THE STATE OF LEGACY SOFTWARE & MODERNIZATION EFFORTS

AN EVOLVEWARE STUDY
INTRODUCTION

On a U.S. Air Force base in August 2010, a software application used to determine personnel promotions, all the way up through three-star generals, crashed. The program, which the USAF had written in COBOL – a computer language introduced in 1959 – was running on an old, unsupported Oracle platform. The software was out of commission for nearly two months and promotions were delayed.

In the Information Technology industry, this is a horror story meant to scare young computer analysts straight. For their bosses in the public and private sectors, it’s a reminder of the staggering problems presented by out-of-date, undocumented software.

And though legacy software is often taken to mean applications written in decades-old programming languages like Assembler and COBOL, the problem isn’t restricted to ancient software. A programmer using a new language can write thousands of lines of code per day, building a new application in a high-flying modern language. However, budget and time constraints often leave those applications undocumented and in need of extensive ongoing maintenance. This problem grows exponentially over time as applications are modified to stay current with changing industry rules and policies. No matter how you define it, legacy software haunts virtually all corners of business and government.

These issues aren't restricted to bureaucratic or corporate processes. People are exposed to the dangers of legacy software every day.

According to the industry association governing Automated Teller Machines, more than 60% of ATMs' operating systems are Windows XP, which has gone unsupported with new virus and malware updates since its end of life in early 2014, despite prominent security risks. Across the financial, retail, healthcare and government sectors – each of which has suffered data breaches in the past few years – use of legacy software to run mission critical functions is notable.

As organizations continue to ignore their legacy software problem, its associated challenges and costs mount. Often, legacy applications comprise thousands of lines of inactive or “dead” code. These code “wastelands” can obfuscate malware produced by advanced hacking groups, also known as advanced persistent threats (APTs). Aside from severe security concerns, legacy applications require a high level of ongoing maintenance relative to other IT operations, stifling the amount of resources that can be dedicated to innovative efforts.

EvolveWare, a developer of automated software maintenance and modernization tools, surveyed 500 public and private sector IT managers in the U.S. to:

• Gauge the prevalence of legacy applications in organizations today
KEY FINDINGS

- 34% of organizations report that legacy software comprises more than a quarter of their IT environment
- 61% of organizations have employees on staff whose absence would leave a large skills gap around legacy systems
- 45% of organizations have attempted to modernize their IT environment in the last five years, with varying degrees of success

LIVING WITH LEGACY SOFTWARE

Despite the headaches associated with legacy systems, they are used throughout the public and private sectors. A third of organizations have legacy systems making up more than a quarter of their total IT environment. As companies grow, both by size and IT budget, so does the share of legacy systems relative to their application ecosystem.

41 percent of organizations with a yearly IT budget over $500,000 report a substantial number of legacy programs in their IT environments, compared to 27% of firms with smaller budgets. Legacy software accounts for greater than 25% of all programs in 43% of medium to large organizations (those with more than 500 employees.) For smaller organizations, this proportion drops slightly, to 25%.

Underpinning the broader legacy software challenge, however, is documentation. Two-thirds of respondents cite having software that lacks up-to-date documentation – whether it's new or legacy – indicating that organizations are not aware of their systems' true functionality. Almost all legacy applications in use have insufficient documentation, leaving IT departments to speculate the exact nature of the business rules the programs are implementing, and which lines of code are now obsolete or "dead."

Organizations can't hope to maintain or modernize their systems without accurate, up-to-date documentation of their business rules and the code that enables them. Even with partial documentation, important components of an existing system's functionality are unknown. These programs require in-depth audits in order to be maintained efficiently and primed for future business rules extraction and modernization.

• Determine what challenges legacy software poses to IT departments, and
• Understand how far organizations have come in their modernization efforts
A Diverse Set of Burdens

Overall, IT managers recognize that legacy software presents various challenges to their organization, with some threats taking precedence over others.

<table>
<thead>
<tr>
<th>Top 5 Challenges Associated with Legacy Software</th>
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<tr>
<td>1. Security vulnerabilities</td>
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<td>2. High cost of maintenance</td>
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<td>3. Lack of staff with legacy IT skills</td>
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<td>4. Disparate systems that can’t be integrated, and inhibit company innovation</td>
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<td>5. Customer service issues</td>
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Security Vulnerabilities Abound

Security vulnerabilities remain a constant concern, with inactive code serving as havens for malicious third parties and sovereign hacking operations to inject malware.

“Legacy applications are quickly becoming the Achilles’ heel for both U.S. businesses and government agencies,” says retired Lieutenant General William T. Lord, former U.S. Air Force CIO. “Some of the country’s most critical transactions and resources – from payments to power generation – run on infrastructure that’s susceptible to legacy vulnerabilities. In 2009, the news media reported that malware was embedded in East Coast power systems, threats that could disable major population centers.”

Legacy or undocumented software presents particular security concerns when it is associated with national defense and industrial systems. SCADA and Industrial Control Systems run large-scale manufacturing, utility and industrial systems like hydroelectric dams and electric grids. That software is often crucial to the stability of national infrastructure networks and, in its current state, most of it is written in outdated, undocumented code.

Well-publicized cyber-attacks on Iran’s nuclear operations by Israeli and U.S. groups were made possible by targeting outdated ICSs. To ensure that U.S. infrastructure is not successfully attacked in a similar manner, the modernization of government and business software should be a top priority at home.
So why aren't we fixing it?

It's a Catch-22. Lack of software documentation, which is especially true in legacy systems, leads to higher maintenance costs. The expense of sustaining legacy systems relative to their modern counterparts is a drag on time and resources, preventing organizations from tackling more ambitious projects like business rules extraction or modernization. Further, as the next section illustrates, the high cost and rarity of legacy software experts places increasing pressure on hiring and budget allocations.

“Take the Air Force. After spending six years and around $1 billion, USAF abandoned an initiative that was supposed to eliminate around 300 legacy programs,” says General Lord. “Now, the Air Force continues to devote time and resources to maintaining nearly 20,000 decentralized, outdated applications.”

It seems clear that this unending cycle of legacy software struggles is rooted firmly in a lack of system documentation. Without proper documentation, any amount of time or money spent maintaining legacy software is unproductive. This lack of visibility into the inner workings of legacy systems makes them difficult if not impossible to modernize, creating an atmosphere of perpetual stasis.

Top Areas of Organizations' Software Environments that require “Fixing”

| 1. Systems are becoming obsolete |
| 2. Lack of staff with in-depth knowledge of systems |
| 3. Too many disparate systems |
| 4. Systems need to be modernized/placed on a common platform, e.g. an ERP solution |

These problems (and eradicating them) become more difficult as an organization’s IT environment grows. 51 percent of medium and large organizations suffer from an abundance of disparate software systems, and are more likely than their smaller counterparts to cite costs as a primary obstacle to modernization efforts. In comparison, small organizations tend to be most worried about security vulnerabilities posed by legacy software.

The difference in focus is likely due to more diverse software portfolios: large organizations are more likely to have highly complex software components, with more lines of code and a corresponding number of business rules that must be addressed. Larger organizations often busy their IT staffs with one-off tasks that require “immediate” fixing, leaving them little time to coordinate the strategic efforts required to address the legacy conundrum. Unfortunately,
the longer an organization delays in addressing its legacy software elements, the more difficult the final modernization process is likely to become.

To escape this cycle of maintenance minus progress, organizations must correct the most problematic elements of their legacy systems, namely obsolete functionality, in-house knowledge gaps and the prevalence of fragmented systems.

**AN ENDANGERED SKILL SET**

Beyond the security and financial pressures that legacy software places on corporate IT environments, lies the issue of human capital. Many organizations already struggle with the lack of available talent to fill emerging IT jobs around Big Data, mobility and cloud computing. Organizations still clutching on to their legacy systems struggle with a separate skills gap.

61 percent of IT managers have employees on their staff whose absence would create a significant knowledge gap in regards to legacy software. This number increases to 64% for medium to large organizations, and 66% in organizations with annual IT budgets above $500,000.

**Help Wanted**

Decades-old programming languages such as COBOL and Assembler continue to power critical business operations worldwide, while universities and training programs have evolved to focus more on modern languages such as Java, Linux and C#.

As Baby Boomer IT professionals with the requisite experience to maintain legacy software begin to exit the workforce, there are few viable candidates to take their place.

This lack of competent resources has resulted in only 27% of organizations hiring new personnel with legacy software skills over the past five years. Instead, many organizations are likely opting to outsource legacy software maintenance, often at higher costs.

Looking at large organizations and those with substantial IT budgets, little has been done to solve the systemic legacy challenge. Only 40% of organizations with more than 500 employees, and 39% with IT budgets over $500,000, have hired legacy skills over the past five years. From these findings, it appears that having a bigger staff or IT budget does not directly translate to increased software optimization or modernization. If anything, these organizations are allocating additional resources towards short-term fixes, not long-term solutions.

**A Bleak Hiring Outlook**

Given the available talent pool, it’s not surprising that only 17% of IT managers expect to hire personnel with legacy software expertise in the next five years. Large organizations and those with larger IT budgets are marginally more determined, with 23% of IT managers from each group planning to bring legacy skillsets in house through 2019.
Aside from the lack of skilled candidates, another factor that could be contributing to this hiring hesitancy is the rise of IT outsourcing. More organizations today rely on (or are considering) third party experts for maintaining new and legacy software. A 2013 MarketsandMarkets report found that the global managed IT services market would grow from nearly $143 billion in 2013 to over $256 billion by 2018. A notable slice of outsourcing contracts include ongoing management and testing of enterprise software applications, diminishing organizations’ impetus to bring these skill sets back in house. Despite these seemingly successful arrangements, managed service firms are beginning to grapple with the same dwindling talent supply their clients face today.

(SLOWLY) MOVING TOWARDS MODERNIZATION

A significant number of IT managers have already pursued legacy software modernization projects, with varying results. 45 percent of respondents have pursued a modernization initiative in the past five years.

Overall, 80% of this group considers their initiatives a success. These efforts have proven to be more effective for smaller organizations, whose systems often contain fewer lines of code and business rules. 89 percent of IT managers at small organizations rate their modernization initiatives as successful, compared to 77% of managers at medium and large-sized organizations.

Considering the number of large mission critical systems that are still legacy, one can speculate that these programs have not been selected for effective optimization or modernization to date.

Why?

Time, Costs, Fear of Failure, Deter IT Managers Away From Change

To an extent, organizations are waking up to the risks posed by legacy software. More importantly, some are beginning to budget for real solutions. Almost one in three (30%) of respondents have plans to pursue legacy software modernization in the next five years.

Money, however, remains a primary obstacle between organizations and their pursuit of software transformation. 37 percent of IT managers cite costs as their organizations’ main reason for not undertaking modernization projects. These cost concerns likely include more than just the expense of application modernization. Time wasted is money lost; lengthy project timelines and delays each inflate the price of software initiatives.

Due to a handful of highly publicized software modernization failures, public and private sector organizations fear the added financial burden of a botched initiative. In 2012, for example, the U.S. Air Force infamously scrapped a six-year, $1 billion modernization project after realizing that an additional $1 billion was necessary to achieve one-quarter of its planned results.
The underlying problems in these examples, and often in larger organizations that attempt modernization, is a lack of automation and an imperfect process. In an effort to “just bill,” large vendors frequently guide clients to dive head first into software modernization without any prior due diligence (e.g., documentation, analyzing what functionality exists in the application, etc.)

Performing these steps simultaneously with the actual application overhaul – or skipping them altogether – complicates an already intricate exercise, resulting in cost overruns and missed deadlines. These consequences are magnified in medium and large organizations, 81% of which report instances of outdated software documentation, compared to 62% of smaller organizations.

**THE STATE OF LEGACY SOFTWARE: INDUSTRY COMPARISONS**

From banks and retailers to the U.S. military, legacy software is a shared struggle, albeit with unique differences depending on the industry. While no sector is immune to the costs and risk associated with legacy software, it is clear that some are adopting a more proactive stance on the issue than others (and with varying degrees of success.)

**Similar software environments, different perceptions of the problem**

Among the five major industries represented in this survey, retail/wholesale IT managers are the most likely to report legacy software in at least a quarter of their organizations’ IT environment (59%)—almost twice the 34% average. The financial services, manufacturing and government industries show above-baseline prevalence of legacy software, at 50%, 46% and 45%, respectively. Only 28% of healthcare respondents report that legacy applications comprise a quarter or more of their environments.

Looking specifically at outdated software documentation, the picture shifts. 45 percent of government IT managers report that at least a quarter of their software applications do not have current documentation, compared to the 31% average. The breakdown is similar for manufacturing and retail organizations, at 42% and 41%, respectively. Only 30% of financial services respondents cite the same documentation concerns.

When asked which area of their organizations’ software environments is most desperate for a solution, respondents from almost all of these industries have different thoughts.
Making Modernization Progress

Organizations across these core industries are exerting notable efforts to eliminate legacy software.

### % Industry Respondents

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<thead>
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<th>Primary area of organizations’ software environments in need of a solution</th>
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<tbody>
<tr>
<td>55%</td>
<td>financial services</td>
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<tr>
<td>66%</td>
<td>government</td>
</tr>
<tr>
<td>46%</td>
<td>healthcare</td>
</tr>
<tr>
<td>58%</td>
<td>manufacturing</td>
</tr>
<tr>
<td>53%</td>
<td>retail</td>
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</tbody>
</table>

### Primary Area of Organizations’ Software Environments in Need of a Solution

- **Too many disparate systems**
- **Obsolete systems**
- **A lack of software-inclined talent**
- **Modernizing and moving systems to a common platform**

**Making Modernization Progress**

Organizations across these core industries are exerting notable efforts to eliminate legacy software.

### Persued Modernization in the Past 5 Years (Baseline = 45%)

<table>
<thead>
<tr>
<th>Persued modernization in the past 5 years</th>
<th>Plans to modernize in the next 5 years (Baseline = 30%)</th>
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<tbody>
<tr>
<td>60% financial services, insurance, RE</td>
<td>44% retail/wholesale</td>
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<tr>
<td>59% healthcare</td>
<td>40% manufacturing</td>
</tr>
<tr>
<td>58% government</td>
<td>32% healthcare</td>
</tr>
<tr>
<td>58% manufacturing</td>
<td>31% government</td>
</tr>
<tr>
<td>47% retail/wholesale</td>
<td>31% financial services, insurance, RE</td>
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CONCLUSION

Based on EvolveWare’s research, it’s clear that legacy software remains a nagging, at times crippling, challenge for businesses and government agencies alike. Even when accounting for one quarter of an IT environment, legacy software funnels dollars away from more strategic spending, puts critical corporate data at risk, and creates a precarious staffing dilemma.

The data also shows that failing to document changes in an application’s code is a chief obstacle to affordable maintenance and modernization efforts.

Comparing the findings from small and large organizations, it becomes apparent that legacy software challenges scale with size and IT budget. The more disparate systems and incomprehensible lines of code living in an IT environment, the more daunting the challenge, proving that successful modernization is not simply a matter of expense.

Fortunately, these issues are not lost on IT managers. Organizations are pursuing modernization, albeit not always the right way. The modernization process shouldn’t be a matter of things getting worse before they get better. Instead, it must be a phased approach that restores IT managers’ understanding of what their applications do, and provides stable ground for future software innovation.

Modernization isn’t, and can’t be, an overnight fix. It requires organizations to do their homework, uncovering the good, bad and unknown information living in a piece of software—before taking any action to change it.

The ultimate solution will depend on what’s found lurking in an application, and the resources available to the organization. For some, the answer could be optimizing the code on its current platform; for others, it could be a total migration to a new system. Regardless, the goal is to free organizations from legacy software’s strain on resources and security, allowing them to focus on future innovation rather than historical upkeep.
Sources


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