



ADOBE LIVECYCLE WORKFLOW v7.0

1. Vendor and Product Overview

Best known for its desktop software, Adobe is now leveraging its LiveCycle Intelligent Document Platform for enterprise business process management. LiveCycle Workflow v7.0, introduced in September 2005, is a scalable full-function BPMS offering that includes business rules, web services, and performance management, which Adobe calls Business Activity Monitoring (BAM). The software is aimed primarily at document-centric business processes that emphasize electronic forms fill and processing, offline tasks, and participation across the firewall. Adobe differentiates LiveCycle Workflow from other BPMS offerings on the basis of three unique features:

- *Intelligent documents based on Adobe's Acrobat PDF format*, including electronic forms, security and digital signatures, and policy-based rights management. The intelligence in PDF documents works both online and offline, and documents can be communicated via email, file sharing, or any other way without losing their intelligent attributes. While some aspects of PDF's inherent intelligence can be leveraged by other BPMS providers, others are available only through LiveCycle. For example, PDF Forms created in Acrobat Professional are not the same as the intelligent XML Forms created in LiveCycle Designer.
- *Acrobat Reader, free and ubiquitous on the desktop or in a browser*. Reader can enforce intelligent document capabilities, such as security and privacy, and can work both online and offline. While the free version of Reader is normally limited in its available intelligent document functions, any Acrobat function can be "unlocked" in Reader via Adobe's server-based *Reader Extensions*.
- *LiveCycle platform*, which provides functionality in four key areas:
 1. *Document Generation* – LiveCycle can generate documents such as statements, invoices, or contracts automatically from transaction systems. These PDF "intelligent documents" serve as onramps to other business processes. For example, a bank statement can provide a secure link to a home equity loan application.
 2. *Document Collaboration* – LiveCycle supports ad hoc or unstructured business processes through markup, review, comment, and approval. These collaborative capabilities can also be integrated within structured workflows.
 3. *Document Control and Security* – LiveCycle supports digital signatures, document/form certification, and policy rights management to allow fine-grained control over how information is managed inside or outside the firewall.
 4. *Process Management* – LiveCycle supports complex long-running processes that require human and system interaction. LiveCycle also supports 2D barcode capabilities, enabling processes to transition from digital to paper and back without re-keying information or losing data.

Adobe describes LiveCycle Workflow as BPMS for end-to-end document-centric processes containing a mix of human and automated steps linked by rules. Examples include new account enrollment and claims processing (financial services), citizen self-service and case management (government), and drug testing and approval (life sciences). This category is distinguished from

“ad hoc” processes, in which steps are manual and linked by human routing decisions, and integration-centric (straight-through) processes. Target use cases for LiveCycle Workflow are illustrated by three beta customers for v7.0:

- A large financial services firm uses it for account enrollment in its financial advisory services. Extensive forms with enrollee signatures are required for each investment account, which are in general distributed over multiple funds or brokerage companies. The ability to distribute the form filling and approval process to various agents and investment companies over the firewall, automate data validation and completeness checking, while automating the integration with backend systems fits well with LiveCycle capabilities.
- The court system in one of the fastest growing counties in the US uses it for issuance of orders of protection. Intelligent Adobe forms contain embedded help text to assist filling out the variable information, and the entire process from form fill to judge’s approval to notification of the sheriff’s office is automated by the workflow.
- A multinational pharmaceutical company uses it to enable physicians to request samples. Requests require completion and digital signing of an intelligent form, all available through the free Adobe Reader via Reader Extensions.

The full BPMS offering is called the **Adobe LiveCycle Process Management Suite**. It contains the following major components:

- **LiveCycle Workflow Designer**, a design tool shared by business and IT, is used to define workflows, business rules, and configure process activities. Adobe customers can build many BPM solutions with little or no programming, simply by configuring and linking process activities, called Quick Process Action Components, or *QPACs*. Adobe provides approximately 40 out-of-the-box QPACs supporting human activities, automated document processing functions, LiveCycle document services, flow control primitives, and various integration components, including web services, JMS, and JCA adapters. The LiveCycle Workflow SDK also provides an Eclipse-based **QPAC Development Environment** that lets Java developers build custom activity types (QPACs). Processes execute on the **LiveCycle Workflow Server**, a J2EE-based process engine that runs on multiple application servers, including scalable and high-availability environments.
- **LiveCycle Designer** is a drag-and-drop design tool for LiveCycle intelligent forms. Forms are defined as XML, and may be rendered either in HTML or PDF. In LiveCycle, forms serve both as signed business documents and as data containers in the task user interface. **Form Manager** is a J2EE-based repository of LiveCycle forms.
- **LiveCycle BAM Workbench** is a browser-based design tool for defining and configuring performance management dashboards, KPIs, and alerts. **BAM Dashboard** allows users to view dashboards and real-time process status, and perform OLAP queries on performance data.

In addition to its native functionality, LiveCycle Process Management Suite rounds out its BPMS capabilities through third party partnerships. These include:

- **iGrafx** for analytical modeling using BPMN standard notation. Process models are exchanged with Workflow Designer using an Adobe-defined XML schema. The iGrafx tool incorporates the same palette of workflow components used within the Adobe workflow design tool, enabling a smooth transition from modeling to deployment.

- **Corticon and ILOG** business rule engines. Each rule engine is supported by a predefined process activity type (QPAC), allowing process designers to select business rules defined in the Corticon and ILOG environments and execute them from the workflow engine. The integration supports decision, routing and content based rules.
- **NetManage** Librados integration adapters based on the JCA standard, linking the process to over 80 packaged applications and mainframe systems. Configuration via introspection is available through the QPAC.
- **Avoka** extends Adobe's palette of out-of-the-box QPACs with a library of additional components. For more information see www.avoka.com.
- **Celequest** provides the analytics engine for LiveCycle BAM Dashboards.

2. Environment and Architecture

2.1 Runtime Architecture

LiveCycle Workflow runs on multiple J2EE application servers, including JBOSS, BEA, and IBM, and supports all popular operating systems (Windows, AIX, Solaris, and Linux) and databases (DB2, Oracle, SQL Server, MySQL). It leverages J2EE services to provide clustering, failover, load balancing, messaging, and transaction management, and has shown to be highly scalable in lab tests and customer environments.

LiveCycle Workflow supports transaction management. The workflow server maintains the state and data of a running process branch within XA transaction boundaries. If a failure occurs, outstanding transactions can be rolled back so both state and data remain consistent.

Adobe LiveCycle Workflow also provides integration with LDAP Directory servers to authenticate users and to leverage the users, groups and roles defined within those Directory servers for routing decisions. LiveCycle Workflow supports the Security Assertions Markup Language (SAML), enabling users to transparently sign on to multiple LiveCycle services without re-login or re-authentication.

LiveCycle Workflow allows multiple versions of a process to co-exist on the engine. For example, tax processing for multiple tax years can be deployed simultaneously. This flexibility allows users to adopt appropriate migration strategies as processes evolve over time.

3. Analytical Modeling

Analytical modeling through a partnership with iGrafx was announced by Adobe in September 2005. iGrafx Process supports creation of swimlane process diagrams (including BPMN), annotation with simulation parameters such as activity cost and duration, and simulation of multiple scenarios on the iGrafx engine (Figure 1). iGrafx Process can import Visio diagrams and can export its data in a variety of standard formats. For integration with Adobe, iGrafx supports export in the LiveCycle Workflow XML schema. These models can be imported into LiveCycle Workflow Designer for conversion into executable processes.

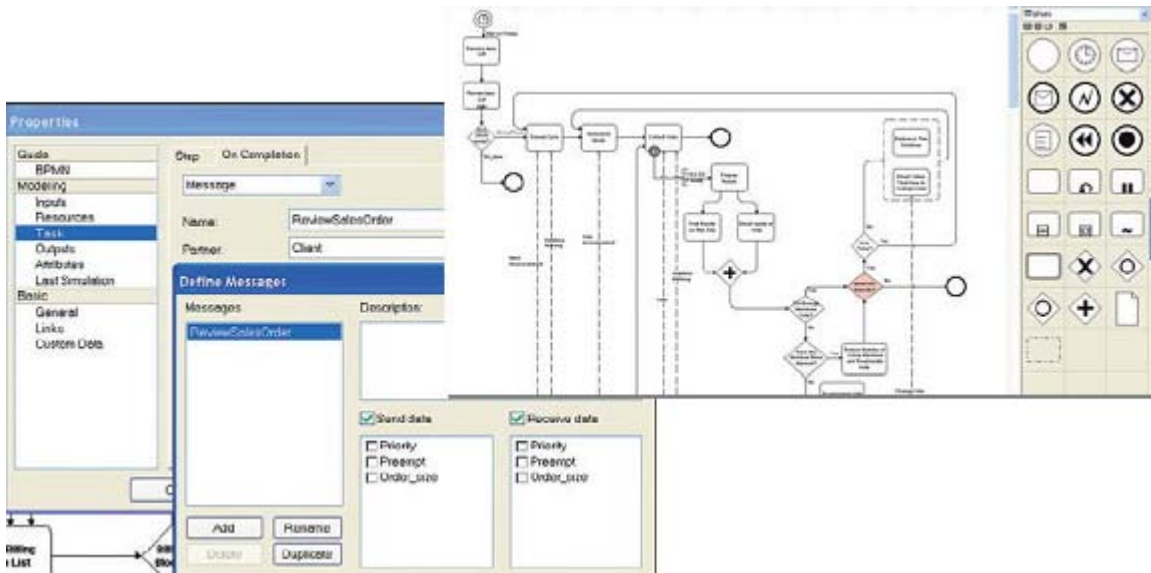


Figure 1. BPMN diagrams from iGrafx Process can be exchanged with LiveCycle Workflow using Adobe's process definition schema. Source: iGrafx

4. Process Structure and Data

The basic metaphor of a LiveCycle Workflow process is one or more “intelligent documents,” such as LiveCycle forms, routed to a sequence of steps. The documents act as both containers for process data and a user interface for human interaction.

In Adobe's terminology, LiveCycle Workflow steps are called *actions*, connected by *routes*. Each route is governed by a conditional expression called a *business rule*, but which we call in Chapter 1 of the 2006 BPMS Report a *process rule*. Processes may be composed of nested and chained workflows. Adobe's *Chained Process* QPAC enables one workflow to initiate another and map variables to it. (Adobe's term *chained process* refers to what Chapter 1 calls both nested and chained subprocesses, depending on whether it is defined as synchronous or asynchronous.) LiveCycle Workflow also supports parallel threads of execution (*splits*) and activities that wait for an event.

4.1 QPACs

All process actions, plus certain flow control primitives such as *Split* or *Wait*, are implemented with QPACs. QPACs give Adobe LiveCycle the flavor of a service-oriented architecture, since they provide a common data representation and invocation model for all human and system activities in a workflow. Moreover, QPACs allow non-technical process designers to visually assemble workflows without programming. Each QPAC bundles a configuration dialog with an executable service component (Figure 2). The configured service component is deployed to the workflow server as a component for execution. Adobe provides QPACs out-of-the-box for most process activities, and allows them to be extended or new QPACs created – both the service component and the configuration dialog – by Java programmers using the LiveCycle Workflow SDK.

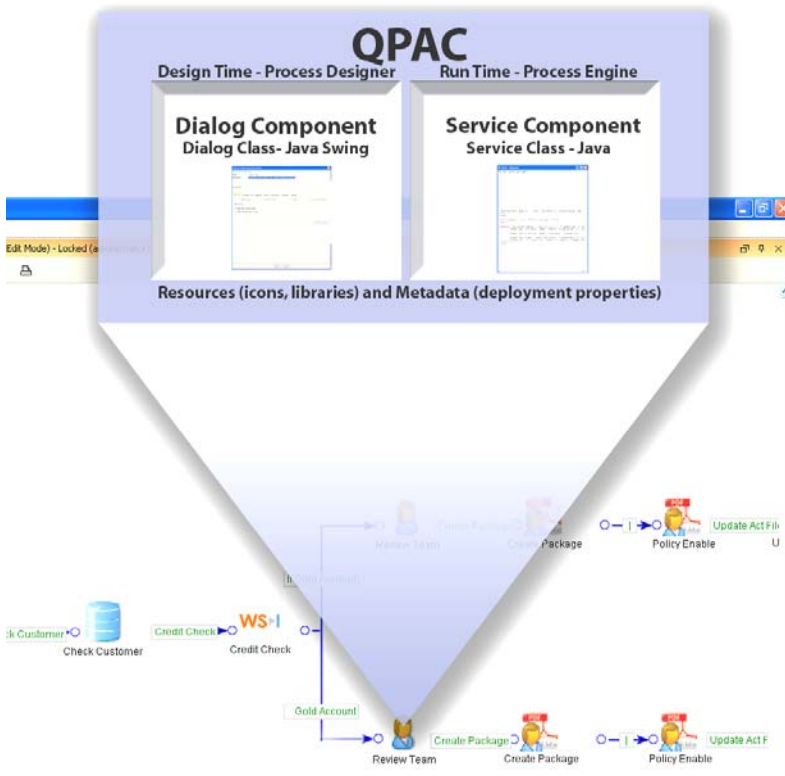


Figure 2. Process steps are implemented with QPACs, each combining a configuration dialog with an executable service component. Source: Adobe

4.2 Process Branches

LiveCycle Workflow implements complex flow patterns such as splits or nested and chained subprocesses using *branches*. The top-level flow is called the *main branch* of the process. Each process branch can be designated as asynchronous, synchronous, or transactional. In asynchronous branches, intended for long-running flows, all actions are invoked via JMS messages and executed on separate threads. Synchronous branches are generally short-running and all activities execute on a single thread. Transactional branches are a special case of synchronous branches in which the actions are not committed until the entire branch completes; failure of the branch triggers a rollback using J2EE Transaction Services. Each QPAC has properties that allow the process designer to specify whether it can be used in synchronous or transactional branches.

In addition, a special kind of branch called an Interactive Branch allows a sequence of User (interactive) steps to be assigned to the same participant. For example, when a form-fill task requires a server-side validation on part of the form before the rest of the form is completed, an interactive branch makes these appear as three subtasks within a single user task. Interactive branches are also useful for creating screenflows, again by assigning a web form to each “subtask” within the branch.

4.3 Workflow Routes and Rules

Figure 3 illustrates LiveCycle Workflow Designer. The palette of actions (QPACs) available to the process designer is on the left. Steps are placed on the flow design workspace and connected

with routes. The step icon indicates the type of QPAC, e.g. email, SQL, web service, user step, etc.

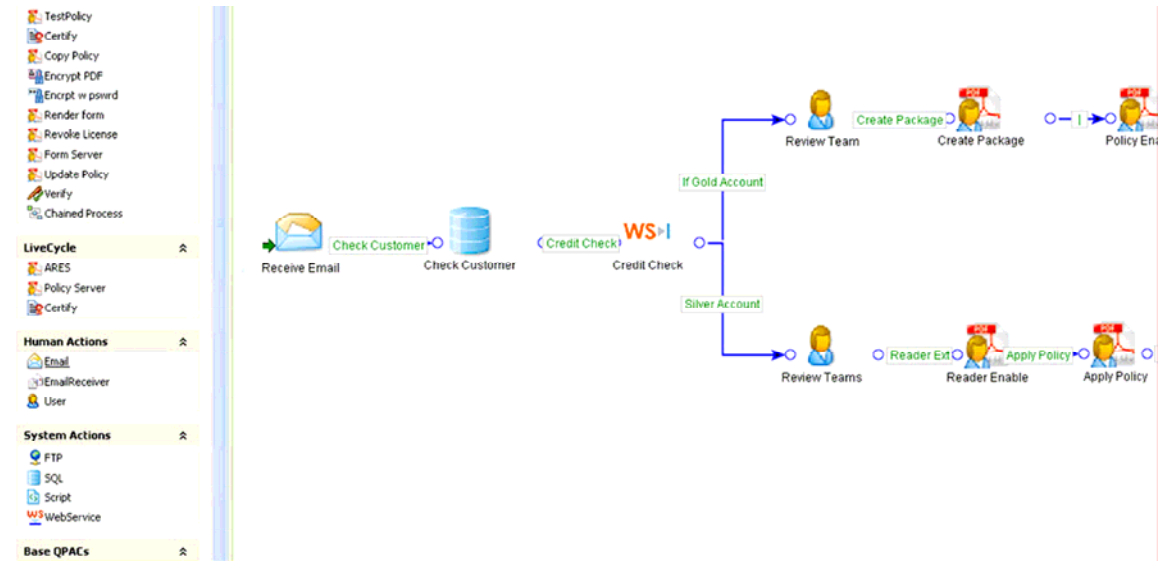


Figure 3. LiveCycle Workflow Designer assembles processes from a palette of actions (QPACs) linked by routes and rules. Source: Adobe

While LiveCycle Workflow does support an explicit Decision activity, most conditional routing is specified by defining a Boolean *condition* that enables a route (Figure 4). Adobe sometimes calls these routing conditions “business rules,” but they should not be confused with QPACs that call true business rule engines such as ILOG or Corticon. Routing conditions are specified using XPATH expressions on process data, including any data element in a form or process attributes (such as owner, etc.)

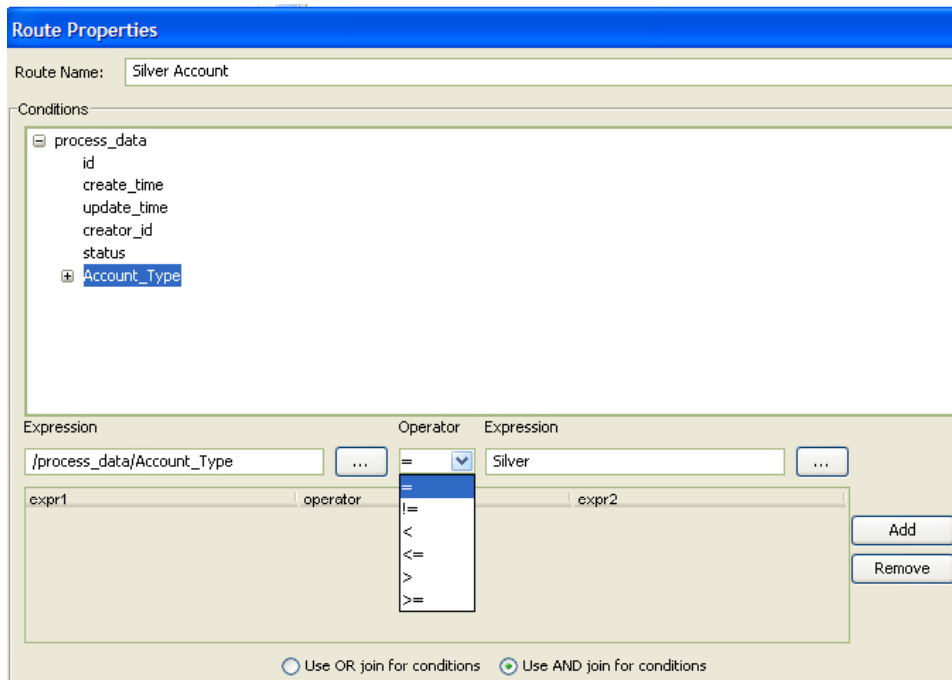


Figure 4. XPath-based expression builder for process rules. Source: Adobe

4.4 Process Data

Process data in Adobe LiveCycle Workflow is primarily in XML, supporting complex business object structures with schema validation and standards-based mapping to external business systems. Process data elements are defined in QPACs and LiveCycle forms. LiveCycle Workflow provides two QPACs for manipulating process data:

- **Set Value.** Manipulates process variables using standard XPath 1.0 expressions. For example, the value of a workflow variable can be set by an expression that references other workflow variables.
- **Script.** Executes a Java-based script that can reference and manipulate process variables.

5. Human Workflow

Human workflow is a major emphasis of LiveCycle. Human interaction is generally modeled using the User step type, which may be combined with automated PDF functions and Adobe Document Services.

5.1 User Step

The User QPAC provided by Adobe configures interactive tasks by a tabbed dialog specifying participant assignment and task delivery, deadlines and escalation actions, forms and attachments used in the task, and data mappings. Tasks can be assigned to users and groups defined in LDAP directories, either by name or calculated from an expression of process variables. Adobe distinguishes between the user initially assigned to perform the task and the user assigned to perform the task if it is *escalated*. Based on the time a process instance has been waiting in a task queue, it may generate a reminder message, reroute the task to the assigned escalation user, or reroute the instance on a *deadline* path.

The screenshot shows a dialog box titled "Process Action Type Properties" with a close button in the top right corner. The "Process Action Type" is set to "User". The "Name" field contains "Review Team". The "Description" field contains "Send Form to review team - if OK, route to manager for approval". There is an "Instructions" field which is currently empty. Below the fields are several tabs: "Initial User", "Escalation User", "Mappings", "Routes & Attachments", "Reminders", and "Deadline". The "Initial User" tab is active. Under this tab, there are four radio button options: "Specify User", "Process Creator", "Group" (which is selected), and "Use Path Expression". Below these options is a section titled "Select Group" containing two radio button options: "Add Task to Group Queue" (selected) and "Select Random User in Group". At the bottom right of the dialog is a button labeled "Select Group...".

Figure 5. Task assignment dialog in User QPAC. Source: Adobe

5.2 LiveCycle Forms and Intelligent Documents

Intelligent forms created with Adobe LiveCycle Designer play a major role in Adobe's BPMS. They serve as task user interface and all-purpose data containers as well as printable electronic forms. The intelligence built into these forms, including autocalculated values, validation rules, and required fields, ensures that they are filled out completely and accurately without a server round-trip. In fact, even security features like digital signatures work offline, so that forms can be routed by email or file transfer without losing their integrity in a business process.

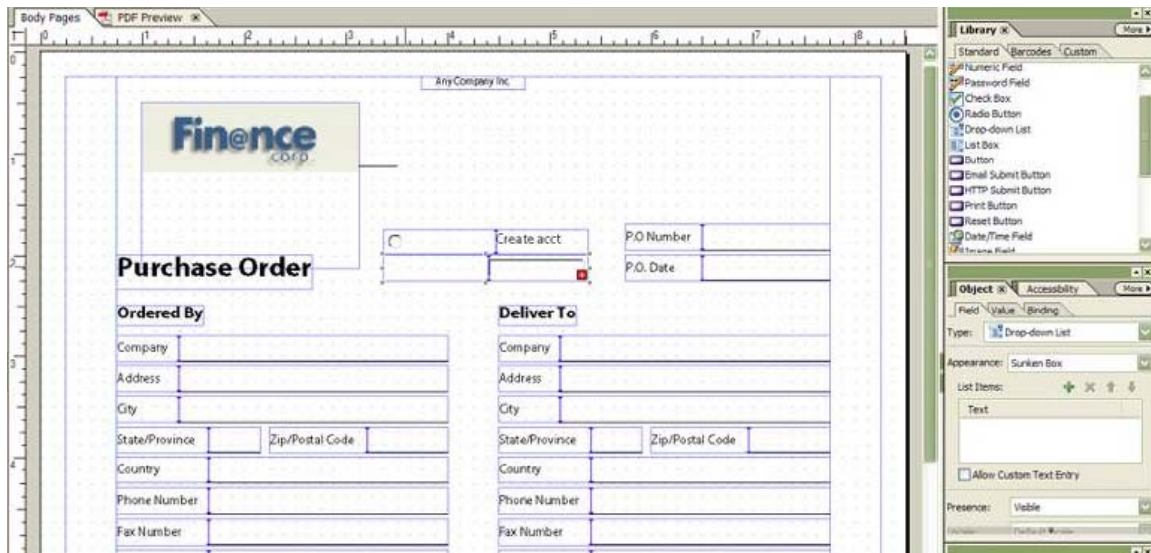


Figure 6. LiveCycle Designer provides drag-and-drop assembly of forms and other intelligent documents. Source: Adobe

LiveCycle Designer provides a drag-and-drop template-based form design environment accessible to business users. Intelligent, secure forms are stored as XML and rendered on demand as PDF or HTML, with LiveCycle Workflow integration built in. LiveCycle forms can be downloaded from the web and completed by users either online or offline. The ubiquitous free Adobe Reader normally does not allow form fill or digital signing, but these or any other feature of the full Acrobat software can be enabled through *Reader Extensions*. With Reader Extensions, form-fill functionality remains free to the process participant, but usage is metered and licensed at the server. Reader Extensions enablement, like other actions, is implemented by a QPAC (Figure 7), which specifies the form and the specific features enabled to Adobe Reader users.

LiveCycle Workflow supports a number of QPACs related to forms and other intelligent documents:

- **Render Form** populates a LiveCycle Form template with data and renders it as PDF or HTML.
- **Submit Form** extracts data from a LiveCycle Form and converts it to an XML document.
- **Barcoded Form QPACs** create and apply barcodes to forms, read barcode data from a scanned image, identify forms from barcode data, and perform other barcode-related tasks. Barcodes allow printed copies of Adobe forms to be integrated into a workflow as scanned images.

- **Document Security QPACs** implement server-based security functions on PDF documents and forms, including digital signature, signature verify, certify, encryption, password-protection, and apply policy.
- **Reader Extensions** enables selected functionality at runtime through the free Adobe Reader (Figure 7).
- **Policy Server QPACs** implement server-based security policies that grant or deny access to documents based on user or role, time, or other criteria.

Process Action Type Properties

Process Action Type: Reader Extension Server

Name:

Description:

Adobe Reader Extension Server Settings

File:

Allow basic form fill-in

Allow form data import and export, SOAP access, database access, and embedd

Allow form submit standalone

Allow dynamic form fields (add and delete form fields)

Allow dynamic form pages (spawn template pages)

Allow digital signatures

Allow 2D barcode decoding

Allow comments to be added, deleted, modified, copied, imported and exported

Draft Level:

Message that will be displayed when a user opens the file in Adobe Reader:

Figure 7. Reader Extensions QPAC configuration. Source: Adobe

5.3 Worklist

Tasks are delivered to assigned participants either by email or via a worklist in Adobe LiveCycle Form Manager (Figure 8). From MyWorklist in Form Manager, users can browse or query for work items, organize assigned tasks into folders, and get interactive PDF or HTML forms as part of a task. LiveCycle Form Manager also allows users to process PDF forms offline. For example, a user receiving a PDF form as an email attachment can detach and complete the form offline, and then submit the completed form by attaching to an email. The form can even be created using 2D bar codes that allow the data in a printed form to be recaptured from its scanned image as XML data.

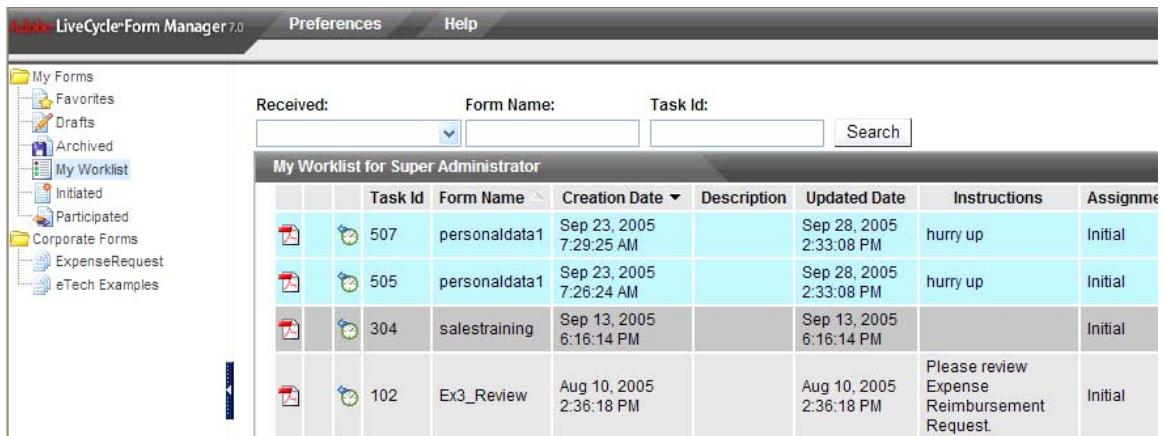


Figure 8. MyWorklist in LiveCycle Form Manager. Source: Adobe

6. Integration Framework

While document-centric human tasks are its primary focus, LiveCycle Workflow provides a full complement of QPACs supporting integration with external applications and data sources. Like other QPACs, each provides a dialog for configuration without programming, and an executable service component. The QPACs include:

- **JMS.** Adobe provides separate QPACs for sending to a JMS queue, receiving from a JMS queue, and publishing to a JMS topic. The QPAC supports all major application servers. Adobe does not provide the enterprise message bus (JMS provider) that may be required to communicate with external systems.
- **Web services.** Adobe provides a QPAC that imports a WSDL definition, invokes a specified web service, and retrieves responses. Process designers map data from the web service request and response messages to process variables. The Web Service QPAC supports the WS-I Basic Profile 1.0 and is interoperable with web service stacks found in environments including .NET, application servers, and the Java Development Kit (JDK).
- **EJB.** Adobe provides a QPAC that invokes an Enterprise Java Bean (EJB), either a stateless session bean or an entity bean, and retrieves responses. Process designers map data from the method call to process variables. This QPAC supports WebSphere, WebLogic, and JBoss application servers.
- **SQL.** Adobe provides a QPAC (Figure 9) that can perform SQL insert, update, and select statements on relational databases including Oracle, IBM DB2, MySQL, Microsoft SQL Server, and Sybase. SQL statements can be defined manually or dynamically generated based on process variables. Returned data is mapped to process variables.
- **FTP.** Adobe provides a QPAC that connects to an FTP server to upload or download a file.
- **LDAP.** Adobe provides a QPAC that queries an LDAP server such as Sun ONE or Microsoft Active Directory, applying a filter script, to collect a list of user-selected attributes. Queries can retrieve attributes such as a phone number, members a specific group or role, or organizational relationships needed for the process.
- **Email.** Adobe provides separate QPACs for email send and receive. The first defines an email message, including headers body, and attachments, and sends it to a specified SMTP server. The second searches a POP3 or IMAP mail server for a specific message

and retrieves its content and attributes. Attachments, PDF and other file formats, can be saved as process variables.

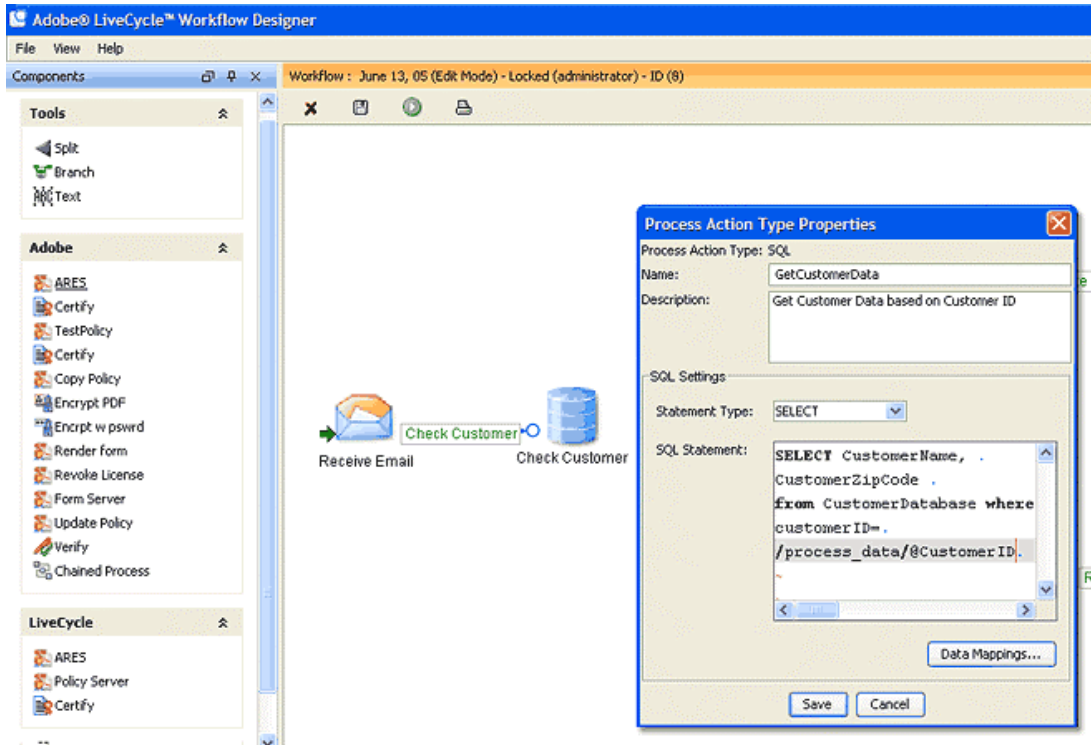


Figure 9. SQL QPAC configuration in Workflow Designer. Source: Adobe

- NetManage Librados Adapters.** Through a marketing partnership with NetManage, LiveCycle Workflow integration with enterprise applications such as Siebel, SAP, and Oracle, mainframe applications, and other external systems will be available via Librados JCA Plus adapters (Figure 10). These adapters are configurable by introspection without programming, and will be supported by LiveCycle Workflow QPACs.

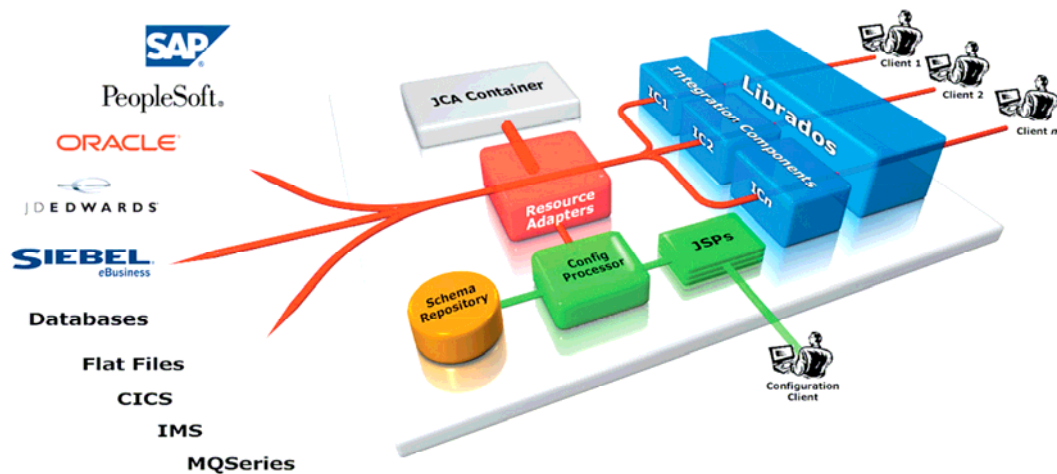


Figure 10. NetManage Librados JCA Plus adapters link LiveCycle Workflow to enterprise applications. Source: NetManage

7. Business Rules

In addition to simple XPATH-based process rules (which Adobe sometimes refers to as business rules), LiveCycle Workflow supports true business rule engines through marketing partnerships with ILOG and Corticon. A business rule action in the workflow model is represented by a distinct icon and QPAC type. For example, a step could invoke a business rule to determine whether an applicant is a new or existing customer. The rule engine result would then be used by process rules to determine the route. Process variables can be mapped to inputs and outputs of business rules using an expression builder. Process designers can also select rules from a business rule repository.

8. Content, Collaboration, and Case Management

LiveCycle Workflow is targeted at content-centric processes, but Adobe does not provide a general-purpose content management repository with features like metadata search, foldering, versioning, check-in/check-out, etc. Rather than focus on repository-based metadata and services, Adobe has chosen to emphasize intelligence based on metadata built into the document structure itself. This intelligence requires that the document be formatted as a PDF or LiveCycle Form, but since any printable document can be converted automatically to PDF, that is not a significant limitation.

While LiveCycle Workflow has no explicit support for online team collaboration, *offline team collaboration* is inherent in the Adobe Intelligent Document program. By embedding security, commenting, digital signatures and approvals directly into the PDF document structure, content can be shared offline in ad hoc collaborations – via email and file shares, not just via the web – and allow the collaboration metadata to participate in a LiveCycle Workflow process. This is a “different” way to do ad hoc collaboration, but effective for many kinds of processes.

Case management involves electronic folders of documents, the number and identity of which may be determined dynamically during runtime execution, and which each may have its own independent workflow (e.g. validation, review and approval). LiveCycle Workflow has no explicit support for case management but provides the hooks through which case management solutions could be built. For example, LiveCycle supports PDF turnaround documents (not just forms) with barcodes that can be used to automatically identify them and correlate their receipt with a running case instance. Because features like approvals and signatures are built into the documents themselves, the dynamic case workflow paradigm is easier for Adobe to handle than it is for most other BPMS vendors.

Also, Adobe Form Server can define Adobe forms within IBM DB2 Content Manager as a unique type of content with its own item type definition. Systems administrators can use the native capabilities of DB2 Content Manager to store, version, and maintain electronic forms and form processes. Form Server has a similar type of integration with Documentum.

9. Events and Exceptions

LiveCycle Workflow has no unified event-processing framework, but provides some hooks that allow solution developers to handle various types of inbound messages, timeouts, and other business exceptions.

- QPACs can monitor for inbound messages received on a JMS queue or by email, and use process rules to gate further action.

- The Wait QPAC implements a time delay in the process, either fixed or based on a data expression.
- The User QPAC supports escalation and deadline properties.

System faults, including Java exceptions and timeouts on synchronous actions and branches, typically put the process branch in a *stalled* state. (Custom QPACs can catch and handle the exception internally to the service component.) The Stall QPAC allows a process branch, such as one selected by a business exception, to put itself in a stalled state. Stalled means the instance is suspended for further manual intervention by an administrator. Depending on the transaction properties of the branch, LiveCycle Workflow may attempt to retry or rollback the activity or branch. LiveCycle has no native support for compensation actions.

10. Performance Management

10.1 Architecture

Adobe LiveCycle Workflow supports performance management through analytics technology OEM'ed from Celequest and integrated into the LiveCycle Workflow environment. The technology creates operational dashboards from LiveCycle process events, processed with business rules and aggregated into OLAP cubes, with KPI charting and real-time alerts. In keeping with LiveCycle's design philosophy, these dashboards are intended to be defined by business analysts without programming.

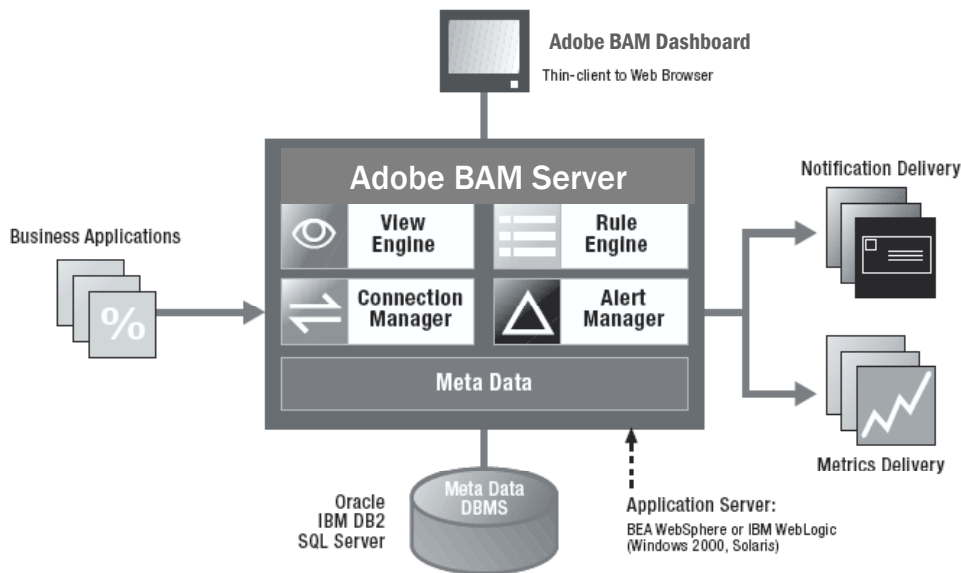


Figure 11. Performance data is aggregated in business views, which generate alerts when exception conditions occur. Source: Celequest, Adobe

The basic architecture is shown in Figure 11. The LiveCycle BAM Server receives *events* from LiveCycle Workflow signaling state changes and possibly directly from business applications as well. These event streams are converted into metadata stored on a relational database. This metadata is processed by the BAM Server to create *business views*, tables of aggregated performance data that provide a real-time picture of a business process. As new events enter the system, the views immediately update to reflect current details about the process. After all of the

relevant views have been updated, *rules* are executed immediately on the updated views to identify any exception conditions in the business environment. These exception conditions can generate alerts and notifications to process owners.

Business views are user-defined tables of performance data that combine event and context information. For example, a view named *DelayedSupplies* might be the combination of an event stream named *DelayedSupplies* and a context named *PartDescriptions*. Business views aggregate event and context information into meaningful business metrics. For example, a view might track the performance of sales representatives to identify which are on target to meet their individual quotas for the quarter. Each sale is recorded as an event, included in a total sales calculation, and compared against quota information retrieved as context. Those performance results can further be combined to compare the performance of different sales regions. Another view might compare sales forecast metrics with current manufacturing projections, and issue alerts when the two are out of balance.

LiveCycle BAM design tools allow business analysts to define *business activities*, which are sets of *scenarios* that monitor event streams, apply rules, and update business views (Figure 12). Each scenario contains rules that identify specific exception conditions and alerts to send to key personnel when the conditions occur. Rules developed in SQL using the BAM Workbench monitor process performance by comparing business view data to specified conditions, using simple expressions. Upon detection of an exception condition, the rule fires an *alert*, a notification message sent to a user or application.

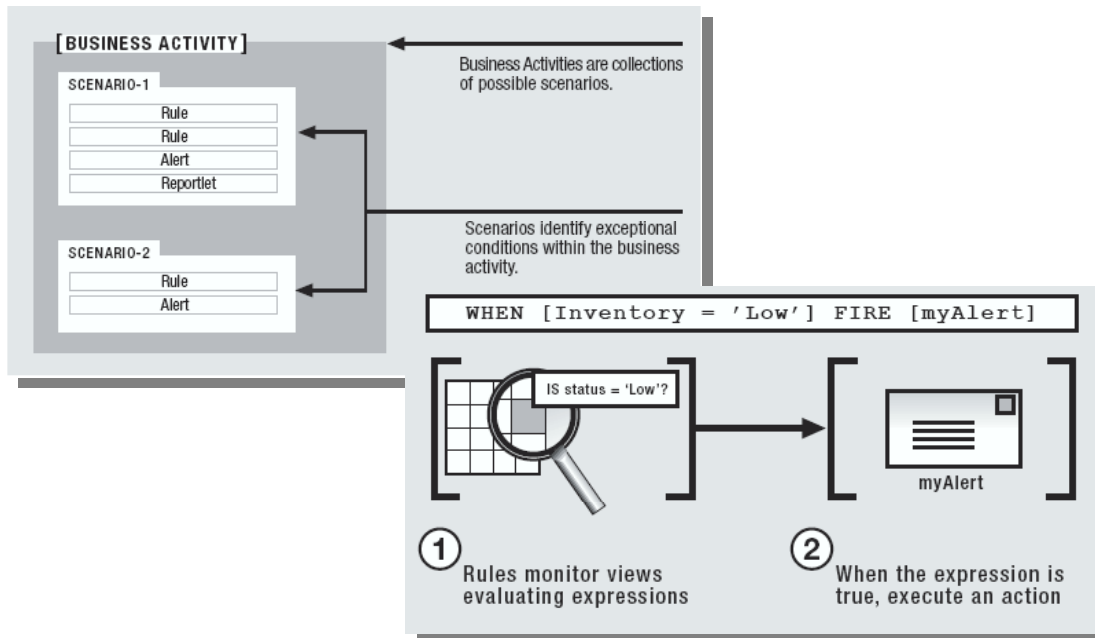


Figure 12. Business analysts can define BAM rules and alerts. Source: Celequest

10.2 BAM Dashboards

Business view data can be presented to process owners graphically in browser-based LiveCycle BAM Dashboards (Figure 13). Multiple charts and graphs can be displayed along with a zoomable process view. Dashboard users can drill down from high-level key performance indicators to a specific instance to see the metrics for that instance alone and identify its participants. End users can customize the chart display, and each chart or metric can be assigned security attributes so that only certain users are able to see them.

LiveCycle provides 16 dashboards out-of-the-box for monitoring such metrics as real-time process status, historical cycle times, workforce utilization, and system activities. Dashboards present performance data through multiple chart types, including pie charts, bar charts and gauges, with point-click drilldown. When a process designer deploys a workflow, the metrics are automatically generated. The schemas of the prebuilt metrics support OLAP-style customization of categories and dimensions (Figure 14), allowing users to slice, dice, and display the data in various ways.

Within the dashboards, a user can define thresholds and alerts triggered when those limits are reached. For example, when the cycle time for a workflow exceeds the threshold, the dashboard can send an email or make a web service call. Users can also trigger processes directly from the dashboard. For example, when a bottleneck is identified, a user-initiated process can be run to determine the root cause.

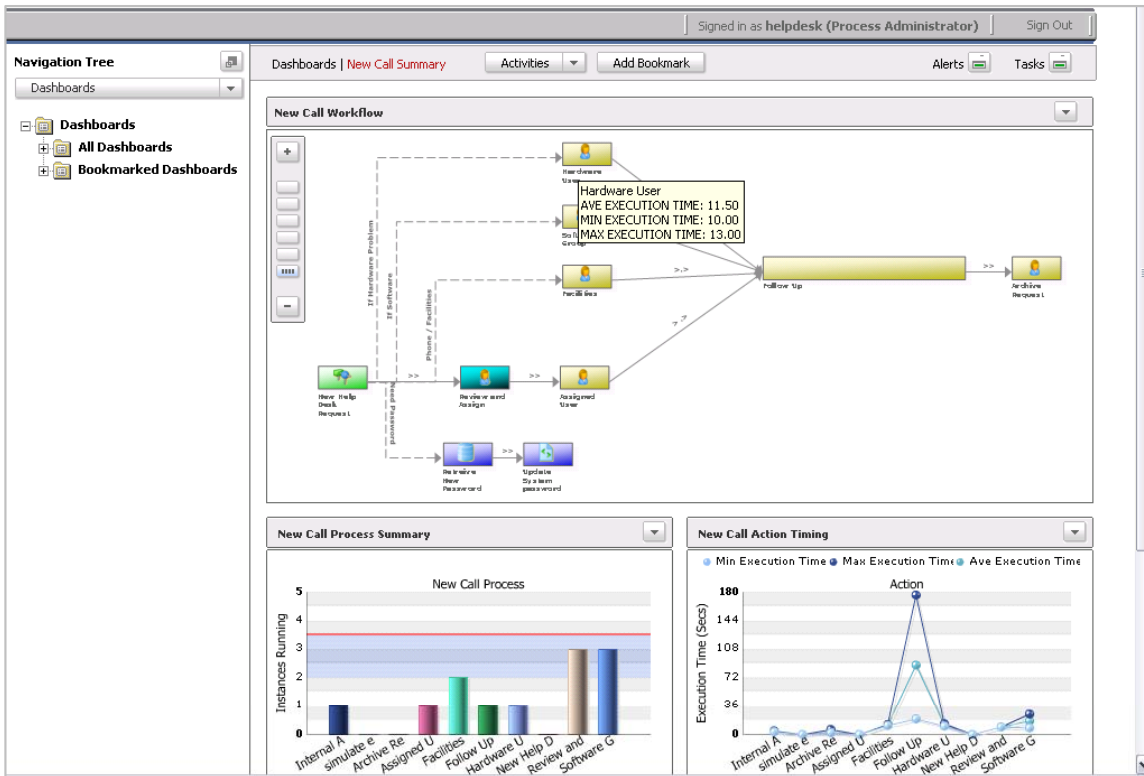


Figure 13. BAM Dashboards combine drilldown metrics, alerts, and zoomable process views.
 Source: Adobe

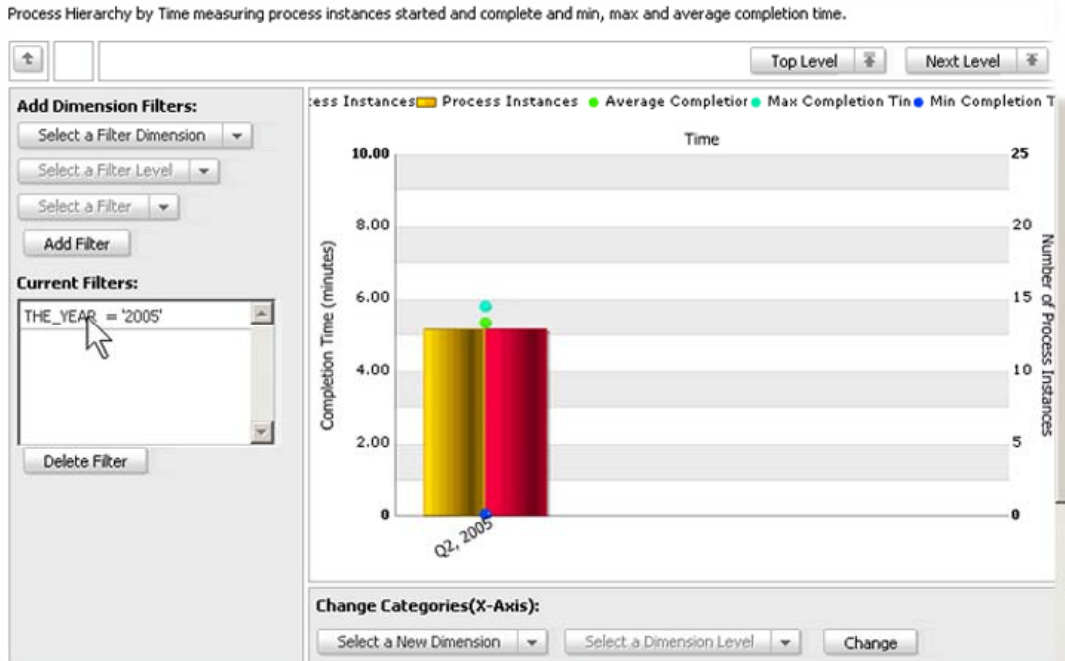


Figure 14. Filters and categories allow the metrics to be customized. Source: Adobe

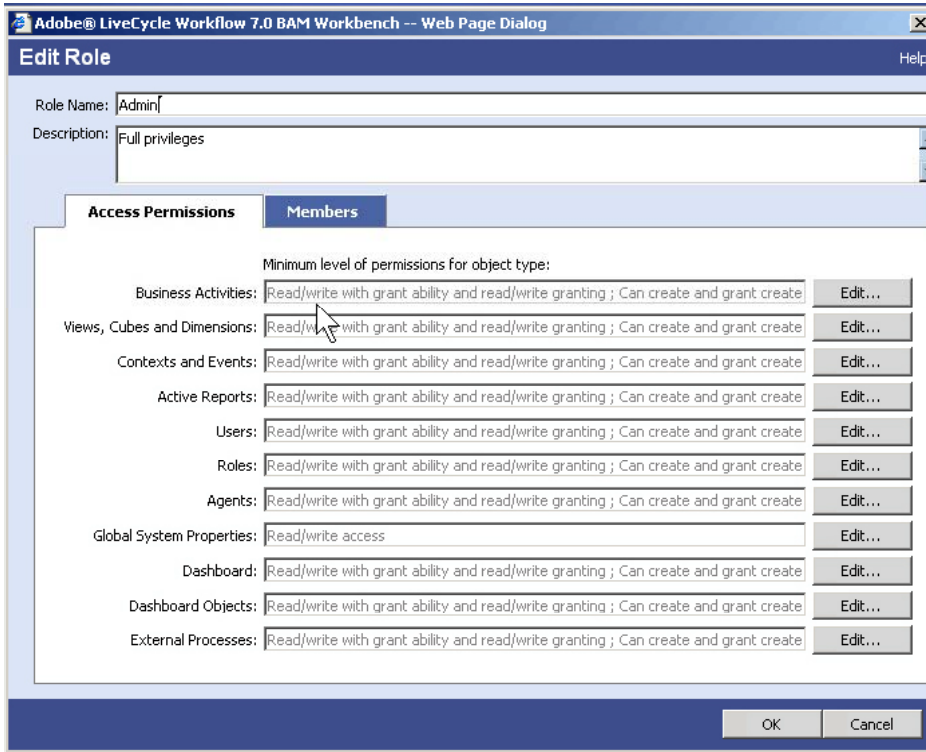


Figure 15. LiveCycle BAM Workbench. Source: Adobe

10.3 BAM Workbench

Adobe LiveCycle Workflow includes a BAM Workbench (Figure 15) that allows SQL developers to define custom dashboards, including complex metrics that correlate data from multiple systems. For example, a dashboard can be created for a supply chain process that tracks inventory

in one database, customer information in another, and correlates that information with a purchase order process.

11. Industry Solutions and Services

Adobe does not offer packaged industry solutions directly based on LiveCycle Workflow, but in general provides vertical market solutions through a partner channel, including Accenture, BearingPoint, IBM, Satyam Computer Services, Tata Consultancy Services, Wipro, and others. Adobe has an Enterprise Developer program, which provides members with content, tools, a monthly newsletter, and software to help them develop solutions based on Adobe LiveCycle software. A one-year subscription entitles members to developer licenses of Adobe enterprise software, including Adobe LiveCycle, as well as developer support via email.

As an established enterprise supplier, Adobe provides global 24x7 support for customers. Adobe has also partnered with some of the largest software and services companies in the world including SAP, IBM and EMC Documentum.

12. Analysis

12.1 Overall Assessment

Adobe LiveCycle Workflow has unique capabilities that allow it to address what other BPMS vendors might call “special segments” of the BPM universe, but which represent problems faced by a large number of companies today. These include the gradual migration from paper-driven to all-electronic processes and recordkeeping and the need for processes to jump back and forth between printable documents and XML data. They also include the need to extend process participation to tens of thousands of customers and partners across the firewall and allow them to work offline, without sacrificing security or overall process monitoring and automation.

Rather than concentrate all process intelligence in a centralized web application, Adobe embeds it in the documents and forms themselves, a key feature of the PDF format and the guiding principle of the LiveCycle program. A document or form is both a data container and a printable/signable transaction record. It also can carry security and specific access rights, also embedded within the document itself. With the intelligence baked into the document rather than the web server, users can work offline and reconnect later to the business process. Other electronic forms technologies, such as Microsoft Infopath, can make many of the same claims, but to date none has achieved the ubiquity of Adobe’s PDF.

Of course, the ubiquitous free version of Adobe Acrobat Reader does not enable much of this document intelligence automatically. It must be first “unlocked” by server-based Reader Extensions, and LiveCycle Workflow has QPACs that do this. It also has QPACs to convert XML data into PDF and back again, barcode it so the information can be recovered from a scanned image of the document, assign security and digital rights to the document, etc. Other BPMSs don’t have this. Also, while other BPMSs can use Adobe’s PDF forms within their own workflows, they do not have access to the advanced LiveCycle forms technology.

These unique capabilities describe Adobe’s sweet spot in the BPMS landscape. Certainly the clearest fit is for what we call basic workflow, largely defined by forms routing. In addition to the richness of the forms themselves, LiveCycle Workflow has gone to great lengths to bring process design and maintenance to non-programmers, while providing IT a modern service-oriented architecture and the power of J2EE.

A second fit is in content lifecycle processes, characterized by creation, revision, approval, and distribution of documents. Again, the strength is PDF’s embedded intelligence combined with workflow automation. Reviewer comments and approvals can be added to the document, and security and digital rights can be attached to the published result. LiveCycle Workflow provides QPACs that connect the process to a relational database or ECM repository, but Adobe does not provide a tech doc or publishing solution out of the box. These seem like good opportunities for the company’s many solution partners.

Similarly, LiveCycle Workflow is one of the few BPMSs that can address complex collaborative processes, again leveraging the intelligence embedded in documents themselves. Document markup and sharing, deadline tracking, ad hoc routing, and other collaborative capabilities are available, but through a sort of “serial” collaboration rather than the shared online experience found in web-based team rooms.

Adobe describes case management as one of its sweet spot use cases, particularly in government. While intelligent PDF forms have an obvious role in case management, and Adobe Form Server is integrated with IBM and Documentum content repositories, it appears that the dynamic case

folder and associated process semantics described in this report for this use case would have to be added on top of LiveCycle Workflow's native capabilities.

12.2 Use Case Fit

12.2.1 Basic Workflow

Fit: ● ● ● ● ●

Checklist:

- ***Rich forms user interface.*** Adobe is the leader in intelligent electronic forms, and enables them with digital signatures, rights management, tamper-proof certification, and other advanced features. Unlike competing offerings, LiveCycle Workflow can unlock this intelligence in the ubiquitous free Reader via Reader Extensions.
- ***Process design and maintenance by non-programmers.*** QPACs let even business analysts configure and orchestrate service-oriented components. Many processes can be built just with the out-of-the-box QPACs Adobe provides; building custom ones requires Java programming.
- ***Easy to deploy and maintain.*** Again, QPACs and business rule support make solutions relatively easy to maintain.

12.2.2 Content Lifecycle

Fit: ● ● ● ●

Checklist:

- ***Support for document attachments and viewers.*** The native out-of-the-box document format supported is PDF or LiveCycle forms, but processes can integrate with source document formats and viewers. The essence of the document lifecycle support is really the embedded intelligence in PDF.
- ***Support for content management library services: check-in/check-out, versioning, metadata search.*** This is not out-of-the-box, but achieved through integration with content repository.
- ***Support for scalable ECM repositories.*** Again, via integration, using custom QPACs.

12.2.3 Complex Collaborative

Fit: ● ● ● ●

Checklist:

- ***Support for collaborative document review and discussion.*** Searchable reviewer comments and markup supported in PDF.
- ***Support for unstructured/ad hoc flow and offline work.*** This is an Adobe strength. Because intelligence is embedded in documents and not strictly centralized, routing

can be email or even paper mail, and work performed offline or on paper, without sacrificing process integrity.

- **Integration of online team rooms.** Nothing along that line.

12.2.4 Case Management

Fit: ● ● ● ●

Checklist:

- **Electronic case folder of independent work objects.** Adobe does not provide explicit support, but a form could act as a container of independent work objects.
- **Ability to add case objects and flows at runtime.** Again, since forms can be dynamic, a form referencing case objects could add new ones at runtime.
- **Content management integration.** Adobe Form Server is integrated with IBM DB2 Content Manager and Documentum repositories.

12.2.5 Production Workflow

Fit: ● ●

Checklist:

- **Support for shared queues and rule-driven task assignment.** Yes.
- **Performance optimization through simulation, analytics, and real-time escalation.** Simulation, execution real-time escalation, and analytics are all provided, but in three different environments: Simulation uses iGrafx models, escalation the LiveCycle Workflow step properties, and analytics the integration between LiveCycle events and Celequest-based business view model – so the optimization cycle is complete but possibly not “seamless.” On the other hand, the BAM Dashboards do provide drilldown reports of user- and group-based task performance.
- **Business rules.** Yes. LiveCycle Workflow integrates with third party Corticon and ILOG engines, although rule environment and data model is external to LiveCycle.
- **High-performance document retrieval/parsing.** Server-based technology exists for retrieval, parsing, and rendering of XML documents. While LiveCycle has no native support for high-speed image retrieval, it does provide for conversion of scanned images of barcoded forms to XML data that can be used in a business process.

12.2.6 Transactional/STP

Fit: ● ●

Checklist:

- **Rich integration infrastructure, including adapters and enterprise service bus.** Adobe supports both native technology adapters and a complete set of NetManage

Librados JCA adapters, all configurable easily via QPACs. Adobe supports JMS but does not provide its own ESB.

- ***Complex business objects, data transformation, and business rules.*** Process data model oriented to simple form fields rather than complex data objects, and transformation mapping is limited to XPATH expressions (or Java). QPACs support Corticon and ILOG rule engines, although the rule definition environment is external to LiveCycle.
- ***Comprehensive event management and automated exception-handling.*** LiveCycle can listen for business events via JMS or email, but has no comprehensive event framework. Most exception handling is via manual administrator action.
- ***Industry solution templates with prebuilt objects, transformations, adapters, protocols, performance metrics and reports corresponding to industry standards and best practices.*** No.

12.3 Process Lifecycle Fit

Business users can import Visio into iGrafx and export BPMN models directly to the LiveCycle Workflow Designer. From there, LiveCycle Workflow provides most of the elements needed for basic workflow as out-of-the-box QPACs that can be configured easily by non-programmers. Custom QPACs, if needed, are created by Java programmers using Adobe's Eclipse plug-in, and become reusable easily-configured components in the Designer palette. The net result is a process lifecycle well suited to organizations with many processes but scarce Java programming resources.