WORKLOAD AUTOMATION

– KEY CONSIDERATIONS –

With the ever-increasing speed of business, enterprise Workload Automation (the evolution of job scheduling) solutions provide the most comprehensive, advanced way to automate business processes and tasks, incorporating multiple applications into those processes. Workload Automation solutions help organizations evolve from the manual management of business processes and data to more sophisticated interconnected systems including CRM, ERP, and more. They can reduce manual steps (freeing up staff time for other business initiatives) in complex processes eliminating common errors, reducing operational complexity and wait times. This can include supporting complex IT processing, support for event-driven workloads, multiple platforms, Web Services, virtual systems and more.

In addition to the speed benefits provided through automating manual business processes, Workload Automation facilitates the visualization and execution of end-to-end business processes allowing management to better view organizational performance and meet business service level requirements. Workload Automation solutions have quickly become a critical component of delivering services; particularly as IT environments become more complex.

Today, Workload Automation vendors provide comprehensive solutions that can replace disparate toolsets and reduce software complexity (and potentially reduce overall licensing costs). With so many Workload Automation solutions available on the market, there can be significant variability in terms of feature functionality. The following looks at a few of the key players, providing a number of key questions and considerations to help facilitate deeper discovery when evaluating a prospective Workload Automation solution.

1 Will a Workload Automation solution support end-to-end application and system integration for full automation of business processes?

How broad is the range of support to ensure all automation needs are met?

Many of the top vendors can provide customers with a broad range of job types out of the box and through agent specific add-ons, in many cases providing comparable support. This includes support for various platforms, databases, ERP solutions, applications, middleware, Big Data implementations, ETL, and more. Some vendors can also provide z/OS support, allowing mainframe automation that is managed and controlled through a distributed-hosted workload engine. When added together with traditional workload processing these objects extend the capabilities of workload automation well beyond traditional job scheduling providing better visibility and manageability.

Are deep integration and specializations available to address even the most obscure automation needs?

Ultimately, vendors provide support for a plethora of job types though there are inevitably differences between the vendors. While it is beyond the scope here to provide an extensive feature for feature comparison, specific customer requirements will play the largest factor with respect to situational vendor advantage. Some vendors provide advanced certified application integrations allowing external application processes (e.g., SAP, Informatica, etc.) to be managed and monitored internally to the workload automation solution. However, some vendors can provide more specialized integration support than others. For example, while Workload Automation vendors provide wide database support, some can provide more granular job support like Microsoft SQL Server Transact-SQL scripts, SQL Server Integration Services (SSIS) packages, and Replication

tasks. In short, most vendors can cater to the varied needs of the customer, but there may be some idiosyncrasies that will only apply to specific customers. These unique requirements must be assessed on a case-by-case basis.

What about an Agentless implementation?

Having a localized agent present on a server can provide (depending on the vendor solution) extensive monitoring capabilities like detecting service and process state, monitoring CPU and disk utilization, validating the contents of a file, managing FTP transmission activity, and more. Agents allow users to more efficiently design, test, and execute workload processes, automating capabilities for a wide variety of processing platforms while consuming very few resources. However, Agentless technology does have an advantage when customers do not require the advanced capabilities of add-on modules (i.e., advanced application integration will inevitably require localized agents). Customers can add connections to fringe systems on the edge of the IT infrastructure without significantly increasing agent maintenance related costs, providing the opportunity to perform jobs on these systems they might not have otherwise created.

2 How do vendors ease workflow design and development while still providing high levels of integration and customization?

What are the options for triggering workflows?

Overall, vendors provide support for user, event, and scheduled initiation of workflows. While time or calendar scheduling fits some workflows, more and more the trigger for a workflow may be the arrival or availability of a file or an interaction on a web page. Event-based triggers such as file actions, message queues, email, SNMP traps, database, system startups, and other events can trigger processes. While vendors do support a number of these, available options or depth of configuration will vary. For example, while most vendors support the use of "calendars" for scheduling jobs, some support the use of common terms, support for natural language understanding, and more sophisticated calendars. Others "recommend" creating smaller calendar objects with a few keywords instead of one large calendar object in order to keep calendar calculation performance efficient, but potentially increasing confusion and ultimately maintenance.

How are different workflow steps interconnected?

Once triggered, workflows can contain any number of steps, some of which are likely to depend on others. Typically through a visual drag and drop interface, Workload Automation solutions support defining pre- and post-dependencies for predecessor tasks that must be completed before subsequent jobs in a workflow can proceed. How these relationships are defined however varies between vendors. While some require pre- and post-conditions for tasks (i.e., may require manipulation on both sides of a relationship), others allow conditions to be placed on the link itself, potentially providing easier configuration. For more advanced configuration not available in the link properties, scripting may be required.

How quickly is custom scripting required, and what are the options?

In cases where the available options are not always sufficient by themselves, Workload Automation vendors provide support for custom scripting. Like many other areas, support and method of implementation is varied. Some vendors are quick to resort to scripting, providing quick access to scripting tabs for each object in order to control and handle various processing (e.g., change and process objects or execute arithmetic operations). In these cases, scripts are intended to simplify the processes because they can replace many steps that otherwise would have been executed individually. They also provide facilities such as arithmetic functions and process loops. A vendor that focuses on providing customers with

significant customization through job settings in the GUI without resorting to custom scripting by default helps reduce complexity and learning curves.

When scripting is required, vendors support a mix of propriety and/or multiple languages. While a number of vendors are moving towards supporting multiple languages (and interpreters), some still support proprietary scripting languages. In general, watch out for the use of languages that must be compiled. These can make upgrades more difficult potentially requiring scripts to be re-compiled. Focusing on a single open and ubiquitous interpretive language (e.g., JavaScript) however, allows for a level of integration that can help ease development efforts with contextual menus for functions and variables.

Support for multiple languages typically means that troubleshooting scripts requires additional outside development tools. Worse, it can introduce a mix and match of languages (sometimes in a single script), requiring developers to switch between them. While this may seem advantageous for initial implementation, it can significantly complicate future maintenance and learning curves when subsequent developers must review and alter scripts, particularly when unfamiliar with a language.

Once workflows are built, is built-in version control available to track edits?

When designing and modifying workflows, some vendors provide more version control than others, each with significantly different levels of feature functionality. This can range from no support, requiring customers to use manual processes and/or use third party (i.e., at additional cost) version control systems, to maintaining a complete list of versions with the management of concurrent updates (i.e., collisions) and impact analysis when deleting artifacts. At a basic level, workflow edits will update objects already set to run. In a best-case scenario, a solution can keep track of versions allowing older versions to be run, with no limit to the number of versions that are kept.

How do we make sure newly designed/edited workflows work as expected?

Once workflows are created, most vendors provide some form of simulation, ranging from a simple button that displays the effects that an agent assignment would have, to more sophisticated what-if scenarios to proactively analyze how an event can impact the workload. This includes simulating different run conditions to verify that the correct jobs are selected to run and jobs are run in the correct order. Customers need to be aware however, that some of these capabilities may be provided through optional (i.e., additional cost) components. Furthermore, where vendors do focus on a single language, it enables a level of support for error and variable checking when running simulations that is impractical where multiple languages are supported.

What about other open integration options?

In addition to most vendors providing command line interface (CLI) tools to provide additional integration support, the functionality available through the CLI can vary. For example, where vendors focus solely on graphical user interfaces, CLI tools are mainly for maintenance related tasks (e.g., database loading and archiving). Other vendors with more complete CLI functionality enable administrators to perform a number of actions (e.g., scheduling, operations, and programming commands) without a requirement for a GUI. Otherwise, most vendors provide support for standard Web Services interfaces allowing the initiation of workflows through custom applications expanding the integration of Workload Automation with other systems.

3 How easy will an implemented Workload Automation solution be to manage and maintain?

How difficult is it to install?

While the focus is on management and maintenance of an already implemented solution, the complexity of the overall architecture and the difficulty (or simplicity) of the installation process can be a significant indicator of future management and maintenance. Larger and more complicated architectures that require a number of individually deployed components inevitably increase associated maintenance. This doesn't even take into consideration additional optional components that are licensed and installed separately. A solution that requires fewer (or a single) core component(s) provides easier installation and maintenance, with a smaller footprint and fewer moving parts; potentially leading to an entire solution up and running with workloads being created within an hour.

Is a thick desktop client mandatory, or is there a thin web-based option?

Today, the industry norm is the availability of HTML-based web interfaces. They provide users with the convenience of connecting directly to a server through a standard web browser. This trend is mirrored by Workload Automation vendors allowing users to monitor and control workloads in a production environment and quickly respond to exception situations without the installation hassle and maintenance of larger desktop clients. Realistically, most vendors are in a state of transition with some vendors only recently switching to Web-based interfaces or offering only limited functionality, ultimately still requiring a desktop client. In short, roadmaps should be taken into consideration.

What about mobile access for users?

Similar to web-based interfaces, mobile access continues to play a key role. Here, web-based interfaces often help address this, easily facilitating access through standard web browsers on mobile tablet devices. Some vendors even provide rudimentary interfaces designed for smaller mobile screens, while others provide dedicated iOS or Android apps. Unfortunately, too often these dedicated apps provide only a subset of the functionality and access available through the full web-based interface.

Are "Self Service" facilities available?

Web-based and dedicated mobile apps are also being used to help address the concept of user self-service. Self-service is increasing in popularity thanks to its reduction in service desk requests and interactions, allowing more actions to be performed directly by the user. Most vendors do provide some form of self-service capabilities although obvious visibility and implementation practices range. The more visible solutions typically involve separate dedicated implementations that come with another price tag, separate user interface, and associated learning curves. Some vendors however, provide more subtle provisions such as supporting role-based customization of the existing user interface. Some even provide the facilities to create custom interfaces, packaging templates that can be simply passed the necessary parameters. This for example, allows for seamless integration into existing Intranet and Extranet portals allowing users to initiate workflows without switching interfaces and with minimal learning curves. Self-service improves business alignment by providing end users with access to view owned business processes, providing a clearer understanding of workload delivery status and progress. However, should this come at an additional cost with completely separate interfaces?

Can all the installed agents be centrally managed?

To ease maintenance woes, many vendors are striving to provide centralized management of deployed agents, significantly reducing manual effort. While some vendors provide dedicated facilities directly through the web-based graphical user

interface, others elect to use additional tools (from existing portfolios), sometimes including them as part of a "packaged" deal. Many agents already consume very few resources, are simple to install and maintain using silent install methods or software deployment automation solutions, and include self-maintenance settings. The addition of centralized management facilities can significantly help to reduce maintenance related costs. It is worth noting however, that some vendor messaging promotes eliminating maintenance windows. Realistically, it would be wise to maintain maintenance windows in case upgrades do not work as expected. In this way, during a planned upgrade if something does go wrong an administrator is already present performing the upgrade and can respond appropriately. If there were an issue during an automated upgraded when an administrator was not present, it could be very inconvenient.

What Reporting and Analytics facilities are included?

For day-to-day operations, vendors provide Dashboards for operations staff and line of business users to get self-service status updates. Delivered through browsers and mobile apps, business users can be included in the outcome of workflows. For more advanced reporting and analytics, vendors provide a range of capabilities from standardized reporting platforms to proprietary implementations. For example, some vendors include BIRT tools (the Business Intelligence and Reporting Tools Project) for reporting on current and historical job and environment information. While they do provide canned reports, customers can create customized reports using the BIRT Designer to meet their specific needs. Furthermore, BIRT addresses a wide range of reporting needs ranging from operational or enterprise reporting to multi-dimensional online analytic processing.

What about Critical Path analysis?

What about Critical Path Analysis. Over the past few years, predictive analytics has increased in popularity and is often a part of every major Workload Automation solution. Rather than simply monitor processes, Critical Path analysis can look downstream to highlight potential issues before they happen. This allows operators to quickly address them before they can (or see how they will) impact other workloads. Critical Path analytics however, are not always included, introducing yet another added expense and separate installation.

Will it help facilitate Governance and Compliance?

Finally, many vendors provide robust auditing facilities to help meet compliance and governance requirements. This includes recording changes performed by users and historical processing details for the outcome of jobs. While some vendors support accessing this information through a graphical interface, more have a tradition in command line interfaces making it more manually intensive to access recorded data.

4 What are the Total Costs for acquisition, deployment and ownership?

Is everything included or are there additional separately chargeable add-ons required to match the functionality provided by competitors?

Marketing material happily touts the benefits and functionality of a product superset that often requires separately licensed add-on modules. While some vendors' products include much of the functionality in the base product, others require that add-on components be purchased separately. Even more, some vendors have rearranged packaging including once separately available functionality within the core product but must still be licensed separately, or conversely separated out once included technology. For example, one vendor no longer included an embedded version of the required application server, "which must therefore be installed as a separate entity." While the acquisition costs of one vendor solution might initially appear more affordable, the slightly higher

option may ultimately include more functionality out of the box without a requirement for additional purchases.

Will the solution provide predictable/fixed ongoing costs?

In addition to the core solution, agents increase the job types that are available for automation. The individual vendor pricing models may play a key role with respect to cost advantage. While some vendors continue to license on a per agent basis, others have started pushing a "per job" or "per task" licensing model; helping better address Software as a Service based implementations. Having freely available agents perpetuates the addition of tasks, easily resulting in higher costs than initially anticipated; and the definition of a task may not be as intuitive as one might think.

Agent-based pricing allows organizations to focus on critical parts of their environment, automating workloads to reduce costs, not increase them. More specifically, as the number of jobs increase, there will be a tipping point where it will be more cost effective to license based on agents. When licensing based on the agent, users can create all the necessary automation tasks no matter how insignificant. Paying on a per task basis, the larger (high valued) tasks would be automated, potentially stalling or hindering the automation of additional smaller processes to keep cost variability down.

Can a vendor solution scale down to meet the specific needs of a smaller implementation?

Unnecessary complicated architectures designed for the largest environments often require the same number of components when scaling down to address smaller organizations. In some cases, each component (or add-on) requires its own database even when installed on the same physical server. This increases complexity and associated hardware and maintenance costs. Many vendors provide a single workload automation engine, which realistically addresses an ideal implementation size, while some can provide more than a single solution allowing customers to select the solution that better fits their architectural needs (e.g., multiple core components vs. a single core component with smaller footprint and fewer moving parts).

Is a SaaS option available?

Over the past few years, there has been a significant transition to Cloud and Software as a Service (SaaS) based solutions. In the case of Workload Automation, there is essentially an even split between whether or not a vendor offers a SaaS option. While a SaaS option can help better address smaller implementations, they are typically charged on a per task basis creating the same unpredictable costs already discussed. However, a SaaS based solution may be a good option when the processes being automated are part of an existing SaaS solution outside the corporate firewall. For those organizations with the majority of existing systems deployed internally, or for security conscious organizations (e.g., financial, insurance, etc.), the preference may likely still be an on-premise deployment.

Will employees need significant training?

The learning curve(s) for a vendor's solution can potentially add a significant requirement for training. A solution that is straight forward, with intuitive interfaces and terminology can reduce costs associated with training and maintenance, while those with a larger footprint and comparatively "archaic" terminology (based on origins and legacy) can reduce intuitiveness and increase learning curves. Furthermore, where multiple disparate products with different management, functionality, terminology, and implementation strategies have been amalgamated, one might surmise increased complexity and learning curves.

Can the vendor provide a well-articulated array of support and services or are partners required?	The successful deployment of a Workload Automation solution often requires professional services for implementation. Ideally with years of experience, customers can be confident in the use of best practices when planning, designing, installing and configuring a solution. While there can be benefits with regard to using partners that specialize in a customer's vertical industry, the experience level with the respective vendor products can vary greatly between partners; event when "certified". Vendors that are able to provide a range of professional services themselves can provide more direct access to support staff, product development, and overall product expertise. This may also have an outcome on a vendor's ability to provide support afterwards as well. More specifically, once deployed, are customers provided with 24x7 support as part of the standard maintenance package or are they relegated to business hour support unless customers upgrade to higher maintenance packages?
How important are vendor "Marketplaces" to augment a vendor solution?	A few vendors have implemented and advertise centralized "Marketplaces" where customers can obtain solutions and templates made available to the general community. This essentially allows partners and others to create solutions more quickly than might be produced by the vendor itself. The difference however, is these solutions are not likely to see the same level of support and service required by enterprise organizations.

Today, there are a number of Workload Automation solutions available on the market. Despite their variability most customers will realistically not be left wanting with regard to the types of jobs that can be automated. There are however some significant differences that can contribute to ease of installation, implementation, management, maintenance, and overall cost of a selected solution. Individual customer cases will dictate which vendor solution best fits their unique business requirements, and the questions as noted above, are intended to help prospective customers quickly get behind the marketing to better assess what matters most to them.

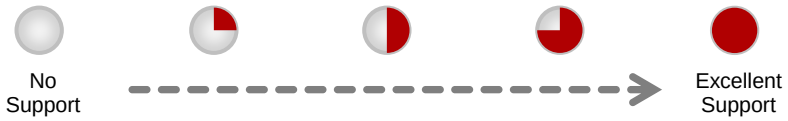
WORKLOAD AUTOMATION

– A COMPARATIVE ASSESSMENT –

The following provides a brief look at four distributed based Workload Automation solutions: Automic Workload Automation, BMC Control-M, CA Workload Automation DE, and IBM Workload Scheduler. While several of the key offerings that play a part in each vendor's approach to Workload Automation are outlined below, this is not an exhaustive list, as each vendor can also provide and integrate additional products from their respective portfolios to further augment their capabilities in other areas.

Solution Components	Automic	BMC	CA	IBM
Product	Automic Workload Automation	BMC Control-M	CA Workload Automation DE (formerly CA dSeries Workload Automation)	IBM Workload Scheduler (IBM Workload Automation is a family of products and components)
Core Component	• Automic Automation Engine • Automic Web Interface (formerly Enterprise Control Center)	• Control-M/Enterprise Manager • Control-M/Server • Control-M/Client • Control-M/Agent	• CA WA DE Server • CA WA Desktop Client • CA WA High Availability • CA WA Web Services • CA WA Agent Monitor	• IBM Workload Scheduler • Dynamic Workload Console
Optional ($) Components	• Workload Automation for SAP • Workload Automation for Oracle E-Business Suite • Workload Automation for Oracle Retail	• Self Service • Batch Impact Manager • Forecast • Advanced File Transfer • JCL Verify	Inclusive	• IBM Workload Scheduler for z/OS • IBM Workload Scheduler for Applications • IBM Workload Scheduler for Virtualized Data Centers
Example Agents and Add-ons (i.e., list not exhaustive)	• Rapid Automation Banner Agent • Rapid Automation BusinessObjects Agent • Rapid Automation FTP Agent • Rapid Automation Hadoop Agent • Rapid Automation Informatica Agent • Rapid Automation JMS Agent • Rapid Automation Oracle EBS Agent • Rapid Automation Oracle Retail Agent • Rapid Automation VMware Agent • Rapid Automation Web Service Agent	• Control-M for Databases • Control-M for Informatica • Control-M for IBM Cognos • Control-M for Business Objects • Control-M for Java, Web Services and Messaging (included in Suite) • Control-M for Hadoop	• Agent for i5/OS • Agent for z/OS • Agent for SAP • Agent for Oracle E-Business Suite • Agent for PeopleSoft • Agent for Databases • Agent for Hadoop • Agent for Microsoft SQL Server • Agent for Application Services and Web Services • Agent for Remote Execution • Agent for Micro Focus • Agent for Informatica • Agent for HP Integrity NonStop	• Plug-in for WebSphere MQ • Plug-in for MQTT • Plug-in for RESTful Web Services • Plugin for Liberty (JSR 352) • Plug-in for SAP BusinessObjects • Plug-in for IBM Sterling Connect:Direct • Plug-in for IBM Netezza Performance Server • Plug-in for Salesforce • Plug-in for Hadoop • IBM Workload Scheduler Plug-in for BigInsights • Plug-in for Oozie • Plug-in for Oracle E-Business Suite

The following table looks at the superset of available functionality from each solution, regardless of price. While prospective customers are not likely to be left wanting from a technical perspective, vendor packaging and licensing practices (and customer budget) will have a significant impact on whether or not that full functionality is available. For example, CA offers features included with the core product that are otherwise licensed options in a BMC solution (e.g., file transfer).



Core Selection Factors				
Feature	**Automic Workload Automation**	**BMC Control-M**	**CA Workload Automation DE**	**IBM Workload Scheduler / Automation**
Platform Support				
Architecture				
Server OS Support (installation)				
Client OS Support				
Application Server Support				
Web Server Support				
Database Support (installation)				
Directory Server Support				
Browser Support (for Web UI)				
Mobile Support				
High Availability and Scalability				
Cloud / SaaS Option				
Agent and Automation Support				
Client User Interface(s)				
Job Types				
Agent Platform Support				
Virtualization and Cloud System Support				

Core Selection Factors				
Feature	**Automic Workload Automation**	**BMC Control-M**	**CA Workload Automation DE**	**IBM Workload Scheduler / Automation**
Agentless Support (aka Remote Execution)				
Topology Discovery				
Database Support				
ERP and Application Support				
Enterprise Middleware Support				
Scheduling / Event Trigger Support				
Disk Storage Support				
Dependencies, Pre- and Post-Processing				
Support for Industry Standards				
Web Services Support				
XML Support				
Communication Protocols				
Security Support				
Multilingual Support				
Integration and Extension of Enterprise Assets				
ETL and Data Integration				
Big Data (Hadoop) Support				
Additional Third Party Support				
API and Developer Tools				
Custom Scripting Support				
Administration and Management				
Administration Facilities				

Core Selection Factors				
Feature	**Automic Workload Automation**	**BMC Control-M**	**CA Workload Automation DE**	**IBM Workload Scheduler / Automation**
Troubleshooting / Diagnostic / Resolution Facilities				
User Management				
Collaboration Tools				
Self Service Capabilities				
Backup and Recovery				
Process Flow Modeling / Scheduling Tools				
Simulation Tools				
Monitoring, Notifications and Alerts				
Maintenance (Deployment, Rollout, and Upgrading)				
Version Control				
Reporting and Analysis				
Auditing				

While this assessment was commissioned by CA Inc., Zibis Group does not endorse any of the above noted solutions, rather using them in this context, to illustrate many of the key factors that should be considered when selecting and Workload Automation solution.

ABOUT ZIBIS GROUP

Zibis Group Inc. ("Zibis Group") is a leading source for market research and advisory services on the Information and Communications Technology (ICT) industry and related sectors. We assist vendors, government institutions, academia, non-profits and other key industry stakeholders by providing them with the tools they need to make informed decisions.

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