



SumTotal[®] Enterprise Suite[™]

PRODUCT ARCHITECTURE WHITEPAPER

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STRONG TEAM, STRONG BUSINESS.

SumTotal is proud to have been chosen and trusted by more than 1500 enterprise customers; most operate their learning and performance platform in a mission-critical capacity. Today, more than 12 million discerning users successfully have leveraged SumTotal's learning and productivity solutions. Our customers and their users are at the center of every architecture and technology decision we make.

Introduction

An architecturally strong foundation is required to achieve the return on investment that software buyers expect. The SumTotal Enterprise Suite capitalizes on three dimensions of architecture (functional, operational, and software) to provide our customers with innovative and pacesetting solutions.

In this document, you will learn about SumTotal's focus on architecture and how it provides a snug fit within your technology ecosystem while delivering positive bottom-line results.

Functional Architecture

Business application software provides a set of features and functionality that assist users to perform real-world tasks. The SumTotal Enterprise Suite addresses learning, training, and overall management of human performance. This section of the document explores four key aspects of Architecture: Modularity, Adaptability, Extensibility, and Conformance.

Functionality in the Suite has been architected into modules that permit a customer to license only those modules required to meet their immediate business objectives. The modules include: TotalLMS™, TotalLCMS™, TotalVCS™, TotalPerformance™, TotalAccess™, TotalInformation™, and TotalCollaboration™. All modules have been designed to integrate seamlessly which allows customers to grow into the Suite as their needs evolve.

Modularity

Customers of learning platforms expect to reap the benefits of having a single infrastructure that satisfies all of their global requirements without having to compromise on functionality. SumTotal's unique modular approach enables customers to grow into the Suite as their needs progress. Because the modules are built upon a single platform, adding additional modules typically only requires that an administrator enter a new license key that is provided by SumTotal Systems. Below is a brief description of the SumTotal modules.

TotalLMS™

The Learning Management System (LMS) is an enterprise-wide, globally scalable application that manages learners content in the form of documents and web-based courseware, scheduled events, and training-related resources. TotalLMS also provides customers with an innovative reporting solution that enables end users to design new reports and modify existing ones in the same user-friendly web-based environment used to run reports.

TotalAccess™

TotalAccess is an innovative solution that enables mobile works to access e-learning even while not tethered to the network. TotalAccess is delivered as a signed Java application that is automatically downloaded on first use or whenever the application is updated. TotalAccess supports all courseware that is conformant to the SCORM 1.2 standard. This module supports a variety of client

operating systems and hardware configurations and uses encrypted XML as its offline data store. TotalAccess has the ability to synchronize tracked learning results with the LMS server.

TotalVCS™

SumTotal provides API-level integrations with WebEx, InterWise and Centra for managing collaborative sessions. The user experience of administrators and learners is completely integrated. Virtual sessions are created and managed from within TotalLMS and learners and instructors access virtual sessions through their TotalLMS home page. Users can also access learner enrollment data, attendance and assessment results for virtual sessions via the SumTotal user interface and from reports. SumTotal supports multiple deployment scenarios including access through firewalls, support for multiple servers for redundancy and added scale, secured channels (HTTPS), and integration with multiple virtual servers simultaneously. Presenting each integration option is beyond the scope of this white paper and is dependent on the chosen virtual training vendor(s).

TotalInformation™

TotalInformation allows organizations to extend the learning experience beyond formal courseware to include informal content and information in the form of documents. Users that possess the appropriate permissions can upload documents that can be selectively shared with others as knowledge objects or included in blended curricula. This component is delivered as an integral component of the application Suite and requires that TotalLMS is licensed.

TotalPerformance™

TotalPerformance is a workforce performance management Suite that includes capabilities such as goal management, career and development planning, competency management, performance reviews, 360 degree reviews, compensation planning, and more. This module is delivered as a hosted solution and is integrated with TotalLMS via SOAP web services.

TotalCollaboration™

TotalCollaboration provides an easy way for employees to get data from experts and share information with colleagues, while also allowing organizations to capture and share knowledge for future reference. To facilitate knowledge reuse, SumTotal provides "deep searching" capabilities where users search inside of the contents of Microsoft Office and Adobe Acrobat documents. Collaboration Centers can be associated with learning activities, documents, and content development projects in TotalLCMS. This module requires that TotalLMS, TotalVCS or TotalLCMS is licensed.

TotalLCMS™ and Simulation Editor

TotalLCMS (Learning Content Management System) provides an environment that enables collaborative and distributed development of rich e-learning courseware. TotalLCMS provides increased productivity over traditional e-learning authoring tools by enabling centralized management and reuse of all learning content. TotalLCMS leverages the central database for storage of meta-data and has its own repository for managing assets such as graphics, audio and video, HTML, and other types of files. For deployments that require hundreds of concurrent users and a high degree of reliability, TotalLCMS supports a web farm configuration. In this mode, the TotalLCMS content repository is automatically synchronized across all SumTotal web servers. TotalLCMS is seamlessly integrated with the other SumTotal modules.

Simulation Editor is a specialized version of SumTotal ToolBook that enables the creation of high-quality software simulations and provides advanced scripting capabilities. Simulation Editor is a desktop application that is integrated with the Suite via TotalLCMS's asset publishing process.

SumTotal's modular approach has multiple benefits for several constituents:

Learners and Managers

Just as users of Microsoft Word can apply what they have learned to other Microsoft Office products, users of TotalLMS will be immediately comfortable using TotalInformation, TotalCollaboration and the other modules of the Suite. Personalization settings for each user, such as time zone, default currency, language selections, etc., are applied across all capabilities in the SumTotal Enterprise Suite. In other words, the modules feel like a unified Suite because they are a unified Suite.

Application Administrators

An application administrator is anyone who has administrative-type security credentials within the SumTotal Suite. This group of users tends to use the product frequently and is primarily concerned with managing users, domains, audiences, training resources, and learning activities as efficiently as possible.

Application administrators benefit from the Suite approach in that they have immediate access to complete data since the entire application runs on a single relational repository and offers a single data warehouse that is optimized for reporting and analytics. The Suite approach is also beneficial in that SumTotal has implemented a robust hierarchical security model that enables policy decisions to be applied to a single domain, throughout the entire enterprise, or anywhere in between with a single click of a mouse. Domain-scoped configuration settings automatically and instantly apply to all modules. Additionally, the user interface for these users respects their "power user" position by providing more bulk operations and by minimizing "clicks".

Business Leaders

How did Wyeth Pharmaceuticals significantly increase market share while slashing their training expenses, Century 21 increase revenue per real estate agent by 30%, and Stream International dramatically decrease learning expenses while increasing proficiency? By thinking of SumTotal not as an LMS and an LCMS but as a closed loop information system that allows them to manage and measure their workforce productivity and the effectiveness of their training programs.

W. Edwards Deming, the father of Total Quality Management taught us that "what you measure, you improve." In addition to API-level integration with Business Object's Crystal Enterprise, SumTotal includes a browser-based and scalable reporting environment that provides business leaders with immediate access to relevant and highly personalized information. This is accomplished via dynamic filtering of data for each user based on their unique security credentials and domain membership. As a result of this built-in personalization, executives can analyze an organization from the top-down while middle-managers and front-line employees can analyze their operations from the middle-out or the bottom-up.

The SumTotal Enterprise Suite includes dozens of built-in reports as well as access to performance-tuned data sets delivered as Star Schemas within the SumTotal data warehouse. From within a single environment, users access both relational and online analytical processing (OLAP) data models.

The alternative is for IT organizations to integrate disparate systems and then to harmonize incompatible data models. SumTotal is built upon a single data model and provides customers with a comprehensive data warehouse optimized for gleaning opportunities for workforce productivity improvements, reducing training-related expenses, and increasing revenue.

System Administrators

With non-modular solutions, Information Technology (IT) organizations struggle with rationalizing systems that began with different visions and are integrated only after they have been deployed. The cost and complexity of implementing heterogeneous systems grows as front- and back-end integrations break during individual component upgrades.

At SumTotal, we strive for simplicity and we reject that it necessarily comes at the expense of flexibility or sophistication. As evidence, the average SumTotal deployment takes 16 weeks, which is approximately half the industry, average, according to data published by Brandon Hall.com, an e-Learning industry consultant. The financial savings that results from a compressed time-to-benefit is primarily due to our focus on modularization and as a result of our progress on the war to eliminate customizations.

IT time and resources are minimized by a greatly reduced need for application customization. Currently, over 65% of SumTotal implementations are out-of-the box and we are working hard at achieving 100%.

Adaptability

So how can a single software deployment satisfy the distinct needs of individual business units and regions without sacrificing the benefits inherent to a centralized deployment? SumTotal's answer is Dynamic Domains.

In an extreme case, a single deployment could configure domains to accommodate multiple separate customers. In this example, each domain could partition off their data, configure their own business logic, design their own workflows, author unique notifications specific to their domain, provide their users with a unique training catalog taxonomy and change the entire user experience independent of any other domain. A more common deployment scenario is where a customer enables access to the platform to their extended enterprise which includes not only internal employees, but also customers and partners.

Dynamic Domains was explicitly designed to enable this increasingly common scenario where within a single implementation some settings are required to be enforced globally (i.e. password expiration, administrative access control for certain data, etc.) while other settings can be delegated to individual business units. In this example, some data will likely be shared (such as global competency lists and a set courses that are appropriate organization-wide) while other data will be available only to those that belong to a specific domain.

Within SumTotal, all objects (users, competencies, organizations, jobs, resources, activities, notifications, etc.) are owned by users of a single domain. Yet this data can be selectively shared across domains. As an object is shared with another domain, the owning domain can indicate the desired permissions (i.e. view, allow associations, etc.). SumTotal imposes no limit to the number of domains within an implementation or the depth within the domain hierarchy.

SumTotal's Dynamic Domains implementation assumes that a business' organizational structure is in constant flux. Thus, users can easily add, edit, delete, and move domains within the hierarchy. In the case of moving or deleting a domain, SumTotal takes the user through a wizard that presents the impacts of such an action and provides the user with multiple options on what to do with objects that are associated with that domain. For example, a user that is deleting a domain is presented with a list of objects (skills, organizations, activities, etc.) that are owned by that domain. The user is then given the option to delete

these objects or to remap these objects to other domains. SumTotal's Dynamic Domains also allow for inheritance, which automatically enforces policy decisions made by upper level domains on lower level domains.

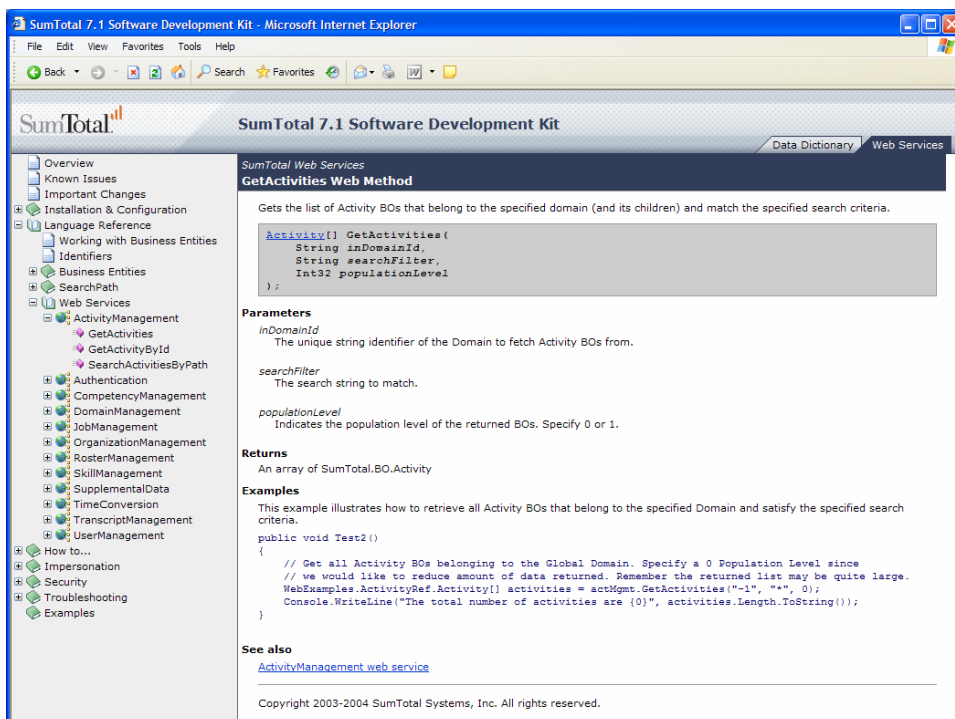
SumTotal's adaptability is achieved via configuration at the domain level. To SumTotal, configuration means that no programming is required and that decisions made by customers do not complicate upgrades. Customization means programming is required and upgrades require individual analysis by SumTotal or your deployment partner and the customer to determine the best way to accommodate changed code. For these reasons, SumTotal has waged war on customizations.

Extensibility

In addition to being highly configurable, SumTotal is also extremely extensible. Extensions provide 'hooks' that enable customers to add additional capabilities within the SumTotal Suite or offer SumTotal's capabilities in the context of other applications. For example, one of our customers has integrated SumTotal's personalized catalog search with their portal to provide users a seamless and unified search experience.

Unlike customizations, extensions do not typically require special effort for upgrades to a newer release. SumTotal extensions are implemented via standards-based web services. SumTotal goes to great lengths to ensure that our APIs are both forwards- and backwards-compatible. Thus, customers that implement these APIs can be reasonably certain that extensions do not need to be addressed when upgrading to newer versions of SumTotal.

SumTotal provides customers with an entire Software Development Kit (SDK) that contains detailed documentation on all public APIs. The SDK provides developer-oriented documentation on all web service



The screenshot shows a web browser window displaying the SumTotal 7.1 Software Development Kit (SDK) documentation. The page is titled "SumTotal 7.1 Software Development Kit" and features a navigation menu on the left. The main content area is titled "SumTotal Web Services" and "GetActivities Web Method". It provides a description of the method: "Gets the list of Activity BOs that belong to the specified domain (and its children) and match the specified search criteria." The method signature is shown as follows:

```
Activity[] GetActivities(  
    String inDomainId,  
    String searchFilter,  
    Int32 populationLevel  
);
```

The page also lists parameters: **inDomainId** (The unique string identifier of the Domain to fetch Activity BOs from.), **searchFilter** (The search string to match.), and **populationLevel** (Indicates the population level of the returned BOs. Specify 0 or 1.). The **Returns** section states: "An array of SumTotal.BO.Activity". The **Examples** section provides a code snippet for a test method:

```
public void Test2()  
{  
    // Get all Activity BOs belonging to the Global Domain. Specify a 0 Population Level since  
    // we would like to reduce amount of data returned. Remember the returned list may be quite large.  
    WebExamples.ActivityRef.Activity[] activities = actMgr.GetActivities("1", "*", 0);  
    Console.WriteLine("The total number of activities are {0}", activities.Length.ToString());  
}
```

The **See also** section includes a link to "ActivityManagement web service". The footer of the page reads: "Copyright 2003-2004 SumTotal Systems, Inc. All rights reserved."

APIs, includes how-to type documentation, and provides sample applications that have been written in both .NET and Java. The SDK also includes a comprehensive data dictionary that includes descriptions of fields, tables, and indexes, information on what has changed between releases, and how the schema differs between Oracle and Microsoft SQL Server.

One innovation implemented within SumTotal's web services infrastructure is technology we call "SearchPath". SearchPath provides developers with an XPath-like notation for expressing queries against business entities. SearchPath queries can be arbitrarily complex and can be used to retrieve entities based on the value of their properties or their relationships to other entities.

Conformance

SumTotal recognizes and appreciates that our customers battle against application complexity by defining and enforcing information technology standards. SumTotal's architecture is based on the following open technology and learning-industry standards. Please see the chart to the right for details.

SumTotal also conforms to Section 508 (Section 1194.22 a-p) from the Rehabilitation Act of 1997, as amended in 1998. For our pharmaceutical customers, SumTotal conforms to CFR 21 Part 11 as it relates to validated computer software systems.

Technology Standards	Industry Standards
WS-I Basic Profile (XML, SOAP, and WSDL)	SCORM Version 1.2 LMS-RTE3 conformant (highest level)
JavaScript	SCORM 2004 CAM and RTE conformant
D/HTML	IMS
TCP/IP	AICC
SMTP	vCalendar
XML/XSLT	

Operational Architecture

This section presents two aspects of architecture that are critical to the operations of learning solutions: scalability and interoperability.

Scalability

The SumTotal Enterprise Suite has been architected to efficiently scale from a 24x7 mission critical application that supports hundreds of thousands of users to an operation that needs to economically accommodate a peak load of a couple hundred users at one time. The chart on page 8 presents the actual infrastructure used to support a large operation that meets or exceeds an uptime of 99.998%. Of course, SumTotal can also be deployed on a single server when uptime is not critical and concurrent loads peak at less than a couple hundred users.

Communication to / from system	Default / primary port
SumTotal web server To End users	HTTP port 80; SSL port 443
SumTotal Remote Content Server To SumTotal web server	HTTP port 80; SSL port 443
SumTotal To External systems via SOAP web services	HTTP port 80; SSL port 443
SumTotal web server To SumTotal web server (required for content synchronization between servers)	NetBIOS ports 137, 138, or 139
SumTotal database server To SumTotal data synchronization utility	SQL Server: port 1433 Oracle: 1521
SumTotal database server To SumTotal reporting database	SQL Server: port 1433 Oracle: port 1521
SumTotal web server To email server	SMTP port 25

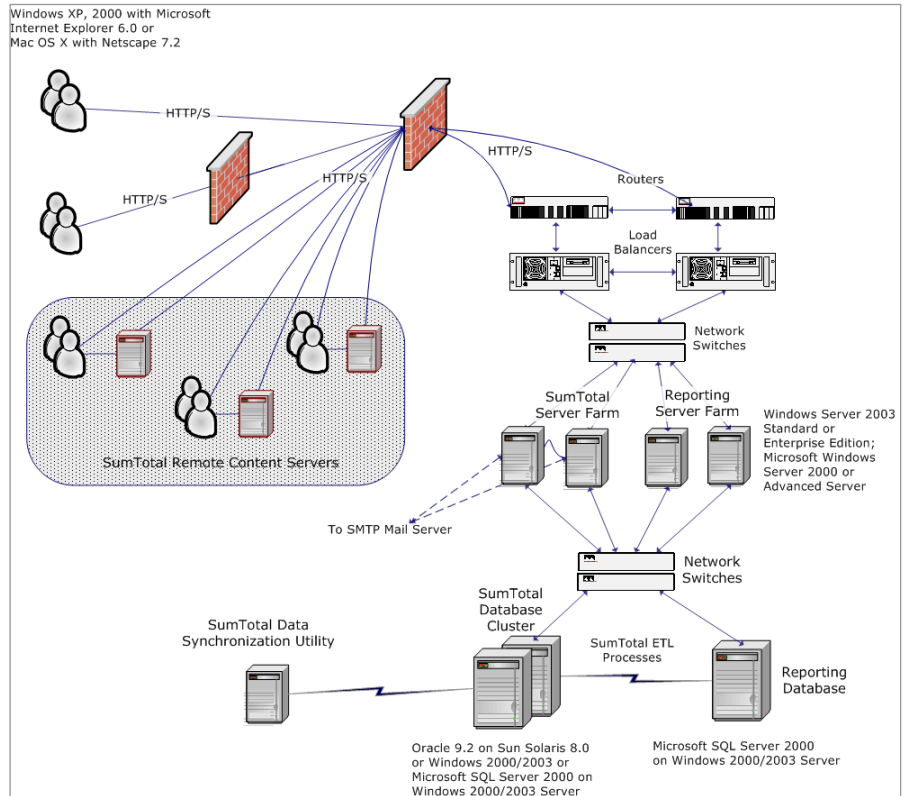
SumTotal can be deployed inside the firewall, within a DMZ or exposed directly to the Internet since only HTTP(S) communication is required between the users and the web server. Please see the chart to the left for information on primary or default port requirements between SumTotal components and between SumTotal and external systems. Please note that in most cases, SumTotal supports alternative port assignments.

The SumTotal application has been optimized for both Windows 2000 and Windows 2003, supports the two most common database management systems (Oracle and

Microsoft SQL Server) and the most commonly used web browsers (Internet Explorer and Netscape on both Windows and the Mac). Database access is through pooled connections using a single user id.

SumTotal does not require end users to have accounts on the database management server. Client access is entirely through standard web browsers and only optional capabilities require ActiveX controls or Java applet support. [For a detailed look at the SumTotal system requirements and guidance on scaling out the SumTotal infrastructure customers can consult the documents titled "System Requirements for SumTotal 7.pdf" and "Performance and Scaling Strategies for SumTotal 7.pdf" that are available on the SumTotal Customer Productivity Center.]

Since many customers categorize their learning platform as 'mission critical', the cost of failure can be very high. For these customers, SumTotal encourages leveraging database clustering and a web farm environment for redundancy, operational simplicity, and accommodation of significant loads. When the SumTotal application detects multiple web servers, it automatically synchronizes all e-learning content, knowledge documents, training certificate templates, Crystal Reports, and other types of content that are uploaded by end users across all servers in the web farm. In order to minimize the cost and complexity of adding new hardware to a farm, SumTotal also provides a means of asynchronously "readying" a server by replicating the required materials from a server in operation to a server that was recently added to the web farm.



For customers that prefer to run content from a 3rd party repository or where bandwidth is in short supply, TotalLMS provides an innovative Remote Content Server. The solution is to co-locate content next to the users so that bandwidth-hungry courseware is only streamed a short distance. With this solution, courseware is associated with users and users are associated with organizations within TotalLMS. Organizations are then associated with remote content servers. When a user launches a course, SumTotal attempts to launch the course from the closest server. If the course or the server is not available, SumTotal instead 'falls back' and launches the course from one of the central web servers. The SumTotal Remote Server is a component of TotalLMS and supports all SCORM 1.2 conformant courseware. The Remote Server includes technology that is delivered to the client's browser as a signed Java applet or an ActiveX control. Since SCORM requires learning management systems to implement a JavaScript API and that JavaScript can communicate between pages but not between domains, this technology is used to relay learner course progress data from TotalLMS's SCORM player to the central SumTotal server. [Customers can access a document titled "Configuring Remote Content Servers.pdf" for additional information about SumTotal's remote content server. This document is located on the Customer Productivity Center.]

Interoperability

Nimble businesses require that systems provide access to current data when and where it is needed. The days of accepting information islands are long since past. Organizations have realized, for example, that combining enterprise resource planning systems and supply chain applications provide greater value than

the sum of these components. This also holds true when integrating learning and productivity systems with other enterprise applications.

Practically all of our implementations include integration with at least two systems external to the learning platform. As an IT veteran would expect, these external systems vary in terms of technology and compliance with industry standards. In some instances, customers desire bi-directional and real-time integration while in others, data is transferred in a single direction and accomplished as a batch-type operation. These integrations also vary depending on whether systems are located inside or outside a company or in front of or behind a firewall.

Philosophically, we recognize that the learning platform is rarely the center of our customers' computing universe. Thus, flexibility in integrating with enterprise applications is an absolute necessity.

The SumTotal Enterprise Suite provides multiple options to achieve seamless and cost effective interoperability with other enterprise systems, portals, and directory services whether implemented in Java or .NET, and independent of whether they are running on UNIX, mainframe, or Windows. In fact, we feel so strongly about the value derived by enabling the creation of *composite* applications, we have placed application integration at the center of our architecture. Through standards-based web services, SumTotal is built for interoperability between business systems.

Implementing an application that provides web services adds to an organization's inventory of discrete functions that can be plugged into other systems without regard to underlying technology or location. For example, one SumTotal customer has provided their sales-force with a targeted list of highly relevant training that can be accessed from within their sales force automation system based on a sales rep's territory and sales activity. Thus, sales representatives get access to exactly the information they need without leaving their current business workflow.

In addition to access to hundreds of functions, SumTotal provides customers with detailed documentation and sample applications written in both .NET and Java. SumTotal's web services implementation supports standards such as Extensible Markup Language (XML), Simple Object Access Protocol (SOAP), and Web Services Description Language (WSDL). This architecture enables other systems to dynamically discover, understand, and utilize SumTotal's *parts*.

SumTotal's web services infrastructure is far more valuable than the time or money saved during implementation and subsequent upgrades. The real value is the business agility that can be achieved as a result of this infrastructure. Customers can use web services seamlessly, securely, and instantly to orchestrate disparate applications created with and running on a variety of platforms. We are excited and inspired to see customers delivering value to their organizations via the SumTotal Suite in ways that we have not envisioned.

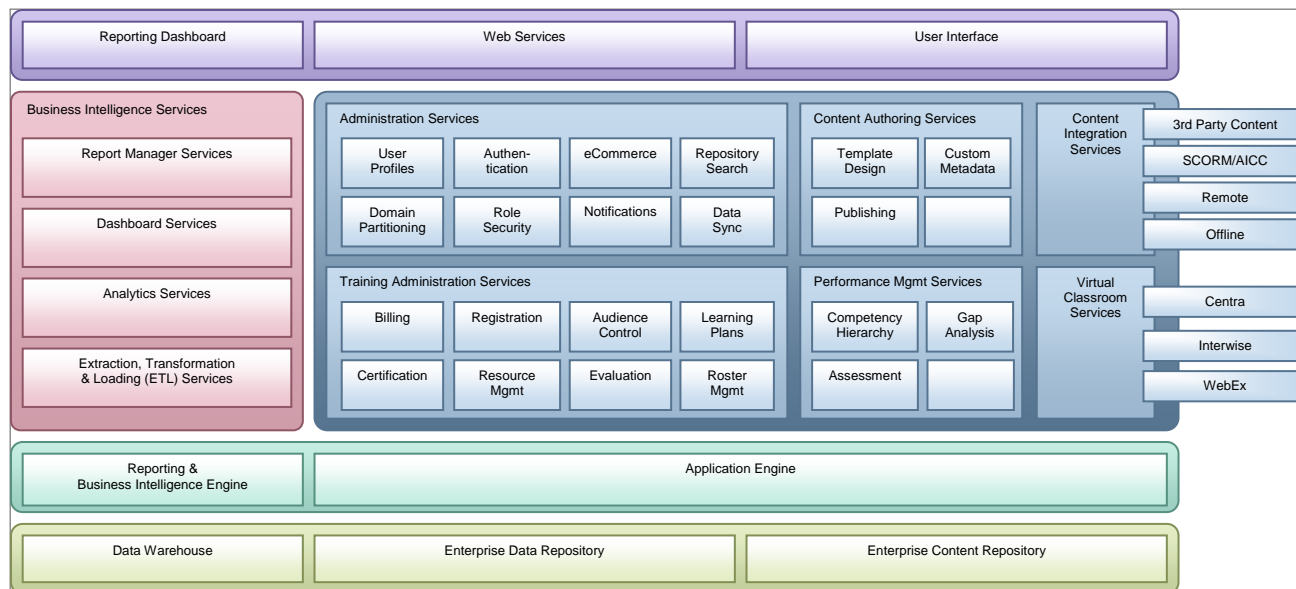
For circumstances that are best addressed with asynchronous synchronizations, SumTotal delivers a toolkit that provides a scalable and secure means of integration. This toolkit provides the ability to map SumTotal to a 3rd party system, perform data transformations, schedule synchronizations, and alert users of any issues that require attention.

SumTotal also provides a number of built-in integrations to connect to 3rd party e-learning courseware and enterprise communication platforms. In addition to supporting the industries top standards (SCORM 1.2, SCORM 2004, AICC JavaScript, AICC HACP), SumTotal supports ToolBook, Macromedia Dreamweaver, Macromedia Authorware, SkillSoft, NETg, NETg content server, Questionmark Perception, Docent CDS, Aspen LCMS, Centra, InterWise, and WebEx.

SumTotal also provides built-in support for multiple silent authentication systems including NT trusted connections and support for Microsoft Passport. Many customers choose to leverage multiple authentication methods simultaneously. This is especially true of deployments that are extended beyond internal employees, to customers and partners.

Software Architecture

The SumTotal Enterprise Suite server consists of Microsoft Active Server Pages (ASP), COM objects, .NET managed code, ISAPI filters, and Windows shell commands. As the application is very data intensive, SumTotal makes extensive use of database stored procedures and is optimized for both Microsoft SQL Server and Oracle. SumTotal also leverages Windows SMTP service to relay notifications to your mail server. This architecture has provided hundreds of customers with a secure and highly scalable environment. SumTotal's user experience is presented as DHTML within the user's web browser. Certain optional components leverage ActiveX controls and Java applets (e.g. Microsoft Outlook integration and TotalAccess).



Performance and scalability are critical facets of the software architecture, ensuring that the Suite can handle the load of even the most demanding enterprise environments. In fact, among our 1,500 customers and 17 million users, more than 20 deployments have more than 100,000 users, 5 have more than 250,000 users and one has well over 1 million users. The logical architecture graphic above presents SumTotal from the perspective of shared services that can be offered directly to end users via the SumTotal user experience or to other applications via web services.

SumTotal includes built-in support for three notification types: scheduled, event driven, and ad-hoc. Scheduled notifications are triggered by calendar events such as in reminder notices for certification expirations. Event driven notifications are triggered by users as they proceed through work flows as in the case of user registration for activities. Ad-hoc notifications are initiated by a user for the purpose of sending an email to a specific audience.

SumTotal's notification infrastructure leverages SMTP and simultaneously supports both plain text and HTML email clients. Users' preferences determine which mail type is received. All notifications can be configured at the domain level which enables individual organizations to specify their own notification logic and text. For example, one domain may choose to disable the activity enrollment confirmation notification while another domain may enable the notification and provide training coordinators with the ability to configure the email template on an activity-by-activity basis. Each notification template is offered in each language that is supported by the system. Currently, SumTotal is localized in the following core languages: Japanese, French, German, Universal Spanish, Brazilian Portuguese, Italian, UK English, US English, Canadian French, Traditional Chinese, and Simplified Chinese.

SumTotal's notification infrastructure also supports vCalendar attachments. Thus, as is the case with a class registration confirmation message, vCalendar documents are attached to the notification that, when clicked, create individual meeting requests on a users desktop calendar (provided the calendaring system supports this standard).

Closing

This document gave you an overview of the key architectural elements in the SumTotal solution and how they integrate within your technology ecosystem in order to provide bottom-line business results. We recognize that your learning and performance solution is one part of your technology infrastructure and have strived to make it a seamless integration into your business processes.

With the largest user base and over 1,500 customers, SumTotal has seen a variety of expected and unexpected uses of our learning and performance solution. We have built on these experiences and gathered best practices, which help our customers continue to improve and expand. Contact SumTotal with any questions regarding your environment or solution needs. Besides helping you find an answer that works for your business, we can get you in touch with customers that have capitalized on similar opportunities or have overcome similar challenges.

About SumTotal Systems, Inc.

SumTotal Systems Inc. (NASDAQ: SUMT) is the business performance and learning technology industry's largest single provider of technologies, processes and services. Formed by the merger of industry pioneers Docent and Click2learn, the company is uniquely focused on helping organizations harness and manage mission-critical intellectual power to solve real-world business problems and produce significant bottom-line results. SumTotal has helped accelerate performance and profit for more than 600 of the world's best-known companies, including Microsoft, Cingular Wireless, Vodafone, Lucent, Accenture, Cendant, Harley-Davidson, Wyeth, Wachovia and D & B. SumTotal Systems is headquartered in Mountain View, CA, with offices throughout the US, as well as London, Paris, Heidelberg, Sydney, Tokyo and Hyderabad, India.

To learn more about how SumTotal can work with you to help maximize business performance, please visit our Web site at www.sumtotalsystems.com

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