BIDIS – A WORKFLOW MANAGEMENT SYSTEM FOR INLAND TERMINALS

A. MATHEJA, C. ZIMMERMANN, M. LARNOULD, M. MISKA AND M. BERNARD

Franzius-Institute for Hydraulic, Waterways and Coastal Engineering
University of Hanover
Nienburger Straße 4, 30167 Hannover, Germany

ABSTRACT

At present inland waterway transport (IWT) is mainly used to carry out transport operations in port-to-port relations. As integrated part of supply chains and key mode of intermodal transport chains it is applied only in few and exceptional cases. So far, IWT does not exploit its full potential as strategic, future oriented transport mode focusing on medium and long distances. To promote the given strategic advantages in terms of loading capacity, security and safety, cost effectiveness, ecological advantages the competitiveness of IWT has to be increased against land based transport modes.
Thus, comfortable and effective workflow management and information systems are required in seaports as well as inland terminals (ITs) to ensure transfer of relevant information between all participants and faster port operation (including quality management). Especially for ship based just-in-time container transports, these systems are fundamental for IT operation.
In this context, a JAVA based workflow management and information system (*BIDIS*) for ITs, focused on container transport with extensions for general cargo, was developed. Basic modules and capabilities of the system (e.g. ship storage planning, gate application, damage handling, personnel planning and EDIFACT data transfer to seaports, ship clients and the end-user) are presented.
Incoming EDIFACT messages are handled by a special application server (IPEM) transferring messages to the internal object oriented format and converting outgoing message to file based EDIFACT file format. ITs connected by *BIDIS Port Clients* are transferring objects via IPEM - not files as necessary in older systems using common software technology.
It is shown how *BIDIS* was setup and adopted to satisfy user needs (e.g. information for skippers, internal planning and handling by port authorities and information for end user), including scalable data base concepts underlying the *BIDIS Port Client.*
The present result of the software engineering process is a modular object oriented tool with dynamic functionality. Its development and following tests in practice have shown applicability, limitations and necessary future developments. The adopted object oriented approach the starting point for future developments towards a distributed workflow management system for ITs.

Keywords: Integrated Transport and Logistical Systems, Inland Terminals, Workflow Management System

1. INTRODUCTION

The quality of inland waterway transport in multi modal transport chains depends on planning and monitoring of combined door-to-door transport, management and processing of logistic tasks including pre-/end haulage and transhipment, tracking and tracing at freight level, interconnectivity and automated data transfer, reduction of handling times and quality of transport itself (fast, just-in-time, secure, cost effective). In this context, ITs play an important rule for collection and distribution of cargo, logistic services and chain management and other services (loading, storage, packing, stripping).
Besides cargo handling (loading, storing), ITs have to provide added value services to their clients in terms of tracking and tracing of freight in/outside their terminals and a better planning of their working activities and services to ensure just-in-time transport for the client.
Thus, an information network between seaports (SPs), ITs, and their clients has to be established to give (a) advanced access solutions (remote access as well as interactive web access), (b) demand or event driven logistic task management and (c) interconnectivity in terms of EDI based interface application in order to develop ITs as communication platform to provide respective services.

Also inside ITs, services and work flows have to be optimised - increasing attractiveness and effectiveness of IT operation.
This scenario motivated the development of an information and operation system for ITs, called *BIDIS* (Binnenhafeninformations- und –dispositionssystem). *BIDIS* has been implemented to combine inter-connectivity management (*BIDIS IPEM Server*) with workflow management for inland terminals (*BIDIS Port Client*), Fig. 1.

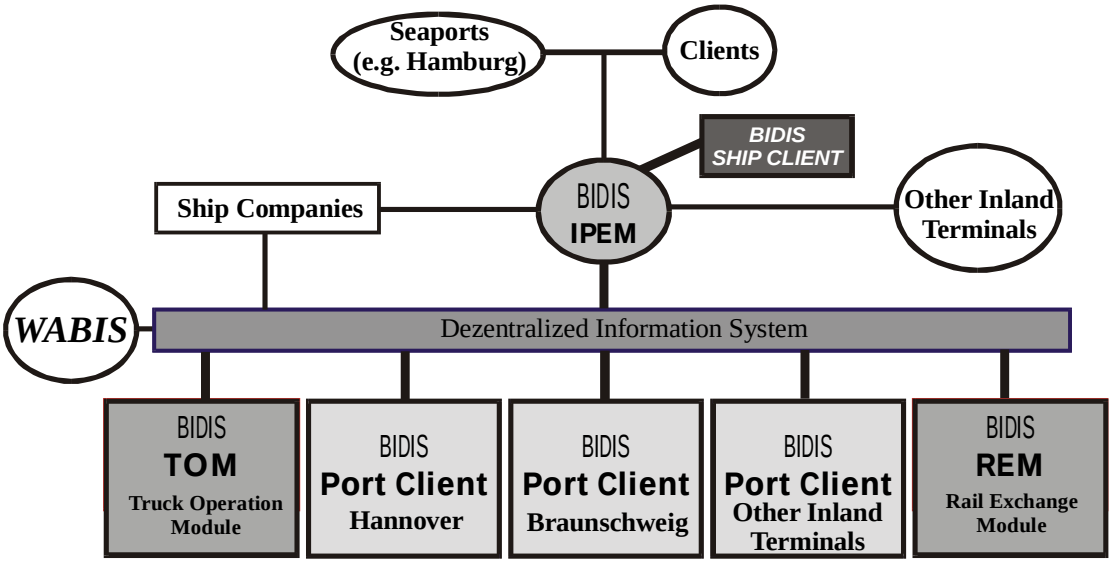

Fig. 1: *BIDIS* Communication Structure and Module Interaction

BIDIS provides a link to *WABIS* (Wasserstrassenbetriebs- und Informationssystem), a waterway traffic management and operational system giving real time access to (a) vessel information (ship position, speed and fuel consumption available from vessels, navigation and engine control equipment), (b) vessel's business information (free loading capacity, time schedule, and route planning loading/unloading times, necessary stops), (c) fairway information (water levels, currents, available water depths) and (d) vessel traffic management (VTM) information (traffic restrictions, actual and future lock planning, traffic density in a regional context, traffic predictions, estimated time of arrival).
Following chapters will describe underlying concepts and functionality of main *BIDIS* applications to give an introduction and overview to system capabilities.

2. BIDIS IPEM SERVER APPLICATION

BIDIS IPEM SERVER handles communication from/to *BIDIS* with other parties (SPs, Its, ship companies, clients) getting/providing information for logistic chain management (Fig. 2). The main application consists of a modul controling information update on the server side, a control panel, an administration tool and a module converting data to/from different formats.

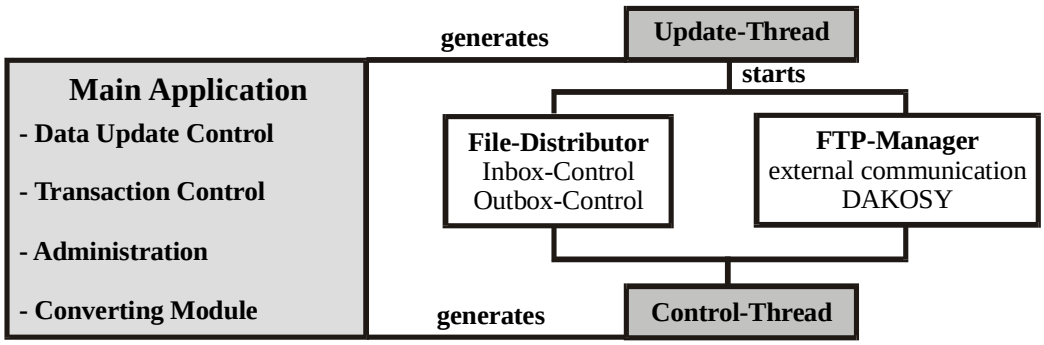

Fig. 2: *BIDIS IPEM SERVER* Structure

The main application can be started as independent server application, controlling available servers for communication, defining the interfaces for different ports and specifying the control options to have a look to data transaction activities (Fig. 3).

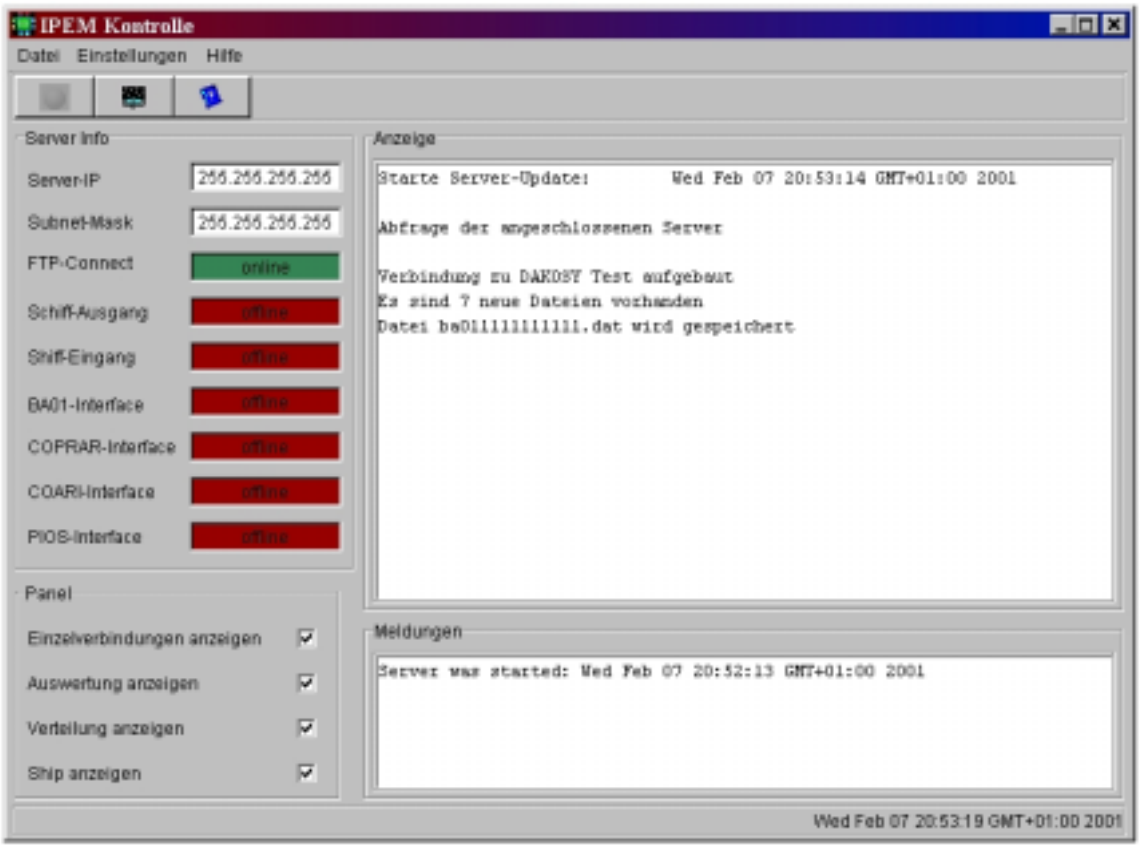

Fig. 3: *BIDIS IPEM SERVER* Main Application

Every module is startet as a thread to be independent against the server application. Threads are messaging to the server reporting their status, updating server information and indicating errors. Server updates are generated by (a) sending a request to external servers, (b) controlling ship messages, messages from ITs, Clients, SPs, (c) converting data and (d) distribution of data.
For data transfer an FTP-Manager was implemented as platform independent application (JAVA), managing secure connection to external servers and getting/sending requests and data (passive in binary mode). Relevant data is extracted from input stream, converted and send to relevant inbox/outbox directories on the server side.

3. BIDIS SHIP CLIENT APPLICATION

The *BIDIS SHIP Client* application is used to establish communication between ITs and ships. Password restricted access to this module was implemented to get up-to-date vessel information (fuel consumption, navigation and engine control equipment if available) and vessel's business information (free loading capacity, time schedule, and route planning loading/unloading times, necessary stops) for the *BIDIS PORT CLIENT*. Most important for IT operation is the cargo position on board of ships (storage plan) after leaving SPs or ITs.

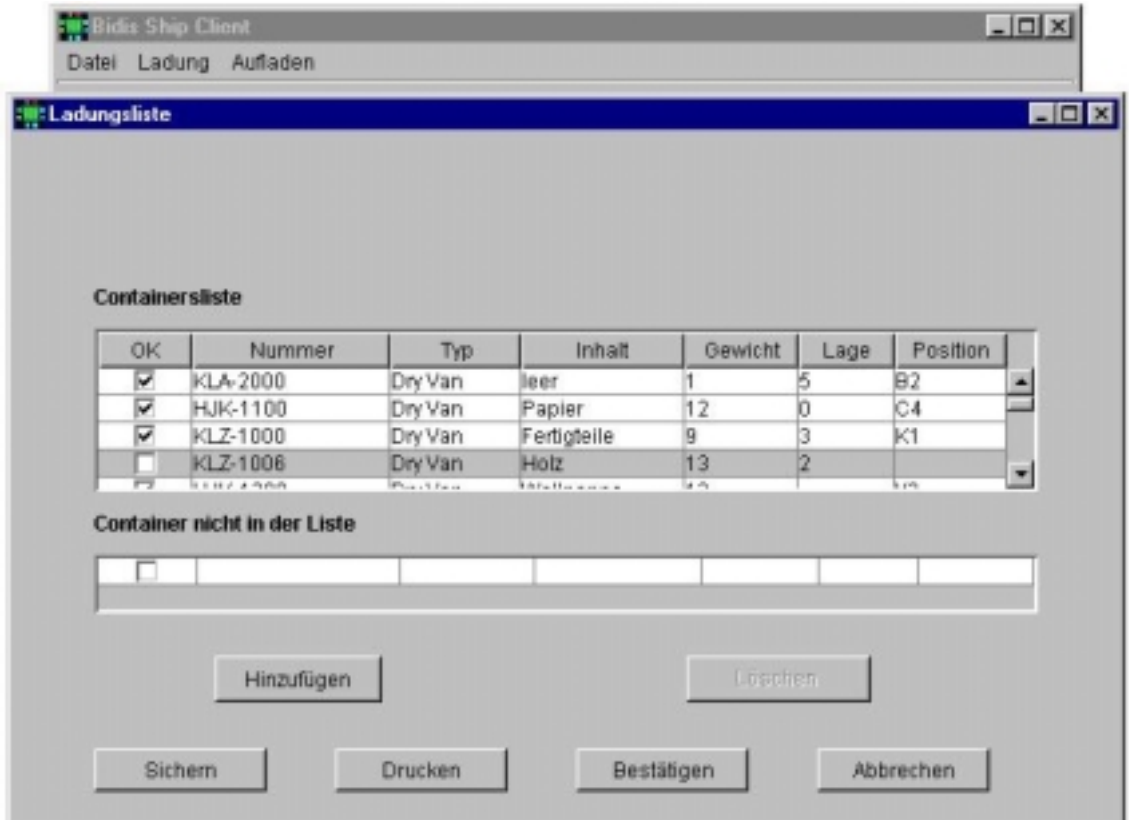

Fig. 4: *BIDIS SHIP CLIENT* Application

Thus, skippers get relevant freight data from *BIDIS IPEM SERVER*, check this data against their actual cargo and resend the revised data to the server application (*IPEM*), which distributes the data back to destinations (ITs), clients and ship companies.

4. BIDIS PORT CLIENT APPLICATION

4.1 User Administration

To guarantee a secure and stable run time, an easy to handle user administration was added after practical testing. It enables *BIDIS* system administrators to define users (personalization), delete and modify their rights, and thus create groups with special user profiles (administration group, cran group, disponents, storage group etc.).
Users have to login to the system by password, accepting that their actions and mistakes are reported by the system.

4.2 Business Client Administration

Business client administration stores all relevant business data (Fig. 5), making it available for pricing and accounting and relates it with client turnover for statistics.

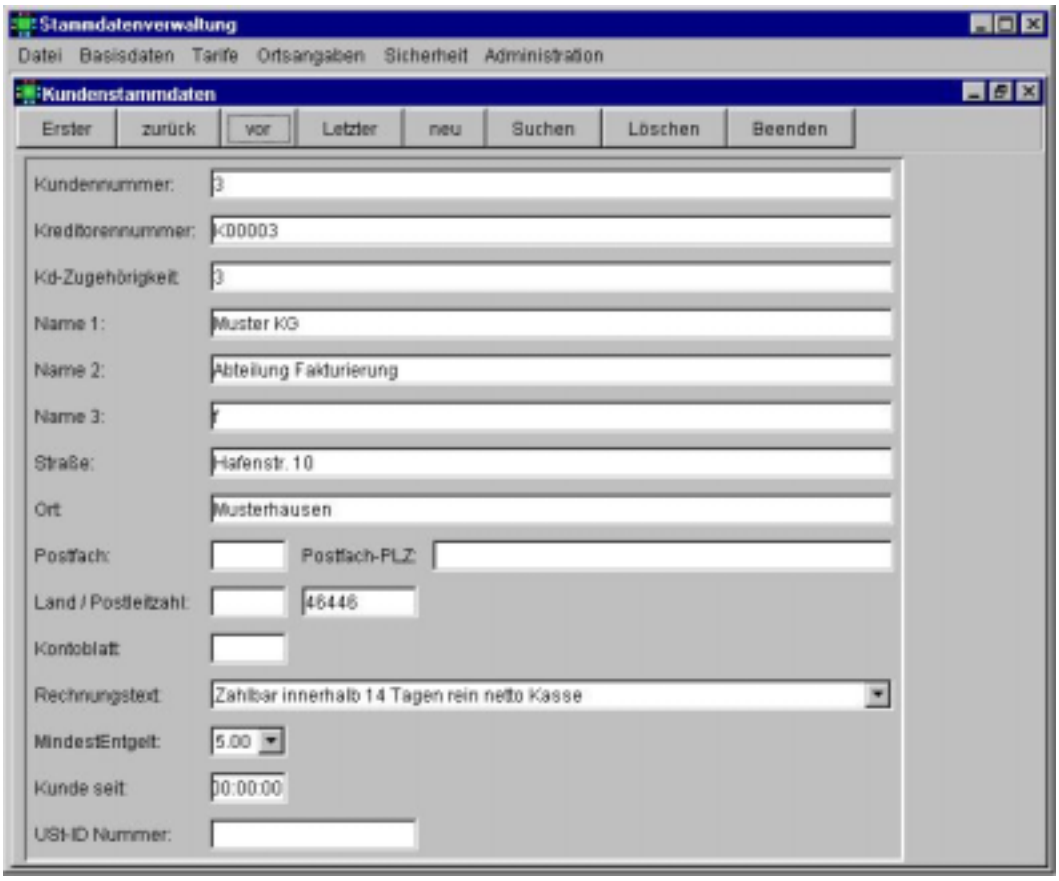

Fig. 5: Business Client Application

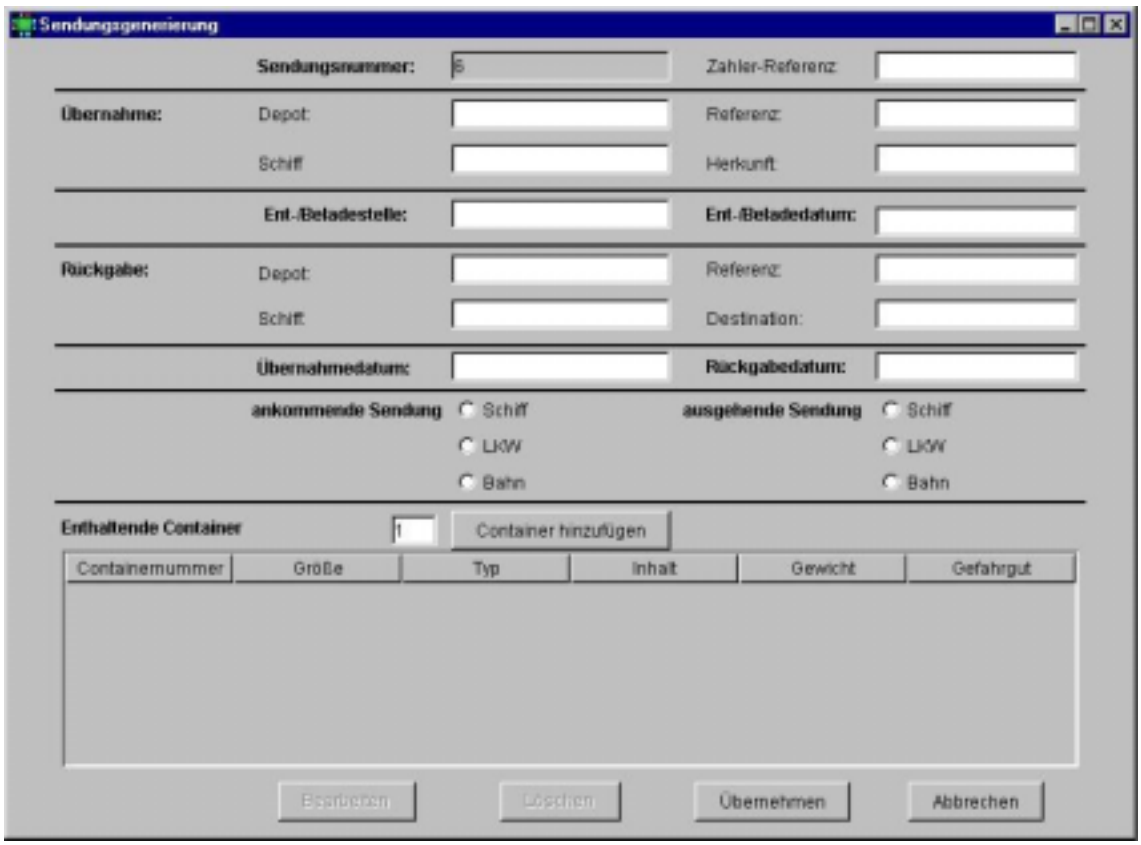

Fig. 6: Definition of Consignments from Business Orders

4.3 Generation of Consignments

Getting an order from business clients, the logistic chain manager transfers it to the system by splitting it into different consignments for requested relations (point-point relations), indicating that this freight should be transported together (Fig. 6).
Each consignment contains cargo information, transport mode and relevant data about take over and return (date, depot, special agreements etc.). Information about single freigt units is available from the list.

4.4 Loading/Unloading List

Transports[1] are set up by performing a loading list for a point-point a relation (Fig. 7). Therefore freight can be selected from a list generated from available consignments. After choosing a transport unit (loading capacity and storage characteristics of barges and ships are managed by templates showing detailed free loading capacity), freight can be placed on the ship by drag-drop functionality.

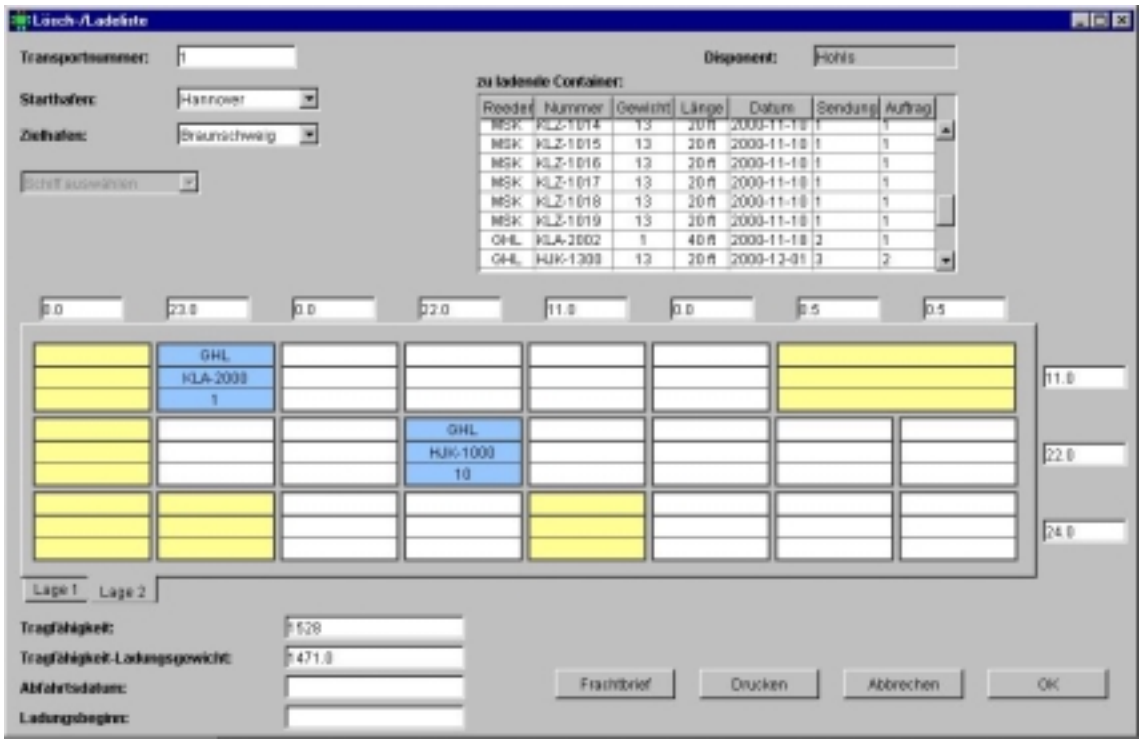

Fig. 7: Loading List for Definition of Transports

Trim of the ship/barge can be optimised by lateral and longitudinal weight control. Loading capacity is automatically restricted by template definition after picking a ship by name from the list. As every task in *BIDIS*, creating loading/unloading lists needs authorisation, which has to be entered separately for this module, due to consequences coming up for transport management in the case of errors.

4.5 Gate Application

ITs are liable for damage of freight in their area. Control of incoming/outgoing boxes becomes an important task, especially for container transport with high added value services (Fig. 8).
The *BIDIS GATE CHECK* application was developed to perform checks for different gates (truck gate, ship gate and rail gate). Implementation is flexible for porting the application to hand-helds. From a incoming/outgoing list (created for the identified gate from the freight list) the transport unit (e.g. container) can be selected and checked. If damaged, a report is send to the repair unit and the logistic transport manager responsible for the transport, checked freight belongs to.

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[1] Def.: Transport of freight (bulk or containers) with a single transport unit (barge or ship) for a point-point relation.

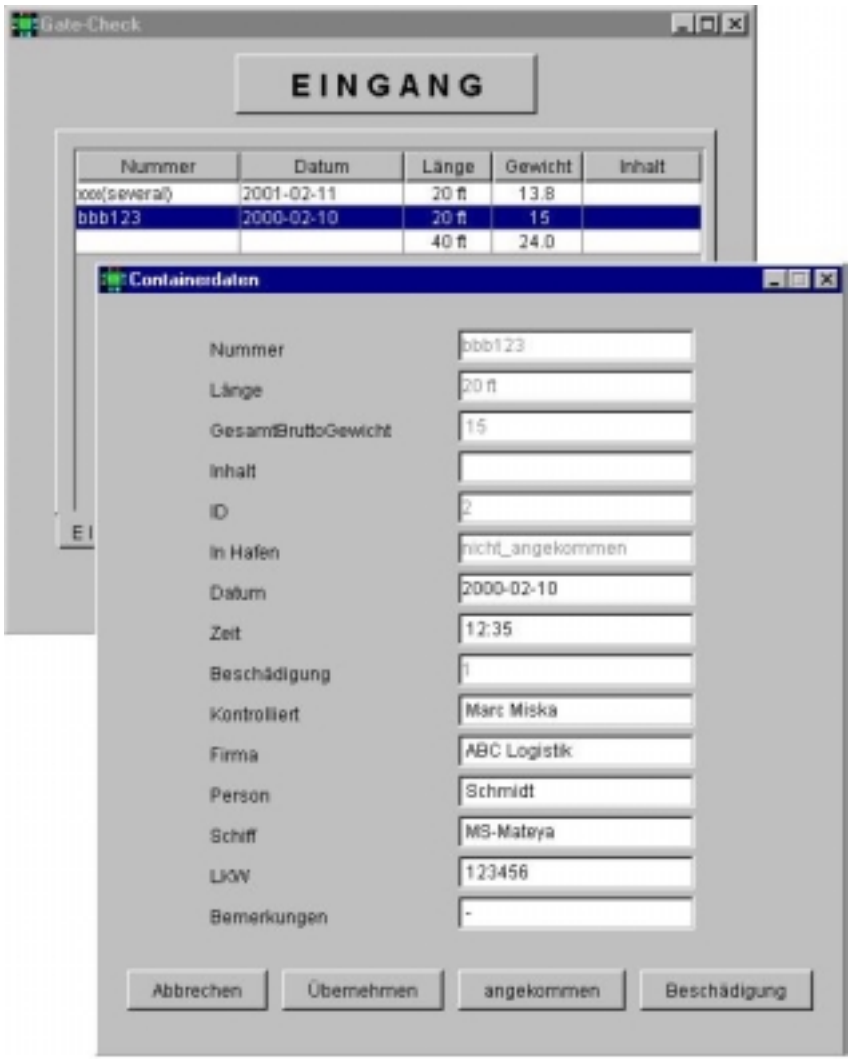

Fig. 8: Multi Purpose Gate Check (here: Truck Gate)

4.6 Internal Communication Scheme

BIDIS PORT CLIENT applications, running on different PCs distributed over the IT area, use the *BIDIS Client Module* sending requests to the *BIDIS Port Client Server* and getting relevant data for their specific tasks (Fig. 9).

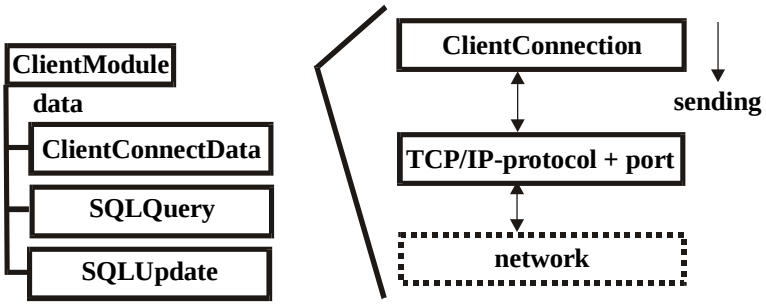

Fig. 9: Communication of *BIDIS PORT CLIENT* Applications with the *BIDIS Port Client Server*

The *BIDIS Port Client Server* holds the established connection and responds to client requests (Fig. 10). Transfer errors (e.g. communication channel not created, locked or destroyed, application on client/server side or system shutdown) are handled by a multi layer model, responding in different steps to requesting applications and/or sending an error report to the system administrator.

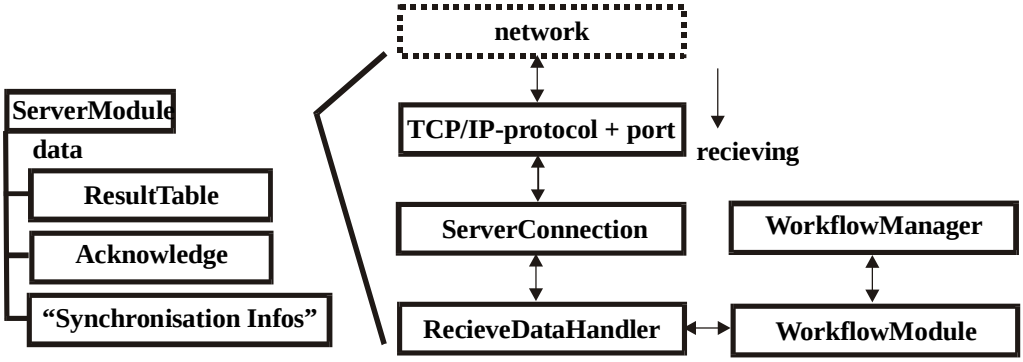

Fig. 10: Communication of *BIDIS PORT CLIENT* Applications with the *BIDIS Port Client Server*

Transactions are managed by the *BIDIS Workflow Manager*, which organize the incoming requests/jobs and executes them. Execution of the job FIFO list is done by periodic triggering and transaction using a two phase lock protocol.
Access to underlying data is restricted by a security concept based on the *BIDIS* user administration. Running *BIDIS PORT CLIENT* applications transfer user names while requesting data and/or functions from the *BIDIS Server Module*. Internal relations between user groups (and associated rights) and data structures manage the final data access.

5. CONCLUDING REMARKS AND FUTURE DEVELOPMENT

IWT has to play a key role for transport on medium and long distances in intermodal transport chain operations. Thus, information and workflow management in ITs and data connectivity between SPs, ITs, logistic service providers and ship companies will be an essential part to improve competitiveness of IWT against land based transport modes. The development of *BIDIS* gave a corridor for ITs to play this part, especially as logistic service providers managing reliable door-to-door transport chains.
Future adaptions and developments of *BIDIS*, such as new data formats and interfaces for external servers (*Logistic Data Platform*), automatisation of IT tasks and optimisation of local storage capacity and automated information of receivers, are easy to gain, due to modularisation and object oriented design of the system.
One of the main future tasks will be the interaction of *BIDIS – WABIS* to provide forecasted ship positions to business clients, ship companies and ITs for optimisation of their internal workflows (facility and personnel planning). Thus, a enhanced simulation model based on cellular automates will be implemented in *WABIS*, forecasting waterway traffic for ETA calculation.

6. ACKNOWLEDGEMENTS

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