E-Business Solutions to Border Control Challenges

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Introduction

- Intercept threats within growing flows
- Security risk management approach
- “virtual” audits of inbound traffic
- “EZ Pass Lane” for international trade
- government-to-business (G2B) solution
IT needed for EZ pass lane for trade involves three steps:

- Receiving raw data relevant to security assessments
- Mining data to detect anomalous behavior that raise red flags
- Giving frontline inspectors access to actionable information in real time
Presentation Outline

1. Challenges of border control
2. US Customs’ IT deployments and agendas
3. Receiving logistics data for public security
4. Data mining
5. Portal for targeting inspector
6. Pilot project leveraging SAP at US Customs
Challenges of border control

- 500 million people
- 125 million vehicles
- 20 million import shipments
- 16 million containers
- 2% of containers physically inspected
- Customs personnel increased only 7%
Threats of terrorism

- Al Qaeda operative inside container
- Chemical, biological, radiological weapon
- Self-embargo on trade
  - Ambassador Bridge
    - 10 million vehicles annually
    - 27% of U.S.-Canadian Merchandise trade
    - 15 hour back-ups
US Customs IT deployments

- Current systems
- Customs modernization
- Post September 11th Agenda
- Remaining Problems
Current systems

* Automated Commercial System (ACS)
  - over $20 billion in revenue
  - Cargo Selectivity System
    - filer
    - consignee
    - tariff number
    - country of origin
    - manufacturer and/or shipper
Automated Targeting System (ATS)

- ATS-Anti-Terrorism
  - high-risk outbound shipments on passenger aircraft.
- ATS-Passenger
  - suspects for transnational crimes.
- ATS-Narcotics
  - automated review and analysis of shipment data
  - ranks shipments by level of suspicion for illegal narcotics activity

- Trend Analysis and Analytical Selectivity Prototype
  - violations of United States laws, treaties, quotas, and policies regarding international trade.
Customs modernization

- Automated Commercial Environment (ACE)
- International Traded Data System (ITDS)
- SAP Financial System.
Automated Commercial Environment (ACE)

- allow processing by accounts rather than transactions
- provide national views of importer activity
- enable faster cycle time at borders
- allow remote filing locations.
International Trade Data System (ITDS)

- single point submission of trade information required by multiple government agencies
- “front-end” for ACE
- Buffalo pilot project
  - Truck manifests transmitted over internet
  - companies could track shipping status
  - transponders, touch screens and GUI
SAP financial system

- Will replace non-integrated legacy systems
  - Budgeting
  - Accounting
  - Procurement
  - Property management

- R/3 will also be used by ACE
  - Payments
  - Collections
  - Refunds
Post September 11\textsuperscript{th} Agenda

- Customs-Trade Partnership Against Terrorism (C-TPAT).
  - Voluntary cargo and supply chain security
  - 60 companies have signed
  - more than 100 additional applications pending
The Container Security Initiative (CSI)

- “push out” the border
  - establish security criteria to identify high-risk containers
  - pre-screen containers before they arrive at U.S. ports
  - use technology to pre-screen high-risk containers
  - smart and secure containers.
Remaining Problems

- ACE envisioned as a trade system
- ATS-Anti-terrorism - exports not imports
- ATS-Narcotics - pre 9/11 focus - drugs
- Trend Analysis - policies, quotas, duties.
- Targeting tools and data not integrated
- New Office of Border Security
Private sector logistics for public sector security

- Leverage two IT trends
  - Global 500 enterprise systems
  - Public sector enterprise systems: e.g. Customs

- International trade packages “bolt-on” to enterprise systems

- Customs Service Engines.

- SAP-MIT Auto-ID - track smart items
- Importers “cc” Customs
- Electronically submitted manifest info on 98% of incoming containers
- Legislation may increase requirements
- 2% of manifests still on paper forms.
- 2% total percentage of containers inspected
- Law enforcement rationale for open-ended submission
- A multi-tiered categorization of data submission and corresponding risk
<table>
<thead>
<tr>
<th>Extent of data submission</th>
<th>Risk</th>
<th>Treatment at border</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete - does not meet current requirement</td>
<td>high</td>
<td>Targeted for inspection</td>
</tr>
<tr>
<td>Minimum to meet existing requirements</td>
<td>standard</td>
<td>Regular treatment</td>
</tr>
<tr>
<td>Meets requirement proposed by Congress</td>
<td>lower</td>
<td>Faster lane</td>
</tr>
<tr>
<td>Open ended submission - transparent supply chain</td>
<td>lowest</td>
<td>Fastest lane</td>
</tr>
</tbody>
</table>
- SAP R/3 at Customs could potentially serve as back-end of the G2B solution to receive data
  - Custom plans to use SAP in ACE for import duty payments, collections and refunds.
  - Customs has also purchased mySAP.com
  - Importers will already be sending key data into Customs’ SAP system

- SAP Business Information Warehouse
  - Gather importer’s data from the accounting systems
  - Other databases, online services and the internet.
  - A unified repository of relevant targeting data

- SAP enterprise system reporting tools
  - More integrated targeting systems
Data Mining

- U.S. customs
  - Goal
- Example Scenarios and Traditional Data Mining techniques
  - Anomaly Detection with Various Cargo Attributes
  - Discovering Rare Patterns from Correlation of Materials Being Shipped
  - Transshipment
- OUTLAW architecture
- Combination of alerts
Goal

- To Supplement the profiling, by making it targeted towards anomalies.
- To utilize data available from different agencies, ports and customs divisions.
- To detect various flags raised by non-conforming shipments or abnormal behavior of the inbound cargo and raise a combination of alerts.
- To identify the anomalous shipment before it enters the country.
Anomaly Detection with Various Cargo Attributes

Scenario 1: Import of Parts of trucks for a company called Meltro Corp. from Canada
March 2001, “Meltro Corp” imports a shipment of truck parts from Toronto going to Denver, Colorado.
Shipping Route Measurement

- **Size of Container**
  - 20ft
  - 40ft
  - LCL

- **Type of Container**
  - Normal
  - Special Case
    - Refrigeration
    - Hazmat

- **Route**
  - Distance
  - Time
  - Value of transport
  - Brand of carrier
Outlier Discovery

- The value of an attribute or a combination may be at a greater distance than the normal, deviation from the standards set by other similar cargo.

There can be multidimensional outlier discovery, by comparing and n-dimensional vector for each importer.

Ref: Data Mining Concepts and Techniques by J. Han
Discovering Rare Patterns from Correlation of Materials Being Shipped

Scenario 2: Company Importing Fertilizer and another company importing cyclotrimethylene trinitramine
Scenario: **HAZMAT CARGO**

Profile: ChemCo a Fertilizer Company, Imports - Chemicals from Canada

Consignee: FarmersFriends  
Consignee Location: Wintersburg, Ariz.,  
Cargo: Liquid Urea, ammonium nitrate  
From: Mexico  
Carrier: Truckers Inc.

Consignee: ChemCo  
Consignee Location: Phoenix, Ariz.,  
Cargo: cyclotrimethylene trinitramine  
From: Canada  
Permits: valid  
Authorized: yes  
Carrier: Trojan Carriers.

Or many other shipments
Cargo route overlaid on Map of nuclear power reactors in North America

At Wintersburg, Ariz.,

<table>
<thead>
<tr>
<th>Plant</th>
<th>Type</th>
<th>Country</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palo Verde 1</td>
<td>PWR</td>
<td>United States</td>
<td>Operable</td>
</tr>
<tr>
<td>Palo Verde 2</td>
<td>PWR</td>
<td>United States</td>
<td>Operable</td>
</tr>
<tr>
<td>Palo Verde 3</td>
<td>PWR</td>
<td>United States</td>
<td>Operable</td>
</tr>
</tbody>
</table>

Source: http://www.insc.anl.gov/pwrmaps/map/north_america.html
Data Mining for Correlation of Cargo: Identifying actionable patterns for Mutually dependent events

- Events become relevant when they occur together.
- Analysis for **specific interval of time and a specific region** (defined based on proximity of occurrence).
- To identify a pattern as to
  - “which cargo, when imported will be harmful if a correlated cargo is purchased in the same time frame and specific region”
  - OR
  - “Which combination is harmful and is occurring as a rare pattern”
- These events become relevant with co-occurrence rather than causation

Ref: Mining Event data for actionable patterns
Multidimensional discovery

The two items are tightly correlated, based on

- Temporal proximity
- Spatial Proximity
- Semantic Proximity
Transshipment

A transshipment involves cargo carried by a second or subsequent ship without intermediate processing in order to reach its final destination.

Scenario 3: Cargo of fish from Spain
Spatial Data Mining: Mining spatial attributes

- A geocoded map can be divided into a grid of cells where every cell is associated with a multidimensional vector. Each vector is made up of spatial attributes.

- Examples of Spatial Attributes
  - Spatial distribution of Terrorist activities (T)
  - Spatial distribution of drug zones (D)
  - Spatial distribution of transshipment hubs (S)
  - There can be several other spatial variables.
  - Previous occurrence of (T or D or S) = P = "Y/N"

- The idea is to determine a geospatial correlation between cells based on a correlation of the multidimensional vectors.

Ref: Predicting locations using map similarity (PLUMS), A framework for spatial data mining
Associating cargo layer with Drug Distribution layer
A Combination of alerts

- There can not be just one technique to catch every kind of anomaly.
- Only by a combinations of alerts can we detect the anomaly.
- Each alert can have its own weight age

<table>
<thead>
<tr>
<th>Questions</th>
<th>Alerts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the Value of shipping route out of the ordinary?</td>
<td>✔️</td>
</tr>
<tr>
<td>Is there a possibility of Transshipment?</td>
<td>✔️</td>
</tr>
<tr>
<td>Is it a Hazmat requiring very high level of secure cargo?</td>
<td>✗</td>
</tr>
<tr>
<td>Could this cargo be used as a weapon of mass destruction if used with another material?</td>
<td>✔️ ✔️</td>
</tr>
<tr>
<td>Did this company change the carrier, shipper, notify party or owner recently? Or is it a company with no prior history?</td>
<td>✔️ Notify party</td>
</tr>
<tr>
<td>Can this cargo be correlated to any drug or terrorist related map layer?</td>
<td>✗</td>
</tr>
</tbody>
</table>

Overall Alert: high
Portal for targeting inspector

- SAP portal for Customs employees
- Useful features
  - Need access to combined analysis
  - Manual intervention
  - Mobile: laptop, handheld, wireless
  - Communication between inspector and firm
## Public-private pilot project

<table>
<thead>
<tr>
<th>Function</th>
<th>Solution(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-ended data submission</td>
<td>ACE, SAP R/3, BW</td>
</tr>
<tr>
<td>Combined analysis data mining</td>
<td>?</td>
</tr>
<tr>
<td>Accessible integrated targeting systems</td>
<td>BW and eGov Portal</td>
</tr>
</tbody>
</table>
Steps:

- Customs agrees to pilot project concept
  - NY/NJ Port Director expressed interest

- Approach firms - identify motivated importers among C-TPAT Members

- Develop Prototype
  - Modify ACE
  - Combined analysis tools
    - perhaps based on Rutgers NSF Proof of Concept
  - Refine Portal

- Test Prototype
  - Port NY/NJ – volunteer firms