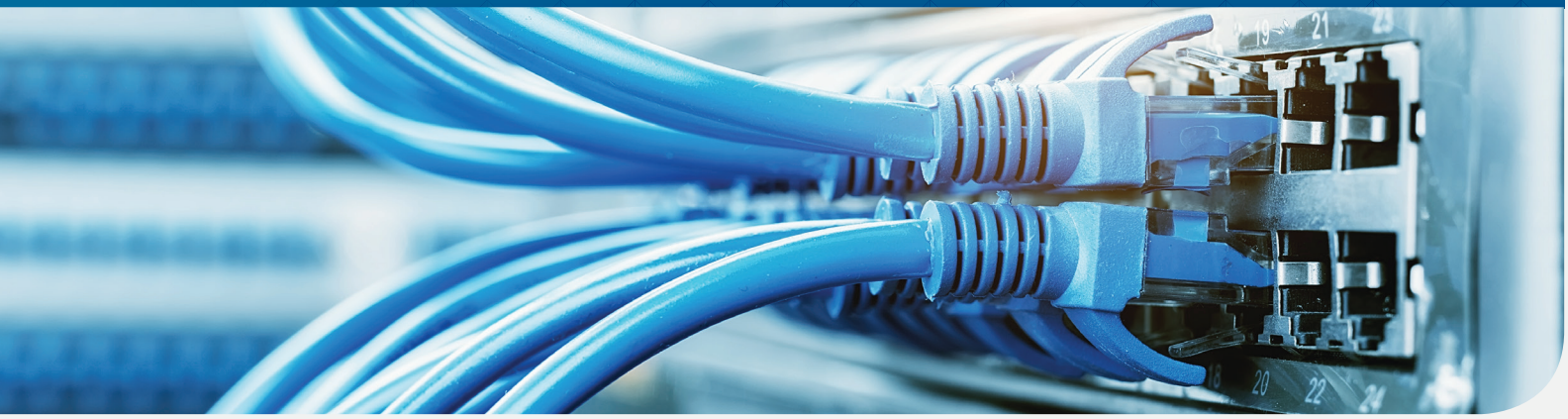
LabVantage®



LabVantage 8 Technical Overview

Run your lab more efficiently, secure your data in a central systems, and ensure compliance.

KEY BENEFITS

- 100% HTML5 browser based so there are no client programs that need to be managed
- System can be centrally hosted for global deployment and can support hundreds of concurrent users located anywhere
- Comes ready for integration with instruments and other business systems

LabVantage provides users the ability to access laboratory information from any device using a commercial web browser. LabVantage is a pure HTML5 compliant browser-based system with a zero footprint at the user level so there are no client programs to install and maintain, and no applets or plugins to be managed. LabVantage uses standard Java EE application servers and modern databases. It can be centrally hosted (on-premise or Cloud hosted) for global deployment supporting hundreds of concurrent users. The system comes ready for integration with instruments and other business systems. LabVantage is easier to maintain than any other enterprise-grade LIMS in the market.

Key Technical Features

Highly Scalable Multi-Tier Architecture

- **Presentation Tier** via a commercial web browser (Microsoft Internet Explorer, Microsoft Edge, Google Chrome or Apple Safari)
- **Application Tier** consisting of a Java EE server (Oracle WebLogic Server, Red Hat JBoss Enterprise Application Platform, or IBM WebSphere Application Server)
- **Data Tier** consisting of a database server (Oracle or Microsoft SQL Server). Reports may be executed from LabVantage on the application server tier using the supplied TIBCO JasperReports® or from a dedicated report server tier using a commercial reporting tool such as SAP's Business Objects or similar.

Web Browser

All user access to LabVantage is from a commercial web browser on the presentation tier. The application does not require any browser plug-ins or applets, which significantly simplifies deployment and system validation.

Application Server

The application server tier is LabVantage's main processing component and is CPU and network intensive. Therefore, when configuring the application server, organizations should consider the number of concurrent users and the complexity of the operations the system will have to perform. Performance and reliability can be improved by adding servers to a clustered installation, which uses third party load balancers to route client requests to multiple application servers within the cluster. If one or more servers fail, client requests are automatically routed to other servers within the cluster so there is no interruption in service.

Database Server

LabVantage supports Oracle and Microsoft SQL Server, two industry-leading database management systems. The database server is the repository for all LabVantage data and configuration information, including metadata generated from the LabVantage Web Page Designer, the user interface configuration tool within LabVantage. This metadata is used to drive the runtime architecture and determine business logic execution. LabVantage has been designed to do most of it's processing on the application server. As a result, the database server is not CPU intensive; rather it tends to be I/O intensive. Therefore, a high throughput disk sub-system is recommended. When configuring the database server, organizations should consider the number of concurrent users, amount of historical data, and which database engine will be used. Database connections are pooled by the application server, so database-level connection pooling is typically not required or recommended.

Barcoding

Barcode label production and use is a common activity employed throughout the LabVantage solution. Native to the system is an interface to Bartender from Seagull Scientific. Bartender is an enterprise label and barcode printing software solution to generate barcode labels.

Instrument and System Integration

LabVantage has a framework to enable integration of instruments, instrument systems and business applications from across the enterprise. This includes a data integration platform for instrumentation and business system interfacing via RESTful web services for system interoperability.

Infrastructure Requirements

LabVantage has experience implementing thousands of systems throughout the world.

To simplify configuration in enterprise environments and to minimize costs, we recommend calculating server needs based on a Base Computing Unit (BCU) model.

A Single BCU Consists of:

PROCESSOR: 4 Cores

MEMORY: 16 GB RAM

50 GB HDD minimum

100 Mbit NIC network minimum

Required BCUs

One BCU[1] supports approximately 25 click-concurrent HTTP sessions. LabVantage suggests 40% click concurrency for an application server. For example, if a laboratory has 125 licensed users, it will require 50 click-concurrent HTTP sessions (125 x 40% = 50). Accordingly, the laboratory needs 2 BCUs to support the application server. This estimate may vary based upon concurrent users, data storage, the complexity of the LabVantage configuration and workflows, and the intricacy of reports.

Note that these requirements incorporate the minimum hardware specifications recommended by the manufacturer of the third-party software products running on each of the LabVantage tiers. Note further, the hardware requirements are for a standard LabVantage implementation and may not be representative of the hardware required for an organization's specific implementation[2]. With the emergence of high performance blade and other low-density systems, simplifying the hardware specification using BCUs eases the task of identifying and procuring systems for an implementation. Additional storage – as in the case of the database server – should be a high performance external disk subsystem such as a U320 array or SAN.

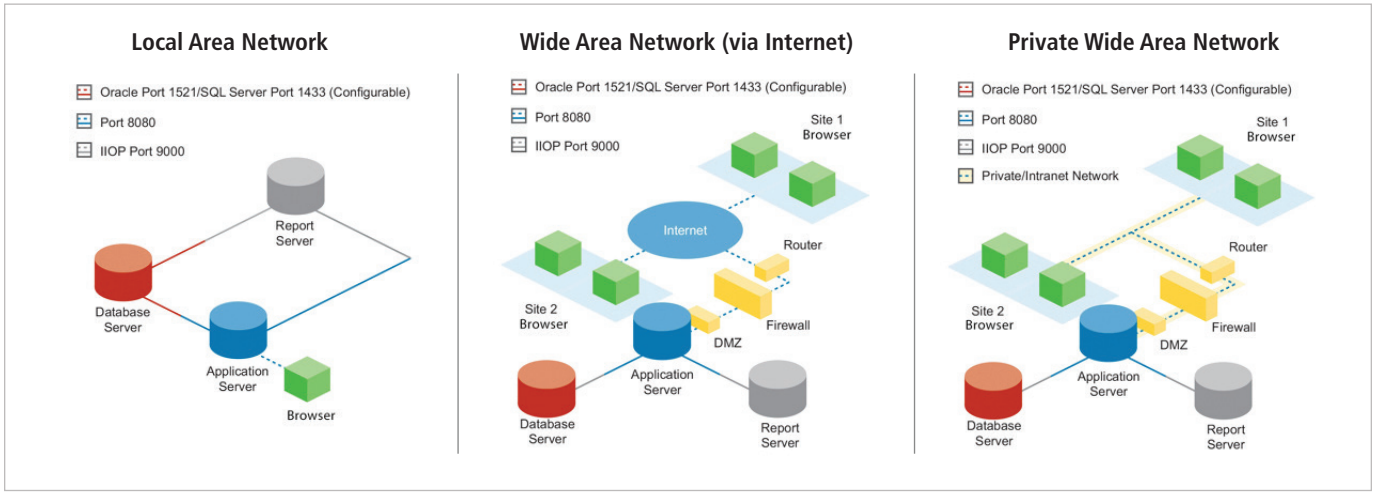
In a non-clustered environment, a basic configuration would require several separate systems. Individual systems may be used for the database server, application server, and optionally, report server (if using a third-party solution other than the one supplied by LabVantage). Storage for the database might be provided separately via SAN or an external storage array. In a clustered environment, if load or performance requirements increase for any tier, an organization can simply add another BCU to that tier in the appropriate cluster configuration. Clustering one tier has no requirement of clustering any other tier. Each tier could be independently clustered according to vendor specific clustering technologies.

At minimum, we recommend the following base systems to be used:

TOTAL USERS	CONCURRENT HTTP SESSIONS	APPLICATION SERVER	DATABASE SERVER
62.5	25	1BCU	1BCU
125	50	2 BCU (cluster)	1BCU
187.5	75	3 BCU (cluster)	1BCU

Network Configuration

Whether running on a local area network (LAN) or a wide area network (WAN), LabVantage can be configured to provide the appropriate network security and requires an HTTPS connection. The following diagrams provide examples of possible configurations.



Supported Software

	SOFTWARE	VERSION
Application Server	Red Hat JBoss EAP	7.1
	IBM WebSphere	9.x 8.5.5.11
	Oracle WebLogic	12c (12.2.1 & 12.1.x)
Database Server	Oracle	12c (12.2.x & 12.1.x)
	Microsoft SQL Server	2017 2016
Report Server	SAP BusinessObjects	BI4.2 SP06 BI4.2 SP04
	JasperReports	6.5
Barcode Printing	Seagull Scientific Bartender	2016 R6
Statistical Process Control	NWA Quality Analyst & Web Server	6.3 (2.4.266) & 2.2.6.0
Chromatography	Waters Empower *(note: other chromatography systems are supported through LabVantage instrument integration)*	FR4
Browsers	Microsoft Internet Explorer	11 and higher
	Microsoft Edge	Latest Version
	Google Chrome	Latest Version
	Apple Safari	Latest Version (Mac Only)

REFERENCES

[1] As of February 2016, Lenovo estimated the following cost for a BCU in the minimum configuration: Lenovo System x3250 M5, Xeon E3-1220, 16GB RAM, and 500GB HDD ($1,673.01); Lenovo System x3250 M5 - 5458AC1; Base LFF Hardware with 80 Plus certified Fixed PSU (300W); Intel Xeon Processor E3-1220 v3 3.1GHz 8MB cache 1600MHz 4C (80W);8GB (1x8GB, 2Rx8, 1.35V) PC3L-12800 CL11 ECC DDR3 1600MHz LP UDIMM x3250 M5 SS LFF SATA DRIVE KIT; Select Storage devices - no configured RAID required 500GB 7.2K 6Gbps NL SATA 3.5" G2SS HDD; ServeRAID C100 for System x 2.8m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable

[2] It is imperative that a thorough scope of work is performed before deciding on the final configuration. Organizations may contact their account representative to request a hardware configuration recommendation tailored to their needs.

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ABOUT LABVANTAGE SOLUTIONS

LabVantage is the recognized leader of enterprise laboratory software solutions with over 35 years of experience. We deliver an integrated laboratory informatics platform including laboratory information management systems (LIMS), electronic laboratory notebooks (ELN), and laboratory execution systems (LES). We support more than 1500 customer sites in the life science, pharmaceutical, medical device, biobank, food & beverage, consumer packaged goods, oil & gas, genetics/diagnostics, and healthcare industries. Headquartered in Somerset, N.J., LabVantage offers a comprehensive portfolio of products and services that enable companies to innovate faster in the R&D cycle, improve manufactured product quality, achieve accurate record-keeping, and comply with regulatory requirements. The LabVantage integrated LIMS/ELN/LES platform is highly configurable, purpose-built, and 100% web browser-based to support hundreds of concurrent users and seamlessly interface with instruments and other enterprise systems.

For more information, visit www.labvantage.com.