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TECHNICAL NOTES

THE VALUE OF TRUE OPEN FRAMEWORKS VS. FRAMEWORKS OPEN IN NAME ONLY

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NOT ALL "OPEN" FRAMEWORKS ARE ALIKE — THEY NEED TO BE EASY AND COST-EFFECTIVE TO UPDATE, AND DESIGNED FOR THE MISSION

Because open frameworks can be updated so seamlessly, they give defense organizations the ability to quickly keep pace with changing missions, emerging threats and new technologies. Compared to more traditional approaches, open frameworks help make defense organizations far more adaptive and proactive. A growing number of defense organizations are now taking advantage of open frameworks in highly classified, mission-critical systems, supporting a broad range of applications — from upstream sensor processing to downstream analytics.

However, it is difficult to achieve the benefits of open frameworks unless they are truly open, rather than open in name only. Too often, defense organizations find themselves with "open" frameworks that are hard to update and don't have the flexibility they need to be adaptive and proactive — and the goal of an open framework is lost.

What Is an Open Platform?

In an open platform, the various components — such as mission applications, shared services and underlying technologies — are modular and largely independent of one another. This allows organizations to plug-and-play the components, easily switching them in and out as needed. For example, an organization may want to add a new application to meet a new mission need, or replace an older technology with a new and better one. This is difficult to achieve with closed platforms, where the components tend to be closely tied to one another and cannot easily be separated out.

Another key characteristic of open platforms is that the elements of system governance — including the concept of operations (CONOPS), business model and data models — are not hardwired in. This enables organizations to make changes to those aspects of governance without major rework to the system. With a true open framework, as the mission evolves, the framework evolves with it.

Open Internally — Not Just at the Edges

It's not enough for frameworks to be open just at the edges, using open interfaces to connect with applications and other systems. With true open frameworks, the internal components are open as well. The shared services that support the applications — such as security, status and health, and monitoring and control — are modular and loosely coupled. This makes it easy to extend or enhance existing services, or to add new ones. At the same time, the underlying technologies are abstracted from the services — making it possible to easily and rapidly replace the technologies as necessary.

True open frameworks are able to achieve this by using approaches that promote loose coupling and modularization. They often also leverage some of the most advanced open source software (OSS), as well as best-of-breed commercial and government off-the-shelf products (COTS and GOTS). This gives defense organizations the ability to quickly and cost-effectively adapt to changing mission and user needs.

Some frameworks may be open at the edges but tightly closed internally. This particularly can occur when frameworks have been transplanted and repurposed from other commercial or mission systems. These frameworks often come with more restrictive design patterns and technologies that predate the kinds of newer approaches — such as microservices — that enable loose coupling and modularization.

When the internal components are so tightly coupled, if a change is made to one, the entire framework must usually be changed. Because this is such an expensive and time-consuming process, these internally closed frameworks essentially deny defense organizations the speed and agility needed to rapidly adapt to change and become proactive.

Adaptable to a Changing Mission

Another hallmark of a true open framework is that the system's concept of operations (CONOPS), business logic and data models are not hardwired in. Rather, they are abstracted from the framework so they can be easily enhanced, or extended, with new mission threads and applications. With a true open framework, as the mission evolves, the framework evolves with it.

This is difficult to achieve when the system CONOPS, business logic and data models are hardwired to the framework, which is often the case when older frameworks are transplanted to new missions. Those frameworks frequently come hardwired with their original CONOPS, business logic and data models. These all have to be completely refactored, or restructured, at the outset to support the new mission — but the new elements are typically hardwired in as well. This hardwiring makes it difficult to extend the framework to keep pace with a changing mission.

There is yet another problem with the hardwiring. Because the original system CONOPS, business logic and data models are so deeply embedded in every crevice of the framework, it's virtually impossible to completely refactor them. As a result, elements of the older system tend to persist into the new system, remaining alongside the new CONOPS, business logic and data models.

But systems cannot serve two masters, and this unfortunate hybrid hampers the framework at every turn. Programmers often try to sidestep the problem with unwieldy workarounds, or through shortcuts and compromises that make the framework less efficient. But even with these efforts — and sometimes because of them — the frameworks are typically riddled with technical debt, dead code and hidden defects that become dangerous time bombs.

Providing Full Value from Data

It is critical that open platforms are data agnostic and data centric, so that defense organizations can get full value from their data to create new mission capabilities. For example, in a typical application pipeline, each application creates an intermediate data product that is then handed off to the next application down the line, until a final data product is produced. These intermediate data products can be particularly valuable, and organizations often want to use them in new sets of applications to create new capabilities.

With open platforms that are data agnostic and data centric, intermediate data products can easily be exposed, or made available, and then leveraged by any application or pipeline. This is one of the key ways that true open frameworks help defense organizations keep pace with changing threats and missions. Defense organizations can take what they've learned from the data in one area and quickly apply it to any number of other areas.

However, with frameworks that are not data agnostic and data centric — often those that are transplanted — it is difficult to expose intermediate data products to create new mission capabilities. And so all too often, a promising new application pipeline — and new capability — is never added.

Why True Open Frameworks are More Cost-Effective

Because true open frameworks feature internal components that are modularized and loosely coupled, as well as abstracted technologies, system CONOPS and other elements, change is localized. Organizations can rapidly and cost-effectively add or extend services, or replace technologies, without affecting other components.

However, frameworks that are not truly open are far more expensive to operate and maintain. With tight internal coupling and hardwiring, even small changes create a ripple effect, and often the entire framework frequently has to be refactored. This can become extremely costly over the lifetime of the system. By contrast, true open frameworks have a substantially lower lifetime system cost.

Leveraging Advanced Approaches — and the Right Expertise

Even when frameworks are designed from the outset to be extensible and adaptable, they still may not be truly open. To create open frameworks in mission-critical systems, organizations need to bring in best practices from across the defense community in modern software development methods, including rapid prototyping and agile development. And because the open frameworks need to operate in highly classified environments they require the latest and most sophisticated cybersecurity approaches, such as automation and orchestration (A&O) and anomaly detection with advanced analytics.

Booz Allen Hamilton's experience in this field has shown that both mission and software experts must play an equal part in developing open frameworks

And yet while all these steps are essential, they're still not sufficient. Creating a true open framework requires yet another, equally crucial step — one that is often overlooked. The technologies and the processes can only be brought together with the right combination of mission expertise, software expertise and user input.

The path to achieving this is not always clear. Some organizations say that while mission expertise is important in developing applications, the framework itself should be built by software architects. Other organizations take the opposite view — that software architects aren't needed for frameworks at all. They argue that the mission experts who build the applications, such as electrical or aerospace engineers, can handle the frameworks as well.

Booz Allen Hamilton's experience in this field has shown that both mission and software experts must play an equal part in developing open frameworks. Mission expertise is needed to make sure that the framework provides the necessary capabilities to support all mission application and user needs. There are untold details that cannot be captured in requirements specifications — and that only mission domain experts will understand.

At the same time, software architects and engineers are best suited to design the open framework — they have the knowledge and experience to take advantage of the latest technologies and design patterns. Without that software expertise, so-called "open" frameworks tend to remain tightly closed. And user input is just as critical. If the open frameworks don't meet their needs — if, for example, the user interfaces are too confusing — the frameworks won't be used, or they'll be used improperly.

Getting the right combination of mission experts, software architects and users is both an art and a science. All three groups not only have to be on board, they have to collaborate closely with one another, almost as one mind. It's important that they work closely throughout the entire process of building and implementing open frameworks, from creating a common vision to the continuous prototyping to extend and add mission capabilities. As the three groups learn from one another and build trust, they integrate their perspectives and expertise. They take a shared approach to a shared vision. This collaboration paves the way for them to bring in the third-party application developers. All work toward a common purpose.

Bringing It All Together

Defense organizations are well positioned to develop truly open frameworks for highly classified, mission-critical systems. It is both practical and cost-effective to build frameworks with the most advanced technologies and approaches — and for the mission at hand. And by bringing all these elements together with the collaborative power of mission experts, software experts and users, organizations can create frameworks that will help them be more proactive and adaptive as they stay ahead of rapid change.

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