



WHITEPAPER | Approaches to Processing Technology for Prepaid Cards

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I. INTRODUCTION

Prepaid cards are the newest entrant in a 50-year continuum of network branded card products that have transformed the way people pay. As with traditional credit and debit cards, prepaid cards utilize the Visa®, MasterCard®, Discover® and American Express® networks as well as various EFT networks to automate payments.

The prepaid card industry emerged about a decade ago and is now in the early majority stage of product adoption. Prepaid cards represent the fastest growing segment of card-based payments and hold tremendous potential to continue to transform payments from inefficient, labor-intensive paper-based methods to electronic systems. The success of prepaid cards is attributable to value propositions such as convenience, cost savings and security for businesses, governments and consumers.

The prepaid card category has many strengths. It consists of a broad product set--ranging from nonreloadable gift cards to health care cards to general purpose reloadable cards. Prepaid cards have utility across a wide range of vertical applications--from incentives to payroll to government disbursements. And, they are commercialized by a broad spectrum of organizations--from financial institutions to non-financial institutions such as incentive companies, payroll service providers, retailers and money transfer companies (referred to in this white paper collectively as "issuers and program managers").

A. Complexities of Prepaid

But the strengths of the prepaid card category also represent many of its inherent challenges. Unlike credit and debit cards, which are homogeneous products commercialized primarily by a single type of organization (i.e., financial institutions), prepaid cards present tremendous complexities:

- Breadth of card products
- Variety of marketing strategies and distribution channels
- Diversity of value chain participants, which include financial institutions (FIs) and non-FIs of various kinds including networks, processors, program managers and distributors
- Divergent business models, value propositions and risks for each stakeholder by product, vertical and distribution method
- Differing technology infrastructure and operational support requirements by product, vertical and distribution method
- Rapid ongoing change and evolution due to the early stage of the market

B. Inability to Use Credit and Debit Platforms for Prepaid

Electronic card processing systems have existed for many decades, initially serving the charge and credit card market and later the debit card market. With the emergence of prepaid cards in the late 1990s, it became apparent that these legacy platforms do not lend themselves to processing prepaid cards because of the unique complexities of prepaid, as described above.

Retreading credit and debit card platforms to process prepaid cards has consistently proven unsuccessful. While credit card processing platforms may be feature and functionality rich for credit cards, their capabilities are fundamentally and materially different from those required for prepaid in numerous material respects, including:

- Account management systems and the need in prepaid for many-to-many relationships between cards, accounts and users (i.e., multiple purse technology)

- Authorization pipeline logic, such as the need to limit the usability of cards by purse, payment type, merchant, time and other parameters, including on a combined basis
- Ease of integration into numerous third-party systems
- Fraud and risk management such as user verification and value load monitoring and controls
- Seasonal platform volume management
- Non-financial transaction processing
- Inventory management
- Real time processing of data and transactions

Adapting traditional card processing platforms for prepaid is also challenging because they tend to limit scale and performance concerns to clearing and settlement. While undoubtedly important, such concerns are the tip of the iceberg for a prepaid processing system. Other forms of activity--such as Web, IVR, activation, bulk issuance, API calls and value loads--can dominate the processing work of a prepaid platform. Credit card platforms are not typically designed to directly process such activity in a real-time manner at significant volume.

While retreaded credit card platforms may give the appearance and perception of viability for prepaid card processing, their utility diminishes beyond the most basic prepaid card products offered through simple channels. The additional architectural and functional "baggage" of credit card platforms further erodes the ability to leverage the limited functionality that would otherwise be appropriate for a prepaid portfolio.

C. Emergence of Specialty Prepaid Card Processors

Based on the inability to utilize credit and other legacy card processing platforms for prepaid, in the late 1990s companies that specialized in prepaid card processing systems began to emerge and dominate the landscape. These companies use primarily a "software as a service" (SaaS) approach to processing. The early prepaid card processors that were successful were acquired by large established payments processors, and additional entrants have since emerged. Today, these specialty prepaid card processors remain the primary option for prepaid card processing systems.

D. Current Approaches to Processing Technology: Software as a Service (SaaS) and In-House Software

Despite the emergence of specialty prepaid card processors, today's prepaid card environment has a number of critical limitations stemming from deficiencies in enabling processing technology that prevents the prepaid card portfolios and businesses of issuers and program managers from attaining their full potential.

The first decade of prepaid has seen only the initial attempt at getting processing technology right for the industry; there remain significant and substantive improvements to be made. The initial generation of technology born in the 1990s has simply failed at providing reliability, scalability, flexibility, transparency and other critical capabilities that the industry needs to grow and evolve fully. As a direct result of the fast paced growth in card volumes and functionality, there is now a web of software platforms that have become difficult to enhance or scale in a material way.

Limitations result from the fundamental ways in which enabling technology for prepaid cards is currently delivered:

- As **software as a service (SaaS)** platforms offered by third-party processors to issuers and program managers on an outsourced basis
- As **in-house software platforms** offered by software vendors and deployed internally by issuers and program managers

II. Inability of Current Approaches to Manage Complexities of Prepaid

As described above, prepaid cards represent a broad array of card types. During the past decade, a diverse group of organizations has emerged that commercialize this wide-ranging spectrum of prepaid cards across various verticals and industries. Even within a product set, these entities may occupy different positions in the value chain. Collectively they use an extensive assortment of sales, marketing and distribution channels. The result is that prepaid products present tremendous complexities not seen with other types of payment cards.

A. Software as a Service (SaaS)

The software as a service (SaaS) model for prepaid card processing has focused on a single, shared platform approach; whereby third-party processors cater to all of their clients and all of their respective card types and go-to-market strategies with a single software ecosystem managed by the processor. While these platforms may lay claim to flexibility when compared to traditional credit and debit card platforms, they have consistently proven unable to manage the complexities of prepaid. The existing offerings have, therefore, failed to stay current in meeting the technical and operational processing needs of the prepaid card industry as it has matured.

For example, an issuer or program manager invariably requires only a fraction of a third-party processor's shared software platform's capabilities for its particular prepaid card program(s). The unnecessary excesses of the platform result in material challenges for issuers and program managers, such as:

- Increased program management costs
- Platform reliability and scaling hurdles
- Time-to-market delays for product enhancements

As a result of the dominance of SaaS shared processing systems, today's prepaid card industry is dependant on "one size fits all" outsourced platforms. Third-party processing is considered by many to be a material weakness of the industry. This weakness should concern almost all prepaid card issuers and program managers. In the case of general purpose reloadable cards, for example, this weakness prevents achieving the day-to-day processing excellence needed to allow consumers to access critically important funds. At the other end of the prepaid product spectrum, it stands in the way of ensuring the scalability needed for large quantities of gift cards and usage peaks.

In some cases, third-party processors have created client-segregated platforms to overcome the challenges inherent in shared software environments. In the process, they have simply added hurdles typical of divergent code bases, such as ensuring new functionality is made available to each platform branch. The divergence of code creates version management responsibilities in the software development, configuration management and data

center operations. These requirements cause delays in the implementation of new enhancements. If not properly managed, some of the product features are completely locked out from a segregated platform. All of this results in higher costs for all the participants in any given program. As software resources continue to be constrained by budgets and bottom-line focus, code divergence represents a strong barrier to the improvement of many prepaid products.

B. In-House Software

In-house software solutions are often marketed to prepaid card issuers and program managers on the premise that (1) they provide greater control over processing than can be attained with SaaS processing systems and (2) the long-term pricing is lower than offered by third-party processors.

In prepaid, however, in-house software solutions only provide the illusion of control and cost savings. Software solutions available for processing prepaid cards have not generally been designed from the ground up to process prepaid but have been modified from other software offerings (such as credit card processing systems), and retrofitted in an attempt to offer in-house prepaid processing capabilities. As described above, due to the origins of these software systems outside of prepaid, they contain many attributes not required or designed for prepaid. As a result, they are challenging to successfully manage long-term for any breadth of prepaid products sold through multiple channels.

The unused attributes, combined with the legacy nature of these systems, manifests itself in hidden system integration expenses that typically spiral out of control. In addition, they invariably have far greater internal build requirements than originally planned. For example, with the variety of integrations typical of prepaid processing systems, much time can be spent fitting square pegs into round holes.

Software vendors may attempt to address the control issue by providing an open-source license to clients. This solution, however, only enhances the illusion. Offering millions of lines of source code does not provide real control; it simply moves the burden of complex source forking/merging issues, security and quality control to clients. This can be extremely burdensome to prepaid card issuers and program managers, where card brand mandates require the deployment of multiple new releases every year.

Another significant issue with an in-house software solution is scalability. These software systems are not designed for the level of aggregate transaction volume that a prepaid processing system experiences, with the majority of them processing relatively low volume credit and debit card portfolios. Due, however, to the seasonal- and/or marketing-focused nature of some prepaid products, even relatively small portfolios of prepaid cards can experience enormous transaction volume spikes. If transaction management is left to an external relational database management system, as is often the case, such platforms are expensive to scale to any magnitude and are ultimately destined to fail.

In the end, a straight software solution to prepaid card processing can easily be the worst of both worlds: the lack of control of an outsourced third party processor arrangement combined with the technical and operational cost of an internal build.

III. TxVia Approach—Platform as a Service (PaaS)

TxVia offers a new approach to prepaid card processing – **platform as a service (PaaS)** – changing the paradigm and allowing issuers and program managers to remove technology-related hurdles to growth and success. With TxVia’s PaaS approach, prepaid card processing can be completely outsourced to TxVia or deployed entirely in-house by the client, as well as in various hybrid forms that can evolve over time; regardless of the configuration, issuers and program managers using PaaS realize significant benefits. All of this is made possible by TxVia’s use of a model-driven architecture (MDA).

TxVia’s PaaS approach to prepaid card processing better manages the complexities of prepaid across the various products, verticals, industries, organizations and channels. PaaS offers an online platform, complete with the application development, data storage and other tools required to run multi-tenanted, massively scalable operations.

Ours is the first and only PaaS solution for the prepaid card industry.

As part of the TxVia PaaS solution, we offer a graphical modeling integrated development environment (IDE) and fully documented template library with which we (or, at their option, our clients) can quickly and efficiently create highly customized processing platforms to meet the specific needs of each client. Clients may completely outsource their processing to TxVia or bring it entirely in-house. Either way, the limitations of platforms shared with other organizations and products are eliminated, as well as the challenges associated with in-house software solutions.

The IDE can be used to describe a fully integrated, end-to-end prepaid card processing system. Starting with our template library, TxVia or a client can model all individual business requirements with the IDE, including:

- Data flows
- Work flows
- Service level agreements (SLAs)
- Cardholder, customer service, administrative and other Websites
- Web services APIs

Once completed, models automatically generate custom processing platform software in executable object code form. TxVia either can host the newly built platform as a separate operating stack within our data centers, or our clients—or a third party hired by the client—can perform this function. Ongoing, either we or our clients model new features and functionality, facilitating the rapid introduction of new capabilities when they are needed. Enhancements to the shared code base approach used by other processors are driven via a single development and QA pipeline, whereas TxVia allows for multiple pipelines to be used—driven by individual client priorities and engagement.

The modeling environment also can be utilized by us and our clients to monitor the runtime performance of the platform in a visual, intuitive manner—providing never before available transparency into a client’s platform and its operations. Data grids complete TxVia’s PaaS offering.

In addition, TxVia offers a complete set of services to support prepaid card platforms and programs, including: hosting and platform services such as technical and financial operations; managed services such as customer service, fraud and risk management; switch services, facilitating access to third-party functions such as issuing and loading; and professional services.

As a result, TxVia provides a far better outsourcing opportunity for issuers and program managers on a third-party processor basis, with less integration complexity, systems requirements and operational headaches.

TxVia believes a PaaS approach provides a fundamental decoupling of the technology, product and operations value chain so that overall complexity is reduced and organizational parallelism is increased; thereby providing the scale and quality the industry demands at this stage of its development.

IV. Ten Specific Limitations with SaaS and In-House Software; TxVia's PaaS Solutions and Benefits

Below are ten specific limitations that result from the current SaaS and in-house software approaches to prepaid card processing described above. Also included are the ways in which TxVia overcomes these limitations with PaaS and the resulting benefits to issuers and program managers.

1. Limitations on reliability and scalability of platforms

Currently, many prepaid cards do not function at appropriate service levels. As portfolios continue to grow, the ability for platforms to scale is seriously in question, and there is a high likelihood that reliability of platforms will deteriorate further.

The reliability and scalability challenges result, in part, from unnecessary complexities in shared platforms—whether deployed by third-party processors as SaaS or as part of in-house software solutions—where any given client uses a fraction of the platform's capabilities. Processors commingle different prepaid card applications on a single processing system to the detriment of each application. As a result, one type of prepaid card or issuer/program manager is unnecessarily burdened with the technical and operational complexities required by another.

For example, processors that are using a single processing system for millions, if not billions, of settlement dollars each year in support of a general purpose reloadable (GPR) card portfolio for one client frequently find the need to load large numbers of gift cards onto the same platforms in short bursts (particularly during the holiday season or as part of marketing and rebate campaigns) for another client. Not only does this create hurdles in loading gift cards, but the sporadic loads can and do cause the GPR portfolios to operate at below acceptable levels of service. Once loaded, GPR and gift volume cycles follow significantly different relative usage patterns, and therefore can interact on a shared platform in detrimental ways to each other and all other prepaid card products on the platform.

The seasonality of various prepaid card products creates multiple peaks for processing resulting in further challenges to reliability and scalability. A travel card (peak in summer holiday season), a gift card (peak in year-end holiday season) and an FSA card (peak in enrollment period) illustrate the conflicting priorities typical of shared platforms.

With a shared third-party processing SaaS solution or in-house software system, any new functionality introduced for any product or any client is introduced onto a shared code base. As a result, from time to time, this impacts the ability for all products and clients to function at acceptable service levels. Similar to the volume cycle issue described above, product release cycles can interact to the detriment of all.

Serious reliability and scalability issues—both third-party processor SaaS solutions and in-house software solutions—also stem from inherent issues with underlying technology architectures such as the commonplace reliance on relational database management systems (RDBMS) to perform online processing. These technical limitations greatly undermine the scale, functionality and quality of service that these platforms can reasonably be expected to provide in processing prepaid cards now and in the future.

The larger an RDBMS gets, the more disk I/O it takes to read and update records in the database. Whereas a client-specific data store provides high performance and reliable response times, larger commingled databases have greater complexity in the management of data. Backups, restores, all archiving processing and administration take longer causing additional problems in meeting issuer/program manager and cardholder expectations.

TxVia Solutions and Benefits

TxVia's PaaS approach reduces the complexity inherent in each client's platform by eliminating any unnecessary functionality; thereby substantially increasing reliability and scalability.

Where the complexity in any given platform for a client cannot be minimized sufficiently with a single platform deployment, as may be the case if a single client is processing large volumes of GPR and gift cards, TxVia can deploy more than one platform per client. As a result, by leveraging the TxVia solution, sporadic high-volume gift card programs never impact the ongoing functioning of GPR programs, and any new functionality introduced for one product or client will not impact another product or client.

Since TxVia manages complexity in models built on a per client/product basis, the challenges of attempting to manage that complexity in a single shared code base as is the case with SaaS and in-house software are also removed.

To further enhance platform reliability and scalability, TxVia provides an advanced data grid-based implementation that can economically scale online processing capability up to tens of thousands of transactions per second, across terabytes of account-on-file data. The grid approach provides predictability in the sizing of processing capacity to meet the needs of a prepaid card portfolio, the ability to handle peaks and a clear path to cost-effectively increase capacity over time.

2. Lack of development transparency

There is a considerable lack of transparency in the development of both third-party processing platforms and in-house software solutions. These systems are typically the result of a "closed-door" development methodology that does not allow clients to monitor progress, check correctness or involve their own technical resource in the process. Even in the rare cases when clients are involved in the development process, such as being invited to daily scrum meetings, it is generally only for the purposes of project tracking, often on systems outside of the most important core transaction processing components, with little or no visibility into the actual technical work being done.

TxVia Solutions and Benefits

With TxVia's PaaS approach, client platforms are defined within "processing models." Model developers, within either the TxVia or client organization, can work together on the same processing model, sharing efforts and enabling effective and efficient inter-organization communication across TxVia, the client and any third parties. The transparency of this process allows the client to be more comfortable with the current state of both the platform and any necessary development effort, vastly improving communication among all parties and providing higher quality solutions within shorter time frames.

3. Lack of operational transparency; inability to timely track service level breaches

SaaS and in-house software solutions are opaque with respect to their internal operations; when performance problems and error conditions occur, they are difficult to anticipate, difficult to diagnose and require an extensive coordinated effort across multiple parties to identify the root cause and remediate. This lack of transparency can lead to extended service outages and an inability to manage communications effectively with cardholders.

For example, SaaS and in-house software processing systems are not well designed to ensure that failures to meet service levels are identified and reported in a timely fashion. It is typical in the industry today that the first indication of a prepaid card processing issue is the resulting increased call volume in an issuer's or program manager's or processor's call center. Prepaid cards are already challenged in acceptance due to the early stage of the market and interrupted service can slow their rate of acceptance, undermining the entire prepaid card industry. In addition, for an issuer or program manager that offers prepaid cards as part of an integrated product or service, a negative cardholder experience can have fallout on its entire relationship with its customer. Existing platforms are generally not designed from the ground up to meet Service Level Agreements (SLAs)—especially client-specific SLAs—and present numerous technical and operational issues in the tracking, reporting and diagnosis of such issues.

TxVia Solution and Benefits

TxVia is far more transparent in its operations than any SaaS or in-house software system in market. The TxVia modeling environment can be utilized by us and our clients to monitor the runtime performance of platforms in a visual, intuitive manner—providing never before available transparency into a client's platform and its operations.

From an SLA perspective, for example, TxVia provides SLAs as a modeling artifact, with thousands of SLA monitoring points throughout a typical processing system. SLA violations are visualized directly within the running model so that issues can be quickly identified and resolved.

This visualization is not only available to TxVia personnel, but also to the issuers and program managers, enabling accurate and timely messaging and communication to cardholders. TxVia eliminates the "black box" nature of processing that exists today, which gives clients little to no transparency into their processing systems.

4. Inefficient allocation of roles and responsibilities and inability for issuers and program managers to take control; lack of sustained utility of program and product configuration screens

In today's prepaid card market, many issuers and program managers want to undertake greater control over their prepaid card processing platforms, reallocating roles and responsibilities to be more efficient and to reduce the overall costs of managing a third-party processing relationship.

With the traditional third-party SaaS approach and in-house software systems, there is little to no ability for issuers and program managers to take practical and cost-effective control over their platforms so as to have a better allocation of roles and responsibilities between the issuer and program manager on the one hand and processor or software vendor on the other. Instead, issuers and program managers must rely on the "black box" processor or software vendor, where the vast majority of control resides.

The inability for issuers and program managers to control their platforms means they are subject to the limitations of the processor or software vendor. Issuers and program managers, therefore, confront tremendous challenges in attempting to build and integrate functionality or third-party connections into their programs, which are frequently

critical for prepaid card portfolios. The additional systems introduced by issuers and program managers create additional points of inefficiency and failure, and can require issuers and program managers to maintain extraneous personnel and systems.

With many software solutions and SaaS processing environments, any program configuration performed by the issuer or program manager is typically done using web interfaces that create, update and delete information from a data-driven options management system. Such an approach can work well in the short term, but as features are added and the number and variety of clients increase, the complexity of developing, testing and managing such a system explodes. Simply changing an option in a data-driven environment can cause new untested code paths to be utilized within the platform, resulting in reduced performance and unexpected results. In order to be PCI-DSS compliant, developers and QA personnel typically do not have the opportunity to test production option and data sets with new code. Adding new features becomes increasingly cumbersome, reducing time-to-market and increasing change management risk. This exponential increase in complexity management ultimately puts an upper bound on the architectural and operational scale software and third-party SaaS vendors can achieve, and reduces the long-term utility of their options management systems to issuers and program managers.

TxVia Solutions and Benefits

Using the TxVia graphical modeling environment and templates, a client can choose to take control over a range of functions and third-party relationships including:

- feature/functionality
- configuration
- product development and release timing
- run-time instrumentation and visualization
- infrastructure and service levels
- third-party vendors

At TxVia, we offer a range of options for clients to deploy and manage platforms either on an outsourced basis or internally, as well as hybrid options—all of which can evolve over time according to a client's needs. The result is a significantly better allocation of roles and responsibilities and the ability of TxVia to vest differing degrees of control with clients that choose to manage these aspects of the solution.

We categorize the types of control we offer into Platform Creation and Enhancement; Configuration; Operations and Third Party Integration.

- *Platform Creation and Enhancement.* Instead of relying on TxVia to model a client platform, an issuer or program manager can utilize the TxVia graphical integrated development environment (IDE) and templates to create, manage and enhance their platform as and when it wishes. TxVia can assist in the task of transforming a client's business requirements into models, or a client can use TxVia tools and templates and, with appropriate training, take complete control over the introduction of new features and functionality for its platform.
- *Configuration.* TxVia provides a model-driven configuration management system that utilizes automated, rigorous continuous integration testing to reduce risk and increase quality. All option changes entered into the web-based workflow management system go through a barrage of compliance, certification, unit and integration tests before being deployed into the production environment. In addition, model developers and QA personnel can work with production configurations while maintaining PCI-DSS compliance. The TxVia solution also provides for data-driven configuration in the handful of situations where the business case warrants, but TxVia recommends keeping this to a minimum for the reasons noted above.

- *Operations.* Once a client model is compiled into the target processing platform, the executable object code can be deployed into an environment of the client's choosing. While TxVia can host the platform, an issuer or program manager can opt to host its platform in-house or have another third party host it. Also, issuers and program managers are no longer locked into the operational constraints of a third party processor. Now they can choose where and when they deploy their platform, and control who operates the platform and how.
- *Third Party Integration.* With TxVia, clients can choose to control any and all third-party relationships. In addition, clients can integrate into their own servicing centers. Alternatively, an issuer or program manager may choose to use TxVia's switch services for turnkey access to key integrations into third parties such as payment networks, load networks, card production and fulfillment facilities and issuing financial institutions.

5. Inability to appropriately manage costs

With SaaS and in-house software solutions, there are serious limitations on the ability for an issuer or program manager to appropriately manage their total cost of ownership (TCO) in operating a prepaid card portfolio. These limitations result from:

- Issues with scaling a platform such as the inability to effectively integrate the solution with existing infrastructure leading to unmanageable data synchronization issues, API volume and overall system complexity at scale
- Inability to properly allocate roles and responsibilities, and for a client to take a meaningful degree of control
- Inability to scale solution in an economically predictable manner, often requiring a series of large, complex and expensive re-architecting efforts to scale to the next level
- Software tuning that does not yield appropriate results in performance, resulting in escalating costs for hardware installations (faster and bigger CPU's, memory needs and disk technologies can run up costs out of issuers' and program managers' control)

TxVia Solutions and Benefits

TxVia offers a rapid process for defining an entire prepaid processing platform, based upon an individual client's needs, and managing the processing platform on an ongoing basis. The TxVia PaaS solution minimizes the use of a client's internal resources, fits naturally into existing infrastructure, avoids data synchronization work and typically requires substantially less resource than deploying and working with traditional third-party shared-platform processors.

For example, typically when an issuer or program manager requires new functionality or integration with a third party, the processor is too burdened with other projects or system complexity to complete the project on a timely basis. It is much simpler for TxVia, or the issuer/program manager, to extend a TxVia model than create a whole new system/integration/deployment infrastructure to make up for missing functionality at a third-party processor. The underlying model-driven architecture of the TxVia PaaS solution also allows an economically predictable method of scaling to support the exponential volume increases some portfolios require.

The result is more competitive programs that are quicker to market with substantially lower TCO.

6. Inability to timely introduce product enhancements; inability to protect intellectual property

The prepaid card industry is in early stages of market maturity. To keep pace, issuers and program managers must introduce new features and functionality on a consistent basis to create the best prepaid products for the marketplace as well as differentiate their offerings from those of their competitors.

A shared platform, whether provided as a SaaS or in-house software solution, must be a “jack of all trades” and ends up being a master of none. For example, in shared platform environments, a client feature or functionality request might have an architectural or design conflict with other existing functionality used by other clients or products.

Enhancements to a shared code base must be driven via a single development/QA pipeline, leading to all enhancements being tightly coupled across products and clients.

With enhancements needing to be made by a third-party processor or software vendor, any new capabilities go into a shared environment where it is at best challenging, if not impossible, to appropriately maintain any differentiation between the intellectual property of a client and the processor or software vendor. Since the code is embedded into the processing system software, typically the new functionality becomes fungible with the rest of the platform and is offered to any given client’s competitors by the processor. To overcome this issue, in some cases third-parties offering SaaS or in-house software solutions offer exclusivity for functionality, but this is typically limited to relatively short periods of time, ranging from six to 12 months.

Software vendors have even larger challenges in providing their clients updated systems, as there is no central systematic method for managing updates such as that employed with PaaS solutions. Each client update represents a significant IT project for the software vendor, thus forcing the software vendor to aggressively move client customizations into the “base” platform to allow their business to scale.

The alternative approach of an issuer or program manager building functionality itself to protect its competitive advantage adds additional cost and increases the likelihood of reliability and scalability issues.

TxVia Solutions and Benefits

TxVia captures business requirements in models, not in code bases. Issuers and program managers can take control over models to introduce new functionality and have those models remain specific to their platform(s). TxVia templates employ a plug-in architecture, so clients can readily extend off-the-shelf functionality in a simple and manageable way. This sustains their competitive advantages and improves protection of their intellectual property in an industry that is consistently introducing new and innovative capabilities.

The split between the business and technical aspects of a system also allow each to evolve at its own pace, vastly increasing the speed and efficiency of both. Business requirements can be modeled an order of magnitude quicker than would be possible using a traditional software development approach (see Star integration example in Section (V) below), and technical architectural changes can be made on their own merits, independent of the concerns of business logic.

7. Limitations on ability to readily integrate into key products and services providers

As the prepaid market has become more sophisticated, the demand for more services and connections has increased, with new and innovative vendors offering products such as SMS transaction and balance updates,

cardholder identification verification, fraud management, bill payment, Internet person-to-person payments and more.

Once an issuer or program manager wishes to extend internationally to launch products that are issued and operate in other countries, there may also be a requirement to install and certify with regional or country-specific payment networks. Connecting and integrating to these services and networks has, until now, been in lockstep with the limitations of shared platform processors. In contrast, software vendors often see these types of integrations as “base” platform enhancements, which results in longer lead times, far reaching changes in their platform, lack of client control, and ultimately increased complexity and decreased stability that affects the overall client base negatively.

TxVia Solutions and Benefits

Any network integration, such as into Visa or MasterCard, is a complicated software development effort to implement in a scalable, secure and functionally correct way. There can be many variations across these integrations; managing these in a software ecosystem is a significant undertaking. However, they also exhibit a great deal of commonality in areas such as data-flow architecture, security and messaging.

The TxVia modeling environment is designed so these considerations are built into the language, but enough flexibility is provided so all variations can be expressed naturally, and as simply as possible. This results in an efficient description of a network integration that is quick to develop, test, deploy and more cost effective to manage. A developer does not need to worry about the complex architecture, security and scale concerns that otherwise would dominate the development effort and is free to focus on describing the relevant functional requirements. The developer can have confidence that the model compilation process will incorporate the best available technologies and architectures in the generated object code.

The main implementation artifact of the TxVia modeling environment is executable Data Flow Diagrams (DFDs). These DFDs allow TxVia or our clients to more naturally describe and implement system integration tasks, where the focus is typically on data sources, sinks and transformations. This same approach is often used in ETL (Extract, Transform & Load) tools, for the same reason; multiple systems need to be integrated for the purposes of moving, analyzing and warehousing data.

Because integrations are modeled within segregated client processing models, they do not burden a shared code base with complex and varied integration code. This provides a more manageable solution in the long run than otherwise available, since each additional integration within a single code base can significantly increase overall complexity (design/operational/QA/management).

8. Limitations on ability to deploy platforms and programs internationally

While existing prepaid card processing systems may be internationalized with multicurrency and multilingual capabilities (although not all third-party processors have these capabilities), the greatest challenge in deploying a prepaid card processing system internationally is tied to the ability to ensure the system is compliant with local laws and regulations and can be readily integrated into local and regional payment schemes and networks.

The ability to deploy and manage multiple systems installed in different geographic regions and time zones is tremendously challenging for existing third-party processors with large shared software platforms and for in-house software vendors. The shared platform approach that third-party processors use and the challenges of managing an in-house software solution, combined with the lack of any integration modeling solution, create deployment and

architectural problems that limit the technical and operational capabilities needed by an issuer or program manager to expand aggressively into international markets.

TxVia Solutions and Benefits

The TxVia solution has full multi-currency support, including support for client-defined non-monetary currencies such as points or miles. This capability extends from the core account-on-file transaction processing to IVR and both B2C and B2B Website interfaces. In addition, TxVia platforms are fully internationalized (I18N) so they can easily be localized across the countries and regions in which the issuer's or program manager's card portfolio operates.

TxVia's approach to prepaid card processing offers tremendous benefits for international implementations that simply are not attainable with any other processing system. TxVia's tools, templates and generated platforms are designed to be deployed globally. From extensive internationalization and localization support, to deployment flexibility (see (4) above) to integration ease (see (7) above) required for a truly global platform, TxVia's PaaS approach represents the first of its kind in the prepaid card industry.

The deployment and architectural flexibility of PaaS that TxVia brings to issuers and program managers can be leveraged in a number of ways for processing in multiple countries. Per-country and/or time zone-related platforms can be created and managed easily in a loosely coupled fashion. Or the issuer or program manager can process in all markets with a single platform, optionally pinning data within a single global grid to servers resident in different countries to adhere to local data protection/privacy laws and regulations, etc. This type of flexibility is not offered today by third party processors offering SaaS or in-house software providers, and severely limits their ability to expand into these markets.

9. Limitations on life of platforms

Processing systems are typically very large software systems, often with millions of lines of code. The size of these systems present great challenges in evolving them effectively over time, to best make use of emerging technologies, architectures and ideas. This issue is compounded by the relative longevity of card processing systems in general. In the credit and debit card worlds, the widespread use of Tandem and IBM mainframe-based transaction processing systems in the 1970s and 1980s has, despite the inherent cost of these solutions, paid long term dividends. In fact, these "big-iron" environments are still well supported and will continue to exist for decades. The underlying server-based technologies used by the first wave of prepaid card processing systems, however, do not offer the same long-term vendor support, which has become a driving factor in the re-platforming initiatives being undertaken or considered across the industry.

TxVia Solutions and Benefits

TxVia provides a model-driven PaaS solution to prepaid processing. Client-specific processing platforms are systematically generated from processing models in their entirety, allowing new technologies and architectures to be leveraged with a straightforward recompilation of the model. This combines the evolutionary benefits of long-lived mainframe-based solutions with the feature, functionality and economics of a modern systems architecture.

10. Challenges with PCI-DSS compliance

In an Internet-connected world, PCI-DSS compliance is an important consideration for all card processing systems. Many processing systems, including those in the prepaid card industry, were designed and built before PCI-DSS

existed or was required, and have struggled to keep up with these evolving requirements. Specifically, the use of encryption within these systems has been weak or non-existent, and difficult to retrofit. This has increased the operational costs of running these systems in a PCI-DSS compliant manner.

These issues are compounded by the fact that over the past several years, major security breaches in the payments industry have occurred on a regular basis. This has led to changes to the PCI-DSS specification, creating even greater challenges for legacy platforms to keep pace with the latest requirements.

TxVia Solutions and Benefits

TxVia's model-driven architecture supports PCI compliance in a number of ways, most importantly via the model compilation process that allows platforms to adhere to the latest standards via a straightforward recompilation and redeployment process. The current implementation architecture uses AES-256 for all data management, providing the highest available level of encryption for all data within the platform. As new encryption standards are mandated, platforms can be updated in a timely manner. This greatly reduces the PCI-DSS related operational costs of the platform, from storage device management to network security. In addition, all model changes are tracked in a PCI-compliant manner, and the entire tool chain is PA-DSS compliant.

V. Example of Efficiency and Effectiveness of TxVia's Platform as a Service (PaaS) Approach—Integration to Star® Network

Integrating a payment platform into a new payment network can be a complex project, with extensive analysis, development, testing and certification processes. Seemingly minor, subtle differences in message sets can create ripples across the underlying core processing system. In a traditional software environment, the process can take three to six months to integrate a new payment network in such a way to ensure correctness, performance and stability.

The creation of TxVia's Star network integration template involved a fraction of this time. Outside of the initial analysis, the overall implementation and certification process occurred over the course of one week—an order of magnitude improvement in development, testing and certification speed. Star had reserved three weeks for certification alone, as is standard for new platforms joining their network. Despite the high speed development process, the end result was a highly scalable, manageable and self-documented integration template.