TRANSPORTATION TAXONOMY PART 2[1]

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Introduction

The transportation industry moves astonishing volumes and varieties of products for diverse industries. To meet these widely diverging needs, the transportation industry employs a various processes. Each product is moved utilizing one of these processes or a blend of two. The goal of this paper is to describe these general processes and the types of products moved by each. Examples from the trucking industry will be provided, though the processes are generalized and applicable to all other transport modes. Once presented in the first section, it will be shown that the processes form a continuum – thus a taxonomy for transportation. The advantages of a taxonomy are threefold:

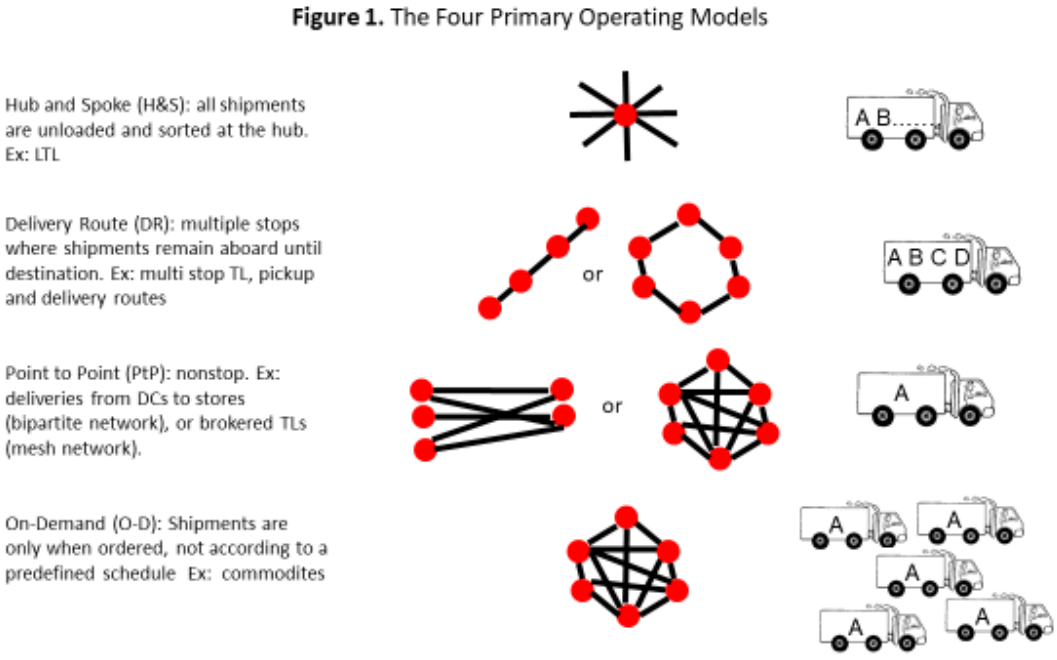
1. It is a useful educational tool to identify the primary segments of the trucking (or other)industry and their interactions
2. For particular types of shipments one can identify the relevant segments of the trucking (or other) industry
3. One can identify the strengths and weakness of each structure

An initial presentation was made at CTRF 2018. This presentation updates the 2018 with additional results which further highlights differences and similarities between the primary transportation models.

Transportation Processes

A transportation process for this paper is defined as a combination of a network (route) structure, along with a discipline under which it operates. Regarding the discipline, the routes can be operated either on a scheduled basis with regularly scheduled deliveries, or on an on-demand basis, where service is provided only when demanded – not scheduled, only dispatched. A figure showing the four basic tenets appears below. Please note that segments of the trucking industry are listed alongside the process they utilize.

Figure 1 Primary Transportation Processes



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Hybids exist between pairs of processes above. As example, consolidation and pooling utilize elements of hub and spoke, and yet benefit from the point to point characteristics of long haul transport.

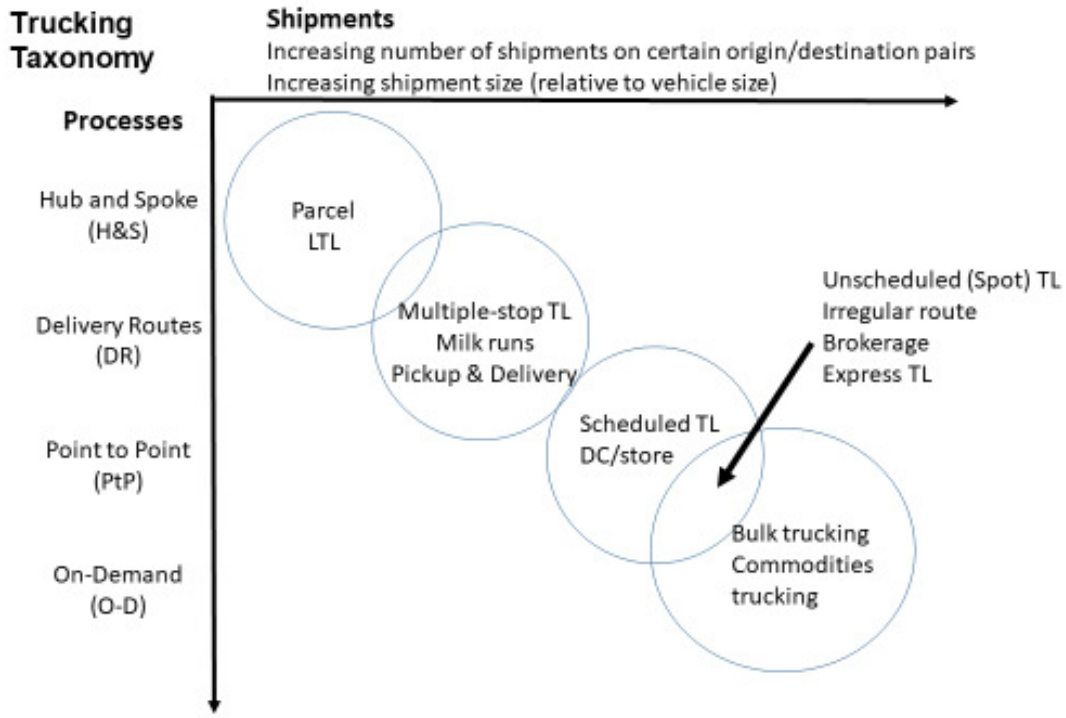
Taxonomy Applied to Trucking

Once the structures are understood, the question arises as to which types of shipments are relevant for each. Some shipments are small and others quite large. Hub and spoke networks are associated with relatively small parcel or LTL types of shipments. For such shipments, the number of shipments per truck is quite large. At the other extreme end, bulk trucking is typically utilized on an on-demand basis, and can entail one or multiple truckloads being required to complete a single shipment.

In addition to large or small shipments, one can categorize their routes as being heavily utilized or lightly utilized. Lightly utilized routes are associated with Hub and Spoke, while more heavily utilized routes can justify full truckloads or multiple full truckloads.

With the above two considerations as a "variety axis" and a "volume axis", the figure below portrays the processes:

Figure 2 Graph of Transportation Processes and Shipments



Please note the overlapping categories. Also please note that the volume axis refers to volume on a subset of the routes. Overall scale of a trucking company in any of the categories above can be either large or small (such as regional versus national LTL, and small versus large TL companies). The next section compares the characteristics of these processes

Characteristics of Transportation Processes

The axes above identify a progression of trucking (or other modes) segments. Other progressions exist as well. For instance, 40' and 53' general purpose vans are included in the upper left of the figure, while both general and special purpose trailers (such as semi dumps, tank trucks, pneumatic trucks) tend to be used in the lower right categories.

A further difference is that the processes differ as to the forms of "waste in transportation" that they employ:

Figure 3 Forms of Waste in Transportation (as one proceeds down the diagonal, there are fewer inherent forms of waste)

WASTE IN TRANSPORTATION	Hub failure or delay	Double handling	Dwell time delays	Out of line miles and time	Scheduling & Demand mismatch
Hub and Spoke	Y	Y	Y	Y	Y
Delivery Route	N	N	Y	Y	Y
Point to Point	N	N	N	N	Y/N
On-Demand	N	N	N	N	N

The column headings on the chart above are self-explanatory:

a. Hub failure risk: Hub failure can shut down the system. Further, a single vehicle arriving late to its hub can delay all other vehicles at a hub, delaying shipments along many spokes.
b. Double handling: unloading, sorting, and reloading shipments at a hub requires additional cargo handlings. While double handling occurs at hubs, it does not occur in Delivery Routes, since shipments are not touched en route.
c. Dwell time delays: With Delivery Routes, shipments are loaded and unloaded in sequenced fashion to be easily handled at stopoffs. Any shipment, though, may need wait through the unloading time at multiple intermediate stops. Hub and Spoke shipments may also experience significant dwell time delays due to sortation times and hub congestion.
d. Out of line: additional miles and time are required to travel an out of line route.
e. Scheduling and Demand mismatch: scheduled vehicles may experience low utilization since they maintain their published arrival and departure times regardless of demand. On-demand does not employ a schedule. When demand is low, On-Demand transport companies redeploy underutilized vehicles to other services. When demand is high, additional vehicles are added to the fleet. Scheduled Point to Point vehicles experience this mismatch, while unscheduled Point to Point vehicles do not.

As one proceeds to the right and down the diagonal, one encounters less handling, sequencing, and out of line delays. When one reaches the on-demand process at the bottom right, one further eliminates the utilization issues encountered by the need to adhere to a fixed schedule.

Summary

The figures above describe the many segments of the trucking industry in an organized way, so as to clearly depict their primary characteristics. As such it is useful as a teaching tool to dispel the initial thought that trucking is simply "A to B transportation". Such a Figure can and has been developed for every transport mode. One can see clearly how transport segments "fit together" such as consolidation as a combination of hub and spoke and point to point. One can further identify the forms of waste inherent mode which is a factor in their selection to move any specific product.