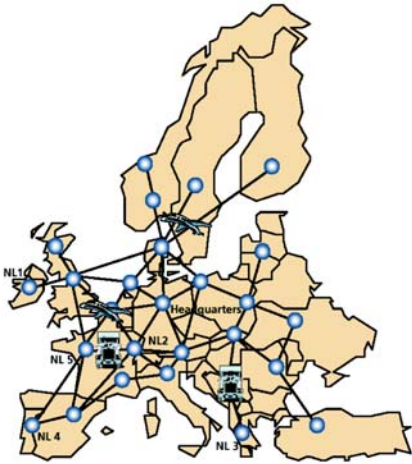


LS/ATN – Living Systems® Adaptive Transportation Networks



LS/ATN is a comprehensive solution for the dynamic optimization and dispatching of full and part truck loads. Delivering superior real-time visibility and dispatching decision support for distributed transportation networks, LS/ATN reduces transportation costs, increases process efficiencies and improves resource utilization.

Business Challenge

Escalating transportation costs are a big challenge. Not only are operative costs continually rising, but the increasing complexity and dynamics of logistics networks motivate a cost-sensitive rethinking of process and optimization strategies. Identifying ways to minimize these costs should include the standardization of business processes and their support by IT solutions. Furthermore, market consolidation boosts the need to integrate established business structures and solution technologies. Handled effectively, this can result in significant savings. Successfully meeting these challenges, however, not only requires efficient processes, but also demands for software that is intrinsically capable of delivering advanced degrees of flexibility, dynamic response to change, and individuality.

A New Solution Approach

With its *Living Systems® Adaptive Transportation Networks (LS/ATN)* software, *Whitestein Technologies* offers a sophisticated software solution that addresses the needs of logistics companies operating in today's increasingly dynamic and unpredictable business world.

At the core of *LS/ATN* is a server-based dynamic optimization module, which implements an economic model tuned to strictly reduce costs. In doing so, it automatically pursues an escalation strategy, enlarging the search scope as needed to seek a global optimum. This way, an effective balance between individuality, scalability and optimization is achieved.

Product features

- Real-time, server-side route optimizer
- Supports hard and soft constraints
- Intermodal transport consideration
- Event management system proactively informs about a wide range of events as they occur
- Drag & drop dispatching
- Tracking facility provides accurate data about the progress of orders
- Simulation mode runs with real operational data
- Open n-tier architecture

Product benefits

- 5-10% lower transportation costs
- 30-50% higher process efficiency
- Improved optimization
- Faster and more accurate communication
- Increased ROI on equipment

<i>Key Features</i>	<i>Benefits of LS/ATN</i>
Dynamic real-time optimization	Continually produces optimized tours despite the dynamic and often volatile nature of the dispatching process
Hard and soft constraints	Allows finely tunable cost-benefit-balancing to handle constraints in a sensitive manner – as dispatchers do day-to-day
Server-side optimization	Displays optimized routes always to all dispatchers and thus avoids misalignment of optimized routes when several dispatchers work simultaneously (from several locations)
Intermodal transport consideration	All available capacities, including trains and ferries, are considered for optimal utilization
Event management	Real-time adoption of existing tour plans based on the handling of events
Drag & drop dispatching	Greatly simplifies the often cumbersome tasks associated with manual dispatching
Simulation mode	Supports tactical and strategic planning
Open n-tier system architecture	A flexible and scalable solution ready to be integrated into a Service Oriented Architecture (SOA)

Key Benefits of LS/ATN

LS/ATN has proven to *save 5-10% of annual transportation costs* under real world conditions and has lead to an *increased process efficiency of 30-50%*.

In overview, the quantitative and qualitative benefits of using LS/ATN are:

- ❑ Higher utilization of capacity
- ❑ Reduction in driven kilometers
- ❑ Increased process efficiency
- ❑ Automated, and thus reduced and improved, communication
- ❑ Improved customer service
- ❑ Managed service level fulfillment
- ❑ Instant scheduling details
- ❑ Scalability to cope with business growth
- ❑ Operational transparency in terms of quality, costs and profit

Multi agent system advantages

LS/ATN draws its strength from a multi agent system core. Built on a bottom-up optimization philosophy, goal-directed software agents interact to dynamically solve sub-problems that, when consolidated, result in a solution to the overall problem. Similar to human decision-making, solutions to problems arise from the interaction of individual decision makers (represented by software agents), each equipped with their own local knowledge.

The centralized and rule-based nature of traditional IT systems imposes intrinsic limits on dealing successfully with unpredictability. Multi agent systems do not suffer from this limitation because collaborating agents quickly adapt to changing circumstances and operational constraints.

The advantages of the LS/ATN multi agent system approach, and the main differences to most existing logistics solutions, are summarized as follows:

- ❑ **Methodological grounding** designed for creating software systems that must operate in dynamic and unpredictable business environments;
- ❑ **Distributed, collaboration-based infrastructure**, unlike the monolithic, centralized approaches of traditional IT systems;
- ❑ **Superior scalability** than traditional IT systems, as software agents adapt quickly to changing circumstances and do not suffer from a “complexity limit”;
- ❑ **Higher cost savings potential** than traditional IT systems because agents thrive on complexity; also, higher potential for scalability pays greater dividends as complexity increases;
- ❑ Anthropomorphic interpretation of system recommendations: The ROI of a Transport management system (TMS) depends crucially on the acceptance rate of system recommendations. A multi agent TMS replaces cryptic mathematical operations with **human-like collaborative decision making**. Dispatchers are more likely to accept recommendations from IT systems that they can intuitively understand.

Easy to use user interface

However, sophisticated IT systems are only part of the solution. The other crucial part consists of dispatching tasks that are often performed manually. A TMS not only has to be technologically mature, but also support dispatchers in their daily routine.

An intuitive user interface provides a single environment for the dispatcher to execute tasks such as order entry, capacity (vehicle) procurement, billing, tracking and event handling. Streamlining of these tasks results in a significant degree of system transparency, far greater than possible with other TMS.

Key Functionalities

Overview

LS/ATN streamlines the entire dispatching process by providing a single point of access to the execution of all essential dispatching tasks, including drag & drop for manual dispatching.

The strengths of LS/ATN emerge from the core technology employed “under the hood”, i.e., in areas that dispatchers do not directly access.

The bottom-up design principle of the LS/ATN multi agent system allows the optimization process to be very efficient. The optimized dispatching of a new order, for example, typically only affects tours that are immediately implicated and exert no influence on the overall tour plan. Local search saves computer resources and significantly speeds up the optimization process without compromising the overall result. Of course,

LS/ATN can also optimize entire tour plans in the event that new orders have consequences with further reaching impact.

Two aspects of the automatic LS/ATN optimizer require a special mention:

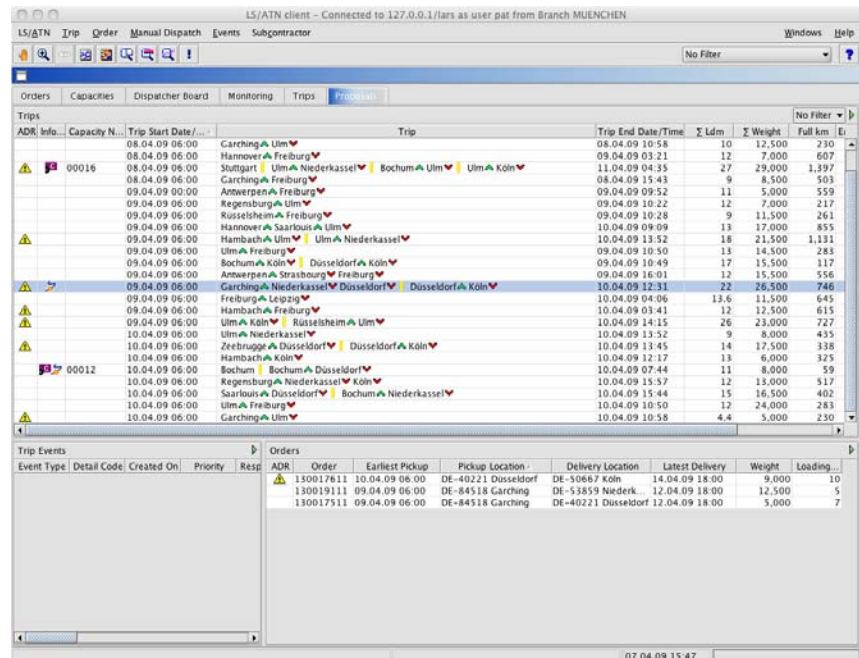
- ❑ Firstly, many factors contribute to the dispatching decision process (e.g., depot opening times and the maximum driving time of truck drivers). The LS/ATN optimizer captures this complexity by considering such factors as constraints within a constraint satisfaction mechanism. This can also be applied in the context of manual dispatching.
- ❑ Secondly, optimization is performed on a central server (or server cluster), so that all connected dispatchers have access to the same optimized tours. Server-side optimization avoids the “conflicting information” pitfalls induced by individual optimization stations (client-side optimization).

The following sections go into the details of the main functionalities of LS/ATN.

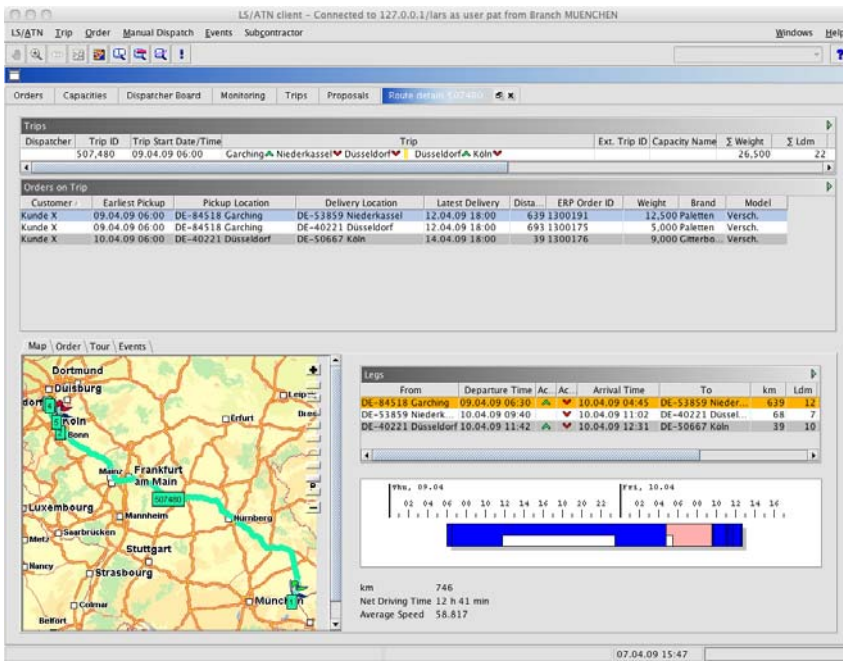
Route optimization

When creating tours, the optimal (most cost-effective) sequence of order collections and deliveries is determined for each vehicle. Tour production and optimization employs a distance matrix used to generate distances and corresponding driving times. The optimization process consists of three main components:

- ❑ **Order consolidation:** In the course of creating and optimizing tours, orders are consolidated into larger units.
- ❑ **Part load merging:** Using part load combinations (to avoid the increased loading meter costs of part loads), an optimal utilization of capacities is achieved.
- ❑ **Intermodal transport:** LS/ATN considers different transportation modes.



Tour proposal screen: All tours that are in the queue for checking and approval are also linked to their respective current events (Event Monitor)



Route Details: This view gives the most comprehensive overview of a route. The dispatcher sees a route summary at the top, followed by the list of orders on this route. Below is the optional map of the route on the left side and the legs presented as a list and graph on the right side.

Hard and soft constraints

Constraints define the boundary conditions for the route optimization process. The *LS/ATN* optimizer operates with two types of constraints, hard and soft:

- ❑ Hard constraints manifest explicit conditions that the optimizer strictly observes when creating tours. Typical hard constraints include capacity limitations of vehicles and maximum driving times of drivers.
- ❑ Soft constraints are characterized by fuzzy boundaries which provide the optimizer with a certain degree of flexibility in determining the optimal route. Typical soft constraints include pickup and delivery times (which dispatchers handle very flexibly). Certain routes may be impossible to create with hard constraints on pickup times – soft constraints manage this effectively.

Event management

Dispatching is a highly dynamic process. Circumstances change quickly to an extent that original plans need to be updated without much reaction time. *LS/ATN* provides an event management system that continuously monitors information channels for incoming events. The system can respond to these events by providing tailored information according to the responsibility of each user. This guarantees optimal information dissemination to affected parties.

Two classes of events are differentiated:

- ❑ **Order-related events:** These events originate in the order management sub-system of *LS/ATN*. Examples include the possibility to add a newly arrived order to a tour already in progress, change an existing order, or cancel one altogether.
- ❑ **Capacity-related events:** Typical sources for capacity events are delays during the collection or delivery of goods and vehicle breakdowns.

Simulation

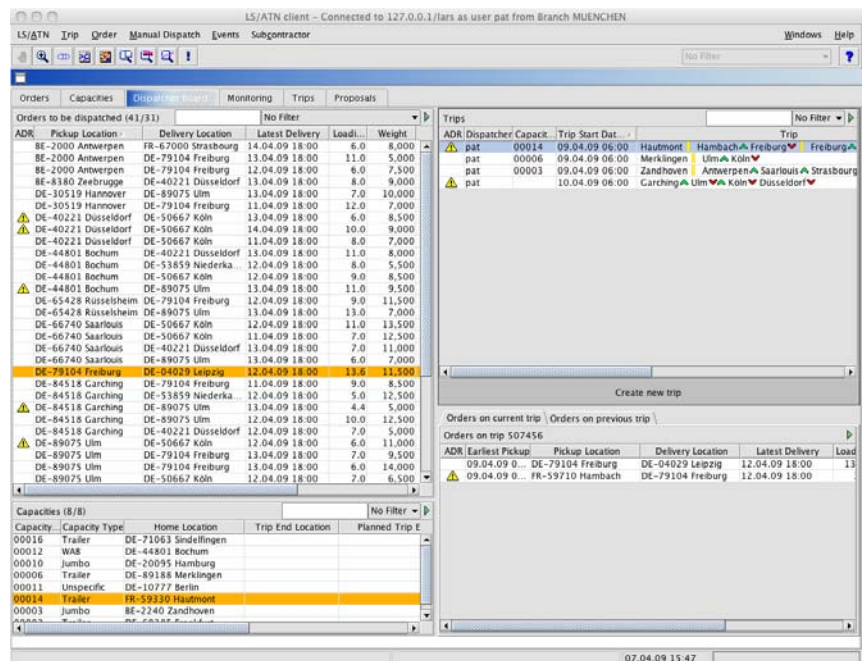
LS/ATN's agent-based route planning and optimization features provide for the operational decision making needs of logistics organizations. Tactical and strategic planning are used for mid- and long-term decision making.

By running *LS/ATN* in simulation mode, operators can easily answer “if-then” questions. The advantage held over traditional simulation systems is that *LS/ATN* uses exactly the same system setup and configuration as it does for real-time operations.

Dispatcher operations

Dispatchers are the key users of *LS/ATN* and much of its functionality is thus centered on the most common tasks involved in a dispatching process, such as:

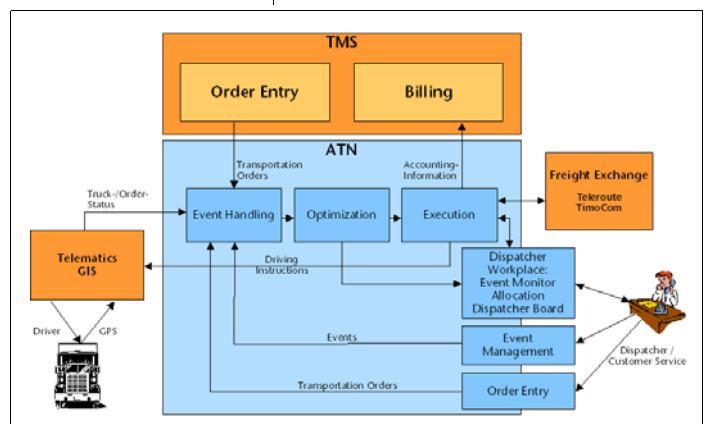
- ❑ **Order entry:** *LS/ATN* provides two alternative methods for new order entry. First, external TMS can be seamlessly integrated with *LS/ATN* to allow orders entered via the external TMS to automatically appear in *LS/ATN* as new orders. Second, orders can be entered directly into *LS/ATN*.
- ❑ **Optimization proposals:** Cost optimized dispatching proposals are automatically generated and presented to the responsible dispatchers for inspection, release and order.
- ❑ **Manual dispatching:** The dispatcher can modify tours suggested by the system at any time and create new tours as required. (Re-)planning of single orders and entire truck loads is possible using *LS/ATN*'s drag & drop feature.
- ❑ **Selection of subcontractor:** Planned and optimized tours need to be assigned to subcontractors or own capacities. *LS/ATN* provides dispatchers with four alternatives: own and contracted fleet, dedicated fleet, spot market, or capacities from freight exchanges.
- ❑ **Execution or capacity procurement:** Once the contract details with the selected contractor are negotiated they can be informed via web, e-mail, fax or phone. In case of an own truck, drivers are informed by SMS or telematics.
- ❑ **Tracking of tours:** The tracking facility of *LS/ATN* monitors the progress of transports in execution and creates an alarm if plan deviations occur that breach a service level agreement.
- ❑ **Subcontractor and capacity (vehicle/truck) management:** Subcontractors and their transportation capacities can directly be managed within the dispatcher's workplace.
- ❑ **Release for billing:** Finished tours are released for billing by the dispatcher after he has checked and confirmed all paper work.
- ❑ **Reporting:** Standard reports are available and can be customized to customers needs. Third-party reporting tools can be used to tailor individual reports.



Manual Dispatcher Board: This view allows the user to dispatch routes manually with drag & drop. All manually dispatched routes are displayed here with the orders on the left side, tours on the right, and a graph per truck showing the utilization at the bottom.

Technology Base

LS/ATN is written entirely in Java to provide a future-proof system and to achieve maximum cross-platform compatibility. The core architecture makes extensive use of standards such as JDBC and JSP. The use of XML and associated standards such as XSL and SOAP ensures effortless integration into existing heterogeneous software environments, with a focus on data independence and flexibility.



Logical Solution Architecture: *LS/ATN* is easily embedded into existing systems, receiving orders from an external system (TMS) or via direct entry. Events arriving from a telematics system or from the dispatcher are handled by *LS/ATN* and optimized as needed. Completed executed orders are exported to an external system for billing.

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About *Whitestein Technologies*

Whitestein Technologies is a pioneer of self-adaptive enterprise software.

We create software that responds to changing conditions so it can optimize your processes and infrastructures in real-time. To stay ahead, we are continuously advancing our innovations in the field of autonomous software agent technology.

Whitestein Technologies was founded in 1999 and is privately held. The firm is headquartered in Zürich (Switzerland) with several global offices.

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