Rail Network Businesses Demand Robust Solutions

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Executive Summary

Surprisingly, the greatest challenge transportation companies face today may not be increases in revenues, nor increases in costs.

Instead, many enterprises are focusing on squeezing asset utilization to make more productive use of supporting assets. By reducing planned downtime, streamlining procedures, and anticipating non-routine events, transportation and network operators know they could increase capacity and revenue without expending capital on new equipment.

Sound promising or impossible? This white paper presents the answer to this question.

Introduction

Asset utilization is *the* operations management challenge in a network business. It's a constant balancing act to match network assets to customer requirements, to people skills and tools availability, and to shared facilities and to external constraints, such as rights of way, congestion, and customer constraints. Network assets are often flexible in that they can be utilized in a variety of ways; many of these ways may well be workable, but only a few will represent good uses of the capability. Because assets are networked, one type of deployment affects many others up line and down line. The only way to squeeze the most out of assets is to have a simultaneous 360-degree view of the elements that are linked together throughout the network. It's a daunting task. Network businesses connect the dots for their customers. Yet networks that drive great value for their customers can also be a source of complexity in driving business improvement opportunities at network operators. Finding solutions for removing constraints and improving throughput depends on equally strong analytical capabilities. Networks are a web of

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interlocking pieces, and the data challenges of supporting networks come from the need to preserve the inherent relationships among the pieces in the data. Network operators need to be able to explore any relationship in their business and capture all the data elements to keep up with the changing nature of the network and to drive business change.

Studies have shown that systematic application of analytical techniques can provide substantial business value from more data driven management of asset intensive network businesses. The following are illustrative from a U.S. northeast corridor rail study, where recent numbers suggested annual infrastructure maintenance costs of $35,000 for each track mile per year:

> Decreased life cycle costs. A combination of timely maintenance, where and when required, made possible by accurate data, continuous visibility, and predictive analytics, would reduce maintenance costs by 10%; this is before any incremental capital investments in optimal capital asset upgrades.

> Reliability and safety root cause analysis reduces costs associated with repeated service failures, and to correct with long-term solutions would save an additional 14%.

> Increasing track throughput, by reducing maintenance occupancy and by reducing slow orders incurred for maintenance or other reasons, would increase throughput by an equivalent of 5% to 15% of revenues.

Enterprise Integration

Business Questions

Many companies have found that as their business matures, the questions they ask become more difficult to answer. Especially simple questions, such as what are total out-of-service hours, or what are the top ten activity drivers, can be hard to answer if your business operates across a complex network with multiple service types and multiple generations of equipment capital investments and environments.

Interestingly, inefficiencies in operations management generally are not caused by a lack of data. Most organizations generate a tremendous amount of data each day related to the hundreds of events in progress and continuously changing demands on people, parts, and tools.

The problem is a lack of transparency – into the data, into the trends, into the organization itself – caused by the inability to integrate across the diversity that makes up the operating environment. While the business may have numerous technology systems that are designed to manage processes – to identify *what* should happen next and *what did happen,* it's a far greater challenge to understand *what could have been done to prevent a certain problem,* or *what should be done, and where,* to avoid future problems. Usually culling out root causes requires more and richer sources of data than does managing a process, because we're looking for performance drivers that are outside of the norm.

Network Transparency

Networks are especially hard to measure for performance, reliability, and financial results. And constraints and impacts in just one or two places in the network can critically affect results of the entire network. For this reason, examining performance reliability and capacity issues in the network requires a tightly integrated data set. It's even doubly hard when the network business relies on complex, capital intensive, long-life assets, because these assets have additional business constraints and factors associated with their use.

In particular, businesses that use such assets in a network environment have a double challenge, which we show as the dual set of intersecting circles in Figure 1. On one hand, the businesses have significant operating environment challenges to manage – a combination of customer requirements, operating plans, and external constraints, which could be regulatory, environmental, and so forth.

At the same time, just keeping the assets maintained and running reliably is an equally challenging task, and one that itself is an integration challenge.

MRO Integration

Let's look first at the challenge of maintaining the equipment – the MRO challenge – the inner set of circles in Figure 1. The MRO activity involves integrating, across a network, the three kinds of activities that MRO needs. This

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includes predicting the work that needs to be done, performing the work, and making continuous investments in assets and maintenance technology to reduce the amount of maintenance to improve the reliability and reduce costs.

The first integration challenge is within the MRO organization itself. Multiple specialized roles coexist, ranging from inspection to maintenance to engineering to capital investment planning. These roles are linked by their shared information, in that actions of one group change the decision making and time frames of the others. Lifecycle cost management is a balancing act of preventative inspections, ongoing timely investments in maintenance that minimize delays, service failures, slow orders that reduce throughput, and new investments that expand capacity, improve long-term reliability, and reduce long-term cost. Continuous change in asset usage patterns is also altering the economic equation. Constantly improving technology is changing the information that is collected and that can be made available to affected parties.

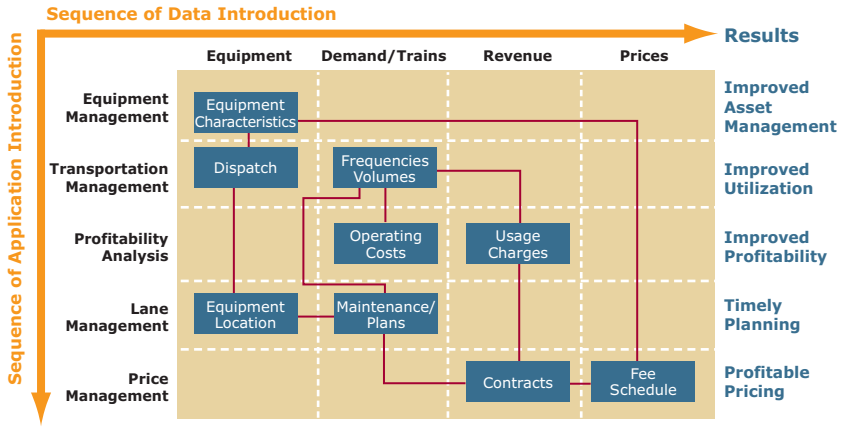

Figure 1. Enterprise integration operates on at least two levels in operations management environments. At the highest level, MRO needs to integrate with three external functions; at a lower level, integrating MRO itself is a challenge because it also consists of three functions.

Enterprise Integration

The outer set of circles in Figure 1 is about integrating the business. Here, we're integrating the demands of customers and the traffic volumes, developing and meshing operating plans around network capacity and customer requirements, and meeting a variety of regulatory, environmental, and local restrictions, as well as accommodating inputs and services from equipment manufacturers.

At the higher business level, the integration challenge is to allow the MRO organization to effectively deliver throughput capacity, low costs, and service reliability in the context of the enterprise. Here the integration challenge stretches from the domain of the customer, where a set of amorphous needs must be translated to a fixed set of network offers. Operations plans need to consider corridor reliability, traffic characteristics, asset characteristics, resource capabilities that can be matched to the customer needs, and appropriate constraints from regulatory and manufacturer requirements.

The enterprise needs to take in multiple information feeds related to market requirements, traffic and tonnage volumes, schedules, and operating constraints. The operations planning ingredient needs to take in time frames from long-term planning to seasonal changes to daily resource deployment committed to minute dispatch related adjustments. Entities such as governments and local authorities may pose requirements, constraints, and in the case of manufacturers, require equipment data about performance, repair, and warranty support, and so forth.

Using Teradata® solutions, the Burlington Northern Santa Fe (BNSF) railroad has created the concept of the e-synchronous railroad, integrating its business with

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three diverse information ingredients to synchronously drive performance of its operations, customer relationship management, and Team BNSF mechanical performance. Through a set of dashboards and dozens of metrics that are updated daily and are available throughout the organization, BNSF can present a single view of its business, which can be drilled down to provide the most detailed data down to the individual applicable productive unit.

Scaling with the Business

Business Growth

Your business knows no growth boundaries. Why should your database? Your customers are demanding more transportation services, with more flexibility and greater reliability. Your suppliers are ready to provide more capable assets and better maintenance technologies and more responsive tools and engineered services. Shouldn't your information technology do likewise?

The very kinds of demands that are growing your top line revenues are the challenges for building your information technology management. Many companies like yours successfully drive business growth, cost containment, and profitable services. But the same growth that drives top line results is driving business complexity throughout the network. When new types of assets, tracks, signals, or high-speed capabilities are added, how easy is it to integrate the relevant information about maintenance events, costs, tasks required, planned investments, and so forth? When new types of track inspection and defect correction technologies emerge, can you quickly integrate them into your maintenance databases and influence the mix of maintenance and investment? Can you tell, among all your maintenance tasks, which ones are discovering problems too late, and which ones will result in future productivity improvements?

Data Growth

In businesses with long life and capital intensive assets, business growth often means much more than productive capacity growth. Usually, it means addition of different types of productive assets that are usually better performing and more complex with more dimensions of performance measurement. Many of these new assets will coexist with much older, less sophisticated assets for many years to come – perhaps decades. By the same token, business advances will also mean new kinds of maintenance technology with vastly increased data collection and monitoring capabilities emerging. The new kinds of data and the more comprehensive performance measurement will need to be interfaced and correlated with history collected from less precise and less comprehensive measurement systems used previously.

Unless information technology is flexible and easily capable of representing this mixture of old and new assets, the old and new maintenance technologies, and the evolving sets of ever more comprehensive data, the business will under-leverage the value from these new technologies. It will do so by either creating islands of data for the newer technologies that are not integrated with older generations of equipment. Or, it will fail to capitalize on the more sophisticated capabilities of the newer equipment.

Teradata Scalability

With Teradata Database, it's like having a turbocharger on your business growth plan. The Teradata Database design allows you to collect and store the data exactly as it is created in your business. There is no need to summarize data or to eliminate details because of concerns for database performance. When new data types emerge, they can be easily added. The Teradata Database is conducive to accepting business logic change and can easily support new uses of the data, such as automated signals reporting, high-speed trains, RFID data, and new rail side assets.

With Teradata Database, business is free to design a data warehouse solution to address its immediate needs without worrying about compromising the ability to answer future questions. With Teradata Database, a solution can be built that

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addresses a specific problem with specific data fields, without concern about the need to redesign the database for future additional data elements or the potential ways in which the business questions may evolve in the future. Teradata customers can start with a data warehouse that integrates the data that they need now, and allows them to scale up the data in the warehouse flexibly as necessary to drive future business value. A Teradata system accomplishes this through two unique capabilities. First, a Teradata logical data model is a network, much like a rail network. It connects the points relevant to the business to capture the attributes that define the business. The new relationships and new attributes need to be added to the rest of the data model; the rest of the network does not need to be touched, just connected where relevant. Second, Teradata Database scales linearly with data volumes – data can be added at any point in time without concern for affecting efficiency or accessibility.

An excellent example of the power of scalability and maintenance of high-value assets is from the U.S. Department of Defense. Starting with just a few hundred gigabytes of maintenance data about aircraft, the U.S. Air Force system has grown into a 10-terabyte warehouse that spans the enterprise with five different types of data and more to come. The warehouse today covers all the maintenance supply chain data needed to support the aircraft in their deployment, from maintenance activities, to supply, to purchase contracts, and financial data. With essentially near-real-time access to its worldwide aircraft capabilities, the U.S. Air Force can deploy aircraft on missions and respond to planning problems with new levels of analytical insight. Business questions that used to take days or weeks to answer can be done in minutes. Likewise, supply chains can be adjusted around systemic solutions and predictive parameters instead of point solutions and reactive approaches.

Taking the Slow Orders out of Business Intelligence

Maintenance Event Data

While the throughput of your network today may determine your revenue for today, it is the throughput of your business intelligence capabilities today that will determine your revenues for the future. Unless your capability for identifying, asking, and answering the critical questions can grow, your business may not be able to grow to its potential.

Most companies generate huge amounts of data that cannot be queried by the very people who are charged with driving business change. Much of the data from operations systems is summarized before it's carried upward into financial reporting systems. Much of the potential business value is locked up in this wasted data resource.

What questions would you ask differently if you could see individual maintenance actions instead of summarized or surrogate statistics? Each maintained asset has a specific history, and each maintenance inspection or repair is unique within its context. Part of your business value is the accumulated knowledge of hundreds of maintenance events and the knowledge of traffic that moved before these events. Using such precise data means making business changes that directly affect productivity, instead of leaving that to guesswork.

Any Query, by Any User, at Any Time

With Teradata Database, you'll be able to retain maintenance event detail and combine it with data from schedules, traffic, other operational systems, and even financial data. You'll be more prepared to avoid the slow orders throughout your network by eliminating them from your database. Teradata Database facilitates access to the data. Teradata Database allows any query, by any user, at any time, greatly accelerating the development of insight throughout your network. We have eliminated the kind of constraints that are needed to separate complex queries from routine analyses; the result is that your employees can ask the complex questions that help prioritize work plans to ultimately improve reliability. Complex questions that can uncover the drivers in

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high maintenance situations or predict optimal maintenance intervals don't need special treatment or the creation of purpose-built duplicate versions of data in separate data marts.

Another ingredient provided by Teradata Database is data freshness and high availability. Teradata Database has eliminated the constraints that can delay updates to complex databases and reduce the effectiveness of data sources because of lack of timely updates. With Teradata Database, information from field locations can be updated in the time frame most appropriate for taking corrective action, assigning maintenance tasks, or updating the database. With Teradata Database, you can have instantaneous access to the "as maintained" status of track or signals, as well as complete history of maintenance, where traffic has touched these elements.

Analytical Sophistication

Along with business growth comes information management maturity and analytical sophistication. This means asking more questions and more complex questions, using more data in a more timely fashion. It means moving away from finding and fixing defects to anticipating and predicting failures before they interfere with operations. Once again, anticipating and predicting failures requires a lot more information available than merely finding and fixing defects. They require a more flexible IT infrastructure, and one that can integrate more information and deliver it quickly.

Through Teradata solutions, a large U.S. aerospace manufacturer has been able to develop solutions to improve ongoing operational aircraft asset availability to its customers. By using Teradata Database's capability to perform extremely complex queries, the manufacturer studies situations that can reduce aircraft reliability. Because of the relatively high reliability of aircraft components, these queries rely on complex combinations of parameters that simply could not be performed effectively without Teradata capabilities.

Teradata solutions are extensible in a number of ways to meet the growing needs of transportation network providers. In an environment where safety and maintenance history in reliability are paramount, much additional information can be captured over and above some of the numeric parameters collected today. Text data that reflects context from railway engineers, production gangs, or shop mechanics can contain valuable data that can be structured and stored in a data warehouse so they can be queried like any other kind of numeric data. Equally important is the capability to overlay traffic and track data with GIS data or to visualize hundreds of thousands of track wear or other reliability data in a way that may point out patterns that otherwise would be difficult to detect. Where and when maintenance work will be performed, if shown in a graphic capability, may be particularly important in identifying combinations of events that can assist the predictive maintenance process. Teradata Corporation has partnerships with software vendors that have been engineered to work in a Teradata environment to take advantage of Teradata Database's unparalleled capability of storing vast quantities of information and delivering them to these powerful front ends.

With Teradata, each functional user group can have its own tailored views of its data, so business intelligence reporting gets off to a fast start. So engineers, financial analysts, and executives alike can obtain the exception reporting, event-based analysis, predictive analytics, and robust dashboards that uncover opportunities that would otherwise remain embedded in a mountain of data.

Teradata Delivers Traction in Asset Intensive Transportation Enterprises

Operations Management

Railroads and MRO intensive businesses are powering their growth with traction through business intelligence enabled by Teradata solutions. Increasingly, Teradata is being chosen to support enterprise analytics in areas that include operations management subject areas, such as asset utilization, maintenance repair and

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overhaul, supply chain, reliability, warranty and quality, and inventory management. Among the Teradata-powered railroads, we have seen top-down approaches to improve performance in operating plans, financial performance, customer service reliability, locomotive velocity, and maintenance performance. These railroads have also focused on increasing asset management and increasing collections. Teradata can support your needs in areas that range from operations management focus on safety and maintenance operations information, to a financial focus that covers everything from pricing to revenue carload analysis, and asset management that focuses on everything from locomotive dwell to trackage rights.

Teradata Growth Path

Railroads that are powered by Teradata solutions are finding new sources of profits and business expansion opportunities by examining revenue, cost, and asset utilization opportunities. While these cover areas as diverse as pricing, carload requests, demurrage, freight payments, energy materials management, maintenance and HR, companies usually start with a specific business area and grow from there. In general, they're laying the track for future profits by leveraging the 'load once, use many' capabilities of Teradata systems.

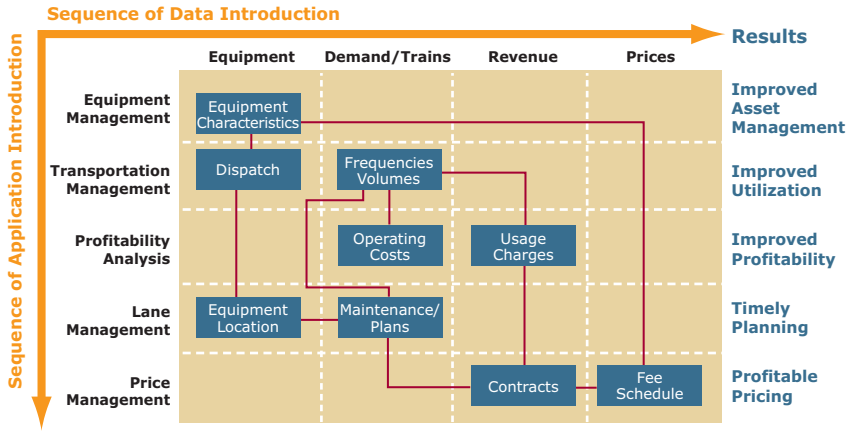

Figure 2. Potential data, application, and business benefits streams from an evolutionary data warehouse implementation and data mart consolidation for a rail network infrastructure business.

In Figure 2, we illustrate a potential scenario for evolving a data warehouse for a rail network infrastructure business. Starting from a small set of data focused on a particular business area, Teradata facilitates data warehouse growth into higher value and more profit generating parts of the business. As you move outward from core track and signal assets, the subsequently added data could include train schedules, volumes of traffic, and tonnage. From there, you could move to revenue data and, ultimately, to pricing. In conjunction with these additional data, the applications could move from track maintenance to managing train volumes ultimately leading to profitability analyses and specific traffic lane management schemes designed to maximize the combined throughput, reliability, and productivity of the system. The business results grow from asset management benefits, which may be intangible, but necessary for business to find its network improvement opportunities, to increasing throughput and utilization, ultimately through better planning, leading to improved profitability. This will lead to more time sensitive planning and finally, to more profitable pricing made possible by a broader range of more desirable services, and customer satisfaction.

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Conclusion

Are you ready for your future? Teradata is. Our experience with more than 850 of the world's largest companies shows they all face major hurdles in answering their business questions. In fact, the greater the daily flow of information, the more challenging it is to bring all this information together for analytical purposes to support the decisions for business change.

What if the questions you asked today really could be answered to produce profits for you in the quarters ahead? If you want improved operations performance, including increased asset utilization, reduced costs, and better analytical coordination, and you want to learn why many questions seem so hard to answer, yet need not be, contact Teradata to learn more about the Teradata Tech Ops/MRO solution.

About the Author

Peeter Kivestu joined Teradata in 2004 with more than 27 years of airline, information technology, and supply chain expertise. He is a senior consultant for travel, transportation, and distribution on the Global Industry Consulting team. He is responsible for leading travel, transportation, and government initiatives, with a focus on operations management, including technical operations, maintenance, repair and overhaul, and related RFID/auto-id initiatives.

Kivestu previously held positions at American Airlines, Canadian Airlines International, Northwest Airlines, Seabury Group, and MergeGlobal.

Kivestu has an undergraduate degree in engineering from Brown University and an advanced degree from the Massachusetts Institute of Technology where he studied aeronautics at the Flight Transportation Lab and finance at the Sloan School of Management.

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