

Integrating Mainframe Applications to a Business' Digital Transformation



THE NEED FOR DIGITAL TRANSFORMATION

If you have been in the mainframe industry for the most part of your life, you might be wondering, why is everyone talking about digital transformation lately? Haven't mainframes been in a state of constant evolution for the past 40 years already? What is different this time around that gets everyone in our industry buzzing about digital transformation?

Well, it started a few years back with the likes of Amazon, Uber, Lyft, and Airbnb. Those tech companies managed to fundamentally disrupt the industry by capturing major market shares within just a few years. In some cases, they even managed to put established industry leaders out of business. How did they do that? What was their recipe? What do they all have in common?

Market Sensitivity

First, those companies have been particularly responsive to game-changing market evolutions, for example:

- The pervasive availability of 4G LTE and other high-speed Internet connections
- The pervasive usage of Smartphones and Smartphone apps
- The exploding mobile consumers market
- Geolocation and other new mobile technologies
- The vastly under-tapped part-time workforce
- The growing pool of young and web-savvy application developers
- And the growing arsenal of web development languages, tools, and technologies.

Customer Focus

Industry disruptors have also focused obsessively on customer experience. They have created new customer experiences in their respective markets and are constantly adjusting their products and services to further



improve their customer experience. It only takes one ride with Uber or Lyft to realize how much more convenient those ride services are compared to traditional taxi services.

Web-Centricity

Industry disrupting solutions are resolutely web-centric. They rely exclusively on Web User Interfaces between customers and products or services, and on web service interfaces between product and service delivery components.

Adherence to Agile and DevOps Methodologies

To increase their ability to adapt to changing marketplaces and customer expectations, those industry disruptors have all elected to adhere to the Agile and DevOps methodologies rather than the traditional waterfall development methodology.

Today, unless established industry leaders undergo a similar digital transformation of their business processes, they are bound to be overtaken by the next market disruptors. And IT – including mainframe IT – is at the core of the digital transformation. This is the reason why everyone in the mainframe industry is buzzing about digital transformation.

DIGITAL TRANSFORMATION VS. MAINFRAME APPLICATIONS

Many industry leading businesses still rely on legacy mainframe applications for core transaction processing. It makes their digital transformation quite challenging, because legacy mainframe applications do not have the attributes required to support the type of transformation that would protect those businesses from future disruption:

• They are not natively web-enabled. They rely on TN3270 rather than HTTP connections, and on screen rather than web user interfaces. And their application components invoke each other through program calls rather than web services.



- They are written in COBOL and other legacy languages. Their code is old, complex, and poorly documented. Changes are risky, costly, and painfully slow, and follow the Waterfall development model, which is just about the opposite of Agile or DevOps development models.
- The pool of mainframe application programmers is shrinking, many of them having reach retirement age. The new generations of application developers haven't been trained to work on mainframe applications and are not too interested to learn.
- Consequently, mainframe IT teams can hardly handle regular application maintenance requirements. Changes are limited to "survival maintenance". Functional improvements fall behind. We know of organizations that have two-year, 50-project backlogs for functional improvements.

The bottom line is that legacy mainframe applications cannot accommodate the extensive changes required for a comprehensive business digital transformation, one that includes the reinvention of the customer experience and supporting business processes. Instead the digital transformation will have to be implemented through the development of new web applications and mobile Graphical User Interfaces (GUIs) by web-savvy developers who can leverage the full arsenal of web development languages, tools, and technologies.

The question then becomes: if the business still relies on legacy mainframe applications for core transaction processing, how will those legacy applications cooperate with the new web applications and portals that will support the bulk of the business' digital transformation?

PRACTICAL TRANSFORMATION PLAN FOR MAINFRAME APPLICATIONS

Transformation Alternatives

The different mainframe application initiatives that could be implemented as part of a business' digital transformation include redeveloping, replacing, front-ending, rehosting, and Web-enabling.

Every single CIO or application manager has — at one point or another — considered redeveloping or replacing their mainframe applications. A number have tried. Those projects cost millions, last years, mobilize the bulk of the



mainframe application development team, and do not deliver any benefits to the business until completion. Many of those projects fail. They are not the best approach to address pressing business digital transformation needs.

On the opposite end of the mainframe application transformation spectrum are front-ending and Web-enabling. They result in new Web user and application interfaces while keeping the application's functionalities and code unchanged — at least initially — which makes them the low-cost, low-duration, and low-risk alternatives. When it comes to mainframe application transformation, front-ending and Web-enablement are the safe, high-value early-return-on-investment alternatives.

	Redevelop	Replace	Re-Host	Front-End	Web-Enable
Application Functionalities	New	New	Same	Same	Same
User/Appl. Interfaces	New	New	New	Same	New
Application Code	New	New	Duplication	Impact	No Impact
Risk	High	High	Medium	Medium	Low
Cost	\$\$\$\$\$	\$\$\$\$\$	\$\$\$	\$\$	\$
Timeframe	Years	Years	Months	Months	Weeks



Transformation Plan

The following diagram provides a practical plan to integrate legacy mainframe applications to a business' digital transformation.



The three main web-enablement steps in this mainframe applications transformation plan are Web access, Web modernization, and Web integration.



Web Access

The first step — which we refer to as "Web Access" — consists of replacing the TN3270 connections with SSL-encrypted HTTPS connections, and TN3270 emulation applets and plugins with browser-based 3270 terminal emulation. It then only takes a custom-developed Cascading Style Sheet to give to the old screen interface the look of a modern GUI, without the smarts, obviously.





Web Modernization

The next step — which we refer to as "Web Modernization" — consists of replacing the look of green screen with that of modern webpages, and unassisted data entry with widget-assisted data entry. Widgets such as dropdown lists, checkboxes, and graphical calendars can be selected from one of many JavaScript frameworks. At that stage, the modernized interface can already be served to new or temporary staff members, business partners, clients and even consumers. Those users will think that they are accessing a mobile web application, when they are in fact accessing a legacy mainframe application. Accessing the business' products and services in self-service mode via a modern and user-friendly GUI is a giant step towards improving the customer experience.





The modernization of the user interface can continue with the development of new workflows and the addition of new Ajax-based features – such as autosuggest, autocomplete, PDF generation, aggregation and display of data collected from distributed servers, and emailing. This stage allows to completely redesign and redevelop the customer experience. It turns mainframe applications into key participants in the business' digital transformation.

Up to that point, not a single line of code needed to be changed in the mainframe applications, which kept the transformation simple, fast, and safe.

Screen Elimination

Optionally, the screen interface of transaction programs can be replaced with data area interfaces, such as COMMAREAs and channels and containers, one program at a time. Because it requires modifying the legacy application code, this step is costlier and more time consuming. It doesn't improve the transaction workflow or customer experience per se, but it can improve the response times and CPU consumption by eliminating the overhead of the transaction server's presentation layer. While everyone would prefer to replace their screen with data area interfaces — nobody likes screen scrapping — the reality is that the return on investment for such a costly and time-consuming transformation is oftentimes not there.

Note that a screen interface is not that much different than a data area interface in that when the screens or data areas change, the components using those interfaces must reflect the changes. This used to be a real issue when web and mainframe developments were taking place in separate worlds, as it was responsible for the fragility that gave screen scraping a bad name. But nowadays both web and mainframe application changes can be controlled with the same change management system, which takes most of the fragility of screen scraping away. Furthermore, screen interfaces tend to change less often than they used to 15 years ago. The bottom line is that developing modern GUIs or web services from screen interfaces should be given serious consideration if it eliminates the need to modify the legacy applications, which is a much more problematic alternative.



Web Integration

As discussed earlier, most organizations develop new web applications and portals to deliver a new and improved customer experience, together with the supporting processes as part of their business' digital transformation. Those web applications need to access the mainframe applications for core transaction processing. They do that through interactive bidirectional connections in the form of API based, one-off or reusable, web services that rely on HTML5, XML, JSON, JavaScript, RESTful, SOAP, HTTP/S, SMTP/S, MQ series, and other such technologies. The end-result is a hybrid Cloud with hybrid transaction processing that involves a mix of application components running on the mainframe and on distributed servers.





Now the full complement of front-ending and web-enablement solutions has been deployed to support the business' digital transformation and the new and improved customer experience it aims to deliver.

CIOs' Priorities

What are the CIOs' priorities for the front-ending and web-enablement of mainframe applications, and the business' digital transformation that they are part of? CIOs want to:

- 1. Retain the mainframe apps for core transactions processing
- 2. Migrate from mainframe-centric to Web-centric IT
- 3. Improve the security of Web access to mainframe assets
- 4. Reinvent the customer experience through mobile portals
- 5. Deliver early tangible benefits and a fast improvement pace
- 6. Migrate from Waterfall to Agile/DevOps methodologies
- 7. Switch from mainframe to web developers
- 8. Switch from legacy to modern languages/frameworks

After we have introduced our suggested mainframe application transformation steps and how to implement them, we will review how they meet the CIOs' priorities.



WEB ACCESS

Thin-Client (Browser-Based) 3270 Terminal Emulation

Virtel Web Access is Virtel's base configuration. It functions out-of-the-box as a thin-client browser-based 3270 Terminal Emulator (TE). It serves 3270 screens as standard HTML5/JavaScript pages with 3270 emulation ergonomics to thin client devices straight off the mainframe, without middle-tier servers, through end-to-end SSL-encrypted HTTPS connections. Those webpages can be rendered by any web browser running on any web-enabled device.

Users instantly retrieve the familiar look and feel of the applet or plugin based TN3270 emulator that they have been using for years, including the possibility to record and replay macros, transfer files, define their own display settings, remap their keyboard, cut/copy/paste, and more.



Key Benefits

- Nothing to install, administer, or support outside the mainframe: no middle-tier servers, no JVM, no client applets or plugins
- Works with any device including mobile devices, any operating system, and any browser
- Improves web-to-host access security
 - End-to-end SSL-encrypted FIPS 140.2 and TLS 1.2 or 1.3 compliant HTTPS connections



- No solution components exposed on client devices: no JVM, applets, or plugins
- Host-storage of user-developed macros
- Compatible with Virtual Device Infrastructure (VDI) and Cloud initiatives
- Allows integrating and auto-synchronizing screen interfaces with GUIs
- Eliminates need for third-party session manager and VPN

Customer Story – Global Deployment

Virtel's simpler implementation and universal device compatibility are best illustrated by the story of one of its first customers, a global car manufacturer. In 2003 they decided to replace a costly private SNA network with Internet connections to access an IMS application. With 400,000 users in 150 countries, deploying and supporting an applet-based solution was out of question. They needed a solution that would instantly support any client device used anywhere in the world by anyone of their thousands of business partners, and that wouldn't require installing, administering, or supporting client applets or plugins. Although the term BYOD hadn't been coined yet, they needed a BYOD compliant solution. This is why they choose Virtel. Note that this customer successfully benchmarked Virtel with up to 16,000 concurrent 3270 TE users per product instance, and that they leveraged Virtel's integrated UNICODE conversion facility to support terminals that did not use the French character set of their IMS database, including DBCS terminals deployed in countries like Japan, China, and Russia.

Customer Story – Virtual Device Infrastructure (VDI)

Another Virtel customer manages the largest commercial vehicle fleet in Europe, where they operate in 15 different countries. In 2017, they decided to go 100% Virtual Device Infrastructure with 1500 ultra-light Chrome devices. The only software components installed on those devices are the Chrome operating system, web browser, remote desktop support applet, and Salesforce browser extension. All applications – including legacy CICS and TSO applications are accessed directly from the Chrome browser. Virtel converts the CICS and TSO application screens into webpages served to the Chrome browser. Read their story in <u>IBM Systems Magazine July/August 2018</u>.



Customer Story – BYOD

To remotely access the CICS applications (CRM, policy, rating, marketing, etc.) of this European insurer, agents had to use dedicated workstations leased from and supported by the insurer. The workstations came with IBM PCOMM 3270 terminal emulation software preinstalled on top of highly reputable but expensive hardware. The agents complained that leasing those dedicated workstations was excessively expensive compared to purchasing generic workstations. They didn't like being restricted from using the leased workstations for anything other than connecting to the insurer's applications. Some agents wanted to use Apple Mac workstations and iPad tablets, instead of the insurer's leased Windows workstations. It was becoming critical for the insurer to find a more flexible and less expensive access solution for its agents, a solution that would be both secure and stable. After evaluating several solutions, they selected Virtel, because it offered:

- Secure access to CICS applications from any web browser
- Nothing to install on client workstations: no applet, Java, or plug-in
- BYOD support including Apple workstations and tablets
- No middle-tier servers
- Competitive pricing
- Simple and fast implementation

The insurer initially left the "green screen" presentation and navigation unchanged to avoid changing the application user experience, and quickly switched their 300 independent agents to the new web access solution. Having eliminated the leased workstations, TN3270 emulator, and VPN allowed the insurer and its agents to drastically reduce the application access TCO. Since then, they are using Virtel to:

- Access the host applications from a variety of web-enabled devices including mobile ones
- Convert the legacy CICS application screens to a user-friendly GUI

Read their story in IBM Systems Magazine May/June 2011.



WEB MODERNIZATION

User Interface Modernization

Virtel Web Modernization relies on the same web-centric infrastructure used by Virtel Web Access to provide browserbased 3270 terminal emulation – except that it uses custom-developed scenarios and templates to convert the screen interfaces into modern and user-friendly GUIs thanks to the insertion of widgets and Ajax features. The GUIs are developed with two IDEs: Virtel Studio and Virtel Screen Redesigner. The user interface transformation is extensive:

- Screen presentation, layout and ergonomics is replaced with GUI presentation, layout and ergonomics.
- Unassisted data entry is replaced with widget-assisted data entry.
- Function key navigation is replaced with tab navigation.
- Multiple screens can be consolidated into a single webpage.
- Screen transaction workflows can be replaced new transaction workflows
- New user interface functionalities and features such as autosuggest, auto-complete, PDF generation, emailing, retrieval and aggregation of server-based data, and more, using Ajax
- Different user interfaces (3270 screen, full display GUI, smartphone GUI) can be served concurrently from the same screens.







Key Benefits

- Users believe that they are accessing a modern web application.
- The stigma typically associated with legacy applications is eliminated.
- The mainframe application interface seamlessly integrates with that of distributed applications.
- New transaction workflows can be developed to support new business processes.
- Users don't need to learn the authorized field values any longer.
- Up to 80% of data entry errors are eliminated.
- Training requirements are drastically reduced.
- It is easier to attract and retain younger, as well as temporary and seasonal, staff members.



- Transactions can be served in self-service mode to business partners, clients and consumers.
- It helps grow revenues and market share.
- The participation of mainframe developers is minimal.
- The bulk of development is done with web developers, languages, and technologies.

Customer Story - Agile GUI Development

The agility of a Virtel GUI development is best illustrated with the story of one of Virtel's largest customers, the 10th largest bank in the world:

- In 2005, they deployed Virtel for browser-based 3270 terminal emulation, but with a cascading style sheet (CSS) to give it a look consistent with that of their GUIs. Then they progressively replaced unassisted screen data entry with widget-assisted data entry (dropdown lists, graphical calendars, checkboxes, and so-on) from highly-used to seldom-used screens.
- In 2008, they redesigned the workflow and added Ajax features such as auto-suggest, auto-complete, PDF generation, e-mail generation, access to distributed transactions and data, and more.
- In 2011, having not seen their screens for years, they replaced them with COMMAREAs one program at a time to improve the response times and reduce the CPU consumption.

Until they started replacing the screens with COMMAREAs in their programs, the CICS application remained unchanged by the GUI development. During the screen elimination phase, they were able to proceed one program at a time and without impacting the user experience.

Customer Story - IBM HATS Portal Replacement

In 2013, SysperTec was contacted to replace HATS with Virtel in a GUI development for the Department of Revenue of a European country. After two years of development, the customer had concluded that, whereas developing simple GUI features was relatively simple with HATS, developing complex ones was cumbersome if possible. They also concluded that their HATS' GUI performances were not acceptable.



With Virtel, they were able to develop both simple and complex GUI features and get good response times. As a side benefit, with Virtel they were able to dynamically convert their PCL documents into PDF documents, and to eliminate 3,000 outdated PCL printers and their hefty maintenance costs. This in itself paid for the licensing of Virtel.

WEB INTEGRATION

Web Services

Virtel Web Integration relies on the same web-centric infrastructure used to provide browser-based 3270 TE – except that it uses custom-developed scenarios to convert the screen interface into API based interactive bidirectional web services.

The services are developed with Virtel Studio, an Eclipse IDE that automates the screen flows capture, XML/COBOL conversion, scenarios generation and testing. The scenarios are generated in a scripting language that includes purposely-designed screen manipulation and conditional processing commands. They can easily be modified manually to handle complex situations that fall outside the capabilities of IDE generation.



Key Benefits



- Extremely flexible mainframe applications interface:
 - HTTP/S, SMTP/S, and custom IP servers
 - Visual (CICS, IMS, Natural, etc.) and non-visual (batch) programs
 - Screen and data area (COMMAREA, channels & containers) interfaces
 - VTAM/SNA, EXCI, VXCI, TCP/IP and VIRSV (asynchronous batch program execution)
 - Synchronous or asynchronous mainframe program execution
 - CPU or zIIP mainframe program execution
- Developer-friendly web service development toolset:
 - o Mainframe developer friendly scripting language: easier than JS
 - Most web services can be developed with Studio IDE
 - Can handle not just simple but also complex web services
- Runs on host for superior performances, scalability, and security

Customer Stories – Flexibility

Virtel's flexibility to any type of web integration need is best described with a short sample of customer stories:

- A truck manufacturer deployed Virtel to consolidate their bills of materials from 50 IMS screens each and serve them in Excel or HTML format to engineering workstations.
- A health insurance provider deployed Virtel to integrate a customer-facing WebSphere portal with a CICS application through reusable HTML/XML web services.
- A mortgage company deployed Virtel to call SOAP web services from a CICS/COBOL application.
- The world's 5th largest bank deployed Virtel to create an interactive bidirectional XML connection between COBOL batch and web applications.



- The world's 13th largest financial and banking services organization deployed Virtel to integrate a customerfacing PHP server with a CICS application through HTTP requests in XML format.
- A world-leading provider of financial solutions deployed Virtel to replace outdated SNA/3745 connections with custom TCP/IP connections, while dividing response times by two.

FINAL WORD

CIOs' Priorities

So how do those transformations fare with the CIOs' priorities?

- 1. Retain mainframe apps for core transactions processing
- 2. Migrate from mainframe-centric to Web-centric IT
- 3. Improved security of Web access to mainframe assets
- 4. Improved customer experience with mobile portals
- 5. Provide early tangible benefits & fast improvement pace
- 6. Migrate from Waterfall to Agile/DevOps methodologies
- 7. Switch from mainframe to web developers
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<u>VWA</u>	<u>VWM</u>	<u>VWI</u>
YES	YES	YES
YES	YES	YES
YES	YES	YES
N/A	YES	YES
YES	YES	YES
N/A	YES	YES
N/A	YES	YES
N/A	YES	YES



<u>Virtel Web Access (VWA)</u> — Replacing TN3270 connections and emulators with browser-based 3270 TE and SSLencrypted HTTPS connections meets the CIOs' priorities #1-2-3-5. Because this transformation doesn't require any development, the CIOs' priorities #4-6-7-8 do not apply.

<u>Virtel Web Modernization (VWM)</u> — Developing a modern and user-friendly GUI with Virtel Web Modernization meets the objectives of the business digital transformation and CIOs' priorities.

<u>Virtel Web Integration (VWI)</u> — Developing API-based web service connections between mainframe and web applications makes hybrid transaction processing possible, and in doing so meets the objectives of the business digital transformation and CIOs' priorities.

More Info:

Virtel is published by SysperTec and distributed in North America by Software Diversified Services.

Quality Mainframe Software since 1982

Software Diversified Services delivers comprehensive, affordable mainframe and distributed software with a focus on cybersecurity and compliance. Hundreds of organizations worldwide, including many Fortune 500 companies, rely on SDS software. Our expert development and award-winning technical support teams are based in Minneapolis, MN. For more information regarding Virtel, visit <u>www.sdsusa.com</u> or email <u>info@sdsusa.com</u>.

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