

An Overview of Plateau Systems' Product Architecture

Best Practices in Action

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Executive Summary

Among the many criteria your organization uses to select an enterprise software product, a major consideration should be the underlying architecture of the software. Even if your users or technical staff will never "touch" this element of the product, you want assurance that the software has the strongest possible foundation for security, scalability, extensibility, and adaptability to your business needs.

This white paper describes the Plateau Systems' Architecture. At Plateau, we have put hundreds of developer-years into creating the most advanced architecture in the Talent Management space. Our architecture is built upon proven dependable building blocks, as well as the latest seminal technology that is changing the way software is developed and maintained. Key elements of the architecture include:

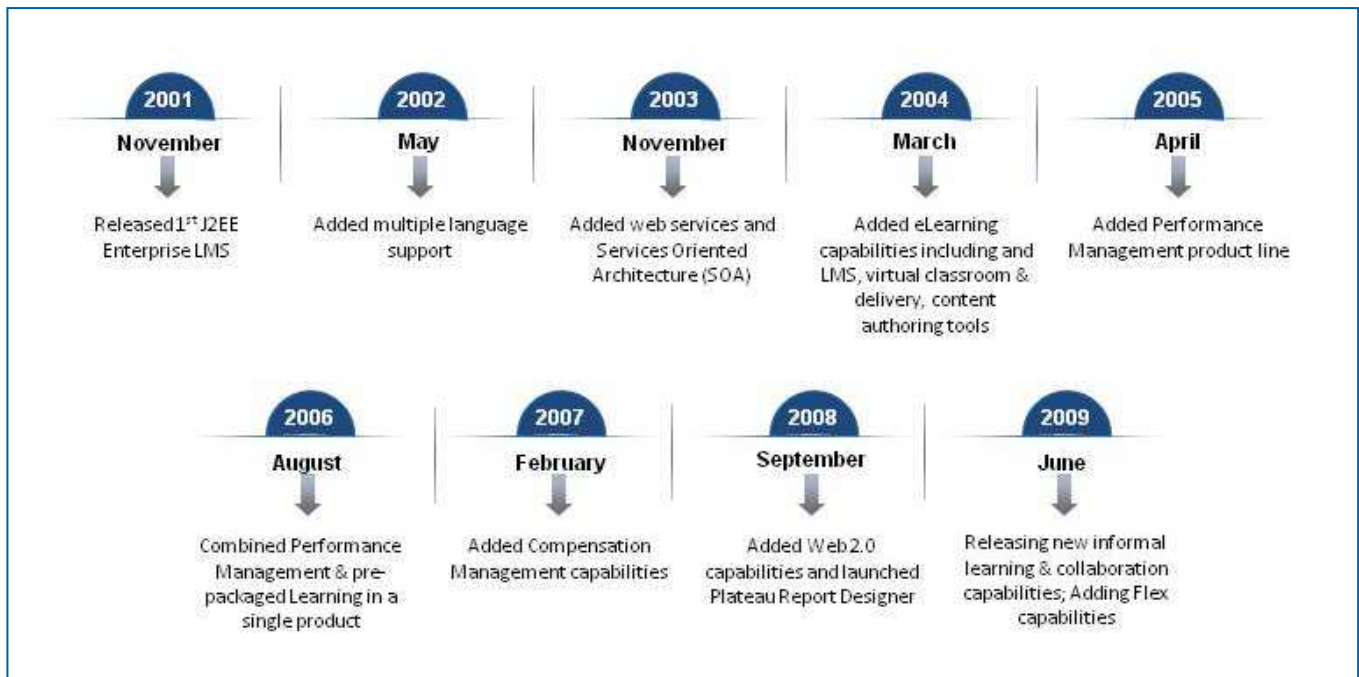
- **A proven, platform-independent JEE (Java Platform, Enterprise Edition) physical architecture**
- **A Service-Oriented Architecture (SOA) based software development approach**
- **A highly configurable Application Services Framework enabled by Apache Struts and Spring Dependency Injection technology**
- **Rapid localization and internationalization (L10N and I18N) capabilities that eliminate the need for separate international or localized versions**

The result is a software product that is:

- **Highly scalable**
- **Reliable**
- **Less expensive to own and maintain**
- **Easily adapted to your organization's business processes**
- **Highly secure**
- **Extensible**

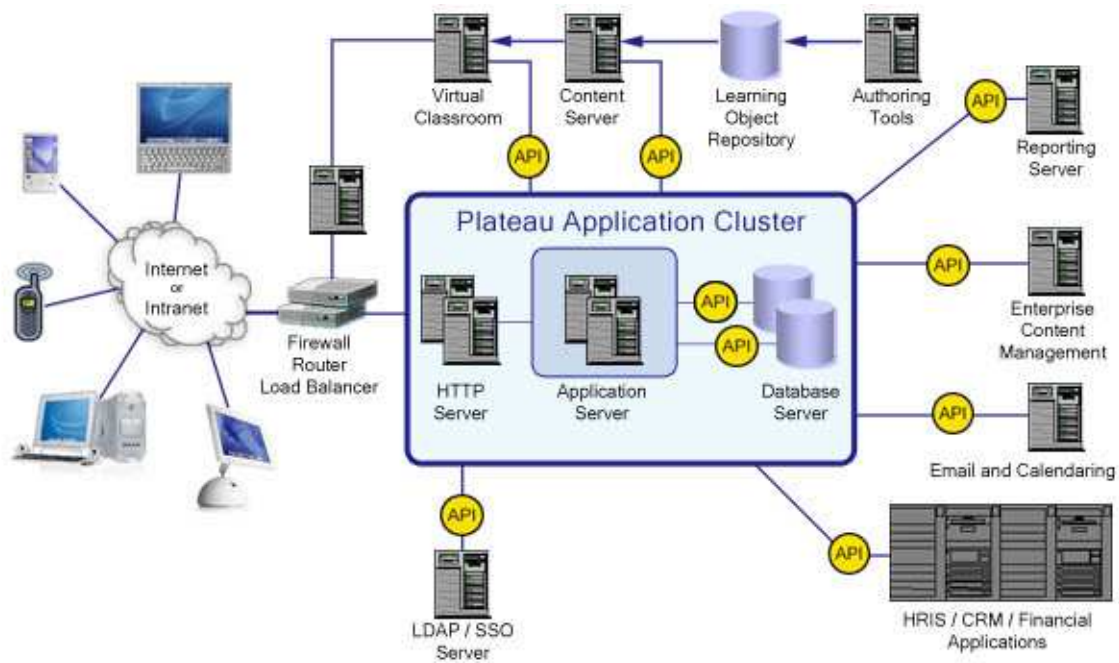
The Vision

Plateau has been a leader in developing enterprise software since its founding in 1996. Our customers hail from a wide range of industries: life sciences, energy, healthcare, financial, manufacturing, and the federal government, to name a few. These industries have diverse requirements, and many must meet stringent federal regulations for their enterprise software systems. Our challenge has been to meet the widely varied needs of our customers, yet stay agile as a technology company. Many enterprise software companies have built monolithic code bases based on aging technologies, or find themselves supporting too many application modules just to satisfy all their customers' changing demands. We sought to avoid these pitfalls by creating a flexible architecture that could meet the widest range of customer needs, deliver the richest possible feature set, and reduce the overall cost of ownership to our customers. The result is the Architecture of Plateau's Talent Management Suite. This architecture has evolved since 2001, as illustrated below.



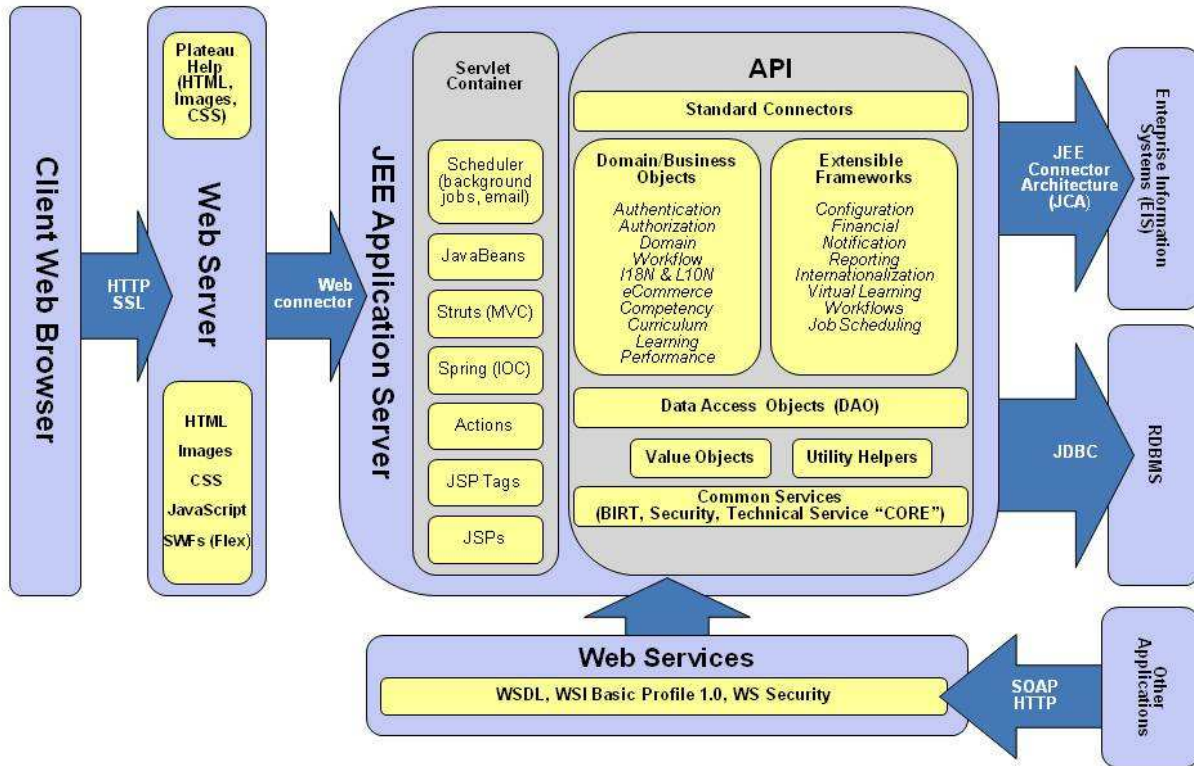
Physical Configuration

Plateau runs on a server or server cluster that is scalable to any number of users. As a 100% web-based system, it provides a user interface via web servers and common web browsers. On the back end, the application manages all access to a relational database management system (RDBMS), and provides integration points to other enterprise applications. A physical view of the architecture configuration appears below.



The Plateau Product Architecture Overview

The underlying technologies and structure of the architecture provides Plateau customers with uncommon benefits. A high level overview of the architecture appears below.



The main elements of the architecture are:

- **Physical Architecture** that supports the major benefits at the foundational level, through the use of the JEE development platform and Service-Oriented Architecture (SOA).
- **A Service-Oriented Architecture (SOA)**, which is widely recognized today as the best way to develop software. SOA utilizes discrete services that work as shared and reusable building blocks and can be easily modified, replaced or re-used without requiring deep-level changes to a monolithic code base.
- **Core Technology Services**, common technologies and standards for which we have developed extensible, easily maintainable services for common use throughout the application.
- **Application Services Frameworks**, based on Apache Struts and Spring, which are highly configurable bundles of specialized services that deliver the application's functionality according to customers' specific business needs.
- **The Standard Connectors and Public API**, provide integration points to the Core Technology Services and Application Service Frameworks.

Physical Architecture

The JEE Platform

JEE (Java 2 platform, Enterprise Edition) consists of software development standards, application programming interfaces (APIs), and protocols that enable development of multi-tiered, enterprise-level, Web-based applications.

It is the most exhaustive set of specifications for creating enterprise applications. By adhering to JEE standards, Plateau assures its customers that talent management applications will not only be reliable and secure, but also easily extensible.

JEE is also among the most mature platforms for developing enterprise applications, being developed and refined since the inception of Java in 1995. Plateau adopted JEE early in the development of the Talent Management Suite (TMS), and since then has steadily refined and matured its application infrastructure based on JEE standards.

Specific Benefits of the JEE-Based Physical Architecture

At the foundational level, the JEE platform brings compelling benefits to Plateau TMS. We encourage organizations that are evaluating talent management vendors to compare them on their ability to deliver these key benefits:

Scalability and Growth

Enabled by JEE, Plateau installations are highly scalable by simply adding servers to the system. JEE prevents interruptions in service when servers are added or reconfigured, and it automatically manages load balancing and fail-over.

Plateau's pure separation of business logic from the presentation tier also enables better scalability and more flexibility in the configuration of servers. Because business objects are distributed, servers can be configured and scaled vertically (adding more hardware resources or increasing the number of server nodes within the same machine) or horizontally (functionality managed across multiple servers). JEE manages the workload in any configuration. As a result, you can more easily manage and balance server loads for all your enterprise systems.

In fact, the largest LMS implementations are run on Plateau. One Fortune 200 corporation is deploying learning to 500,000 employees across 14 countries on one instance. And, the single largest implementation of learning management in the industry is a Plateau customer; this non-profit organization will deploy Plateau to train over 1.5 million learners annually.

Platform Independence

Thanks to JEE, Plateau's architecture is platform independent in the truest sense: not only can it be adapted to any client, browser, server, and operating system, but the same code base runs on each platform. Therefore, even across large organizations using a variety of technologies, Plateau's deployment and maintenance remains simple. In fact, typical Plateau implementations are conducted in weeks instead of months thanks to the simplicity of its platform-independent code base. The uniform code base also helps make Plateau more stable, more scalable, and easier to integrate with multiple applications. The unified code base allows Plateau to set new features, service packs, and bug fixes to its customer box much more rapidly.

Plateau has tested and certified applications for the following environments:

Client Operating Systems:	<ul style="list-style-type: none">• Microsoft• Macintosh
Browsers:	<ul style="list-style-type: none">• Microsoft (Internet Explorer, Firefox)• Macintosh (Safari, Firefox)
Java Plug-ins:	<ul style="list-style-type: none">• Sun JRE
Application Servers:	<ul style="list-style-type: none">• IBM Websphere, JBoss, Oracle Weblogic Server and their supported operating systems
Web Servers:	<ul style="list-style-type: none">• IBM, Oracle, Apache, Microsoft and their supported operating systems
Databases	<ul style="list-style-type: none">• Oracle and their supported operating systems

Reliability

As the most mature and stable development platform for Web-based enterprise systems, JEE gives Plateau superior reliability. JEE's development standards are rigorous, and force a software design that eliminates memory errors and other "bugs" inherent in less stringently designed systems. Not only is the JEE platform more mature, but the Plateau Architecture under JEE is the most mature in the industry, having been developed on the Java platform from the beginning. For example, Plateau relies on the underlying JEE compliant application server to viably manage all the access to the underlying database.

Security

The security features inherent in the JEE platform are well documented. JEE gives Plateau built-in functionality for firewalls, authentication, and single sign-on. Additionally, Plateau enhances JEE's basic security functionality through the Data and Role Security application framework. (See "Data and Role Security" later in this paper). Plateau utilizes spring security framework for both native and external authentication and relies on JCE (Java Cryptographic Extension) for protecting sensitive data.

Extensibility

The modularity of Plateau's architecture provides clearly superior extensibility compared to systems based on more traditional architectures. As a direct result of the architecture, our customers enjoy several benefits in integrating and extending its capabilities:

- **Ease of Use.** Plateau's APIs are completely JEE-compliant; therefore any professional familiar with JEE standards will be able to extend the system easily.
- **Many Integration Points.** The middle tier of the architecture is composed of services, which function as reusable "building blocks," and are exposed to the APIs via Plain Old Java Objects and Spring Beans. Therefore, all of the core functionality is accessible and reusable. Additionally, Standard Connectors use

the APIs to ensure records are inserted into the database according to the system's business rules. In addition, a subset of the core application is also made available as remote JAX-RPC Web Services.

- **Configurable Business Rules.** For data synchronization, business rules can be configured in the Standard Connector Framework. These business rules can determine which records and fields are synchronized, and which data sets take precedence. In many cases, data synchronization can even be configured without coding, through the framework's user interface.
- **Secure Access to Data.** The Plateau POJO/Spring API provides a secure abstraction log-on over the underlying data. Since all data access functionality is exposed via the APIs, the data tables need never be accessed directly for integration. In this manner, the architecture makes data more accessible, ensures that data access is consistent and reliable, and enhances security by abstracting the data layer.
- **Easy Maintenance and Reduced Workload.** The service-oriented, "building block" approach makes upgrades and maintenance easier. In many cases, our customers can upgrade to the latest version of software with little or no updates to their custom applications. For this reason, 90% of Plateau's clients are within two minor ("point") releases of the current production version.

Service-Oriented Architecture (SOA)

Service-Oriented Architecture is a philosophy of software development in which application functionality is carried out by small discrete services instead of large software modules. These services work as shared and reusable building blocks. Instead of writing and rewriting code that provides similar functionality in many places throughout many applications, a software developer can create one service and use it everywhere. The result is a more efficient, holistic, and integrated application. SOA also supports greater interoperability both across applications and across enterprises. SOA is “plug and play” in that services are interchangeable, and can be modified easily without requiring deep-level changes to a monolithic code base.

The benefits of Plateau’s Service-Oriented Architecture are most apparent in the middle tier of the architecture (Core Technology Services and Application Services Frameworks), where business logic is clearly separated from data. The result is that:

- Business rules are strictly and consistently enforced, because they are carried out by discrete services that adhere to the principle, “Write Once, Run Anywhere” (WORA).
- Application functionality is easily changed or modified, often by users themselves.
- Modifications to one service do not compromise the reliability of any other service, because services are independent.

Deep Adherence to SOA

Unlike Web Services standards such as SOAP (Simple Object Access Protocol), which describe one set of technologies for implementing a service-oriented architecture, Plateau employs SOA at a deep level. The use of Web Services, or even of “services” in a generic sense, does not indicate a commitment to SOA as a unifying methodology of software development and deployment. In fact, a large enterprise system can use Web Services to enable communications between components, yet still be built around a monolithic code base that lacks the flexibility of a true SOA system.

Core Technology Services

Core Technology Services are those middle-tier services that are not specific to one Plateau application, but can be used by multiple applications in multiple ways. The modularity of Plateau's Architecture lends itself to abstracting these services into this layer, where higher level services, interfaces, and custom applications can call them.

Under the architecture, these Core Technologies are easily updated and deployed as best practices and standards change. Therefore, Plateau's clients are the first to leverage new technologies and comply to new standards. Without the SOA model, other software vendors are forced to review, update, test, and deliver much larger and more cumbersome software components to stay up-to-date.

Application Service Frameworks

The Application Service Frameworks are the most distinctive and tangible feature of the architecture. The frameworks provide a leading-edge, highly beneficial interface to application functionality.

The frameworks are built using Apache Struts (also known as Jakarta Struts), a leading development technology for JEE, which provides a flexible way to control workflow through a model-controller-view (MVC) structure and Spring Beans. In this manner, the business logic (controller) is completely separated from the database (model) and application (view) components, making the software highly configurable without changes to the core code or compromises in database security. Spring provides the powerful capability of Dependency Injection that allows any "core" class in the system to be replaced without changing the classes that involve them within the API.

In keeping with the spirit of SOA, each Application Service Framework is a bundle of highly configurable application services, which itself operates, and can be updated, independently. The configurability of the frameworks allows customers to accomplish many of their unique and specialized objectives without touching any program code.

These non-hardwired frameworks can be easily upgraded without impacting other frameworks or their configurations. And, like the rest of the middle tier, the frameworks are exposed through the APIs, and some configuration files, adding to the extensibility of the architecture.

The Application Service Frameworks give Plateau TMS customers these key advantages:

- In implementations, business users routinely relieve IT staff of customization work, because they are able to interactively configure business rules.
- Upgrades do not require customers to reconfigure the system.
- The user interface is easily branded for the customer, globally and locally, so that each user associates the learning experience with the organization, division, department, or location. Branding requires no

coding, and persists through product upgrades.

- Users stay up-to-date with software upgrades; 90% are within two minor releases of the latest field-deployed version, and are therefore benefitting from Plateau's latest feature enhancements.
- The combination of scalability and configurability allows are customers to create user experiences that are as complex as their businesses require, all from a centralized installation.
- The service framework allows customers to make significant extensions to the system that are easily upgradeable.

Examples of Framework Configurability

The frameworks enable a large enterprise to internationalize, localize, and individualize the performance and learning management experience for its employees. For example, customers can easily:

- Internationalize and/or localize their software in the right language and reading orientation (left-to-right, right-to-right, top-to-bottom), and even provide for variations of the language (for example, Canadian, American, or British English) depending on the user's domain, location, or user preferences.
- Customize menus and buttons via simple XML configuration to give wider and varied functionality to users in certain management roles.
- Accommodate differences in business culture and terminology by customizing text for different offices, divisions, companies, or roles in the organization: for example, *consultant*, *associate*, *employee*, *direct report*, *subordinate*, *colleague*, *member*, *staffer*, or *worker* may have different meanings across the enterprise.
- Build business rules to control how data is imported or synchronized from other enterprise systems. For example, two legacy systems use different codes to uniquely identify employees. Depending upon the employee's location, title, and start date, one code or the other could be imported.

There is virtually no limit to the number of ways that Plateau software can be configured to accommodate the unique business rules and objectives of your organization—all without programming. No other Learning and Performance Management system offers a comparable configuration interface that persists through product upgrades and is as easy to maintain.

Data and Role Security

The Data and Role Security framework stands out as a critical differentiator for our customers. The security model goes beyond common "row and column" security that limits the records and fields that a user may access. It also goes beyond the role-based security that requires all users to be categorized into generalized roles, and controls only the ability to perform specific work flows. Instead, security is configurable across records, roles, and specific functionalities within the system. Using the configurable business rules of the framework, our customers can devise a security scheme that truly fits their diverse business needs.

For example, security can be configured so that one user can schedule training classes based on the training needs for a group of employees, but cannot enroll individual attendees. Another user might be able to enroll the attendees but not access each attendee's performance data. Each of these users can access the same employee records, but can only use it to perform limited functions, within specific domains.

The security also benefits from the JEE platform, with single-sign-on capabilities and encryption. It meets the rigorous standards of government and regulated industries.

Common Data Model

The model-view-controller structure of the application, enabled by Apache Struts, forces Plateau to take a highly structured approach to database access and customization. All access to data is controlled in the middle-tier, so that the frameworks, core services, custom-built services, and the APIs all access the data tables in a consistent and controlled manner. Our common data model adds robustness to the system, enhances security and extensibility, and helps make the application scalable.

Since the common data model contains both learning and performance data, the data is always synchronized without duplication. No additional integration or configuration is needed to process and view learning data together with performance results.

Custom Data

To allow our customers to add their own custom data to Plateau, the common data model includes tables that are dedicated to user-defined data. Using the application system frameworks, users can add user-defined fields for use in any application area. Like the other configurations performed through the frameworks, custom data configurations persist through product upgrades with no additional maintenance required. For example, Plateau customers have used custom data to consolidate demographic information that was previously stored in multiple systems such as HRMS and financials. Other types of custom data include courseware metadata, existing performance information, or a learner's professional development goals. In addition, our extensible custom data model also allows customers to validate the data that can be stored within these custom fields.

Learning Industry Standards and Compliance

While Plateau's Architecture seeks to be compliant with software industry standards and best practices, we also endeavor to comply with, and often lead, learning industry standards.

Plateau is certified under SCORM 2004, the Sharable Content Object Reference Model for the learning industry, and is also certified by the AICC, the Aviation Industry CBT Committee, which has led the way for learning standards and is highly influential in contributing to SCORM standards. Plateau executives sit on the AICC, giving Plateau an important role in shaping the standards for the entire learning industry.

Plateau has undergone independent tests to become certified as SCORM-conformant. Our certification ensures our customers that:

- Learning content from third-party vendors will work seamlessly
- Scores and other data recorded during a user's session will be properly recorded and stored by the LMS
- As standards evolve, applications will remain current; and, thanks to Plateau's Architecture, applications will be easy to upgrade to these evolving standards

Federal agencies, and corporations in highly regulated industries, require a high degree of compliance to SCORM, which only SCORM certification can guarantee.

About Learning Industry Standards

Plateau is dedicated to remaining on the leading edge of defining and implementing learning industry standards. Plateau is certified under SCORM (Sharable Content Object Reference Model) 2004 standard specification, and is also certified by the AICC (Aviation Industry CBT Committee). Through our direct involvement with the AICC (whose standards are incorporated into SCORM), Plateau leads the LMS industry in its involvement and influence in learning industry standards. The goal of SCORM is to create flexible training options by ensuring content that is reusable, interoperable, durable, and accessible, regardless of the content delivery and management systems used:

Reusable: Content is independent of learning context. It can be used in numerous training situations or for many different learners with any number of development tools or delivery platforms.

Interoperable: Content will function in multiple applications, environments, and hardware and software configurations regardless of the tools used to create it and the platform on which it is delivered.

Durable: Content does not require modification to operate as software systems and platforms are changed or upgraded.

Accessible: Content can be identified and located when it is needed and as it is needed to meet training and education requirements.

Conclusion

As you evaluate enterprise Learning, Performance, and Career and Succession Management Systems side-by-side, you will look “under the hood,” into each product’s architecture, to measure and compare their potential value for your organization. The Plateau Architecture excels at providing the benefits that are critical to any enterprise application:

- **Scalability.** Any enterprise system must grow with your business. Look for solutions that will scale either horizontally or vertically as needed, without complications or interruptions in service.
- **Reliability.** A robust and worry-free system both reduces your costs and increases your benefits. Look for an architecture built on proven, mature technologies. Look for companies with proven track records for fast, easy implementations and superior customer service.
- **Security.** Although tight security is obviously important, it must be balanced with enough flexibility to enable your business processes. Look for a security schema that can be configured appropriately for both your present and future needs. Look for a platform that supports the application’s security at a foundational level.
- **Adaptability.** Rarely can any organization anticipate its future needs and processes, especially as external technologies and standards change. Once you have determined that a system will support your business processes today, look for configurability that will support your processes as they evolve.
- **Extensibility.** Both the integration interface (APIs) and the database model must not only enable adequate integration to your other applications, but should do so in a manner that reduces the need for maintenance over the long term.
- **Low Total Cost of Ownership.** The costs of a new enterprise system can far exceed the initial price if it is difficult to implement, difficult to maintain, or not a good fit for your organization. Evaluate the long-term costs, and look for validation of the solution’s long-term value.

Plateau has dedicated itself not only to providing these benefits now, but also to architecting a sustainable learning and performance solution that will evolve to keep pace with new developments in technology, business standards, and the nature of human learning and performance.

About Plateau

Plateau is a leading, global provider of adaptable, web-based software for developing, managing, rewarding and optimizing organizational talent to increase workforce productivity and business operations performance. Plateau's award-winning software is being used to power talent management initiatives across some of the world's most successful organizations, including the American Red Cross, General Electric, the Internal Revenue Service, Capital One Services and the National Aeronautics and Space Administration (NASA). Industry analysts at Bersin & Associates, Forrester Research and other leading information and technology research and advisory firms continue to recognize Plateau's leadership in delivering best-in-class functionality, technology and customer satisfaction. Plateau is headquartered in Arlington, Virginia, with offices across the United States, Europe and Asia Pacific. For more information, please visit www.plateau.com.

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