Big Data Analytics Meets Internet of Things: Paradigm Shift in Bio-logistics

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Abstract: The demand of **temperature** and **time sensitive** shipping service are growing exponentially. The technology has clearly not kept pace with the demand and realities in the ground. For example, a report compiled by Pharma presented in the 3rd biologistics conference 2015, identifies that "*inefficiencies in the process lead to seven out of ten trials being delayed or cancelled, at a cost of $1.1 million in daily prescription revenues.*" Instead of investing to develop an in-house supply chain, industry trend is to rely on shipment services such as FedEx, UPS, and others. FedEx has been serving its users through a number of X-services. For example, FedEx custom critical provides temperature control, records humidity, light exposure, etc. throughout the shipping. Healthcare Shared Network – Cold Chain LTL transportation, reports the temperature every half an hour. FedEx Temperature control solution, uses liquid nitrogen to keep constant temperature for 10 days. FedEx Priority Alert for time critical and temperature sensitive packaging offers Provides temperature monitoring., re-icing such as dry ice replenishment or gel pack conditioning and also makes effort to deliver shipment on time. The SenseAware technology which logs all the data in the shipment package. This generates a big data that can be used to check if the package encountered any unusual condition.

Aim: We propose to perform a feasibility study on how to combine concepts from big data analytics to design optimal packaging and flexible routing. This study will consider simulated and potentially publicly available temperature sensitive logistics data along with weather data, shipment restrictions, time windows, and other domain specific factors to create input data needed for analysis. Big Data Analytics will learn the representations optimal route with alternates and provide real-time update for changes in delivery routes/maintain shipping requirements and provide optimal packaging pertaining to specific temperature controlled commodity. *First, we will conduct a feasibility study on how to use big data analytics to compute flexible routes and will optimize the use of packaging. We will also conduct the feasibility study by using graph mining technique in the context trans-national logistic network. We will adopt best practices from the Internet of Things* (IoT) to ensure real-time update to improve tractability (for the customer and the shipper) and simpler data & information flow and visualization to enable timely decision making or adapt strategy that will ensure timely delivery.

Well thought out feasibility study at various levels of granularity and complexity considering risk tolerance of the users and types of biomaterials will help us to identify and advance research in the this emerging interdisciplinary field. Lessons learned can be used to derive predictive analytics to enhance sustainability and reduce congestion. **If successful, we plan to conduct pilot study with shipping companies like FedEx/ UPS to test our ideas on a more realistic setup.**