Hyperconnected Logistics for Farm-to-Table Platforms

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Introduction

In a technology driven era, start-ups have gained more momentum in the marketplace, particularly user-based platforms. As startups develop, their logistics systems grow in complexity. Here we introduce several components that make up a hyperconnected logistics system for Farm-to-Table (F2T) platforms. In the examples seen in this poster we use the use case of Farm'd, a North American based start-up. Such platforms induce logistics that must consider both the downstream side of markets, such as urban agglomerations with restaurants, institutions, and households demanding fresh and local food, and their upstream side consisting of farms producing and selling fresh and local food.

What are F2T's?

Farm-to-Table platforms enable farmers to be directly connected to restaurants. They provide an infrastructure that ensures the same day or next day delivery of local produce, meat and dairy from farms to restaurants.

The left is a farm and the right a restaurant. Both are users of the food-to-table platform Farm'd.

Why F2T's?

Food supply chains have gained traction moving towards sustainability and transparency. Consumers are demanding more information from restaurants. Where did the food come from? Are the products genetically modified? What is the carbon footprint of my food [1]? In turn, restaurants have increased responsibility for the raw supplies they purchase [2]. One way to shift towards sustainability is through local food supply chains. They are generally known to be sustainable, notably helping to reduce emissions by eliminating long-distance transport and minimizing "food miles" [3–5]. Local food supply chains also bring more money into rural communities, helping producers and disrupting the large scale supply chains controlled by giant food distributors [6].

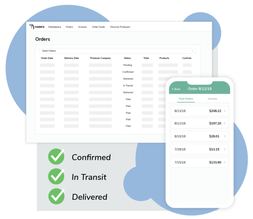
Logistics

We examine three main components of logistics systems for F2T's: overarching Hyperconnectivity, routing and hub analysis.

Hyperconnectivity

Hyperconnectivity allows for efficient and seamless information, transaction and material flow across stakeholders throughout the supply chain. This in turn means knowledge of origin of the products, and the treatment of the products in transit, which are satisfying the requests of the public. Since the platforms dealt with stem from technology business ventures, they ultimately never want to touch or own the product.

Online mobile ordering system with live tracking



To transport the goods in this manner, we take advantage of a no-asset logistic system. Certified drivers are contracted out and paid for their services. The drivers are not employees of the platform. We examine a sample pricing method for the drivers and show results comparing the different systems.

Routing

We examine a pricing strategy where drivers are paid per stop. Pickups are worth more, as they include more goods and often drivers have to travel much further distances.

Goals:

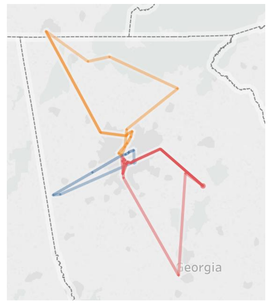
- Ensure on time delivery of all goods.
- Reduce amount of distance traveled.
- Reduce amount of time spent.

Methodology:

- Traveling Salesman Problem.
- Vehicle Routing Problem.

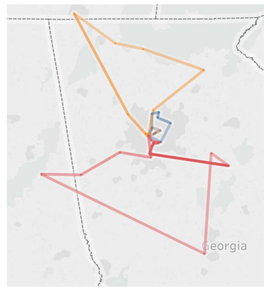
Initial Strategy:

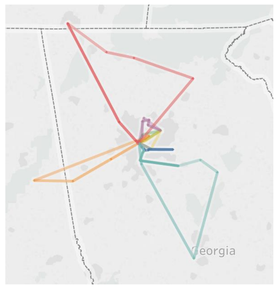
- Try different amounts of drivers.
- Try drivers either only doing pickups or only doing drop offs.



Sample Route with 3 drivers
Total Distance: 677 miles
Total Time: 1167 min
Late Deliveries: 30%

Sample Route with 4 drivers
(Same Day as route above)
Total Distance: 610 miles
Total Time: 1134 min
Late Deliveries: 25%





Sample Route with 7 drivers
(Same Day as route above)
Total Distance: 823 miles
Total Time: 1117 min
Late Deliveries: NONE

Findings:

- Addition of drivers may reduce or increase total mileage or total time.
- Addition of drivers decreases the amount of late deliveries.
- With the current pricing strategy it does not cost more to add drivers or increase total distance.

In conclusion, add more drivers!

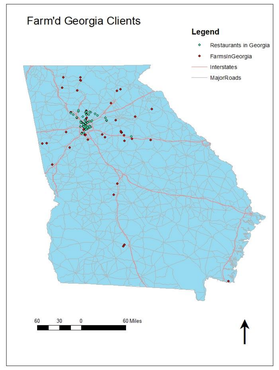
Hub Analysis

After solving initial routing scenarios we explored the idea of using hubs, both static and movable. To ensure freshness, refrigerated hubs would be used.

Important Factors for Hub Location:

- Ease of Access. (Interstate Buffer)
- Close to the city center but not in a high congestion zone. (Atlanta Ring)
- Either a current supplier or customer.

Example of a refrigerated moveable hub



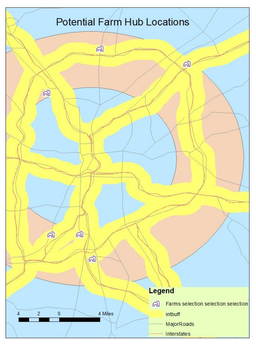
Farm'd restaurant and farm locations (Left). Ring around Atlanta along with interstate buffer (Right).

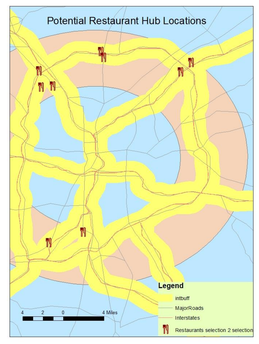
Using ArcGIS we were able to find locations which could be suitable for Hub placement. ArcGIS allowed us to shrink the candidate pool from 148 restaurants and 48 farms to 13 restaurants and 6 farms seen below.

FID	Shape *	Restaurant	Ling	lit
7	Point	The el Felix	-84.471545	33.888678
16	Point	Adalina	-84.452027	33.867117
53	Point	HOBNOB - Midtown	-84.408881	33.658816
82	Point	Wrecking Bar Brewpub	-84.379671	33.907809
87	Point	Local Republic	-84.408881	33.658816
91	Point	Atlanta Airport Marriott Gateway	-84.379671	33.907809
92	Point	HOBNOB - Brookhaven	-84.457572	33.843829
94	Point	C&S Chowder House	-84.457572	33.843829
102	Point	Canoe	-84.269821	33.887118
106	Point	Peach & the Porkchop	-84.468408	33.865061
111	Point	Superica	-84.468408	33.865061
113	Point	The Grub Gastro Pub	-84.255099	33.900156
133	Point	Wahoo! Grill	-84.383224	33.915953

FID	Shape *	Farm	Lat	Long
2	Point	Farm'd Next Day	33.623023	-84.389897
12	Point	Happy Camper	33.658167	-84.407742
34	Point	CallyRoad Creamery	33.921867	-84.379092
41	Point	Canoe	33.858999	-84.454925
42	Point	Banner Butter	33.900156	-84.255099
63	Point	Metro Atlanta Urban Farm	33.657547	-84.448398

Potential Farm and Restaurant Hub Locations (Above)





Potential Farm (Left) and Restaurant Hub Locations (Right).

This reduction should allow for the routing optimization program to run in much less time with significantly fewer inputs. It also lessens the amount of sites that Farm'd has to visit to test physical feasibility of hubs.

Further Study

The optimization briefly discussed in this project is performed using principles of the physical internet, dynamic programming and traveling salesman heuristics. We hope to extend the initial routing optimization code to include hub placement to test for feasibility and success. We also hope to integrate this code with ArcGIS visualization to better show our results.