Key Factors to Improve the Modernization of a System within the Military

Abstract

This paper aims to determine how organizations can modernize their systems at a faster pace than their military counterparts. We identify the key contributors to the commercial non-DoD organization's accelerated pace. We summarize with solution ideas to aid DoD organizations in determining the modernization process. Modernization, as used in this paper, refers to updating a legacy system. Legacy refers to software or hardware that is no longer supported by the organization or the vendor. A system refers to all hardware nodes, software, and networking and network interfaces.

Different Approaches to Modernization

The commercial sector and the government sector approach modernization in vastly different ways. The commercial sector focuses on the end goal in terms of cost savings that will be seen once the system is modernized, the life of the technology, and the efficiency of the IT processes they are modernizing. They do not focus on the initial cost to modernize over the end game. Commercial companies are also more apt to use a third-party tool rather than create their own tool; thus, saving time and resources to maintain the tool. The government far too often relies on their own custom-built IT tools. By the time these custom tools have been developed and deployed, they often are no longer useful. For the tools that are useful, they must continuously be maintained, and the organization must train new administrators of the tools as the administrators come onboard[1].

Use-Case for Commercial Organization

A large US-based life insurance and investment company modernized three large applications in six years[2]. The company had struggled with legacy systems which had been brought onboard through mergers and acquisitions over many decades. Half of their 13 policy administrative systems were outdated. Almost 70% of these legacy systems posed potential business risks. The company hired Cognizant to modernize their systems over a six-year period. Within the first two years, two of their systems had been modernized using a Business Process as a Service (BpaaS) approach hosted by Cognizant for a specified time. This solution resulted in the company saving money, protecting its intellectual property, and boosting its technical currency. By the end of the sixth year, all applications were modernized. This resulted in a 20% reduction in operating costs, 46% reduction in price per insurance policy, and they were able to consolidate 13 policy administration systems to a single platform[2].

Use-Case for Military Organization

In contrast to the speed of the commercial company's modernization; G2 Ops has observed military entities taking as long as four years to complete an integration of one system into an existing system-of-systems within the DoD environment. This includes the processes of requirements gathering, fielding, logistics planning, training, and implementation.

One of the largest contributors to a DoD organization's time-consuming modernization process is that commercial companies are not required to certify their systems. For instance, when updating a lab environment, a DoD entity must ensure all lab administrators are fully trained and certified. On the other hand, a commercial organization has the option to hire personnel solely based on their technical experience. Secondly, a DoD organization cannot purchase equipment without prior authorization. They must follow the acquisition process of securing bids, selecting qualified vendors, and waiting for the equipment to be delivered. Once received, the organization's equipment must comply with the Security Technical Implementation Guide (STIG) and security requirements.

The accreditation processes required by DoD organizations can provide a bottleneck in the modernization process. New software and hardware must be on the Approved Products List (APL) before it can be purchased and installed. DoD Instruction 8420.01 establishes policy and provides procedures for the use of commercial Wireless Local Area Network (WLAN) devices, systems, and technologies that must be followed. The Defense Acquisition Guidebook Chapter 10 – Acquisition of services[3] defines the required processes and procedures of a DoD organization in order to purchase new technology. The DoD Information Assurance Certification and Accreditation Process (DIACAP), outlined in DoD Instruction 8510.01, defines the risk management process required. These are just a few of the processes needed to modernization a system. If the platform manages Secret or Top Secret data, the process may take even longer due to the classification.

Approaches

The procedures and policies are not something a DoD organization can change. However, there are some take-aways from the commercial world that could be implemented to assist with expediting the rest of the modernization process. One such approach is to choose the best modernization approach to take based on the organization's needs. Listed below are the five modernization approaches: the Revolutionary Method, the Evolutionary Method, Migration and Enhancements, Correction and Growth, and Complete Software Re-engineering. The last three approaches are determined as a result of analyzing the steps presented in table 1[4].

Technologies Analysis	Identify and analyze the technology stack of an existing system. Determine the programming language and framework used to determine relevance.
Architecture Audit	Conduct and architecture audit. Define the system elements needing modernization.
Code Review	Perform a code review to assess the quality and "updateability" of the system's source code.
UI/UX Review	Perform a UI/UX review to assess the quality and "updateability" of the system's interfaces.
Performance Testing	Perform a performance test to determine potential issues with the legacy system.
Current Requirements and Opportunities for future growth	Look for opportunities for future growth while considering current needs and requirements.

Table 1: Modernization Step Analytics

1. The Revolutionary Method

This method revolves around developing and conducting a legacy system replacement strategy. Its implementation requires shutting down the old system and building a new one from scratch. Sometimes it is better to retire the system completely to avoid some serious damage, such as, security breaches, lost data, and system downtime. The revolutionary method can also be applied when the original product no longer supports business requirements. Therefore, re-engineering or porting is not an optimal strategy.

2. The Evolutionary Approach

This approach presupposes a systematic, step-by-step software modernization process. This approach fixes the system parts as they break or are no longer useful. It is usually less painful; it does not disrupt the major business processes and introduces significantly lower risks for the company. Yet, it often turns into a band-aid approach, where you focus on solving the problems instead of removing the factors that cause them.

3. Migration and Enhancements

This approach is used if you determine in the UI/UX review that your interfaces need updating. It is also the best approach if you detect areas of future growth potential while considering the current requirements. Migration and enhancements are the easiest way to make sure your product will keep serving your needs now and in the future. It pre-supposes the system migration (typically re-hosting using cloud solutions or test labs) and some minor enhancements. This includes UI/UX updates, performance optimization, and database migration. This method has a number of limitations. One to mention is that the core business logic and architecture mostly remain unchanged, as this type of change requires a more invasive approach.

4. Correction and Growth

This approach is used if it is determined, while performing an architecture audit, that the parts of the system are not functioning well and need to be modernized. During the audit, it will be seen how different parts of the system interrelate and an understanding will be gained of how future changes will not affect the whole product. Correction and Growth is also used if a code review is performed, and a determination is made that parts of the software have become stale and/or unreliable. If the product technology stack is relatively modern and does not represent a threat for future product growth, modernization can involve some minor enhancements/corrections. This might be architecture optimization or code refactoring, UX updates or performance optimization without significant changes in product business logic. As soon as the product is up to date, more features can be added. These might be third-party integrations or custom-built modules.

5. Complete Software Reengineering

This approach is used if a technology analysis is performed and it is determined that the software and/or hardware is found to be outdated or no longer supported by the vendor. Re-engineering may also be used if poor performance is detected during a performance test due to major flaws within the system. This method requires identifying the features that are still crucial to the business and the ones that are no longer used or required. After that, the required features are prioritized and modified if needed. Taking the legacy system as a base, the team creates an up-to-date product with matching capabilities, better performance, look and feel, modern technologies, and scalable architecture. Depending on the functionality analysis and prioritization, the new product might 100% match the previous version in terms of functionality or lack some features that are no longer required/used.

Modernization Checklist

Another useful tool is a checklist to use while planning for a modernization. This will ensure the process is continually progressing. In Table 2, we provide a sample checklist from AltexSoft, a technology consulting company that has been hired by over 300 businesses to improve their systems[4].

1. Assess the current state of legacy systems.	Review the code and architecture's visual look and feel, considering future business plans for product growth.
2. Select the modernization method that would be the fastest to deliver value.	Choose the modernization approach that best fits company needs based on step 1. Consider existing products you can use instead.
3. Rethink the architecture and prioritize for simplicity.	Implement only the most important features. A microservices approach aids with scalability. Ensure all applications will work well together. Keep requirements in mind when building the application.
4. Choose the technology stack to deliver optimal performance and user experience.	Ensure you use a solid and future-ready technology stack based on the product specifics.
5. Document for future system growth.	Introduce a set of coding standards and internal processes that make the software easy to understand, extend, and maintain in the future.
6. Create a separate support and retirement schedule for your legacy system.	Document and archive solutions to easily access and refer to them when needed. Legacy systems will need support until they are replaced, plan for this and for retiring legacy system once the new system is up and running.
7. Budget for training and system updates.	Invest in staff training for better performance and efficiency. Plan for regular system updates.

Table 2: Modernization Checklist

Summary

There are several key differences between DoD organizations and Commercial organizations. Some differences cannot be changed while others present opportunities to introduce efficiencies in the modernization effort. Table 3 lists some of the main differences between the two organizations.

DoD Organizations	Commercial Organizations
Strict scheduling and time constraints due to deployment schedules.	Flexible scheduling and relaxed time constraints.
External STIGs, DIACAP, compliance requirements required when updating IT systems.	Internal compliance requirements, only requires C-Suite approval.
Staffing requires training individuals and certifying the administrators.	Staffing requires hiring qualified and certified personnel.
Timely acquisition process.	Streamlined acquisition process.
Forced modernization due to lack of support by the vendor or DOD.	Modernization is performed as often as necessary to maintain a competitive advantage.

Table 3: Key Differences between DoD and Commercial Organizations' Modernization Process

References

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