

# Middleware to 'littleware': vendors catering to smaller labs

Karen L. Wagner

If you asked middleware companies to summarize, in just three bullet points, the driving force behind changes to the middleware market in the past two years and how they've adapted their marketing strategies to those changes, they might write:

- Federal government passes American Recovery and Reinvestment Act of 2009
- Health care entities increasingly adopt electronic health record

systems because of incentives offered through ARRA of 2009

• Middleware vendors begin catering to smaller laboratories and physician-owned labs.

In other words, incentives offered through the 2009 federal stimulus package are leading smaller medical practices to implement EHRs and, thereby, driving up demand

for middleware products and services. Middleware vendors believe they can benefit by catering to this niche

market and leveraging their expertise through partnerships with other software manufacturers.

#### New market demand

"Traditionally, middleware's sweet spot has always been in the hospital and reference lab marketplaces," says Jay Sax, senior sales executive for Dawning Technologies, Fort Myers, Fla. "But we're seeing an expanded opportunity in the physician-owned laboratories. For the right

POL, middleware can provide a user-friendly, flexible, cost-effective

method for interfacing their IVD [in vitro diagnostics] instruments directly to the EHR without the need for an LIS."

Dawning receives queries on a regular basis from smaller



Sax

POLs that don't have a laboratory information system but that need to transfer data from their diagnostic instruments to the EHR. "POLs are implementing EMRs, often in response to financial incentives of the HITECH [Health Information Technology for Economic and Clinical Health] Act," he says.

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## Letters

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that if diabetes patients can use a glucose meter, then warfarin patients should have no problems. Diabetes patients can usually tell if their glucose is high or low; it is difficult for warfarin patients to tell if their INR is therapeutic. The consequences of a low or high INR can be life-threatening.

We have had patients come in to have their meters checked out just to find out their strips were bad. We have had patients come in who say they have been increasing their warfarin but their INRs are not increasing, and when we do a venipuncture, we find out that their INR is critical and they have to be treated with vitamin K or fresh frozen plasma. I do phlebotomy training for home health nurses in our area, and most of them get no training on INR meters. As was said in the article, training is crucial.

I believe the results of the THINRS study; in fact, it's better than what we have experienced. We in laboratory medicine must always be vigilant and make sure that the patients are getting quality results, especially if they have their own meters. Patients must always be at the forefront of everything we do, and expeditiousness should never be substituted for quality.

Marilyn C. Kenyon, MT(ASCP)  
Director of Laboratory Services  
St. Joseph Hospital  
Bangor, Me.

Send letters to Editor, CAP TODAY, 325 Waukegan Road, Northfield, IL 60093. Fax: 847-832-8873; [srice@cap.org](mailto:srice@cap.org).

## Middleware

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"They want to get their one or two instruments interfaced to the EMR... and middleware really fits the bill."

Dawning started adding functionality to its middleware a few years ago to address the growing use of electronic health record systems and to better accommodate workflow. For example, the company added the ability to manually enter orders into its JResultNet middleware and review test results from that system before sending the results to the EHR. JResultNet can also print bar code la-

bels for specimen tubes, so that data can be entered into the EHR electronically. "We had seen a number of occasions where the lab wanted to print bar codes but the EMR didn't offer that functionality," Sax says. Unlike a scanned image, he continues, the data are structured, meaning they can be mined or queried, which meets meaningful use criteria.

Like Dawning, Roche Diagnostics too sees the value of targeting POLs. The company is preparing to offer a middleware bundle specifically for such entities and recently created a sales force dedicated solely to the POL marketplace. Roche traditional-

ly has provided middleware to larger labs and health networks but began expanding its focus once smaller practices started looking for cost-effective solutions to link their testing devices with EHRs, says Aime Chidester, marketing manager of information technology solutions for Indianapolis-based Roche.

Roche is working on a middleware offering that will include such features as the ability to provide an elec-



Chidester

tronic record of the lab's scheduling and management of activities, which is required for industry auditing purposes, and the ability to connect analyzers to quality control systems, she says.

Smaller POLs have asked whether Roche's middleware can act as an LIS when connecting to their EHR systems, Chidester continues. "That is something that we'll have to look into in the future," she says. "We recognize that this is an opportunity to broaden our middleware functionality to meet this particular customer need."

### What middleware offers

While middleware cannot function as an LIS, it can translate data sent from one system to another, a task that many EHR systems cannot perform well, if at all, according to Mike Heckman, chief information officer for Pathagility, Little Rock, Ark. "My belief is that's where the middleware vendors can really shine," he says.

Most EHR systems, Heckman continues, have the capability to send or receive results, or both, but these functions require tailoring by the sender or recipient, and the EHR does not have

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## Middleware

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the flexibility to adequately translate the data being sent. "That's where we come into play," he adds. "We try to give both parties as much capability as possible."

### Partnership opportunities

As the need for connectivity between lab instruments and EHRs or other information systems increases, so do the opportunities for middleware vendors to partner with manufacturers of software systems that don't offer extensive linking capability. One strategy is to package middleware with EHR systems.

"What HITECH/meaningful use has done is provide another impetus for the market to begin adopting more technology," which only benefits the middleware vendor, says Data Innovations CEO Mike Epplen.

Recognizing this potential for growth, Data Innovations, which traditionally has partnered with software and diagnostic instrument manufacturers that cater to larger labs and health networks, is now beginning to explore partnerships with manufacturers that cater to smaller practices. "We see this as a partnering strategy enabling EHR and IVD manufacturers to be more successful, especially those that are in ambulatory care," Epplen explains.

Dawning too is reaching out to the ambulatory care market. The company is partnering with EHR vendors, including Elekta Software and Digital MD Systems, to provide connectivity in ambulatory settings, specifically to oncology practices. Along with having robust EHR systems, these practices typically have diagnostic instruments, Sax says. "But where the EHRs tend to really fall short is in interfacing directly with instruments," he continues. "That's where middleware comes into play and where the right LIS really comes into play."

Pathagility, as well, is "pursuing relationships with EMR vendors," says Heckman. The company is investigating partnerships that would marry its middleware with EHRs, LISs, and practice management systems. Users would "get the best of both worlds," he explains. "They'd have the interoperability capability as well as the platform to manage and conduct their business."

Middleware vendors have the opportunity to expand their footprint by installing more solutions and forming long-term business relationships with a whole new set of customers, summarizes Sax. "[And] the rapid and widespread adoption of EHRs only bodes well for that goal." □

Karen Wagner is a writer in Forest Lake, Ill.

## Middleware systems

<i>Part 1 of 6</i>	Abbott Diagnostics Amelia Presley amelia.presley@abbott.com 100 Abbott Park Road, CP-1-4 Abbott Park, IL 60064 847-935-0039 www.abbottdiagnostics.com	Beckman Coulter Holly Kachelmeyer hkkachelmeyer@beckman.com 250 S. Kraemer Blvd. Brea, CA 92821 714-871-4848 www.beckmancoulter.com/clinis
<i>See accompanying article on page 14</i>		
Name of middleware system	Instrument Manager (supplied by Data Innovations)	Remisol Advance† (supplied by Normand-Info SAS)
First ever middleware installation/Most recent installation*	2007/January 2011	1996/January 2011
Last update of middleware system	October 2010	August 2010
No. of contracts for sites operating middleware	—	~2,200
• U.S. contracts/Foreign contracts (countries)	—	— (Canada, Europe, New Zealand, Australia, others)
• No. of these contracts signed in 2010	—	—
No. of sites operating middleware/Percent of business that is middleware	67/—	—
No. of employees in firm/In middleware development, install, support	~90,000/—	~12,000/—
Hardware platforms	Windows PC, server	Dell
• Proprietary hardware required	no	no
Software platforms	Windows 2000 Professional, XP, 2000 server, 2003 server, 2008 server, Vista, Windows 7 Professional	Microsoft Windows, SQL
Fault-tolerant solutions/Hardware must be purchased from company	yes/no	yes/yes
Able to operate in a virtual hardware environment	yes	no
Databases used or supported	InterSystems Caché	Microsoft SQL 2008
No. of results/orders that can be stored in database	unlimited/unlimited	10,000,000 results/8,000 orders
Middleware can interface with instruments from any manufacturer	yes	no (with Beckman Coulter, Instrumentation Laboratory)
Types of data middleware can receive, store, transmit	alpha numeric, image	alpha numeric, image, other binary
No. of instruments one middleware device can support	unlimited	5
Protocols middleware supports to interface to instruments	HL7, ASTM, XML, proprietary	ASTM (E1394-97 high-level protocol, E1381-95 low-level protocol), proprietary, HPRIM
Low-level transport middleware supports to interface to instruments	serial RS232, serial USB, TCP/IP, FTP, LAT	serial RS232, TCP/IP, FTP
Middleware can send results to and receive orders from reference labs	yes	yes (any reference lab that uses ASTM protocol)
LIS/HIS/EMR interfaces for receiving orders	Sunquest, Meditech, Healthvision, Cerner, Allscripts, GE Healthcare, SCC Soft Computer, others	commercial LIS vendors
LIS/HIS/EMR interfaces for sending results	Sunquest, Meditech, Healthvision, Cerner, Allscripts, GE Healthcare, SCC Soft Computer, others	commercial LIS vendors
No. of diff. host system connections that can operate at once on middleware	unlimited	2
Protocols system supports to interface to other systems	HL7, ASTM, XML, proprietary, ODBC	ASTM (1381, 1394), proprietary, ASTM 2
System can be configured to automatically forward reportable diseases and other data to public health surveillance systems	no	no
Human languages (other than English) middleware supports	most languages	French, German
• Multiple languages can be used at same time on one system	yes	no
Middleware supports local date and time formats	yes	yes
No. of users that can access middleware at once	unlimited	one user per console
No. of user security levels middleware supports	unlimited (user defined)	unlimited
Middleware supports compound nested rules with multiple event actions	yes	yes
• Multiple event actions fired from one "if" condition statement	yes	yes
Programming or script language required to write rules	no	yes
Full and persistent audit trail of rule execution/System supports rules testing	yes/yes	yes/yes
Rule sets applied to individual instruments or connections	yes	yes
Quality control data used as part of auto-verification or rules process	yes	yes
Data from external databases retrieved and incorporated in rules processing	yes	no
Results that are entered manually processed by rules	yes	yes
Rules test cases created, saved, used on demand for rules validation testing	yes	yes
System supports event notification	yes	yes
System user notified of rules-based events/Notification methods supported	yes/pop-up windows, e-mail, pager, audio/visual device	yes/scrolling event log, pop-up windows, filtered window views, color and flag codes
Automation routes determined by user-defined rules	yes	yes
Middleware supports test-based load balancing across instruments	yes	yes
Events that lead to automation routes being dynamically updated	new test requests, reflex test requests, instrument down	new test requests, reflex test requests, instrument down
Audit trail of route a sample has taken	yes	yes
Laboratory automation system interfaces	Abbott	Beckman Coulter, Olympus America
Middleware interfaces with noninstrument automation devices	yes	yes
Back-end specimen storage and retrieval tracking	yes	no
System allows management of inst. & automation device maintenance records	yes	no
• System provides alerts when an instrument needs maintenance	yes	no
System provides LIS downtime functions/System allows manual order entry	yes/yes	yes/yes
System generates downtime specimen ID/Algorithm user definable	yes/yes	yes/yes
Orders manually entered in middleware are sent back to LIS automatically	yes	yes
Quality control module	yes	yes
Middleware interfaces to third-party quality control packages	yes (Bio-Rad Unity Real Time, others)	no
System supports multi-rule quality control	yes	yes
System supports moving averages or average of normals	yes	yes
Users can customize screens/Users can define custom fields	yes/yes	no/no
Users can populate custom fields via user-defined rules	yes	no
Screen has image support for any type of image	yes	yes
Users can design own reports/Report-generation software used	yes/ODBC-compliant applications	yes/proprietary
• Reports can include any data elements in database	yes	yes
Around-the-clock customer service in U.S.	—	yes
System training available/On-site consulting	classroom, on site/yes	classroom, on site, e-learning/yes
Smallest cost for hardware/software/monthly maintenance	—	—
Largest cost for hardware/software/monthly maintenance	—	—
Fee for additional users	—	—
Distinguishing features of middleware (supplied by company)	<ul style="list-style-type: none"> <li>connectivity to any vendor's instrumentation and to multiple disciplines inside the lab, including immunoassay, clinical chemistry, hematology, coagulation</li> <li>scalability through connectivity to multi-departments, multi-sites, multi-LISs, more</li> <li>skilled Abbott implementation and support team</li> </ul>	<ul style="list-style-type: none"> <li>extended quality control module monitors quality of diagnostic system operation using patient moving average data, more</li> <li>alerts operator of critical test results; lab's key operators can develop and maintain complex rules</li> <li>on-site customization and implementation services available</li> </ul>

\*based on January 2011 survey deadline

Note: a dash in lieu of an answer means company did not answer question or question is not applicable

† formerly DL2000

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## Middleware systems

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## Middleware systems

Part 2 of 6		
	Data Innovations sales department sales@datainnovations.com 120 Kimball Ave., Suite 100 South Burlington, VT 05403 802-658-2850 www.datainnovations.com	Data Innovations Europe—PGP Bob Rothstein europe-sales@datainnovations.com 34 Avenue Jacques Brel Brussels, Belgium B-1200 +3227706222 www.datainnovations.com
Name of middleware system	Instrument Manager	Laboratory Production Manager (LPM)
First ever middleware installation/Most recent installation* Last update of middleware system	1993/January 2011 December 2010	1982/December 2010 October 2010
No. of contracts for sites operating middleware • U.S. contracts/Foreign contracts (countries) • No. of these contracts signed in 2010 No. of sites operating middleware/Percent of business that is middleware	6,300+ 5,600+/750+ (Austria, Brazil, Denmark, many others) 345 5,300+/100%	239 3/236 (Belgium, France, U.K., Netherlands, many others) 2 500+/100%
No. of employees in firm/In middleware development, install, support	94/50	92/46
Hardware platforms • Proprietary hardware required Software platforms	Windows PC, server no Windows 2000 Professional, XP, 2003 server, 2008 server, Vista, Windows 7	PC no Windows 2000, 2003, XP
Fault-tolerant solutions/Hardware must be purchased from company Able to operate in a virtual hardware environment Databases used or supported No. of results/orders that can be stored in database	yes/no yes InterSystems Caché limited only by storage size/limited only by storage size	yes/no yes Oracle limited only by storage size/limited only by storage size
Middleware can interface with instruments from any manufacturer Types of data middleware can receive, store, transmit No. of instruments one middleware device can support Protocols middleware supports to interface to instruments	yes alpha numeric, image unlimited HL7 (2.2, 2.3, 2.4, 2.5, 3.0), ASTM (1238, 1394), XML, proprietary, ODBC/SQL	yes alpha numeric, image, sound 250 HL7, ASTM (1238, 1394), XML, proprietary
Low-level transport middleware supports to interface to instruments Middleware can send results to and receive orders from reference labs	serial RS232, serial USB, TCP/IP, FTP, LAT, files, Web services, http yes (Quest, LabCorp, ARUP, others)	serial RS232, TCP/IP, FTP, files, specific .dll no
LIS/HIS/EMR interfaces for receiving orders  LIS/HIS/EMR interfaces for sending results	McKesson, Cerner, Siemens, SCC Soft Computer, Sunquest, Meditech, GE Healthcare, Wyndgate, Epic, CliniSys, Healthland, Eclipsys, Omnitech, others McKesson, Cerner, Siemens, SCC Soft Computer, Sunquest, Meditech, GE Healthcare, Wyndgate, Epic, CliniSys, Healthland, Eclipsys, Omnitech, others	MIPS, Cortex, Molis, Agfa, Medasys, MBC, Seralis, Helios, Hexaflux, SBIM, others MIPS, Cortex, Molis, Agfa, Medasys, MBC, Seralis, Helios, Hexaflux, SBIM, others
No. of diff. host system connections that can operate at once on middleware Protocols system supports to interface to other systems	unlimited HL7 (2.2, 2.3, 2.4, 2.5, 3.0), ASTM (1238, 1394), XML, proprietary, ODBC/SQL, Web services, http, files	64 HL7, ASTM (1238, 1394), XML, proprietary
System can be configured to automatically forward reportable diseases and other data to public health surveillance systems	yes	no
Human languages (other than English) middleware supports • Multiple languages can be used at same time on one system Middleware supports local date and time formats No. of users that can access middleware at once No. of user security levels middleware supports	all known languages yes yes unlimited unlimited (user defined)	French, German, Dutch, Hebrew, others on request yes yes 256 user definable
Middleware supports compound nested rules with multiple event actions • Multiple event actions fired from one "if" condition statement Programming or script language required to write rules Full and persistent audit trail of rule execution/System supports rules testing Rule sets applied to individual instruments or connections Quality control data used as part of auto-verification or rules process Data from external databases retrieved and incorporated in rules processing Results that are entered manually processed by rules Rules test cases created, saved, used on demand for rules validation testing	yes yes no yes/yes yes yes yes yes yes yes	yes yes yes yes/yes yes yes yes yes yes yes
System supports event notification System user notified of rules-based events/Notification methods supported	yes yes/pop-up windows, e-mail, pager, audio/visual device, data color coding	yes yes/pop-up, pager, e-mail, phone call, fax, audio/visual devices
Automation routes determined by user-defined rules Middleware supports test-based load balancing across instruments Events that lead to automation routes being dynamically updated Audit trail of route a sample has taken Laboratory automation system interfaces	yes yes new test requests, reflex test requests, instrument down yes Beckman Coulter, Ortho-Clinical, Abbott, Roche, Olympus, Siemens, Thermo Scientific, Sysmex, A&T Corp., others	yes yes new test requests, reflex test requests, instrument down no Beckman Coulter, Ortho-Clinical, Abbott, Roche, Siemens, Thermo Scientific, Sysmex, others
Middleware interfaces with noninstrument automation devices	yes	yes
Back-end specimen storage and retrieval tracking System allows management of inst. & automation device maintenance records • System provides alerts when an instrument needs maintenance	yes yes yes	no no no
System provides LIS downtime functions/System allows manual order entry System generates downtime specimen ID/Algorithm user definable Orders manually entered in middleware are sent back to LIS automatically	yes/yes yes/yes yes	yes/yes yes/yes yes
Quality control module Middleware interfaces to third-party quality control packages System supports multi-rule quality control System supports moving averages or average of normals	yes yes (Bio-Rad Unity Real Time, many others) yes yes	yes yes (Bio-Rad, Instrumentation Laboratory, SKML) yes yes
Users can customize screens/Users can define custom fields Users can populate custom fields via user-defined rules Screen has image support for any type of image Users can design own reports/Report-generation software used • Reports can include any data elements in database	yes/yes yes yes yes/any ODBC compliant; internal proprietary yes	yes/yes yes yes yes/Report Builder no
Around-the-clock customer service in U.S. System training available/On-site consulting	yes classroom, on site, e-learning, Web based/yes	no classroom, on site/yes
Smallest cost for hardware/software/monthly maintenance Largest cost for hardware/software/monthly maintenance Fee for additional users	—/\$3,075/1.5% —/\$300,000/1.5% \$1,650 for each concurrent access	\$2,000/\$4,500/\$68 \$200,000/\$300,000/\$4,500 \$2,300
Distinguishing features of middleware (supplied by company)	<ul style="list-style-type: none"> <li>efficient workflow solutions for multiple laboratory disciplines affecting areas beyond results production</li> <li>affordable solutions for the smallest clinics, yet scalable solutions for the world's largest labs</li> <li>intuitive solutions allow customers to achieve self-sufficiency while comprehensive services are available to support customers' goals</li> </ul>	<ul style="list-style-type: none"> <li>high level of workflow customization meeting customer-specific requirements via a powerful parameterization tool</li> <li>rules across multiple disparate specimens belonging to the same order</li> <li>multi-site, multi-lab, multi-LIS implementation support with full LIS downtime management</li> </ul>

\*based on January 2011 survey deadline

Note: a dash in lieu of an answer means company did not answer question or question is not applicable

Tabulation does not represent an endorsement by the College of American Pathologists.

## Middleware systems

Part 3 of 6	Dawning Technologies Jay Sax sales@dawning.com 8140 College Parkway, Suite 202 Fort Myers, FL 33919 800-332-0499 www.dawning.com	Dawning Technologies Jay Sax sales@dawning.com 8140 College Parkway, Suite 202 Fort Myers, FL 33919 800-332-0499 www.dawning.com	Horiba Medical Stephanie Rimer stephanie.rimer@horiba.com 34 Bunsen Drive Irvine, CA 92618 949-453-0500 www.horiba.com/us/en/medical/
Name of middleware system	JavaLin interfaces	JResultNet Middleware	Genesis 4/G4 (supplied by Technidata America)
First ever middleware installation/Most recent installation*	1984/January 2011	1984/January 2011	2007/—
Last update of middleware system	June 2010	December 2010	November 2010
No. of contracts for sites operating middleware	2,900	1,600	<10
• U.S. contracts/Foreign contracts (countries)	2,550/350 (30+ countries)	1,400/200 (30+ countries)	<10/0
• No. of these contracts signed in 2010	300	150	—
No. of sites operating middleware/Percent of business that is middleware	2,975/100%	1,650/100%	<10/—
No. of employees in firm/In middleware development, install, support	23/19	23/19	—
Hardware platforms	Dawning JavaLin/PDI	platform-portable Java-based application, JavaLin interfaces, PCs, Macintosh, servers	hardware independent
• Proprietary hardware required	yes	yes	yes
Software platforms	Linux OS, Java-based embedded JResultNet software	Windows 7, 2000, XP Professional, 2000 server, 2003 server, 2008 server, Linux, OS X	Windows 2008 server, XP, Vista, 7
Fault-tolerant solutions/Hardware must be purchased from company	yes/yes	yes/no	no/yes
Able to operate in a virtual hardware environment	yes	yes	yes
Databases used or supported	HSQL, Codebase	Postgre SQL, HSQL, Codebase, Microsoft SQL, others	Microsoft Access, proprietary
No. of results/orders that can be stored in database	1,000+ internal and unlimited external results/1,000+ internal and unlimited external orders	unlimited/unlimited	500,000 results/500,000 orders
Middleware can interface with instruments from any manufacturer	yes	yes	no (with Horiba Medical's Pentra 400, Pentra XL, Pentra 60 C+, Micros 60, Micros CRP)
Types of data middleware can receive, store, transmit	alpha numeric	alpha numeric	alpha numeric, image
No. of instruments one middleware device can support	2	unlimited	4 per PC
Protocols middleware supports to interface to instruments	HL7 (all versions below 3.0), ASTM (NCCLS LIS1A, 2A), XML, proprietary, CSV, flat file, direct database, others	HL7 (all versions below 3.0), ASTM (NCCLS LIS1A, 2A), XML, proprietary, CSV, flat file, direct database, others	ASTM (1394), proprietary
Low-level transport middleware supports to interface to instruments	serial RS232, serial USB, TCP/IP, FTP, flat file	serial RS232, serial USB, TCP/IP, FTP, ODBC, flat file	serial RS232, serial USB, TCP/IP
Middleware can send results to and receive orders from reference labs	yes (Quest Diagnostics, Specialty Laboratories, AML)	yes (Quest Diagnostics, Specialty Laboratories, AML)	no
LIS/HIS/EMR interfaces for receiving orders	Cerner, CPSI, Custom Software Solutions, GE Healthcare, McKesson, Psyche, Siemens, Sunquest, others	Cerner, CPSI, Custom Software Solutions, GE Healthcare, Healthcare Management Systems, Elekta, others	—
LIS/HIS/EMR interfaces for sending results	Cerner, CPSI, Custom Software Solutions, GE Healthcare, McKesson, Psyche, Siemens, Sunquest, others	Cerner, CPSI, Custom Software Solutions, GE Healthcare, Healthcare Management Systems, Elekta, others	Antek, Allscripts, Fletcher-Flora, Altos, others
No. of diff. host system connections that can operate at once on middleware	2	unlimited	1
Protocols system supports to interface to other systems	HL7 (all versions below 3.0), ASTM (NCCLS LIS1A, 2A), XML, proprietary, CSV, flat file, direct database, others	HL7 (all versions below 3.0), ASTM (NCCLS LIS1A, 2A), XML, proprietary, CSV, flat file, direct database, others	HL7 (2.3), ASTM (1238, 1394)
System can be configured to automatically forward reportable diseases and other data to public health surveillance systems	no	no	no
Human languages (other than English) middleware supports	German, French, Spanish, Portuguese, others	German, French, Spanish, Portuguese, others	Spanish, French, German, Greek, Italian, Dutch, Mandarin, Japanese, others (21 languages)
• Multiple languages can be used at same time on one system	yes	yes	no
Middleware supports local date and time formats	yes	yes	yes
No. of users that can access middleware at once	unlimited	unlimited	5 (requires Windows 2008 server)
No. of user security levels middleware supports	unlimited	unlimited	5
Middleware supports compound nested rules with multiple event actions	yes	yes	yes
• Multiple event actions fired from one "if" condition statement	yes	yes	yes
Programming or script language required to write rules	no	no	no
Full and persistent audit trail of rule execution/System supports rules testing	yes/yes	yes/yes	no/yes
Rule sets applied to individual instruments or connections	yes	yes	yes
Quality control data used as part of auto-verification or rules process	yes	yes	yes
Data from external databases retrieved and incorporated in rules processing	yes	yes	no
Results that are entered manually processed by rules	yes	yes	yes
Rules test cases created, saved, used on demand for rules validation testing	yes	yes	yes
System supports event notification	yes	yes	yes
System user notified of rules-based events/Notification methods supported	yes/pop-up windows, e-mail, audio alert, message displays, save to file, print and logs	yes/pop-up windows, e-mail, audio alert, message displays, save to file, print and logs	yes/background color, review status
Automation routes determined by user-defined rules	yes	yes	no
Middleware supports test-based load balancing across instruments	yes	yes	no
Events that lead to automation routes being dynamically updated	new test requests, reflex test requests, instrument down	new test requests, reflex test requests, instrument down	—
Audit trail of route a sample has taken	yes	yes	no
Laboratory automation system interfaces	Beckman Coulter, Ortho-Clinical, Abbott, Roche, Olympus America, Siemens, Sysmex	Beckman Coulter, Ortho-Clinical, Abbott, Roche, Olympus America, Siemens, Sysmex	—
Middleware interfaces with noninstrument automation devices	yes	yes	no
Back-end specimen storage and retrieval tracking	no	no	no
System allows management of inst. & automation device maintenance records	no	no	yes
• System provides alerts when an instrument needs maintenance	no	no	no
System provides LIS downtime functions/System allows manual order entry	yes/yes	yes/yes	yes/yes
System generates downtime specimen ID/Algorithm user definable	yes/yes	yes/yes	yes/yes
Orders manually entered in middleware are sent back to LIS automatically	yes	yes	yes
Quality control module	yes	yes	yes
Middleware interfaces to third-party quality control packages	yes (Bio-Rad)	yes (Bio-Rad)	no
System supports multi-rule quality control	yes	yes	yes
System supports moving averages or average of normals	no	no	yes
Users can customize screens/Users can define custom fields	yes/yes	yes/yes	yes/no
Users can populate custom fields via user-defined rules	yes	yes	no
Screen has image support for any type of image	no	no	yes
Users can design own reports/Report-generation software used	yes/Crystal Reports	yes/Crystal Reports	yes/proprietary, export to Excel
• Reports can include any data elements in database	yes	yes	no
Around-the-clock customer service in U.S.	yes	yes	yes
System training available/On-site consulting	classroom, on site, Web based/yes	classroom, on site, Web based/yes	on site, e-training/no
Smallest cost for hardware/software/monthly maintenance	\$2,200/included/\$18.75	—/\$1,900/\$19.17	—
Largest cost for hardware/software/monthly maintenance	\$2,200/\$1,500/\$32.92	—/\$4,000+/\$36.25	—
Fee for additional users	none	none	—
Distinguishing features of middleware (supplied by company)	<ul style="list-style-type: none"> <li>distributed processing in a 3-in. x 5-in. footprint</li> <li>can add a new instrument on a single connection to the LIS using any standard protocol without disturbing existing connections</li> <li>complete message-mapping control with instrument and LIS connection</li> </ul>	<ul style="list-style-type: none"> <li>JResultNet Rules Development Kit allows middleware rules to be developed, tested, validated, and saved</li> <li>Dawning DataMiner—a patent-pending application that is part of Dawning's database rules option</li> <li>JResultNet rules organization features—develop nested "if" and "then" rules statements</li> </ul>	distinguishing features not provided
*based on January 2011 survey deadline Note: a dash in lieu of an answer means company did not answer question or question is not applicable			

Tabulation does not represent an endorsement by the College of American Pathologists.

## Middleware systems

Part 4 of 6	Horiba Medical Stephanie Rimer stephanie.rimer@horiba.com 34 Bunsen Drive Irvine, CA 92618 949-453-0500 www.horiba.com/us/en/medical/	Pathagility Mark McCuin mark@pathagility.com 10810 Executive Center Drive, Suite 100 Little Rock, AR 72211 501-327-7700 www.pathagility.com	PVT LabSystems Miriam Hoelzel info@pvtlabsystems.com 3980 DeKalb Technology Parkway, Suite 670 Atlanta, GA 30340 877-788-5227 www.pvtlabsystems.com
Name of middleware system	IM <sup>2</sup> (supplied by Technidata America)	AgilityEngine	Silver Server
First ever middleware installation/Most recent installation*	2007/January 2011	2008/December 2010	1997/March 2010
Last update of middleware system	November 2010	December 2010	—
No. of contracts for sites operating middleware	150+	6	47
• U.S. contracts/Foreign contracts (countries)	150+/0	6/0	7/40 (Germany, Belgium, Netherlands)
• No. of these contracts signed in 2010	30+	3	2
No. of sites operating middleware/Percent of business that is middleware	150+/-	6/20%	49/-5%
No. of employees in firm/In middleware development, install, support	—	6/3	15/2
Hardware platforms	hardware independent	hosted virtualized servers (partnership with BlueLock)	IBM PC-compatible x86 computer
• Proprietary hardware required	yes	no	no
Software platforms	Windows 2008 server, XP, Vista, 7	Windows 2003 server, SQL server 2005, BizTalk 2005	QNX
Fault-tolerant solutions/Hardware must be purchased from company	no/yes	yes/no	yes/yes
Able to operate in a virtual hardware environment	yes	yes	—
Databases used or supported	Microsoft Access, proprietary	Microsoft SQL server 2005	SAM database
No. of results/orders that can be stored in database	500,000 results/500,000 orders	unlimited/unlimited	1,000,000+ results/1,000,000+ orders
Middleware can interface with instruments from any manufacturer	no (with Horiba Medical Micros 60)	yes	yes
Types of data middleware can receive, store, transmit	alpha numeric, image	alpha numeric, image, sound, any file attachment	alpha numeric
No. of instruments one middleware device can support	3 Micros 60 instruments per PC	—	16
Protocols middleware supports to interface to instruments	proprietary	HL7, XML, proprietary, custom as necessary	ASTM, proprietary
Low-level transport middleware supports to interface to instruments	serial RS232	serial RS232, serial USB, TCP/IP, FTP, ODBC	serial RS232, TCP/IP, FTP
Middleware can send results to and receive orders from reference labs	no	yes	no
LIS/HIS/EMR interfaces for receiving orders	Antek, Fletcher-Flora, Altos, others	Elekta Software, AP Easy, eMDs, multiple proprietary system interfaces	—
LIS/HIS/EMR interfaces for sending results	Antek, Allscripts, Fletcher-Flora, Altos, others	Elekta Software, AP Easy, eMDs, Allscripts, DigiChart, multiple proprietary system interfaces	—
No. of diff. host system connections that can operate at once on middleware	1	unlimited	2
Protocols system supports to interface to other systems	HL7 (2.3), ASTM (1238, 1394), proprietary	HL7 (2.x, 3), XML, proprietary	ASTM, proprietary
System can be configured to automatically forward reportable diseases and other data to public health surveillance systems	no	yes	no
Human languages (other than English) middleware supports	Spanish, French, German, Greek, Italian, Dutch, Mandarin, Japanese, others (21 languages)	—	German
• Multiple languages can be used at same time on one system	no	no	no
Middleware supports local date and time formats	yes	no	yes
No. of users that can access middleware at once	5 (requires Windows 2008 server)	unlimited	20+
No. of user security levels middleware supports	5	~5	—
Middleware supports compound nested rules with multiple event actions	yes	yes	—
• Multiple event actions fired from one "if" condition statement	yes	yes	—
Programming or script language required to write rules	no	no	no
Full and persistent audit trail of rule execution/System supports rules testing	no/yes	yes/yes	yes/yes
Rule sets applied to individual instruments or connections	yes	yes	—
Quality control data used as part of auto-verification or rules process	yes	yes	—
Data from external databases retrieved and incorporated in rules processing	no	yes	—
Results that are entered manually processed by rules	yes	yes	yes
Rules test cases created, saved, used on demand for rules validation testing	yes	no	—
System supports event notification	yes	yes	—
System user notified of rules-based events/Notification methods supported	yes/background color, review status	yes/e-mail, fax	—
Automation routes determined by user-defined rules	no	no	yes
Middleware supports test-based load balancing across instruments	no	no	no
Events that lead to automation routes being dynamically updated	—	new test requests	new test requests
Audit trail of route a sample has taken	no	no	yes
Laboratory automation system interfaces	—	—	PVT Probenverteiltechnik GmbH, Sarstedt
Middleware interfaces with noninstrument automation devices	no	no	yes
Back-end specimen storage and retrieval tracking	no	no	yes
System allows management of inst. & automation device maintenance records	yes	no	—
• System provides alerts when an instrument needs maintenance	no	no	—
System provides LIS downtime functions/System allows manual order entry	yes/yes	no/yes	yes/yes
System generates downtime specimen ID/Algorithm user definable	yes/yes	no/no	—
Orders manually entered in middleware are sent back to LIS automatically	yes	yes	no
Quality control module	yes	yes	no
Middleware interfaces to third-party quality control packages	no	no	no
System supports multi-rule quality control	yes	no	—
System supports moving averages or average of normals	yes	no	—
Users can customize screens/Users can define custom fields	yes/no	no/no	no/no
Users can populate custom fields via user-defined rules	no	no	—
Screen has image support for any type of image	yes	yes	no
Users can design own reports/Report-generation software used	yes/proprietary, export to Excel	no/—	—
• Reports can include any data elements in database	no	yes	—
Around-the-clock customer service in U.S.	yes	yes	yes
System training available/On-site consulting	on site, e-training/no	on site, Web conference, others/yes	on site/yes
Smallest cost for hardware/software/monthly maintenance	—	0/—/\$250	—
Largest cost for hardware/software/monthly maintenance	—	0/—/\$5,500	—
Fee for additional users	—	—	—
Distinguishing features of middleware (supplied by company)	<ul style="list-style-type: none"> <li>flexible patient reporting—customizable, cumulative, or single-patient reports</li> <li>patient result data can be stored externally for virtually unlimited patient data storage</li> <li>optional expert rules for enhanced autovalidation</li> </ul>	<ul style="list-style-type: none"> <li>software-as-a-service platform that provides infrastructure savings to clients</li> <li>provides a blend of interoperability and customized workflow solution potential; company involved in short- and long-term business strategies of clients</li> <li>Web-based collaboration portal and multi-channel report distribution management tool can enhance the capabilities and extend the lifespan of technology investments and lab systems</li> </ul>	<ul style="list-style-type: none"> <li>flexible; can be adapted to customer needs</li> <li>efficient and effective; improves and expedites workflow</li> <li>simplifies handling and coordination of various tests for samples</li> </ul>

\*based on January 2011 survey deadline

Note: a dash in lieu of an answer means company did not answer question or question is not applicable

## Middleware systems

Part 5 of 6	Roche Diagnostics Aime Chidester aime.chidester@roche.com 9115 Hague Rd. Indianapolis, IN 46208 317-521-2000 www.roche-diagnostics.us	Siemens Healthcare Diagnostics Sepehr Seyedzadeh sepehr.seyedzadeh@siemens.com 511 Benedict Ave. Tarrytown, NY 10591 914-524-3827 www.siemens.com/diagnostics	Siemens Healthcare Diagnostics Sepehr Seyedzadeh sepehr.seyedzadeh@siemens.com 511 Benedict Ave. Tarrytown, NY 10591 914-524-3827 www.siemens.com/diagnostics
Name of middleware system	Roche Middleware Solutions (supplied by Data Innovations)	Advia Centralink (supplied by MIPS)	EasyLink Informatics System
First ever middleware installation/Most recent installation*	1998/February 2011	2001/January 2011	2001/January 2011
Last update of middleware system	July 2010	July 2010	August 2010
No. of contracts for sites operating middleware	780	—	—
• U.S. contracts/Foreign contracts (countries)	780/0	—	—
• No. of these contracts signed in 2010	40	—	—
No. of sites operating middleware/Percent of business that is middleware	780/—	—	—
No. of employees in firm/In middleware development, install, support	4,200 (U.S. centralized diagnostics)/61	—	—
Hardware platforms	Dell OptiPlex 780, Dell PowerEdge	dedicated computing high-capacity and standard-capacity servers	Windows-based PC
• Proprietary hardware required	yes	yes	yes
Software platforms	Windows XP SP3, 2003 server SP2	Windows server 2003, XP	Windows XP Professional
Fault-tolerant solutions/Hardware must be purchased from company	yes/yes	no/yes	no/yes
Able to operate in a virtual hardware environment	no	no	no
Databases used or supported	InterSystems Caché	OpenEdge	Firebird
No. of results/orders that can be stored in database	limited only by storage size/limited only by storage size	40,000,000 results/960,000 orders	34,000,000 results/7,000,000 orders
Middleware can interface with instruments from any manufacturer	no (with Siemens, Diagnostica Stago, Sysmex, Beckman Coulter, Abbott, Bio-Rad, Thermo Fisher, others)	yes (third-party manufacturers' instruments can be interfaced upon Siemens' approval)	yes (third-party manufacturers' instruments can be interfaced upon Siemens' approval)
Types of data middleware can receive, store, transmit	alpha numeric, image, other binary	alpha numeric, image	alpha numeric, image
No. of instruments one middleware device can support	128	32	8
Protocols middleware supports to interface to instruments	HL7, ASTM, XML, ODBC/SQL	HL7 (2.5), ASTM (1394), proprietary	ASTM (LIS1A, LIS2A [old standard E1394-97]), proprietary
Low-level transport middleware supports to interface to instruments	serial RS232, TCP/IP	serial RS232, TCP/IP, FTP	serial RS232, serial USB, TCP/IP, FTP
Middleware can send results to and receive orders from reference labs	no	yes	yes
LIS/HIS/EMR interfaces for receiving orders	McKesson, SCC Soft Computer, Cerner, Meditech, Sunquest, homegrown LIS, others	Siemens, Orchard, Aspyra, Schuyler House, Cerner, McKesson, Meditech, Sunquest, Multidata, others	Siemens, Cerner, Meditech, Sunquest, SCC Soft Computer, others
LIS/HIS/EMR interfaces for sending results	McKesson, SCC Soft Computer, Cerner, Meditech, Sunquest, homegrown LIS, others	Siemens, Orchard, Aspyra, Schuyler House, Cerner, McKesson, Meditech, Sunquest, Multidata, others	Siemens, Cerner, Meditech, Sunquest, SCC Soft Computer, others
No. of diff. host system connections that can operate at once on middleware	unlimited	1	2
Protocols system supports to interface to other systems	HL7, ASTM	HL7 (2.5), ASTM (1394), proprietary	ASTM (LIS1A, LIS2A [old standard E1394-97]), proprietary
System can be configured to automatically forward reportable diseases and other data to public health surveillance systems	no	no	no
Human languages (other than English) middleware supports	none	Spanish, French, Italian, German, Dutch	Spanish, French, Italian, German, Portuguese, Japanese, Greek
• Multiple languages can be used at same time on one system	no	yes	yes
Middleware supports local date and time formats	no	yes	yes
No. of users that can access middleware at once	operating system dependent (up to 100 concurrent users)	15	25
No. of user security levels middleware supports	unlimited	4	3
Middleware supports compound nested rules with multiple event actions	yes	yes	yes
• Multiple event actions fired from one "if" condition statement	yes	yes	yes
Programming or script language required to write rules	no	no	no
Full and persistent audit trail of rule execution/System supports rules testing	yes/yes	yes/yes	yes/yes
Rule sets applied to individual instruments or connections	yes	yes	yes
Quality control data used as part of auto-verification or rules process	yes	yes	yes
Data from external databases retrieved and incorporated in rules processing	yes	no	no
Results that are entered manually processed by rules	yes	yes	yes
Rules test cases created, saved, used on demand for rules validation testing	yes	no	yes
System supports event notification	yes	yes	yes
System user notified of rules-based events/Notification methods supported	yes/pop-up windows, e-mail, audio/visual devices	yes/visual, trace logs	yes/visual notifications
Automation routes determined by user-defined rules	yes	yes	yes
Middleware supports test-based load balancing across instruments	yes	yes	yes
Events that lead to automation routes being dynamically updated	new test requests, reflex test requests, instrument down	new test requests, reflex test requests, instrument down	new test requests, reflex test requests, instrument down
Audit trail of route a sample has taken	yes	yes	yes
Laboratory automation system interfaces	Roche, Sysmex, Stago, PVT LabSystems, TTA	Siemens	Siemens
Middleware interfaces with noninstrument automation devices	yes	yes	no
Back-end specimen storage and retrieval tracking	yes	yes	yes
System allows management of inst. & automation device maintenance records	yes	no	no
• System provides alerts when an instrument needs maintenance	yes	no	no
System provides LIS downtime functions/System allows manual order entry	yes/yes	yes/yes	yes/yes
System generates downtime specimen ID/Algorithm user definable	yes/yes	no/no	no/no
Orders manually entered in middleware are sent back to LIS automatically	yes	yes	yes
Quality control module	no	yes	yes
Middleware interfaces to third-party quality control packages	yes (Bio-Rad Unity, Thermo Fisher MAS)	yes (export-only feature into Bio-Rad)	yes (export or uni-directional connectivity to Bio-Rad)
System supports multi-rule quality control	yes	yes	yes
System supports moving averages or average of normals	yes	yes	yes
Users can customize screens/Users can define custom fields	yes/yes	yes/yes	no/no
Users can populate custom fields via user-defined rules	yes	yes	no
Screen has image support for any type of image	yes	yes	no
Users can design own reports/Report-generation software used	yes/any ODBC-compliant reporting application (Crystal Reports, MySQL, Excel, others)	yes/Advia Centralink's internal software	yes/Jasper Reports
• Reports can include any data elements in database	yes	no	yes
Around-the-clock customer service in U.S.	yes	yes	yes
System training available/On-site consulting	classroom, on site, Webinar/yes	e-learning, on site/yes	e-learning, on site, classroom/yes
Smallest cost for hardware/software/monthly maintenance	—	—	—
Largest cost for hardware/software/monthly maintenance	—	—	—
Fee for additional users	—	—	—
Distinguishing features of middleware (supplied by company)	<ul style="list-style-type: none"> <li>dedicated pool of IT sales consultants, PMP-certified IT project managers, and IT installation consultants to help design and install the right solution the first time</li> <li>mature, experienced middleware vendor; over a decade-long partnership with Data Innovations</li> <li>multi-faceted customer-to-customer information sharing on how to use Roche middleware, including PACE credit Webinars</li> </ul>	<ul style="list-style-type: none"> <li>robust and mature multi-discipline data-management and networking solution with proven record</li> <li>comprehensive and integrated quality control package—patient moving averages used in quality control and autoverification</li> <li>market-leading automation system controller</li> </ul>	<ul style="list-style-type: none"> <li>browser-based system utilizing standard Internet browser for access to patient results, quality control data, and specimen information across multiple network locations</li> <li>comprehensive and integrated quality control package</li> <li>supports preventative maintenance and remote diagnosis/access of connected instruments</li> </ul>

\*based on January 2011 survey deadline

Note: a dash in lieu of an answer means company did not answer question or question is not applicable

## Middleware systems

Part 6 of 6	<p><b>Sysmex America</b>            Tammy Kutz communications@sysmex.com            1 Nelson C. White Parkway            Mundelein, IL 60060            847-996-4500 www.sysmex.com</p>	<p><b>Technidata America Medical Software</b>            Ricardo Nunez ricardo.nunez@technidata-web.com            1760 E. River Rd., Suite 302            Tucson, AZ 85718            520-577-2872 www.technidata-web.com</p>	<p><b>Technidata America Medical Software</b>            Ricardo Nunez ricardo.nunez@technidata-web.com            1760 E. River Rd., Suite 302            Tucson, AZ 85718            520-577-2872 www.technidata-web.com</p>
Name of middleware system	Sysmex WAM†	TD-Harmony LPM	TD-Harmony suite: TD-IDM/WAM
First ever middleware installation/Most recent installation* Last update of middleware system	2003/January 2011 November 2009	1991/March 2010 November 2010	1991/January 2011 November 2010
No. of contracts for sites operating middleware • U.S. contracts/Foreign contracts (countries)	164 156/8 (Canada)	48 3/45 (Canada, France, Netherlands, Italy, Singapore)	688 265/423 (Canada, Spain, France, U.K., Netherlands, Germany, Taiwan, Singapore, Thailand, others)
• No. of these contracts signed in 2010 No. of sites operating middleware/Percent of business that is middleware	25 424/5%	5 55+ (primarily via OEM and distributors)/25%	89 723 (primarily via OEM and distributors)/25%
No. of employees in firm/In middleware development, install, support	589/80	227/80+	227/80+
Hardware platforms • Proprietary hardware required	Red Hat Linux no	hardware independent no	hardware independent no
Software platforms	Compuware Uniface	Windows 2008 server, Linux/Unix, VMWare ESX	Windows 2008 server, XP, Vista, 7
Fault-tolerant solutions/Hardware must be purchased from company	yes/no	yes/no	no/no
Able to operate in a virtual hardware environment	yes	yes	yes
Databases used or supported	Oracle	SQL server, Oracle	Microsoft Access, proprietary
No. of results/orders that can be stored in database	2 years worth/2 years worth	unlimited/unlimited	500,000 results/500,000 orders
Middleware can interface with instruments from any manufacturer	no (with Sysmex hematology analyzers and automation, Bio-Rad, CellaVision)	yes	yes
Types of data middleware can receive, store, transmit	alpha numeric, image	alpha numeric, image	alpha numeric, image
No. of instruments one middleware device can support	unlimited across multiple sites	200	6 per PC
Protocols middleware supports to interface to instruments	HL7 (2.3), ASTM (E1394), proprietary	HL7 (2.3), ASTM (1394), XML, proprietary, POCT1-A	HL7 (2.3), ASTM (1394), XML, proprietary, POCT1-A
Low-level transport middleware supports to interface to instruments	serial RS232, serial USB, TCP/IP	serial RS232, serial USB, TCP/IP, FTP, LAT	serial RS232, serial USB, TCP/IP, FTP
Middleware can send results to and receive orders from reference labs	no	yes (Quest, LabCorp, Mayo, Specialty Laboratories)	no
LIS/HIS/EMR interfaces for receiving orders	Sunquest, Cerner, Meditech, McKesson, SCC Soft Computer, Siemens, others	homegrown, Technidata, Meditech, Molis, Sunquest, Eclipsys, Allscripts, Altos, others	Cerner, McKesson, Sunquest, Meditech, Siemens, SCC Soft Computer, Technidata, Antek, Allscripts, Altos, homegrown, others
LIS/HIS/EMR interfaces for sending results	Sunquest, Cerner, Meditech, McKesson, SCC Soft Computer, Siemens, others	homegrown, Technidata, Meditech, Molis, Sunquest, Eclipsys, Allscripts, Altos, others	Cerner, McKesson, Sunquest, Meditech, Siemens, SCC Soft Computer, Technidata, Antek, Allscripts, Altos, homegrown, others
No. of diff. host system connections that can operate at once on middleware	unlimited	8 levels	1
Protocols system supports to interface to other systems	HL7 (2.3), ASTM (E1394), proprietary	HL7 (2.3), ASTM (1238), proprietary	HL7 (2.3), ASTM (1238/1394), proprietary
System can be configured to automatically forward reportable diseases and other data to public health surveillance systems	no	yes	no
Human languages (other than English) middleware supports	none	Spanish, French, German, Greek, Italian, Dutch, Mandarin, Japanese, others (21 languages)	Spanish, French, German, Greek, Italian, Dutch, Mandarin, Japanese, others (21 languages)
• Multiple languages can be used at same time on one system	no	yes	no
Middleware supports local date and time formats	yes	yes	yes
No. of users that can access middleware at once	unlimited	unlimited (licensing and hardware dependent)	5 (requires Windows 2008 server)
No. of user security levels middleware supports	unlimited	8	5
Middleware supports compound nested rules with multiple event actions	yes	yes	yes
• Multiple event actions fired from one "if" condition statement	yes	yes	yes
Programming or script language required to write rules	no	no	no
Full and persistent audit trail of rule execution/System supports rules testing	yes/yes	yes/yes	no/yes
Rule sets applied to individual instruments or connections	yes	yes	yes
Quality control data used as part of auto-verification or rules process	yes	yes	yes
Data from external databases retrieved and incorporated in rules processing	no	no	no
Results that are entered manually processed by rules	yes	yes	yes
Rules test cases created, saved, used on demand for rules validation testing	no	yes	yes
System supports event notification	yes	yes	yes
System user notified of rules-based events/Notification methods supported	yes/pop-up, audio/visual	yes/e-mail, ISMS (pager), POP/VP, visual coloring	yes/background color, review status
Automation routes determined by user-defined rules	yes	yes	no
Middleware supports test-based load balancing across instruments	yes	yes	no
Events that lead to automation routes being dynamically updated	new test requests, reflex test requests, instrument down	new test requests, reflex test requests, instrument down	—
Audit trail of route a sample has taken	yes	yes	no
Laboratory automation system interfaces	Sysmex	Beckman Coulter, Abbott, Roche, Siemens, others	Roche, Siemens, Sysmex, A&T Corp.
Middleware interfaces with noninstrument automation devices	yes	yes	no
Back-end specimen storage and retrieval tracking	yes	yes	no
System allows management of inst. & automation device maintenance records	no	yes	yes
• System provides alerts when an instrument needs maintenance	no	no	no
System provides LIS downtime functions/System allows manual order entry	yes/yes	yes/yes	yes/yes
System generates downtime specimen ID/Algorithm user definable	no/yes	yes/yes	yes/yes
Orders manually entered in middleware are sent back to LIS automatically	yes	yes	yes
Quality control module	yes	yes	yes
Middleware interfaces to third-party quality control packages	no	yes (Bio-Rad Unity, export to Microsoft Excel)	yes (export to Microsoft Excel)
System supports multi-rule quality control	yes	yes	yes
System supports moving averages or average of normals	yes	yes	yes
Users can customize screens/Users can define custom fields	no/yes	yes/yes	yes/no
Users can populate custom fields via user-defined rules	yes	no	no
Screen has image support for any type of image	yes	yes	yes
Users can design own reports/Report-generation software used	no/—	yes/proprietary, Crystal Reports, others	yes/proprietary, export to Excel
• Reports can include any data elements in database	yes	yes	no
Around-the-clock customer service in U.S.	yes	yes	yes
System training available/On-site consulting	classroom, on site, e-learning/yes	classroom, on site, e-training/yes	classroom, on site, e-training/yes
Smallest cost for hardware/software/monthly maintenance	—	—/—/1.5% of software cost	—/—/1.5% of software cost
Largest cost for hardware/software/monthly maintenance	—	—/—/1.5% of software cost	—/—/1.5% of software cost
Fee for additional users	—	—	Windows terminal server license
Distinguishing features of middleware (supplied by company)	<ul style="list-style-type: none"> <li>flexible rule engine with extensive rule-variable combinations for building rules for autovalidation, reflexing, add-on testing, specimen aging, more</li> <li>can support orders and results from multiple LISs and multiple sites for managing patient and quality control results</li> <li>proactive alert monitoring system</li> </ul>	<ul style="list-style-type: none"> <li>general lab module: ergonomics, simplicity, speed, context-based navigation; user-friendly, powerful rules editor; production and operational audit trail; comprehensive management tools and reports; more</li> <li>specialized microbiology module with paperless microbiology workflow, epidemiology analysis and threshold alerting, more</li> <li>company: seven subsidiaries in three continents; ISO 9001-2000 certified/ISO 1348S certified</li> </ul>	<ul style="list-style-type: none"> <li>remote quality control function allows users to view QC values from multiple instruments and generate QC reports from remote locations</li> <li>dashboard approach to sample results management, with the same user interface for all instruments in the clinical lab, providing a simple and consistent end-user environment</li> <li>easy to install and simple to use while offering robust functionality</li> </ul>

\*based on January 2011 survey deadline

Note: a dash in lieu of an answer means company did not answer question or question is not applicable

†formerly Molis WAM