WHITE PAPER

INCREMENTAL FREIGHT TRANSPORTATION CORE BUSINESS MODERNIZATION

Abstract

This whitepaper aims to pivot modernization efforts from "mission impossible" to "mission inevitable" so that freight logistics business can minimize revenue leakage by establishing visibility to services rendered by disputed fees, and write-offs, and address asset usage optimization by reducing idle, maintenance time, excess trips, and inefficient configuration. In this white paper we try to facilitate the simplification, standardization, and automation of processes, enable data-driven decision-making to improve information accuracy, and enhance customer, and employee experience and transparency. The goal is to help Enterprises how to become a scheduled, improved operations objective – profitably delivering customers' goods on time.

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NextGen Freight Logistics Core Business Modernization

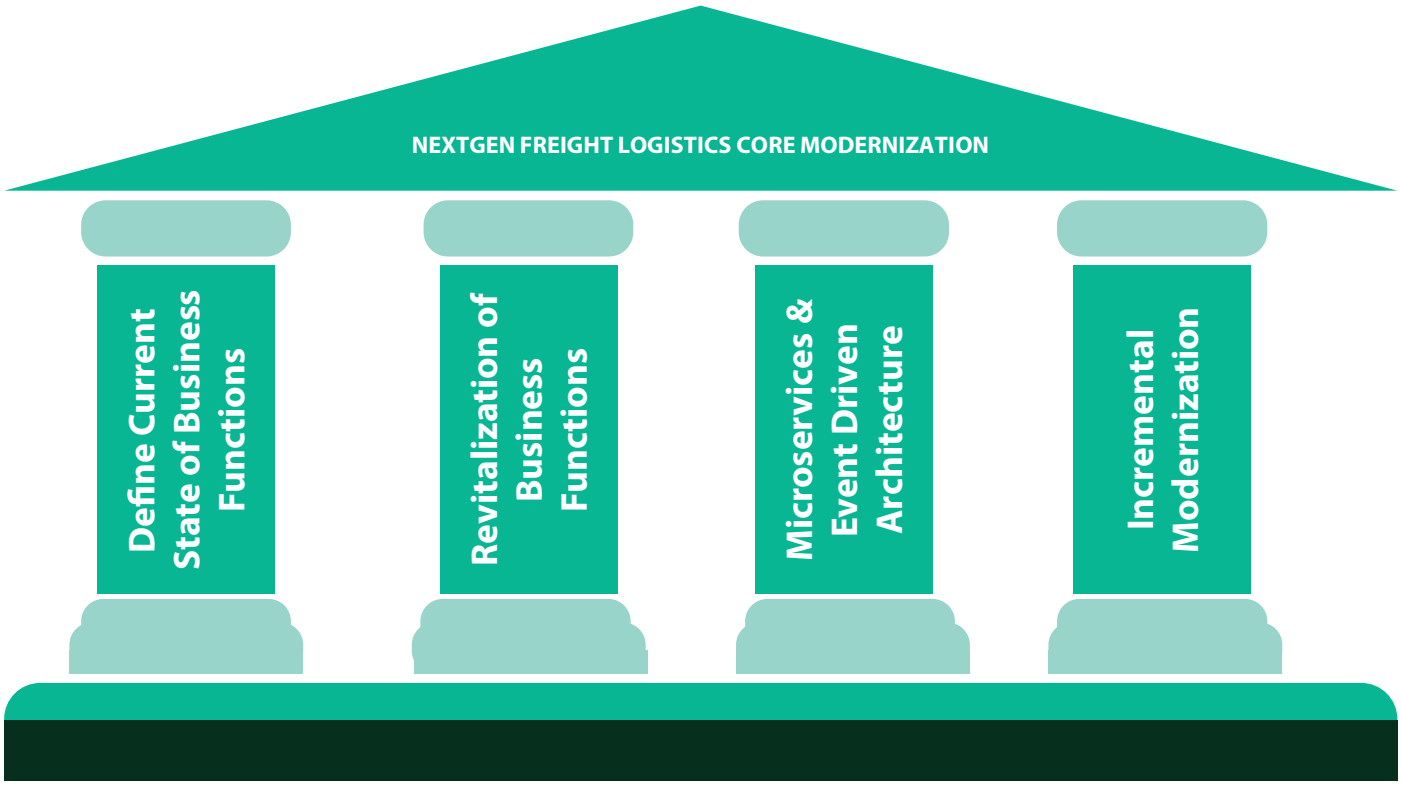
While all Freight companies are already modernizing their system of engagement to modern technologies on the cloud, the core operations such as freight operations, crew operations, and asset allocation are still retained in core legacy systems. It might be due to the business logic that is built decades ago and is very complex to understand and rebuild. This prevents Freight logistics companies from more dynamic course corrections of freight, crew scheduling, data-driven asset management, and capacity planning capabilities.

Business impediments/needs of NextGen Freight Logistics Core Modernization

- For integrated operations to break silos and improve collaboration and information flow between departments, business functional areas, and Lines of business
- To improve the speed of customer service and efficient use of assets
- To continue to invest in networks, technologies, and capabilities to improve efficiency and profitability
- Most of the freight companies' transportation systems technologies which were becoming increasingly difficult to support –were deemed obsolete.
- With increasing customer demands for timelier & ever-changing information, systems are becoming more difficult and expensive to support –are deemed approaching obsolescence.
- Lack of visibility in the entire network to manage the plans of every ship, airplane, truck, and railcar on the network.
- The complexity and dependencies introduced over time make it difficult to execute simple changes and make extensive changes difficult and risky.
- Extended maintenance costs increase and labor costs for the legacy skill sets increase (when they can be found).
- Delaying NextGen Modernization will defer the associated business benefits which taken together present a significant, growing, and missed opportunity for organizations
- The costs for modernization and risks of successful modernization will increase with additional delay.

Add to the above impediments, huge idle time, maintenance turnaround time, excess trips, and inefficient asset usage (use of assets such as locomotives, ships, cars/ trucks, and crews) do impact missed revenue, disputed fees, and write-offs.

NextGen Freight Logistics Core Modernization is built on the following key pillars



Define Current State of Business Functions

Any modernization of the Freight Logistics legacy application starts with inventory analysis that helps define the boundaries of current capabilities by defining various factors such as functional definition, size, complexity, CRUD operations, internal and external dependencies, events triggering each function, and events triggered by each function, etc., various tools can perform the inventory analysis in a fully automated fashion such as Infosys IMMP, Micro Focus Enterprise Analyzer, CAST Imaging, Averi Source iSAT, etc.,

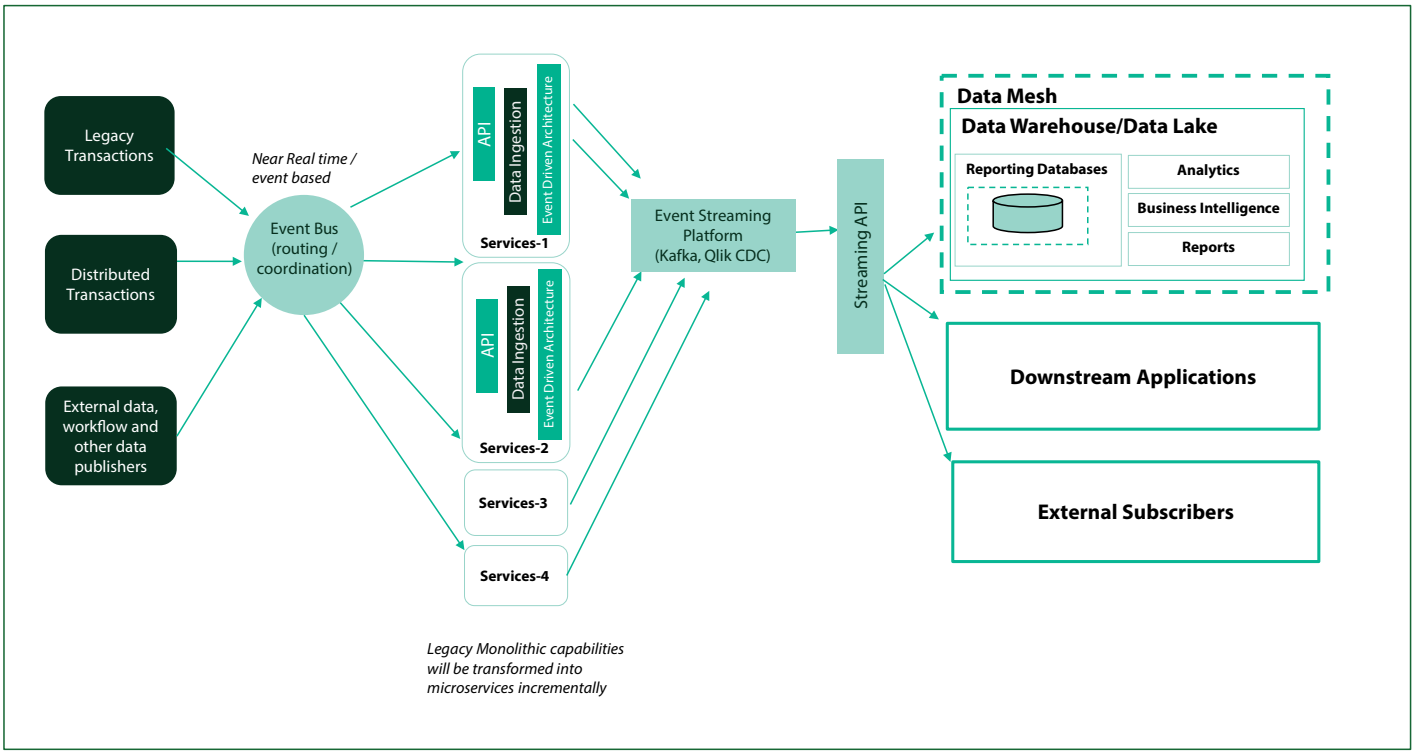
Revitalization of Business Functions

Most of the core applications typically are decades old and those capabilities need to be enriched by modern technological advancements – IoT-based real-time tracking and AI-driven ETA predictions for trains, fleet, and other assets; digital ecosystem and multi-channel support for collaborative applications used by yard operators, truck drivers, fleet managers, and crew; big data processing for data analytics to support more dynamic capacity planning; data-driven decision-making system for real-time course corrections on train schedules and trip plans; event-driven workflow processing to capture real-time events and trigger respective processes based on those events rather than waiting for the nightly batch operations.

Microservices and Event-Driven Architecture

> One Railroad logistics customer reported that it takes 16 to 32 hours for an empty car release event to reflect in the capacity management portal since the car is offloaded at the destination, depending on which nightly batch process it is being picked up for processing

In Freight logistics operations, most of the tasks - right from order capturing and car allocation to shipment and car release are event-driven. E.g., the release of an empty train car is an event that happens after it is offloaded at the destination. In the traditional approach, the further actions will have to depend on nightly batch processes, however, in microservices and event-driven architecture, this event could trigger further services such as customer notification service, managing car-pool service, capacity management service, etc., in real-time.



Incremental Modernization

> More than 50% of customers are very cautious in modernizing their core legacy applications as they are highly critical, decades old, lack of SMEs to support rebuilding them and a long payback period.

Often the core application systems are huge and complex, and big bang modernization would be mission impossible. The modernization should be incremental to take up the least critical and highly valued components first. Thanks to microservices and event-driven architecture, the big core systems can be broken down into multiple services, re-engineer in a modern tech stack with enriched capabilities, and integrate with legacy applications so that they both co-exist and function seamlessly. The event streaming platform such as Confluent Kafka will help to capture all the events happening in both legacy and modern systems while change data capture tools such as Qlik CDC will help to keep both legacy and modern data in sync.

Attempting the modernization of the core monolithic legacy applications as a single entity would be risk-prone, various patterns help achieve it incrementally.

Pattern-1: Unlock Legacy Data:

Decades-old legacy applications have huge data locked in legacy systems – not readily accessible nor available for the business analytics platform in real-time. "The Data First" approach will expose legacy data to business intelligence platforms to integrate with other distributed data domains and derive various operational insights. The legacy data will be transformed in such a way to have various data domains like Order, Billing, Crew, Yard, Train, Fleet, Trip, and Customer data domains so that it will be easy to leverage Data Mesh architecture during modernization down the line. Data First approach also plays a key role in incremental modernization by keeping both legacy and modernized systems coexisting and in sync during modernization.

Pattern-2: Decouple Front-End:

Retain core business logic on legacy but modularize them as business functions and expose them as REST APIs. This will decouple the front-end components from the tightly coupled monolithic applications. The UI will be modernized in Angular or REACT-based single-page applications and can be integrated with core business logic using REST APIs. On top of available core services such as REST APIs, new business capabilities and product features will be built on a modern technology stack. User Experience will have an abstract view of backend services irrespective of their legacy or modern platform. Customer or employee-facing services such as real-time tracking of train and assets, crew management, etc., are more appropriate for this pattern.

Pattern-3: Modernize Core Business Logic:

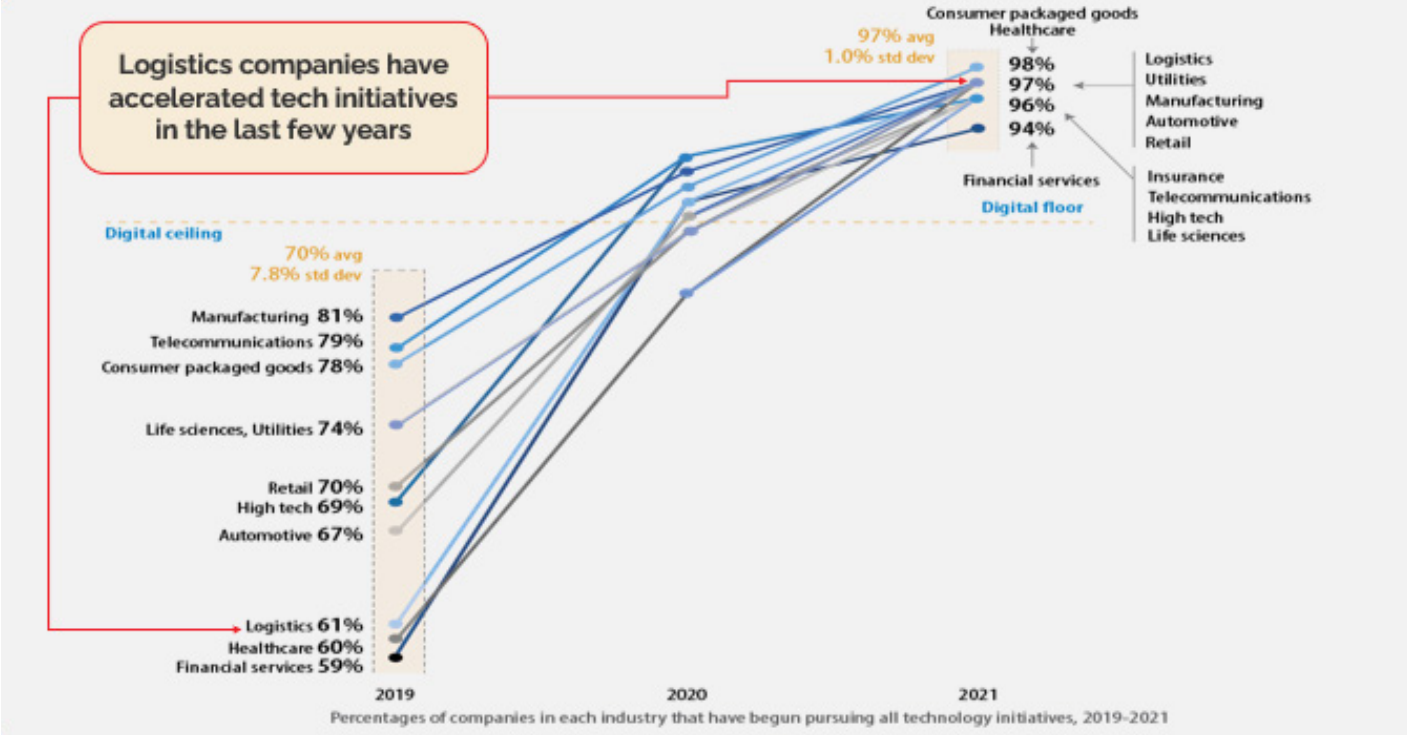
Identify the most dynamic and cloud-appropriate core legacy services and rebuild them in the cloud-native technical stack. These services will be modernized incrementally and iteratively. Some services are the quick wins and the most beneficial in modernization.

- High CPU-consuming services such as Trip Scheduling
- Services that can dynamically scale such as Car Allocation
- Services that frequently change such as Intermodal operations, Yard operations, etc.,
- Processes that are highly integrated with IoT and AI/ML capabilities such as ETA and Rescheduling process, Bad Order, and Track Maintenance services
- Event-driven services for straight-through processing rather than batch processing such as InGate and OutGate services, Car Allocation and Release Events, etc.,

Until all services are migrated to a modern platform, the data will be synced back to legacy systems wherein the compliance and audit reporting workloads are still hosted on. The event streaming platform such as Confluent Kafka will help to capture all the events happening in both legacy and modern systems while change data capture tools such as Qlik CDC will help to keep both legacy and modern data in sync.

Benefits when powered by IoT, Data Science, AI Platforms/Solutions doing the course correction and adapt to excel

- Laser Vision AI and Video portals and analytics to reduce idling. Increase insights from data in video files by using AI to automatically detect, analyze, and interpret activity in real time.
- IoT and GPS-based real-time remote monitoring of Infrastructure and assets.
- IoT-based Asset Management to provide real-time information on equipment location and health
- IoT-based real-time fleet tracking and AI-driven ETA prediction and calculation
- IoT Automated loading/unloading at smart yards with real-time location tracking and improved yard efficiency.
- New digital tools for data-driven operations and maintenance: sensors, e-seals, drones, etc.
- Biometric scanners and GPS to record truck driver and arrival ETAs respectively
- Automation of mainline/shunting operations, including driving
- Trusted digital ecosystems for transportation and cargo data sharing.
- Advanced algorithms and simulations for Trip Planning, Scheduling, and Route Optimization
- Big data-driven advanced demand-driven statistical planning, booking, and demand-based pricing models
- Automated gate system apps for easy driver check-in checkout and paperwork



Percentages of companies in each industry that have begun pursuing all technology initiatives, 2019–2021

50%

of the legacy applications are to be modernized in the next couple of years

50%

of the applications to be modernized are core to business

By 2024

14%

of IT revenue globally will be on cloud spending

Freight Logistics Organizations Alive (Live Enterprise)

Facilitate Enterprises Business Transformation by identifying what's core to their business and investing in initiatives that strengthen their core. Make the Enterprise connected by connecting humans, data, and machines and create an active ecosystem where interactions happen synchronously & asynchronously. Gain scale & agility with business & technology platforms on the cloud. After connecting, enterprises can observe the telemetry data and signals streaming events from these connections to know what's happening within the Enterprise. When the Enterprise has the power of observability then it will have the ability to sense, feel and respond in real-time. Transformation initiatives would need to focus on instrumenting systems & processes for environmental & operational feedback from the edge. Enterprises should leverage automation and AI-powered insights, enabling algorithms, and inference systems that need to evolve to effect actions and bring a certain level of autonomy to business operations. As the enterprise becomes data-driven, connected, observable, sentient, autonomous, alive, and agile, the ability to perform rapid experiments and innovations becomes possible and this helps increase the velocity of new ideas (fail fast, fail-safe & quick wins).

Conclusion – Final Words

With a domain-driven decomposition approach and VRM (Value Realization Method) capability model, any monolith legacy platforms can be broken down into logical functional components by applying a decision matrix to identify the target dispositions (disposition strategy) and augment platform engineering approach (combination of COTS + SaaS+ Microservices). In Freight and logistics organization operations, 90% of tasks - right from order capturing, and shipment can be modernized to event-driven. Very few are time-triggered and batch operations. As soon as a truck/car/container release event happens, it can trigger the next truck/car/container allocation process instead of waiting for the nightly batch process. We should also consider creating financial engineering and offering the modernized platform as a Service. By doing this organizations can gain meaningful insights through selectively pulling key business & operational data from core systems to draw key observations and sensing behavioral and learned patterns. Conclusively to underwrite the risk & cost of modernization, organizations should modernize the core shared digital infrastructure, services with event-driven architecture, and integrated products and services across Experience, Process, Integration, Data, and Cloud to provide the ability to visualize, take & make autonomous decisions (enabled by AI/ML), manage the platforms, the data, cloud deployments with operational tools, dashboards, and insights.

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