

Software AG, Inc. Tamino

Datapro Summary

Software AG's Tamino--an acronym for *Transactional Architecture for Managing Internet Objects*--is also the hero of *The Magic Flute*, one of Mozart's most popular operas. The product itself may well be a heroic choice for organizations that need to store and integrate data in a variety of formats located on multiple disparate platforms. Currently the only native-XML database on the market, Tamino uses XML schemas, querying tools, stylesheets, repositories, DTDs--and, in some cases, SQL tools--to create, store, manipulate, and retrieve data from virtually any source. It is an excellent solution for organizations integrating and Web-enabling information from multiple sources and applications in order to create e-business systems.

--By D. A. Hess

Note:

Software AG is releasing Tamino 2.0 through the summer. The Solaris version has been available since June, and the Windows NT/2000 version will be released in July. OS/390 and Linux versions are also in the works. See the sidebar for information about new and upgraded features.

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Overview

Software AG's Tamino is a data server that uses XML for data exchange, storage, and retrieval. Tamino can store nearly any type of document, including XML-formatted information, HTML pages, letters, spreadsheets, audio, video, still images, and data from SQL or object databases. It can also integrate information from any of these sources--as well as information from business partners outside the

enterprise--within a single view or in response to a query. It validates incoming XML documents information against the Tamino database.

Tamino Components

Tamino consists of seven basic components that implement processes on the server. The X Machine and XML Store provide processing, transformation, and internal storage and retrieval of XML documents. The SQL Engine and SQL Store process and store SQL data. The X-Node provides industry-standard interfaces to external information in applications, databases, or files. The Data Map maintains (RDBMS and XML) schemas, DTDs, stylesheets, vocabularies, as well as generation and retrieval details, for both internally and externally stored information. The Tamino Manager provides Internet-enabled administration tools for one or more Tamino servers. The optional Server Extension feature--analogous to stored procedures or triggers in relational databases--lets developers create user-defined behavior or complex data mappings and embed these into any Tamino object. The components are shown in Figure, "Tamino Components."

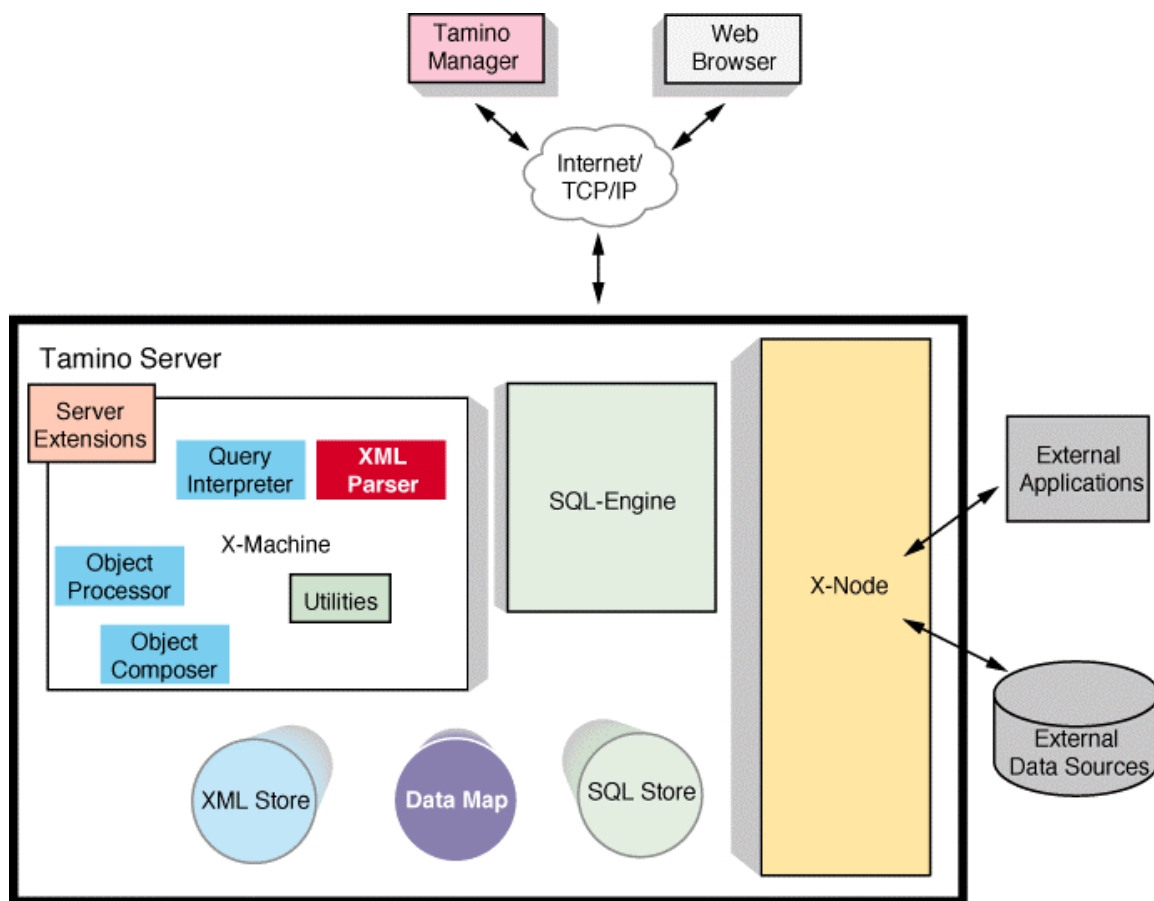


Figure 1.
Tamino Components

The X-Machine sits at the core of Tamino and functions as the product's XML engine. The parser validates incoming and outgoing XML documents, even if these do not include DTDs. The query interpreter, which works with XQL, provides information retrieval. The server extensions can move client logic to the server side or embed behavior (written in C, C++, COM/DCOM, or Java code) in XML objects or documents. A diagram is shown in Figure, "The X-Machine."

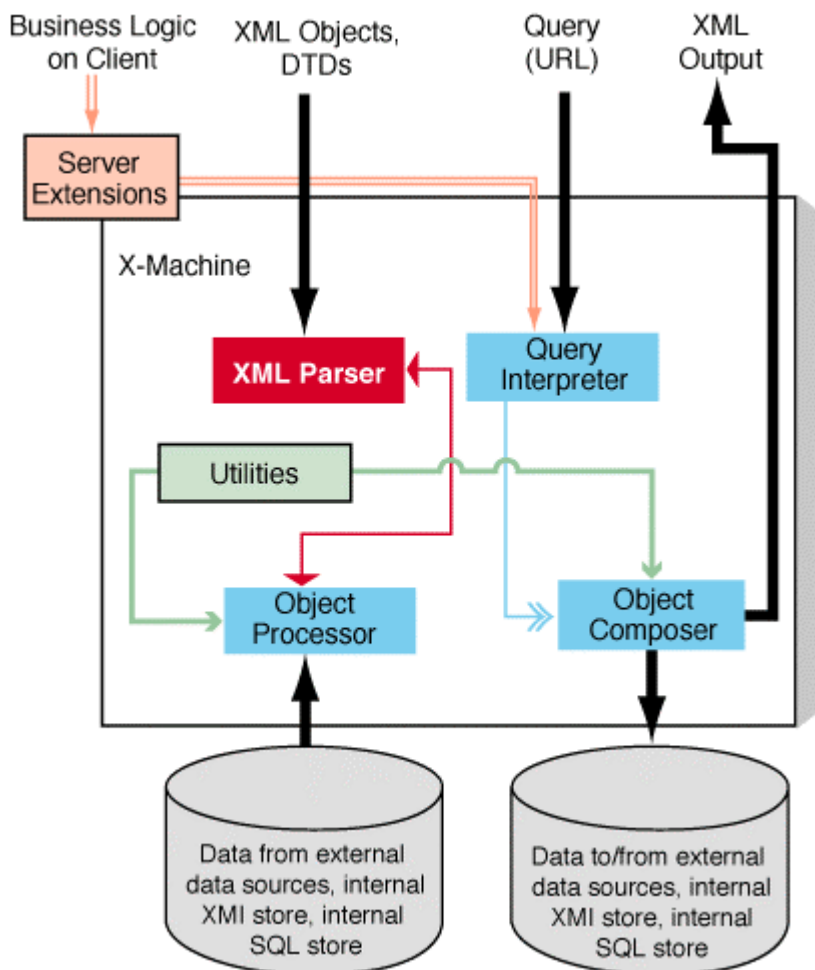


Figure 2.
The X-Machine

Using Tamino

Tamino can be used for storage, updating external databases, or integrating data from multiple sources. Working with Tamino involves two basic steps: (1) describing the data via Document Type Definitions (DTDs) (or XML schemas when these become available) and (2) defining a Tamino schema--using a text editor or the supplied graphical editor--for the Data Map to use for storage and retrieval, if needed.

The first part is relatively easy in that it involves identifying--rather than changing--existing data structures into XML metadata. This normally takes place outside of Tamino using an editing tool. The X Machine can parse any incoming data already in XML format, and Tamino also provides graphical tools for creating DTDs for non-XML data such as files, relational database tables, or other documents.

The second step explains how Tamino can access this data using stored schemas. A Tamino schema is actually an implementation of an XML schema; it identifies the structure of a dataset, where the data is stored, and how to retrieve it. Today, most Tamino schemas are based on DTDs or provide mappings to external relational database systems using a set of grammatical and lexical rules. When the Tamino schema is complete, users can store schema instances in the Data Map, which in turn stores and retrieves data according to the schema's rules.

Tamino primarily uses the XML Query Language (XQL) to retrieve any type of information accessible through the Data Map. The query language itself is transparent to end users, who simply make requests using the graphical, browser-based Tamino Interactive Interface. In response to the query, Tamino accesses the appropriate schema(s) in the Data Map and uses schema rules to extract information from the appropriate sources, compose the information as XML objects, and assemble them into an XML document which is returned to the user. Users who prefer to use SQL to access information in the SQL Store or via the X-Node can do so through the SQL-Engine.

All Tamino objects can be accessed directly through Web URLs. This makes information in older databases and legacy mainframe applications available to business partners and customers through the Internet.

Features/Functions

Product	Tamino
Version Reviewed	1.2
Type	XML database and information integration server
XML Standards and Technologies Supported	XML 1.0, Document Object Model (DOM), stylesheets (XSL and CSS), XQL, XML namespaces, DTD
Other Standards Supported	ODBC, OLE DB, JDBC, HTTP (transport protocol), SQL-2 entry level, ISAPI, Apache API

X-Machine and XML Store

Overview	Provides storage and retrieval of XML objects using information in the Data Map. Includes an XML parser, query interpreter, XML object composer, XML object processor, and utilities.
XML Parser	Validates internal object schema syntax and checks incoming objects' well-formedness.
Query Interpreter	Processes XQL requests, works with Object Composer and Data Map to retrieve XML objects.
Object Composer	Retrieves internally or externally stored information objects and delivers them as XML documents. Works with both non-XML and XML formatted data.

X-Node

Overview	Provides interfaces to external databases or other information sources. Combines information from multiple sources into an integrated package for client applications.
External Interfaces	Uses ODBC and OLE DB interfaces.
Data Exchange	Via HTTP. Tamino includes a secure HTTP server but can also work with any HTTP server. Supports HTTP 1.0 and 1.1.
Internet Communication	Supports ISAPI, NSAPI, Apache API.

Tamino XML Features

XQL Query Language	Designed to work with hierarchically structured XML documents. Provides querying features based on XPath including filters and joins. Software AG provides additional operators; otherwise, all features conform to W3C proposal. Will implement final W3C implementation when available.
Tamino XQL Operators	AND, OR, EQ (=), LT (<), GT (>), LE (<=), GE (>=), NEAR, ADJ (adjacent), SORT, SORTD (descending sort), * (wildcard), BETW (values within a specified range).
Tamino Schemas	Record rules for storing and indexing data, provide data retrieval information to the Object Composer and provide data storage information to the Object Processor.
Tamino Schema Language	Implemented as a DTD with three elements: <ul style="list-style-type: none"> • Collection (database-like information groupings of Doctypes) • Doctype (analogous to tables or views in relational databases) • Nodes (nestable document elements)

Collections	Work like relational database schemas; include zero or more Doctypes and can combine Doctypes.
Doctypes	Work like tables or views; consist of real-world objects to be stored in the collection; include one or more Node elements.
Node Elements	These are the actual elements within the Doctype. These can be arranged in a tree structure to express hierarchical or "nested" relationships.
Tamino Schema Editor	Provides graphical tools for defining and updating XML schemas and DTDs, indexing XML documents, and storing non-XML documents. Can index entire XML document or specific nodes (elements) within a document. Shields end users from DTD syntax.
XML APIs	Supports Document Object Model (DOM) and SAX. The latter is an event-driven API that provides fast access and Java programmability.
Other XML Standards	Supports XML namespaces.

SQL Engine and SQL Store

Overview	Executes SQL statements from Tamino or other sources and manages internal SQL storage repository.
SQL Versions	Supports SQL-2 (entry level) and dynamic SQL.
SQL Sublanguage Support	DML, DDL, DCL.
External SQL Processing	Works with SQL from ODBC, JDBC, or OLE DB interfaces or embedded in applications.
Embedded SQL	Provides a SQL precompiler that translates the SQL statements into appropriate host language calls and comments out the SQL so that the entire statement can be compiled by the host language compiler.

Data Map

Overview	Maintains schemas for storing and composing XML objects. Stores and indexes XML objects, maps data to appropriate data structures, and executes any code required by an object.
Mapping XML Data	Can store a well-formed XML document and let Tamino generate an index, manually generate a schema from a document's DTD, or write the schema using an external editor.
Mapping non-XML Data	Construct a DTD to model relevant parts of the data, then read the DTD into the Schema Editor and define the schema. Can also write a schema manually using an external editor.

Tamino Manager

Overview	Performs central database administration from any location. Interacts with Tamino Server and Data Map.
Interface	Uses graphical interface that runs in any browser that supports XML and Java, such as Internet Explorer 5.x and Netscape 6.
Tasks	Create/delete database, start/stop database, backup and restore, space management, user administration, create and manage XML and SQL schemas, adjust parser processing, add/change objects, install Tamino Server Extensions.

Server Extensions

Overview	Allow organizations to create custom mapping and event functions, formatted as Microsoft COM objects that act on external and internal XML objects or access databases. Development can take place in any language supporting COM. There is no limit to the number of extensions used by a single Tamino database.
Development Tools	SXS Application Wizard and add-in for C/C++ development in Microsoft Visual C++.
Mapping Extensions to XML Objects	Can use schema definitions to map an XML object to a user-defined function. Functions execute while parsing incoming objects or composing internal objects.

Transaction Management

Overview	Part of SQL command set. Can define session context and maintain state. Provides commands to commit and rollback SQL transactions. Supports ACID transaction properties.
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Other

Security	Supports single signon, SSL, RACF, NTLM, and Kerberos security schemes.
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Software AG Products Supported

Adabas	Interprets Adabas FDT structures as XML structures and Adabas records as XML objects.
EntireX	Uses EntireX's DCOM interface to access legacy and ERP applications.
Natural	Bidirectional access between Tamino and Natural via XML.
Bolero	Can use Bolero with DOM for assigning behavior to XML documents.

Operating Requirements

Processor	Pentium III 300MHz or higher
RAM	128MB minimum; 256MB or more recommended
Operating System	Windows NT, Service Pack 5 or higher
Disk Space	150MB or more
Display	VGA adapter and monitor; SVGA and 17-inch monitor recommended
Web Server	Apache Web Server 1.3.3-1.3.12; Microsoft IIS version 3 or later

Analysis

Software AG has been a presence in the worldwide database market for over 30 years, having been founded in 1969. The company's headquarters are in Darmstadt, Germany, with offices in over 60 countries around the world, and it completed an IPO on the Frankfurt Stock Exchange in 1999. Its legacy products--the Adabas database and Natural 4GL--continue to be actively used throughout the world.

Several years ago the vendor set up a distribution outlet called SAGA, or Software AG America, to support and distribute these two products in North and South America. SAGA became an independent company in 1997 and has since introduced a new product, SAGAVISTA, that integrates ERP, legacy, and packaged systems across an enterprise.

Three months prior to Tamino's April 2000 U.S. introduction, Software AG set up a subsidiary operation--Software AG, Inc.--in northern California, so that it would be closer to customers and business partners and increase its visibility in the Americas. This company is completely separate from SAGA. Software AG, Inc. hired its first salespeople in April and moved to larger headquarters two months later.

Not content to exist on its laurels, Software AG has been aware of the need for organizations to extend information beyond the confines of the enterprise and out to business partners and customers. To this end, it announced two new products at the end of 1998: Bolero, a Java IDE for creating e-business applications, and Tamino. The latter first appeared in Europe in late 1999, but was not introduced to the U.S. market until April 2000.

Software AG is an active participant in the Internet standards process. It joined the World Wide Web Consortium (W3C) in 1999 and also belongs to OASIS standards consortium.

Tamino uses XML to take the database management system paradigm and carry it one step further into the era of electronic business. While the relational database format is well suited for stable information structures and data that fits well into fully populated rows and columns, this paradigm runs into trouble with so-called "rich" data, such as audio and video files, software components, nested data structures, or very complex documents. Today, most database vendors offering XML provide it as an add-on and still do

most of the work with SQL and tables. These products store and manage information in tables and only convert it to XML on an as-needed basis.

Unfortunately, this adds a great deal of overhead to the relational database system, which may have its own performance problems. The database has to execute a separate procedure each time a table or SQL query is converted to XML (and vice versa), further deteriorating performance, and the rows and columns used by the XML document must be locked. In order to process a complex XML query, the database would likely have to execute several joins even before the conversion process takes place, further deteriorating performance.

Storing and modifying XML documents creates another set of headaches. A relational database must know all of the tags to properly decompose the document, so that in most cases users could change values but not the XML elements or attributes. Alternatively, XML documents can also be stored as BLOBs or CLOBs, but this would make it impossible to search or index the document and would eliminate the document's structure. If a document has to be changed, the database structure and any associated triggers and stored procedures would also have to be changed and would likely need to be renormalized (or denormalized).

Tamino, on the other hand, uses XML as the primary means for structuring, organizing, and storing information. Like SQL, XML provides full searching and indexing, but XML goes one step farther by letting users modify the structure of a document without destroying any preexisting data. Since Tamino uses schemas and DTDs to describe, store, and locate data, there is no need to programmatically design XML-RDBMS mappings. Tamino can even parse and structure any well-formed XML document and automatically create a DTD, even if one did not exist. Relational data must have its structure already specified before it can be imported into a database.

Tamino is aimed at traditional Software AG customers--those who already have Adabas and Natural applications and would like to extend these across the Internet as well as to new customers. The customer list includes many of the largest companies in the world.

In its relatively short lifetime, Tamino has already received three awards. It received an Editor's Choice from VNU Publications' CM Corporate Networking Awards 2000 in Amsterdam and was declared Best Software and Best of Comdex s at Comdex Singapore in April 2000.

Pricing

Tamino is priced at US\$25,000 per processor for Windows, \$40,000 for Solaris.

GSA Pricing

No.

Competitors

Most of the competition today comes from relational databases that include XML support, primarily as parsers on top of a relational engine. These products still rely on SQL for most database operations, whereas XML has been added as a way to communicate with other applications. All data--including "rich" materials such as voice or graphics--still must fit into rows and columns, so these products perform some type of XML-SQL transformation for every document whenever it is stored, retrieved, or modified. Competitors in this space include Oracle and IBM DB2.

Object databases store information natively as objects, and are commonly used for rich data formats. They normally use the native programming language--Java, Smalltalk, C++, or another language--to store, retrieve, or modify information. These products use XML for communication with other applications and require a similar transformation between the language and XML.

Other competitors include dedicated data servers, most of which use EJBs for data integration and caching. These include Persistence PowerTier and eXcelon's Javlin and B2B Servers.

Strengths

Uses Native XML for all Database Management Tasks

"Native XML" means that Tamino stores XML data without modification, and the database engine itself works with XML. This is different from relational--and some object-oriented--databases which are just starting to provide XML as an add-on. In the latter case, vendors most commonly offer external XML parsers or mapping technology that translates between XML and some other data format (SQL, BLOB, Java or C++ objects, etc). This can impact performance--especially when the requested information involves multiple JOIN operations or combines data from different platforms. The native XML format also makes it easy to modify information structure on the fly, whereas implementing even very minor changes to a relational table can take anywhere from hours to months. Its hierarchical structure also works well with nested data (impossible in an RDBMS).

Uses DOM for Customizing XML Documents

Tamino supports the Document Object Model, or DOM, a language-independent interface for editing and manipulating XML documents. DOM is actually an API for creating and navigating structured documents and also adding, deleting, or manipulating a document's content. DOM uses the OMG's Interface Definition Language (IDL) to hook into a variety of programming languages, allowing organizations to embed behavior within an XML document.

Vendor Has Longstanding Database Expertise

Software AG has been developing databases and query tools for over 30 years. The vendor's products include the ADABAS database, the EntireX enterprise application integration toolkit, the Bolero Java IDE, and the NATURAL 4GL, and its areas of expertise include pure-relational, nested relational, formatted data, and text database models. Tamino is the first XML-centric product to be positioned as a database and information server, and its vendor's pedigree should help it make an impact in U.S. and worldwide markets.

SQL RDBMS Tools Available

If specific data does not fit well in an XML document, Tamino also offers traditional SQL tools for working with this type of data. Tamino's SQL-Engine and SQL Store provide tools and internal storage for information better suited to traditional relational database tables. Data stored in SQL relational databases can be queried using SQL or via XQL if a corresponding schema exist.

Uses XQL for Queries and Indexes

Tamino provides XQL for querying and searching any type of document, including non-XML data that has a schema defined in the data map. End users can perform XQL queries using the Tamino Interactive Interface, which shields them from the complexities of the syntax. Also, XQL queries can be limited to searching only specific elements or values, making it much faster than other querying mechanisms.

Limitations

Incompatible With Windows 2000

Tamino 1.x versions will not work under Windows 2000 unless the operating system upgraded a previous version of Windows NT 4.x. This is because Tamino detects "artifacts" from Windows NT and uses these to install and boot itself. Unfortunately, users who purchased new Windows 2000 or those installing Windows 2000 over Windows 95 or 98 will be unable to install Tamino. Software AG has corrected this problem in Tamino 2.0, due out later this summer.

Datapro Insight

Tamino is an excellent product from a seasoned vendor--Software AG--which has over 30 years of experience with a wide variety of data models and querying tools. The product has already garnered awards in Europe and Asia, but has only just been introduced to the U.S. in June. Tamino uses native XML as its storage format as well as for creating schemas, making queries, and amalgamating data from just about any information source. Its visual development metaphor makes it very easy to use, for anyone who understands relational and/or object databases. Tamino is especially well suited for any organization that needs to integrate information from many different platforms and in a variety of formats and send it over the Internet to business partners or customers.

Tamino 2.1 New Features

Tamino 2.1--due for release by mid-August for Windows and already available for Solaris--will include the following new features:

- **Server Support:** Windows edition supports the iPlanet Web Server.
- **Security:** Access to elements in a document is based on structure rather than content, and servlets can be used to implement security options.
- **XPath and Queries:** The query language now implements the XPath standard and provides filtering and server extensions in queries.
- **Read-Only Databases:** Will support read-only databases for distribution and security.
- **Data Loading and Unloading:** Tamino includes Perl and Java tools for moving large quantities of XML data between external sources and Tamino databases.
- **Document Locking:** Can lock up documents in use to prevent corruption.
- **Dynamic XSL:** Stylesheets can be applied to XML documents before they reach the client, as long as the stylesheet is a Tamino object and stored in a Tamino collection.
- **Java Server Extensions:** These require JDK 1.2.2 or newer and are available for Solaris and Windows NT. Extensions are written as Java classes and their functions as Java methods.
- **Visual Basic and Natural APIs:** These are client-side APIs that allow users to work with Tamino data from both of these environments on Windows NT machines.
- **New Tools:** Tamino 2.1 includes SoftQuad's XmetaL XML editor, XML Authority's schema and conversion facilities, eXcelon's Stylus stylesheet editor, and Breeze's XML Studio 2.1 that lets developers use Java for XML data access.

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