The "Network Effect" in a Collaborative Shipping Model

An LMS White Paper

Introduction

"Collaboration" in current supply chain literature traditionally defines initiatives between a corporation and its trading partners – suppliers, customers, carriers, and 3PL providers – that seek to substitute information for inventory in the supply chain. "CPFR" (Collaborative Planning, Forecasting, and Replenishment) is but one such example.

However, this is a one-dimensional view constrained to inventory and to the corporation's own supply chain. We believe companies will increasingly turn to *cross-supply chain* collaboration and will look beyond inventory to other cost savings opportunities. This paper considers one of these initiatives – a collaborative shipping model.

In a previous white paper, we noted that the nation's motor carrier freight bill now exceeds 50% of total US business logistics costs (Robert Delaney, "State of Logistics Report©," June 2002). It was suggested that cost reductions targeting motor freight must become the centerpiece of US corporate logistics agendas. To this end, we defined a portfolio of "Ten Best Practices" targeting specific modes within the motor freight market as follows:

	BEST PRACTICE	TARGETED MODE					
		Parcel/ Min Charge Freight	Small Mark LTL Freight	Medium Mark LTL Freight	Large Mark LTL Freight	< Full Capacity TL Freight	Full Capacity TL Freight
1	Parcel Case Strapping	X					
2	Parcel/LTL Min Charge Analysis	X					
3	Parcel Zone Jumping	X					
4	Cross Dock/Pooling		X	X			
5	Cross Dock/Merge-in-Transit		X	X			
6	Pooling		X	X			
7	Aggregation		X	X	X	X	
8	Consolidation			X	X	X	
9	Co-loading			X	X	X	
10	Continuous Move Routing					X	X

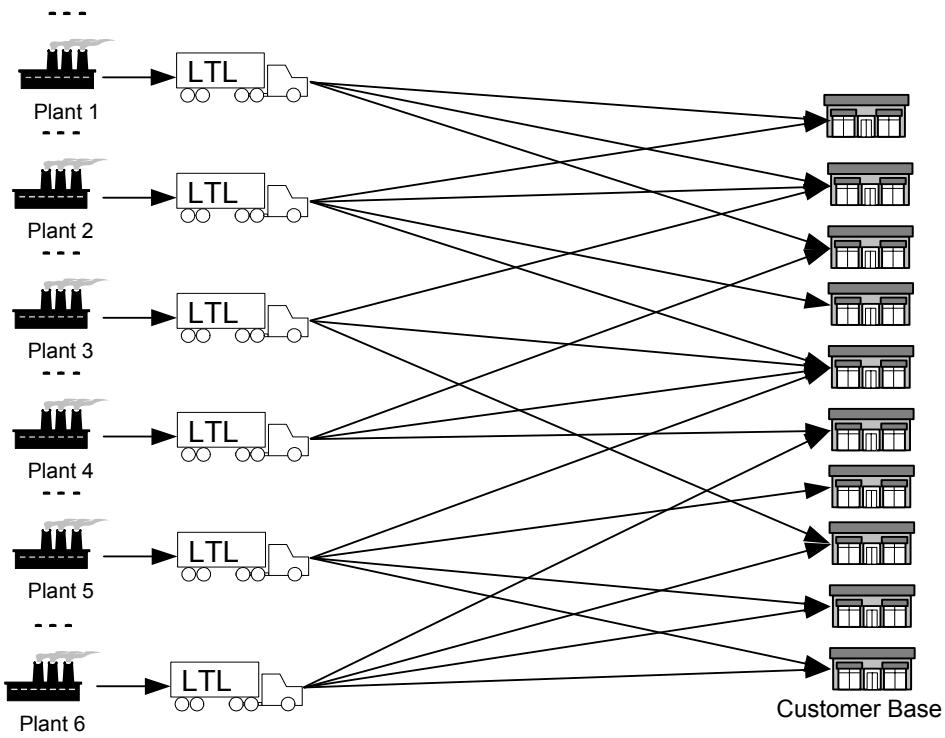
With one exception, these Best Practices were presented as individual corporate initiatives. Co-loading, as a specific collaborative strategy, was the exception. But, collaboration may be extended beyond co-loading to other Best Practices as well. These are highlighted in red above. In this LMS white paper, we consider the enormous impact of "leverage" and the "Network Effect" operating on these Best Practices in a collaborative shipping model.

Collaborative Leverage

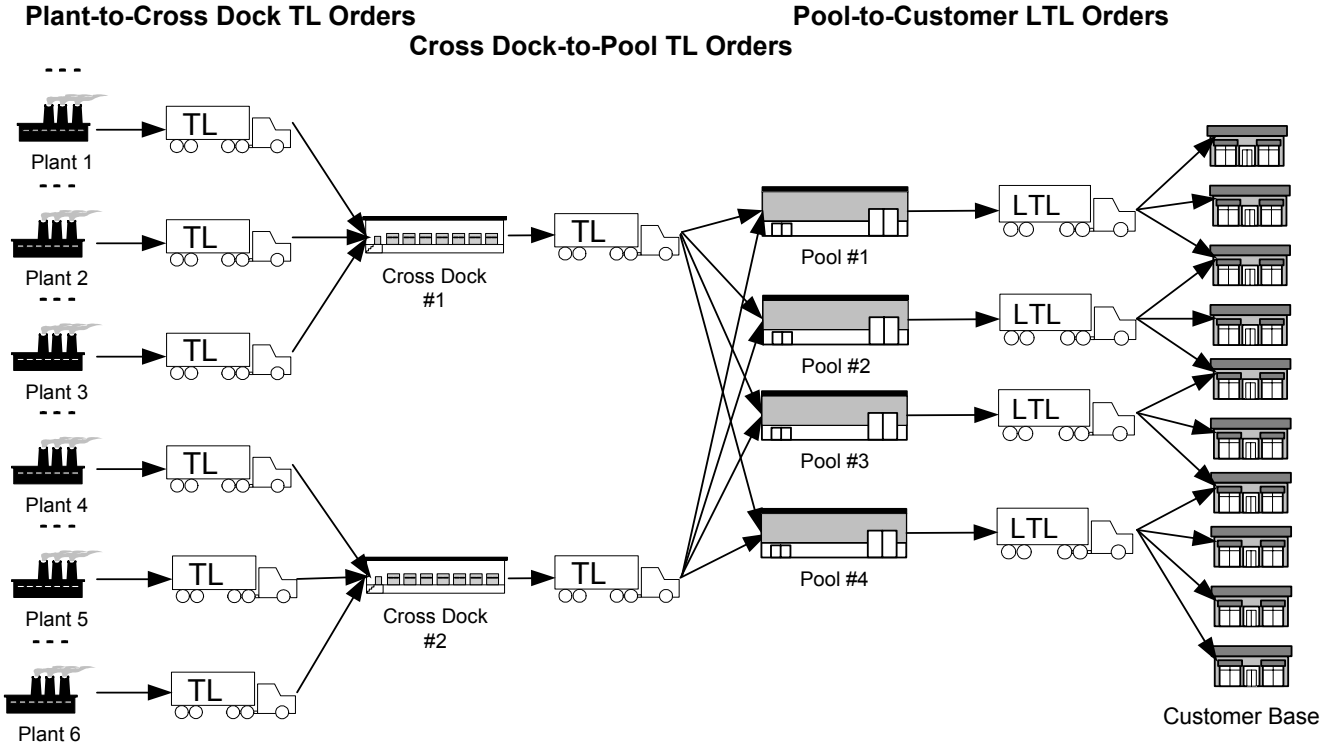
The essence of a collaborative shipping network is "leverage." The following scenario considers the impact of this collaborative leverage applied to a cross dock/pool distribution network. (We could as easily consider scenarios for parcel zone jumping, cross dock/merge-in-transit, co-loading, or continuous move routing that would illustrate this same collaborative leverage impact.)

Shipper A is a large manufacturer shipping small and medium mark LTL freight direct from plants to a national client base. Since each plant manufactures, fills, and ships complete orders direct to any national customer, freight is by definition long haul. This logistics network is depicted as follows:

Plant-to-Customer LTL Orders



To reduce transportation costs, Shipper A builds a cross dock/pool distribution network. The objective of this network is to "mode-shift" high volume lanes from LTL to truckload freight for the maximize feasible distance shipped, subject to existing customer order transit time constraints. This network is depicted as follows:



Shipper A has 25,000 lbs. of weekly LTL freight shipping from its Midwest plants to Southern California customers each week and is considering a new pool distribution point in Los Angeles to serve these customers. St. Louis, MO has already been selected as the cross dock site serving Shipper A's Midwest plants in this network.

Shipper A determines that on average, lead times are sufficient on 18,000 lbs. of these weekly orders to ship a truckload once a week from the St. Louis cross dock to the proposed LA pool. Shipper A then calculates its total cost shipping these 18,000 lbs. through the cross dock/pool network as:

Allocated TL Freight Costs from Midwest Plants to St. Louis Cross Dock
\+ St. Louis Cross Dock Handling Costs
\+ St. Louis Cross Dock to LA Pool TL Freight Cost (once each week)
\+ LA Pool to Customer LTL Freight Costs

But when Shipper A compares this total cross dock cost to the alternative cost of shipping LTL direct from Midwest plants to Southern California customers, Shipper A finds that the LTL direct shipping option is still the most cost effective alternative.

Shipper B is also a large manufacturer shipping LTL freight direct from its plants to its national client base. Shipper B is considering a cross dock/pool network to reduce its transportation costs. To exploit joint shipping opportunities, Shippers A and B agree to share costs and create a collaborative cross dock network.

Shipper B also has 25,000 lbs. of weekly LTL freight shipping from its Midwest plants to Southern California customers each week. Shipper B determines that lead times are sufficient on 17,000 lbs. of weekly orders, on average, to ship a truckload once a week from the St. Louis cross dock to the LA pool. Like Shipper A, this volume alone is insufficient to justify shipping through the cross dock network.

But combined, Shippers A and B have 50,000 lbs. of LTL freight shipping from their Midwest plants to Southern California each week, of which 35,000 lbs. can ship on a truckload once a week from the St. Louis cross dock to the LA pool. The remaining 15,000 lbs. of freight can continue to ship LTL each day direct from A and B's plants to Southern California customers. These volumes are depicted as follows:

Midwest to Southern California LTL Freight					
	Total Weekly Freight	**Available to Ship 1 X a Week thru Cross Dock**			**Remainder Shipping Daily LTL from Plants**
Shippers A & B	**50,000 lbs.**	**35,000 lbs.**			**15,000 lbs.**

Shippers A and B decide to build this weekly truckload run and ship each Tuesday. The result:

- 35,000 lbs. or 70% of total weekly freight formerly moving LTL from the Midwest to Southern California has been leveraged and mode-shifted to TL freight moving through the cross dock network.

To exploit other collaborative shipping opportunities, Shippers A and B decide to open their collaborative cross dock network to Shippers C and D. Shippers C and D have 40,000 lbs. of combined LTL freight moving from the Midwest to Southern California each week. Of this freight, 25,000 lbs. is available to ship on a once-a-week schedule, with the remaining 15,000 lbs. shipping LTL daily. These volumes are:

Midwest to Southern California LTL Freight					
	Total Weekly Freight	**Available to Ship 1 X a Week thru Cross Dock**			**Remainder Shipping Daily LTL from Plants**
Shippers A & B	**50,000 lbs.**	**35,000 lbs.**			**15,000 lbs.**
Shippers C & D	**40,000 lbs.**	**25,000 lbs.**			**15,000 lbs.**
Total	**90,000 lbs.**	**60,000 lbs.**			**30,000 lbs.**

Combined freight from Shippers A, B, C, and D available to ship on a once-a-week schedule from the St. Louis cross dock to the LA pool is now 60,000 lbs. Therefore, two 30,000 lb. truckloads can now be built each week. However, in lieu of shipping both truckloads on Tuesday, Shippers A, B, C, and D decide to create bi-weekly runs from the St. Louis cross dock to the LA pool.

But these shippers now find that while 60,000 lbs. of freight was available to move under a once-a-week schedule, order lead times are now sufficient on 75,000 lbs. of freight to move under this new bi-weekly schedule as follows:

Midwest to Southern California LTL Freight					
	Total Weekly Freight	**Formerly Available to Ship 1 X a Week thru Cross Dock**	**Now Available to Ship 2 X a Week thru Cross Dock**		**Remainder Now Shipping Daily LTL from Plants**
Shippers A & B	**50,000 lbs.**	**35,000 lbs.**	**40,000 lbs.**		**10,000 lbs.**
Shippers C & D	**40,000 lbs.**	**25,000 lbs.**	**35,000 lbs.**		**5,000 lbs.**
Total	**90,000 lbs.**	**60,000 lbs.**	**75,000 lbs.**		**15,000 lbs.**

Shippers A, B, C, and D decide to build these bi-weekly truckload runs averaging 37,500 lbs., and ship each Tuesday and Friday. The result:

- Initially, 25,000 more lbs. of freight from Shippers C and D is leveraged through the cross dock network, for a total of 60,000 lbs.

- But, this 60,000 lbs. moving on a once-a-week shipping schedule is further leveraged into 75,000 lbs. moving on a bi-weekly schedule. Of all Midwest to Southern California freight, 83% is now moving through the cross dock network.

- And, two 30,000 lb. truckloads moving at 75% of capacity each week have been leveraged to two 37,500 lb. truckloads now moving at 94% of capacity.

Finally, Shippers A, B, C, and D agree to open their collaborative cross dock network to Shipper E. Shipper E has 30,000 lbs. of Midwest to Southern California freight each week, of which 20,000 lbs. is available to ship on a bi-weekly schedule as follows:

Midwest to Southern California LTL Freight					
	Total Weekly Freight		**Available to Ship 2 X a Week thru Cross Dock**		**Remainder Shipping Daily LTL from Plants**
Shippers A & B	**50,000 lbs.**		**40,000 lbs.**		**10,000 lbs.**
Shippers C & D	**40,000 lbs.**		**35,000 lbs.**		**5,000 lbs.**
Shipper E	**30,000 lbs.**		**20,000 lbs.**		**10,000 lbs.**
Total	**120,000 lbs.**		**95,000 lbs.**		**25,000 lbs.**

A total of 95,000 lbs is now available to ship on a bi-weekly schedule. Since three 31,666 lb. average truckloads can now be built each week, these Shippers decide to create tri-weekly runs from the St. Louis cross dock to the LA pool. But these Shippers find that while 95,000 lbs. of freight was available to move under a bi-weekly schedule, order lead times are now sufficient on 109,000 lbs. of freight to move under this new tri-weekly schedule as follows:

Midwest to Southern California LTL Freight					
	Total Weekly Freight		**Formerly Available to Ship 2 X a Week thru Cross Dock**	**Now Available to Ship 3 X a Week thru Cross Dock**	**Remainder Shipping Daily LTL from Plants**
Shippers A & B	**50,000 lbs.**		**40,000 lbs.**	**45,000 lbs.**	**5,000 lbs.**
Shippers C & D	**40,000 lbs.**		**35,000 lbs.**	**38,000 lbs.**	**2,000 lbs.**
Shipper E	**30,000 lbs.**		**20,000 lbs.**	**26,000 lbs.**	**4,000 lbs.**
Total	**120,000 lbs.**		**95,000 lbs.**	**109,000 lbs.**	**11,000 lbs.**

Shippers A, B, C, D, and E decide to build these tri-weekly truckload runs averaging 36,333 lbs. and ship each Monday, Wednesday, and Friday. The result:

- Initially, 20,000 more lbs. of freight from Shipper E is leveraged through the cross dock network, for a total of 95,000 lbs.

- But, this 95,000 lbs. moving on a bi-weekly shipping schedule is further leveraged into 109,000 lbs. moving on a tri-weekly schedule. Of all Midwest to Southern California freight, 91% is now moving through the cross dock network.

- And, three 31,666 lb. truckloads moving at 79% of capacity each week have been leveraged to three 36,333 lb. truckloads now moving at 91% of capacity.

We can see that adding more shippers to this collaborative network will inevitably support daily truckload runs from the St. Louis cross dock to the LA pool, with each truck moving at nearly 100% of capacity. A collaborative shipping network therefore leverages:

1. The amount of freight eligible for a given Best Practice in a given traffic lane.
2. The frequency of execution of a given Best Practice in a given traffic lane.
3. The efficiency (load factor) of a given Best Practice in a given traffic lane.

But two other leverages are also occurring:

- Obviously, Midwest to Southern California freight is not the only lane being leveraged. As more and more shippers are added to the collaborative cross dock network, other lanes are being similarly leveraged. A collaborative shipping network therefore also leverages:

4. The number of traffic lanes eligible for a given Best Practice.

- Exploiting one collaborative Best Practice – cross dock/pool distribution in our example – creates other Best Practice opportunities.

    - Assume in the above cross dock scenario that in addition to Southern California LTL freight, Shippers A, B, C, D, and E are also shipping UPS parcel ground freight to Southern California customers. Shipping direct from Midwest plants, this parcel freight moves at UPS Zone 7 rates. But, by moving this parcel freight through the cross dock network each day, shipping as part of a truckload run to the LA pool, and then shipping UPS from the LA pool to Southern California customers, these shippers “zone jump” from UPS Zone 7 rates to UPS Zone 2 rates.

- Or assume that Shipper F, not part of the collaborative cross dock network above, ships primarily large mark LTL orders to its customers. Shipper F has a 15,000 lb. order shipping from the Midwest to Anaheim, CA and no trucks heading to the West Coast with available capacity. But Shipper A, B, C, D, and E's cross dock network has a truck with only 25,000 lbs. moving from its St. Louis cross dock to the LA pool. By co-loading Shipper F's 15,000 lb. order as a stop-off in route to the final LA pool destination, Shipper F mode-shifts from large mark LTL to full capacity truckload. And Shippers A, B, C, D, and E simultaneously mode-shift from less-than-full capacity truckload to full capacity truckload.

Therefore, a collaborative shipping network also leverages:

5. The number of Best Practices that may be executed in a given network.

The "Network Effect"

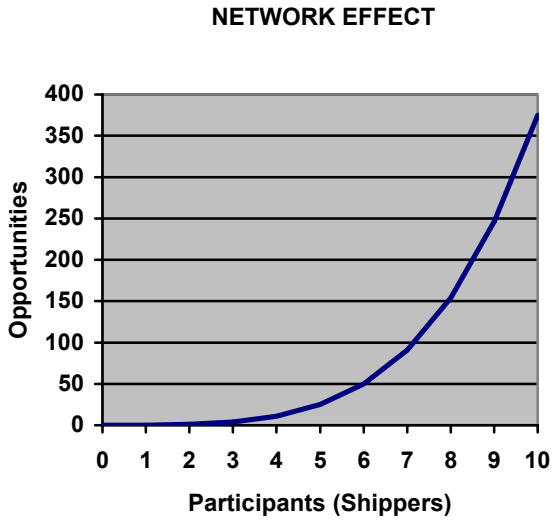
These leverages, operating simultaneously, *compound* collaborative opportunities as more shippers are added to a network. This is termed the "*Network Effect*." To illustrate this phenomenon, consider the following generic collaborative example:

- Shippers A and B decide to create a collaborative shipping network. With two shippers, there is only **one** possible collaborative opportunity: A-B.

- Shipper C then joins this network. Collaborative opportunities are now A-B, A-C, and B-C. That is, A may collaborate with B, A may collaborate with C, and B may collaborate with C. But, these are two-party collaborations only. An additional three-party collaboration is created: A-B-C. With three shippers, there are **four** possible collaborative opportunities.

- Shipper D now joins this collaborative network. Six two-party collaborative opportunities now exist: A-B, A-C, A-D, B-C, B-D, and C-D. Four three-party collaborative opportunities are also created: A-B-C, A-B-D, A-C-D, and B-C-D. Finally, one four-party collaborative opportunity is created: A-B-C-D. With four shippers, there are **11** possible collaborative opportunities.

We may graph the number of collaborative opportunities created in this network against the number of network participants (shippers) as follows:
(See Appendix 1.)



We find that as the number of network participants increases *arithmetically*, the number of collaborative opportunities increases *exponentially*. Robert Metcalfe, founder of 3Com Corporation, originally coined the term "Network Effect" to describe this exponential relationship. Also known as "Metcalfe's Law," the Network Effect states:

> "The usefulness, or value, of a network increases in proportion to the square of the number of users."

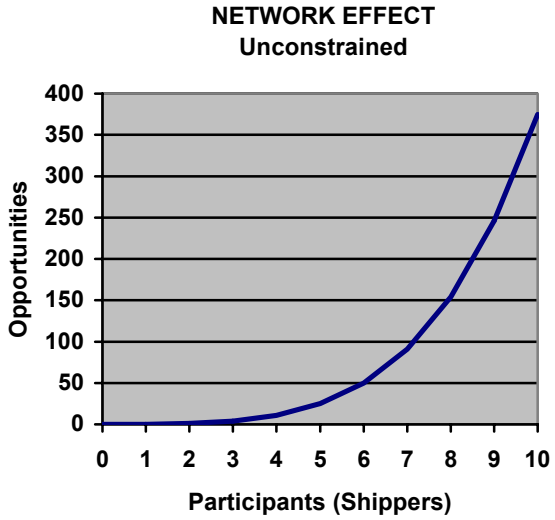
Conclusion

Like telephones, fax machines, and the Internet, a collaborative shipping model operates under the Network Effect. The impact of this phenomenon on Best Practices execution is enormous.

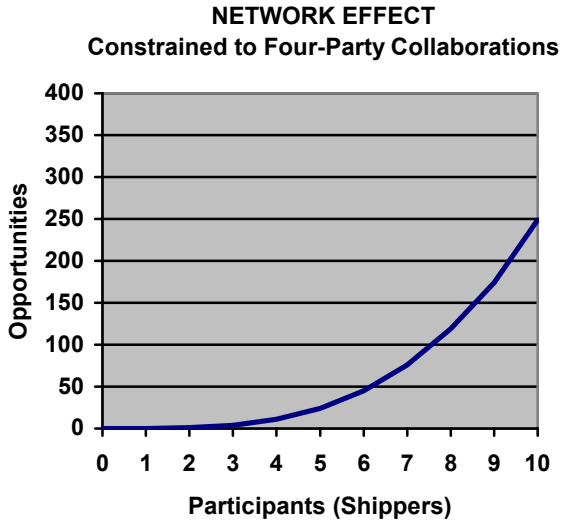
Appendix 1: Best Practices Constrained by Realistic Numbers of Collaborative Participants

For practical purposes, a given Best Practice is constrained by the number of realistic collaborative participants. For example, our collaborative cross dock/pooling scenario above may easily support 10-party collaborative opportunities, i.e., a cross dock to pool truckload with 10 shippers' LTL freight on board is realistic. Conversely, co-loading would generally support no more than four-party collaborative opportunities, i.e., large mark LTL freight may realistically be picked up at no more than four shipper origins, line-hauled, and stopped off at four destinations.

In an "unconstrained" collaborative network, the exponential relationship of collaborative opportunities to network participants (shippers), as previously referenced, is:



In a collaborative network constrained to four-party collaborations, for example, the relationship of collaborative opportunities to network participants (shippers) is:



Therefore, even when constrained by the number of realistic collaborative participants, the relationship of collaborative opportunities to network participants is still exponential.

About LMS

LMS is a non-asset-based, third party logistics provider that brings millions of dollars in transportation cost savings to companies like Emerson, BASF and Monsanto.

We use proven logistics practices and Web-enabled technology to offer optimization, execution and data management services that significantly reduce transportation costs.

What makes us different?

- LMS does not offer an “all-or-nothing” solution. We work with our clients – as well as their existing technology and business practices – to cut costs and improve customer service.

- LMS employs proven logistics strategies – Best Practices – and operates within a collaborative network to achieve significant savings for our clients.

- LMS offers a proprietary, Web-enabled transportation management solution – TOTAL – that allows customers to significantly cut transportation costs in as little as 60 days without a large investment or system commitment.

For more information, visit www.lmslogistics.com.