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Port Community Extranet System Validation

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16. Abstract

With the emergence of a global economy, companies are increasingly pressured to improve efficiency. In the transportation industry a growing need exists for better tracking of container status. The Transportation Development Centre (TDC) of Transport Canada and the Port of Montreal have joined forces on an intermodal technology program designed to improve the efficiency and productivity of container movements through the Port. The goal is to improve Port operations efficiency by developing communication and information technologies applicable to container transport. The Internet is the new medium for data transmission and can result in reduced communication costs and delays associated with congestion. Without accurate information the Port has difficulty planning efficient terminal management and equipment use.

This study recommends that the Port of Montreal implement an Extranet (defined as a virtual private network separated from the public Internet by a firewall) solution to address information exchange and gate congestion issues. It will also serve as the foundation for implementing new technologies adopted by other leading world ports. The Extranet system would allow electronic data interchange (EDI)-capable Port stakeholders to exchange EDI documents with non-EDI trading partners. The benefits to the Port community would be: less congestion at the gate, with fewer delays; reduction of paperwork; provision of real-time container information; improved operational efficiencies brought about through better visibility of container status; improved customer service; and better planning and decision-making capabilities of all stakeholders.

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16. Résumé

La mondialisation de l'économie oblige les entreprises à être de plus en plus efficaces. En transport, il devient urgent d'assurer un meilleur suivi des conteneurs. Le Centre de développement des transports de Transports Canada et le Port de Montréal ont uni leurs forces pour mener à bien un programme de technologie intermodale visant à améliorer l'efficacité et la productivité des mouvements des conteneurs dans le port. Le but est d'accroître l'efficacité du Port en développant des technologies de communication et d'information applicables au transport de conteneurs. Le réseau Internet, ce nouveau véhicule de transmission de données, peut être la voie vers une diminution des coûts de communication et des retards dus aux congestions. Sans une information précise, il est difficile pour le Port de planifier une exploitation optimale des terminaux et des installations.

Cette étude recommande que le Port de Montréal mette en place une solution Extranet (soit un réseau virtuel privé, séparé du réseau Internet public par un pare-feu), pour l'échange d'information et l'allégement de la congestion à l'entrée du port. Une telle solution servira également de base à la mise en oeuvre de nouvelles technologies déjà en place dans d'autres grands ports du monde. L'Extranet permettrait aux intervenants dotés de capacités EDI (échange de données informatisées) d'échanger des documents avec des partenaires commerciaux non pourvus de telles capacités. Le milieu portuaire y trouverait de multiples avantages : moins de congestion à l'entrée; moins de retards; moins de paperasse; diffusion en temps réel d'informations sur les conteneurs; plus grande efficacité des opérations, grâce à une meilleure diffusion de la situation des conteneurs; meilleurs services aux clients et planification et prises de décisions plus faciles pour tous les intéressés.

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EXECUTIVE SUMMARY

The Port of Montreal is constantly seeking ways to make the Port system more competitive and productive. It is firmly committed to investing in facilities improvements and in the latest information technologies for the benefit of its stakeholders. In this context, the Transportation Development Centre (TDC), the Port of Montreal, and GE Information Services (GEIS) have joined forces on an intermodal technology project designed to improve the efficiency and productivity of container movement through the Port. The project is part of a larger program designed to achieve fully integrated electronic data interchange (EDI) among the Port's trading partners/stakeholders. The program involves the implementation of Internet-based technology linking the Port and its major trading partners. It is focussed on the terminal/truck, rail, and shipping interface, and particularly on the provision of advanced scheduling/appointments and container status information to carriers.

This study examines the feasibility of implementing Web-based EDI document transmission among the Port's non-EDI trading partners using the Internet's low-cost network service. The focus of this project was to be on the terminal and truck interface. The Web-based information/document interchange service would enable "EDI-capable" Port stakeholders to be able to communicate with non-EDI trading partners, use the Internet as a communication gateway for all trading partners, and demonstrate the use of open and flexible electronic data exchange capabilities. The expected benefits to the Port community of implementing such a system were: diminishing congestion at the terminal gates, minimizing delays at the gates for trucking companies, reducing paperwork, improving data accuracy, providing real-time container information, and improving service to the customer.

GEIS was contracted to perform the business analysis and conduct a validation study of an Extranet concept for the Port of Montreal community on behalf of Transport Canada. The study recommended both physical and technical enhancements to address the Port gate congestion issue. In validating the results of that study, it was found that current communications among Port of Montreal stakeholders are mostly by telephone and fax, with minimal electronic communications. This is the primary cause of congestion.

The analysis indicated that the basic cause of gate congestion at the Port of Montreal is not a physical one. Therefore, adding additional parking areas at the gates addresses the symptom, but not the cause. The cause of the gate congestion is incorrect and/or missing information that results in an inefficient gate process. The terminal gate operations analysed were very efficient; however, the problems encountered lie in the inaccuracy and incompleteness of information presented to them, usually on paper, by the drivers.

Another symptom is that communications are between two parties with no visibility to others that may require that information. This results in drivers being

dispatched to terminals for container pickup when containers are unavailable. This may be due to (a) the containers not being released either by Revenue Canada and/or the shipping lines; (b) those releases not being communicated to the terminal; or (c) the containers not being off-loaded from the vessel.

The Port of Montreal is experiencing continued high growth rates. To sustain this growth, the Port and its stakeholders will be required to invest in technology to respond to the increased volume of containers.

The Port of Montreal is not alone in having to face this problem. Industry trends throughout the world port communities reflect significant advancements in electronic communications and high-tech solutions to address port congestion and service expansion. These technologies include:

- Local community electronic communications infrastructures
- Pager and Smartcard technologies to efficiently speed drivers into, through, and out of the port

These two features, when implemented together, also tend to heighten the security associated with the movement of containers through and beyond the port.

The results of the implementation of these technologies are dramatic. For example, the Port of Singapore has reported a 58 percent reduction in the time it takes trucks to pass through its terminal gates. This process now takes 25 seconds per vehicle.

The need for a common communications methodology within the Port community is acknowledged. Currently, over 75 percent of the freight forwarders and customhouse brokers are EDI-capable and over 90 percent of the shipping lines are using EDI in their day-to-day operations with other ports around the world. However, no coordinated efforts have been made to use these capabilities within the Port of Montreal community.

We recommend that the Port of Montreal implement an Extranet solution to address the information exchange and gate congestion issues. This will also serve as the foundation for implementing new technologies, bringing it up to the level of other leading world ports. The system requirements of the proposed Port Community Extranet consist of many parts, of which the following are integral to the entire process:

- Databases
- Application servers
- Format Translator
- Communications
- EDI, VAN, Direct Connect, Internet

By using Internet technology combined with a central data repository, Extranet allows all community members to participate in and contribute to efficient Port operations. In addition, the recommended solution adds value to those internal systems implemented by stakeholders. For example, it will allow the terminals to provide visibility of container status during hours when the terminal gates are closed. All those interviewed were most enthusiastic regarding the proposed solution and recognize that this would bring immediate benefits to each community member. All parties also acknowledged that business efficiency would increase significantly from time-saving and cost benefits arising from the use of electronic communications rather than telephone and fax. Some of the benefits mentioned were:

- Increase in accuracy and timeliness of paperwork
- Decrease in gate dwell time for drivers
- Reduction in number of data entry points
- Improved operational efficiency through improved visibility of container status
- Improved planning and decision-making capabilities by all stakeholders

We recommend that the Port of Montreal embrace the concept of providing an Extranet to serve their community. We also recommend that the Port spearhead this effort and facilitate and sponsor its implementation. The Port Authority, in its position as an objective third party to the community it serves, is best positioned to play this role. We believe that unless the Port Authority plays this role, the system will not be implemented.

SOMMAIRE

Le Port de Montréal est constamment à la recherche de moyens d'accroître sa capacité concurrentielle et sa productivité. Il est d'ailleurs fermement résolu à investir dans l'amélioration de ses installations et dans les technologies d'information de pointe, pour le plus grand bénéfice de ses partenaires. C'est sur cette toile de fond que s'inscrit le projet de technologie intermodale lancé conjointement par le Centre de développement des transports, le Port de Montréal et GE Information Services (GEIS), qui vise à améliorer l'efficacité et la productivité des mouvements de conteneurs dans le port. Ce projet s'inscrit dans le cadre d'un programme de plus grande envergure ayant pour but la mise en place d'un système d'échange de données informatisées (EDI) parfaitement intégré entre le Port, ses partenaires commerciaux et d'autres organismes intéressés. Le programme vise la mise en oeuvre d'une technologie fondée sur Internet pour relier le Port et ses principaux partenaires commerciaux. Il porte une attention particulière à l'interface entre le terminal et les transporteurs routiers, ferroviaires et maritimes, et à la communication hâtive aux transporteurs des calendriers de manutention et de la situation des conteneurs.

Cette étude examine la faisabilité de mettre en oeuvre un service EDI fondé sur le Web pour la transmission de documents entre les partenaires du Port non dotés de capacités EDI, mais branchés au réseau Internet. Il s'agit d'assurer une présence sur les interfaces camion et terminal. Ce service d'échange de messages/documents doit permettre aux intervenants «dotés de capacités EDI» de communiquer avec leurs partenaires commerciaux dépourvus de telles capacités, d'utiliser Internet en tant que passerelle de communication entre tous les partenaires, et de permettre la souplesse et l'ouverture associées à l'échange électronique de données. Le milieu portuaire devrait trouver dans la mise en oeuvre d'un tel système de multiples avantages : moins de congestion à l'entrée des terminaux, moins d'attente pour les camionneurs, moins de paperasse, une information plus précise, une information en temps réel sur les conteneurs, et de meilleurs services aux clients.

GEIS a été chargé de réaliser, au nom de Transports Canada, une analyse des besoins et une étude de validation d'une solution Extranet au sein de la collectivité du Port de Montréal. L'étude recommande des améliorations tant matérielles que techniques pour atténuer les congestions à l'entrée du port. Ainsi, il a été constaté qu'à l'heure actuelle, les partenaires du Port communiquent surtout par téléphone et par télécopieur, et très peu par voie électronique : c'est là que réside la cause principale de la congestion.

La congestion à l'entrée du port n'est pas due à des causes matérielles. Donc l'agrandissement de l'aire de stationnement pourrait atténuer les symptômes de la congestion, mais n'en éliminerait pas la cause. Car la congestion tient essentiellement à des informations erronées et/ou manquantes, qui rendent inefficaces les procédures appliquées à l'entrée des terminaux. Or, une analyse approfondie a révélé que ces procédures sont bien pensées; le problème réside

dans l'inexactitude et l'insuffisance des données communiquées par les conducteurs, habituellement sur support papier.

Autre symptôme : les échanges d'information ont lieu entre deux parties seulement et demeurent invisibles aux autres, qui pourraient en avoir besoin. C'est ainsi que des camionneurs reçoivent l'ordre de se présenter à un terminal pour le ramassage de conteneurs qui ne sont pas prêts. Cela peut avoir trois causes différentes : a) les conteneurs ne sont pas encore libérés par Revenu Canada et/ou la compagnie maritime; b) les libérations, le cas échéant, n'ont pas été communiquées au terminal; c) les conteneurs sont encore à bord du navire.

Le Port de Montréal connaît un essor constant de ses activités. Pour soutenir une telle croissance, le Port et ses partenaires devront investir dans une technologie capable de traiter un trafic accru de conteneurs.

Montréal n'est pas seul à devoir faire face à ce problème. Dans tous les ports du monde, on observe une percée importante des communications électroniques et des technologies de pointe comme moyens de réduire les congestions et d'accroître les services. Voici des exemples de ces technologies :

- infrastructures locales de communications électroniques
- radiomessagerie et cartes à puce pour activer la chaîne des procédures, de l'entrée à la sortie du port

Ces deux technologies combinées tendent en outre à améliorer la sécurité associée à l'acheminement des conteneurs dans le port et au delà.

La mise en oeuvre de ces technologies donne des résultats remarquables. Par exemple, le Port de Singapour a signalé une diminution de 58 p. 100 du temps nécessaire aux camions pour franchir l'entrée de ses terminaux. Celui-ci ne dépasse pas, actuellement, 25 secondes par véhicule.

Tous reconnaissent le besoin d'un réseau unifié de communication au sein du milieu portuaire. Présentement, plus de 75 p. 100 des transitaires et des agents en douane sont dotés de capacités EDI et plus de 90 p. 100 des compagnies maritimes utilisent l'EDI pour leurs communications courantes avec les autres ports dans le monde. Mais aucun effort coordonné n'a été fait pour mettre à profit ces capacités au sein même de la collectivité du Port de Montréal.

Nous recommandons que le Port de Montréal mette en place une solution Extranet pour répondre à ses besoins de communication et résoudre les problèmes de congestion à l'entrée des terminaux. Une telle solution servira également de base à la mise en oeuvre de nouvelles technologies, qui hisseront le Port au niveau des autres grands ports du monde. La configuration du réseau Extranet proposé pour le Port de Montréal comporte de nombreux éléments, dont les suivants sont essentiels à l'ensemble du processus :

- bases de données
- serveurs d'applications
- convertisseur de format
- communications
- EDI, VAN, communication directe, Internet

En conjuguant Internet avec un fichier central de données, l'Extranet permet à tous les membres du milieu de tirer parti de l'efficacité des opérations portuaires en même temps que d'y contribuer. De plus, la solution recommandée ajoutera de la valeur aux systèmes internes mis en oeuvre par les intervenants. Par exemple, elle permettra aux terminaux de faire connaître la situation des conteneurs même pendant les heures de fermeture. Toutes les personnes consultées ont réagi avec beaucoup d'enthousiasme à la solution proposée, reconnaissant les avantages immédiats qu'elle représente pour tous les membres du milieu. Toutes les parties ont également reconnu que la rentabilité des entreprises augmenterait considérablement grâce aux gains de temps et d'argent résultant du recours aux communications électroniques plutôt qu'au téléphone ou au télécopieur. Voici certains des avantages mentionnés :

- processus administratifs plus précis et plus rapides
- réduction du temps d'attente des conducteurs à l'entrée des terminaux
- réduction de nombre de points de saisie des données
- plus grande efficacité des opérations, grâce à une meilleure diffusion de la situation des conteneurs
- planification et prises de décisions plus faciles pour tous les intervenants.

Nous recommandons que le Port de Montréal approuve en principe le projet d'instaurer un réseau Extranet pour desservir le milieu portuaire. Nous recommandons également que le Port soit le moteur et le parrain de ce projet. L'Administration du Port, en tant que tierce partie neutre par rapport à la collectivité qu'elle dessert, est la mieux placée pour jouer ce rôle. Nous croyons que le réseau ne sera instauré que si l'Administration du Port accepte d'en prendre l'initiative.

CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

GLOSSARY

AC	Agriculture Canada
ANSI	Identifies the predefined EDI message that should handle the message
ASYNC	Asynchronis
BISYNC	Bisynchronis
CAMS	Computer Aided Modelling System
CC	Canada Customs
CGS	Communication Gateway Subsystem
CHB	Customhouse Broker
CTS	Container Tracking Subsystem
Destination	The party or parties that need to receive the message
EC	Electronic Commerce
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
ERS	Enquiry Reporting Subsystem
Estimated Message Length	The estimated length of the message in characters
FF	Freight Forwarder
FTP	File Transfer Protocol
GEIS	GE Information Services
GUI	Graphic User Interface
HTTPS	Secure Hyper Text Transfer Protocol
IETF	Internet Engineering Task Forces
LAN	Local Area Network

LDAP	Lightweight Directory Access Protocol
# Msgs/Container	The estimated number of messages that will be sent per container
MTS	Message Translator Subsystem
Originator	The party that sends the message
PKI	Public Key Infrastructure
Port of Montreal Extranet Community System	Indicates whether the message needs to be captured in Port of Montreal Extranet Community System
SNA	System Network Architecture
SL	Shipping Line
SSL	Secure Sockets Layer
SSS	Subscriber Security Subsystem
TC	Trucking Company
TCP/IP	Transport Control Protocol/Internet Protocol
TDC	Transportation Development Centre
TIR	Terminal Interchange Report
TE	Terminal
TMS	Terminal Management System
VAN	Value Added Network
VMS	Validation Manager Subsystem

1 INTRODUCTION

With the emergence of a global economy, companies are under increased pressure to improve efficiency. In the intermodal transportation industry, there is a growing need for better tracking of the status of containers in transit. The Transportation Development Centre (TDC) of Transport Canada is engaged at the Port of Montreal in an intermodal technology project designed to improve the efficiency and productivity of container movements through the Port. The project is part of a larger program designed to achieve fully integrated electronic data interchange (EDI) among the Port's trading partners/stakeholders.

In this context, TDC, the Port of Montreal, and GE Information Services (GEIS) have joined forces on an intermodal technology project involving the implementation of Internet-based technology linking the Port and its major trading partners. The project's focus is on the terminal/truck, rail, and shipping interface, and particularly on the provision of advanced scheduling/appointments and container status information to carriers.

2 PROJECT OBJECTIVE AND SCOPE

This project falls within the scope of a larger program whose ultimate aim is to achieve fully-integrated electronic data interchange (EDI) among the trading partners/stakeholders of the Port of Montreal. The objective of the project was to develop and prototype a Web-based information/document interchange service between the Port and its major stakeholders/trading partners, with the focus on the terminal and truck interface. The Web-based information/document interchange service would enable "EDI-capable" Port stakeholders to be able to communicate with non-EDI trading partners, use the Internet as a communication gateway for all trading partners, and demonstrate the use of open and flexible electronic data exchange capabilities. The expected benefits to the Port community of implementing such a system were: diminishing congestion at the terminal gates, minimizing delays at the gates for trucking companies, reducing paperwork, improving date accuracy, providing real-time container information, and providing better overall service to the customer.

The GEIS study examined the feasibility of implementing Web-based EDI document transmission among the Port's non-EDI trading partners using the Internet's low-cost network service. The work performed by GEIS for Transport Canada on behalf of the Port of Montreal consisted of the following tasks:

- Undertake a series of user interviews with Port community members to determine the feasibility of implementing a Web-based communication system. Community members to be interviewed included various shipping lines, the Port forwarders, terminals, trucking companies, and government agencies. The interview process should be used to:

    - Make an inventory of existing date interchange/port management information systems operated by the interviews.

    - Assess the capabilities and technological readiness of each partner to meet the future Web-based electronic data exchange needs of the Port.

    - Carry out a needs analysis/business process survey identifying problems areas and business processes that require improvements.

    - Examine current information flow requirements among stakeholders and determine how a Web-based document/interchange system can best be achieved.

    - Recommend a Web-based solution to meet the requirements of the Port community and validate proposed solutions with the Port steering committee.

    - Develop an "electronic commerce model" for the "future state" process, including network architecture, functional requirement specifications, general system architecture, user interface, and security system.

- Deploy a three-month working prototype of the proposed system.
- Based on the results of the working prototype, make recommended changes and submit a final report.

- Other than the deployment of a three-month working prototype of the proposed system and possible recommended changes based on the results from that working prototype, all of the tasks outlined above were achieved and this report with the final proposed solution is the result of that activity. Regarding the three-month working prototype, the steering committee determined that funds allocated to the development of a working prototype should be redirected to other tasks. These "other" tasks included: a more in-depth interview process, the development of sample user interface screen to emulate the proposed solution, and a Web-based prototype demonstrating Web forms to EDI.
- Based on the information gathered, GEIS developed a transaction model for the "future state" EDI/EC import process at the Port. As part of this process, six transactions were identified as key business opportunities. The documents to be supported by the Port Extranet Community System are shown in **Table 1**.

Table 1 – EDI Documents Supported by Port of Montreal Extranet Community System

Document	Sent From	Sent To
Notice of Arrival	Shipping Line	Customhouse Broker Notify Party
Canada Customs Manifest	Shipping Line	Revenue Canada
Shipping Line Release	Shipping Line	Customhouse Broker
Container Status	Terminal	Trucking Line, Customhouse Broker CP Logistics
Delivery Order	Customhouse Broker CP Logistics	Trucking Line
Customs Release (includes releases by other government departments)	Revenue Canada	Customhouse Broker Terminal

3 BACKGROUND

In the intermodal transportation industry, a growing need exists for better tracking of containers in transit. This would lead to improved handling operation, fewer errors, increased throughput, and the use of electronic data exchange. This project is part of a larger program designed to achieve fully integrated electronic data exchange among the Port's trading partners/stakeholders.

The Port of Montreal is constantly seeking ways to make their system even more competitive and productive while at the same time adopting innovative technologies to increase their international level of competitiveness and attractiveness. To meet this challenge, the Port is firmly committed to invest in facilities, improvement, and technologies that will:

- Allow the Port to maintain and strengthen its leading position among ports around the world.
- Improve operational efficiencies between various stakeholders and trading partners.
- Expand the scope and size of the Port community.
- Generally improve overall customer service and responsiveness to the Port stakeholders and trading partners.

As part of a larger, more comprehensive program whose ultimate aim is to achieve fully integrated EDI among the trading partners/stakeholders of the Port, GEIS was contracted by TDC to investigate the viability of introducing a Web-based information/document interchange service among the Port stakeholders. The work involved carrying out a business analysis, and documenting flow and requirements analysis among the Port stakeholders, leading to a set of prioritized recommendations to Port stakeholders for prototype implementation.

4 BUSINESS ANALYSIS

The business analysis reflects the views of each of the stakeholders interviewed, e.g., terminals, customhouse brokers, freight forwarders, shipping lines, and trucking companies.

4.1 The Port of Montreal

The Montreal Port Authority's primary mandate is to facilitate domestic and international trade and thus contribute to the achievement of local, regional, and national socio-economic objectives. The Port addresses this role by providing highly efficient facilities and services to its clients and promoting the competitive advantages of the port. It also provides terminal operators with land, services, infrastructure support, and security. The Port also provides railway-switching services to both Canadian Pacific Railway and Canadian National railways and controls and coordinates vessel arrivals and departures.

4.1.1 Business Drivers

The key business drivers affecting the Port of Montreal during the period of the study were:

- Desire to improve the overall efficiency and effectiveness of the Port community as a whole.

  The Port of Montreal views its role within the port community as one of an objective central entity. It competes against other ports within North America in attracting premier shipping lines. It attracts these lines by providing a strategic geographic location, year-round access, multiple intermodal connections, multiple port functions, and world-class services and infrastructure. The Port is continually making improvements to these facilities.

- Respond in a proactive manner in addressing the needs of the Port stakeholders and in maintaining a 6-7% annual growth rate of containers.

  The Port of Montreal has been experiencing annual container growth rates of 6-7% over the last few years. Unless a more efficient manner of increasing container throughput is found, the Port can expect greater terminal congestion resulting in the need to either expand container storage facilities and/or truck waiting areas or implementing some other solution (non structural). Sources at the Port of Montreal estimate costs for expanding these services at between $3mil to $5mil.

- Reduce the cost infrastructure of the community and improve overall services provided to stakeholders and trading partners.

  The Port of Montreal has been experiencing gate congestion at the three terminals. This congestion is becoming more visibly inefficient. In fact, the Port has been receiving letters and complaints from various trucking companies and trucking associations, such as the Quebec Trucking Association, regarding this issue. It is imperative that the Port addresses this issue before it becomes more serious.

- Remain competitive with the world port community and maintain a world-class image as a port of call.

  Competition for shipping line traffic is becoming increasingly more competitive. The Port of Montreal should be investing in facilities and technologies that allow it to compete on a worldwide scale. The Port of Montreal is currently evaluating a new Enterprise Resource Planning (ERP) system to improve internal efficiencies and has recently installed a fibre-optic network around the Port. As stated in ***Appendix A, Industry Trends***, ports around the world have for years been investing in community systems that improve the exchange of communications among the various stakeholders.

4.1.2 Business Process Improvement

Although the Port Authority has only limited involvement in the flow of information taking place within the community, it nonetheless represents the key central entity of the community and is the logical entity to manage a community data exchange system. At present, the Port of Montreal receives the Vessel Manifest from the various shipping lines for billing purposes. By adopting the proposed Extranet solution, The Port could ultimately look at eliminating their existing EDI system and rely solely on the proposed system to retrieve the required billing information. This approach becomes increasingly relevant given the imminent migration of the port to an ERP system and the likely impact this migration could have on the Port's EDI system. An evaluation of future EDI plans at the Port would need to take place as well as an understanding of the level of integration to internal systems currently in place prior to recommending this approach. In conclusion, it is conceivable that, the Port of Montreal could alter its role from administering an internal EDI system to acting as the Port community administrator of the proposed system without incurring substantial additional costs.

4.2 Terminal Operators

The three terminals at the Port of Montreal (Cast, Racine, and Termont) are tasked with managing the efficient flow of containers between the shipping lines

and the consignee. The terminals fill this role by off-loading containers from the vessels in an efficient manner and tendering the containers to railways and various trucking companies. They provide equipment, personnel, and space to support these services.

4.2.1 Business Drivers

The key business drivers affecting the terminal operators during the period of study are the following:

- Priority being given to the shipping lines, the railways, and then the trucking companies.

  Ships berthed at the terminals have very tight sailing schedules. Import containers must be off-loaded and export containers must be loaded to meet tight sailing schedules. Second in priority after the shipping lines are the railways. Forty percent (40%) of import traffic is destined for the Chicago Hub, which is a hotly contested lane by all the major ports on the North Atlantic coast. Finally, after the needs of the shipping lines and railways are satisfied, the needs of the trucking companies are addressed. This prioritization is based on economics and market demand.

- Ensuring that terminal operation remains efficient once a trucking company is in the gate area.

  Terminal operators are aware that there will always be periods of extreme congestion even with new technologies being implemented. This congestion typically takes place just prior to a vessel departure or after a vessel arrival. This congestion is caused by four primary factors:

  - The desire of trucking companies to deliver an export container while picking up an import container.
  - A certain sense of urgency associated with the arrival of a ship.
  - The timeframe between a ship's arrival and departure which is often under 48-hour turnaround time. Shippers wanting to deliver an export container as close to cutoff as possible (50% of all export containers arrive very close to cutoff).

  All three terminals currently have plans to implement a best-of-breed terminal management system. This will positively affect the flow of information and terminal operations.

- Addressing administrative inefficiencies that take place at the terminals.

  As noted previously, the adoption of the terminal management system by the terminals will significantly improve operations and information flow, providing the capability for real-time container status updates to the port community.

4.2.2 Business Process Improvement

Current metrics uncovered at the three terminals were as follows:

- They receive on average a 100 phone calls an hour pertaining to container status.
- Two full-time personnel operate the phones at Racine terminal.
- Five individuals respond on a rotating basis to phone calls at Cast terminal.
- They continue to receive carrier releases and delivery orders via fax.
- Termont receives up to 500 faxes per day.
- Cast Shipping provides Racine terminal with shipping release via fax.

All three noted that any information improvement that the new system could provide would be beneficial to everyone. It was also noted that since information was not easily available, there could often be as much as a 24-hour delay in response time on a container status inquiry. A new terminal management system would help, but without a tool to provide container status visibility to the outside world, it would still not reduce the number of calls being received by the terminals.

The only EDI implemented by the terminals thus far are the Bayplans and Terminal Activity Reports. The terminals receive delivery orders via fax and enter them into their internal systems. When the driver shows up and presents the container number, it is validated against the system. At times the container number is transposed, either by the driver or when the delivery order is entered into the system. This creates delays at the gate.

Many times when the driver arrives at the terminal with a full export container, either he or the terminal is missing appropriate documentation (booking/contract reference), creating unnecessary gate delays. As many as 25% of the trucking companies had issues with paperwork.

Other problems occurring at the terminal include:

- Customs and shipping line releases are not available at the terminal when truck arrives to pick-up the container.
- The terminal has not received the vessel bookings from the shipping line before the trucker arrives with the export container or for an empty container.

4.3 Shipping Lines

The major shipping lines using the Port of Montreal are Cast Shipping and CANMAR Agencies, both owned by CP Ships. Other shipping lines, such as Hapag-Lloyd, OOCL, and DSR – Senator Lines, also use the Port's facilities.

4.3.1 Business Drivers

As the focus of understanding the shipping lines' key business drivers was beyond the scope of this project, the shipping lines were nonetheless interested in understanding any system that would improve overall customer service levels provided to Port community users. They also wished to understand how such a system might affect their business processes as well as the use of their internal resources.

4.3.2 EDI Infrastructure in Place

The majority of the EDI utilized by the shipping lines was for the electronic exchange of documents to Revenue Canada, the Port of Montreal, the terminals, the railways, and the major freight forwarders. Very minimal electronic exchange of information has been implemented between them and the terminals and trucking companies. The only electronic data exchange between the shipping lines and the terminals is the Bayplan. Most exchanges that take place are done through e-mail, not EDI.

4.3.3 Business Process Improvement

The current process used at the shipping lines (Cast Shipping) is to auto-fax Notices of Arrival to their customers. Cast noted that an electronic file containing Notices of Arrival could easily be duplicated and posted to a Web server to improve overall service, reduce faxing costs, and free up staff currently dedicated to this manual process.

For all shipping line releases exchanged between the shipping lines and terminals, the responsibility of updating the system was left to the individual branches (CAST Shipping Lines). Since both Cast terminal and C-Truck (a CP Ships division) have access to the same internal systems,

they are able to see shipping line releases on-line. The problem between Cast Shipping Lines and Racine terminal is that shipping line releases have to be faxed by Cast's head office to Racine on a daily basis.

4.4 CP Logistics

CP Logistics, owned by CP Ships, plays a key role in assigning and transporting a high level of container volume brought in by both Cast Shipping and CANMAR Shipping.

CP Logistics accomplishes this by relying on three to four major strategic trucking companies with strengths in key markets served.

4.4.1 Business Drivers

CP Logistics' primary function is to ensure high levels of service to the two shipping lines, CAST and CANMAR Shipping Lines. As discussed, competition for North Atlantic container traffic is increasingly competitive. Transit vessel schedules are critical in winning and maintaining this business. CP Logistics provides a full door-to-door service and provides very competitive schedules into the northeastern and midwestern United States. CP Logistics also relies on its relationship with the terminals and shipping lines to provide a competitive advantage over a busier port, such as New York/New Jersey.

CP Logistics uses C-Truck, as its main over-the-road carrier. Another three to four trucking companies are used for any overflow usually caused by seasonal imbalances. Communication between CP Logistics and C-Truck is via T-Cards. The T-Cards are initiated by CP Logistics and contain information for containers to be picked up at the terminal. These T-Cards are then physically given to personnel at C-Truck who use the information to schedule and assign drivers for container pick-up. This process results in entry of the same information into two different systems. CP Logistics is currently evaluating different dispatching packages to automate this process.

4.4.2 Business Process Improvement

It was noted that all communication among CP Logistics and the terminals, C-Truck, and trucking companies is manual. CP Logistics works with a Bayplan report provided by CAST terminal and, although this does help, it requires validation throughout the day to ensure that the terminals are on target. As for the Racine terminal, CP Logistics has to call to determine whether the container has been actually discharged from the vessel. This process can take more than 30 minutes to resolve. They

have found that communication with Racine terminal is time-consuming and fragmented since it is accomplished using phone, fax, and e-mail (where accessible).

All communications between CP Logistics and its external shipping lines are via fax and phone.

4.5 Trucking Companies

Even though CP Ships provides a significant volume of container movements, the Port of Montreal deals with many other trucking companies, e.g., C-Truck, Highland Transport, Transpel, and Intra Quebec. However, since these four represented the largest volume, our interviews focused on them.

The primary role of the trucking community is the pick-up and delivery of export and import containers to and from the Port of Montreal. Customer requirements tend to drive the scheduling for pick-up and delivery.

The loads moving out of the Port of Montreal tended to be for delivery into the local Montreal area, Ontario, and the northeast United States. Because of sailing schedules, shipping lines are able to draw export traffic from as far away as Chicago and thus require the services of trucking companies to move these loads from the United States northward. This activity tends to push the delivery of export containers to maximum cut-off time.

4.5.1 Business Drivers

The key business drivers affecting the trucking companies were:

- Satisfying CP Logistics, the logistic provider of CANMAR and Cast Shipping.

  As mentioned above, the main customers of the trucking companies are Cast and CANMAR Shipping. Container volumes are substantial and the shipping lines have a significant amount of influence with these trucking companies. In addition, CP Ships have their own trucking arm, C-Truck, which has priority for the loads.

  This one-sided relationship, combined with Quebec's competitive conditions, lead to trucking companies' inability to charge the shipping lines for excessive waiting time.

- Lobbying the Port of Montreal and other agencies to make improvements.

  Based on discussions with many of the trucking companies, they feel that adding an office shift at the terminals would provide relief to the gate congestion issue. They believe that the long haul, over-the-road containers would be picked up later at night for delivery the next

morning. This would shift some of the peak traffic from the afternoon into the evening hours. It would also provide a wider window for both pick-up and delivery, which would provide some peak traffic smoothing. In addition to the benefits suggested, it would improve the overall capability of the Port.

- Finally, the trucking community has clearly articulated their concerns regarding gate congestion at the Port of Montreal through their private member association, the Quebec Trucking Association.

4.5.2 Business Process Improvement

Due to potential large variances in times to pick up containers at the Port, C-Truck and Transpel both maintain staging areas at a significant cost. Instead of being able to provide door-to-door service, additional handling is required by a local driver. Costs incurred include double handling, yard space, security, shunting, and equipment depreciation.

C-Truck employs drivers on an hourly basis, and waiting times at the gate have a direct effect on costs of a pick-up and delivery. As drivers wait in line they handle fewer containers themselves on a daily, weekly, and annual basis and thus, more containers must be tendered to other carriers or C-Truck must hire additional drivers. This results in higher costs due to lack of driver productivity, less efficient asset use higher outsourcing costs, and a higher pick-up cost per container than that of competitors.

Finally, trucking companies appear to be their own worst enemy. Twenty-five percent (25%) of container pick-ups and deliveries involve paperwork problems. This is especially prevalent with the smaller carriers and independent brokers.

All carriers interviewed observed that information flow could be improved at the Port of Montreal. They use manual resources in an effort to solicit container status information from the terminals.

C-Truck noted that, although improvements could be made in disseminating information to the various trucking companies, the real benefit is having the smaller trucking companies participate in the system. At present these trucking companies are so far “out of the loop” in obtaining container status information that it is common practice to simply take a chance in sending a driver for a container pick-up based on a guess. With no priority given to the trucking companies, especially those moving higher volumes, a congestion problem has resulted for everyone.

5 CURRENT PROCESS

5.1 Current Environment

As previously stated, the implementation of electronic commerce in the Port of Montreal community has been very fragmented. Those organizations exchanging documents electronically are Canada Customs (entries and clearance information), shipping lines (vessel manifests), terminals (Bayplans), and customhouse brokers (Customs entries and clearances). A smattering of other EDI messages by the customhouse brokers and freight forwarders have also been implemented in a fragmented manner. There is no EDI between the terminals and the trucking companies. Most of the information exchanged within the community is by telephone, fax, or courier. The import information consists of container status, pick-up/delivery orders, bills of lading, etc. **Figure B-1** in Appendix B shows the information flow as it exists today; export information is shown in **Figure B-2**. The shaded areas depict where EDI is used in the current process. The reader will immediately notice that this includes only communications between the shipping lines and the terminals and between Canada Customs and the terminals and customhouse brokers.

5.2 Import Process

The import process actually begins offshore, as illustrated in **Figure B-2**. However, except where noted below, those communications have not been mentioned because they do not affect the terminal or gate congestion. The way in which import information (documents) flow is as follows:

- The previous port terminal transmits a Bayplan document to the next terminal. The terminal uses this information to show the location of containers within the ship. The information in the document is 90% accurate due to miss-stows. The following information is included in the Bayplan document.
    - Bill of lading number
    - Stowage cell location
    - Container number
- As containers are processed from the vessel, a terminal interchange report is transmitted to the shipping lines. This document is used as a proof of receipt between the shipping lines and the terminals.
- The customhouse broker completes his entry and transmits it to Revenue Canada.
- Revenue Canada matches the vessel manifest with the Customs entry and determines whether to inspect the cargo or clear it.

- If Revenue Canada determines that the cargo is to be inspected, based on destination of the container, source of the container, content and miscellaneous tips they contract with LaFrance Transport to move the container(s) to Revenue Canada's inspection facility. Here, LaFrance will unload the container. Revenue Canada then inspects the cargo, and if all is well, instructs LaFrance to reload the container and move it back to the terminal.

- Revenue Canada issues an electronic release to the customhouse broker and to the terminal.

- Once the customhouse broker has received the electronic clearance from Revenue Canada, the broker contacts the terminal to determine whether the container is available for pick-up. This is currently performed over the telephone.

- Some customhouse brokers, instead of contacting the terminal themselves, issue a delivery order to the trucking company designated to deliver the container to the ultimate destination.

- Upon receiving the delivery order from the customhouse broker, the trucking company will contact the terminal by telephone to check the status of the container. If the container has not yet been grounded, the company will continue telephoning until notified that the container is available for pick-up.

- The trucking company then gives the driver the delivery order containing the number of the container to be picked up as well as other information. The driver is often already on the road and the trucking company contacts him via cell phone and provides him with the number of the container to be picked up. In this instance, the driver shows up at the terminal gate with just the container number written on a piece of scrap paper. Under agreements with the shipping line, the customhouse broker, and the customhouse broker, the terminal has agreed to allow the driver to pick up the container if he presents a valid container number.

- After presenting the terminal gate with the container number, the gate personnel generate a terminal interchange report, give it to the driver, and direct the driver to the container.

- The driver proceeds into the terminal, where the container is loaded on his chassis.

- The driver then proceeds to the terminal exit gate where he surrenders the terminal interchange report and the gate clerk proceeds to inspect the container.

- The terminal interchange report is then entered into the terminal system later that day showing a “depart” status.

5.3 Export Process

The export process is much simpler that the import process and is illustrated in **Figure B-2**. The entire process is manual. The documents and information exchanged are the vessel booking and the vessel booking confirmation, the deliver/pick-up order, and the terminal interchange report.

The way in which export information (documents) flow is as follows:

- The freight forwarder telephones the shipping line and requests a booking on a particular vessel.

- The shipping line confirms the booking and gives the freight forwarder the booking confirmation number. This can happen while the freight forwarder is on the phone with the shipping line, or the shipping line may fax the booking confirmation to the freight forwarder at a later time.

- When the freight forwarder receives booking confirmation from the shipping line, he faxes a delivery/pick-up order to his trucking company.

- The trucking company assigns a driver and gives the driver the delivery/pick-up order.

- The driver arrives at the terminal with the delivery/pick-up order and presents it at the terminal gate.

- The gate validates the booking number with bookings it has received from the shipping line and inspects the container.

- If the booking number is valid, the driver is given a terminal interchange report and instructed where to pick up the empty container. At times, the terminal has not received the bookings report from the shipping line and the driver has to contact his trucking company, who in turn contact the freight forwarder, who then contacts the shipping line to resolve the problem.

- The container is loaded on the driver’s chassis and the driver proceeds to the exit gate.

- At the exit gate, the driver surrenders the terminal interchange report, which contains the number of the empty container, and departs the terminal.

- The terminal enters the terminal interchange report information into its internal computer system, showing the status of the empty container.

- The driver delivers the empty container to the shipper as designated on the delivery/pick-up order.

- The shipper loads the empty container, completes all appropriate paperwork, and contacts the freight forwarder to pick up the full container and deliver it to the Port.

- The freight forwarder generates a delivery order and faxes it to the trucking company, who designate a driver.

- The trucking company gives the driver the delivery order and the driver picks up the container at the shipper's location and delivers it to the terminal.

- The terminal validates the booking number, generates a terminal interchange report, and directs the driver where to drop off the container.

As stated earlier, this process is all manual. The shipping lines and freight forwarders do not interchange bookings and booking confirmations electronically. Nor are the freight forwarders and the trucking companies exchanging delivery orders electronically.

6 FINDINGS AND RECOMMENDATIONS

In the initial interviews, it was found that the use of EDI systems within their various business operations scaled across a fairly large subsection, especially among the larger stakeholders, but that the scope of the use the systems was somewhat limited and fragmented. Except for Highland Transport, all trucking companies had no EDI infrastructure in place nor plans to implement it.

Finally, among those currently using EDI as a means of exchanging messages, most of the community interviewed were using GE Information Services.

Table 2 lists what documents those Port community members are now exchanging via EDI.

Table 2 – EDI Infrastructure of Stakeholders

Stakeholder	EDI Infrastructure	Documents
Port of Montreal	Premenos/AS400	Ocean Manifest
Cast Shipping	Mentor/HP Unix	Ocean Manifest, Customs Release
Canmar Shipping	Gentran/MVS	Ocean Manifest, Customs Release
Racine Terminal	Premenos/AS400	Gate Activity
Cast Terminal	Uses Cast Shipping System	Gate Activity
C-Truck	No EDI	No Documents
Highland Transport	EDI-Capable	Bill of Lading
Tower Group	AI/ Windows NT	Customs Release
Transpel	No EDI	No Documents

Because of the lack of scope of electronic interchanges within the community, many stakeholders are not leveraging their investment in EDI and are thus supporting ineffective cost models. For example, many of the stakeholders interviewed are using EDI systems to support one or two EDI messages and must pay for annual software upgrades, support staff, training, and higher unit EDI costs.

In addition, many of the major stakeholders are making important changes to their internal information technology (IT) systems. These changes will affect legacy EDI systems and likely result in additional EDI development requirements, software acquisition, and additional training of support staff.

Therefore, it is the position of GEIS that many of the stakeholders should begin assessing how to either increase their use of EDI with their trading partners or look at alternative ways to support their existing EDI requirements.

6.1 Technological Readiness of Port Community Members

Most of the major stakeholders operating in the Port of Montreal have EDI capability and could support an increase in the use of EDI messaging within and outside the Port community. This is especially true of the shipping lines, major customhouse brokers, government agencies, and terminals. It was also found that both Cast and CANMAR Shipping Lines had a highly skilled EDI staff and sophisticated EDI infrastructures.

The adoption by the trucking companies and freight forwarders of a Web-based document exchange system does not pose any significant technological threat. In fact, adoption of a Web-based system was viewed as a way to experience the same EDI benefits traditionally enjoyed by the medium to large businesses. Having to understand, support, and use a browser was considered much more advantageous than having to maintain skilled EDI resources.

All of the mid to large users interviewed had the technical capability to communicate electronically. Others agreed that if access to the information could be achieved via the Internet, it would be valuable. Most l of the stakeholders surveyed either had Internet access or were planning to implement it.

Both shipping lines indicated that they had additional capabilities to generate and send electronic Shipping Line Releases and Notice of Arrival documents in either a proprietary file or EDI format over a Value Added Network (VAN) or via the public Internet.

In conclusion, the only technological issue noted by all the interviewees was the terminals' inability to provide electronic container status to the Port community. It is noted that the new terminal management system (TMS) will rectify this situation by providing real-time container status between the checker and the host system located at the terminal. This information can then be distributed on a timely basis to the community members.

6.2 Initial Recommendations

The recommendations resulting from the initial interviews were:

- Increase the size of the vehicle waiting area at the terminal gates.
- Extend operating hours of the terminals.
- The terminal gate clerk, based on accessibility of the container (least number of container lifts) assigned to the driver's company, assigns the container to the driver. The paperwork supporting this move is printed at the terminal exit gate. This is referred to in this document as the "pooled container concept".
- Make EDI and Internet technologies the number one communications method used by Port stakeholders.
- Create centralized information repositories that would initially maintain container status, but would also provide other critical information essential to the Port community.

6.3 Validation Results

As stated earlier, GEIS consultants conducted a second and expanded round of interviews with members of the Port of Montreal user community to validate the recommendations outlined above. As a result of this series of interviews, we were able to determine that the Port gate congestion issue was the visible effect of an underlying communications problem within the Port community. Our findings are as follows.

6.3.1 Terminals

Our observations at two of the terminals, CAST and Racine, demonstrated that their gate operations are highly efficient and, although we did not observe the operations within the container yard, each of the terminals appeared to operate efficiently. Current targets used at the terminals are 20-minute processing time, with a throughput of 55 trucks per hour.

Within the current environment, an electronic communications implementation will not alleviate the gate congestion problem because of the current state of technology within the terminals. The systems currently in use at the three terminals are not capable of providing real-time electronic container status information to the port community members. With the planned implementation of new, state-of-the-art TMS, all three

terminals will be able to support real-time updates to the proposed centralized database within the proposed Port of Montreal Extranet Community System.

As one participant noted, the proposed system would help alleviate the problem, but would not completely solve it. As he said, *"If you have three vessels calling at all three terminals at the same time, you're going to have some congestion."*

Expanding hours of operation created potential labour issues and had been tried out previously on at least one occasion. The increased hours of operation were found to have simply moved gate congestion from 8:00 a.m. to 4:00 p.m. to between 6:00 a.m. and 10:00 p.m.

Regarding the current prioritization of the modes at the terminals (ships, rail, and trucks), it is clear that trends such as just-in-time (JIT) and guaranteed delivery will begin to shift priorities from modal prioritization towards container prioritization.

By implementing electronic communications with the Port of Montreal community members, terminals stood to gain significant improvements in the deployment of internal resources, both administrative and operational, and in services provided to the community as a whole.

It has also been suggested that if the terminals send the container stack list to the trucking companies, perhaps the dispatcher can schedule the pick-ups in such a way as to reduce the repositioning of the containers in the yard. It can take as long as an hour to reposition containers to get the container to be picked up.

6.3.2 Port of Montreal

Increasing the size of the parking area outside the terminals to accommodate trucks will only exacerbate the problem, not provide a solution.

Variation in the business needs and desires of the terminals, trucking companies, railways, and shipping lines dictates that a need exists for electronic program coordination within the Port community. We believe that the Port of Montreal best serves this role.

Some suggestions that were offered concerned infrastructure changes (tunnels, bridges, etc.). This type of change, although not directly affecting the gate congestion problem, is outside the scope of this study.

6.3.3 Shipping Lines

One shipping line noted that the move to a Web-based system would not be a significant migration as many of the shipping lines had already invested in Web sites to facilitate bookings and container tracking. One shipping line noted that adoption of a Port of Montreal Extranet Community System will reduce the fax costs associated with arrival notifications and steamship releases.

6.3.4 Freight Forwarders/Trucking Companies

CP Logistics currently has a very close relationship with CAST and receives the Bayplan and the Discharge Plan from CAST Terminal that allow them to estimate their container availability. They do not have this same relationship with the other terminals and shipping lines. As a result, they foresee significant benefits from the proposed solution as it will provide better access to container availability and status at the other terminals and carriers.

Overall, the trucking companies supported an electronic information exchange at the Port. They perceived benefits through advance information regarding container status. In addition, they saw significant benefit in having access to container information even when the Port gate (office) was closed. Currently, they cannot obtain container status from the terminal until the office is open, usually at 7:30 a.m. or 8:00 a.m. Monday through Friday.

The initial concept of the terminal assigning a container to a driver based on destination and available equipment with the associated paperwork printed at the gate, was rejected by the trucking companies and the other stakeholders associated with placement of the containers at the shipper's/importer's facilities. The primary problem with this approach was appointment times. The trucking companies call the consignee or the delivery party to establish a delivery appointment and the "pooled" container concept would not support this process.

6.3.5 Community as a Collective

The overall communication between the shipping lines, customhouse brokers, freight forwarders, trucking companies, and the terminals is inefficient and contributes to the Port congestion problem.

The user community would embrace electronic communications between all members for the exchange of shipment/container availability information.

When presented with the system concept, most community members accepted it and stated that they would participate. In fact, several would like to be included in the initial implementation pilot.

All of the mid-to-large users interviewed had the technical capability to communicate electronically. Others agreed that if access to the information could be achieved via the Internet, it would be valuable.

Implementing the proposed system will benefit all parties in the process by reducing and, possibly eradicating, the time on telephones obtaining container availability. The system will also improve the accuracy of documentation on shipments.

6.4 Final Recommendations

This study recommends that the Port of Montreal implement an Extranet (defined as a virtual private network separated from the public Internet by a firewall) solution to address the information exchange and the gate congestion issues. It will also serve as the foundation for implementing new technologies adopted by other leading world ports. The system requirements of the proposed Port community Extranet comprise the components integral to the entire process, such as databases, application servers, format translator, and communications interfaces via VAN EDI, Direct Connext, and Internet.

By using Internet technology combined with a central data repository, it allows all community members to participate in and make a contribution to efficient port operations. In addition, the recommended solution adds value to those internal systems implemented by stakeholders. For example, it will allow the terminals to provide visibility of container status during hours when the terminal gates are closed. Thus, business efficiencies become immediately apparent to all parties in terms of time and cost benefits arising from the use of electronic communications rather than the existing reliance on telephone and fax.

The Extranet Port community system would allow “EDI-capable” port stake-holders to exchange EDI documents with non-EDI trading partners. The benefits to the Port community are: less congestion at the gate, fewer delays; reduction of paperwork; real-time container information; improved operational efficiencies brought about through better visibility of container status; improved customer service; and better planning and decision-making capabilities of all stakeholders.

7 PORT OF MONTREAL BUSINESS/SYSTEM RECOMMENDATIONS

A major goal of the Port of Montreal is to maintain its leading position as a world port. To this end, it will be necessary for them to invest in technologies similar to those described in “Industry Trends”, shown in Appendix A. The system under consideration and further refined in this report is a major step in this direction.

Although many options are available to the Port of Montreal, we have been able to identify that ineffective information exchange is the main cause of gate congestion.

7.1 Port of Montreal Extranet Solution

We recommend that the Port of Montreal implement an Extranet solution to address the information exchange and gate congestion issues. This will serve as the foundation for implementing new technologies, bringing it up to the level of other leading world ports.

This solution will significantly help alleviate gate congestion and allow the terminals to better serve the community, while adding value to their investment in the TMS. The TMS, as implemented, will greatly improve the operating efficiencies within the boundaries of the terminal. This solution will allow external Port community members access to that information while preserving the security of those systems. Benefits to the other stakeholders will allow them to:

- Reduce time spent on telephones obtaining container status.
- Reduce fax costs.
- Improve accuracy of documentation and data.
- Maintain a central repository of container information and status.
- Provide accessibility to container status, 24 hours a day, 7 days a week.
- Establish a baseline for enhancing EDI and Internet communications to other organizations such as railways, consignees, and shippers.

This solution brings value to all stakeholders in the Port of Montreal user community.

7.2 Business Requirements

To satisfy the requirements of the community, the Extranet must support:

- A central data repository for holding and maintaining visibility of container status until container departs the Port.

- Event-driven message delivery from the mailbox.
- Flexibility of the data format it brings in.
- Data entry screens and container inquiry screens accessible through the Internet, to alleviate any significant investment in technology by the user community.
- Access to container availability 24 hours a day, 7 days a week.
- Real-time container status inquiry and update.
- Proactive notification of container status change to appropriate parties.
- Reduction or elimination of dual entry data into multiple systems, by interfacing via EDI or other formats with community users' internal systems.
- Reports on container status.
- Truck driver authentication and ability to match containers and drivers.
- Date/time stamps as each transaction is added to the database.
- Adequate security at the sign-on and data access levels.
- Maintaining container status as the container moves through the Port logistics cycle. This information must be accurate and timely.
- Reduction of paper, telephone calls, and faxes.

The recommended system is shown in **Figure 1**. This example shows data entered into the system via EDI, direct connect, the Internet, and the Extranet.

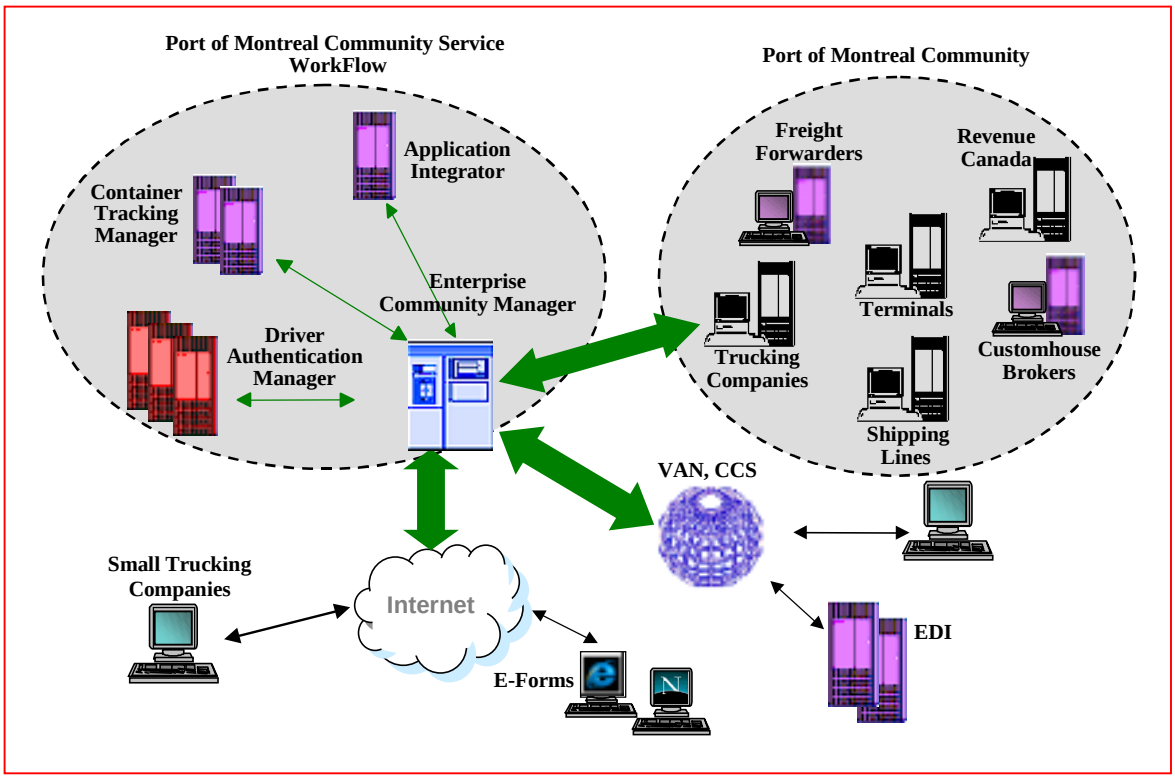

Figure 1 – Port of Montreal Extranet Community System Solution

7.3 System Requirements

System requirements of the proposed Port community Extranet consist of many parts, of which the following are integral to the entire process:

- Port Extranet
- Databases
- Application servers
- Format translator
- Communications
    - VAN, Direct Connect, Internet
    - Interfaces to Legacy and newer ERP systems

The basic premise underlying the system relies on electronic communications between:

- The shipping lines and the terminals (shipping line releases).

- Canada Customs and the customhouse brokers, freight forwarders, and terminals (releases).

- Trucking companies and the terminals (container status).

- Shipping lines, customhouse brokers, and freight forwarders and trucking companies (delivery orders and arrival notifications).

- Shipping lines and freight forwarders (export bookings requests and confirmations).

The messages flowing between these organizations will populate the container and driver validation databases with data sufficient to update and maintain the status of the container as it is discharged from the vessel, picked up by a driver, and taken from the terminal. On the export side, by capturing the booking number and storing the driver/booking number association in the database, it will alleviate those instances where the driver arrives to pick up an empty container without the booking number and/or the terminal not having the booking number in advance. The basic electronic messages we are recommending are:

- Notice of arrival

- Vessel manifest

- Delivery order

- Container status

- Customs clearance status

- Ocean bill of lading

- Booking/contract confirmation

These basic EDI messages contain sufficient data to populate the container database and maintain the status of the container as it moves between the vessel and the terminal gate.

7.4 Desired Transaction Flow Model

Figure 2 shows the flow of the suggested EDI transactions through the container logistics cycles.

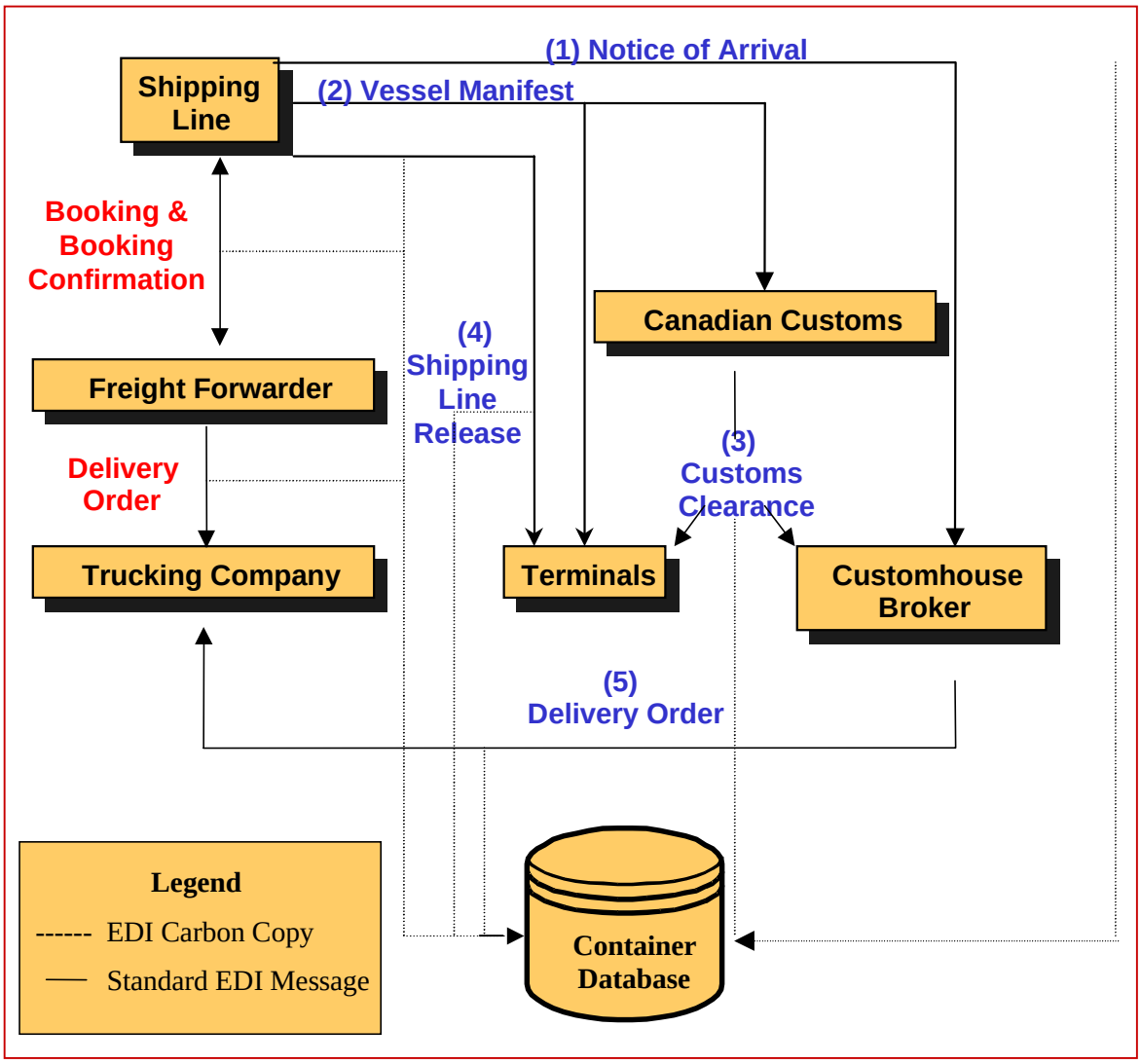

Figure 2 – Port of Montreal Import Transaction Model

The underlying premises of the system recommendation are:

- EDI users of the Port of Montreal will use the "carbon copy" feature on all envelopes when sending EDI messages. These carbon copies will be directed to the Port of Montreal Extranet Community System, where messages will either be "pushed out" or retrieved, translated, and pertinent data elements extracted and inserted into the container database.

- Other users not wanting to send an EDI transaction will be able to send a user-defined flat file to an Extranet mailbox, where messages will either be "pushed out" or retrieved, translated, and where pertinent data elements will be extracted and inserted into the container database.

- All documents entered into the Port of Montreal Extranet Community System via data entry screens may have to be translated into standard EDI formatted

messages. The reason is that when the customhouse broker creates the delivery order via a Port of Montreal Extranet Community System screen, the receiver of the message may be EDI-capable and wish to receive the message via a VAN. Otherwise, it is assumed that the delivery order will be displayed through an Internet browser either by the trucking company designated to collect the container or will be printed at the terminal and provided to the driver at that location. These communications would also be copied and the key data elements added to the container database.

- The basic premise behind our recommended design is that the interface of the data into the container database will be transparent to users. That is to say, they will not have to enter the information into their internal system, as well as in the Port Extranet. That is the purpose of the "carbon copy" functionality.

- Access to the information stored in the container database can be accessed through two methods: inquiry access and the download method. Inquiry access is via a screen on the Extranet Home Page. Once the user has entered the appropriate password and all other security information, he or she can enter a container number on the screen and receive the latest status, e.g., available for pickup, shipping line released, Customs release, etc.

  Method two is the download method. If the user desires to download all information relating to containers for which he is designated as the notify party, the system will pull this information from the database and download it to the appropriate user. If, during the design phase, the user would like this information "pushed" to him every day, then the system could be designed to fulfill this function.

7.5 Proposed Import/Export Process Configuration

The process begins with the shipping line transmitting the vessel manifest to Revenue Canada. A carbon copy of the manifest is sent to the mailbox of the Port of Montreal's Extranet system and specific data elements are extracted – e.g., consignee, notify party, vessel, voyage, container number, Ocean Bill of Lading numbers, and Cargo Control Number – and inserted into the container database.

The shipping line then transmits the notice of arrival to the party on the ocean bill of lading. Using a "carbon copy" option, a copy is delivered to the Port of Montreal Extranet Community System, where it is translated, and the pertinent data elements are extracted and inserted into the container database. If the sender is not utilizing a VAN, and is sending files directly to the Port of Montreal

Extranet Community System, the message will be immediately forwarded to the desired recipients and the pertinent data elements in that transaction copied into the database.

Revenue Canada then receives the entry from the customhouse broker who, upon clearance, transmits the release to both the terminal and the customhouse broker. The Port of Montreal Extranet Community System retrieves this release from its mailbox, translates the message, extracts various data elements from the transaction and updates the container record in the database. When this occurs, a status update is made of the container(s) being released showing that the shipments have cleared Customs.

When the original ocean bill of lading has been presented to the shipping line and all outstanding monies have been paid, the shipping line transmits a release to the terminal and to the consignee or customhouse broker. The system retrieves this release from its mailbox, translates the message, extracts various data elements from the transaction, and updates the container record in the database.

When the vessel arrives, the customhouse broker asks the Port of Montreal Extranet Community System to determine whether the container has been “grounded” and is available for pick-up. If so, the customhouse broker generates a delivery order and transmits this to the trucking company. This information is captured and inserted into the container database.

On receiving the delivery order, the trucking company asks the Port of Montreal Extranet Community System to determine whether the container is available and, if so, assigns a driver through the system and dispatches the driver to the terminal. The assignment of the driver into the system can be performed via an online screen in the Extranet.

On reaching the terminal, the driver presents his ID at the gate and this is validated against what was entered into the Port of Montreal Extranet Community System by the dispatcher. If the driver is validated to pick up this container, the gate issues him a terminal interchange report (TIR). The driver takes this TIR into the terminal and the container is loaded onto his chassis. When leaving the terminal, the driver submits the TIR to the exit gate and leaves the terminal.

The exit gate, upon receiving the TIR from the driver, enters it into the terminal system which updates the Port of Montreal Extranet Community System. The system then updates the container record in the database with a departed status that closes the cycle for the Port of Montreal Extranet Community System.

The export process is less complicated than the import process. The documents required are the ocean booking request and confirmation and the delivery order. In the majority of instances, bookings are handled over the telephone and we

foresee this continuing. The freight forwarder will issue a delivery order to the designated trucking company and the port Extranet will capture this message, populate the central database, and pass the message to that location, holding the empty equipment as designated by the shipping line.

One of the current concerns is the accuracy of the export documentation and its availability when the truck arrives at the terminal. To address this issue, the system will be designed with a document print capability, e.g., Crystal Reports. When the driver arrives at the terminal and produces identification, the terminal operator will have the capability to print the appropriate documents directly from the Port Extranet. This addresses the issue of the driver receiving a container pickup call from his dispatcher and being able to obtain the Pickup/Delivery Order at the terminal gate. This feature would apply to the import process also, as needed.

This is a general overview of the process, and it should be understood that the documents might not be generated in the same order as stated. The system will have the flexibility to accept documents in almost any order. Section 8 describes the system components.

8 SYSTEM ARCHITECTURE

The solution that GEIS is recommending provides electronic communications among all members of the Port community. It will allow users to communicate via:

- EDI standard formats (ANSI, EDIFACT) through Value-Added Networks (VANs), or,
- A direct connection to the Port's Extranet, or
- The Internet.

This flexibility allows all members who have, at a minimum, a PC with a connection to the Internet via an Internet Service Provider (ISP), access to the Extranet for submitting electronic documents and retrieving container status.

The standard solution approach includes:

- Secure Extranet
- Data transformation – application integration tool
- Data repository
- Hosting services or on site support
- Variety of connectivity options – Internet, High Performance Network, and point-to-point
- Community implementation – focus resources to facilitate EC participation
- Customer service – help desk with problem tracking and escalation procedures
- Secure Extranet
    - ID and password
    - Secure Session Layer (SSL)
- Web server technology
- Potential Scalable for future phases

8.1 Software

- Off- the- shelf/Port of Montreal customized
- Commercialized
    - Enterprise application integration tool
    - Working with "best-of-breed"
    - Database
    - Web Enterprise Server

8.2 Security

- User authentication
    - Password
    - Public/private key
- Secure transfer of data
    - Firewall with passwords
    - Secure pipeline via private IP network
- Access controls
    - Control access to information
    - Control level of access
- Internet security – secure socket layer
- Secure data centre
    - Data protection and physical security

8.3 On-Line Translation Server

- Provides technologically advanced mapping, translation, and integration capabilities for multiple systems and uses.
- Operates in an electronic commerce environment as a universal information translation and integration system.
- Accepts and generates any type of structured data format, permitting integration of multiple applications without changes to existing formats.

The solution includes HTML screens, allowing users to make inquiries on container availability (status) and data entry forms for generating and interchanging delivery orders and any others, as the need arises. **Figure 3** shows the system architecture of the recommended Extranet solution.

Architectural Design

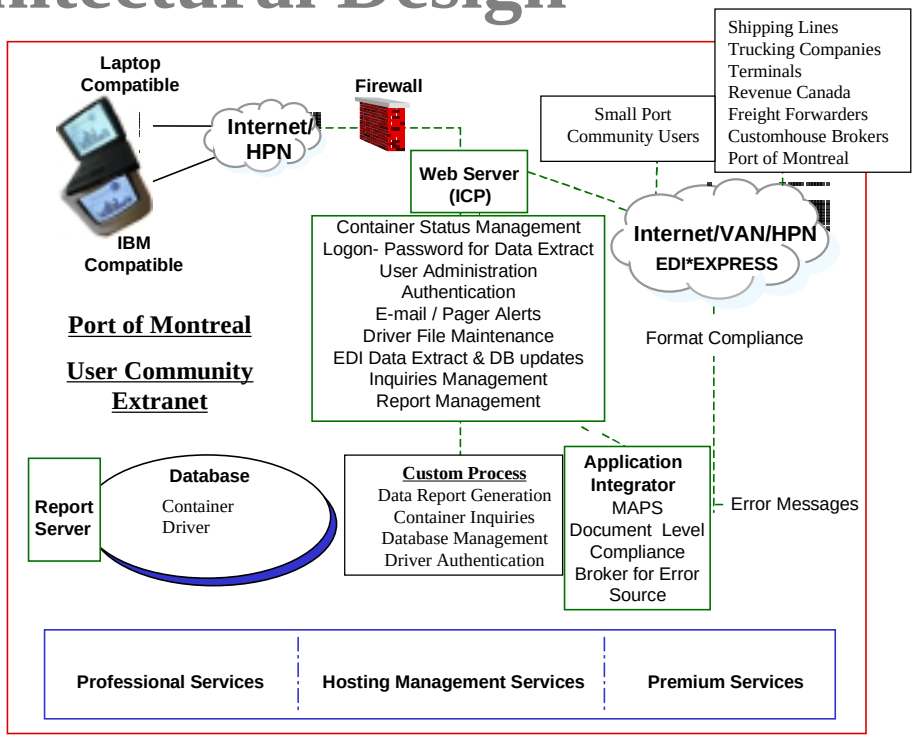

Figure 3 – Port of Montreal Extranet Community System Solution

9 SYSTEM DESIGN

GEIS has engineered an agile, logistics-oriented solution for the Port of Montreal that is based on commercially available products successfully used by freight forwarders, customhouse brokers, trucking companies, terminals, ports, and shipping lines worldwide in numerous mission-critical applications. Our Port of Montreal solution components are based on open systems, industry standards, and are Year 2000 compatible.

9.1 Operational Architecture (Concept of Operations)

The primary products comprising our design solution are identified in **Figure 4**, and their functional contributions are also discussed in depth later in this section.

We have carefully analysed the Port community's processes against the functionality we propose, and we are confident that our design enables Port members to reliably move information electronically.

Our solution is based on an analysis of the requirements of the Port of Montreal user community with special attention to the Port's terminal operations. The resulting functional and operational architecture is illustrated in **Figure 4** and discussed in detail in this section. From our analysis extended to the existing product sets, we have selected a product set that can be integrated to form a seamless technology to support the Port's vision, while maintaining flexibility to accommodate new features and services.

9.2 Solution Features

The recommended Port of Montreal Extranet Community System solution features:

- A centralized database based on an existing proven system. The system tracks each container through the terminal.
- A secure Extranet for use by Port community members.
- Existing worldwide connectivity to the community's communications services to ease migration to the Extranet and provide flexibility in connectivity options.
- In-transit visibility of container movement and status to the Port user community.
- Existing connectivity to the shipping lines calling on the Port of Montreal and Revenue Canada for electronic pre-clearance of cargo.

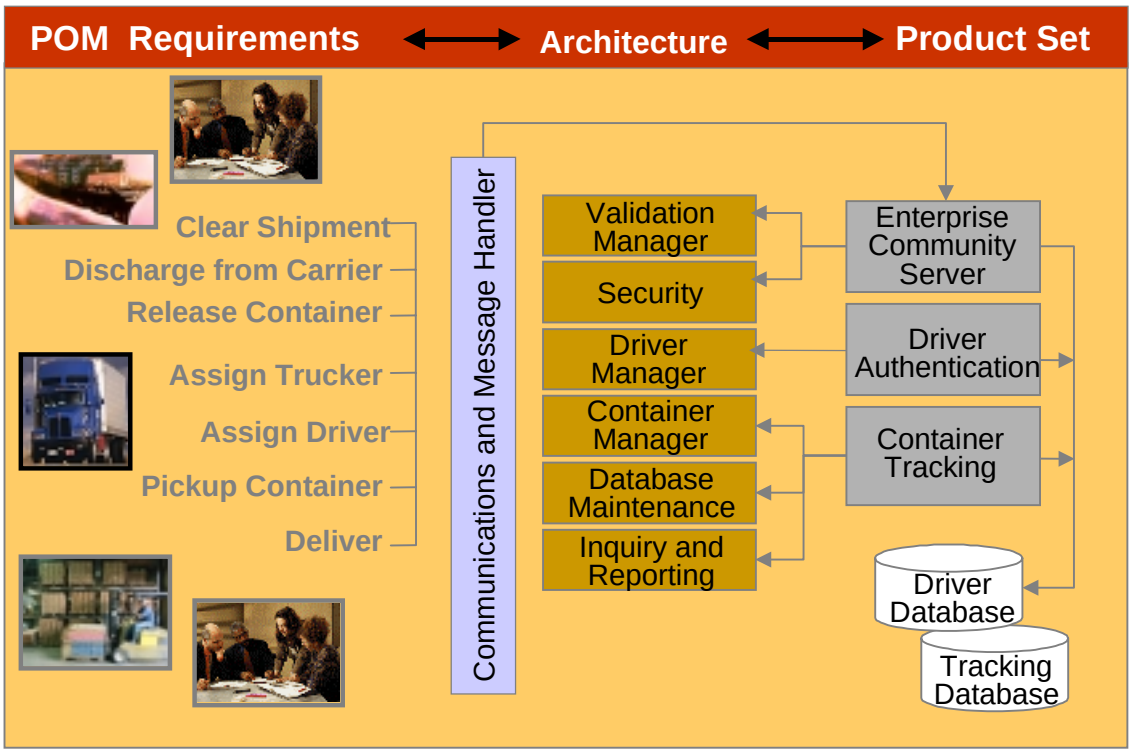

Figure 4 – Port of Montreal Extranet Community System Architecture

9.3 Technical Approach

The recommended technical approach to the requirements of the Port of Montreal Extranet Community System in both time and functionality involves implementing “best-of-breed” software components. They will be integrated with one another and with the Port community members’ software systems, providing one seamless container inquiry system.

One requisite for choosing these components was their ability to meet not only the current requirements of the Port community, but to address and achieve future requirements as viewed by community members. Another, and perhaps more important requisite, was the necessity of these components to be integrated, allowing the Port community member companies to present themselves to their customers as a single, seamless enterprise providing container status information.

The system architecture supporting the Port of Montreal Extranet Community System is described below, showing interfaces to current and future users and systems.

9.4 System Architecture Overview

The system architecture provides the following high-level functions:

- Accepts, extracts, and stores information from messages
- Provides container visibility
- Provides for driver authentication and database management
- Wrapped around the Port of Montreal Extranet Community System is a communications gateway that manages:
    - Communications interfaces
    - Message handling
    - Message translation
    - Audit logs and alerts
    - Network communications management
    - Help desk services

9.4.1 Port of Montreal Extranet Community System Subsystems

The system architecture consists of the following system components:

- Communications gateway subsystem
- Message translator subsystem
- Message handler subsystem
- Validation manager subsystem
- Subscriber security subsystem
- Inquiry and reporting subsystem
- Container tracking subsystem
- Databases

9.4.2 Communications Gateway Subsystem

The communications gateway subsystem (CGS) sends and receives messages between Port community member host systems and the Port of Montreal Extranet Community System. The CGS supports a broad range of connectivity options, such as TCP/IP, X25, SNA, BISYNC,

BATAP, and ASYNC. The CGS also provides message audits, verifies that messages were received by the intended recipient, and provides alerts in the event of system failure.

9.4.3 Message Translator

The message translator subsystem (MTS) translates messages into a format compatible with the receiver. The MTS is a full-featured software subsystem featuring any-to-any translation, application integration, graphical user interface (GUI) mapping and administration, and an industrial-strength processing architecture. Designed to operate in an electronic commerce environment as a universal information translation and integration system, the MTS accepts and generates any type of structured data format, permitting integration of multiple applications without changes to existing formats. The administration and maintenance of the system are supported through a GUI. In addition, a computer-aided modelling system (CAMS) has been developed to reduce the amount of time required, increase the level of flexibility, and design and maintain an EDI environment.

9.4.4 Message Handler Subsystem

The message handler subsystem controls the flow of information through the system. The latter's subsystems are integrated with one another where appropriate. The message traffic, internal and external, is controlled by the message handler subsystem, which directs the messages to the appropriate subsystem for processing. The security of the messages is managed through the business partner profiles. Support for the EDI standards, such as EDIFACT and ANSI X12, is provided. Audit trail information and error and warning information are provided to assist with exception management processing. As shown in **Figure 5**, messages from member systems are received (1). These messages are collected (2) and translated by the message translator subsystem (MTS), validated (3), and dispatched (4). Messages are flagged to indicate the current status (e.g., ready for loading, service failures, outgoing message). The information from these incoming messages is extracted (5) and loaded into the tracking database (6) by the container tracking subsystem (CTS).

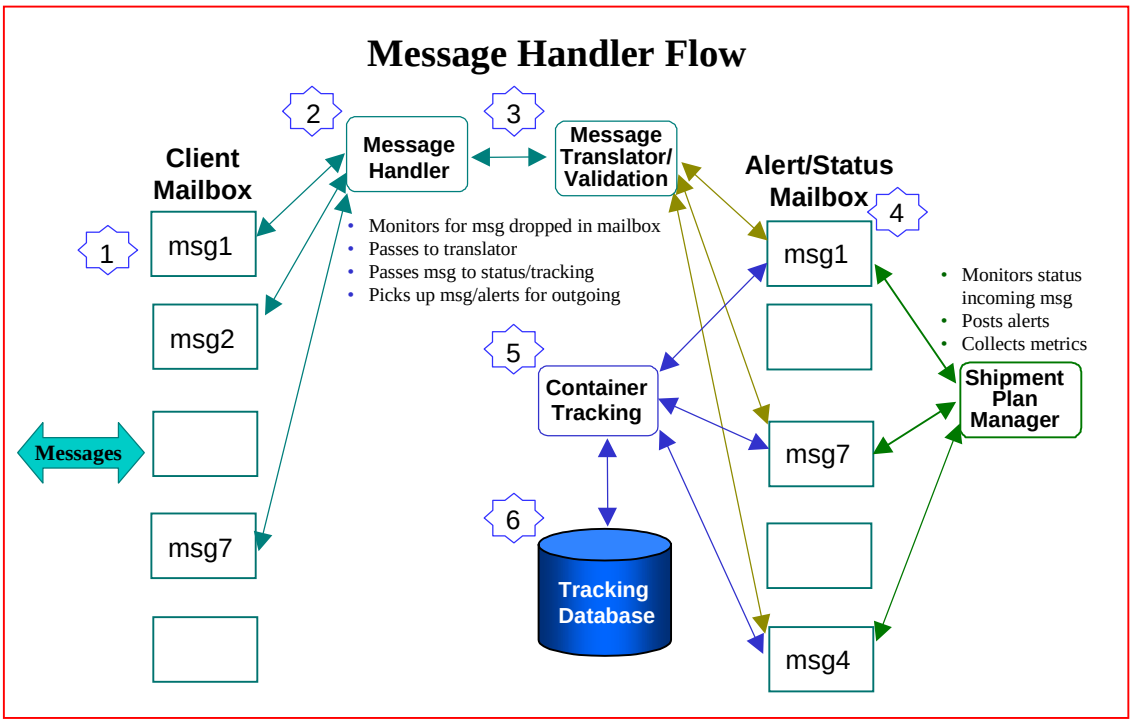

Figure 5 – Port of Montreal Extranet Community System Message Handler Flow

9.4.5 Validation Manager Subsystem

The validation manager subsystem (VMS) uses the Port of Montreal community business rules to ensure that any events or data entered into the system conform to the standards established by the community. The validation includes:

- Incomplete, corrupted, or erroneous messages
- Out-of-sequence messages
- Unsupported messages types

For all valid messages, control is passed back to the message handler subsystem for disposition. For all invalid messages, i.e., those that failed the verification process, an error message is generated defining the nature of the error and is returned to the sender.

9.4.6 Subscriber Security Subsystem

The subscriber security subsystem (SSS) provides compartmentalized security for members. This subsystem verifies and identifies all client systems. Only those party to a given shipment have knowledge of or access to that information.

The Port of Montreal Extranet Community System is a password-protected system that provides two levels of password protection: network access and application access. The first, network access, is controlled through the CGS. The second level, the application level, allows only Port community member companies to interrogate information within the database to which their containers are linked. In order to have access to container data, the user must have a valid interest in the shipment, i.e., they must be included as a party to the shipment they are interrogating.

9.4.7 Inquiry and Reporting Subsystem

The enquiry and reporting subsystem (ERS) provides the capability to query the Port of Montreal Extranet Community System for container status and to generate consolidated reports.

The system offers two options to Port community members for obtaining the status of a container. The first option, host-to-host, allows members real-time access to the Port of Montreal Extranet Community System through the Extranet from their host computer systems. In this scenario, the user, connected through the host, is able to query the Port of Montreal Extranet Community System container database to obtain container status. For members who offer their customers access to their host systems for obtaining container status, the customers will be able to access the system for the same purpose. This allows each member to control access to the system.

Option two provides the capability for the members and their customers to directly obtain the status of a particular container or containers. Again, this is real-time access and will allow the user to only view the status of containers on which he is named as a party on one of the electronic documents. This access is very tightly controlled. We know that many of the Port community members will want to strictly control customer access. It is for this reason that we provide both access methods. Port community members and others who have been authorized by a Port community member, e.g., a freight forwarder’s customer, will have access.

9.4.8 Container Tracking Subsystem

The container tracking subsystem (CTS) provides visibility of containers while in one of the three Port terminals, e.g., Racine, CAST, and Termont. This subsystem includes a central repository database that collects container information and status from various sources as the container progresses through the import/export cycle. The tracking database is updated with EDI container messages that provide information on containers. The process begins with the receipt of the vessel manifest, which includes all containers to be off-loaded at the Port of Montreal.

Upon receipt of the vessel manifest, the container records are added to the container database. When the container is unloaded from the vessel, a status message is generated by the terminal's internal system and transmitted to the Port of Montreal Extranet Community System. When this occurs, a status record is generated and linked to the appropriate container. As the container moves through the container cycle, until its departure from the terminal, CTS links the container status of the containers (e.g., discharged from vessel, cleared by Canada Customs, assigned to a driver, loaded onto truck chassis, and departed terminal).

9.4.9 Port of Montreal Extranet Community System Hardware Components

The system consists of hardware to support the external interfaces, Port of Montreal Extranet Community System server, and Web server.

The Port of Montreal Extranet Community System Web Server supports access pages via a Web browser link from member Web pages. In addition, a Port community Web page is provided for member, shipper, or consignee access. The Web Server applications are Java, HTML, or Java Script programs, accessing the tracking database for status information.

The system server provides access to all Port community participants, primarily through the Port of Montreal Extranet Community System. Access is also through CCS, and traditional industry networks are supported. The Port of Montreal Extranet Community System houses the applications for status and tracking of containers and maintaining the container database.

9.4.10 Web Access Module

The Port of Montreal Extranet Community System's Web Access Module supports access over the Worldwide Web to incorporate gateway services, allowing small trading partners to join EDI and electronic commerce (EC) programs, once available only to larger businesses. Having the Web Access Module allows trading partners to access to the system, using a simple browser interface.

The browser interface enables:

- Administrative functions
- Transfer of data to and from the system
- Selection and completion capabilities of the appropriate form for trading partners

9.4.11 Security

GEIS recognizes that information created by, and stored within, computers is a vital corporate asset. Virtually everyone makes business decisions or takes action based on such information. Because this information is expensive to gather, create, store, and use, it makes good business sense to protect that information.

9.4.11.1 Mechanisms

The Port of Montreal Extranet Community System Hosting Service employs a number of mechanisms for providing both security and accountability. These mechanisms provide the means to repel intruders, track suspected intruders, and perform audits. The Port of Montreal Extranet Community System design ensures data security and protection of information assets. Some of its features include:

Modification

Integrity is fundamental if information is to be trusted. Data must be changed only in predictable ways.

Protection from Data Destruction

Availability of information is critical. When information is destroyed, it must be recreated. If the original documents or backups are not available, recreation can be excessively costly or even impossible.

Denial of use

Another critical concern is continuity of service. Unavailability of services at critical times may affect business operations.

Any of these threats can have results, ranging from mild corporate embarrassment and loss of customer confidence to direct, serious financial loss.

The responsibility for achieving data security is a joint one. Port of Montreal, and its community members share this important obligation. The Port's responsibility is twofold:

- To design a secure environment in which clients may execute their applications.
- To provide tools with which clients can further secure their applications according to their sensitivity and/or value.

9.4.12 Audits

The Port of Montreal Extranet Community System Hosting Service employs both internal and external auditors. Internally, systems integrity personnel attempt to access certain key system resources and review closely the activities of the Port of Montreal Extranet Community System privileged user population. Systems integrity staff members visit Port of Montreal Extranet Community System service locations to ensure that personnel are following the security practices mandated by the security policies.

A prominent CPA firm periodically conducts a major external audit. This firm inspects and evaluates the security of the total organization relative to the security policies and procedures and evaluates the security policies and procedures themselves. They produce a “service auditor report” (SAS-70) describing the extent to which security procedures implement the spirit of the policies and procedures. This report is available to client auditors in lieu of on-site client audits, since client personnel may not conduct audits.

9.4.13 Security Policies

A comprehensive written set of security policies drives all Port of Montreal Extranet Community System’s physical, administrative, and data security measures. The security policies define Port of Montreal security posture. The purpose of the policies is to establish consistent protection requirements and to ensure that the system’s security features and practices meet client, auditor, and regulatory requirements. The scope of the policies includes services provided by the Port of Montreal Extranet Community System software. The policies apply to client and Port of Montreal Extranet Community System Hosting Services’ assets, and they ensure explicit consideration of security matters in all interfaces with external personnel and systems.

The policies tested by auditing and systems integrity comprise six major categories:

- Organizational and administrative controls
- Physical security
- Protection from environmental hazards
- Software development and maintenance controls
- System operations security practices
- Client interface security and control

In summary, the Port of Montreal Extranet Community System security program provides:

- A common protection level for all Port community members.
- A set of user-selectable optional controls.
- Full-time systems integrity staff whose purpose is to continual upgrade the security of the computer system environment and application systems.
- A commitment to maintain security by preserving the confidentiality, integrity, and availability of vital member information assets.

9.5 Electronic Messages Required to Enable the Cycle Framework

GEIS has analysed and reviewed the messages required to enable the container tracking system. **Table 3** contains the EDI messages required to deliver the functionality of our recommended solution. These messages support all of the milestones documented in this report. At some future time, other documents may be required to support the intermodal rail operations. When this occurs, the Port will be able to add the appropriate messages to the existing message set to support such functions as required.

Table 3 – EDI Messages

Message	Estimated Msg Length	# Msgs/ Container	ANSI	Dest.	Port Extranet	Originator
Booking Confirmation	1000	1-3	301	FF	Y	SL
Change Booking	1000		301	AL	Y	FF
Cancel Booking	200	1	303	SL	Y	FF
Vessel Manifest	>100K		311	CC	Y	SL
Customs Entry	1000	=>1		CC	N	CHB
Shipping Line Release	200	1	315 (Code =CR)	CHB	Y	SL
Canadian Customs Released	200	1	315 (Code =CT)	CHB	Y	CC
Delivery Order	500	1	317	TC	Y	CHB
Driver Assignment by Dispatcher	N/A	N/A	N/A	N/A	Y	TC
Terminal Interchange Report	500	1	322	CHB/TC	Y	TE
Ocean Bill of Lading*	2000	>1	310	CHB	Y	FF
Bayplan	>10000	1	324	TE	Y	SL
Container Status	200	1	315	All	Y	SL/TE/CC/AC

* Not included in initial implementation, but may be added later

The recommended system will support many different status codes relating to containers. **Table 4** describes the most common ones. It is expected that these will be further refined when the final systems specifications are generated with GEIS and the Port of Montreal.

Table 4 – Port Extranet System Supported Status Codes

Status Code	Description	Source
A	Arrived – shipment has arrived at the location specified	**SL**
I	Ingate	**TE**
L	Loading – container is being loaded at the carrier's terminal or facility	**TE**
N	No paperwork received with container	**TE**
P	Departed terminal location	**TE**
T	At terminal – intra-terminal movement	**TE**
U	Unloading – container being unloaded	**TE**
A1	Agriculture Canada hold	**AC**
A2	Agriculture Canada released	**AC**
A3	Agriculture Canada refused entry	**AC**
A4	Agriculture Canada conditional release	**AC**
AC	Awaiting clearance	**CC**
AE	Loaded on vessel	**TE**
AM	Loaded on truck	**TE**
AL	Loaded on rail	**TE**
BF	Booking confirmed	**SL**
BR	Bill of lading released	**SL**
C1	Canadian Customs hold	**CC**
C2	Canadian Customs inspection scheduled	**CC**
CA	Shipment cancelled	**SL**
CR	Carrier release	**SL**
CT	Customs released	**CC**
CU	Carrier and customs releases	**TE**
OA	Outgate	**TE**
TC	Held for terminal charges	**TE**
UV	Unloaded from vessel	**TE**
X4	Arrived at terminal location	**SL**
ZZ	Mutually-defined within the community	**ALL**

10 SECURITY ISSUES RELATED TO IMPLEMENTING WEB EDI

Security considerations will be a key issue for the Port community in implementing a Web-based document exchange system. Since the system will involve multiple trading partners operating within a secure firewall as well as accessing other information over the public Internet.

Information created by and stored within computers is a vital corporate asset. Virtually everyone makes business decisions or takes action based on such information. Because this information is expensive to gather, create, store, and use, it makes good business sense to protect it as well.

A number of mechanisms for providing both security and accountability for commercial Internet based systems are available. These mechanisms provide the means by which intruders can be repelled, audits can be performed, and tracking of suspected intruders can be performed.

Security in a distributed system is a major challenge because more points of contacts (files and programs accessible from the network) exist and each host cannot remember all of the users. Infrastructure services must be able to support authentication, authorization, and audit. Security within a one-vendor environment is easier to deal with than security between systems that cross many vendor environments.

Threat analysis is typically the first step in dealing with security issues. Threats to Web-based applications can be broken down into the following groups:

- **Confidentiality threats**. Users of Extranet applications must be assured that their data are only being viewed by those for whom they are intended, and not by other individuals, be they legitimate users of the application or unauthorized parties.
- **Integrity threats**. Users of Extranet applications must also be assured that the data that they obtain from the application are legitimate, and in the same form as created by the originator.
- **Authenticity threats.** Users must be assured that they are communicating with exactly whom they believe they are communicating.
- **Authorization threats.** Certain portions of the application services may be restricted to authorized users.

To implement the appropriate level of security, the value of the assets contained on the Extranet must be considered. If you're planning to publish documentation that would benefit your company if it were printed and disseminated without permission, there's little need to be concerned with security. If exchanging information regarded as highly confidential (such as design specifications or marketing plans), greater security is needed. **Figure 6** illustrates secure access to hosted Extranet solutions. If one is transferring financial and transactional data, a much higher security level is needed.

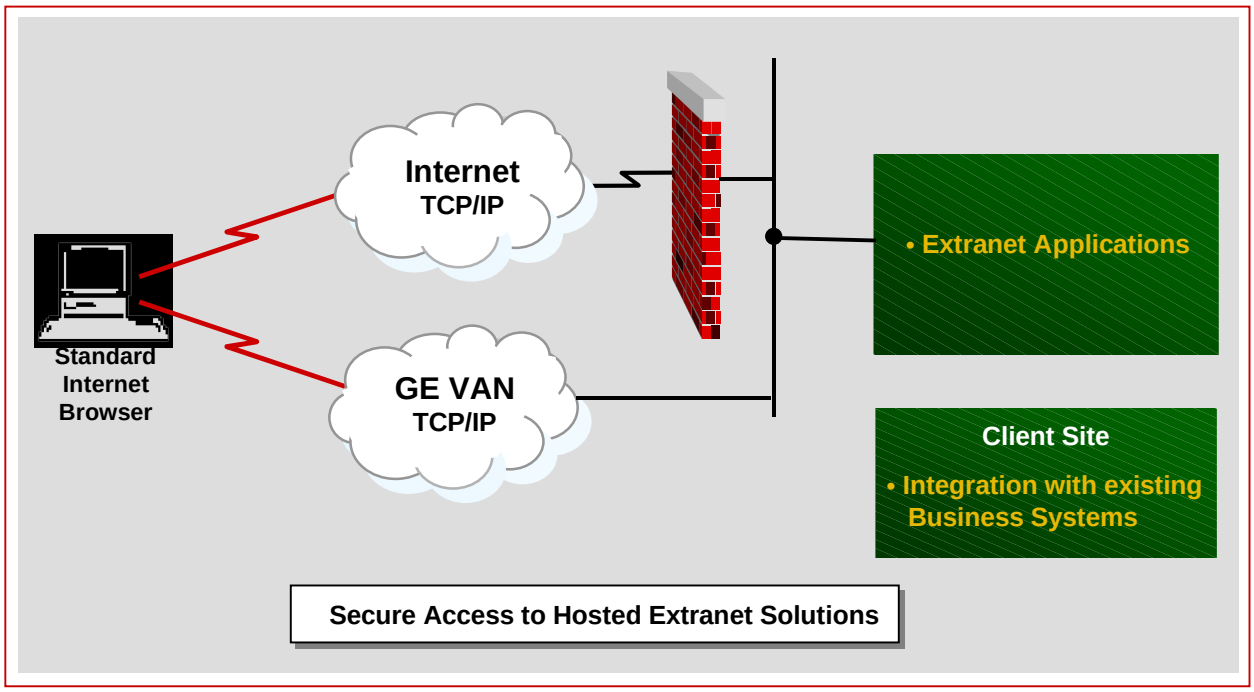

Figure 6 – Secure Access to Hosted Extranet Solutions

10.1 Internet Network Security

It is assumed that the Internet Protocol (IP) will be the predominant network transport protocol, while non-IP protocols will diminish in importance and use.

Private networks will increasingly yield to public networks as the predominant form of interconnection between businesses. IP is the entrenched communications infrastructure of public networks. The performance, security, and robustness of the Internet will soon be sufficient to meet the needs of even the most critical business operations.

The hardening of the Internet for business-critical use is occurring on two fronts. First, the protocol itself is being extended to accommodate varying classes of service depending upon user requirements for bandwidth, availability, and security. Second, the hardware vendors who produce the devices providing the connection, routing, and switching fabric for the Internet are adding capabilities to their products that address a similar class of service requirements for IP networks.

It is practically a given that IP will prevail as the network transport protocol for business-to-business electronic commerce. As mentioned previously, this is due in large part to its ubiquitous availability and common communication mechanisms that have been adopted by virtually every enterprise as a link with the outside world. Other network protocols, such as IBM's system network

architecture (SNA), are certain to be around for many years within the enterprise. However, even within the enterprise, there will be an inexorable migration to IP as the standard networking protocol.

For this discussion, the emphasis will be on the Port of Montreal's use of a third-party hosted service. In doing so, we will focus on the security issues related to protecting the Port of Montreal hosted Web site from a compromise of security.

Security must be planned from the start.

- Will the site be visible on the Internet?
- How much of the data is sensitive?
- Where and how will users reach the site?
- How will the content be loaded?
- Are there back-end connections required?

Two types of Web sites can be implemented: public and/or private. Typically, in a public Web site, the user is not required to enter any form of identification, although you may wish to capture some demographic identification information about the user. This can be accomplished with the user knowledge or otherwise. You may ask the user to provide the information in a Web form or you can capture information using cookies generated by the browser.

In a private Web site, users are not allowed to proceed without identifying themselves and must be pre-authorized to access one or more components/applications of the Web site. If the user fails to provide identity, access may be rejected.

10.1.1 Network Architecture

The network architecture must ensure that customer networks are properly isolated from one another and secured from third party networks.

The network design consists of a two-level interconnection of routers. The first set of routers provides access points to other third party facilities and clients. These routers have access controls and filters defined to only allow customers to access third party service offerings; they are prevented from gaining access to other parts of the network. In addition, access is only allowed from customers through their directly attached network, preventing accidental exposure resulting from a customer's external connections. The second set of routers provides access to the

various third party service offerings. The access controls on these routers only allow access to the supported software; all other network access is rejected.

Dial-up network connectivity is also provided. User authentication includes access control statements that only allow access to specific functionality and/or standard service offerings. To provide a support infrastructure, a network management LAN provides systems status information, software status information, and allows direct access to commercial systems via a firewall.

10.2 Internet Access

Third-party service offerings are supported from the Internet through means of encryption and a strong authentication. Other business offerings are provided via Web access using secure access where necessary. Secure access for the Web includes a secure sockets layer (SSL). Support of the strong authentication method is forthcoming. The access methods follow two different paths. Applications requiring strong authentication connect to a firewall for services. Applications requiring Web and other services connect directly to hosts via a router with strict access controls allowing access only to the specific services defined for the application. Hosts connected to, in this fashion, have additional host-based security and the routers have additional network connections to support secured data requirements.

Inbound Internet access is offered via a virtual private network (VPN), which requires strong authentication and encrypts all data passing between the customer's PC or network and the private network. This allows the client to have access to more than just Web services. These services include FTP, EDI, and e-mail. In addition, if a client wants just Web services, but does not want to make their site visible on the Internet, VPN provides the means for the client to safely reach the Web site once they authenticate first to the VPN.

10.2.1 Outbound Internet

For example, the GEIS outbound Internet service is via application gateways on a firewall. Only specified networks and hosts are allowed access and all connections are logged. The service only provides Web, FTP, and Telnet access to the Internet. Other services are being evaluated.

10.2.2 Firewalls and Auditing

All outbound and secure inbound Internet connections are performed via a commercial firewall. All connections to these firewalls are logged. Direct access to these systems is only allowed via the internal firewall. Access to

all commercial systems is audited. All activities are logged and access is only allowed via the internal firewall (which currently performs these audits) or a through a console server, which also logs all activities. This is illustrated in **Figure 7**.

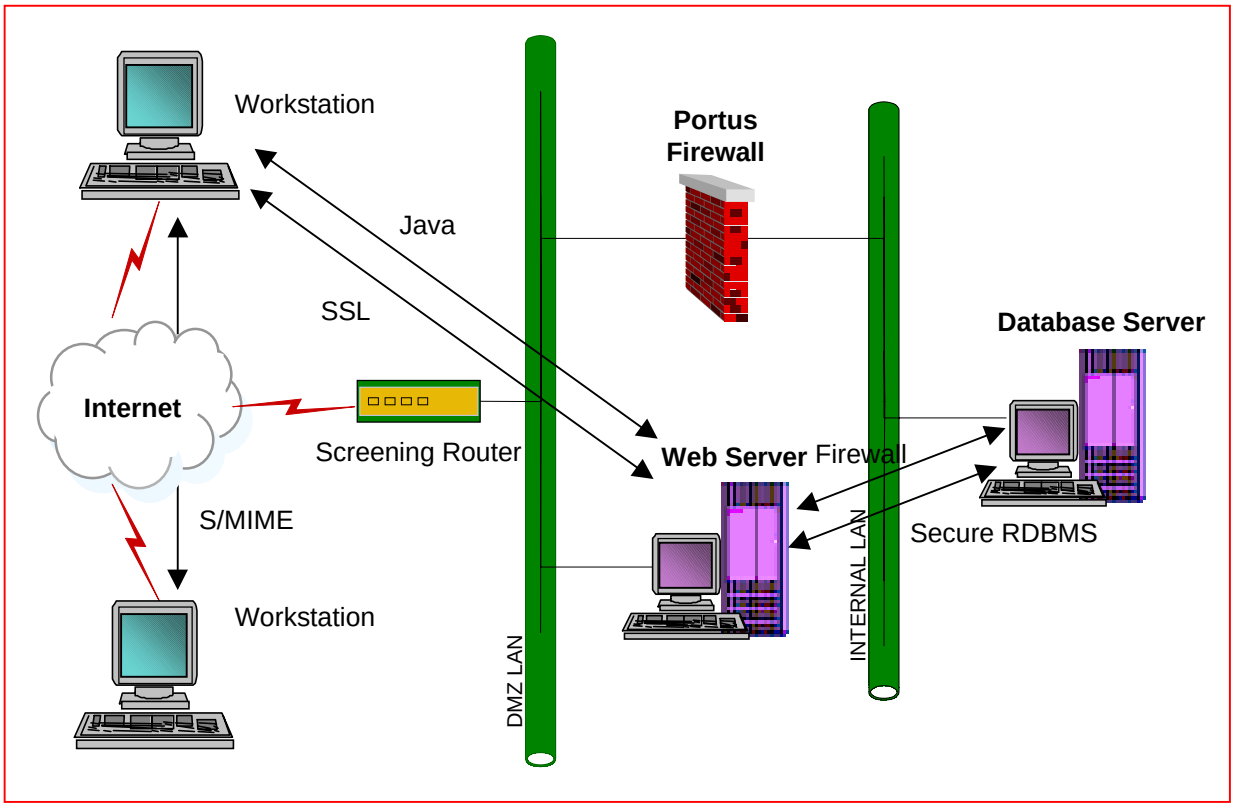

Figure 7 – Where the Security Pieces Fit In

10.3 Port of Montreal Extranet

In developing the security model for the Port of Montreal Extranet site, you need to understand the technology environment you have today and know where you plan to be in the near future. In addition, you need to understand the sensitive nature of the information you will be providing. Today, the Port of Montreal supports a public Web site, which is used to publish important information about the Port and its business. This site is accessible from the public Internet with a standard Web browser. This information is not considered confidential and therefore does not require user identification or controls to restrict access.

Today, a third party service provider supports this Web site outside the Port data centres. There is no network connection from the Port of Montreal data centre to the third party Web site. Web users who access the site have no means to pass through the site (no direct contact) to the Port data centres. This level of security meets Port of Montreal requirements as they exist today.

This report outlines a potential Web-based Extranet application for the Port of Montreal, to allow its business partners to access a centralized database

containing the status of shipping containers. This application must be restricted to only the business partners involved in the container movement from ship, to port, and to its final destination. To restrict access to this application, users who access the system must first identify themselves. The Web site must have a method for capturing user identity and must determine user privileges.

10.3.1 Web Site and Application Security

Web site security measures are aimed at ensuring that only pre-authorized individuals can gain access to your site. Security is achieved with the use of technologies such as mutual authentication, data encryption, firewalls, and access controls to ensure the integrity of your organization's information. The firewall technology protects applications and requires an authentication procedure before any business partners are granted permission to access the system. This feature limits access from the public Internet. If your business partners use a private IP network, they must also identify themselves, but data will not go out over the public Internet.

10.3.2 Authentication

Authentication provides the Web server proof of "who you are". The most frequently used method is the UserID and Password. Other options include Token Cards, Smart Cards, and Digital Certificates.

The Token Card is a physical card that provides an enhanced password feature where the password is made up of a PIN code plus the Token Code. The Token Code changes every 60 seconds, essentially changing your password every 60 seconds.

The Smart Card is also a physical card, embedded with an integrated circuit chip. The chip contains detailed information about the user, as well as the ability to store other types of information. It can also be updated. However, a reader device is necessary to read the information on the card.

Digital certificates are electronic documents with certified information about the Web server, the user, and the community. The amount of trust in the information contained in a certificate depends on the process used to verify that information and trust in the entity that verified the information.

Public key infrastructure (PKI) is a form of digital certificates. All applications defined for the Port Extranet Solution today will reside within the same Web application environment. This makes it easier to retain a user’s identity as long as the user remains in the hosted environment.

Should the Port of Montreal require access to other applications outside of a proprietary hosted environment, then the use of PKI to retain the identity of the user across all applications, without the need to continually ask for user ID and password, should be considered.

If PKI were implemented, Port of Montreal would have a unified directory service of their trading community in which all applications will have a place to access user information that is not just unique to a given application. By basing authentication on digital certificates, sign-on for all applications process is ensured in an easy, secure fashion.

Instead of each application issuing passwords, a digital certificate can be issued. No matter how many services a person uses, the same certificate will handle the authentication. Because the certificate is discrete from any application, it can be used by applications even after the certificate is issued. Finally, if a user resigns from the Port community, a single action (revoking the certificate) will handle all services.

PKI technology is a recent arrival in the marketplace and is changing rapidly. Furthermore, the administrative requirement for managing certificates may be more of a burden than the Port is willing to take on at this time. It is not recommended that this technology be implemented unless the requirement to extend beyond the Web server environment is necessary or is excluded from the chosen solution

10.3.3 Access Controls

Authentication and access controls should be integrated within the services you are providing using standard practices, as illustrated in **Figure 8**. Ideally, you want to implement a “single” logon system that will provide authorization once and detailed user profile information that determines access levels for any user in the system. The method of providing this capability may depend on the whether all the services you are providing (and that require authentication) reside within the same Web environment.

When a user logs onto the Web server, information supplied by the user should be used to check stored access control lists. These access control lists may apply to directories (URLs) or individual files and applications. Furthermore, an access control list may define special attributes that must match for a user to gain access to an application, or that can be used to filter and search for appropriate information the user may see within an application. For example, only an assigned trucking company may have access to information on a particular container.

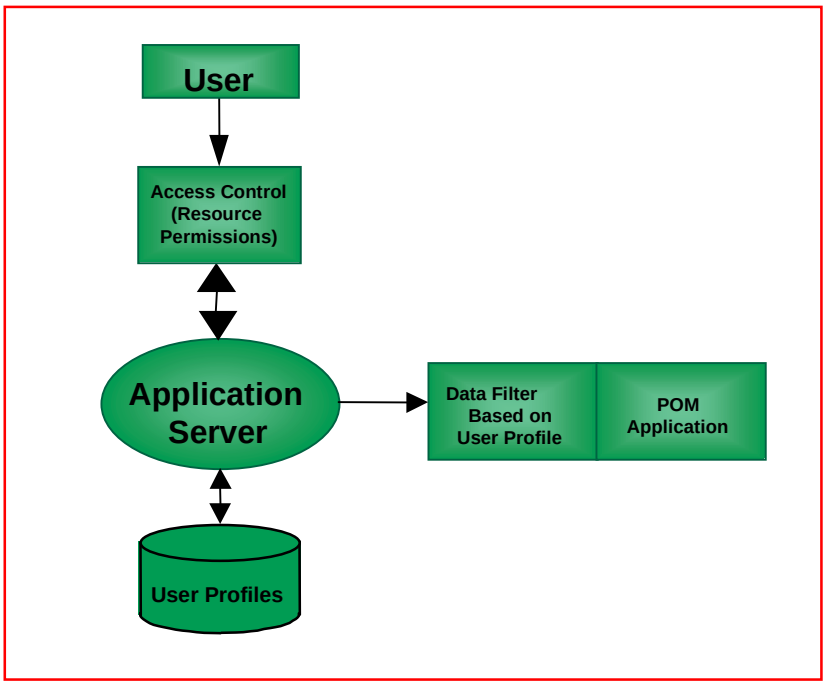

Figure 8 – Authentication and Access Control

Most Internet service providers can develop an access control solution that will incorporate this level of security. Lightweight Directory Access Protocol (LDAP) will be utilized for user profiling. User profiles will store data regarding a person's contact information, user name, password, and access levels to the application.

Modification of access controls may require the development of custom filters and development of standard functions to be included in the Port applications for further data filtering.

These access control lists will be defined according to the Port's requirements, and will be stored on the host running the Web application server.

10.3.4 Secure Data Transmission

Secure data transmission from a Web browser can be provided using most standard Web browsers and a secure sockets layer (SSL) connection. SSL uses the public-and-private key encryption system from RSA, which also includes the use of a digital certificate.

SSL is a program layer created by Netscape for managing the security of message transmissions in a network. Netscape's idea is that the programming for keeping your messages confidential ought to be contained in a program layer between an application (such as your Web browser or HTTP) and the Internet's TCP/IP layers. The "sockets" part of

the term refers to the socket method of passing data back and forth between a client and a server program in a network or between program layers in the same computer.

Netscape's SSL uses the public-and-private key encryption system from RSA, which also includes the use of a digital certificate. SSL is an integral part of each Netscape browser. If a Web site is on a Netscape server, SSL can be enabled and specific Web pages can be identified as requiring SSL access.

Secure data transmission from other TCP/IP-enabled servers can be provided using secure hyper text transfer Protocol (HTTPS). HTTPS is a Web protocol developed by Netscape and built into its browser that encrypts and decrypts user page requests, as well as the pages that are returned by the Web server. HTTPS is really just the use of SSL as a sublayer under its regular HTTP application layer.

HTTPS and SSL support the use of X.509 digital certificates from the server so, that, if necessary, a user can authenticate the sender. SSL is an open, nonproprietary protocol that Netscape has proposed as a standard to the Worldwide Web Consortium (W3C). HTTPS is not to be confused with SHTTP, a security-enhanced version of HTTP developed and proposed as a standard by EIT.

If you are communicating over a private connection, you may rely on standard file transfer protocols using TCP/IP without encryption. This may include FTP and HTTP.

FTP enables you to transfer files to and from an external system. The proposed Extranet system will not accept anonymous FTP from hosts and provides a private directory for each FTP user and restricts the user to only that directory.

The HTTP is the set of rules for exchanging files (text, graphic images, sound, video, and other multimedia files) on the Worldwide Web. Relative to the TCP/IP suite of protocols (which are the basis for information exchange on the Internet), HTTP is an application protocol.

Essential concepts that are part of HTTP include the idea that files can contain references to other files whose selection will elicit additional transfer requests. Any Web server machine contains, in addition to the HTML and other files it can serve, an HTTP daemon, a program that is designed to wait for HTTP requests and handle them when they arrive. Your Web browser is an HTTP client, sending requests to server machines. When the browser user enters file requests by either "opening" a Web file (typing in a URL) or clicking on a hypertext link, the browser builds an HTTP request and sends it to the Internet Protocol address

indicated by the URL. The HTTP daemon in the destination server machine receives the request and, after any necessary processing, the requested file is returned.

Based on the Port community's requirements, all data moving between the Web browser and the Port of Montreal Extranet Solution over the Public Internet will utilize SSL and/or HTTPS.

Those users who will be sending transactional data to the Port Extranet Service to feed the container database could use the existing private VAN network (at least during the pilot) and therefore will not need to employ secure file transfer protocols. These users will use either FTP or HTTP over a TCP/IP private connection.

10.4 VPN Service

With VPN-Security, you can utilize virtual private networks (VPNs) to economically extend the reach of secure network communications to remote offices, telecommuters, mobile users, customers, and trading partners around the globe.

VPN-Security improves the security of your data traffic while delivering the cost benefits of using shared networks including the Internet. With VPN-Security, sensitive data is encrypted and tunnelled to its destination network. Whether you use the Internet or a VAN, important data traffic receives enhanced security and the highest reliability. It is the ideal solution for business processes and applications, including Extranets and flexible, yet secure, Intranets.

VPN-Security ensures end-to-end privacy and protects sensitive data from would-be hackers. A standards-based solution that is interoperable in the growing community of electronic business, VPN-Security includes:

- Encrypting and tunnelling of data traffic using optional triple DES technology over any shared IP networks including the Internet, Extranets, intranets, etc.
- Compliance with standards set forth by the Internet Engineering Task Force's (IETF) IPSec, and ISAKMP/Oakley (IKE).
- Elimination of the fixed costs associated with multiple private dedicated lines.
- No operational cost for supporting modem pools.
- Lower information technology (IT) management costs.

- Increased control and lower supply costs as a result of central Extranet management.
- On-line registration and no additional training for the client's network users.

10.4.1 Significant Cost Savings

VPN-Security can offer cost savings of up to 60% over private leased lines and 30% over frame relay networks. Cost savings are achieved in several areas including:

- The fixed cost associated with multiple private dedicated lines is eliminated.
- No operational cost for supporting modem pools.
- Lower Information Technology (IT) management costs.
- Central management of Extranets increases control and lower supply costs.
- On-line registration and no additional training for client's network users.

VPN-Security offers the highest system flexibility in the industry. Features and benefits of VPN-Security include:

- Clients can add users incrementally without significant expense.
- User communities can range in size from a few members to thousands.
- Security policies can be defined and enforced by the client's home gateways.
- Applications, router gateways, and authentication serves can be hosted in-house or with the service provider.
- A wide mix of computing platforms are supported, including Windows® 95/98, NT, and UNIX.
- Optional outsourcing of on-site installation and performance management of your VPN-Security solution to the network experts.

10.5 In Summary

Deploying an Extranet involves many issues and can involve many different types of users. Extranets are providing organizations like the Port of Montreal a competitive advantage, which leads to lower costs and increased profits. However, Extranets require much planning to be successful.

Today's technology will allow the Port to evolve from a simple security model to a very sophisticated model as the applications increase in value and consequently require more secure infrastructure. Today's requirements can be easily identified and supported using simple User Authentication (User ID and Password), access control lists for application security. SSL and HTTPS will be adequate for data transmission.

As user requirements expand and technologies improve it is likely that Smart Cards will play a role in providing a secure Extranet environment.

Appendix A – Industry Trends

During the 1980's, many major ports around the world implemented Cargo Community Systems, (CCS). Southampton, Felixstowe, Rotterdam, Antwerp, Hamburg, Hong Kong, Singapore and New York are examples.

The port community in Felixstowe has benefited from their local port community system, FCPS, since 1984. The rationale behind the formation of FCPS was to help speed the flow of cargo through the port. This has proved to be extremely successful and has allowed for the elimination of a large proportion of official and commercial documentation, which traditionally was the source of many of the delays in and around the port.

In the mid 1980's, the advancement was the use of EDI, EDI, which looked to standardize documents and their electronic exchange. However, it quickly became apparent that through the use of EDI much of the traditional paperwork could be eliminated, especially in the release of containers, notification of Customs' status and transshipment notification and approval.

The initial focus was on imports, but exports and transshipments are now fully supported. All of these processes have seen enormous reductions in dwell times through the use of electronic communications, a central information source and early notification of status and status changes to the appropriate parties associated with a specific container and/or Bill of Lading.

Another immediate benefit to the port community stakeholders was the provision of a local electronic messaging facility.

Initially, the focus of these Port community systems was on the release of the cargo, but by the middle of the 1990's, with the focus moving to the integrated Supply Chain, the intermodal members of the logistics chain and port communities were encouraged to enter the electronic port community systems.

By entering into the electronic port community system, many stakeholders have benefited. Drivers no longer have to collect paperwork prior to arrival at the terminal gate, which not only saves time but also reduces congestion in and around the port. From the central information source dispatchers are immediately notified of container availability and can direct drivers, while they are still local to the port, to the appropriate gate or terminal, knowing the containers are available for immediate pick up.

With the advent of Internet technology, communications are now simple and cost effective. Not all members could previously cost justify the use or implementation of traditional EDI.

In parallel to the developments in low cost, simple to use communications, other technological advances have been made which, when applied to a port community, can greatly enhance the value of the investment made in systems and electronic communications, by all stakeholder members.

Two examples can be seen in Singapore and in Rotterdam.

The port community, and especially the trucking companies, in Singapore have been using “pager” technology to speed containers in, out and through the port. This system of communication with the drivers, along with the introduction of the port’s “Flow-through Gate System”, has more than halved the old gate clearance times. First piloted in 1995, with 250 container trucks, the system had over 80% of the registered prime movers participating within the first 12 months.

Through the use of these technologies, trucks are now able to pass through the terminal gates in 25 seconds, a 58% reduction. This has resulted in an increased gate capacity of more than 50%. Mr. Lim Quee Huat, Honorary Secretary of the Singapore Lorry Owners Association, has stated *“This innovative system saves drivers a lot of waiting time, so that they can spend more time moving containers. Soon, we will be able to use the pagers to maintain on-going communications with the drivers. This will greatly enhance our ability to communicate with the prime mover drivers while they are in the port and keep them informed if there are any emergencies or changes in container location or status.”*

In Rotterdam the port stakeholders have introduced “Smartcard” technology to prevent delays in expediting containers through the port and to increase the drivers' efficiency whilst in the port facilities. The “Smartcard“ contains details of the driver and provides the driver with their own unique electronic identity whilst operating in the port. As an additional security measure, the “Smartcard“ contains 3 dimensional details of the driver’s left hand which, when read by scanners, provides the security that truly identifies the driver to the “Smartcard“.

In addition, the “Smartcard“ can act as a microcomputer, storing data regarding loads/containers to collect and fill Delivery Order details. This information, created by the dispatcher and transmitted through the electronic port community system, can route the driver to the correct bay for loading or discharge of the correct containers and can be used to print appropriate paperwork at the terminal gates.

Over 4000 registered truck drivers are using the “Smartcard“ today and, along with the other members of the international container logistics chain, are benefiting from the efficiencies associated with the reduction in dwell times, waiting times and paperwork.

Many port communities, inland clearance locations and intermodal facilities worldwide are, or have, implemented electronic community communications systems along with automated driver and equipment recognition. All members of the container logistics chain are increasingly facing tremendous pressures to:

- Cut costs
- Diminish gate, port, terminal congestion
- Reduce damage claims
- Attain higher levels of operating efficiencies

Many of these entities and their stakeholders are looking to embrace Internet technologies, enhance the current usage of EDI and put new communications technologies, Pagers and Smartcards, together with central community information repositories to leap frog their competition and attract new users to their communities by being able to:

- Decrease gate dwell time
- Reduce labor
- Improve data accuracy
- Reduce the number of data entry points
- Reduce or eliminate verbal communication
- Reduce or eliminate fax communication
- Increase security

Appendix B – Port of Montreal Import Process Current Information Flows

Figure B-1 Port of Montreal Current Business Process

Appendix B-2: Port of Montreal Export Process (Empty Container Pickup Process)

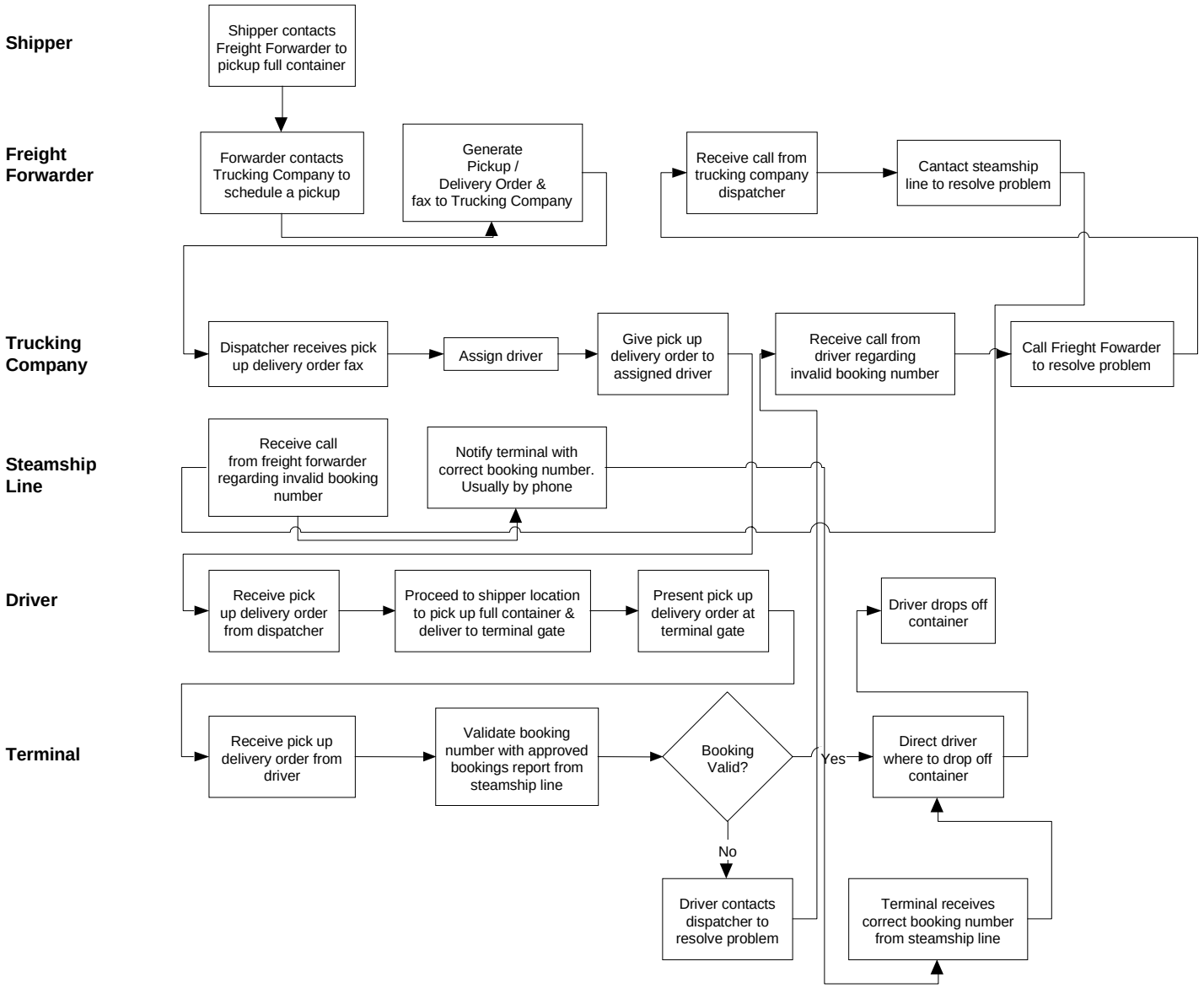

Figure B-2 Port of Montreal Export Process (Empty Container Pickup Process)

Appendix C - Port of Montreal Export Process “Future State” Information Flows

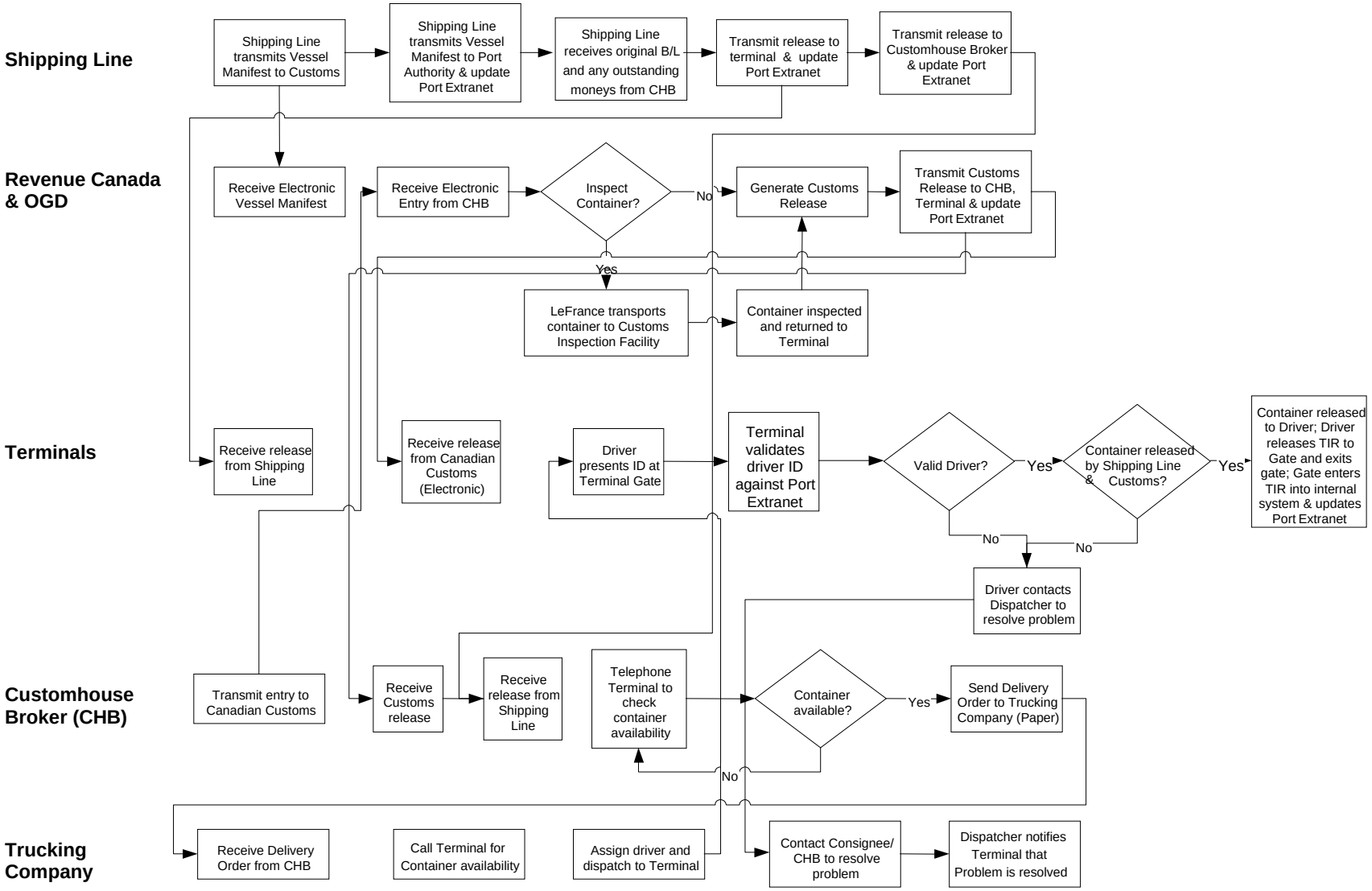

Figure C. Port of Montreal "Future State" Business Process