Designing your TimeControl® 6 Architecture

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TimeControl is one of the most flexible and extensible timesheet systems on the market. TimeControl was designed from the beginning to be a system that accommodates the needs of the client rather than a system that requires that clients adjust themselves to the product's features.

TimeControl is used in deployments for as few as 10 users and has been used by as many as approximately 10,000 in a single implementation. The system has been used on its own or integrated with numerous project, financial, payroll and human resources systems simultaneously. The open architecture of TimeControl provides a tremendous range of architecture options but must also maintain a highly secure environment.

Understanding the various components that are a part of TimeControl and the components which are required to operate TimeControl and those which can optionally extended the functionality of the system is a key element of designing the architecture of your TimeControl environment.
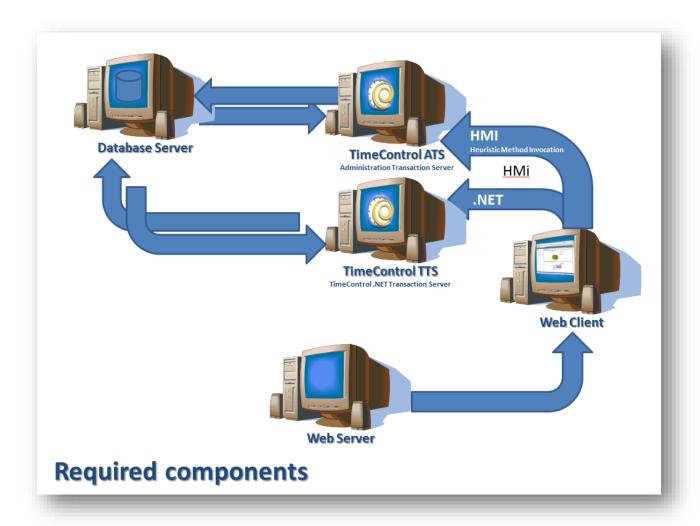
This paper will give an overview of both the required and optional elements of a TimeControl environment and discuss some of the decisions you must make as you create a TimeControl implementation specific to the needs of your organization.

This white paper is a guide to designing your implementation not a set of installation instructions. In the IT world, the components referenced here are changing day-by-day. The operating systems themselves, the databases, even the web browser on each client station is being updated every several days. To get more specific answers about how TimeControl supports a particular version of a component listed in this white paper, we recommend contacting HMS Software directly:

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TimeControl has some key components that are critical to system operations. TimeControl is an n-tier application with a design that allows for the system to be infinitely scalable. The key components include a Database Server, the TimeControl Administration Transaction Server middle-ware, the TimeControl Transaction Server Middleware Web Server components and the web-based client. We'll describe these components in more detail here.

Database Server

TimeControl stores all of its data in a SQL database. The system supports 3 main vendors of databases including Microsoft's SQL Server, Oracle, MySQL and Sybase.

There are numerous database versions supported. To check if a particular version of your database is supported, contact HMS Software's support services at support@hmssoftware.ca.

TimeControl Transaction Server (TTS)

Starting with version 6, TimeControl includes a 2nd middleware component called the TimeControl Transaction Server or TTS. The TTS is a .Net web service which interfaces with web-based .Net components and interacts with the database. The Microsoft .Net architecture is highly secure. In early versions of TimeControl 6, the TTS will manage the server-side commands for the timesheet, approvals, Debit/Credit adjustments, the dashboard and the User Options/My Account area. In future versions more and more of the ATS will be migrated into the TTS structure.

The TTS runs as a Windows Service which starts automatically on a Windows Server. Multiple instances of a TTS can be established on the same server. The TTS is typically installed on the same Windows Server as the ATS.

Administration Transaction Server (ATS)

For legacy support, TimeControl includes its proprietary middleware called the Administration Transaction Server or ATS. The ATS translates requests from the web based client interface into SQL database commands that the database can understand and sends the data required from the database back to the user's terminal.

The ATS contains an extensive selection of functionality but can only be talked to by the client interface. Aside from the database, the ATS can also communicate directly with some server-based project management software such as Microsoft Project Server or Primavera. This is in addition to the client-based project management links that can be effected from an end-user's terminal.

While the ATS is often exposed to the outside world through the Internet, having a middle-tier layer like this makes for a highly secure system since the database server and database itself are isolated from the outside world.

The ATS runs as a Windows Service which starts automatically on the Windows Server. Multiple instances of an ATS can be established on the same server.

Clients who do not require any of the legacy modules of TimeControl will not need to run the ATS.

TimeControl Schedule Service

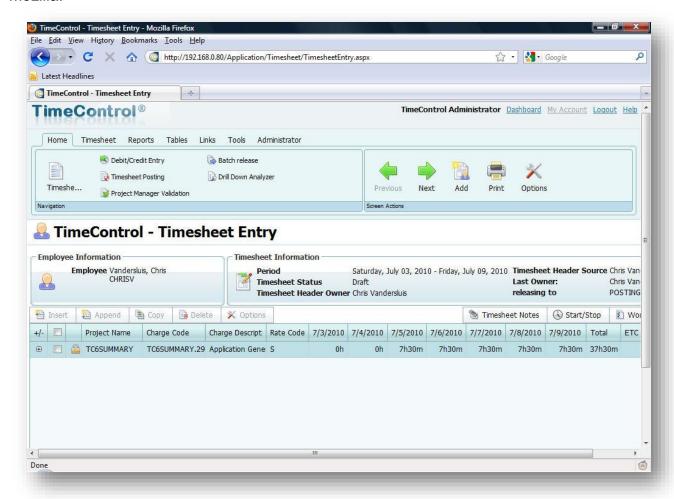There are several automated functions which can be run as scheduled events within TimeControl. These include unattended emails sent on a schedule, for example, when timesheets are missing and overdue or the posting of timesheets or linking of TimeControl to server-based project management tools. To manage the schedule of these events, the TimeControl Schedule Service is installed on the same Windows Server as the ATS and TTS.

Web Server

TimeControl 6 users are presented with a browser-based web interface written in an AJAX (Asynchronous JavaScript and XML) structure. To deliver this interface to the browser, TimeControl uses Microsoft's Internet Information Services (IIS) which is included with every Windows Server.

Timesheet Web Client

The TimeControl web interface requires a web browser. Numerous browsers and hardware platforms are supported. TimeControl 6 works with Internet Explorer, Firefox, Safari and Mozilla.

The multi-browser functions are those which do not require an ActiveX. This includes the timesheet, approvals, Debit/Credit adjustments, the Login and Dashboard and the Options/My Account page.

Administrator Web Client

Additional functionality in TimeControl 6 is available to administrators. These functions may require the installation of ActiveX components. If so, accessing these components for the first time, the user will be asked for permission for TimeControl to install several ActiveX controls. Only those users who require TimeControl's administrative functionality require the installation of these ActiveX components. Administrators can also install the ActiveX controls using the

supplied MSI installation packages which can be "pushed" using Active Directory or other push technologies.

Communications: .Net

TimeControl's user web client uses Microsoft's .Net architecture to communicate between the web page and the TimeControl TTS middleware service. This is a highly secure, encrypted environment which uses a streaming object protocol to package data and transmit it quickly from one end to the other.

Communications: HMI

TimeControl's administrative functions must communicate also. The ActiveX components communicate with TimeControl's Administration Transaction Server middleware service using a proprietary communications layer developed by HMS Software. Heuristic Method Invocation (HMI) is a socket-level encrypted object-streaming communications protocol. What this means is that once the end user has logged into TimeControl, every communication between his or her terminal and the TimeControl Server will be encrypted and protected. This makes compromising a TimeControl transaction while enroute virtually impossible.

There are a number of additional components that might be included in a TimeControl implementation. These components are not required but may be appropriate for particular situations.

Active Directory / LDAP

Some clients will wish to control all application access from Active Directory, LDAP or Windows Authentication. TimeControl supports all of these authentication methods as well as its own security model.

In the TimeControl User Table, select TimeControl Security, Windows Authentication, or Active Directory / LDAP as the authentication type. You may be asked for the location of the LDAP or Active Directory Server. A password needs to be entered into TimeControl only if the TimeControl Security type is selected.

TimeControl will take the User name and Password combination that were used during the login and validate them according to the method selected. If the method was TimeControl Security, TimeControl will search the TimeControl User database for the encrypted password. If the method was Windows or "NT" Authentication, TimeControl will call the Windows Server Authentication module, pass the User Name and Password to it and wait until Windows Server returns a pass or fail reply. If the method was Active Directory or LDAP, TimeControl will send the User name and Password to the AD or LDAP server and wait for a pass or fail.

This is sometimes desirable in very large organizations with the management of new users. Security for various applications and security on servers, is a huge undertaking. TimeControl is an application that is often distributed to every employee and that makes it one more application that requires administrative involvement when the employee is added. When linking to Active Directory or and LDAP server, the management of user passwords in TimeControl need not be done twice.

Access to TimeControl is something that should be rigorously managed. Timesheets, while they take up a minimal part of one's week, contain data that is considered among the most sensitive to the entire organization. This is not like ensuring that someone can start a word processing package so they can write a memo.
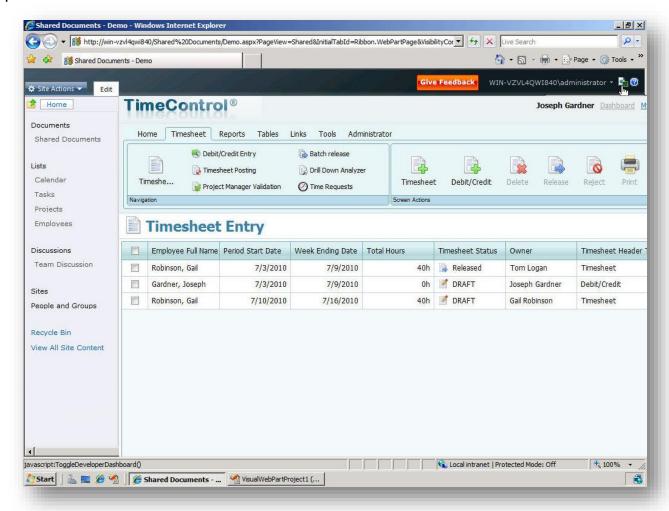
Some organizations ask why there is a requirement for creating a User entry in TimeControl at all. After all, couldn't Active Directory control this? Entering information for a new employee in TimeControl involves more than just the user name and password. Depending on the configuration of a given implementation, numerous fields and entries might need to be populated to define a wide range of properties for that employee for reporting and analysis purposes with any timesheet data entered. Also, rate information is often entered on an employee-by-employee basis. This type of information is far more extensive than what LDAP servers or Active Directory were designed for.

This is why access for new users is more often keyed off the human resources system. In some TimeControl implementations, direct links have been established to trigger a direct entry

in TimeControl by the database itself. Database triggers can be established to move all the pertinent data from the HR or payroll system to TimeControl in order to properly enter all data required by the system to get the employee started with TimeControl.

SharePoint

SharePoint is Microsoft's collaboration solution. It is available as Windows SharePoint Services which is included with Windows or as Microsoft Office SharePoint Server (MOSS); a portal solution.

TimeControl can be installed directly within SharePoint. The Microsoft Project / SharePoint Integrator is an installation option which is included with all versions of TimeControl. The Integrator works with SharePoint version 2007 and higher. For organizations which have chosen SharePoint as their collaboration platform, implementing TimeControl into the SharePoint interface presents users with an uninterrupted user experience as they move from other SharePoint applications to their TimeControl timesheet. The screen pictured here shows TimeControl installed into a Windows SharePoint Services site.

HTTPS

Security of TimeControl data is critical and HMS Software's HMI communications layer and the Microsoft .Net communications later protects all transactions between the TimeControl

interface and the TimeControl server but what about during the actual login process before the user even gets into TimeControl? For organizations that are implementing TimeControl with an outward facing site that is open to users who will login through the Internet, installing the login page in an HTTPS protocol encrypts even the login process. HTTPS is supported by all major web servers including IIS from within Windows Server.

Firewalls and Proxy Servers

A port on the TimeControl ATS server must be available to any client terminal which needs to access it for TimeControl to work properly. If the TimeControl site is outward facing this means putting the ATS server into what webmasters call the "DMZ" or "Demilitarized Zone". The DMZ is an area of the network which is allowed access to the outside world through the Internet and is allowed access into the network's protected areas. This area is controlled by the organization's firewall. The network firewall must be configured to allow TimeControl traffic.

Many servers and client stations also include individual firewalls which can restrict traffic to and from the network or the Internet. These firewalls must also be configured to allow TimeControl traffic.
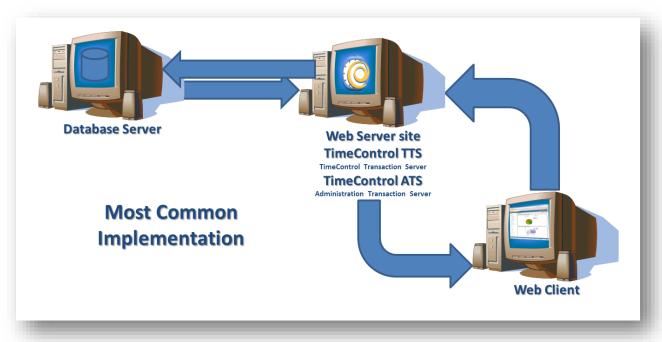
For those implementations which are outward facing, TimeControl also includes the capability of implementing extended security architecture using a proxy server. Using a proxy server redirects traffic from the web server to an internal machine that is not otherwise available outside the network.

This allows the standard web security that is part of every web server to intercept and evaluate traffic. It also allows the internal middleware server to be completely hidden from access from outside the network.   A proxy server is accomplished by registering a redirector with the web server that knows how to interpret TimeControl traffic that arrives from the end user browser.

Setting up a proxy server environment can be done at any time either during installation or afterwards.
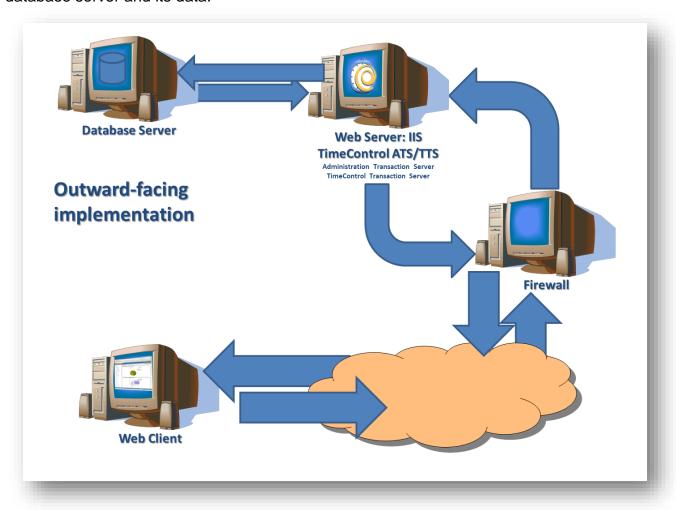
The simplest working implementation of TimeControl is a single-click installation. TimeControl is installed into a Windows Server with the TimeControl ATS, The TimeControl Transaction Server (TTS), the TimeControl Scheduler and Web Components installed at the same time.

Database Server

**Web Server site
TimeControl TTS**
TimeControl Transaction Server
TimeControl ATS
Administration Transaction Server

Most Common Implementation

Web Client

The best practice would be to not install the database on the same server to protect that server from direct access from the end users although this too could be done in a smaller implementation. This does not require special IP numbers or domain name registration as all users would be within the organization's network.
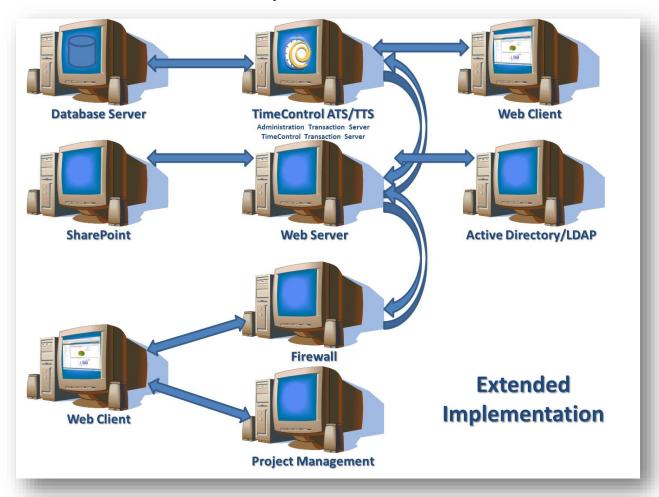
By far the most common TimeControl implementation is one where the end users can access the system from within the organization's walls or remotely via the Internet. This is what is referred to as an "outward facing site". In this case it is quite important for the database server to be kept separate from the TimeControl ATS and TTS middleware for the protection of the database server and its data.

Database Server

Web Server: IIS
TimeControl ATS/TTS
Administration Transaction Server
TimeControl Transaction Server

Outward-facing implementation

Firewall

Web Client

TimeControl in this case will likely work through a firewall to ensure that only traffic which should reach the TimeControl ATS and TTS arrives there and the Web Server will need to be configured to have an externally reachable IP address. This too is managed from within the firewall along with the network's webmaster and Internet Provider. A domain name is often registered by companies for their TimeControl implementation such as timecontrol.companyname.com.

TimeControl is an infinitely extensible system. There are numerous components that can be installed or integrated or referenced by the implementation. Not every component we've listed here is required but it is important that an organization which needs to be able to integrate these elements are able to do so in a system that often becomes mission critical.

TimeControl is designed as a solution but at HMS, we know the problems to which that solution will be applied are as diverse as there are organizations which need a timesheet. That's why TimeControl was created as an open-architecture system.

Whether it`s for linking to a commercial ERP or an in-house project management tool or to Active Directory for password authentication, TimeControl is able to do so.

There are additional ways that TimeControl can be extended because the database schema or design is also published. Many organizations link TimeControl to systems which the TimeControl developers never even hear about because the creation of those links are managed by the clients themselves.

For most implementations, the basic TimeControl system is more than enough to handle all that is required. Multi-thousands of users can be supported by the basic version which must be installed on a single Windows server with the ATS, the TTS and web server all installed with a single click such as described above in the "Most Common implementation.

However, some organizations will require implementations that are more complex. HMS has developed the TimeControl Advanced CD for these situations. The TimeControl Advanced CD is purchased separately and includes the following capabilities:

Multi-Server Installations

The TimeControl Advanced CD includes a more technically involved installation procedure which allows a skilled administrator to install the TimeControl components on different servers. This would allow the Web Server components, the TimeControl Administration Transaction Server (ATS) and the TimeControl Transaction Server (TTS) to be installed separately. Also, this would allow multiple ATS's, TTS's and multiple websites to be created for load-sharing on a very large scale implementation. TimeControl has been designed to support up to 100,000 users using such techniques.
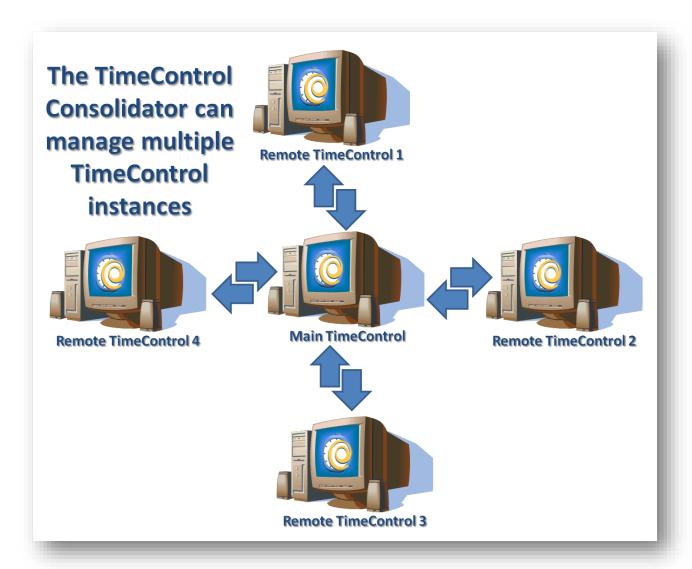
The TimeControl Consolidator

There are some situations where remote installations must be separated from the main TimeControl database. This might be the case for geographically remote satellite offices where Internet or Network connectivity cannot be guaranteed. For these situations, the TimeControl Advanced CD includes the TimeControl Consolidator. This tool works between satellite installations of TimeControl and a central TimeControl to update certain data files for the remote installation and the main posted timesheet to the central installation. In this manner, the remote installation can be operated independently and yet the central database can be maintained for auditing, financial or system integration purposes. It's the best of both worlds for those deployments where multiple remote locations must be managed.

There are an infinite number of implementations which can be designed using TimeControl as part of the solution. When using the TimeControl Advanced CD however, there are some extended implementations which are not otherwise possible. We've described two of those here.
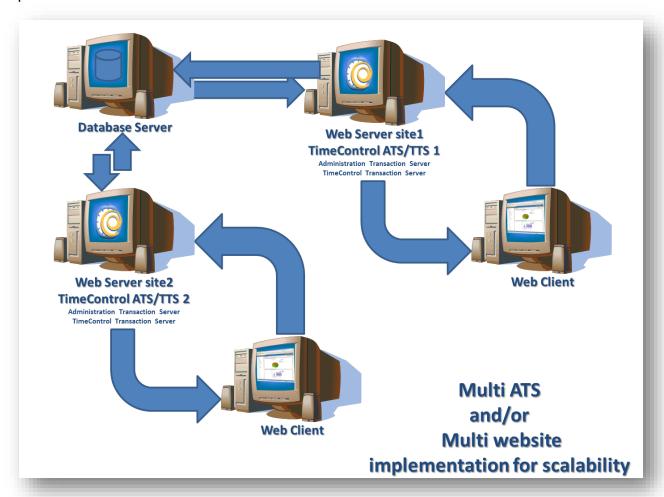
Satellite Installations

Some TimeControl implementations are done where some users can easily access the system from the organization's central offices yet other users may be unable to do so due to geographic or other restrictions. Perhaps there are a number of satellite offices which do not have reliable Internet access because they are in countries with telephone service which have very low bandwidth or intermittent stability issues. Perhaps there are TimeControl users located offshore on ships or oil platforms. Or, perhaps there are groups of TimeControl users in remote offices in high-security defense situations where access to the Internet is highly restricted and controlled. For these situations, HMS designed the TimeControl Consolidator.

The Consolidator is designed to have remote offices work on a separate remote TimeControl database with their own instance of TimeControl and to have that remote office either send their data physically (by CD or USB key for example) or to create a batch of data and send that in an email to a central TimeControl installation. This allows the system to provide reliable access at the satellite office yet update the central office with all timesheet data from the satellite while maintaining referential integrity of that data for auditing purposes.

Multiple Websites or ATS/TTS's

A single server TimeControl ATS/TTS and web server is capable of serving thousands of users simultaneously. The TimeControl traffic is extremely light and even with up to 10,000 users, this can be served from a single server. However, there may be situations where an organization wishes to establish multiple connections to the database to scale for very large implementations or because of environmental factors.
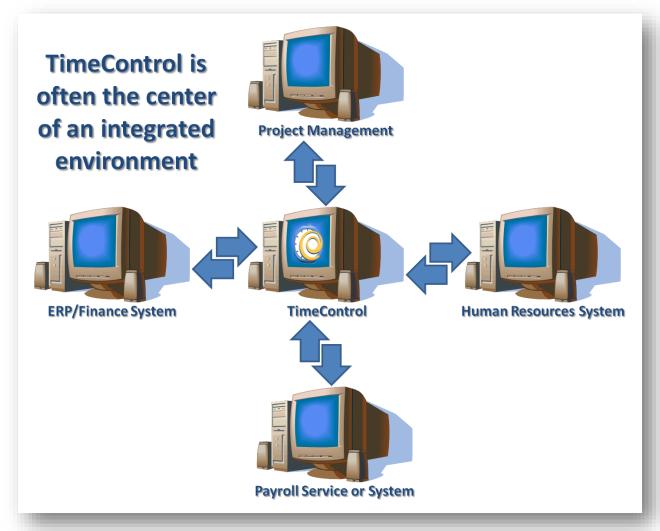

The TimeControl Advanced CD allows for the individual components of TimeControl to be installed separately. This would allow multiple TTS's ATSss or even multiple web sites to be established on different servers. TimeControl can also work in a load-sharing environment where the web server will redirect users to the lowest load TTS or ATS although the tools to create the load sharing log in are not included as part of the TimeControl installation.

There is no limit to the number or type of systems that can be integrated to TimeControl. We've identified a couple of the most commonly requested systems below.

Integrating with ERP, Payroll, Human Resources and Project Management Tools

TimeControl is often the most flexible and maneuverable enterprise tool in the organization and, as such, often becomes a central pivot in creating an effective enterprise environment for tracking work. TimeControl already includes links to project management tools and a General Link module for creating links to and from other enterprise systems such as Finance/ERP tools, Human Resources, Payroll software or a Payroll service.

TimeControl has internal controls to link to project management tools including Microsoft Project and Project Server, Primavera and Deltek's Open Plan and Cobra.   It uses transaction files in either CSV or XML format to move data to ERP tools such as SAP, Oracle or Microsoft Dynamics as well as HR tools like PeopleSoft or Payroll services like ADP.

When used with Microsoft Project Server 2003 or higher, TimeControl can also be integrated directly into the Microsoft Project Web Access interface. This displaces the timesheet within

Microsoft Project Server and provides a timesheet to users that will update Microsoft Project tasks and the Finance system with critical financial information for purposes such as payroll, R&D tax credits or government compliance such as DCAA (US Defense Contractor Audit Agency) within a single interface that is within the project management tool.

TimeControl Hardware Requirements

The hardware, operating system and version requirements for each component of TimeControl are described below:

TimeControl ATS and TTS middleware Servers

The Administration Transaction Server (ATS) and the TimeControl Transaction Server (TTS) are the two elements of the TimeControl middleware that communicate between the end-user's station and the database. The middleware elements include the TimeControl ATS and the TimeControl Scheduler and the .Net TimeControl Transaction Server (TTS) which are installed as Services on the target machine.

Requirements
- Windows Server operating system capable of supporting .NET version 4.0+
- Both 32bit and 64 bit Windows Servers are supported
- Minimal RAM should be 8GB
- Minimal speed should be 3Ghz
- A dual core CPU is the recommended minimum. Quad core i7 is recommended particularly for implementations of more than 1,000 users.
- Windows .NET 4.0 Framework or higher
- TimeControl can be installed on a virtual environment such as VMWare or Hyper-V.

The typical load for the ATS and TTS combined is 2% - 20% of CPU cycles.

Web Server

A standard installation of TimeControl installs both the Middleware and Web components on the same server. In this situation, TimeControl requires that the server be running Windows Internet Information Services (IIS) and the hardware requirements are the same as the Middleware Server above.

Database Server

TimeControl works with one of several client/server databases, including Oracle, Sybase, MySQL and Microsoft's MS SQL Server. Since each database has its own requirements and several of these databases support a wide range of hardware, it is impossible to determine all the hardware and operating system configurations which TimeControl can support. The data-load of TimeControl is minimal. The Database Server must be accessible from the ATS, the TTS and Web Service servers.

Requirements
- Microsoft SQL Server 2005 Standard Version or higher
- Oracle 10g or higher
- Sybase 11 or higher
- MySQL 5.5 or higher

TimeControl Users

Administrators
For Administrators, the TimeControl 6 web interface requires Windows XP or later and Internet Explorer browser version 6 or higher. Both 32 bit and 64 bit versions of Windows are supported for the client stations. Most administrators will have to be able to install ActiveX controls within Internet Explorer

End users
Multiple browsers and hardware are supported for end-user clients who will be entering and approving timesheets. Internet Explorer, Firefox, Mozilla (on Linux), Safari (on PC, Mac, iPad and iPhone) and Chrome are supported. Numerous other browsers may be supported. The functions in TimeControl 6 which support these browsers include:
- Timesheet entry
- Approvals:
  - Release timesheet for approval
  - Automated approvals
  - Approve timesheet
  - Reject timesheet
  - Re-release timesheet
  - Approve TimeRequest vacations
- Adjust timesheet while it is under the supervisor's control (if permitted)
- Debit/Credit adjustments
- Manage personal options in MyAccount
- Enter TimeRequest Entries

TimeControlMobile End-Users

TimeControl includes a mobile interface designed for Smartphones. Each TimeControl implementation includes this interface available by adding "/mobile" to the system's URL (e.g. www.yourtimecontroldomain.com/mobile).
TimeControl Mobile has been tested with Blackberry, iPhone, Android and Windows Mobile 7 devices and their native browsers.

Combining Servers

When clients implement TimeControl, there is often a question about whether TimeControl's installation can be shared with other applications. While every situation is different, here are some general guidelines.
- In an outward-facing TimeControl implementation, it is very unusual to install TimeControl on the same server as the middleware as this might expose the database server itself to attack.
- In an implementation where TimeControl is being integrated with SharePoint, it is common to install TimeControl on the same server as SharePoint.
- In an implementation where TimeControl is being integrated into Project Server or both Project Server and SharePoint, it is common to install TimeControl on the server being used by Project Server.
- In most circumstances, TimeControl's middleware services can be implemented on servers being used for other purposes.

Engineering/Construction

Lockerbie & Hole
AeroInfo
Koch Business Solutions
Kongsberg Devotek
Thompson Beta

Gas / Utilities

Gulf South Pipeline
Acergy
Petrocon
VenCorp

Manufacturing

Alcan
Parker Hannifin
Dofasco
Georgia Pacific
John Deere
Magneti Marelli
Mercury Marine
Tennant
Wagner Spray Tech
Vision Systems

Defense / Aerospace

Bombardier Inc.
CAE Electronics
General Motors Diesel
Lockheed Martin
Rolls Royce
SAAB

Government

Amsterdam Port Authorities
Atlanta Airport
City of Montreal
Dutch Railways
Government of Saskatchewan
Railway Procurement Agency (UK)

Technology

Arivia
CSI Piemonte
DRS Power Control Tech
EDS
Face Technology
Fuel Plus Software
GE Access
Lockheed Martin
Microsoft
Positron
Psion Techlogix
DRUCK Ltd

Telecommunications

Cable & Wireless Bartel
Ericsson
EXFO
Motorola
Philips Semiconductors
SARA Amsterdam
Stratos Global

Financial

Standard Life
Development Bank of Canada
Alliance One

Health/Pharmaceutical

Boehringer Ingelheim
Azko Nobel (Organon)
RTS Thurnall
Canadian Institute for Health Info
Iogen
Registrat

HMS Software, a division of Montreal, Canada-based Heuristic Management Systems Inc., is a leading provider of enterprise timesheet and project management systems.

Founded in 1984, HMS Software's expertise in implementing enterprise project-management and enterprise timesheet systems is recognized worldwide by some of the world's best known organizations. HMS's signature product, TimeControl, an enterprise timekeeping system designed to serve the needs of both Finance and Project Management, is distributed worldwide through an extensive list of distributors and dealers located on every continent with representatives in the US, the UK, Australia, Mexico, Europe, Asia, South Africa and the Middle East.

HMS Software's client list includes some of the world's leading corporations in the telecommunications, IT, finance, engineering, defense/aerospace and government sectors including such organizations as Acergy, Aecon Construction, Alcan, the Atlanta Airport, Akzo Nobel, The Canadian Business Development Bank, The City of Montreal, EDS, Ericsson, General Motors, the Government of Saskatchewan, John Deere, Kelly Services, The UK's National Health Service, Standard Life, UPS, Volvo Novabus and hundreds of others. HMS maintains offices in Montreal, Quebec and Toronto, Ontario.

For more information about HMS, please visit www.hmssoftware.ca.

TimeControl

First published by HMS in 1994, TimeControl has been adopted hundreds of clients and over 150,000 users around the world. TimeControl is designed to serve the needs of both project and finance simultaneously. It allows an organization to use a single timesheet for project tracking, time and attendance, time and billing, HR tracking, R&D Tax Credits, DCAA and project costing instead of having to deploy many timesheets to serve these needs. TimeControl is available for purchase for an on-premises implementation or as a subscription as service. TimeControl's architecture is flexible and extensive supporting numerous databases such as Oracle, Microsoft SQL Server and MySQL, multiple browsers such as Internet Explorer, Firefox, Safari and Chrome and even includes a mobile interface for Smartphones

For more information about TimeControl please visit: www.timecontrol.com.

Strategic Services

In addition to being a publisher of one of the world's best known timesheet systems, HMS provides a full range of support services including technical support, training and consulting tailored to meet clients' specific needs. HMS Software consultants are skilled in activity-based-costing, timekeeping methodology, project management techniques, cost and earned-value management as well, of course, in the HMS-supplied products.

For more information about HMS Software services, please visit www.hms.ca.