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(54) **SYSTEME ET METHODE DE TRANSPORT DE REMORQUES PAR CHEMIN DE FER**

(54) **SYSTEM AND METHOD FOR RAIL TRANSPORT OF TRAILERS**

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SYSTEM AND METHOD FOR RAIL TRANSPORT OF TRAILERS

Field of the Invention

The present invention is related to intermodal transportation, and more particularly to a system and method of controlling the transport of trailers over a railway system.

Background Information

The transport of goods by truck plays an important role in keeping the machinery of business moving. Trucks are a very efficient transportation medium, especially in short and medium haul corridors.

Over the last 10 to 15 years, there have been a variety of attempts in the railway industry to move truck trailers onto rails. Most of these attempts to create intermodal transportation systems, however, require expensive modifications to reinforce the trailer in order to make it sturdy enough to withstand the forces applied by cranes and by transport on the rails. In addition, trucking companies chafe at the long delays and complex processes of the railway companies. Increasingly, however, the cost and environmental impact of truck transportation, and the paucity of skilled drivers present an opportunity for rail transport of non-reinforced trailers along high density corridors.

What is needed is a system and method for efficiently and economically transporting trailers via train across high density corridors.

Summary of the Invention

According to one aspect of the present invention, what is taught is an integrated system and method for efficiently and economically transporting trailers via train across high density corridors.

The result is increased reliability, reduced cost structure and enhanced ease of use.

Brief Description of the Drawings

Fig. 1 is a representation of an intermodal reservation and control system; and

Fig. 2 is a more detailed representation of a system according to Fig. 1.

Description of the Preferred Embodiments

In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

Some portions of the detailed descriptions which follow are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like. It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussions, it is appreciated that throughout the present invention, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical

quantities within the computer system memories or registers or other such information storage, transmission or display devices.

As noted above, there is a need for a low cost, high-quality, profitable intermodal product for the short-haul, truck competitive market which allows the railway to partner with the trucking industry. Truckers want a simplified business process for their intermodal shipments. They also desire fast terminal throughput.

It is possible to leverage information technology to simplify the intermodal business process. This is desirable not only to eliminate the familiar line-ups at the terminal entry gate, but also to guarantee the delivery of a customer's shipment on a designated train, at a specified time.

In one embodiment, one or more guaranteed slots can be reserved on each intermodal train. (In contrast, conventional intermodal procedures can often result in the customer's container being left behind for the next train.) In one such embodiment, customers use the Internet, phone or fax to reserve a slot on the train using an automated reservation system.

The data confirmed by the customer on the automated reservation system drives the rest of the transport process. When a driver arrives at the terminal, there is no waiting for a clerk to input the details of the shipment at the gate. The data already has been captured on the system prior to the driver's arrival at the facility.

In one embodiment, hand-held portable computers are used to control all terminal operations. The paperless environment created by the hand-held units and the automated reservation system reduces the driver's time in the yard to a fraction of the time spent at a conventional terminal.

In contrast to conventional intermodal terminals, where it is often the case that a trailer is dropped off without any guarantee that it will make it on the next train, the reservation system of the current approach guarantees customers a slot on the train. The system's scheduled service assure customers that their freight will arrive consistently on time, regardless or weather or road conditions. This is a major factors in competing with truck only approaches.

The Internet functionality discussed above also facilitates business processes with customers, while increasing productivity.

Fast terminal throughput times can be attributed to the simple terminal design and business process, which are enabled by the hand-held computers used to control everything from trailer check-in, safety inspections of each load, to the departure of the loaded train.

Each terminal comprises at least one set of loading tracks, an office building and a spacious yard for easy maneuvering. The terminal is designed so as to eliminate the entry gate; which function is performed by the automated reservation system in combination with the hand-held computer units.

Instead of lining up and completing paperwork with a clerk at the gate, the driver simply takes an automated ticket and moves into the terminal. By the time the trailer has been dropped off or picked up, the terminal operator has already referenced the shipment data from the automated reservation system and completed the "electronic paperwork" on a hand-held computer. The driver signs the computer screen, then punches in an exit code on the way out of the terminal.

In one embodiment, each terminal is a long, thin design with multiple loading areas. In a train system using multiple sets of spline cars, one or more sets of spline cars can be separated and loaded using portable loading ramps and hostler trucks operating in parallel.

The innovative use of a wireless network and client-server technology for the operation of the hand-held units is critical to the success of this application. Internet access to the automated reservation system is an important alternative to offer customers who are continually seeking ways to automate their own business processes.

Separate from the information technology, the train itself has many unique features. It is not a train in the conventional sense, but a flexible railway element which bends around curves, therefore it doesn't have the between-car coupler action rail roaders call "slack". This unique ability to eliminate slack improves the ride and reduces the chances of damaging high-value freight. In addition, by reducing the forces exerted on the trailers, this approach permits the use of rail to transport conventional

trailers without modification. In one embodiment, each train includes twelve sets of five-spline cars.

In one embodiment, each train includes a split ramp car which provides two drive-on/drive-off surfaces. Standard highway trailers can be driven on and off the platforms. This compares favorably to conventional intermodal terminal technology where reinforced trailers are hoisted on and off the train using expensive and sophisticated cranes. In another embodiment, portable ramps are attached to each set of spline cars in order to facilitate loading and unloading using a hostler truck.

The automated reservation system means that all data relating to a customers' shipment is already captured prior to their arrival at the Iron Highway facility. This data, in turn, drives the rest of the business and operations processes of Iron Highway.

The hand-held computer units and the Iron Highway Access System application are used to register a truck's arrival at the terminal; assign the truck's parking space; load the train; perform the air brake inspection; record departure & arrival times; unload the train; accounting systems, and produce management reports.

The elimination of the entry gate is a revolutionary concept from typical intermodal terminals where truckers line up to complete paperwork with a clerk. Such line ups can sometimes be 10 to 15 trucks long. After completing the paperwork at the intermodal terminal gate, the trucker proceeds into the terminal where he/she can then expect to spend less than 30 minutes delivering his/her trailer.

This is in stark contrast to the present terminal design, where a driver does not wait at the terminal gate but simply presses the button on a ticket dispenser to enter. The driver proceeds to a parking area and is met by a terminal operator who uses a hand-held computer to scan the entry ticket and check-in the trailer. Since the automated reservation system already knows the details of the shipment, the driver does not have to provide any additional information. He/she simply signs the screen of the hand-held unit as a receipt for the trailer, then departs the terminal by inputting an exit code at the departure gate.

The access system employs a leading-edge technical infrastructure to provide the greatest potential for delivering business value and to support the fast-paced business

operations. In one embodiment, the system includes five main client-server components including: application server, mainframe systems, client workstations, Web server, mainframe systems, client communicate using a wireless network.

In one embodiment, the central server stores the operational data in a back-end message receiving application. Automated interfaces extend through MQ to Customer billing and train consist mainframe systems.

In one embodiment, customer service representatives access the reservation system through Windows NT workstations to manage reservations, setup operating trains, and track customer shipments. A Web server enables customers to create reservations and track shipments online.

Radio Frequency (RF) technology is used to implement the Terminal Management System, a pen-based application running on portable computers, creating a paperless environment to manage terminal operations in the yard.

In one embodiment, an intermodal transportation system includes two or more specially designed terminals. Each terminal includes a Token Ring local area network (LAN) that connects the client workstations, the gate system, and the RF network. The gate system controls and manages security for the entry and exit gates. The RF wireless network consists of external access points mounted throughout the yard providing an RF coverage area for communications with the hand-held units. The access points are connected by fibre optic cables to an Ethernet FiberLink HUB, networked to the LAN through a router. The LAN is connected to CPR's computing facility via a router, providing access to the application server and mainframe.

The following outline summarizes the components involved in one exemplary embodiment of the intermodal transportation system:

Hardware Components:

- Client workstations - Dell Pentium GXM5100
- Application server - IBM RS6000
- Gate server - Dell Pentium GXM5100

- Mainframe	- MVS IBM ES9000
- Web Server	- HP LH Pro
- Access Points	- Symbol Spectrum 24 Ethernet Access Point
- Hand-held units	- Symbol PPT4600
- Portable printers	- Symbol RP3S

Software Development Tools:

- Terminal Management System	- PenPal 5.3
- Reservation Management System	- PowerBuilder 4.0,
	- Oracle PL/SQL
- Internet Customer Access System	- Web objects 2.0
- Gate System	- Borland C++
- Mainframe Interfaces	- COBOL
- Server Message Receiving	- Pro*C, Oracle PL/SQL

Database Components:

- Oracle 7.3 RDBMS

Operating Systems:

- Windows NT 3.51
- UNIX
- DOS 6.0

Networking Components:

- Terminal LANs	- 16 MBPS IBM Token Ring,
	- 10 BaseT LAN Art Ethernet
- Terminal Routers	- Cisco
- Ethernet Hub	- LAN Art
- RF Network	- Spectrum 24
- Protocols	- TCP/IP, SNA LU6.2

- Middleware - SQL*Net, MQ, Socket Communication

In one embodiment, a client-server architecture is used. A client-server architecture typically differs from traditional mainframe-based systems in the following ways:

1) PC applications with graphical user interfaces vs. terminals or terminal emulators with character-based interfaces;
2) Servers vs. mainframe for file, print, application, and other services;
3) relational database systems vs. hierarchical database systems;
4) LAN, WAN, and dial-up inter-networking vs. SNA 3270-based communications;
5) open standards-based technology vs. proprietary technology.

Client-server technology provides the greatest potential for delivering business value. It is the area which has greatest product support in the market, the area where hardware and software innovations are being made, and the technology which can deliver the responsiveness required by a changing business environment.

As the move to client-server accelerates, the role of the mainframe will change from running on-line systems to heavy-duty batch processing and enterprise data storage. The use of client-server technology for system 10 is consistent with the industry trend and other projects in information technology.

In one embodiment, networking is based on the TCP/IP protocol and to move towards an inter-network of LANs and the WAN. Such an "intranet" allows higher speed communications between any network nodes and any applications supporting the TCP/IP protocol. In one such embodiment, TCP/IP is the native protocol for database communications between workstations or hand-held computers and the application server, file- and print- services (if required), and Windows NT networking while SNA LU6.2 is used between the application server and the mainframe interfaces. Customer access is via direct modem dial-up.

In one embodiment, the client-server infrastructure is designed to handle a wide range of data and transaction volumes, ranging from workgroups (10's of users) right up

to enterprise levels (1000's of users). Processing power and data storage can be scaled in relatively small, cost-effective, increments. The same is mostly true of the network. WAN communications, because they comprise mostly leased circuits, is relatively simple to upgrade, but at incrementally higher cost for more bandwidth. On the other hand, LAN communications is relatively more difficult and costly to upgrade. However, this is generally not an issue because the existing applications are not, for the most part, LAN bandwidth limited.

Application scalability is highly dependent on design, involving the partitioning of data and processing, and making tradeoffs between local and global performance optimization. The application should be designed with scalability in mind unless it can be guaranteed that it's use will not grow beyond initial expectations.

In one embodiment, the user interface is designed to follow Microsoft's Common User Access interface guidelines.

In one embodiment, a "trust line" splits the application architecture into two regions: an "access region" permitting flexibility to respond to individual user needs, and a "control" region where the enterprise rigidly applies enterprise validity rules to transactions to ensure integrity of enterprise data.

In one such embodiment, the access region includes the user desktop PC or workstation and the hand held PC's. The control region includes a server located at an off-site location. The trust line separating the two regions is drawn across the Wide Area Network connection separating the two regions.

Transaction Management

No distributed units of work/distributed updates spanning multiple databases are anticipated. Transaction Management will be handled by the Oracle relational database management system rather than through use of the CICS transaction processing monitor. MQ Series will be used to support asynchronous communication between the system 10 and other internal company systems.

Cooperative Processing

In one embodiment, system 10 is a client/server application based on a partial three tier model (partial in that use will be made of proprietary Oracle features to handle most of the application layer). Presentation, data input edit checking, and application logic will be on the Hand Held, Desktop, and Customer Access Client machines. SQL will be generated from the Client for Read, Delete, Insert, and Update access to Oracle tables. Stored Procedures and Pro-C programs resident on the Server will also be used to Read, Delete, Insert, and Update Oracle tables.

The application logic and database data together with its referential integrity, business rules, stored procedures, and triggers will reside on the Server. MQ Series, resident on the Server, will be used to send data for update to EDI, Fastway, and Master Train Plan legacy systems.

For Customers, who will be accessing the application via a BBS, only the BBS Browser will be resident on the Client.

In one embodiment, the structures of the programs generated via the use of the PowerBuilder product, will be based on the standards used and published by the EDPS project supplied to the Iron Highway project Applications Architecture. Metasolv's Powerframe product will be used to aid in the program generation process. Similarly, existing standard routines are used to handle application errors wherever possible. Where these are not available the error handling routines tend to be internal company standards, such that they will be reusable by other applications. Metasolv's Powerframe product is used to aid in the production of standard re-usable error handling routines.

Common Services

Wherever possible existing common services are used to perform required systems functions e.g. the existing TCP/IP based network for client/server communications; the internet infrastructure for customer to system 10 communication; existing systems management infrastructure for server management. Metasolv's Powerframe product is used to aid in the creation/provision of common services where necessary.

Wherever possible common re-usable modules are used to construct the application. Where they must be custom built they are constructed in accordance with internal company standards, and are potentially re-usable by other applications.

Design Approaches

In one embodiment, as is shown in Fig. 2, the application is made up of six components: application Server, Standard Client Workstations, Customer Access (Bulletin Board) Server, Terminal Management PC's (Remote PC's), Legacy Mainframe Systems and EDI Server. The following section describes the application functions that will be performed on each of the components.

The application server is a central server that will store all of the operational data. Oracle 7.x is the RDBMS that manages the databases.
Also running on the server is a back-end message receiving application that operates with the remote PC's in the terminal management facility.

In one embodiment, there are six MQ Queues set up on the server. Each of the Queues has corresponding message processing programs written in Pro*C.
The queues:

⇒ Send bills of lading to Fastway.
⇒ Send consist packages to CLV and MTP
⇒ Send EDI 214 messages to the EDI server
⇒ Receive triggers from the client workstation to initiate the consisting and billing processes
⇒ Receive messages from the remote terminal workflow PC's
⇒ Send Messages to the remote terminal workflow PC's

In one embodiment, SQL*NET is used as the protocol to access the Oracle databases from the client workstations, the bulletin board server and the message processing programs running on the server.

The Customer Access server runs the base bulletin board services to support connectivity via modem to the customer's computer. Within the BBS environment

application specific programs execute to drive the bulletin board application. These programs are written in a combination of proprietary scripting language and Pro*C. The application accesses the corporate database using SQL*NET. The customer workstation will only run the bulletin board browser application.

The client application was developed using Power Builder 4.0. In one embodiment, the application accesses the Oracle database via SQL*NET. The application programs perform edit checks and validations. In one embodiment, some business logic is performed on the client.

The application programs initiate Arrival, Departure, Billing and EDI Service exception notification processing via messages sent to programs on the Application Server using MQ Series. The business logic for these processes runs on the application server.

The EDI server runs MQ Series to receive EDI messages from applications within or outside system 10. The application formats a message and sends it to the EDI server. In one embodiment, the format of the message includes an identifier that the EDI server mapping applications can use to identify the source and format of the EDI message. The EDI system translates the application message to an outbound EDI message format and then sends it.

The terminal workflow PC's use the same device for both the hand held and the truck mounted operations. In one embodiment the user interface is based on Pen Pal. The remote PC contains some application logic to support edit checking and input validation. The client sends update messages back to the Application Server via MQ series. A message processing program will reside on the Application server to perform the terminal management business logic.

In one embodiment, legacy mainframe applications (shown as Fastway, CLV and MTP) are sent bills of lading, consist packages and train arrival / departure times from the Application Server. Each of the application interfaces will require their own MQ Series queue to receive the information messages. The queue processing programs on the mainframe will run as IMS transactions written in COBOL. Each queue will have its own transaction.

A more detailed description of aspects of one embodiment of the above-described system is shown in the attached Appendices A and B.

The above-described intermodal transportation system does not compete against truckers, but rather partners with them. One of the most important things truckers are looking for is on time, fast and reliable service. Tests have shown that the integrated intermodal transportation system should provide an on-time performance average of at least 95%.

In addition, the use of information technology in terminal operations has helped revolutionize and simplify the process by which trailers are transferred from truck to rail. For instance, the hand-held computer technology has eliminated paperwork for the customer and, combined with the automated reservation system, has limited the time he/she spends in the terminal to 15 minutes or less.

In addition to the railroad and trucking industries, the general public is another stakeholder with much to gain from shifting intermodal traffic from the highway onto the rails. As an environmentally-friendly transportation route, this approach takes trucks off already congested highways, reducing road wear and maintenance costs to taxpayers.

Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement which is calculated to achieve the same purpose may be substituted for the specific embodiment shown. This application is intended to cover any adaptations or variations of the present invention.

What is claimed is:

1. An intermodal transportation system comprising a long, thin, terminal design permitting loading of trailers in parallel.

2. An intermodal train comprising a plurality of sets of spline cars.

3. A the method of loading and unloading an intermodal train comprising:
tracking truck egress and exit automatically from the loading area in order to process the trucks through in an expedited manner.

4. A transportation system, comprising trucks and intermodal trains, wherein the intermodal trains includes slots which can be reserved for each trailer.

5. A simplified terminal access system driven by a computerized reservation system for accepting and tracking trailers, comprising:
- automatic production of bill of lading, work order for drivers and consist
- design which allows one to quickly add new terminals to the system
- handheld check-in and processing
- does system perform any balancing function for determining if more cost effective to transport by truck or rail?

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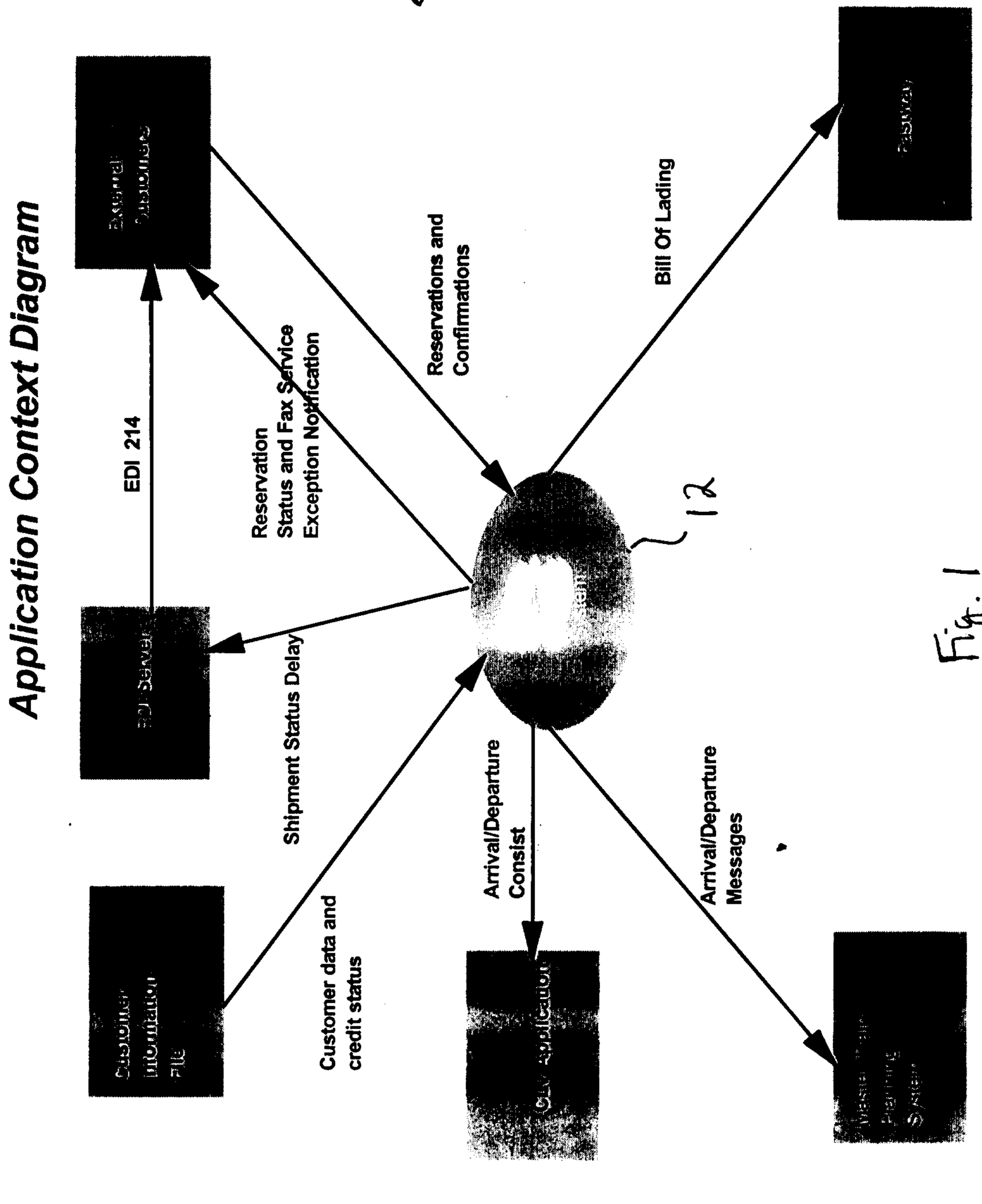
Application Context Diagram
EDI 214
Reservation
Status and Fax Service
Exception Notification
Shipment Status Delay
Customer data and
credit status
Reservations and
Confimations
Arrival/Departure
Consist
Arrival/Departure
Messages
Bill Of Lading
12

Fig. 1

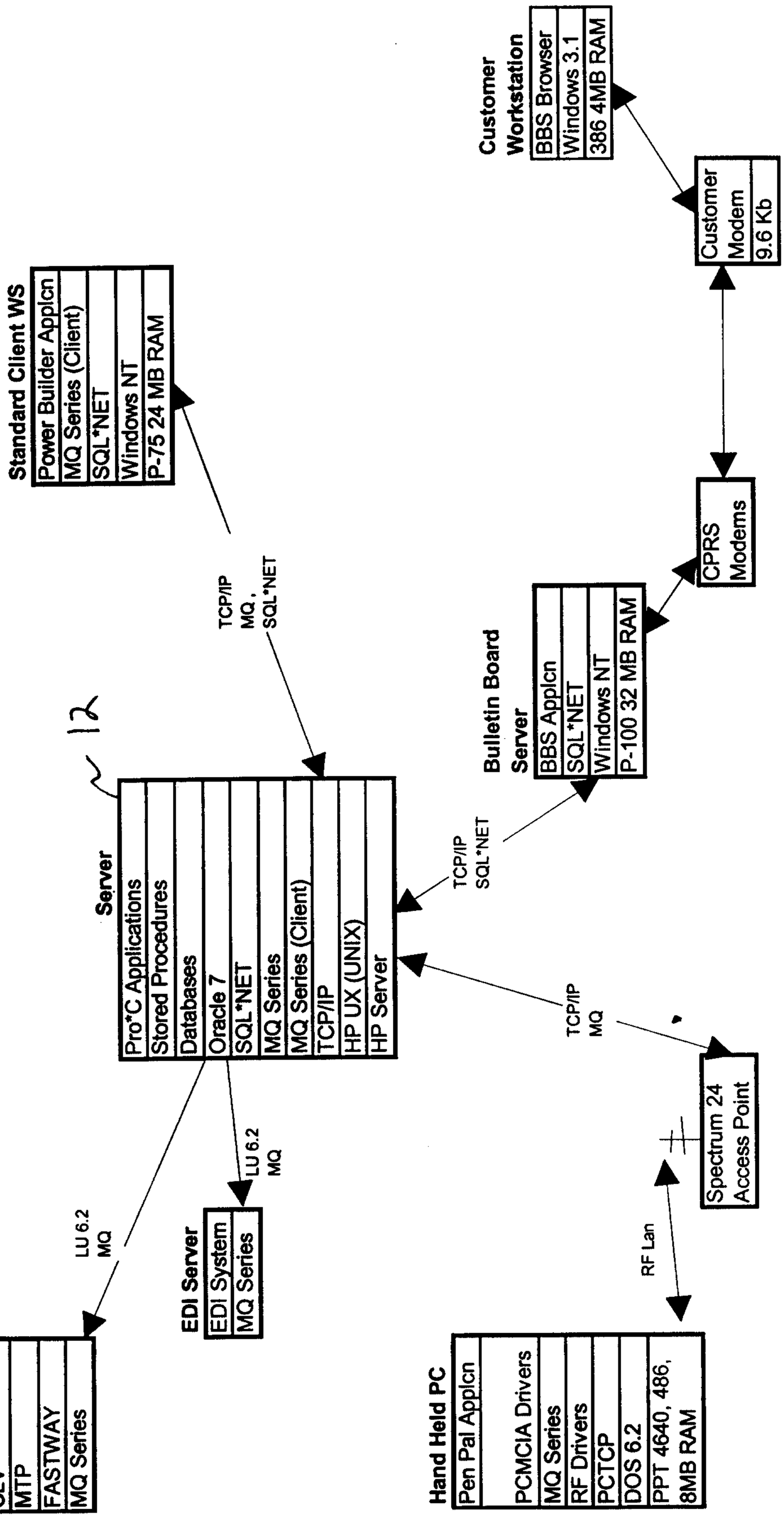
Customer Workstation
BBS Browser
Windows 3.1
386 4MB RAM
Customer Modem
9.6 Kb
Standard Client WS
Power Builder Applcn
MQ Series (Client)
SQL*NET
Windows NT
P-75 24 MB RAM
TCP/IP
MQ,
SQL*NET
12
Server
Pro*C Applications
Stored Procedures
Databases
Oracle 7
SQL*NET
MQ Series
MQ Series (Client)
TCP/IP
HP UX (UNIX)
HP Server
Bulletin Board Server
BBS Applcn
SQL*NET
Windows NT
P-100 32 MB RAM
CPRS Modems
TCP/IP
SQL*NET
TCP/IP
MQ
LU 6.2
MQ
LU 6.2
MQ
EDI Server
EDI System
MQ Series
Main Frame
CLV
MTP
FASTWAY
MQ Series
RF Lan
Spectrum 24 Access Point
Hand Held PC
Pen Pal Applcn
PCMCIA Drivers
MQ Series
RF Drivers
PCTCP
DOS 6.2
PPT 4640, 486, 8MB RAM

Fig. 3