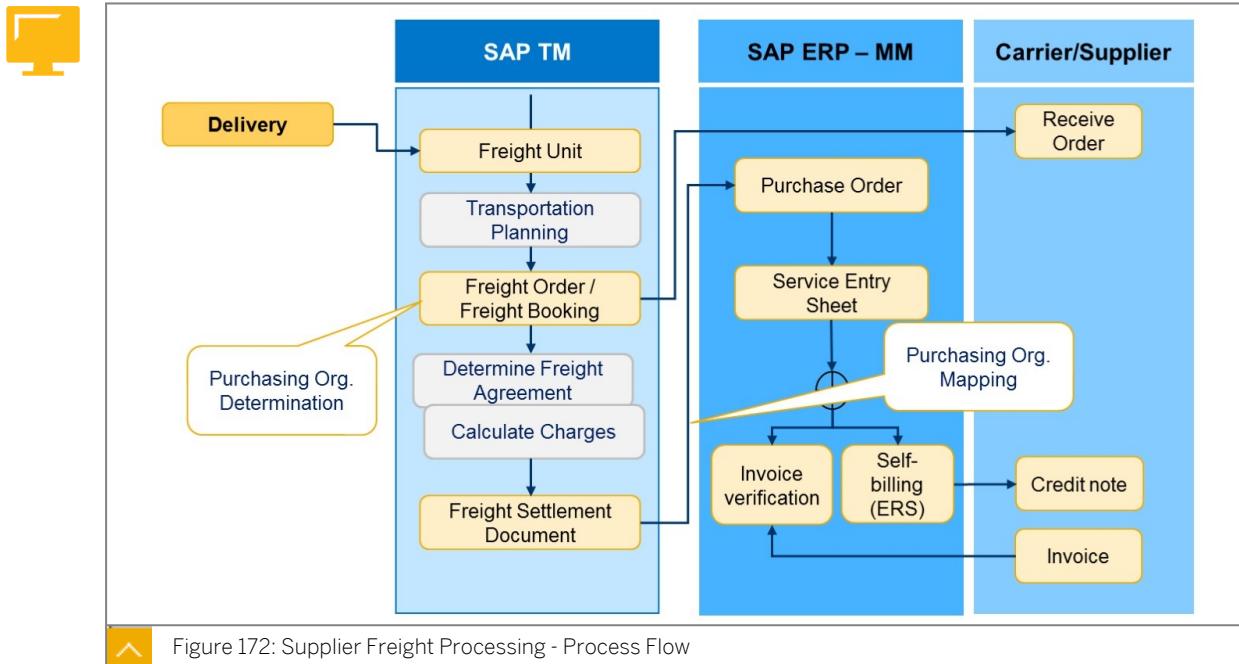
Figure 171: Freight Settlement Document Creation 2

When the FSD creation is triggered for a freight booking/freight order (FB/FO), the corresponding document type is used to determine the FSD type used.

The purchasing organization specified in the FB/FO is used to determine the settlement profile. All of this information is then used to create FSDs for the selected FO/FB.

Freight Charges Posting

Supplier Freight Processing - Process Flow



As you can see in the figure, Supplier Freight Processing - Process Flow, the typical freight settlement process flow is as follows:

Based on a delivery, the planner carries out several planning steps and creates a freight order or a freight booking to subcontract to a carrier.

On settlement, the system creates a Freight Settlement Document (FSD). This document contains all relevant logistical data, as well as the charges and other commercial data. The charges can be copied over from the freight order or freight booking (most common) or another charge calculation is triggered based on the freight agreement between the purchasing organization and the carrier. It is possible to manually change charges in the FSD. FSDs can be created online or in batch. It is possible to do a collective settlement (several freight orders or bookings are settled with one FSD). The FSD can then be posted to MM.

A purchase order and a service entry sheet are created in MM. This constitutes the working list for invoice verification. You also have the option of self-billing.



Note:

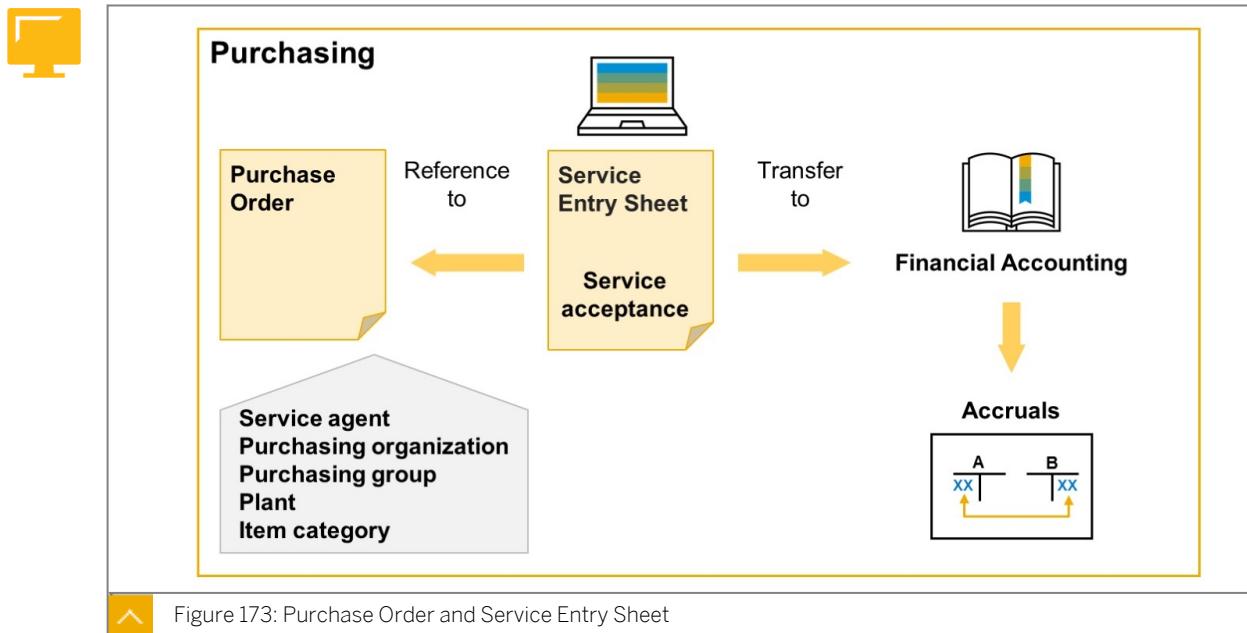
The purchase order and service entry sheet are only used for technical purposes to post accruals. The service entry sheet comprises a list of services performed by a vendor on the basis of a purchase order, containing service descriptions and details of quantities and values. The descriptions of planned services deriving from the purchase order are used as default descriptions in the service entry sheet.

You can create a partial freight settlement document for a previously invoiced freight order.

The invoicing status of the freight order changes from *Completely Invoiced* to *Partially Invoiced* before the additional freight settlement document is created. You can add charges to

an invoiced FO, but it is not possible to remove them. Invoice verification can be done with reference to the freight order, carrier, bill-of-lading, air waybill, flight number, and voyage number.

Purchase Order and Service Entry Sheet



Each service entry sheet is based on an external service order. Determining a valid purchase order is required for transfers to Financial Accounting and for settlements. You can also create the purchase order every month for the carrier. Important criteria for the service order include carrier, purchasing organization, purchasing group, plant, and item category.

When the system has automatically determined a valid purchase order, a service entry sheet is created that refers to the purchase order. During posting, you accept services and, in Financial Accounting, an accounting document for generating accruals is created.

During account assignment, the system determines the correct G/L account in Financial Accounting for each cost item and the assignment for Controlling. Account assignment can be carried out at different levels, depending on the level of detail at which you want to track costs.

The transfer to Financial Accounting to establish accruals requires entering and accepting the services rendered. The system automatically creates a service entry sheet. Using the credit memo procedure, also referred to as the evaluated receipt settlement (ERS) procedure, you can settle the freight costs with the carrier without having received invoices. You can choose from different settlement periods. You transfer the calculated freight costs to Financial Accounting. The invoices are verified by the carrier. If the carrier discovers variances, you can post these as subsequent debits or credits.

If you receive invoices from the carrier, you can also verify the invoices manually and create the invoices manually.

Dispute Management

Dispute Management for Freight Settlement

As a requester of transportation services, such as a shipper, you can have one of the following freight settlement processes in place with a provider of transportation services, such as a carrier:

- Self-billing:

Your service provider does not submit an invoice. Instead, you settle automatically based on the information in your freight order. Self-billing is also named evaluated receipt settlement (ERS).

- Submission of an invoice by the service provider:

You pay the service provider the amount contained in the invoice.

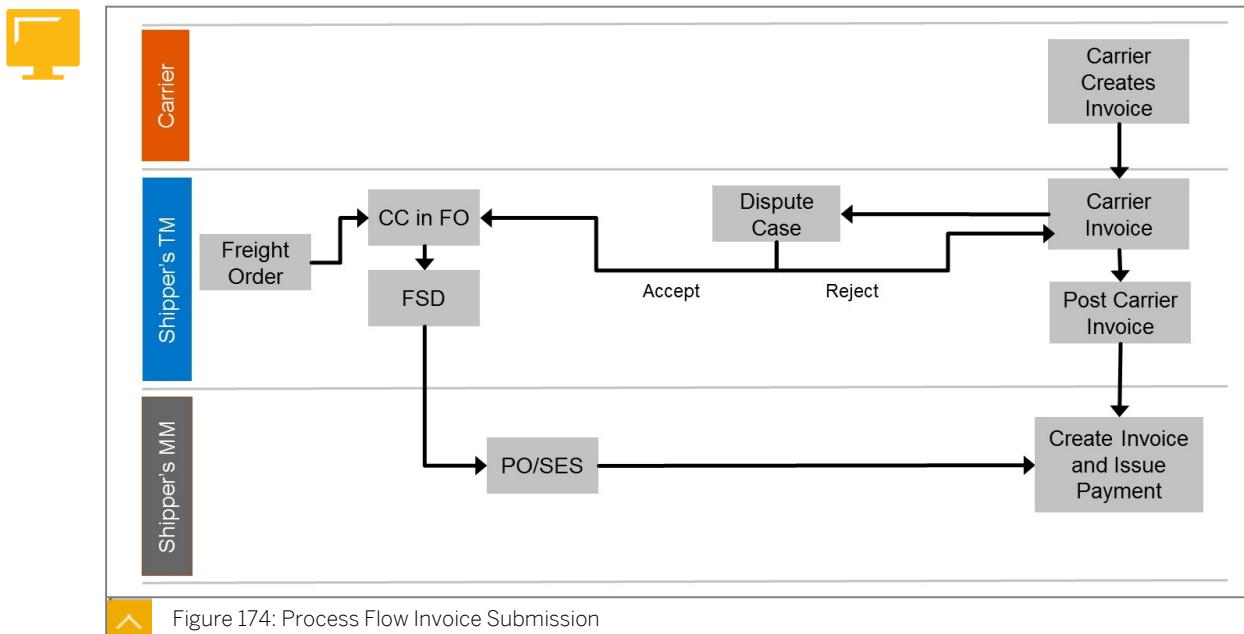


Figure 174: Process Flow Invoice Submission

In both processes, you can have differences and potential disputes between what you expect to pay against what the service provider expects to be paid. To keep good business relationships, you need to work closely with your service provider to resolve these differences in a collaborative way. You need to get clarification on what the differences are, and converge on an agreement with the service provider on how to resolve the differences.

In SAP Transportation Management (TM), you can use the invoice submission settlement process with enterprise services. You are a shipper who requests transportation services from your service provider. You can enable your service provider to use enterprise services to submit invoices for the freight orders that the service provider executes. The service provider creates an invoice document in their external system and uses enterprise services to send you the invoice. You use the external invoice to create a carrier invoice in the TM module of your SAP S/4 HANA system.

Your service provider may have included additional unplanned freight costs, or may have different charges to what you expect to pay in your freight order. Your SAP TM system automatically evaluates the external invoice. It automatically creates a dispute case when your service provider submits an invoice that contains different values to what you expect.

The system captures these differences in a dispute case. The system captures the individual differences in charges as dispute items.

On the dispute case screens, you, as a shipper, can approve or reject a dispute case. Open the *Settlement → Dispute Cases Worklist* app from the launchpad.

If you approve a dispute case, the system updates the freight order with information for the charge type, such as rate and quantity information. However, the system does not update logistics information, such as gross weight, gross volume, and total distance of the freight order.

When you resolve disputes early, you have the following business advantages:

- Inclusion of changes and unplanned costs in one invoice
- Accuracy in payment to the service provider

Invoice Dispute Management

The following are the typical steps that can happen in an invoice submission process:

- SAP Transportation Management (TM) creates a freight settlement document for a freight order and posts the freight settlement document to Materials Management (MM). For example, you have specified an event in your organization where the system triggers the creation and transfer of a freight order when a freight order gets into execution.
- You can use the background processing function *Creation and Transfer of Freight Settlement Documents* to create and transfer freight settlement documents.
- On posting, purchase order and service entry sheet (SES) entries are created for the freight settlement document.
- Your service provider uses enterprise services to submit an invoice in line with the terms you have agreed with your service provider.

SAP Transportation Management creates a carrier invoice in the shipper's system. The carrier invoice captures the invoice details submitted by your service provider. SAP TM creates a dispute case if your service provider submits an invoice in which there are charges that are different from the charges in the original freight order. The system links the dispute case to the carrier invoice.

The system does not create a dispute case if your service provider does not submit any changes against the charge amounts or logistics data in the carrier invoice.

- You work closely with your service provider and either accept or reject the dispute case for the carrier invoice. When the carrier invoice is successfully posted to Materials Management (MM), the life cycle status of the carrier invoice is set to Accepted.
 - You reject the carrier invoice when you do not agree with the service provider on the carrier invoice. If the carrier invoice has an associated open dispute case, the system closes the dispute case when you reject the carrier invoice. You can add a note to the carrier invoice to record the reason for your rejection.

The life cycle status of the carrier invoice is set to *Rejected*.

- You accept the dispute case for the carrier invoice.

SAP TM updates the freight order with the new or changed charges that are contained in the carrier invoice. You can use the background processing function *Creation and*

Transfer of Freight Settlement Documents to update the new or changed charges for the freight orders to MM.

- You use the background processing function Posting of Carrier Invoices to transfer the carrier invoices that are ready for posting to Materials Management (MM). The system creates an incoming invoice in MM. The system posts the carrier invoices to MM for posting only when the following conditions are satisfied:
 - No dispute case exists, or the dispute case has a life cycle status of *Resolved*.
 - The carrier invoice has a life cycle status of other than *Rejected*.
 - All the freight orders associated with the carrier invoice have the invoicing status *Completely Invoiced*.
 - All the freight settlement documents associated with the freight orders have the life cycle status *Accruals Posted*.
 - The carrier invoice has a block status of *Not Blocked*.
 - The carrier invoice has a consistency status of *Consistent*.

Freight Settlement Document Changes

There can be late changes in the freight order requiring changes to logistical data, which may result in a change in the charges (an increase or decrease). These changes can occur at the time when the old values are already transferred to settlement documents and / or the settlement documents have also been transferred to financials.

Business example:

Accruals are posted as soon as the financial liability is known (for example, departure or confirmed pickup of the freight by the carrier). However, there can be mid-execution changes (for example, diversions (consignee changes), loss of cargo (in transit), unavailability of cargo, unplanned costs due to detention, demurrages, loading and unloading activities, tolls, and so on).

These changes may only be known after execution or during the invoicing process (when carrier sends the invoice).



		Strategy 1: Reverse and Repost	Strategy 2: Create New Document for Delta Amount	
Document Type		Freight Order		Follow up Action
Freight Settlement Document	Invoicing Status/ Lifecycle Status	Partially Invoiced / Over Invoiced	Partially Invoiced	
	In Process / Ready for Accruals	Cancel the existing settlement document/item	None	Create new settlement document
	Accruals Posted/ Invoice Verified in ERP	Create credit memo to reverse settlement document/ item	None	Create new settlement document
	Not yet Transferred to ERP	Cancel the credit memo document/ item	None	Create new CM for the total amount in the FSD
Credit Memo	Transferred to ERP	Create credit memo for the remaining credit amount in FSD	None	Create new CM for the remianing credit amount in FSD

Figure 175: Freight Settlement Document — Update Strategies

The configuration of the FSD change process is done in the Settlement Profile.

When an order is changed and the invoicing status changes to *Over Invoiced*, the system automatically applies the reverse and repost strategy.



LESSON SUMMARY

You should now be able to:

- Generate a freight settlement document
- Post freight charges to MM
- Verify freight invoices

Distributing Costs

LESSON OVERVIEW

Freight costs incurred by the organization need to be allocated to individual cost or profit centres in SAP ERP so that profitability can be properly assessed. In this lesson you will examine the steps performed by the system in assisting the allocation of freight costs in SAP ERP. You will also examine how to distribute costs in a LSP scenario.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

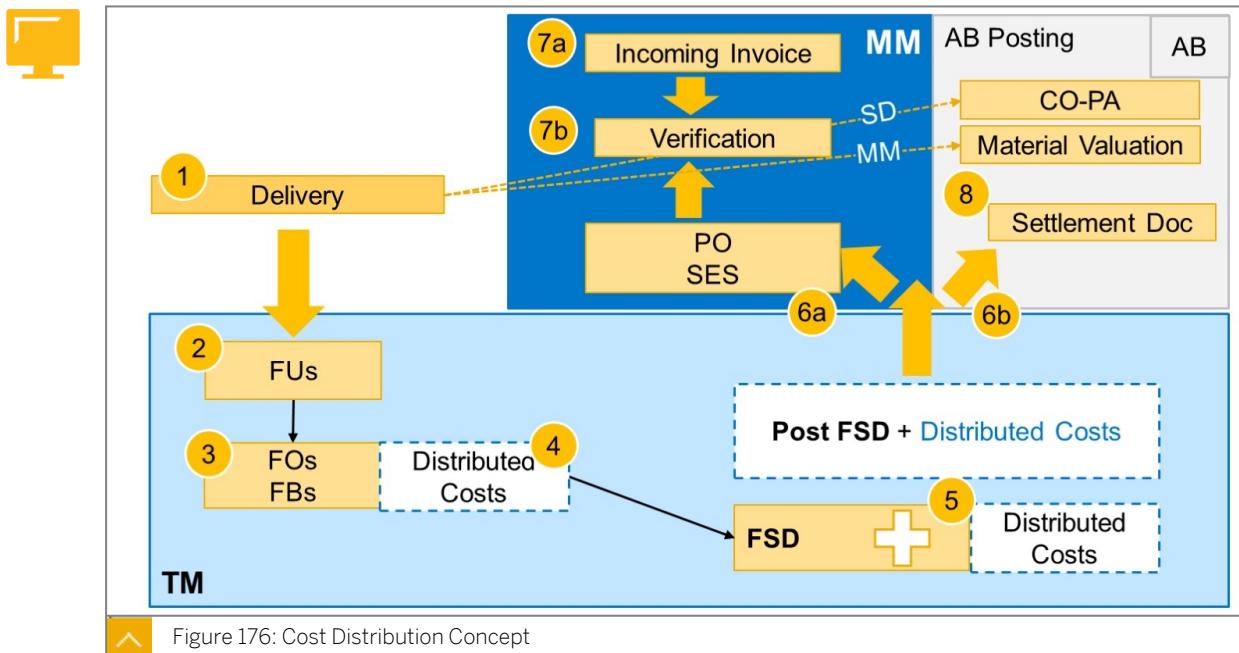
- Distribute freight costs
- Include freight costs into the SD billing document

Freight Costs

Freight costs incurred by the organization need to be allocated to individual cost or profit centers so that profitability can be properly assessed. In this lesson, you will examine the steps performed by the system in assisting the allocation of freight costs.

To compute true profitability for any manufacturing organization, all operational costs need to be computed correctly. Most organizations would like the freight costs for material procurement to be included in the material cost. Similarly, for customer deliveries, the freight cost for the delivery needs to be considered for margin and profitability computation. SAP TM can distribute each of the charges used in the freight cost calculation to the item level of the delivery. The item level cost then can be processed when the accrual is posted for the supplier freight invoices.

Cost Distribution Concept



The figure, Cost Distribution Concept, shows the data flow. Deliveries are the starting point for this process. These create freight units, which are subsequently planned to create freight orders or freight bookings. In addition to the charges in the freight order/booking, the calculated charges are distributed to the delivery items contained in the freight order/booking. Afterwards, freight settlement documents are created. When the FSD and distributed costs are posted, a purchase order and service entry sheet are created in MM for a subsequent invoice verification process. Additionally, a settlement document is created to post the entries to CO-PA, CO or material valuation.

Cost Distribution Configuration

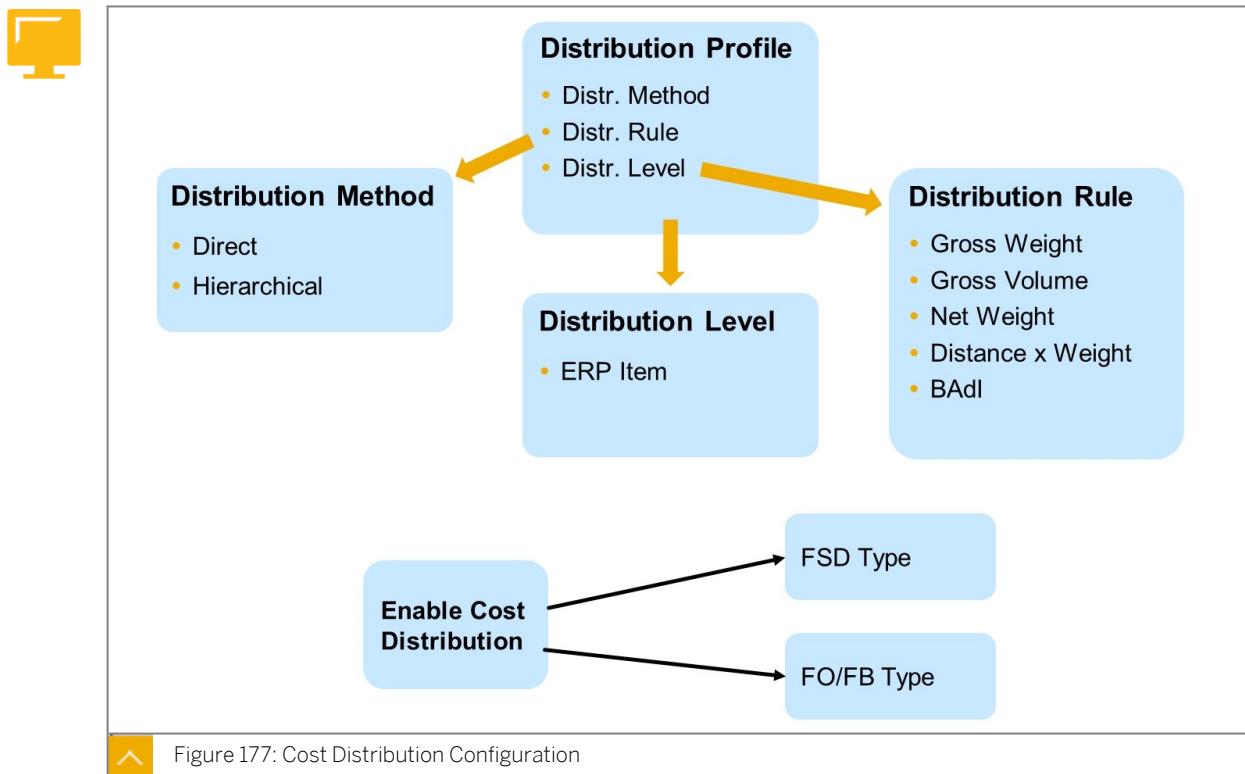


Figure 177: Cost Distribution Configuration

Cost distribution needs to be enabled in the Freight Order / Freight Booking / FSD type Customizing. Further settings for cost distribution include distribution profiles, methods, rules, and levels. The distribution profile is assigned to the organizational unit for charge calculation via the charges profile.

Cost Distribution Profiles, Methods, and Rules

Cost distribution profiles are used to identify the rules for distributing freight costs. A profile consists of distribution methods, distribution rules (basis for distribution), and distribution levels.

SAP TM provides two methods for cost distribution, as follows:

- Direct:

This method is normally used when all charges incurred can be distributed to individual line items of a delivery based on gross weight or volume. Normally, the charge elements may be calculated at the header or individual item level.

- Hierarchical:

This method may be used when the resolution base may include other levels, such as containers or rail cars. In such cases, there may be charges for the individual container or rail car, in addition to other charges. So, other charges need to be distributed to the container level first and then the final distribution should take place to allocate the cost to the line item level.

If required, you can add your own distribution methods.

SAP TM supports the following rule basis to be used for cost distribution:

- Gross Weight

- Gross Volume
- Net Weight
- Distance times Weight

The distribution level specifies the target level to which the system allocates transportation charges for a freight order or freight settlement document. In the basic shipping scenario, the distribution level is ERP item (delivery item).

Agency billing configuration needs to be completed before cost distribution data can be posted.

Posted data can be viewed using the transaction code `WLFLTM2` or via *Display Cost Distribution Documents*. Distribution data can be searched using the FSD number as the reference document number.

Various scenarios are supported, including the following:

- Transfer freight costs for inbound deliveries and stock transfers into material valuation.
- Post distributed costs to CO so that material-relevant costs can be tracked at the profit center level. (In such cases, material valuation is not impacted.)
- Post freight costs back to CO-PA for the customer outbound delivery to be accounted during profitability analysis.

Billing TM Freight Costs in SD

When you sell your products to a customer, you may also take the responsibility of delivering these products to that customer. For this, you incur costs for transportation, for example, through a carrier. You can pass on these costs to your customer.

You use integration of sales orders and deliveries to facilitate transportation planning and execution in SAP Transportation Management (TM). The SAP TM component creates or updates freight units directly for sales orders or deliveries. You plan transportation for these freight units by creating freight orders that you then subcontract to the carrier. The freight order determines the freight costs to be paid to the carrier. You configure SAP TM to distribute the freight costs in the freight order according to delivery items. You can then add the distributed costs for each delivery item to the final amount in the billing document that you send to your customer.

This involves integration of the following processes:

- Freight orders in TM
- Pricing in SD
- Billing in SD



Billing Freight Costs from TM to Customers in SD

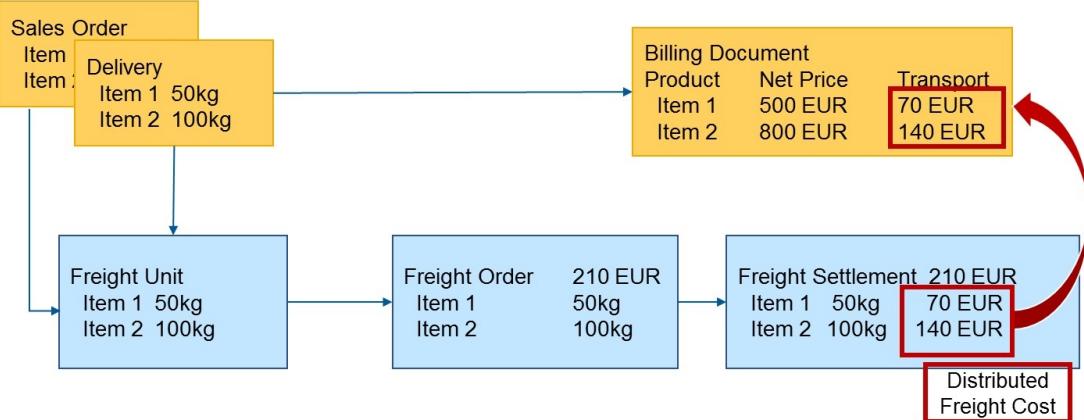


Figure 178: Billing TM Freight Costs in SD



Note:

You must integrate SD with an internal TM component to be able to include the freight cost in the billing document for all deliveries of products.

You can only include the freight cost in a billing document when you have one freight order document for the delivery and the freight order has only one currency in which you calculate the cost.



LESSON SUMMARY

You should now be able to:

- Distribute freight costs
- Include freight costs into the SD billing document

Calculating and Settling Charges in Forwarding Orders

LESSON OVERVIEW

In this lesson, you will examine how to calculate customer charges for forwarding orders. You will also examine how to initiate the customer settlement process.

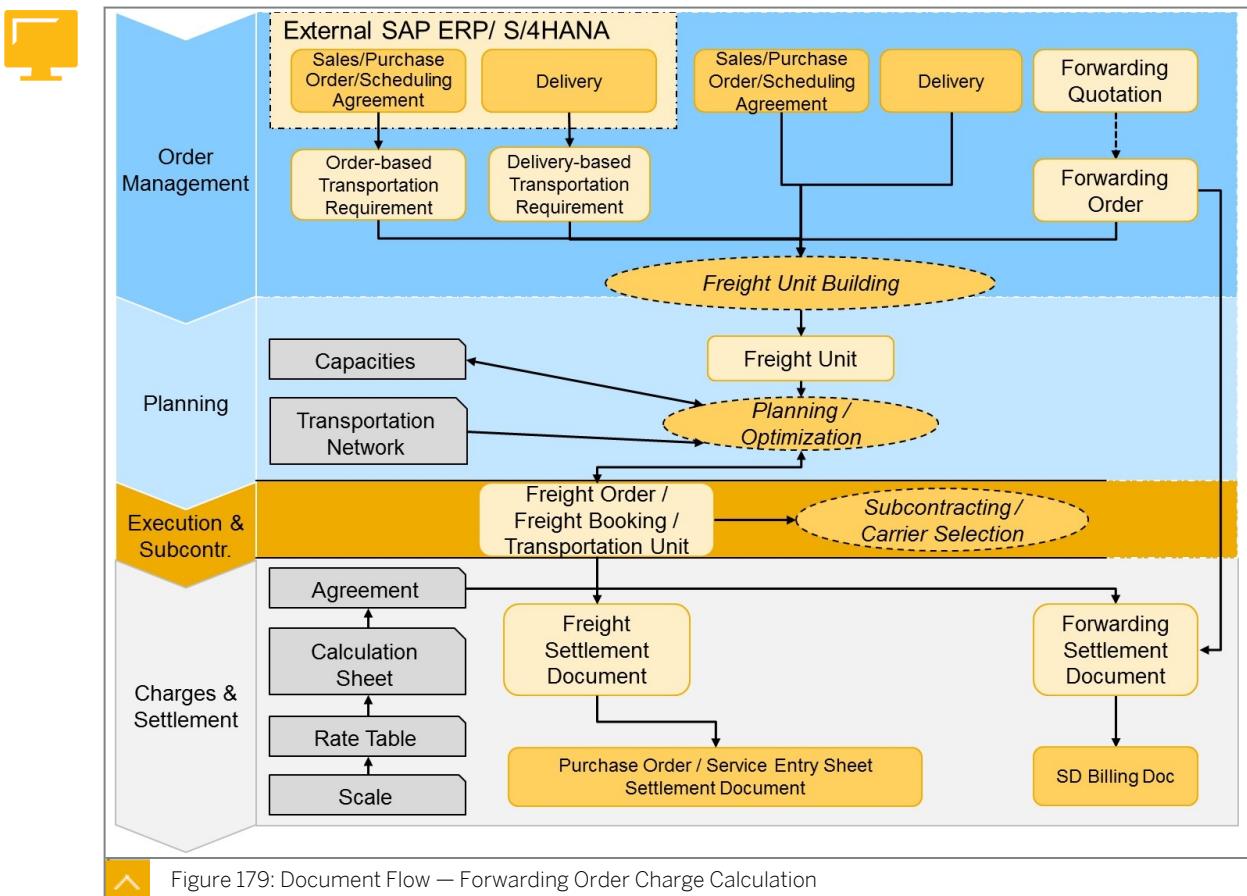


LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Identify how charges are calculated for a FWO
- Generate a forwarding settlement document
- Settle an internal charge

Charge Calculation in Forwarding Orders

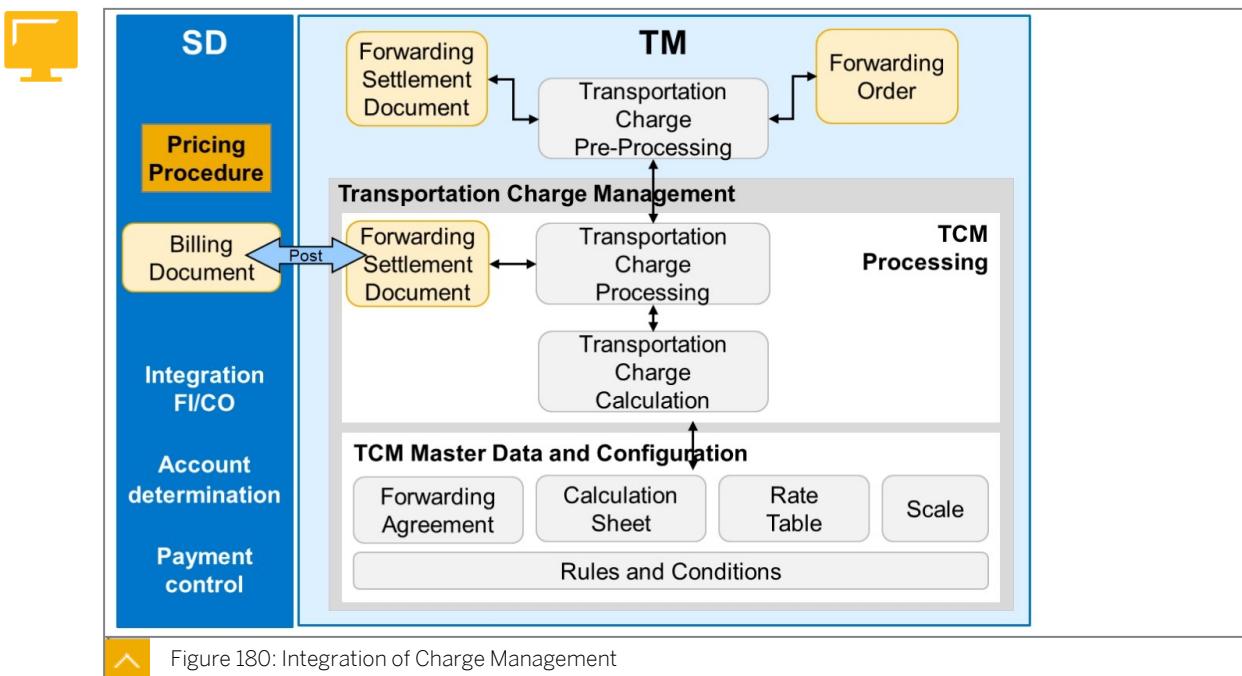


Transportation charge management in SAP TM calculates charges that customers are required to pay for the transportation services (and to the carrier), including the integration of invoice requests to SD. In the context of forwarding order (FWO) management, we are only concerned with the functionality of charge calculation and what the customer is supposed to pay for the transportation process entered in the FWO.

The charge calculation is enabled in the FWO type. Additionally, the charge calculation can be configured so that it runs automatically when the FWO is saved and when required changes to the document are made.

Integration of Charge Management

The charge calculation is carried out using the same charge calculation engine that is used for calculating supplier charges on a freight order/booking. Based on the customer (ordering party) and the sales organization of the FWO, a forwarding agreement is determined. Based on the forwarding agreement (FWA) and the FWO data, customer charges are calculated.



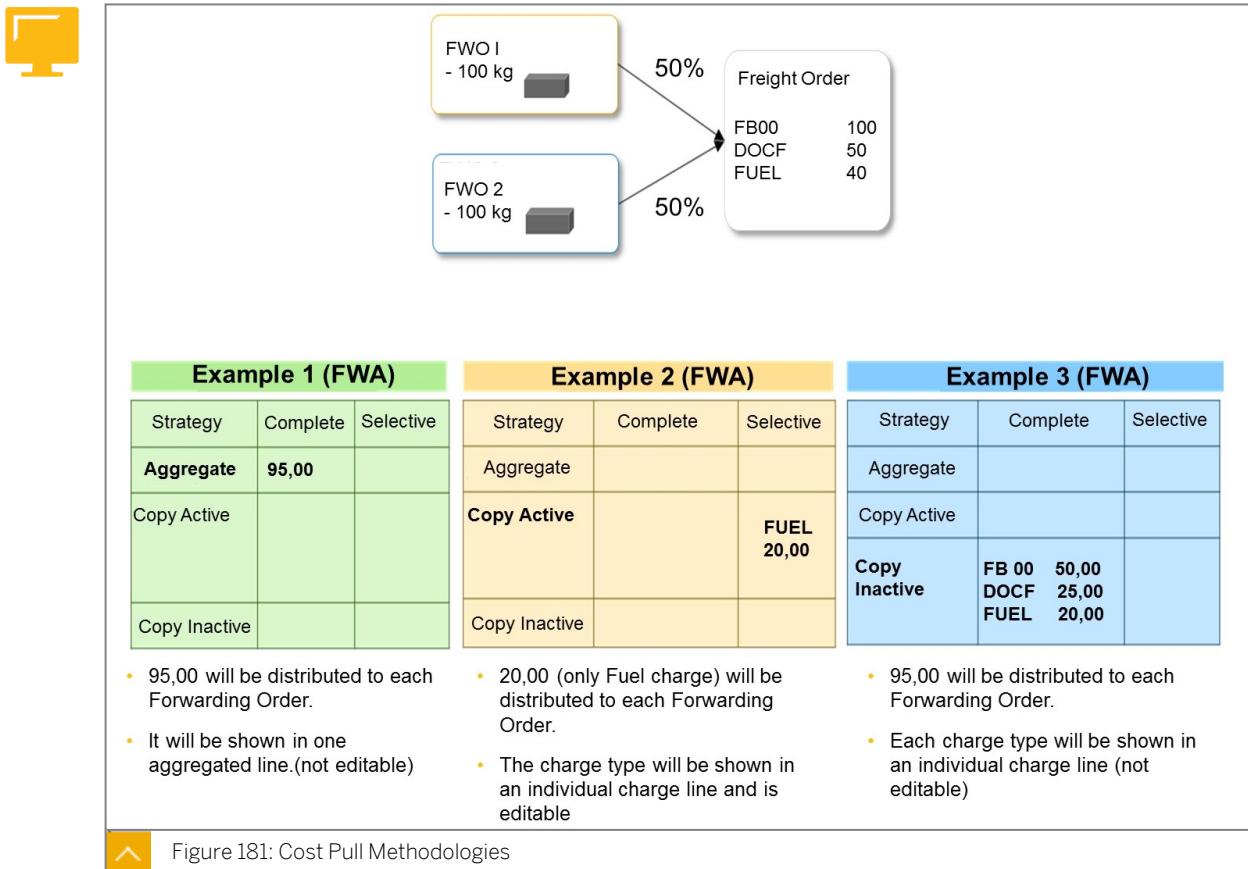
Forwarding Agreement

Forwarding agreements represent a long-term contract between a shipper and a customer who agrees to pay the contractual freight charges as reflected by the forwarding agreements. Agreements contain validity information, as well as organizational data and the relevant partners. The system determines the agreement based on preconditions. Agreement determination is based mainly on the partner relationship and the sales organization. You define which partner roles are relevant to the agreement in Customizing for Transportation Management. These roles are assigned to an agreement, and contain charge elements that will be applied. This helps to bill customers for transportation services and pay suppliers or carriers for subcontracted transportation services.

Forwarding House

The forwarding business requires forwarding organizations (for example, a branch or department) to act as a sales organization towards customers and as a purchasing organization towards the carriers from which they purchase transportation services. This requirement is met by an organizational unit function which provides both the sales and purchasing capabilities in a single organizational unit.

Cost Pull



The cost pull methodology allows costs that occurred on execution documents like Freight Orders (FOs) or freight bookings to be used by a FWO. In order to do so, the cost distribution is enabled. If several FWOs are consolidated into one FO, the cost distribution profile distributes the costs. If an agreement is made with the customer that some of the charges incurred by the logistics service provider (LSP) are charged to the customer, the cost pull methodology is used.

The cost pull methodology offers three different strategies, which are documented in the figure, Cost Pull Methodologies: aggregate, active copy and inactive copy. For each strategy, you can choose whether all of the costs or selective costs should be released to the FWO.

Customer Settlement

Forwarding Settlement Document

Once the charge calculation is performed, the charges can be invoiced to the customer.

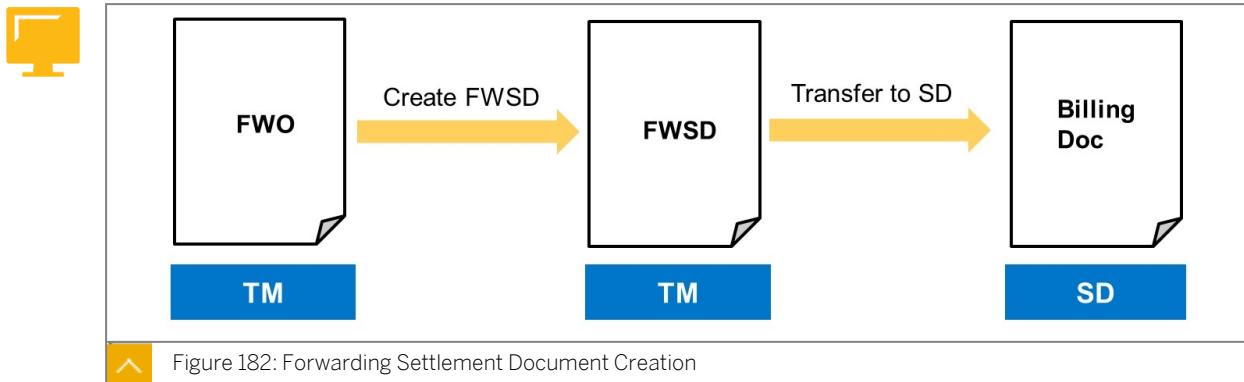


Note:

SAP TM does not create invoices, instead it creates forwarding settlement documents that are used to integrate with SD, where invoices are created.

From the forwarding order charges, a new document is created — the forwarding settlement document. Therefore, if you enable the charge calculation and the settlement (the settlement can be enabled separately) in the forwarding order type, you must also maintain the

document type of the forwarding settlement document that is created for the charges. The creation of this document is shown in the figure, Forwarding Settlement Document Creation.



The forwarding settlement document does not necessarily need to be created for all charges but several forwarding settlement documents can be created for one forwarding order, based on the settlement Customizing. It is also possible to create forwarding settlement documents collectively for several forwarding orders.

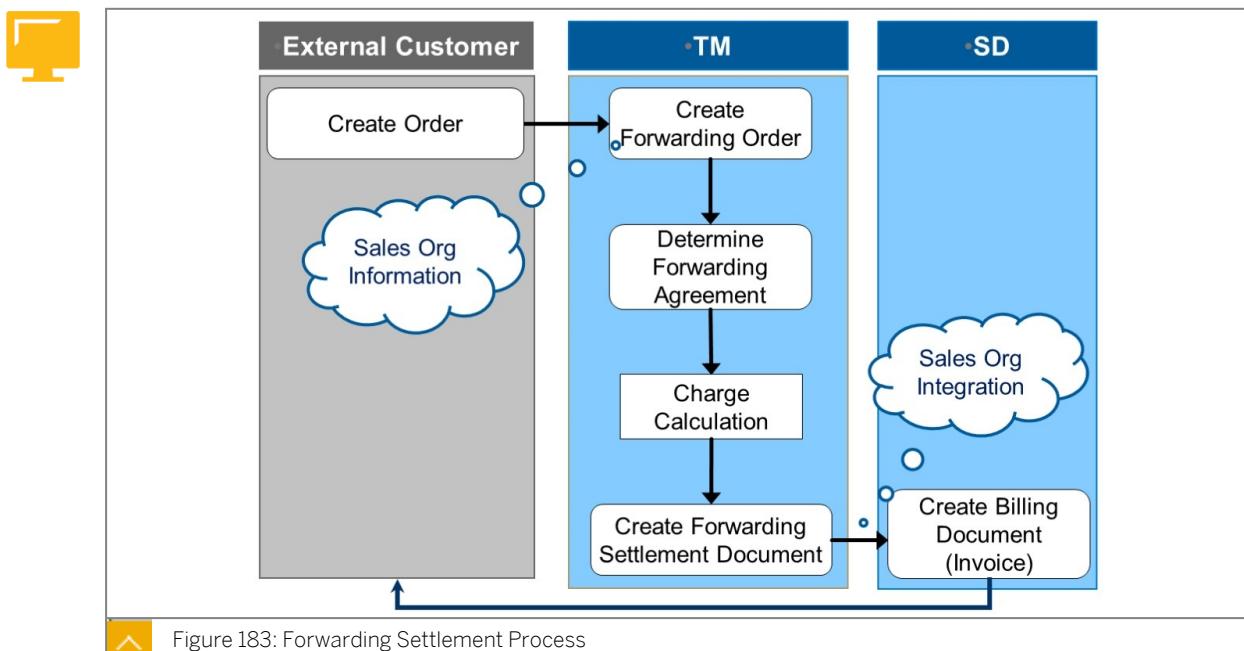
Forwarding Settlement Process

Business Case

A sales organization wants to create an invoice or billing document in SD for the services rendered to a customer.

Forwarding Settlement Document (FWSD)

A document created in SAP TM that can be transferred to SD to request the creation of an invoice to be sent to a customer.



An external customer sends an order to a freight forwarder. The freight forwarder creates a forwarding order in the SAP TM system. The charges in the forwarding order are calculated based on the relevant forwarding agreement. In this process, when it is time for the freight forwarder to initiate customer billing, a forwarding settlement document is created in SAP

TM. This is a preparatory document in SAP TM. The forwarding settlement document is transferred to SD. In SD, a billing document is created that forms the basis for integration with Financial Accounting and Controlling (FI and CO).



Note:

The charge calculation does not have to be triggered explicitly in the forwarding order; the calculation is completed automatically when the FWSD is created.

FWSD Change Process

Forwarding Settlement Document — Change Process

As a logistics service provider (LSP), you may need to make changes in your forwarding order process after you have billed your external customer in a forwarding settlement scenario. In SAP Transportation Management (SAP TM), you may need to change a forwarding order after you have created a forwarding settlement and after you have posted the settlement document.



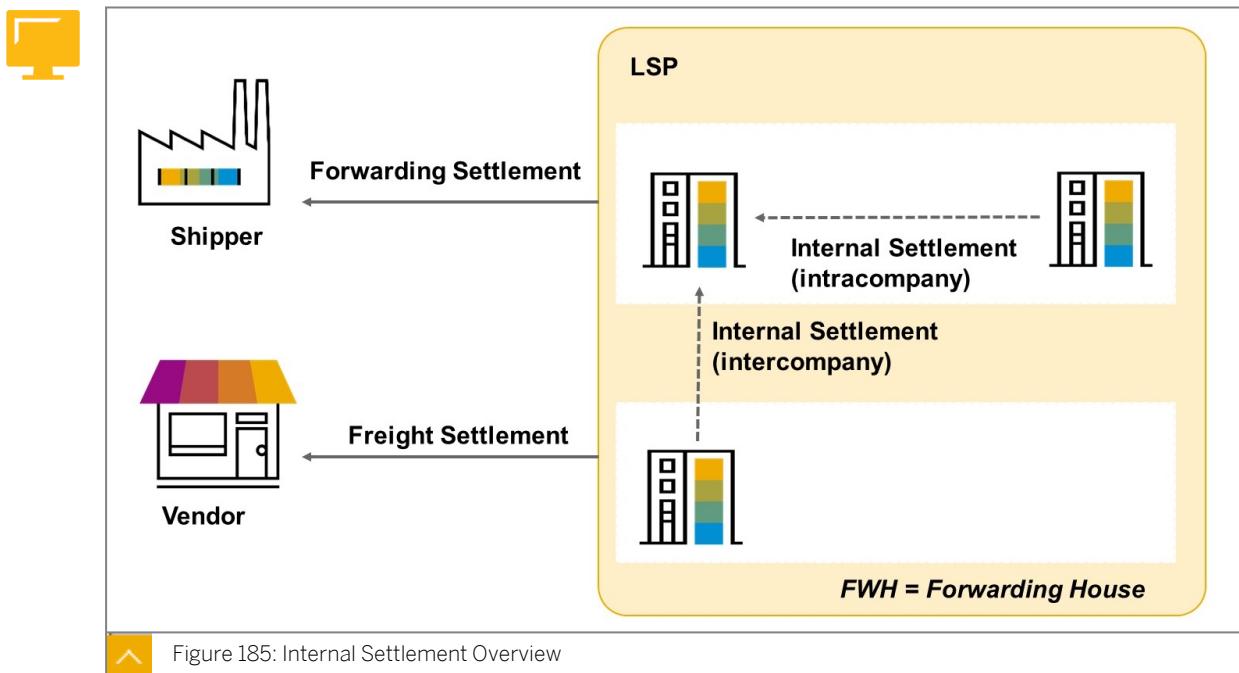
		Strategy 1: Reverse and Repost		Strategy 2: Create New Document for Delta Amount		Follow up Action	
Document Type		Forwarding Order					
Forwarding Settlement Document	Invoicing Status/ Lifecycle Status	Partially Invoiced / Over Invoiced	Over Invoiced	Partially Invoiced			
	Not yet Transferred to ERP	Cancel the existing settlement document/item	Cancel the existing settlement document/item	None	Create new settlement document		
Credit Memo	Transferred to ERP	Create credit memo to reverse settlement document/ item	Create credit memo to reverse settlement document/ item	None	Create new settlement document		
	Not yet Transferred to ERP	Cancel the credit memo document/ item	Cancel the credit memo document/ item	None	Create new CM for the total amount in the FSD		
	Transferred to ERP	Create credit memo for the remaining credit amount in FSD	Create credit memo for the remaining credit amount in FSD	None	Create new CM for the remainning credit amount in FSD		

Figure 184: Forwarding Settlement Document — Update Strategies

The configuration of the FWSD change process is done in the Settlement Profile.

Internal Settlement

In a logistics service provider, while the main business units take orders from customers, it is the gateway consolidation centers that consolidate shipments from various business units and create consolidated bookings with the ocean carrier.



This requires an internal settlement between the gateway and the business unit, because only the business unit is in contact with the customer. An internal settlement document can be sent from an internal organization in a company to another internal organization to recover costs incurred in delivering transportation services. In the standard internal settlement process, the internal settlement is between the purchasing organization of the freight order and the sales organization of the forwarding order.

In some cases, the business unit and the gateway belong to different company organizations. In this case the settlement is called an **intercompany settlement**.

When the business unit and the gateway belong to the same company organization, the settlement is called an **intracompany settlement**.



LESSON SUMMARY

You should now be able to:

- Identify how charges are calculated for a FWO
- Generate a forwarding settlement document
- Settle an internal charge

Settling Freight Charges in a Group Logistics Scenario

LESSON OVERVIEW

This lesson describes a group logistics company settlement.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe a group logistics scenario

Group Logistics Scenario

Companies are adopting various models to consolidate the transportation (and logistics) operations within a company to achieve various benefits.

Transportation and Logistics Consolidation Models



- Strategic reasons:
 - Better visibility of transport costs across the business units
 - Complete transportation demand visibility
- Consolidation:
 - Higher volume of better rates
 - Centralized handling of goods and logistical operations
- Standardization:
 - Tracking and tracing across the companies
 - Document handling and design across the companies

Embedded Logistics Service Providers (LSP) Scenarios

In the embedded LSP business scenarios, some organizational units take care of the logistical activities of the group company. These units can either be separate business units, exclusively managing the transportation activity, or business units that take care of transportation for their own needs and those of other business units.

This leads to a scenario in which such embedded organizational units need to take care of the settlement with carriers for outsourced transportation, as well the settlement with internal business units, billing them for the transportation service provided.

You need support for external and internal financial reporting of all such relevant financial transactions to reflect on the financial statements, such as balance sheet and profit and loss statements, and other management accounting statements.

Process Example

Company_C1, Company_C2, and Company_C3 belong to the same enterprise. Company_C1 manufactures product, but also provides a transportation service for Company_C2 and Company_C3.

Company_C2 and Company_C3 act as internal shipper companies, buying transportation services from Company_C1. Company_C1 acts as a forwarding house. It buys transportation services from Logistics_Service_Provider_LSP, and sells transportation services to Company_C2 and Company_C3.

SAP Transportation Management (TM) creates an order-based transportation requirement (OTR) or delivery-based transportation requirement (DTR) for each of the sales orders or deliveries that each company has in place with their respective customers in Sales and Distribution on an external SAP S/4HANA or SAP ERP system. Company_C1 then creates a freight order for the OTRs or DTRs, with itself as the purchasing organization in SAP TM. It sends the freight order to Logistics_Service_Provider_LSP.

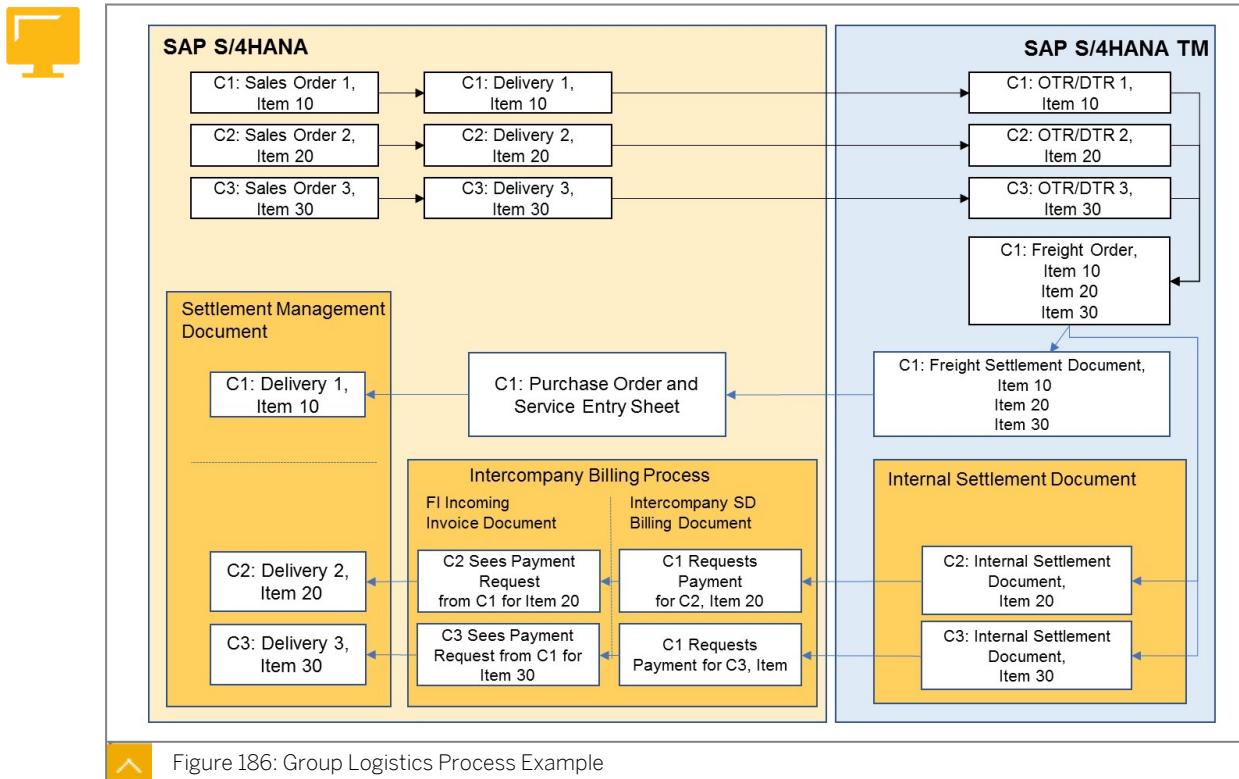
Logistics_Service_Provider_LSP collects the cargo at the warehouse and delivers the cargo to multiple destinations. The destination locations are geographically close together.

Logistics_Service_Provider_LSP sends an invoice to Company_C1 for the freight order.

Company_C1 pays Logistics_Service_Provider_LSP. Company_C1 uses the internal settlement process to recover the cost of providing the transportation service from Company_C2 and Company_C3.

In a group logistics scenario, Company_C1 can create and post internal settlement documents when the life cycle status of the freight order is *In Execution*.

To run a group logistics process, you must integrate orders based on orders created in Sales and Distribution (SD) or Materials Management (MM), and deliveries created in Logistics Execution (LE) from an external SAP S/4HANA or SAP ERP system with a TM component.





LESSON SUMMARY

You should now be able to:

- Describe a group logistics scenario

Managing Freight and Forwarding Agreements

LESSON OVERVIEW

In this lesson, you learn how SAP TM can support the process of negotiating long-term transportation contracts with customers and transportation service providers alike.



LESSON OBJECTIVES

After completing this lesson, you will be able to:

- Describe the process of strategic freight management

Strategic Freight Scenarios

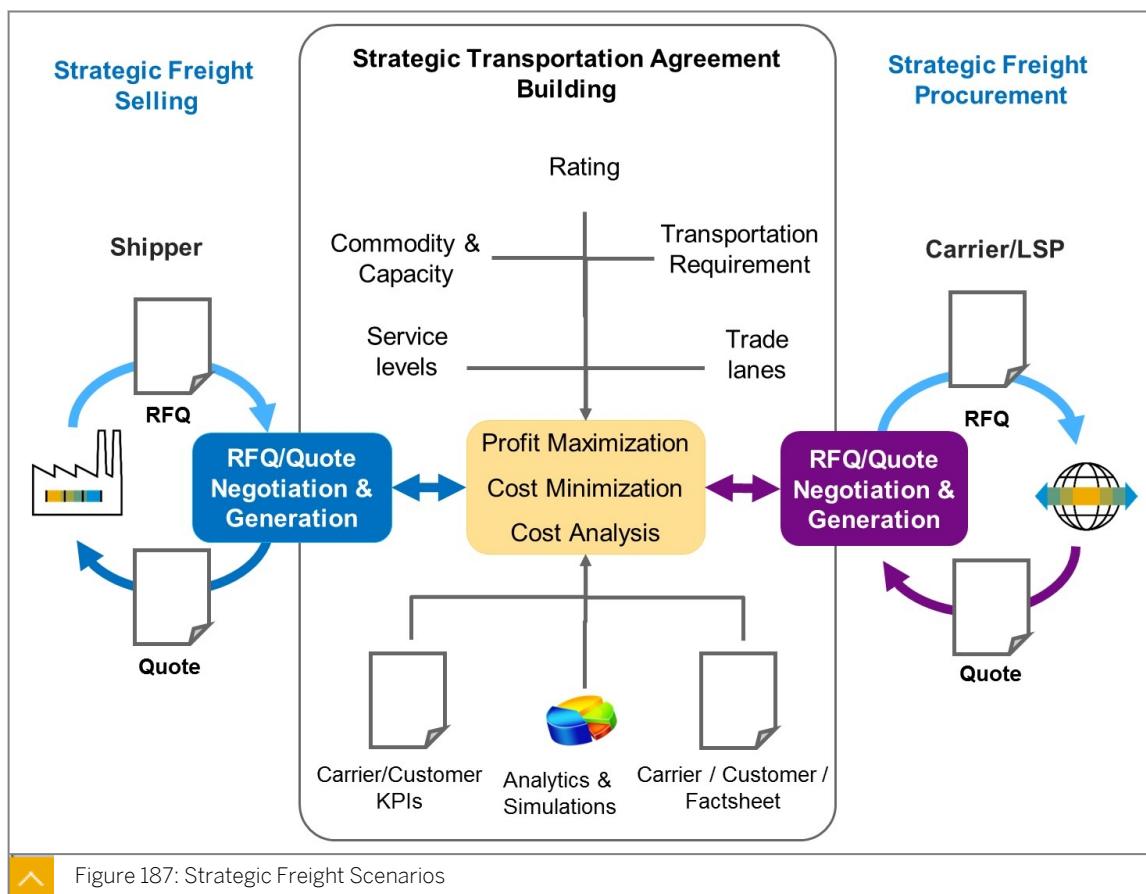


Figure 187: Strategic Freight Scenarios

Strategic Freight Management (SFM) impacts the scenario in which you propose, negotiate, and create agreements for long-term transportation service contracts with both transportation service providers and customers. SFM can be divided into two different processes, as follows:

- Strategic Freight Procurement

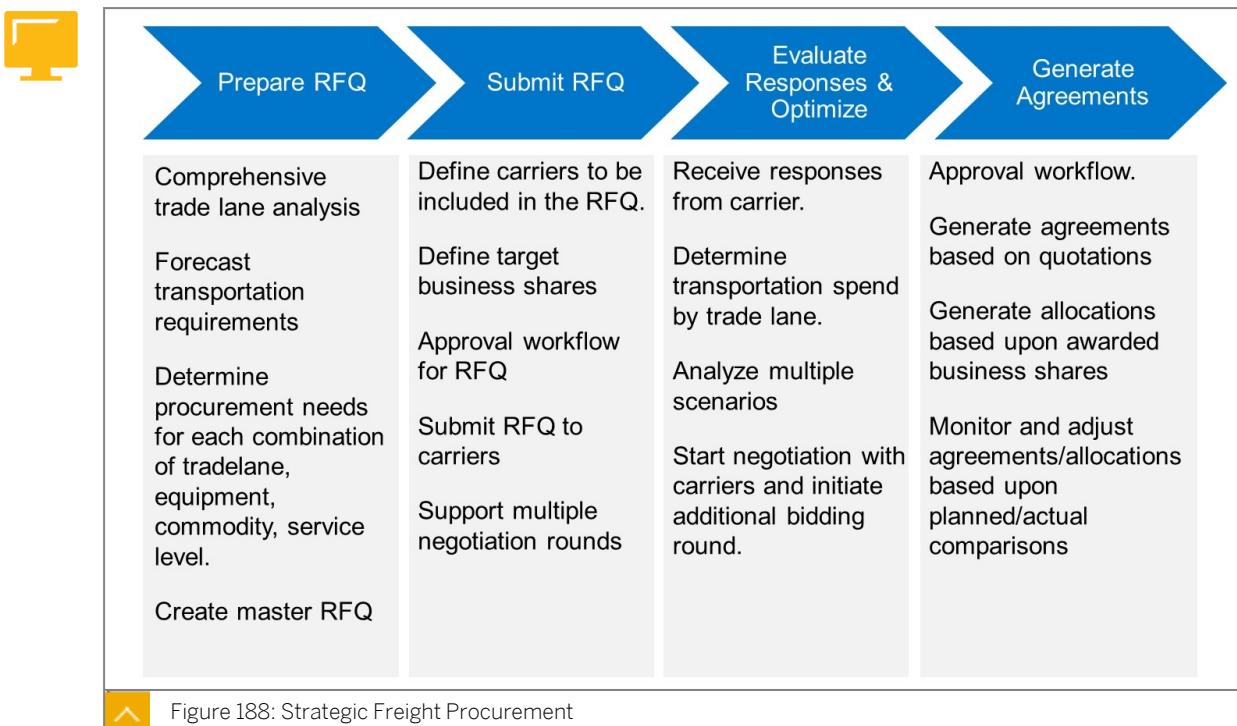
A shipper, using SAP TM, requests a contract proposal from one or several logistics service providers (LSPs), providing them with information such as requested volume and other prerequisites. This information is gathered by SAP TM in collaboration with SAP Analytics tools. The request for a contract is sent to the LSP as a Request for Quotation (RFQ) and is answered with a quote received from the LSP.

- Strategic Freight Selling

The LSP uses an SAP TM system and receives an RFQ from a customer. In this case, the LSP needs to compare the customer's request with the existing services offered and needs to find the matching service products, adapt them to the customer's needs, and respond by creating and sending an appropriate quote to the customer.

It is rather likely that only one of the two SFM scenarios are used in any specific company. However, both scenarios make use of Transportation Charge Management master data provided by SAP TM, or else create new master data for Transportation Charge Management.

Strategic Freight Procurement



Strategic freight procurement is tailored to support shippers (for the most part) to procure long-term transportation services from LSPs or carriers. However, LSPs can also use this scenario to procure transportation services from carriers, while offering transportation services to clients at the same time. The strategic freight procurement process is divided into four process steps, as follows:

- Prepare RFQ
- Submit RFQ
- Evaluate Responses and Optimize
- Generate Agreements

Prepare RFQ

In the first process step, the shipper prepares the procurement requirement. There is no interaction with carriers during this process step. The preparation step includes the analysis of historic transportation and turning the analysis into a forecast for the forthcoming period. Once the procurement need or requirement has been determined, the shipper divides the requirement into different scenarios, separated by trade lanes, commodity codes, transportation modes, and so on. The preparatory work up to this point does not necessarily need to be done in an SAP TM system. The analysis of historic data, forecast of transport volumes, and classification of procurement needs could also be carried out in legacy systems. As the final task of the first process step, the central document for the strategic freight procurement process, the Freight Agreement Master RFQ is created. All procurement needs and their classifications are entered in this master RFQ.

Submit RFQ

In the second process step, the interaction with carriers begins. Carriers supposed to take part in the strategic freight procurement process are added to the Master RFQ and, if needed, target business shares are assigned amongst them. After an optional approval step inside the purchasing organization, the individual RFQs are created for each carrier and sent.

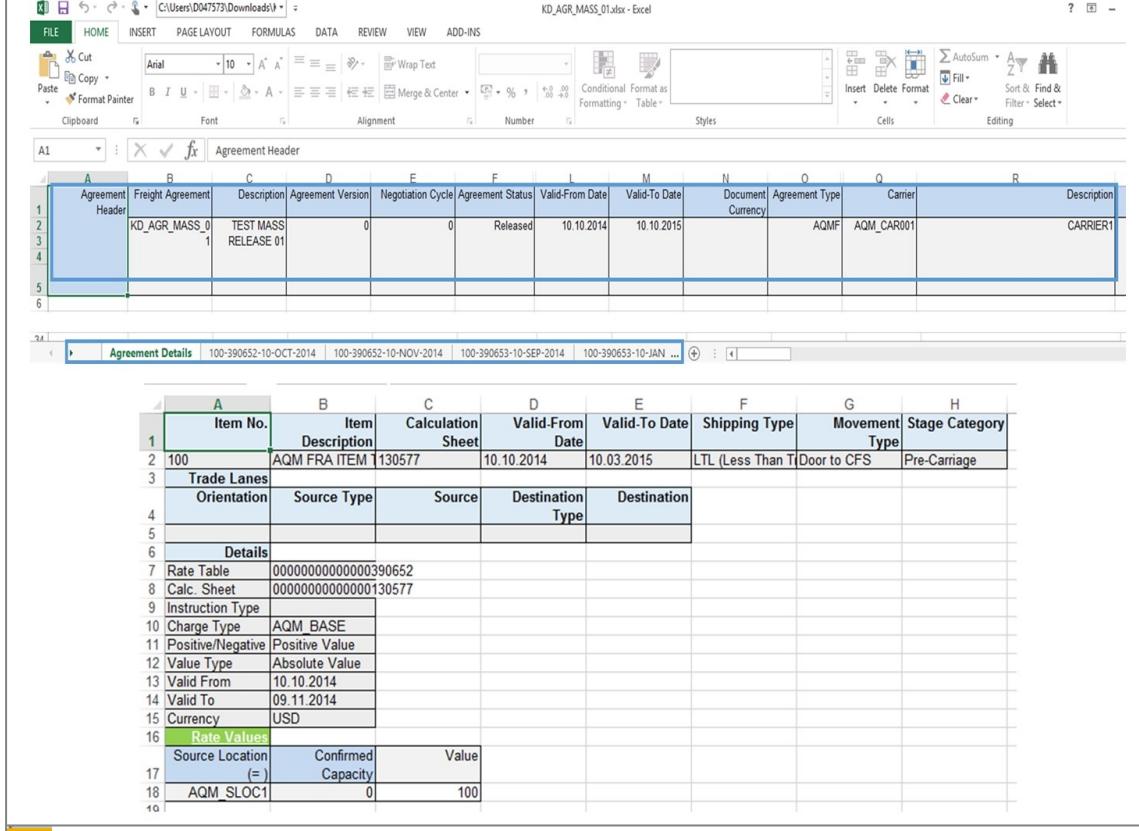
Evaluate Responses and Optimize

Once the carriers have responded to the RFQ, the responses can be evaluated and compared. The SAP TM system supports the comparison by creating ranking lists and suggesting the optimal business shares. Negotiation rounds with carriers can also be started from here.

Generate Agreements

Once the optimal business shares and carriers are selected for the next period, they can be awarded. Awarding the carriers in the SFP process means freight agreements are generated for them. Freight agreements act as the contract between shipper and carrier.

Freight Agreement Microsoft Excel Integration



The screenshot shows a Microsoft Excel spreadsheet titled "KD_AGR_MASS_01.xlsx - Excel". The "Agreement Header" tab is selected, displaying the following data:

Agreement Header	Freight Agreement	Description	Agreement Version	Negotiation Cycle	Agreement Status	Valid-From Date	Valid-To Date	Document Currency	Agreement Type	Carrier	Description
KD_AGR_MASS_01	TEST MASS RELEASE 01		0	0	Released	10.10.2014	10.10.2015		AQM	AQM_CAR001	CARRIER1

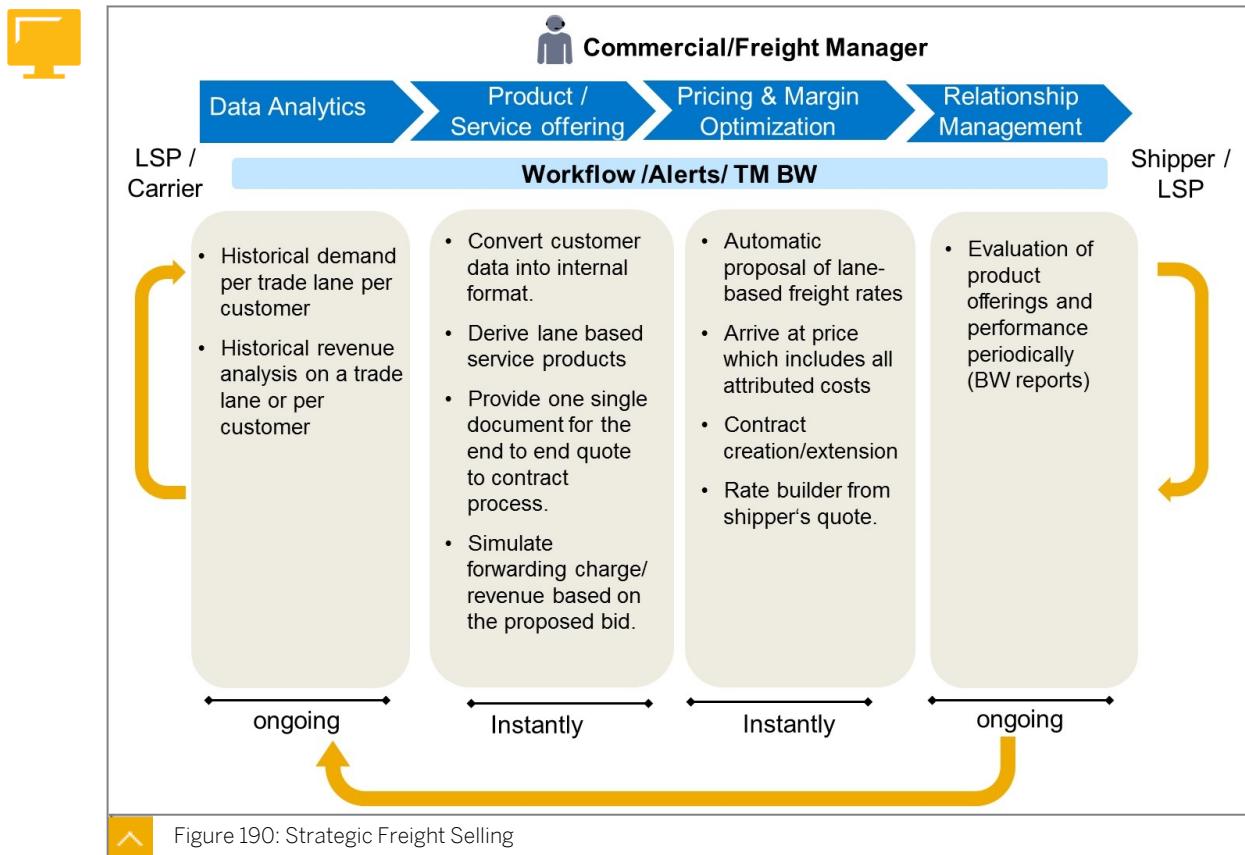
The "Agreement Details" tab is also visible, showing a detailed breakdown of the agreement. The table structure includes columns for Item No., Item Description, Calculation Sheet, Valid-From Date, Valid-To Date, Shipping Type, Movement Type, and Stage Category.

A	B	C	D	E	F	G	H
Item No.	Item Description	Calculation Sheet	Valid-From Date	Valid-To Date	Shipping Type	Movement Type	Stage Category
100	AQM FRA ITEM	130577	10.10.2014	10.03.2015	LTL (Less Than Truckload)	Door to CFS	Pre-Carriage
Trade Lanes	Orientation	Source Type	Source	Destination Type	Destination		
Details							
7 Rate Table	0000000000000390652						
8 Calc. Sheet	000000000000130577						
9 Instruction Type							
10 Charge Type	AQM BASE						
11 Positive/Negative	Positive Value						
12 Value Type	Absolute Value						
13 Valid From	10.10.2014						
14 Valid To	09.11.2014						
15 Currency	USD						
Rate Values							
17 Source Location (=)	Confirmed Capacity		Value				
AQM SLOC1	0		100				

Figure 189: Freight Agreement Microsoft Excel Integration

You can export the content of a freight agreement to a Microsoft Excel file.

Strategic Freight Selling



The strategic freight selling process also consists of four process steps that are designed to lead to a forwarding agreement (FWA). The steps are as follows:

- Data Analytics

Similar to the strategic freight procurement process, analysis of historic demand is crucial in allowing LSPs and carriers evaluate whether a trade lane is in demand. This analysis is not mandatory for the strategic freight selling process.

- Product / Service Offering

Once the RFQ has been received from the customer, the LSP creates the leading document for the strategic freight selling process, the Forwarding Agreement Quotation (FWAQ). This document contains all data requested by the customer.

- Pricing & Margin Optimization

Once the FWAQ has been created, the correct rates can be derived for the customer. Because the LSP already provides standard service product catalogs, the task of the sales agent is to determine the service products that match the customer's requirements. Once the matching service products are found, the corresponding rates are drawn from the service product into the FWAQ, where it can be amended if the customer requires some deviations from the standard services or has a particular discount applied. If the customer accepts the offer and signs a contract, the FWAQ is turned into a forwarding agreement which acts as a contract between the LSP and the shipper.

- Relationship Management

Similar to the data analytics process step, the customer's orders are monitored in order to decide whether the currently offered services and volumes are appropriate for the customer. Data analytics and relationship management are ongoing processes, while product or service offering, and pricing and margin optimization are instant process steps initiated by a customer's RFQ.



LESSON SUMMARY

You should now be able to:

- Describe the process of strategic freight management

Learning Assessment

1. Which of the following charge lines can a charge type classify?

Choose the correct answers.

- A Whether a charge line can be a positive or a negative value
- B Whether a charge line can be an absolute value or a percentage value
- C Whether the charge line has a default calculation base
- D Whether the charge line has a minimum amount and a maximum amount

2. Scales have a 1:1 relationship to rate tables.

Determine whether this statement is true or false.

- True
- False

3. Based on what you have learned about calculation sheets, which of the following options are true?

Choose the correct answers.

- A The CS is closely connected to rate tables and scales.
- B The CS provides a clear view on how the final amounts owing to carriers are arrived at.
- C Even though the final amounts for two deliveries, A and B, may vary according to the specifics of each individual delivery, the underlying rationale as defined in the CS may be the same.
- D A new CS must be created for each delivery.

4. Using a rate table, a rate can be determined based on different dimensions.

Determine whether this statement is true or false.

- True
- False

5. When calculating carrier charges in a freight order, the freight agreement is determined based on what?

Choose the correct answers.

- A Sales organization
- B Purchasing organization
- C Carrier
- D Ordering party

6. If you assign a calculation profile to an organizational unit and to a business partner role, which calculation profile is applied during charge calculation?

Choose the correct answer.

- A The system applies the profile assigned to the organizational unit.
- B The system applies the profile assigned to the business partner.
- C Depending on the scenario, the system will apply the relevant profile.
- D The system applies both and determines which profile is cheaper and uses that.

7. During freight settlement, a separate FSD is created for every freight order.

Determine whether this statement is true or false.

- True
- False

8. Which of the following business documents are created when posting a freight settlement document?

Choose the correct answers.

- A Sales order
- B Purchase order
- C Service entry sheet
- D Shipment cost document

9. Which of the following options are methods of cost distribution provided in SAP TM?

Choose the correct answers.

- A Direct distribution
- B Indirect distribution
- C Hierarchical distribution
- D Sequential distribution

10. Cost distribution takes place in which of the following documents?

Choose the correct answers.

- A Freight order
- B Freight booking
- C Freight settlement document
- D Delivery

11. When calculating charges in a forwarding order, the forwarding agreement is determined based on what?

Choose the correct answers.

- A Sales organization
- B Purchasing organization
- C Carrier
- D Ordering party

12. When transferring a forwarding settlement document to SD, a billing document is created in SD.

Determine whether this statement is true or false.

- True
- False

13. A forwarding agreement is used to define the contractual agreement between you and the carrier you sub-contract to deliver goods. It forms the basis of the charges payable by you to the carrier.

Determine whether this statement is true or false.

- True
 False

14. In the embedded LSP business scenarios, some organizational units take care of the logistical activities of the group company. These units can either be separate business units, exclusively managing the transportation activity, or business units that take care of transportation for their own needs and those of other business units.

Determine whether this statement is true or false.

- True
 False

15. SAP TM supports the negotiation and creation of agreements for long-term transportation service contracts with both transportation service providers and customers.

Determine whether this statement is true or false.

- True
 False

Learning Assessment - Answers

1. Which of the following charge lines can a charge type classify?

Choose the correct answers.

- A Whether a charge line can be a positive or a negative value
- B Whether a charge line can be an absolute value or a percentage value
- C Whether the charge line has a default calculation base
- D Whether the charge line has a minimum amount and a maximum amount

Correct. A charge type can define whether a charge line is positive/negative, whether it is absolute/relative, or it can default a calculation base.

2. Scales have a 1:1 relationship to rate tables.

Determine whether this statement is true or false.

- True
- False

Correct. There can be multiple scales assigned to one rate table.

3. Based on what you have learned about calculation sheets, which of the following options are true?

Choose the correct answers.

- A The CS is closely connected to rate tables and scales.
- B The CS provides a clear view on how the final amounts owing to carriers are arrived at.
- C Even though the final amounts for two deliveries, A and B, may vary according to the specifics of each individual delivery, the underlying rationale as defined in the CS may be the same.
- D A new CS must be created for each delivery.

Correct. It is not necessary to create a new CS for each and every delivery.

4. Using a rate table, a rate can be determined based on different dimensions.

Determine whether this statement is true or false.

True

False

Correct. The statement is true. A rate can be determined based on up to 14 dimensions.

5. When calculating carrier charges in a freight order, the freight agreement is determined based on what?

Choose the correct answers.

A Sales organization

B Purchasing organization

C Carrier

D Ordering party

Correct. The freight agreement is determined for the purchasing organization and carrier of the freight order.

6. If you assign a calculation profile to an organizational unit and to a business partner role, which calculation profile is applied during charge calculation?

Choose the correct answer.

A The system applies the profile assigned to the organizational unit.

B The system applies the profile assigned to the business partner.

C Depending on the scenario, the system will apply the relevant profile.

D The system applies both and determines which profile is cheaper and uses that.

Correct. If calculation profiles are assigned to the business partner and the organizational unit (via the charges profile), the one assigned to the business partner takes precedence.

7. During freight settlement, a separate FSD is created for every freight order.

Determine whether this statement is true or false.

True

False

Correct. Collective settlement is also supported.

8. Which of the following business documents are created when posting a freight settlement document?

Choose the correct answers.

- A Sales order
- B Purchase order
- C Service entry sheet
- D Shipment cost document

Correct. Posting a freight settlement document will create a purchase order and service entry sheet.

9. Which of the following options are methods of cost distribution provided in SAP TM?

Choose the correct answers.

- A Direct distribution
- B Indirect distribution
- C Hierarchical distribution
- D Sequential distribution

Correct. In standard, SAP TM supports direct or hierarchical cost distribution.

10. Cost distribution takes place in which of the following documents?

Choose the correct answers.

- A Freight order
- B Freight booking
- C Freight settlement document
- D Delivery

Correct. Cost distribution can take place in freight orders/bookings and freight settlement documents.

11. When calculating charges in a forwarding order, the forwarding agreement is determined based on what?

Choose the correct answers.

- A Sales organization
 B Purchasing organization
 C Carrier
 D Ordering party

Correct. The forwarding agreement is determined based on the sales organization and the ordering party.

12. When transferring a forwarding settlement document to SD, a billing document is created in SD.

Determine whether this statement is true or false.

- True
 False

Correct. When transferring a forwarding settlement document to SD, a billing document is created in SD.

13. A forwarding agreement is used to define the contractual agreement between you and the carrier you sub-contract to deliver goods. It forms the basis of the charges payable by you to the carrier.

Determine whether this statement is true or false.

- True
 False

Correct. The description here refers to a freight agreement, not a forwarding agreement.

14. In the embedded LSP business scenarios, some organizational units take care of the logistical activities of the group company. These units can either be separate business units, exclusively managing the transportation activity, or business units that take care of transportation for their own needs and those of other business units.

Determine whether this statement is true or false.

- True
 False

Correct. These business units can either be separate business units, exclusively managing the transportation activity, or business units that take care of transportation for their own needs and those of other business units.

15. SAP TM supports the negotiation and creation of agreements for long-term transportation service contracts with both transportation service providers and customers.

Determine whether this statement is true or false.

True

False

Correct. SAP TM supports the negotiation and creation of agreements for long-term transportation service contracts with both transportation service providers and customers using strategic freight management.