

An Epicor® White Paper

Epicor ERP 10— Architected for Efficiency



EPICOR®



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Introduction

Today's global business environment has transformed what enterprises need from their ERP systems. Global competition has led to the development of extended value networks, with facilities, suppliers, and partners in every part of the globe; moreover, it is much more nuanced than was ever imagined. Change is constant. Innovation is accelerating. Competitive pressures and customer expectations are higher. In this dynamic and challenging environment, technology must support the goals of better collaboration, increased agility, real-time responsiveness, and higher performance while reducing complexity in what is inherently a complex structure. Failing to do so may hinder what technology is meant to drive: growth and opportunity.

Epicor ERP 10 has been built from the ground up to comprehensively respond to these needs and provide the support organizations require to thrive in today's competitive global business landscape. Guided by the needs of today's organizations, Epicor ERP 10 streamlines the use of ERP across multiple devices while providing greater deployment choices, reduced complexity, and remarkable ease-of-use. Built on agile technology to provide rich, global functionality, we believe it is a truly inspired ERP solution, one that not only unleashes the full potential of ERP, but also changes its role from necessary infrastructure to active facilitator of business growth and sustainability.



How Epicor ERP 10 Is Built

Epicor ERP 10 is built on a server architecture fully optimized for Microsoft® Windows® Server and Microsoft SQL Server®. This helps make it simple to manage and very hardware efficient. Relatively easy to deploy, the solution includes new features such as Epicor Social Enterprise and Epicor Enterprise Search, while incorporating all the rich business capabilities and global functionality of its predecessor suite, Epicor 9. In addition, Epicor Web Access, the browser client for Epicor ERP, has been re-architected to improve speed and user friendliness.

Microsoft® .NET® 4.51 and SQL Server combine to form the underlying platform for Epicor ERP 10. These platform components were chosen not only for their proven reliability, but also because the stack has a very low total cost of ownership (TCO). Microsoft SQL Server has long been a popular database technology for Epicor customers, and ERP 10 doubles down on the Epicor commitment to build fast and robust applications that make the most of SQL Server's capabilities in the enterprise. ERP 10 services are hosted on Microsoft Internet Information Services (IIS), which means the entire architecture can be managed and extended using commonly available technical skills.

Generally speaking, ERP 10 delivers twice the performance of Epicor 9 and scales more than four times higher than the previous release. Most hardware configurations cost less than \$90 (USD) per concurrent user. What's more, ERP 10 is "by the book" architected for Windows Server and SQL Server, which means all the management and monitoring tools familiar to IT staff can be leveraged with little or no additional training—a real time and cost savings. The solution is highly interoperable with all kinds of IT systems and supremely adaptable to unique and constantly changing business environments.

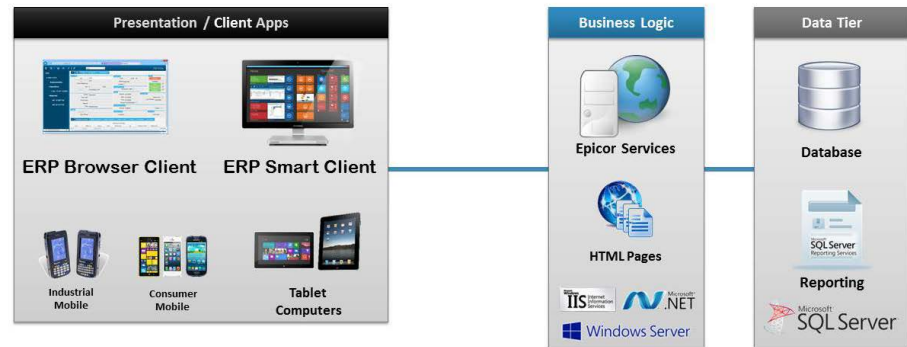
Built on a comprehensive services architecture, Epicor ERP 10 is easy and flexible to deploy, either on premise or in the cloud. Consequently, it provides the flexibility and choice today's organizations need for deploying and managing multiple ERP instances.

Epicor has been offering ERP as a subscription service (SaaS) since 2009 in three editions: Express and Standard for small manufacturers and distributors, and an Enterprise edition, which includes the same functionality suite as on premise Epicor ERP. Epicor does not dilute development, support, or services resources by managing multiple code lines for cloud and on premise deployments. Epicor SaaS ERP 10 follows the same strategy but with a new architecture that provides cloud-based customers with better performance, higher reliability, and exceptional IT efficiency.

System Architecture

Epicor ERP 10 is completely built on the Microsoft .NET® Framework using managed code, written primarily in C#, along with state-of-the-art components such as Windows Communications Foundation (WCF) and Entity Framework. This approach allows the Epicor ERP applications code to run on any system compatible with Microsoft .NET 4.51 and the relevant extensions. ERP 10 relies on Microsoft SQL Server for data storage, Microsoft SQL Server Reporting Services (SSRS) for reports, and Internet Information Services (IIS) for hosting.

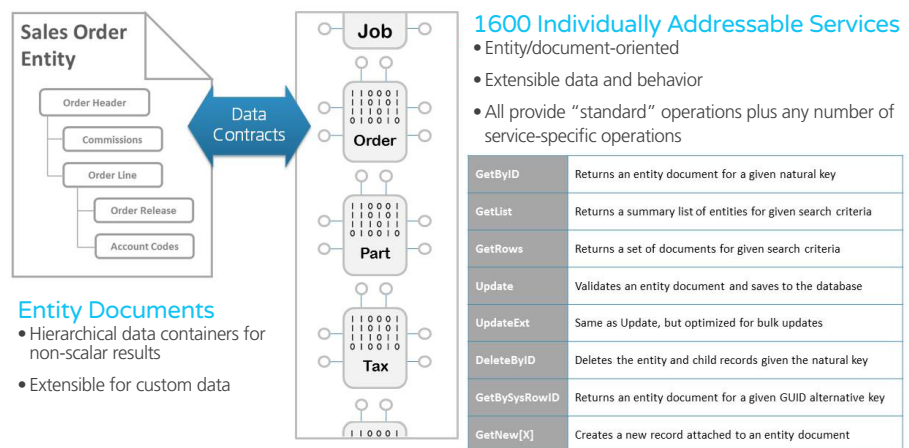
Scale Up or Scale Out



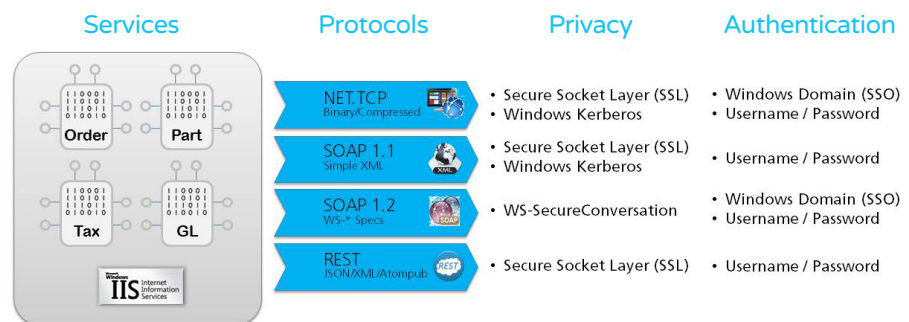
Epicor ERP 10 was designed for Microsoft Internet Information Services (IIS), an exceptional application server. IIS is a proven, reliable, and scalable technology that includes a powerful administration console and tools to configure, secure, and troubleshoot application services. Epicor ERP 10 also includes a dedicated management system for deploying and managing ERP instances. Once an ERP 10 release is installed, the Epicor Administration Console is used to easily create and manage databases, migrate data and applications from previous versions of Epicor ERP, bind ERP instances to licensing, and manage users and sessions.

The Epicor ERP Administration Console, ERP 10 architecture, and IIS all work together to provide a highly available ERP system. ERP 10 services are fully multi-threaded and load resources on demand, as they are needed. ERP services can be hosted in a single process, a multi-process Web garden (recommended), or by using load balancing across multiple application servers. Hardware-based load balancing is recommended for configurations intended to support more than 200 to 300 users. (ERP 10's Sizing Guide provides complete details.)

The solution is built as a collection of more than 1,300 independent services and nearly 20,000 operations. All access to the application logic—whether from an Epicor client application or any other enterprise system—is managed by calling one or more of these services. There are no private APIs or application logic unavailable for IT to exploit. Each application service has a number of standard operations for retrieving or updating entities such as orders, customers, parts, and manufacturing orders. There are a multitude of other utility operations, depending on the specific needs of user operations. Finally, ERP 10 supports other approaches to integration, including high-speed imports using flat formats or EDI messaging.



The Windows Communication Foundation (WCF) is used to host Epicor ERP 10 services. By default, three protocol endpoints are supported for each service. The first is a binary Net.Tcp protocol endpoint that uses an Epicor-specific wire format, optimized and compressed for use by the Epicor ERP client application. The Net.Tcp protocol is available for general-purpose access via service contract assemblies that can be used in any .NET-based project.



All protocols available concurrently, single site, zero extra deployment steps

Interoperable access to services generally requires use of SOAP, which is an XML-based messaging protocol. ERP 10 supports two SOAP implementations: SOAP 1.1 and SOAP 1.2/WS-*. SOAP 1.1 is an earlier SOAP format with simply message formats. SOAP 1.2, along with a large number of Web Services specifications (WS-*), is the predominant standard for sending interoperable messages across systems and platforms. ERP 10 services are all declared as WCF service contracts and non-scalar data types are defined as data contracts. This approach ensures maximum interoperability because ERP 10 services accept/emit simple object graphs, without any proprietary data containers.

There are three aspects to ERP service security: authentication, privacy, and authorization. ERP 10 has two authentication providers: Windows single sign-on (SSO) and Epicor-defined username/password tokens. The Windows single sign-on option is fully integrated with the Windows operating system and Active Directory. Privacy ensures that messages between ERP services and callers cannot be read by intercepting network traffic. ERP 10 uses either a Windows domain or secure socket layer (SSL) and X509 certificate to encrypt the communications channel.

Authorization defines which services and data the caller is allowed to access. Epicor ERP 10 includes a comprehensive access rights system, where users—or groups of users—are assigned access rights to any table, field, form, menu option, or service operation. Access rights can be defined inclusively (explicitly allowed access) or exclusively (explicitly disallowed access). In addition, there are a number of ERP-specific security partitions supported through the system. These include companies, departments, territories, and manufacturing sites.



ERP Security Partitions

ERP Services are highly extensible. The underlying data model can be extended with custom fields and tables. These fields are usable all the way through the stack, including client applications. Service behavior can be modified or extended using Epicor Business Process Management. Moreover, services and data exchanges can be orchestrated with other systems using Epicor Service Connect.



System Security

The foundation of any modern enterprise application is a well-designed physical data model coupled with a great database engine (e.g., Microsoft SQL Server). The Epicor ERP 10 data model is comprised of about 2,000 well-normalized tables. Each table includes a declared primary key, a GUID alternate key (with a SQL “row guide” attribute), and a row version column (commonly called a “timestamp” value). These features make it much easier to enlist advanced SQL Server replication and integration services. Each application table has an intermediate “shadow” companion defined that is used by master data management features as suspension data containers. ERP 10 also uses stored procedures generated by the Internet Component Environment (ICE) Framework SDK to optimize data access for standard operations and efficient data paging.

PartClass (Erp)		
Column Name	Data Type	
Company	nvarchar(8)	Company partition value
ClassID	nvarchar(4)	
Description	nvarchar(30)	
BuyerID	nvarchar(8)	
RcvInspectionReq	bit	
CommodityCode	nvarchar(12)	
AvailForReq	bit	
MtlBurRate	decimal(7, 2)	
SplitPOLine	bit	
NegQtyAction	nvarchar(4)	
PurchCode	nvarchar(8)	
ConsolidatedPurchasing	bit	
GlobalPartClass	bit	
GlobalLock	bit	
SysRevID	timestamp	Versioning column
SysRowID	uniqueidentifier	Alternate key (rowguid attribute)



Database Tables

- ~290 Systems Tables, 644 Indexes
- ~1660 ERP Application Tables, 6460 Indexes
- ~1900 Data Sync Suspension Tables

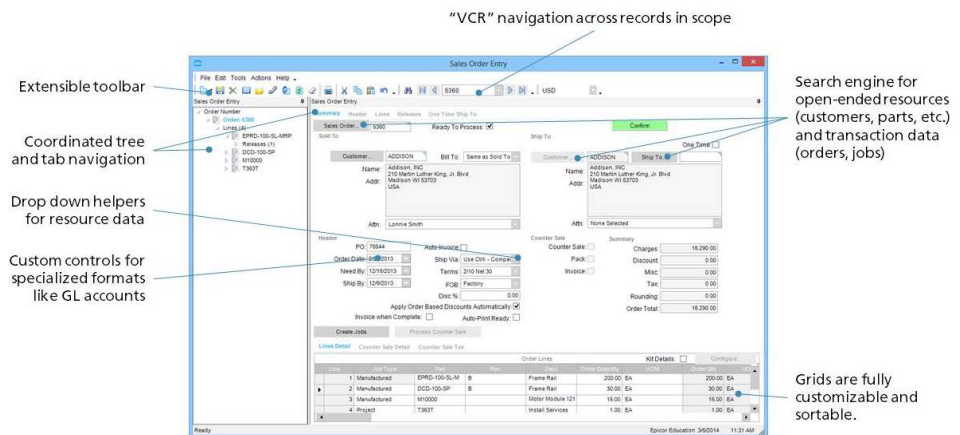


Transactions

- Snapshot isolation eliminates share locks on reads
- Exclusive locks are generally row-based
- Change data capture available on all tables

Supporting the applications code is the Epicor ICE Framework, which is an enterprise grade application framework purpose-built for the Epicor ERP programming model. Epicor ICE separates many technology aspects (e.g., hosting, data access, caching, protocols, security, assembly management) from the applications code. The ICE framework ensures that the 1,600+ services and hundreds of forms that make up ERP 10 are built and behave consistently. The ICE Framework also serves to “separate concerns,” a software architecture approach that ensures that different areas of a large software set can evolve independently. The Epicor ICE Framework can also work as a stand-alone system providing bridge services to external data and legacy systems as well as business queries, dashboards, and search indexing.

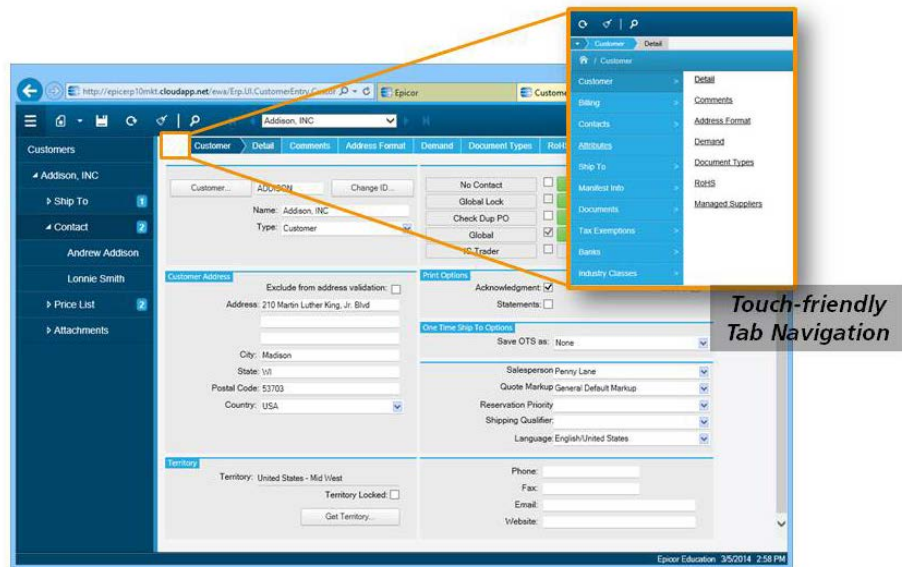
Most Epicor ERP users access the system using the Epicor ERP smart client application, which is also architected for Microsoft .NET. Epicor ERP is highly regarded for the rich capabilities and flexibility of the ERP Client application. Popular features include a consistent navigation across hierarchical business information, string usability design for “heads-down” data entry tasks, and highly personalized styling capabilities. Application forms are comprised of multiple “tear-off” information panels—each related to a data entity—that can be oriented or even removed to suit the needs of the enterprise or individual users.



Most data entry forms represent information both in free form and as a spreadsheet-like grid. Epicor ERP grid controls are powerful data entry tools. Columns can be rearranged, sorted, or filtered. Data can be collapsed into groups and all data entry is instantly reflected in other views contained in the same form. One of the most popular grid features is the instant export to Microsoft Excel. Users can also paste/insert data directly from Excel into the data entry grid. This capability is frequently used for creating orders, adding parts, or managing pricing.

Forms can be fully customized. The ERP 10 Client includes an embedded integrated development environment (IDE) that allows controls to be moved, dropped, or added. Developers can declare dynamic “row rules” to create data-driven behaviors such as changing color or style. Additionally, form logic can be created in C# or VB.NET and assigned to form, panel, or control events. All customizations are managed and stored as metadata that is propagated to deployments automatically and on demand. More importantly, the metadata-based approach for customizing Epicor ERP 10 is “non-invasive” to Epicor-supplied application resources. In other words, customizations do not touch baseline code, which means deploying service packs is an easy process.

Epicor Web Access (EWA) allows users access for ERP 10 forms using a browser. EWA renders the client application content using pure HTML without dependencies on browser plug-ins. HTML forms are derived directly from the same metadata that defines ERP Client Application forms. Many constructs supported by the Client Application customization tools are supported by EWA. This means it is possible to customize Epicor ERP using the embedded IDE tools, and for those changes to appear in browser versions of the form.



For ERP 10, Epicor has re-engineered the Web Access stack for easier usability, much faster performance, and intuitive navigation via touch-enabled devices. Rather than trying to faithfully reproduce the “heads-down” ERP Client Application, EWA reimagines form navigation using dynamic sections and touch-friendly jump panels. This makes it easier for users carrying mobile devices to access information and make decisions.

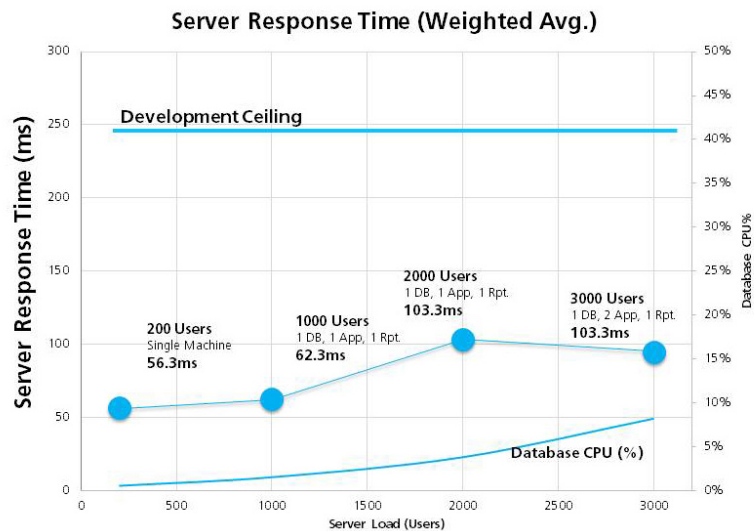
Performance and Scalability

There are three aspects to Epicor performance testing:

- ▶ Absolute responsiveness as measured (or perceived) by users running the Epicor Client Application
- ▶ Server processing times under various load models
- ▶ Throughput testing that demonstrates how typical bulk load operations perform

Epicor development guidelines mandate that no service pack or release can ever perform worse than a previous product version, as measured by our standardized tests. *Compliance to that mandate is required even when functionality is added to the system.*

The approach Epicor takes to scale testing is simple: be accurate and report results truthfully. Comprehensive load testing is complex and expensive. Epicor invests in load testing to understand how products perform and how to make them better. It also publishes detailed results to provide



customers with the best information to help plan capacity and system responsiveness. As of this publication, Epicor ERP 10 is still in beta test; scale testing has been performed for interactive loads up to 3,000 users, and throughput testing for distribution business scenarios.

Epicor ERP 10 shows good linear scalability from one user through 3,000 users. More importantly, database server utilization remains very low, never exceeding 10 percent CPU utilization. SQL batch requests at 3,000 concurrent users averaged about 6,940 per second, which reflects about 12 percent of capacity for typical hardware and well under Epicor guidelines of no more than five requests per second per user.

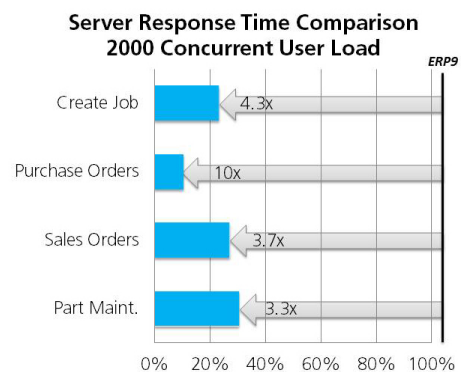
Interactive load tests are modeled using real-world Epicor ERP logs collected from live customers who are primarily manufacturers or distributors. The test results above are from a manufacturing model tested at 200, 1,000, 2,000, and 3,000 user levels. Note: each load test is conducted on hardware consistent with Epicor recommendations. (For example, the 200-user test was conducted on a single machine. For the 1,000- and 2,000-user tests, the database server, application server, and a reporting server were used. At 3,000 users, an additional application server was added as a load-balanced cluster.)

Epicor throughput tests are designed to allow customers to model integration capacity. Initial tests conducted on a beta release for Epicor ERP 10 show good throughput numbers in order and shipping transactions, which are typically automated for distribution scenarios. The results below were demonstrated on a single machine solution. All three tests were running simultaneously. Note: conditions for data loads vary widely and much higher throughput is possible when the systems and integrations are tuned to match the business requirements.

Generally speaking, Epicor ERP 10 performs twice as fast as Epicor 9 and scales more than four times higher. With Epicor 9, achieving high performance for large numbers of concurrent users required rigid adherence to infrastructure requirements, especially in scale-out (multimachine) deployments with SQL Server. Epicor ERP 10 server processing times are two to five times faster than ERP 9 server response times. Some aspects, notably Business Activity Queries, can be one or two orders of magnitude faster. Most server performance gains are the result of massively reducing the number of SQL Server batch requests.

Epicor is constantly measuring the performance characteristics of Epicor ERP. Microsoft Windows Server and SQL Server platforms make optimizing ERP 10 product performance easier because these products are very well instrumented. Performance testing is now even more endemic to all areas of Epicor because measuring resource impact through unit tests, standardized performance tests, and load testing are integral parts of the tooling and practices that make up the Epicor development process.

Transaction	Per Hour
Order Lines	62778
Invoices	74658
Shipments	34662



System Requirements

Epicor ERP 10 development is tied to two foundational technologies: Microsoft .NET Framework and Microsoft SQL Server. This allows great flexibility for hosting and managing ERP 10 because both .NET and SQL Server can run on hardware as small as a Microsoft Surface Pro tablet. Certifying a platform for ERP 10 is an involved task because of the large testing regimen and the costs to maintain each certified environment for the QA and Product Support teams. As such, not every combination of hardware, operating system version, and SQL Server version that ERP 10 is able to successfully run with will be formally certified.

At release, Epicor has certified two platform configurations for Epicor ERP 10 server applications:

- ▶ Windows® Server 2008R2 and Windows Server 2012 operating systems (all editions)
- ▶ SQL Server 2008 R2 and SQL Server 2014 Databases (all editions*)

SQL Server 2014 (all editions*, pending certification) is expected in Q2 2014. (*Express editions of SQL Server are not recommended due to constraints on memory, CUP, and database size.)

Required prerequisites include Microsoft .NET Framework 4.51, Internet Information Services, Windows Process Activation (HTTP and non-HTTP), TCP Port Sharing, and options required to support the desired security configuration. Epicor ERP 10 reports are rendered using SQL Server Reporting Services (SSRS). (See the Epicor ERP 10 Installation Guide for details.) Some companion product features require Microsoft SharePoint Services or SharePoint Server.

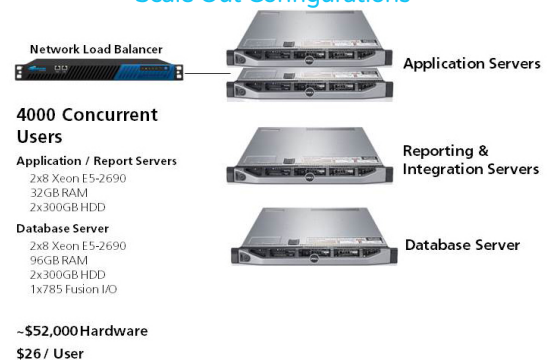
The ERP 10 Client Application is also based on Microsoft .NET Framework and will run any version of Windows (other than Windows RT) supported by Microsoft. Windows XP is not supported for the ERP 10 Smart Client. At least 1GB of available memory is recommended for running the ERP 10 Smart Client. For Epicor Web Access, Mozilla® Firefox®, Google® Chrome®, and Internet Explorer® 9 (and later) desktop browsers are all fully supported.

Hardware configurations for ERP 10 are fully explained in the Epicor ERP 10 Hardware Sizing Guide. A single machine server can be scaled up to support 200 or more concurrent users. Guidance for a 200-user system includes a 2x8 (16-core) Xeon machine with 96GB RAM and an I/O accelerator (e.g., FusionIO) for SQL data storage. For scale out configurations, typical application server hardware includes 16 cores, 32GB RAM, and HDD storage. Database servers require similar hardware, although FusionIO and 96GB RAM are both recommended. Scale out configurations have been tested to 3,000 concurrent users using one database server and three application servers (one dedicated for generating reports).

Single Machine Configurations

	
50 Concurrent Users	200 Concurrent Users
1x4 Xeon E5-2690 64GB RAM 2x146GB HDD 4x200GB SSD	2x8 Xeon E5-2690 96GB RAM 2x300GB HDD 1x785 Fusion I/O
~\$8,500 Hardware \$170 / User	~\$18,000 Hardware \$90 / User

Scale Out Configurations





Epicor ERP is fully compatible with VMware and Hyper-V virtualization technologies. (See the Epicor ERP Guide to Virtualization for details and best practices.) Implementers need to pay special attention when virtualizing the database server to avoid performance issues caused by slow I/O performance.

Conclusion: A Foundation for Success

Epicor ERP 10 provides today's organization with the core technological foundation to meet the difficult and rapidly evolving challenges of today's global competition. The five principles of Epicor ERP support this:

- ▶ **Collaboration** - In today's extended value chains, collaboration is essential to drive innovation, uncover opportunity, and respond to change in often-volatile markets. To do this successfully, ERP must be accessible to everyone involved in a company's value chain, and business processes must be linked directly to that chain. Knowledge retention, traceability, deep domain expertise—Epicor ERP 10 supports these objectives by enabling communication without latency, and providing easy access and leverage via means that users want to use.
- ▶ **Choice** - Designed for rapid, flexible deployment—on premise or via the cloud—ERP 10 gives organizations the ability to adapt to their unique circumstances, easily configure, stay current with technological advances, and scale up or out as demands dictate. This is all done without taxing IT demands or frustrating delays.
- ▶ **Responsiveness** - In a time where events on one side of the world can immediately impact business on the other, the ability to respond is paramount. Business analysis must be in context and business response must be agile; customer expectations allow for nothing less. Epicor ERP 10 is designed to deliver in this taxing milieu, providing rich, global functionality that organizations can use, in an instant, for strategic response and competitive advantage.
- ▶ **Simplicity** - As value chains become increasingly extended, nuanced, and complex, you can't have your core systems adding to complexity. By simplifying deployment, management, and usage—and by providing accurate, up-to-date information that enables a single version of the truth across multi-faceted supply and demand networks—Epicor ERP 10 reduces complexity and makes it simpler to make the right decisions for sustained success.
- ▶ **Mobility** - Today's workers aren't chained to their desks or their computers. They want 24/7 access to the information they need, wherever they are, on whatever device they use. Epicor ERP 10 is designed to deliver this kind of flexibility.

Built on an unparalleled technology foundation—Epicor ICE 3, a 100% Microsoft stack, and global functionality that includes embedded capabilities, easily configurable engines, real time BI and analytics, as well as industry-specific business layers and support—Epicor ERP 10 delivers performance from day one, from the ground up. In a business world where waste, delay, complexity, and uncertainty are anathema, it provides clarity on an ongoing basis, when and where you need Epicor ERP 10.

It is architected for efficiency as well as for your success.

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