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A-to-Be drives innovation in telematics with MoveBeyond back office

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Abstract

A-to-Be MoveBeyond™ is a platform for an integrated back office that combines operational excellence with commercial reliability to offer a seamless user experience. The architecture is modular, lean, highly configurable, feature-rich and easy to use. This paper describes the implementation of the project Smart Drive using MoveBeyond™ mobility platform. Smart Drive project was born from a partnership between Brisa and Fidelidade. The goal of this project was to provide Via Verde clients, a usage-based insurance offer by collecting client driving styles information and reward favorable drivers with discounted premiums through Fidelidade Car Insurance and toll credits through Via Verde. In this article, we will describe how we have tailored MoveBeyond™ to be used in Smart Drive and the potentialities of this platform that can be leveraged to support several types of services.

Keywords:

Mobility Platform, MaaS, Usage-Based Insurance

Introduction

The transportation industry is moving in the direction of mobility-as-a-service (MaaS) where the use of a single, integrated back office will facilitate the infinitely adaptable delivery of mobility and payment services across all modes of transport to ensure planning efficiency and fiscal sustainability across state and local governments nationwide. Designed with the end customer in mind, MoveBeyond™ a platform for an integrated back office. This solution combines operational excellence with commercial reliability to offer a seamless user experience.

A-to-Be MoveBeyond™ is a modular, scalable, and highly configurable mobility platform built on open standards to process large data volumes in near real-time. The architecture of MoveBeyond™ is designed as a set of small, discrete, independent, and standardized microservices operating in parallel. The modular design gives the system the capability to expand as the operations grow without losing quality or adding complexity. The A-to-Be MoveBeyond™ multi-operator back office consists of two suites — the Operational Suite and the Commercial Suite — each encompassing essential business modules that can be easily configured, adapted and extended to satisfy customer's requirements. Operational Suite, designed for the most demanding volume scenarios, serves as a two-way communicational link with the multiple operators and processes the entire transaction lifecycle exchanging and verifying crucial data. Commercial Suite is a set of services and applications managing complex business processes, end-to-end commercial operations, and relationships with

customers and partners. The Commercial Suite analyses, processes, and coordinates transactions lifecycle from account posting to billing. It enables authorized users to perform billing and payment operations, document management and all CRM activities, such as account management and customer communications. New modules can be implemented from scratch and added to the system to expand functionality in the future. The system is based on a Container Platform-as-a-Service (cPaaS) service model and provides a set of core services to the business modules, some of which are non-optional to the system's functionality. This business model helps speed up the customization and implementation time for additional modules, as the core system services reside in a central repository.

Changes Integration

One of A-to-Be MoveBeyond™ design drivers were to be Future Proof Technology. The following points relate to the way A-to-Be achieved this design goal, and its relevance for the Smart Drive project implementation.

- Modular by design – each business domain is a module (subsystem), that, if needed, can be composed of several smaller modules. Each module serves a specific purpose with a published (REST) interface to the outside world. This means that each module can evolve separately from each other.
- Platform Core Services are themselves modules (systems) that can be replaced one-by-one. For example, the API Management Module can be replaced and integrated into the system, which provides clean and transparent mechanisms for upgrades (albeit with potential impact on re-certification costs).
- To have a base system that supports today's needs, as well as tomorrow's technologies, A-to-Be employs a Platform-as-a-Service architecture. This allows new functionality to be implemented in standard java, PHP, node or .net code for native applications, or as container applications (docker) that can be developed in any programming language.
- The core platform is lean and encompasses an extensive set of Mobility libraries and services, which enables rapid adaption of the platform for a specific use-case. For edge cases, where new features are needed, one can still take advantage of the core platform services, the PaaS, for running the solution and one can develop the module(s) needed for the specific use-case from scratch.
- A-to-Be chose a technology and platform design that was based on open standards to encourage multiple suppliers for each component.

This means that the solution can be continuously enhanced, and modules swapped out with newer ones without having to worry about integration issues due to external dependencies. This also implies that MoveBeyond™ is flexible and lean. The operator can pick and choose the modules with the features they require to meet today's demand and add additional modules in the future. These modules can then be provided by third-parties, be homegrown or requested as an upgrade from A-to-Be.

Interactive Touchpoints

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A-to-Be MoveBeyond™ platform was designed to provide a 100% digital experience to both customers and internal system users. The front-end is a responsive web-based app, that runs seamlessly on smartphones, tablets, and desktop computers alike.

Unified Employee Portal

The Unified Employee Portal is a responsive centralized portal with a consistent, user-friendly interface for every department and role-based interaction. It includes account management, reporting, inventory, notifications, CRM, team management and work assignment screens. The portal pages are presented in the form of intuitive dashboards. The search can be done in seconds with the help of a system-wide search engine, that searches through all user-accessible system objects.



Figure 1 – Unified Portal

Customer Self-Service Portal

This self-service portal comprises all account management options for the registered users and allows them to alter any configurable attribute of their account or accounts. This includes attributes such as name, address, number and type of vehicles associated with the account, credit card information and preferred notification means – all online and without the need to visit or call the customer service center.

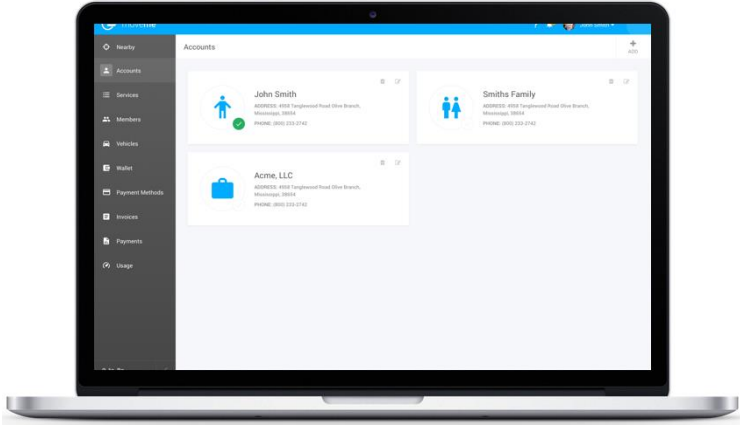


Figure 2 – Self-Service Portal

Mobile Apps

Both unified employee and customer self-service portals are available as mobile apps. The employee

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app displays key business figures as well as team to-do tasks, performance KPI, and important workflow notifications. The customer mobile app offers the same rich functionality as the self-service web portal.

Adherence to Performance Requirements

A-to-Be MoveBeyond™ platform follows a (micro) service, event-driven, oriented architecture. Most services run as a docker image on Kubernetes container orchestration managed by Redhat Openshift Container Application Platform. The event-driven solution is based on a central message queue/event stream (Apache Kafka [1]) that is fault-tolerant, scalable and a very fast “middleware”. We use SQL and NoSQL databases. SQL databases for relational and transactional data and NoSQL as the Search Engine for the entire solution.

What this means is that A-to-Be MoveBeyond™ platform has the following capacities:

- Can scale business services up and down manually (one click) or automatically based on resource consumption – scales easily;
- Each service can have multiple instances and as soon as one instance stops responding it's killed and a new one created automatically – self-healing;
- Each service instance, ideally, runs on a different host (if a host goes down the system continues to work) – high availability;
- For databases, is used cold failover, that allows very quickly recover times, or synchronous multi-master strategies, depending on the project requirements and constraints – high availability;
- It uses Apache Kafka [1] for event streaming and as a fault-tolerant, fast message queue – high availability;
- Services have compensation routines that allows to detect, replay and fix (or replay and alert) about potential data inconsistencies in a timely manner – Consistency and Self-Healing;
- Communication between services is mostly through events which means that all running services are waiting for work (polling only when there's no other way for business requirements) which makes it easy to understand when one service needs to scale – scalability and real-time;
- Each service has a well-known responsibility and all other services delegate the tasks accordingly. Asynchronous services have an SLA and it executes within the agreed timeframe or alerts if it fails – SLA ready;
- Adopt events over batches whenever possible – real-time.

In addition, some of the key benefits of this include its high scalability, near real-time handling of all requests and processes, versatile deployment options - both on-premises and on cloud, customer-centric and user-driven front-end interface and big data business intelligence engine producing operational reports, statistical dashboards, and predictive analytics.

Smart Drive Project

Brisa, the largest road operator in Portugal and Fidelidade, the largest insurance company in Portugal, joined to provide advanced telematics-based insurance products to Via Verde clients. With this project, Via Verde customers in Portugal are able to benefit from usage-based insurance (UBI) solutions. Via Verde Portugal was founded in 2000 and is one of Brisa's most significant companies, having made Portugal the first country in the world to have an integrated electronic non-stop toll network. Nowadays, customers can use Via Verde in other services such as on- and off-street parking, drive-thrus, public transport, car-sharing, ride-sharing, and fuel stations.

Within the project, drivers that use the Smart Drive app will be evaluated and scored based upon driving behaviors, fatigue levels, compliance with speed limits and mobile use. At the conclusion of each trip, the Smart Drive will recommend tips to reduce personal costs and improve driving behavior. In an effort to improve road safety, favorable drivers will be rewarded with discounted premiums through Fidelidade Car Insurance and toll credits through Via Verde. Subject to a trial period of 20 trips and approximately 500 km, Smart Drive users are eligible for additional telematic discounts on car insurance through Fidelidade of up to 15 percent. The better the score, the greater the discount. Drivers also benefit from Via Verde toll credits worth 15 percent of their paid insurance premium.

The customer journey starts by installing the Smart Drive App in the mobile phone and sign the legal authorizations necessary to the data collection. The Smart Drive will record all the journeys that the customer made, being this first phase of the project called Try Before You Buy(TBYB). All the journeys that the customer will make will collect the driving style information in 4 vectors:

- Driving Style – Sudden Accelerations and Breaks, Turns;
- Velocity;
- Fatigue – The hours of the day that the customer is driving;
- Use of mobile phones.

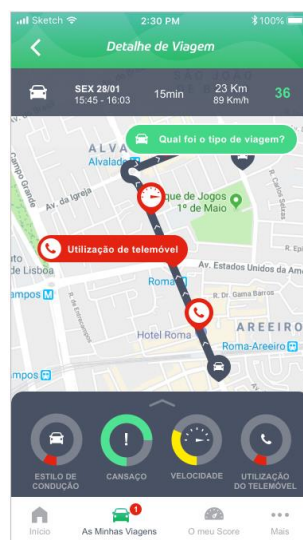


Figure 3 – Smart Drive App detailed journey and driving style vectors

All the journeys that the app recorded are transmitted to a central system to be processed and scored. The SDK that was used in the Smart Drive App that enables the collection of the driving metrics was

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implemented by the company The Flow Solutions. The score of this journey is a ponderation of the 4 vectors collected by the Smart Drive App. Each journey is assigned with a score, and the average of all the journeys that the customer made gives the customer's score as a driver.



Figure 4 – Smart Drive App Customer Score

Based on this driver score and after a given period, that customer will be eligible to access an insurance policy with a custom price. In this part of the program, the customer will get a proactive simulation from the insurance company with a discount that is proportional to the driver score. The higher the score the higher the discount. The customer can choose to accept this offer by underwriting the insurance policy or decline it. If the choice was the acceptance of the insurance, the customer will transition to the Telematics Supported Policy (TSP) phase. In this phase, customers will continue to use the Smart Drive App and the journeys will continue to be recorded and scored, but if the customer continues with a correct and safe driving style then he will receive more rewards on a monthly basis. These rewards are points that can be converted in credit to be used in tolling services. The customers will continue to receive tips to help them improve their driving style and hence their score/rewards. Later, in the insurance policy renewal, customers will continue to benefit from better pricing conditions

The challenge for A-to-Be

For this project, A-to-Be MoveBeyond™ was used to administer the project's mobility back office with the correspondent management Portal. MoveBeyond™ is capable of integrating with external systems while simultaneously preserve sensitive service provider information and delivering seamless user experience. To this date, this solution is deployed in 4 different states in the United States, where there are successfully implemented tolling and road usage charge (RUC) A-to-Be back offices.

As previously referred, extensibility was one of the requisites of this tool, being essential the use of open standards and technologies allowing the customer, or a third party, to configure and extend the

functionality of the platform without external intervention. In this sense, the core business modules and services are very lean and simple so that upgrades are straightforward and secure. The next figure presents the architecture of the project and the flow of information between the different intervenient.

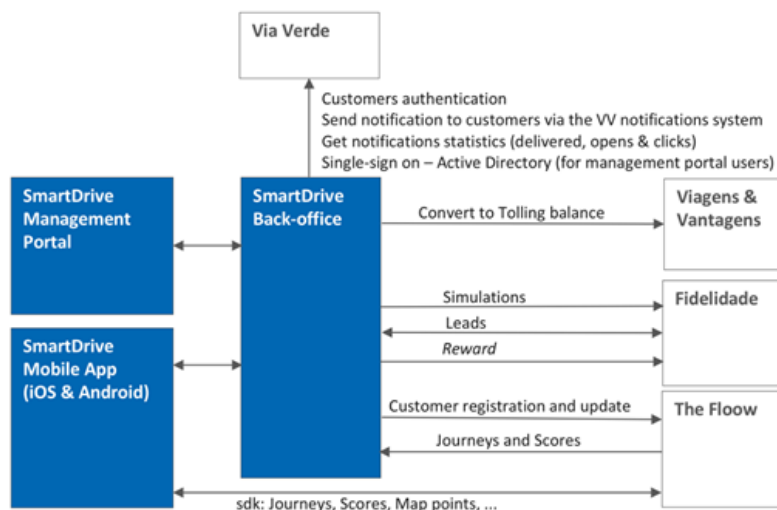


Figure 5 – Smart Drive project overview architecture

Integration as a major objective

MoveBeyond™ platform presents several extension and configuration points that are relevant for the subsequent work that needed to be developed. Some of these extensions include:

- APIs for everything (API first, then design) meaning that new business modules or services can be created from scratch using available application SDKs;
- Business Process Manager (BPM), Event Processor and other subsystems handle all complex logic leaving system modules lean with only basic configuration and patronization set up;
- BPM processes, Business Rules, Complex Event Processing, and Data flow visual editors to configure business rules;
- An event-driven platform architecture;
- The architecture that enables creating new services that wrap, or replace the old ones and changing the API routing to point to these new services;
- With the SDKs for modules, one has access to the source code to add new fields, entities, relationships, services, and much more;
- Data integration process (an ETL-like tool) enables integration with external services;
- A reporting tool that allows to customize and develop new reports.

These extension points enable easy integration with external systems. In the Smart Drive project one of the major challenges was the interaction and integration with all the intervenients in the project: Fidelidade, Via Verde and The Flow. For this integration, we used MoveBeyond™ SDK for building new modules specific for this project that interact with the external entities, and API First by design to expose Smart Drive information when needed. These modules have the communication protocol with the external entities both for inbound and outbound communication.

Another challenge was the real-time process of the transactions/journeys that arrive at MoveBeyond™.

The processing of these transactions/journeys has a lifecycle and set of transformations that had to be adapted for Smart Drive. Having that in mind MoveBeyond™ already provided a tool, StreamSets, embedded in a module that is capable of ingesting, transform and validate large volumes of data. This module is highly configurable and enables the customization of the project business rules in a programmatic but visual way.

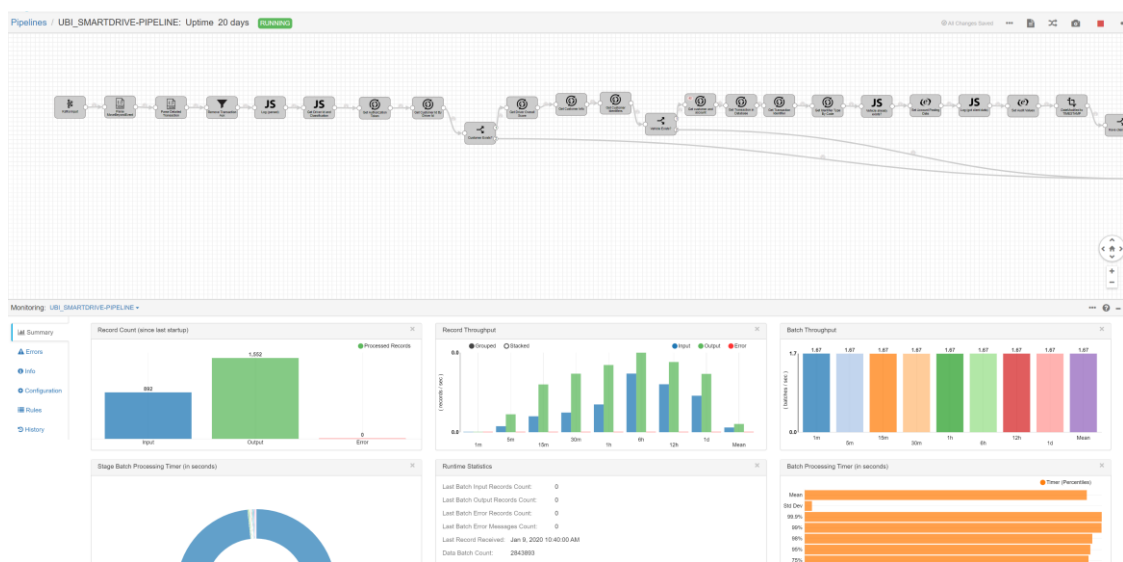


Figure 6 – Smart Drive pipeline for injecting, transforming and validating journeys/transactions

StreamSets [3] also gives natively performance and error metrics by providing dashboards such as processed events per second with success and percentage of events in error. MoveBeyond™ is certified to process up to 140 events per second in this module.

Monitoring and Alarms

Inspection, active monitoring, and automatic generation of alarms are some of the features necessary for the project that was offered by the MoveBeyond™ platform. For the alarm monitoring, a commercial off-the-shelf solution, ELK stack (Elastic, Logstash, and Kibana), was used. ELK [4] is a market-proven solution, used by companies such as Cisco and eBay to monitor and reduce their platform downtime. Active monitoring is achieved by installing lightweight agents on all servers to collect information such as application logs, availability metrics, and network traffic. This information is then sent through Logstash to the Elastic Search Engine, where it's analyzed and visualized in real-time on the Kibana dashboards. This solution has built-in functionality for monitoring VMs and all applications. Dashboards for each metric were adapted to Smart Drive needs, and alarms for preventive maintenance were defined. All system and application logs are aggregated, processed and visualized in this component, to provide a centralized overview of all system functions. MoveBeyond™ solution also offers detailed insights into per-application performance data suited for real-time monitoring and troubleshooting.

In the following figures, it is possible to see the VM and service monitoring environment.



Figure 7 – Smart Drive VM Monitoring



Figure 8 – Smart Drive Service Monitoring

Interactive Touchpoints

In the Smart Drive project, there are two interactive touchpoints: the Unified Portal for system operators and the mobile app for the end clients.

MoveBeyond™ Unified Portal was also customized to fit Smart Drive demands in terms of naming and branding. All the information that exists in the Smart Drive can be searched and visualized in the Unified Portal such as drivers, vehicles, simulations, benefits and system information (Figure 10). The initial dashboards in the portal allow us to rapidly identify trends and provide a detailed overview of the system. The user access is role-based, meaning that different users with different roles can have access to different information. The Unified Portal provides a unique 360° view of all the entities in the system enabling the rapid research and quick access to information only two clicks away.

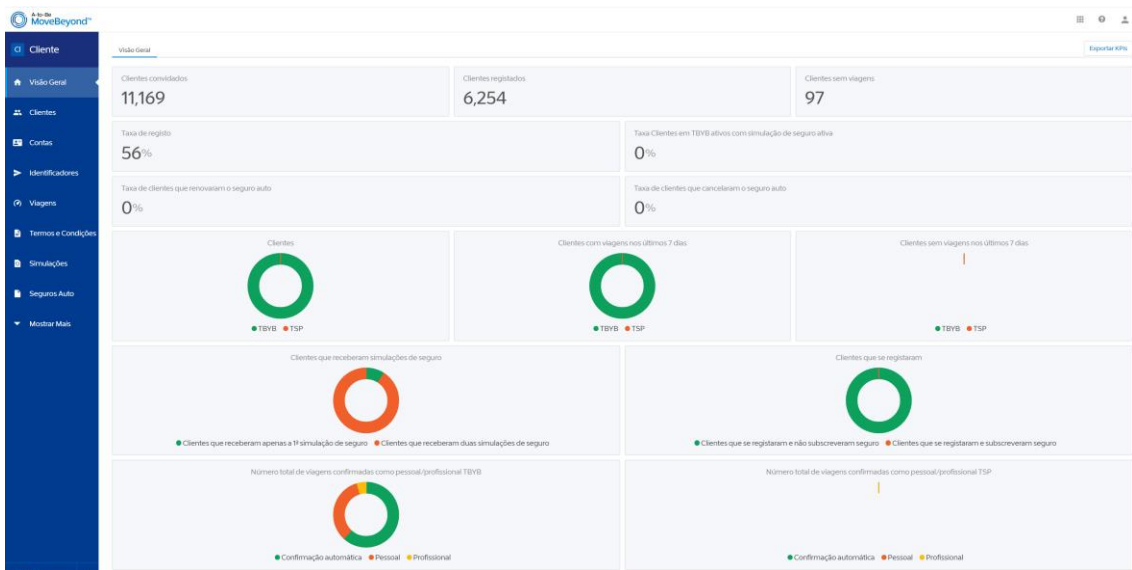


Figure 9 – Smart Drive Unified Portal Dashboards

The information displayed in the Smart Drive App is retrieved from MoveBeyond™ back office and the Floop SDK. MoveBeyond™ back-office exposes via permission-based API’s all the information available on the system. For the Smart Drive project, the exposed APIs were designed to fit the demanding needs of performance to accommodate many clients.

Performance and Scalability

This platform is a micro-service event-driven platform. These two capacities allow the system to be modular and to scale horizontally. As referred before all the services in MoveBeyond™ run in docker images on a Kubernetes[2] container and therefore is very easy to scale up a service. The system can be scaled both up and down as needed either through the click of a button or automatically, based on the resources demand. Additional processing volumes are accommodated by simply replicating already existing services while maintaining data integrity. The system also supports asymmetrical scaling to be cost-efficient. For example, if traffic load has increased but not the number of accounts, only the modules corresponding to the increased traffic data will be ramped up. The microservice model is equally effective for both higher and lower operational volumes. All the services are prepared to run in multiples instances and it is desired and recommended to have that to provide high availability. Another benefit of having multiple instances and since this is an event-driven platform are the gains in performance. More instances processing events mean more events processed per second. Apache Kafka is being used for the event-driven solution. Kafka [1] is used for building real-time data pipelines and streaming apps. It is horizontally scalable, fault-tolerant, wicked fast, and runs in production in thousands of companies. Since the majority of our modules scale horizontally the performance achievements are related to the number of instances of each module and the capacity of the machine where they run.

Conclusions

A-to-Be drives innovation in telematics with MoveBeyond back office

With the transportation industry moving in the direction of MaaS, A-to-Be MoveBeyond™ mobility platform back office has proven to be a robust, fault-tolerant, performant and multi-service platform.

The micro-service architecture yields easier scalability. The system can be scaled both up and down by replicating existing services. The benefits of this architecture are cost and time efficiency, flexibility and fault-tolerance. These benefits mean that accommodating an increase in volume does not require additional development effort, and implementing new features or bug fixing is addressed only in the relevant modules without affecting the rest of the application components making the system less prone to adverse side effects.

The platform support for active monitoring and automated real-time alarms reduces the system downtime as information is provided in real-time and in a way that problems are anticipated (e.g. informing above normal resource usage giving the DevOps team the time to react without disturbing user experience).

A-to-Be's MoveBeyond™ is prepared for high availability. The system can automatically handle increased load during peak traffic hours and recover in case of downtime. The cloud-hosted solution benefits include high uptime, high availability, high durability, and no hardware maintenance, with a system that is easy to scale and deploy anywhere.

A-to-Be's MoveBeyond™ is a configurable, adaptable, and extensible platform that will meet MaaS operator's necessities. The platform provides drag-and-drop visual flow designers for business process configuration so there is no need to comb through thousands of lines of code. Functionalities are encapsulated in simple pre-built elements that can be added or removed with one click. In the case of Smart Drive, the choice of such a flexible and configurable back office technology allowed us to deliver the project in only 6 months.

Currently, we have all platform services in high availability mode, processing up to 140 events per second and supporting up to 7500 users simultaneously in our Unified Portal.

MoveBeyond™ platform is an A-to-Be's flagship product carefully designed with an outlook on industry trends. MoveBeyond™ platform provides scalability for future volume growth and seamless integration with new interfaces in an easy to deploy, durable and upgradeable system.

Acknowledgments

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