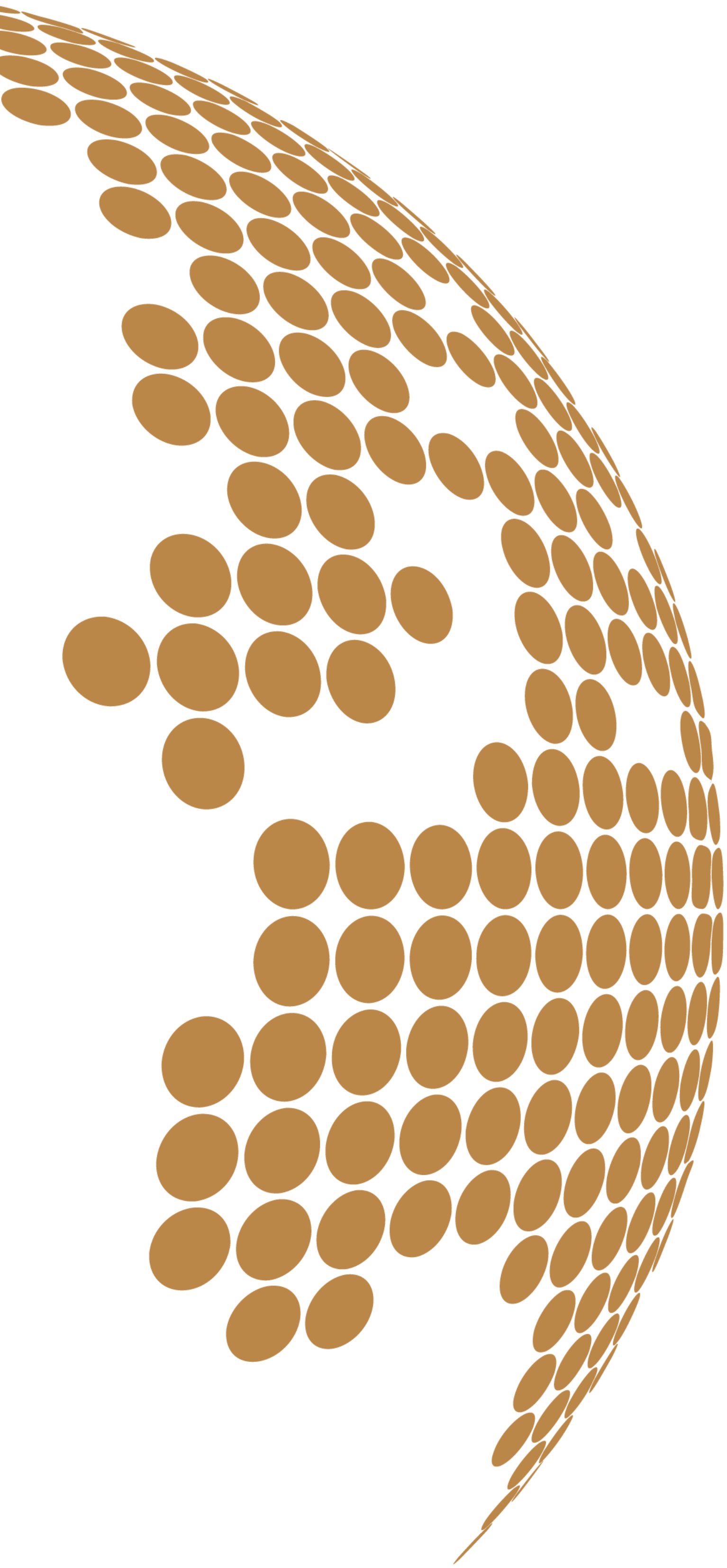

MIT CTL ROUNDTABLE SUMMARY REPORT

MANAGING GLOBAL SUPPLY CHAINS: BUILDING END-TO-END RELIABILITY

18 OCTOBER, 2011
MIT CAMBRIDGE, MA

MIT Center for Transportation & Logistics

This report was prepared by the MIT CTL Global Transportation Reliability Initiative research team (led by Drs. Chris Caplice & Basak Kalkanci) and included notes taken at the roundtable by Working Knowledge.

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Introduction

This document is a summary of the discussion conducted at the Roundtable *Managing Global Supply Chains: Building End-to-End Reliability* that was held by the Center for Transportation & Logistics (CTL) at the Massachusetts Institute of Technology (MIT) on 18 October 2011. It is being sent only to attendees of the roundtable.

CTL holds Roundtables to assess whether to commit resources to a potential new research initiative. Roundtables differ from the other types of events that CTL runs in that they are very small, invitation-only, unstructured, and anonymous. The size is typically limited to two dozen in order to encourage and ensure participation from all attendees. The attendees are hand picked by the CTL research team to best represent the problem at hand. The day is loosely organized with the attendees expected to lead the discussion and debate. The outcome is rarely known at the outset. Finally, while notes are always taken during a Roundtable, the comments are never attributed to individuals in any documents or reports. All of these rules lead to very interesting and open-ended discussions with experts in the field.

Thirty supply chain and freight transportation practitioners and researchers participated in the interactive daylong discussion. The group was comprised of shippers (both importers and exporters), carriers (ocean, rail, and truck), third parties, as well as MIT researchers.

The Roundtable had four objectives:

1. Is Global Transportation Reliability worth MIT CTL researching further?
2. Is there interest among companies present to participate in this research?
3. What specific aspects of Global Transportation Reliability are most interesting?
4. What should MIT CTL's next steps be for this initiative?

The remainder of this report is organized into three sections, as follows. The first section presents and summarizes the observations of the MIT CTL research team based on its initial research with a few pilot firms. These informal findings prompted the team to consider diving deeper into this topic.

The second section provides a summary of the discussion during the roundtable and is organized by theme. Comments by individual are referenced (when at all) to the type of the firm and whether they are an importer or exporter and if a carrier, by mode.

The final section describes the recommended course of action that we propose the MIT CTL research team takes.

Initial Observations: The Challenge

Global trade is critical to the US economy. The United States is the world's largest trading nation with international trade representing 25% of its GDP. In less than 50 years, the value of US exports, measured in terms of percentage of GDP, more than doubled while imports more than tripled!

While critical to the economy, conducting and coordinating this trade is a complex task. Every freight movement by necessity involves multiple companies, modes of transport, and regulatory agencies. These transactions span across time zones and geographies and involve different cultures and languages.

Transportation is the critical link in these complex transactions with the majority of the goods moving via ocean container. The total end-to-end transportation time of a shipment from a point of origin to the final destination is made up of a series of individual and often independently managed movements and activities. The end effect of the individual movements is the total transportation lead-time. A receiving firm sets their inventory policy, specifically their safety stock, using this lead-time. The variability of the transportation lead-time is often more impactful on a firm's safety stock than the average value. Unfortunately, most inventory systems either ignore the transportation variability or simplify it dramatically. Additionally, the elements that contribute to the total end-to-end transportation time are not well studied. Companies tend to rely more on anecdotes than data for this critical component of the global economy.

The CTL research team made a first set of analysis earlier in 2011 with a small set of companies – both forwarders and individual shippers. We examined various sets of data – primarily transactional shipment data from point of origin to final point of destination. Out of this admittedly small and potentially biased sample of transactions as well as interviews with small set of executives, we developed six initial observations:

Observation 1. Contract reliability in procurement and operations do not match

As part of our analysis, we collected the transit time promised by carriers in the annual contract for a set of ocean trade lanes as well as a year (or more, in some cases) of transactional data. Comparison of the promised or contracted transit time to the mean actual transit time for these trade lanes shows that in most cases the contracted time is much shorter than the actual transit time. The relation between the two is shown in the figure below.

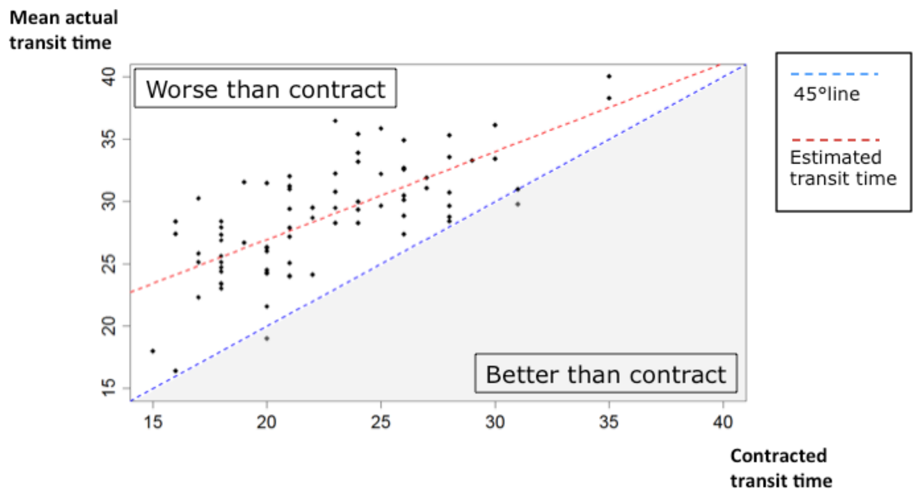

Figure 1. Comparison of contracted versus actual transit times. Each point is a single trade-lane and the data set includes both door-to-door and port-to-door lanes. The definition of the lane is consistent for both contracted and actual transit time.

Note that all but two of the observations indicate a performance worse than contract. The linear regression line for the actual transit times implies that this effect lessens for longer transit times.

There are two major problems with having contracted transit times that are much longer than the actual times. The first is that inventory levels are set based on the contracted terms. If the actual transit times are much longer than the contracted times (such as a week or more as observed in our data set), then the result could be increased stock-outs and shortages. The second problem is that carriers are rewarded for providing unrealistically short transit times during the procurement and contracting process and are not held to that standard during the actual execution. This suggests that there is a gap or lack of coordination between the procurement and the operations groups in many firms.

Observation 2. Contract reliability differs dramatically across route segments

In order to better understand the sources of contract unreliability in end-to-end shipments, we divided the movements into three components: origin landside pick up to departure from origin port (door-to-port), origin port departure to destination port arrival (port-to-port), and destination port arrival to destination landside drop off (port-to-door). We included only those movements that were door-to-door and contained transit time data (contracted and actual) for each of the three components. We again charted the contracted versus the actual mean transit times for these three components as shown in the three figures below.

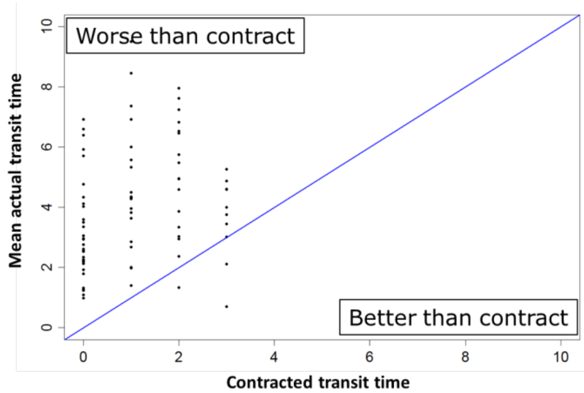

Figure 2. Contracted versus actual transit time for origin landside pickup to departure from origin port (door to port). Each point represents a single trade lane.

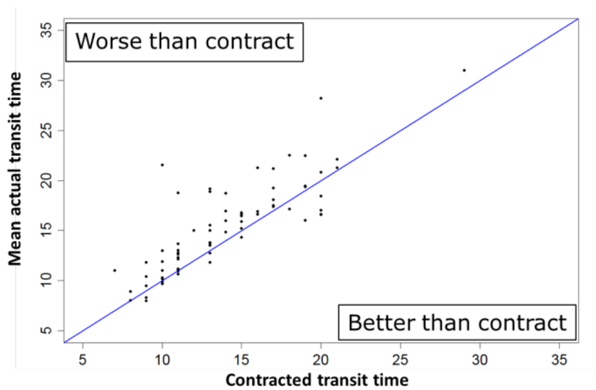

Figure 3. Contracted versus actual transit time for departure from origin port to arrival at destination port (port to port). Each point represents a single trade lane.

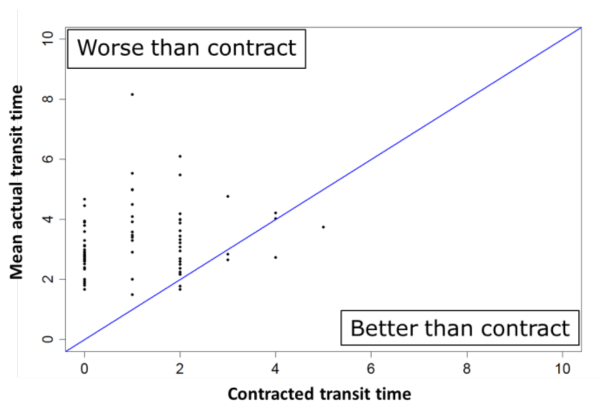

Figure 4. Contracted versus actual transit time for arrival at destination port to arrival at destination door (port to door). Each point represents a single trade lane.

Comparison of the three charts shows that all three of the time components tended to have shorter contracted than actual transit times. However, the port-to-port component appeared to be the most accurate of the three. Conversely, the actual transit time for the landside components (door-to-port and port-to-door) were consistently longer than the contracted. This implies that most of the contracting issues occur at the origin and destination rather than on the water. This does not necessarily imply that the variability lies there – just that the actual times do not match the contracted times.

Observation 3. Most variability occurs in inland transit and at the ports

In order to test where variability in the end-to-end transit time comes from, we further divided the shipments into five segments. These are: origin-to-port, load port dwell, port-to-port, destination port dwell, port-to-destination. The origin dwell time is the elapsed time (for a container) from arrival at the origin port to loading on the vessel and the destination dwell time is the elapsed time from arrival to the destination port (by vessel) to departure from the destination port. This finer definition separates the inland transportation from the actual port operations.

Rather than comparing the mean actual to contracted times, we looked at the variability of the actual times for each of the five segments. The table below shows the mean transit time followed by the standard deviation, in parentheses, and the coefficient of variation, in brackets. The coefficient of variation is simply the standard deviation divided by the mean. It provides an easy way to compare variability of different processes. As a rough proxy, a coefficient of variation near or greater than 1.0 is considered to be highly variable.

	Origin Landside Transit	Origin Port Dwell	Ocean Transit	Destination Port Dwell	Destination Landside Transit	Total Transit
Pacific Rim to North America	2.1 (2.5) [1.2]	3.2 (3) [0.9]	14.4 (5.1) [0.4]	4.1 (4) [1.0]	6 (4.8) [0.8]	29.9 (6.4) [0.2]
South America to North America	2.4 (3) [1.3]	6 (4.8) [0.8]	17.2 (3) [0.2]	3 (2.4) [0.8]	3.2 (2.9) [0.9]	31.8 (5.3) [0.2]
Europe to North America	4.2 (3.1) [0.7]	4.4 (3) [0.7]	12.6 (3.5) [0.3]	2.7 (1.8) [0.7]	4.3 (3.1) [0.7]	28.3 (5.5) [0.2]
North America to Europe	3.1 (2.4) [0.8]	3.1 (2.8) [0.9]	11.2 (5.6) [0.5]	3.1 (2.6) [0.8]	1.9 (2.5) [1.3]	22.4 (7.8) [0.3]

Table 1. The table shows the mean, (standard deviation), and [coefficient of variation] of transit times for each segment for the different trade lanes. All numbers are in days. Each data point is a container shipment.

The table shows that the port-to-port ocean transit segment is the least variable segment across all the trade lanes. The landside transportation and port operations, on the other hand, tend to have the largest variability. Some of this is to be expected. For example, if a firm sends one container of material per day to a port with a weekly liner service, we would expect an average of 3 days of delay at the port with a standard deviation of 2.2 days. Note that this would be an extreme case and in all of the trade lanes above, the mean and the standard deviation for the origin port is greater than this.

The key takeaway is that the source of variability in end-to-end shipments is mainly the landside connections, not the port-to-port segment. That this is also the main source for lack of contract adherence is not surprising since these segments involve multiple players while the port-to-port segment is solely owned by the ocean liner.

Observation 4. The number of interim stops in a shipping string seems to impact the transit time variability

While the variability of the port-to-port segment was not the worst, it still has impact. We tried to explore what drives the variability in this segment and found that, as expected, the number of stops within a string impacts the variability. The figure below shows that as the number of stops in a string that are prior to the destination port increases, the standard deviation in the ocean segment increases.

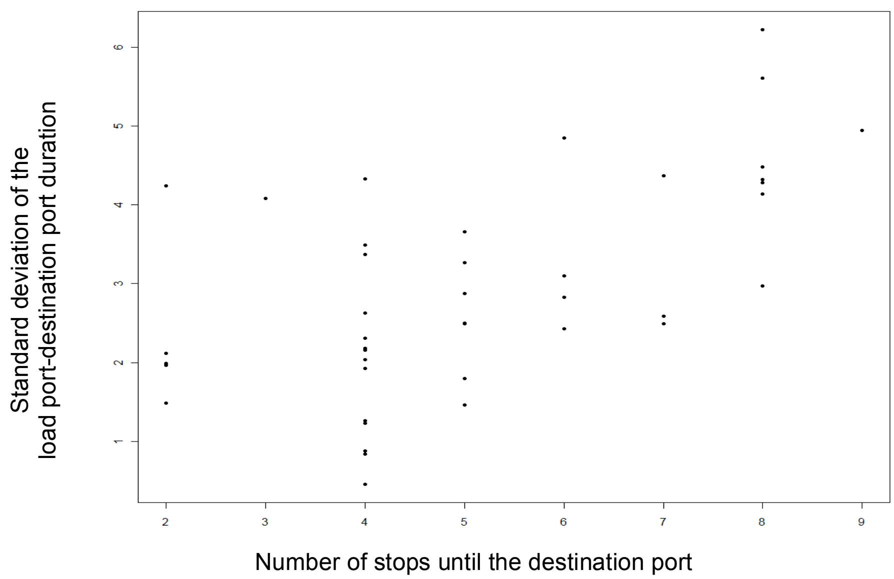

Figure 5. This chart compares the number of stops in a string prior to the final port destination and the standard deviation of the ocean (port-to-port) transit time. Each point represents a trade lane.

This makes sense since any delay or disruption at an earlier port has a ripple effect on the later stops in the same string. It is difficult to make up a lost day. The correlation between the number of stops and the standard deviation was 60%. This implies that it might behoove firms to request the specific strings that carriers are planning to move their freight on during the bidding process.

Observation 5. Port dwell times vary dramatically

In order to better understand how the landside and port operations impact the overall end-to-end variability, we explored specific port performance. Our data was only for inbound container shipments. We found that the median number of days it took to process a container through the port varied from 2.4 days up to over 8 days for different ports. The West coast ports had lower median throughput times – about 1 day faster than the East coast. The data was not complete enough to publish performance statistics by port – we would need more comprehensive data set. However, it was sufficient to show that there is a wide range in throughput time for ports. This suggests that firms should take specific port performance into consideration when designing their transportation network. Additional research is planned to try to understand what specific features of the port are driving the dwell time performance.

Observation 6. Traditional inventory planning methods can over-estimate variability impact

The final observation presented at the roundtable concerns how firms consider transit time variability in their inventory decisions. Generally, most software tends to over estimate the impact of lead-time variability. This is primarily due to assuming that the lead-time is Normally distributed. In fact, most freight transportation lead-times are not Normal. Instead, they tend to have a truncated left tail and a very thick right tail – that is, there are longer transit times than very short ones. Also, something that is rather unique to ocean transportation, many trade lanes exhibit "multiple mode" distributions where there are two or more "humps" in the data. This is caused by the typically weekly schedules of ocean liners. If a container misses a pick up at a port by one hour, it will not be one hour late at the destination; it will be a week late.

Most software systems make the Normality assumption for ease of calculation, but this over estimates the amount of inventory required in most cases. Interestingly, this over-estimation might be countered by the under-estimation caused by poor contract adherence (observation 1)! In any case, this is an area of further research.

Discussion of Challenges

Following the introduction to the overall problem and the six observations by MIT, the remainder of the roundtable was organized into six sessions – each lasting one hour and focusing on a single topic. Each session was "opened" by one of the participants and discussion from all participants followed. Each of the session discussions is summarized in turn.

Challenge 1: Container Forecasting

Container forecasting helps carriers anticipate shipment volumes and make appropriate asset deployment decisions. One retailer noted that container forecasting has much more impact on transportation reliability than people think. If carriers don't have accurate, timely forecasts, then they must be ready for everything, facing deficits and surpluses of assets across world, and be constantly repositioning their fleets. This impacts both costs and service. An ocean carrier noted that poor forecasting exacerbated the 2010 crisis. Retailers provided unreliable and divergent forecasts, which gave carriers no clear insight into total container demand.

Container forecasting requires estimating both the volume and the timing of container shipments. Estimating the volume means converting forecasts of unit sales or dollar-volume sales into orders from factories or suppliers and then converting the shipped order into estimates of the numbers of required containers on trade lanes between the origin and destination. That implies determining the amount of product per container in the context of decisions regarding TEU vs. FEU, normal vs. high-cube, as well as transloading. Container forecasting also means accounting for lead-times at the supplier and the various post-production but pre-shipment tasks such as packaging, labeling, and container stuffing. Container forecasting means predicting when the shipment will be ready for pick-up and when it will arrive at the container terminal in time for loading on the vessel.

From rolling forecasts to committed bookings

An ocean carrier stated that shippers use a very wide range of forecasting cycles. Some provide no forecasts or only a quarterly update. Others go to the opposite extreme with twice-weekly updates of a 4-week rolling forecast. Most shippers at the roundtable had similar rolling forecast processes with horizons ranging from 1 month to 13 weeks. Exporters from the U.S. seemed to rely less on forecasts and contracts and more on the spot market, according to both ocean carriers and exporting shippers in attendance. The U.S. trade imbalance with Asia means that U.S. exporters can readily find space at any time.

Another ocean carrier reported that shippers vary widely not only in the frequency, but also in the *sophistication* of their forecasts. Small companies seem to have very primitive forecasting -- they often convert annual volume commitments into estimates of weekly volume by simply dividing by 52. Others use historical seasonal data to segment peak and non-peak volumes but don't adjust the forecast using order data. Larger shippers seem to use much more refined forecasting methods that convert annual volumes to quarterly, monthly or weekly volumes based off of historical distributions and peaks.

One importing shipper shared its process for container forecasting that it has developed over a 10-year period. The company works hard on forecast accuracy and in sharing timely forecasts with freight forwarders and carriers to improve transportation operations. The shipper creates an 8-week rolling forecast that it shares with service providers. The service providers, in turn, warn the shipper if they can't handle those volumes. The shipper refreshes the forecast weekly and then makes booking commitments about two or three weeks out.

The shipper also revealed that it forecasts down to specific vessel sailings -- defining exactly how many containers it will put on which vessels, ports, and dates. This lets the company accurately forecast exactly when goods will arrive. Some attendees wondered if any of the ocean carriers objected to such detailed specifications, but the shipper said the opposite was the case. Carriers, it appears, really like to know that each specific vessel sailing has reliable bookings. The greater the forecast detail (if it's reliable), the more reliably the carriers can fill each ship.

The shipper further explained that they use a stage-gate process to ensure an accurate and detailed forecast. "There are 1000 inputs we touch to build that forecast, from all retail markets so we have a stream of historical data, merge it all, and use some technology to digest it all and boil it down," said the shipper. The process works with suppliers to verify shipping dates and with freight forwarders to optimize cargo dimensions and container sizes. The shipper's accuracy runs in the mid-90s to get accuracy -- 95% is good enough and 99% is not needed. "By improving forecasting we've gotten better performance from carriers," the shipper said.

Useful horizon of forecasts

Shippers' forecasts help carriers only if the horizon of the forecast matches the horizon of carriers' activities. That is, the carrier must be able to do something with the forecast. One participant noted that detailed forecasts beyond a certain horizon don't help much because the carrier doesn't know what to do with them. That a particular shipper needs some exact number of slots in some long-distant week doesn't really influence the carrier's operational activities. Similarly, forecasts on too short a horizon don't help either because they give the carrier no time to react.

Very long-term forecasts and plans on business trends can help carriers in asset planning. Plans with horizons of months to years can help carriers make plans for new assets and shifting levels of development at different ports. Understanding the shifting patterns of business demand, expansion strategies, and supply chain strategies helps carriers know where to invest. The longer-range piece is harder but it is critical for carriers to set up the networks, which take time.

The attendees discussed and noted that the "optimal" forecast horizon varies by mode. Ocean carriers stated that a two-week forecast is the shortest useful horizon for full containers due to the time it takes to adjust sailing schedules. Part of the challenge of the 2010 surge and capacity shortage was in the time it took for ocean carriers to re-mobilize ships and re-establish trade-lanes. In contrast, less-than-container (LCL) loads have a 5 to 10 day useful planning horizon. Full truckload carriers can handle a 48-hour forecast due to the shorter distances and greater mobility of their assets. Two days offers plenty of time to ensure that the trucking firm can send a nearby truck and driver to the forecast pick-up point. LTL and parcel delivery is even shorter since their routes are more scheduled and assets are already in place. Rail's forecast horizon fell somewhere in between that of ocean and TL due to rail's intermediate distances and times required for activities such as transcontinental repositioning of containers, wells, and locomotives.

Challenge 2. Ocean Carrier Contracting

Ocean shipping contracts create a commitment between a shipper and a carrier. With the contract, the shipper commits to certain shipping volumes over the course of a year – typically by trade lane. Similarly, the carrier commits to provide capacity (by trade lane) under the price terms. The contracts can also define incentives and penalties for performance for both the shipper and the carrier. The roundtable members described various aspects on their contracts.

The capacity crunch exposed weaknesses in ocean shipping contracts said one shipper that imports and exports. He explained that several of his ocean carriers had their lawyers comb through less profitable contracts to look for loopholes. Loose contracts let carriers avoid some peak-time shipments. In response to this, the new contracts in 2011 have more specificity in terms of peak-time volume commitments as well as incentives and disincentives for both carriers and shippers. Some shippers reported that they increased the number of carriers they have relationships with to ensure an adequate capacity.

Long-term contracting

One ocean carrier commented that very few shippers seem to be using long-term contracts – most have one year with a handful of two-year contracts and none longer. Only one of the participating shippers mentioned having a contract longer than one year. That shipper, an importer and exporter, has just set up a three-year contract with one of its four carriers. The terms of this transatlantic contract include a signing bonus for the shipper, a long-term volume commitment to the carrier, but also terms that let the shipper pull a fraction of the committed volume if the carrier's annual bid goes too far above “prevailing” market rates. The shipper expressed interest in setting up more long-term contracts such as this.

One key issue with longer-term contracts is GRI (General Rate Increase) clauses and the use of some type of freight index to provide a fair adjustment of prices. Different shippers want to use different indices (e.g., Shanghai, Drury, Alphaliner), and it's hard to find middle ground between the carrier and shipper on the choice of index. As an alternative, a shipper can create its own benchmark of prevailing rates by running periodic bids to find market rates. One of the ocean carriers felt that index-based contracts will become more prevalent in the future.

Centralized versus Decentralized Contracting

Most of the shippers (both importers and exporters) reported using a unified sourcing approach by bidding all trade lanes used across the company at one time. In these cases, one group within the shipper represents (and works with) the various divisions in the shipper to run the bid process from a single location. For example, one shipper has a 30-person working group that meets weekly to make all decisions. Other shippers have a more decentralized procurement approach. This requires that the same carrier might have to work with multiple divisions and contacts for the same shipper. Similarly, some carriers reported that they are decentralized geographically and the shipper needs to work with different contacts within their organization.

Regardless of whether the sourcing is conducted centrally or decentrally, the actual award process seems to be lane-by-lane, with little bundling of lanes. When asked if any shipper conducts global contracting, the answer seemed to be “no.” The experiences of three shippers (mainly exporters) suggested that internal silos inside the carrier organizations seem to stymie carriers’ creation of global, bundled contracts. Moreover, unlike trucking companies, ocean carriers won't take cargo to ports they don't already serve in order to win a large global contract. Bundled deals seem hard to negotiate due to trade-lane-based profit-center silos with the carrier. The exception may be in Europe, where intertwined relations may permit bundled contracts for multiple lanes between Northern Europe and the Mediterranean.

Challenge 3. Ocean Carrier Management

Once contracted, shippers manage their portfolio of carriers through a wide variety of means. Overall, there seemed to be less emphasis on transactional incentives such as bonuses and penalties to motivate carriers’ short-term behavior. The feeling is that once the shipper's container is on the ship or once the ship sails without the shipper's container, there's really very little recourse. Instead, shippers focused on the long-term nature of shipper-carrier relations and modulating how much business they give to each carrier.

Few use bonuses and penalties

Very few of the roundtable participants reported that they actually apply penalties with carriers. Only two shippers stated they have a penalty for when a carrier rolls a container. The general sense, among the attending shippers, was that a token penalty doesn't motivate a carrier to make real changes to the operations of a large vessel. With mega-ships carrying many thousands of TEUs, the modest penalty on a few TEUs won't motivate the carrier to make any changes to ship schedules or deployments. Moreover, the token penalty doesn't recompense the shipper for its losses due to late freight.

Only one shipper noted having a bonus program for carriers. Carriers who achieve a certain high level of performance in the Q3 and Q4 get a bonus on every container carried. The scheme only rewards outstanding service, not merely achieving the stated contract terms. If the bonus program were too easy, the company's CFO would not be happy. So far, the shipper has yet to pay out a bonus to a carrier.

More shippers use allocations and contracts

Most of the shippers said that they award business based on carrier performance. This affects carrier selection both short-term and long-term. On shorter timescales, shippers tender fewer containers to "unreliable" carriers. One shipper, for example, noted that they have contracts with volume carriers but holds some of its business for the spot market. Depending on how the carriers perform, the shipper will shift business from under-performing carriers to better-performing ones.

On longer timescales, carrier performance affects which carriers receive bid solicitations and which ones win long-term contracts. Shippers do track carrier performance and several of the shippers noted that they don't pick the cheapest option -- reliability and service do matter. Over time, shippers shift volume allocations and contract awards from "bad" carriers to "good" ones. This leads shippers toward a relationship-based approach with sharing scorecards and communications to manage good performance. To the extent that companies share scorecards and KPIs, they can work together toward a common goal.

Relationships matter in ocean shipping

The general consensus among all attendees was that relationships matter in ocean shipping. One shipper (importer) argued that a more collaborative approach yields performance improvements for both shippers and carriers. They have pursued a 10-year collaborative effort with all its carriers, including ocean carriers. Some shippers felt that living up to commitments with carriers led to preferential treatment by those carriers down the road. Just as shippers know which carriers are more reliable than others, so, too, carriers know which shippers are more reliable. At least one shipper, however, adamantly noted that they had never seen evidence of that kind of reciprocity from the ocean carrier community.

A few shippers commented that the strength of a relationship depends on communication frequency and depth. Several shippers reported holding quarterly reviews with its carriers. One shipper commented that when a carrier visits the company, they bring in both procurement and logistics people to help build trust and understanding. During peak shipping times, that shipper holds weekly conference calls with its carriers. They also talk to under-performing carriers to try to fix the problems before shifting the business to other carriers. A major component of these communications should include sharing scorecards so that all parties understand how they are doing and what is expected of them in the relationship. No shippers reported seeing the carrier's scorecards of their own operations.

Challenge 4. Inventory Implications of Transit Variability

As noted in the overview, uncertainties in ocean shipping lead-times force companies to increase inventory. If a shipper doesn't know the transit lead-time of a shipment, it must hold extra inventory in case its shipments are delayed. One shipper estimated that it holds 20%-30% more inventory than the optimal plan due to unreliable transportation. A few shippers commented that slow steaming also leads to increased inventory. One attending shipper reported a 5% to 10% increase directly due to slow steaming.

An importing shipper opened the discussion of this issue. The company just implemented a new safety stock system that includes both supply and demand variability. One major issue lies in balancing stated lead-time versus "on-time". Anyone with an incentive to reach an "on-time" goal can do so by padding to create a longer stated lead-time. But long lead-times have costs in terms of added safety stock and in-transit inventory. The shipper realized that it should minimize inventory costs, which implies minimizing lead-time. Currently, the company is focusing on the worst performing trade lanes but is also seeking a more objective solution to think about the correct amount to pay for better lead-times and more reliable service.

How much safety stock is enough?

The roundtable discussion uncovered two additional reasons why companies probably don't carry the right amount of inventory for the level of lead-time uncertainty. First, few shippers (aside from roundtable attendees) appear to collect lead-time reliability data. That means that this data doesn't feed into their systems to automatically recalculate safety stocks and re-order patterns. The roundtable members confirmed this observation, saying they use "long-hand" methods and only update lead-times infrequently (e.g., once a year). Companies also act conservatively to avoid any problems. For example, transit lead-time might increase by one day, but a risk-averse shipper might pad the lead-time by one week to ensure the goods don't arrive late to store shelves.

Second, most current generation inventory systems provide no way to input the lead-time variability. The software expects a single value for lead-time, not a range of values or even a standard deviation. Even if a company collects data on the various promised and realized lead-times, they'd have no place to enter the variability figures. Having one lead-time number forces companies to fudge the system in some way -- padding the lead-time, order, or the forecast to cover the hidden uncertainty in the lead-time. This lack of a "variability knob" forces people to fudge numbers to create ad hoc compensation for stochastic lead-time.

Safety stock issue: better reliability only counts if it's consistent

One general challenge to improving the reliability of transportation is that partial improvements don't count for much. To the extent that a shipper or a carrier improves reliability only some of the time or on some trade lanes, they won't really have solved the bigger problem. With a partial solution, shippers still need to hold excess inventory and plan for worst-case lead-times. That is, shippers and carriers won't have a solution until they improve reliability consistently and across the board.

Challenge 5. Drayage and Chassis Container Management

The preliminary data on ocean shipping lead-times found substantial delays and variability in lead-times for landside and port operations. This led to a discussion of how companies manage drayage and chassis. This critical link in container movements occurs both around ocean terminals and around hinterland intermodal terminals. Yet many economic, structural, and regulatory factors conspire to complicate drayage -- especially port drayage -- and reduce both visibility and control of this segment of container movements.

Getting into and out of ports also adds to landside unreliability. Congested gates, security stops, inspections, container availability, and defects in chassis can add delays. The economics of dray isn't favorable for dray drivers, who run relatively few round trips and revenue miles per day due to all the idle time and empty miles driven in recovering chassis and containers. The unique properties of each port and the surrounding areas mean that each port is different and many ports have local dray companies.

Playing pass-the-chassis: ownership issues

In the port dray arena, no one wants to own the chassis, but everyone needs them. Some ocean carriers have been divesting themselves of chassis. Individual owner-operators don't have the capital to buy chassis and even the larger trucking firms don't really want to own them. Customer-dedicated chassis ownership would be inefficient, especially for companies that have infrequent needs for large numbers of chassis. Asset utilization on chassis tends to be quite low -- 60% of the time chassis sit idle waiting to be picked up, in customer's yard, or being repaired.

Chassis require tracking, maintenance, and extra mileage in pick-ups and deliveries of chassis. Tracking moving and idle chassis and containers adds a layer complexity and administrative costs for both the owners and the users of these assets. Various mark-ups and administrative fees might apply depending on who owns, moves, and holds the chassis. Different dray companies charge different fuel surcharges. Shippers don't know if their bill for chassis use is correct, and chassis owners worry about surreptitious use of chassis during free-time.

One challenge to improving the reliability of the port dray portion of shipping is the relatively unsophisticated nature of the business. Most attendees agreed that dray is where old trucks go to die and many are 8-10 years old with hundreds of thousands of miles on them. Many dray companies are small local firms with only 10-15 drivers while some of the larger ones might have 50-100. Low revenues per trip, low investment in assets, and the small scale of most dray firms makes them unlikely or unable to invest in the kinds of technologies and processes needed to more intensively track and manage dray movements.

The group also discussed alternative models for chassis ownership. One solution is to create a shared chassis pool such as the one operated by the Port of Virginia. A pooled arrangement reduces the total number of chassis required in a region, reduces storage of chassis, reduces the distances travelled to pick a chassis, centralizes chassis management, and increases dray truck turns. Yet some participants warned that Virginia's chassis pool suffers from the same problems as pallet pools: poor quality of in-pool chassis because chassis users try to keep the "good" ones.

Some wondered about the European approach to dray, which uses live unloading. This substantially increases the driver's dwell time but eliminates extra miles in going to recover empty containers and chassis. Some suggested that Europe tolerates the asset and labor inefficiencies of live unloading due to land constraints. Denser populations and smaller land plot sizes leave little room for sprawling freight yards of chassis and containers.

Another alternative is grounded operations, in which cranes and pickers lift containers onto and off of the chassis with much less dwell than live unload (but more dwell than a simple drop-and-hook operation). Some intermodal terminals use grounded operations in which overhead cranes move containers to and from wells on trains and to and from dray trucks. Some EU factories also use grounded operations. The key is that the tractor remains hooked to the chassis at all times. This enables the owner-operator or dray trucking firm to own and maintain the chassis without the problems of chassis tracking or poor asset utilization that occurs if the truck leaves the chassis behind.

Intermodal dray

As more shippers use intermodal rail to handle long-distance container movements, more shipments have an intermodal dray leg in the miles between the rail terminal and the loading dock. One truck carrier described its large tractor intermodal division, which handles drayage of intermodal containers. The company's model illustrates the potential for drayage owned and operated by a trucking company.

In contrast to the situation in many ports, this carrier owns the chassis and containers. That asset ownership may bring costs (e.g., maintaining the equipment) but it gives the company control. They view the entire system as a network of containers, chassis, and tractors. That network view lets them track and manage the deployment of all of these assets in rail ramp areas. The company handles 85% of the moves itself but also builds relationships with other local dray companies, IMC (intermodal marketing companies), and over-road trucking companies to help handle surges and longer-distance trips. Yet the company has eschewed the port dray business due to the presence of extremely low-cost operators in many port areas.

Key Unanswered Questions

The discussion during the day was continuous and fluid. There was a fair amount of consensus on approaches and challenges. At the end of the day, a handful of open questions emerged. The following is a listing of these open questions – the order is based on our estimate of the level of interest by the attendees.

1. How much money does improving a container forecast save? Is it worthwhile improving from 80% to 90%? 90% to 95%? 95% to 99%? What is "good enough" for an importer or exporter?
2. What is the cost of better transit-time reliability? How much effort should an importer (or exporter) place on reducing the variability within its global transportation network? What is the business case here?

3. How can we align the shipper and carrier interests in terms of delivering more reliable service?
4. What index should shippers use to track whether their rates are "at-market" or not?
5. How do carrier management and operations differ for forehaul versus backhaul lanes?
6. Is there a role for future markets in ocean transportation?

Next Steps

Based on the discussion at the roundtable as well as an informal survey after the event, the MIT CTL research team will take the following next steps:

1. MIT will formally kick off the Global Transportation Reliability Initiative in January 2012. An initial team has already been assembled.
2. A follow-on, invitation-only symposium is planned for Fall 2012 at MIT to discuss the initial efforts of the initiative. The approximate size will be larger than a roundtable, but less than fifty.
3. The three initial research questions that the MIT team will focus on are:
   I. What is the business case for increased transit reliability?
   II. What are the sources of variability and unreliability in end-to-end shipments?
   III. What are the root causes of throughput time variability at different ports?
4. The MIT research team will contact roundtable attendees (and other firms) for transactional and other data to assist in addressing these three questions.