The 2010 BPM Suites Report on Singularity’s Singularity Process Platform

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1. Product Overview

The Singularity Process Platform™ (SPP) is an enterprise-scale Business Process Management system that supports the entire lifecycle of business process management, from initial modeling, through execution, monitoring, and optimization.

Singularity is focused on enabling companies to become more agile, by developing and delivering comprehensive BPM solutions that handle the full spectrum of business process types. While Singularity’s product supports those easily standardized business processes that can be fully designed before they are executed (such as standard accounts payable processes), it is distinctive in its sophisticated support for highly variable processes. These processes, variously called dynamic, unstructured or emergent processes, cannot be designed fully before they are executed. They are typically long-lived collaborative processes that require coordination of knowledge, content, correspondence, and resources to achieve an objective or goal. The path if execution cannot be pre-defined. Human judgment is required in determining how to proceed and the state of the process can be affected by external events. The process’s design emerges as time passes and these processes must therefore remain adaptable throughout their lifespan. Examples include Case Management processes (such as Freedom of Information requests in the Government sector or Claims Adjudication in the Insurance sector) and New Product Development processes (which involve highly collaborative and unpredictable work).

Case Management is widely regarded as one of the most difficult areas for organizations to address and is characterized by a list of demanding requirements and high degree of flexibility, which many competing BPM Suites and other technologies in the market find difficult to address. Key challenges to case management solutions include: being goal driven; supporting knowledge-intensive processes; highly variable processing paths; long-running case durations; complex information and documentation requirements; highly collaborative environments; multiple human participants in fluid and evolving roles; interlinked and interrelated cases; juggling fixed and variable timescales; susceptibility to external/out-of-band events; cross organizational visibility/interaction requirements; demanding security requirements; and, coordinating isolated pockets of automation.

In terms of functionality, this mandates the ability for separate workflows to be created and deployed (case fragments) during the lifetime of a case (often instigated and selected by key Knowledge Workers dealing with the case), case modeling, case relationships and predictive analysis on cases.

In addition to its BPMS software, Singularity’s total solution portfolio includes a range of “knowledge transfer services” designed to enable its clients to become self-sufficient in BPM. The company’s agile implementation methodology, known as ASAP, draws on SCRUM and other methods to support rapid, iterative business process improvement. Other services help ensure that new business processes are readily adopted and deployed within an organization, utilizing SPP as the delivery platform.

Singularity also differentiates itself through its focus on high speed process modeling, the product’s ease of integration, rapid process deployment, and accelerated ROI. Singularity has also sought to
reduce the time needed to deploy new processes through more effective screen design, report design, system integration, and data integration capabilities.

Designed to provide an optimal solution for the Microsoft environment, the SPP exploits .NET, COM+ technology along with open standards such as BPMN, Web Services, and LDAP. The product integrates and builds on the broader Microsoft product range, including Microsoft Office, SharePoint, Dynamics/CRM, SQL Server, Office Communication Server, Visual Studio, Outlook, Visio, etc.

Singularity has adopted a Service Oriented Architecture for the product – one that they refer to as their Services Everywhere Architecture. In SPP, all components behave as a service, i.e. each subcomponent of the Platform can be called as a service by a third-party component (call-in). Every service can call other services, i.e. each SPP component can extend, alter, or substitute its service fulfillment by calling other services (call-out). Each service can modify its behavior by calling other services within the platform (self-call). Service orchestrations are themselves services – SPP orchestrates the sequencing of service provision into processes. All processes are available as services, and any service can be fulfilled by calling a process. This approach ensures support for the formal design goals of the Platform. These include the provision of an environment that is open, stateless, interoperable, multi-channel, multi-lingual, fault tolerant, and scalable.

The process modeling environment supports easy-to-use, point-and-click integration to external systems, with automated support for call outs to Web Services, and an intuitive data access wizard to guide business users through data integration steps. Work routing capabilities include fine-grained control navigating up or down organization hierarchies based on resource utilization, staff availability, skill set, or priority. The incorporated simulation environment can utilize live and historical data, and different versions of processes, simulated in parallel to compare relative costs and efficiencies, with output to Excel and other applications for subsequent analysis.

The Platform provides comprehensive Business Activity Monitoring (BAM) that employs an “Event Manager” to gather Key Performance Indicator (KPI) measurements during execution, and then display this information in user-configurable dashboards. Further, in line with Singularity’s focus on facilitating business ownership of business processes, a Forms builder tool enables business users to design the work queue and other process entry and display forms, using simple drag-and-drop techniques. The Forms tool exposes process related controls and data items, simplifying screen design, and, as a result, reducing deployment times. The product also provides sophisticated version control and release management capabilities. A process catalogue enables the sharing and re-use of pre-designed processes, significantly improving efficiency and facilitating the distribution and adoption of best-practice across an organization.

Key functionality that has been added since the previous BPTrends report on SPP, includes:

- Case Management for the Microsoft Enterprise, offering out-of-the-box integration to SharePoint (including integration to SharePointLive) and Dynamics/CRM.
- Business Rules: integrated business rules management
- SaaS-enablement: to support BPM-as-SaaS and also to support the delivery by 3rd parties of SaaS-based business applications on a BPMS platform
- Data Entity Management: to support storage of detailed data entity definitions (e.g. all the data you require in an “Insurance Claim”) and instances of those data entities (e.g. all the details of the particular insurance claim “Jim Smith Claim #2”). This drives further toward a zero-code BPM environment.
- Report Builder: to support drag & drop specification of reports drawn from our process intelligence database and also including business data drawn a database of our clients business information
- HP/TRIM Integration: built-in map node in the design environment to enable rapid integration with HP’s TRIM eDRMS
- Graphical organization modeling: integrated to existing resource management features

2. BPM Engine

The Singularity Process Platform (SPP) is a suite of stateless Enterprise Service components. From its conception, the Singularity Process Platform embraced the principles of Service Oriented Architecture in recognition that high performance systems can only be suited for purpose if they are also highly componentised.

<table>
<thead>
<tr>
<th>Core Functions</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Design, &amp; Analysis</td>
<td>Business Process &amp; Case Modeling</td>
</tr>
<tr>
<td></td>
<td>Forms Design &amp; Generation</td>
</tr>
<tr>
<td></td>
<td>Walkthrough &amp; Simulation</td>
</tr>
<tr>
<td></td>
<td>Resource Management and Organization Modeling</td>
</tr>
<tr>
<td></td>
<td>Performance Management</td>
</tr>
<tr>
<td>Process Execution</td>
<td>Business Process Automation</td>
</tr>
<tr>
<td></td>
<td>Workflow (Human to Human and Human to System)</td>
</tr>
<tr>
<td></td>
<td>Real-time System to System integration</td>
</tr>
<tr>
<td></td>
<td>Event Management</td>
</tr>
<tr>
<td></td>
<td>Exception and Escalation Management (aka Compensating Transactions)</td>
</tr>
<tr>
<td></td>
<td>Case Management</td>
</tr>
<tr>
<td></td>
<td>Real-time Data integration</td>
</tr>
<tr>
<td>Process Monitoring</td>
<td>Business Activity Monitoring</td>
</tr>
<tr>
<td></td>
<td>Real-time dash boarding</td>
</tr>
<tr>
<td></td>
<td>Reporting</td>
</tr>
<tr>
<td></td>
<td>Alerting</td>
</tr>
<tr>
<td></td>
<td>Analytics</td>
</tr>
<tr>
<td>Dynamic Process Optimization</td>
<td>Load balancing</td>
</tr>
<tr>
<td></td>
<td>Dynamic Process Invocation</td>
</tr>
<tr>
<td></td>
<td>Dynamic Resetting of Process Milestones, Resources, etc</td>
</tr>
<tr>
<td></td>
<td>Real-time Performance Improvement</td>
</tr>
</tbody>
</table>

**Process Design and Analysis** (Builder), enables graphical construction of process flows and case fragments. There is comprehensive support for sub-processes, links to external databases, web components and integration into enterprise collaboration tools, including Microsoft SharePoint and HP Trim. A comprehensive simulation environment is included, which enables both full-simulation and individual process “walkthroughs” for fast turn-around modeling during development.

**Process Execution** (Driver) is a robust and scalable process execution engine. Processes are executed according to the business logic, rules, policies, and resource profiles specified in the map created using Process Design & Analysis. It guides process execution toward completion, orchestrating the combination of system and human activities. Reflecting the dynamic environment in which organizations operate, SPP can react at runtime to changes in throughput, capacity, workload, and utilization to modify its scheduling and routing of workload and process tasks. As exceptions occur, it can launch new processes to rectify the cause of the problem (without manual intervention).

**Process Monitoring** (Monitor) enables the easy reporting and visualization of a process or complex case model, enabling the user, manager or business analyst to measure the performance of a system, check for errors and produce meaningful metrics on which to take decisions. Time-periods and milestones can be defined at design time, and process designers can also set monitoring points at any stage. Performance and event data is gathered at run time and related business data is also captured.
and can be subsequently analyzed, enabling key performance data to be available for real-time reporting. The browser-based monitoring solution provides comprehensive Business Activity Monitoring (BAM) functionality. It includes a configurable dashboard and a set of user-definable reports to display real-time and historical performance metrics.

**Dynamic Process Optimization** (Optimizer) enables execution-time improvement and self-optimization of business processes. It provides the ability to execute a process differently, or even execute a different process, depending on circumstances, such as during periods of increased demand. It also utilizes performance data captured by the event-driven architecture of SPP, to determine the current state of the system and can instigate changes to running processes in real-time in response.

Technically, the Singularity Process Platform has a modular, n-tier multi-threaded architecture. Each component implements a separate service, encapsulating a distinct aspect of the functionality. SPP comprises a set of stateless components, with all operational data and business relevant data managed within an enterprise database or multiple databases.

SPP communicates with external systems through standardised protocols such as .NET, SOAP etc. These external systems can include legacy applications, third party Web Services or other instances of the Singularity Process Platform.

- The Process Platform’s Builder is implemented as a .NET UI configurable via Web Services or Enterprise Proxy to facilitate server communication
- The Process Platform’s Driver is implemented through a series of stateless Enterprise Service components hosted within Component Services. Enterprise Services provide common services such as transactional integrity, load-balancing, data access etc.
- The Process Platform’s Monitor is implemented as a service. The Monitor polls for information at discrete intervals, then raises events through the Event Manager and writing to a database. The Monitor can run on a separate platform to the Driver.
- The Process Platform’s Optimizer is implemented through a combination of Enterprise Service components. Optimizer must run on the same platform as the Driver.

Figure 1 illustrates a typical solution architecture in which the Singularity Process Platform interacts with other system components.
3. Platforms

Singularity is a Microsoft Gold Certified Partner and is focused on providing best-in-class BPM and Case Management solutions utilizing Microsoft technology. SPP supports the Windows Server 2000 and 2003 and 2008 platforms. Design time client components that are not browser-based support all recent desktop versions of Microsoft operating systems, Windows 7, Vista, and XP. All other client components deploy on any platform that supports standard internet browsers. SPP supports Microsoft SQL-Server and Oracle databases out-of-the-box, but can be modified to run with other database products if required.

Singularity offer a SaaS solution for SPP deployment, *SPP on Demand*, for those companies who seek to move to a model of using a hosted application rather than installing large scale applications on their premises. Companies are investigating this model as an option that can deliver low initial set costs, simpler deployment across the enterprise, easier accessibility (especially to field based personnel and home workers), a reduction in hardware requirements and reduced I.T staffing requirements.

At the heart of the SaaS on-demand model is a multi-tenant architecture, in which all users and applications share a single, common infrastructure and code base that is centrally maintained.

SPP Version 4.0 onwards has been architected to support such a ‘multi-tenant’ model, where a single instance of the Singularity Process Platform runs on a secure dedicated host server, serving multiple client organizations (tenants).
3.1 User Interface

Singularity provide a web application per tenant which hosts all existing SPP web services, the admin suite, the WorkSpace and any deployed SPP forms based solutions. This web application runs under the identity of a specific user i.e. each tenant has their own identity generated on a per tenant basis and run its own application pool to ensure isolation and security. In effect, each tenant has their own instance of the key SPP services and connection strings to their own databases.

With zero maintenance, end user support and administration costs coupled with comparatively low implementation and customization costs, the SPP on Demand service offers a better TCO (Total Cost of Ownership) to some customers, than traditional deployment offerings.

In addition, Singularity has released a full SaaS solution, based on SPP core technology, called LiveAgility, which is specifically designed to meets the needs of SMEs and other organizations (clubs, charities etc.) by providing access to the significant benefits a BPM solution can deliver, without having to commit to the up-front and ongoing costs of installing and maintaining a complete system in-house. Built with a front-end that utilizes Microsoft Silverlight technology, LiveAgility provides an engaging user experience, providing an easy-to-use, complete end-to-end BPM modeling and execution environment, with rich Internet Application interface, that displays high-quality 3-dimensional rendering, coupled with an innovative ‘carrousel’ based interaction model that enables simpler management of multiple tasks and real-time monitoring of process performance.
2.2 Scalability

The componentized architecture of the Singularity Process Platform (SPP) is such that systems incorporating SPP can easily scale using standard load balancing technologies. These technologies include WLBS, NLB, App Server and other load balancing hardware and software.

The number of servers required for a given implementation will be determined by the scaling requirement of the organization and its processes. If a single-server SPP configuration is insufficient, then one or more farms of servers can be configured to ensure high performance in heavy load environments.

SPP allows each process engine request to be serviced by any node in the farm which the load balancing software/hardware picks. State is maintained in a relational database, which can be further scaled e.g. by using an ‘active-passive’ application setup in MSCS to support the heaviest of loads.

Figure 4 shows a simple multi-server setup in which client requests are routed to the least busy SPP server by the load-balancing component. The load-balancing component may be a piece of hardware or Microsoft’s NLB technology. By use of load sharing across the SPP nodes the overall system is able to scale, with more nodes being utilized or added to the farm to handle the highest of loads when necessary.

The stateless nature of SPP is one of its particular architectural strengths, providing powerful capabilities in scalability, availability, resiliency and disaster recovery. Since state is stored in databases, external to the process engine itself, the performance of the overall system of which SPP is a component is influenced by the specification and configuration of the database servers chosen. As more SPP nodes are added to achieve higher performance, it is straightforward to scale the specification of the database servers to handle the higher load that the SPP processing engine will be placing on them.
The core components and architecture of SPP make a wide variety of configurations available. In order to choose the most suitable configuration of all system components, Singularity works with its clients to achieve the appropriate balance of performance, availability and redundancy needed.

1.3 User Interface

There are two sets of client User Interface elements

(1) those used by process designers and business analysts at design time, and
(2) those used by process participants (workers) at runtime. (Workers only need an Internet browser).

During process execution, users interact with business processes via browser-based work queues, or browser-based portlets (e.g. web-parts in Microsoft’s SharePoint). SPP fully integrates into Microsoft Office, so users can also interact with processes via Microsoft Outlook and other Office applications. The Business Activity Monitor (BAM) also utilizes a browser-based interface for monitoring the operational performance of processes, including a user-configurable dashboard, and textual and graphical reports which utilize Microsoft Silverlight technology, for an enhanced user-experience.

At design time, process designers use a client-rich, graphical modeling tool within SPP that also supports multi-user access. Screen designers use the Forms Generator component, which is a Windows client for forms design. Once satisfied with screen layout, clicking on the “deploy” button automatically generates web forms. SPP can also deliver information to users or applications, using
Web Services, COM+, and .NET Enterprise Services across multiple channels, including SMS, email, and Instant Messaging.

Figure 5. The primary user interface is via browser-based access work queues

3.2 Scalability

SPP has a modular, stateless, multi-threaded architecture that allows for additional processing components to be added as demand increases, and fully exploits the capabilities of Microsoft’s .NET environment to support clustering, scalability, failover, and load balancing. Requests from the application to the database layer are mediated by server-clustering technology to distribute accesses to the database servers. The database servers can operate in either active-active mode or active-passive mode.

It is possible to have a number of execution engines deployed on multiple machines. Load balancing is handled either by hardware or Microsoft .NET Network Load Balancers (NLB) that pass the work to an available execution unit. Microsoft Transaction Server (MTS) enforces transaction commit and rollback at the activity node within a process map.

SPP also supports the capability to set up a “Thread Pool” that can then be given priority over other work on the server. At design time, processes or specific steps are assigned to the Thread Pool, providing the ability to ensure performance for specific parts of the process, while other, less important phases of the process execute more slowly.

Since SPP is a stateless system, the state for each process step is stored in and retrieved from a database. This increases the system’s availability and reliability — if a state was stored at the SPP server, when one server failed it would disrupt the processes of all connected clients. Instead,
because SPP stores state at the database, if an SPP component fails, the load balancer redirects the clients to the next available server, which picks up the state from the database layer.

4. Processing Modeling

SPP's Process Design and Analysis functionality provides a visual modeling environment for process designers and business analysts. It can also import previously created process maps from Microsoft Visio and other modeling tools. The modeling environment supports multi-user access and integrated process version and change control, and has BPMN capabilities.

![SPP process-modeling environment](image)

**Figure 6. The SPP process-modeling environment**

To create a process map, the designer opens a blank map, clicks on a palette to select an activity, and then drops this onto a node on their map. An activity is an individual step (service) that forms part of the business process, e.g., to get customer details. An activity in a process map can have various uses: a call to an automated script; a form to invoke; a call to a third party application; a request to a mail server to generate an e-mail; etc. The designer selects the type of activity that a node represents (a manual task, a web service, a scripted activity, an XML activity, a COM+ activity, etc.), and links it to others using a drag and click technique.

The designer specifies the resources (human and system) required for each activity node. This information supports the routing of the process instance based on factors such as cost, utilization, resource availability, staff-skill set, or priority of the case in progress. The product also supports sophisticated routing needs via an Advanced Workflow Rules capability. For example, this feature might be used where three out of a possible group of four are expected to review a document (either sequentially or in parallel); members of a group must be specifically excluded; or the instigator of a process instance must be excluded from an approval task; etc.

To facilitate high-speed process formation and modeling, Singularity has added shape and handwriting recognition and electronic-whiteboard support to its environment. This enables business
analysts to sketch and annotate processes in freehand during workshops, either on screen or on a whiteboard. The sketch is interpreted in real-time and converted to a BPMN process model, without any requirement to further document the model.

Using an integrated “Web Services Tool,” designers can seek web services on the web and then subsequently register these within the SPP environment. The expected parameters for the service are automatically identified from the WSDL description of the service. Using this tool, designers build up a catalogue of web services, which then become available for use when designing new process maps.

SPP also includes comprehensive XML support through an XML parser (part of the standard XML node). As a result, the system can manipulate XML documents directly without the need for third party components. For example, the system can identify the City from the XML address information returned in an online Zip code locator. Similarly, the process design tool includes a Data Access Wizard that enables designers to specify a query to a database and include it in their process maps without requiring technical expertise or writing any code.

Configured activities (and process maps) that are particularly useful can be stored in SPP’s library for re-use in other process maps, aiding reuse of valuable intellectual property throughout the enterprise. Designers can drag-and-drop maps and activities from the library into their current maps. The process models themselves are stored in a proprietary XML-based format (which may be changed with relative ease to another structure if required).

4.1 Subprocesses

The Process Design and Analysis modeling environment provides a number of standard mechanisms to leverage sub-process concepts. Sub-processes are embedded at design time, or dynamically identified and called at runtime. The platform supports both synchronous and asynchronous (fire and forget) calling of sub-processes.

“Nested” process maps are inserted as a single node into another map and are usually employed when the initial process map is getting too large, or if the designer has identified a process that may be reused in other maps (as a first step toward supporting reuse). This may also apply in situations where work is carried out by another department or another company.

A “Sub Job Activity” calls a sub-process as part of the parent process and exchanges input and output variables between the parent and sub job. It also enables a number of instances of the sub job to be initiated at the same time. Advanced Workflow Rules, mentioned above, can be applied to the entire sub job.

Finally, and most powerfully, a process can be invoked at runtime – this is known as dynamic process invocation. This is the method used by the runtime Event Manager to respond to exceptional events (e.g., job time overrun), by invoking a related process to rectify the exception, depending on the particular circumstances. The exception processes are defined at design time, but the selection of the appropriate exception process to be adopted is made at runtime.

In addition, SPP processes may be published as Web Services and, therefore, can be called by other processes, enabling even greater system design flexibility.

4.2 Shared Data Space

Using the design tools, designers define local and global process variables. The scope of the variable can be limited to the current process, to the current and to all child processes, or to the entire process space. These variables can include the declaration of arrays and complex variables. Designers create variables one at a time, which may then be associated with elements of an introspected web
service. To facilitate cataloguing and library storage of potentially reusable process components, process maps and variables can be allocated a “Category,” which is used to store and retrieve associated reusable components in the Singularity process library.

In addition, SPP supports storage of detailed data entity definitions (e.g. all the data you require in an “Insurance Claim”) and instances of those data entities (e.g. all the details of the particular insurance claim “Jim Smith Claim #2”). These entities are business data objects that can be identified by a unique identifier, e.g. Employee, Customer, Product, etc. Entities enable users to encapsulate all the data for a business object in one container within SPP.

For example, an Employee entity is uniquely identified by an Employee ID, however, within this entity much more information regarding the employee can be stored, such as name, address, telephone numbers, salary details, account number, etc.

Users can define entity definitions (templates), utilize entities as input data to processes and then store output data from processes.

The Entity Management functionality enables much more flexibility in managing data. It reduces the requirement for a 3rd party databases, thus reducing the technical expertise required significantly.

4.3 Forms

SPP provides a Forms sub-component as part of the design time modeling environment. The Forms designer is a wizard-driven tool that gives designers the ability to quickly and easily create and deploy customizable screens, without requiring technical expertise or software coding. It provides an automatic generation facility, as well as the ability to customize forms. Further customization is possible in Microsoft Visual Studio with all the relevant interoperability and code automatically generated.

![Forms generator](image)

Figure 7. Forms generator

The Forms designer is tightly integrated to the underlying process maps, and it can automatically pre-populate web screens with fields and process variables associated with the process being modeled.
The Forms designer eliminates the requirement to manually create these fields on the screen design and link the fields to instance variables and database fields. A Business Analyst can generate a process solution with multiple work queue pages, new process instance pages and all corresponding activity pages without resorting to code: he or she can simply select the process map and automatically generate the corresponding web pages.

It is also possible to use third party forms packages to develop process interfaces, although these do not provide the process-specific supports available in the Forms designer.

Singularity provides a number of pre-built screen templates for different applications, including a range of Case Management screens, via use of the Singularity Workspace. In addition to the Forms Designer, Singularity provides a default Process Portal framework and standard look-and-feel for process interfaces. These browser-based standard interfaces are laid out in a standardized format, made up of changeable portlets and quadrants that can be configured and personalized for specific customer requirements. If preferred, customers can use the Forms designer to generate entirely customized screens suited to their particular needs.

4.4 Time

SPP handles time at a number of different levels – during design time specification of expected performance; during runtime monitoring of performance; and in the scheduling of running processes. It can apply at the level of an individual activity or for an entire process.

![Figure 8. Setting expected duration for an activity](image)

Process Execution and Monitoring functions track the actual elapsed time so that KPIs can be assessed and milestones monitored. An Event Manager traps standard exceptions such as process duration overrun, process cost overrun, activity duration overrun, activity overdue, etc. Exceptions may initiate standard alert mechanisms (i.e., send email or SMS based notifications). Notifications delivery is itself based on a process (and therefore changeable).

SPP is especially strong in providing the full power of its BPM capability to allow users to handle exceptions in highly sophisticated ways. Exceptions may trigger processes that can be designed, executed and tracked using the full power of the SPP BPMS. For example, an exception can trigger
the initiation of customer care case and automatically link that case to the further execution of the business process which triggered the exception.

As regards the timing of running processes, SPP includes an administrative interface to control how processes execute. The system uses an internal Business Calendar for specifying working and non-working days and standard working hours. It also includes a job-scheduling tool that allows administrators to set-up processes to run at regular intervals.

### 4.5 Process Optimization and Simulation

Dynamic Process Optimization enables execution-time improvement and self-optimization of business processes. It can execute a process differently, or execute a different process, depending on circumstances – for example, during periods of increased demand. Beyond simple load balancing and optimized work routing, Dynamic Process Optimization drives dynamic modifications to execute processes at runtime, based on the current state of the system. Utilizing the performance data captured by the Event Manager to determine the current state of the system and activate changes to running processes in real-time, anything from the priorities, due dates, process routing, or even structure of the process can be dynamically modified.

Optimization can be configured to support tactical operational decisions (e.g., use a different process to get rid of a backlog today) or to identify longer-term process enhancements (this process is repeatedly running into problems under these circumstances). Examples capabilities include

- **Performance-driven Optimization** – Reconfigure any aspect of a process to ensure achievement of pre-defined performance levels (such as cost or utilization thresholds).
- **Revised Resource Allocation** – The Platform supports automatic re-assignment and delegation of work in real-time, dependent on user-defined criteria such as resource utilization, resource availability, productivity, and so on.
- **Execution-time Process Optimization** – Enables organizations to automatically add staff and/or computing power or swap in replacement processes when a threshold is reached; for example, if the backlog of customer orders reaches a user defined level. Non-urgent steps in a process can be temporarily bypassed during peak demand to ensure cases are dealt with promptly.
- **Load-driven Process Prioritization** – Automatically reallocates resources to high priority tasks and de-allocate from lower priority tasks at execution time when demand is heavy, returning to default resource allocations when demand returns to normal.

Process Design and Analysis includes a comprehensive simulation environment, which enables both full-simulation and individual process “walkthroughs” for fast turn-around modeling during development. (See figure 9). The walkthrough facility enables users to analyze a path through the process and quickly determine ahead of deployment, if its flow, cost and duration are in line with business objectives. The estimated running time and cost of the chosen path is displayed in a dynamic bar chart, so the analyst can visually see if the process map will achieve SLAs (or target costs and timings).

The simulator is a “wizard-driven” simulation and analysis environment that allows testing and “what-if?” scenario analysis.
Figure 9. Walkthrough Simulation for quick simulation in SPP

Process Designers can simulate the workload of a process by upper-configuring information on expected process throughput, resource costs, resource availability impact, and so on. Simulator returns the test results showing idle resources, etc. simulator facilitates testing of exception handling and escalation processes, checking for adherence to Service Level Agreements (SLAs). It can use both live and historical data when running process simulations. The output data can then be displayed, using Microsoft Excel, other Office products, or more sophisticated analytical tools.

Figure 10. Simulation runs are available for further analysis in Excel and other products.
It is also possible to view and analyze process maps, using “Swimlanes” to organize and group process by Cost, Duration, Resource and Resource Notes. Swimlanes, and other layout views offered within SPP, enable the designer to quickly assess and comprehend those process nodes that are critical with respect to cost, duration and resource allocation.

![Swimlane view to assess process costs](image)

**Figure 11. Using a Swimlane view to assess process costs**

### 5. Business Rules

Singularity provides a number of mechanisms to support business rules. The platform features a fully integrated rules engine. Rules can be defined as logical rules or flow rules that are stored at a server level and can be reused across multiple processes.

A logical expression editor is included to define business rules at decision nodes within the process. The defined business rule executes using the variables of the process instance.

In addition, designers can set a Transactional flag for Activities (or sub-processes). This enables application roll-back in case of failure, effectively creating a two-phase commit capability in the database.

The Flow Rule construct in SPP provides a powerful ability to link rules to external inputs in real-time, so that the outcome of rules reflects instantly any changes in relevant external circumstances. For example, a flow rule could be used by a bank to set an individual customer’s home improvement loan rate based on the value of a stock-market index, where the rate would be evaluated as a result of a web-service call made while the customer was on the phone with the bank's loan representative.

Rules are also reflected through the Advanced Workflow Rules concept. This facility supports highly sophisticated routing conditions that would otherwise require complex procedural models to resolve. Examples of this sort of functionality include routing work to three out of a possible group of four expected to review a document (either sequentially or in parallel); identifying members of a group that must be specifically excluded; or where the instigator of a process instance must be excluded from an approval task, etc.
6. Integration

The primary integration mechanisms for SPP are Web Services, COM+, .NET, and scripting, using predefined modeling nodes in the process modeling environment to facilitate these types of integrations. These nodes are used to model integration to and from a process. Internally, a Process Integration Agent supports these interfaces. Out-of-the-box, SPP can integrate any system that supports any of these interfaces. Different types of activities in the process model support different types of interface. For example, a COM+ activity might integrate the published API of a third party application. Similarly, a web service activity embeds the WSDL description of the target web service that provides the required methods. Developers can build up a library of integration components and reuse them directly in process models. Similarly, a catalogue of web services interfaces can be developed.

External applications that need to call SPP services (or its processes) can use the same approach. SPP exposes all of its functionality via Web Services, .NET, and COM+. Singularity provides extensive API documentation to enable integration of SPP technology into or alongside other partner solutions.

Singularity integrates into a broad range of Microsoft’s products, including the Microsoft Office Suite. For example, Outlook can be used for sending email alerts, Excel used for displaying simulation outputs and BAM data, and document generation using Word. SPP integrates to Visio and supports the import of Visio process maps into its modeling environment. SPP also supports direct interoperations with SharePoint Server, Dynamics/CRM, BizTalk Server and Office Communication Server to support “time critical processes” that exploit presence-aware technology and enable both design time and runtime use of Instant Messaging and “presence detection,” enabling SPP to support highly integrated collaborative business processes, a capability which has been termed Social–BPM.

7. Organizational Structure

SPP supports the import of user data from Microsoft Active Directory, LDAP, or the existing Windows Domain user-group structure. Alternatively, the organizational structure is built directly
within the product. There is strict security control over who can and cannot create resources and set their security levels in the modeling environment. It is also possible to model non-human resources, enabling the routing of work to specific servers or applications.

Groups and Roles are defined, and associated with specific supervisors and line managers if required. Against individual resources, the administrator can record information such as skill level, supervisor status, security level, and cost-per-hour. This information is then available to support routing decisions and overall process cost calculations. For example, designers can specify work routing at a particular step to go to a particular group, to a staff member with a particular skill set or security profile, or even to specific individuals.

A rich set of configuration options is available to determine work routing. Depending on the process definition, the recipient might resolve to the supervisor of the person who worked on a previous step (or the individual who created the job); or, alternatively, a specific task may be delivered to all the members of a given role (sequentially or in parallel). Rules can be used to specify that if the original recipient does not complete work within a given time, it will be redirected to a second or third person for completion.

8. Process Adaptability

Singularity has developed significant process optimization capabilities in the product, including process adaptability at runtime. Anything from the priorities, due dates, resources route of the process, or even structure of process may be dynamically modified by the system. Resources can be swapped in or out, work can be routed differently, and sub-processes can be selected and modified at runtime.

At runtime, every instance of a process map has a unique identifier, as does each activity within that instance that the Singularity Process Platform's runtime engine uses for orchestration and tracking. If a process instance requires modification, it is possible to change the underlying process model, effectively releasing a new version and then automatically linking that instance to run under the modified version of the process.

Invoked sub-processes can be dynamically changed through user selection – i.e., workers can dynamically alter the current instance and all subsequent instances of that process. In addition, if a sub-process object is modified, any running process instance will by default use the latest version of the called sub-process.

This degree of flexibility is frequently essential in enterprise case management systems, and Singularity has deployed comprehensive Case Management solutions for clients worldwide. Case Management is the management of complex interactions between an individual and a company or government agency. Case Management has characteristics that require significant process adaptability, including the need to handle out-of-bounds breaks in process steps caused by external intervention; the need to manage and record large amounts of correspondence that include phone calls, email, and standard mail; the ability to link case processes to other cases; the ability to have processes dynamically invoke sub-process fragments in real-time; and so on. In terms of functionality, this mandates the ability for separate workflows to be created and deployed (case fragments) during the lifetime of a case (often instigated and selected by key Knowledge Workers dealing with the case), case modeling, case relationships and predictive analysis on cases. Singularity's commitment to providing full-function case management solutions has seen recent further enhancements to its product to maximize visibility and improve case handling, for example by the inclusion of a Case Diary, Associated Jobs tab and, importantly, the addition of features that allow the easy linking together of different cases.
The Singularity Process Platform supports dynamic process invocation, where one process is replaced by another, or a process is dynamically changed, to reflect current circumstances. The ability of SPP to enable users to dynamically invoke case fragments “in-flight,” while maintaining the overall case systems requirements and metrics is considered to be a major capability of the product. As a new fragment is invoked, it acquires the overall system requirements and settings, such as current milestones, costs and “actual verses planned” metrics etc., which allow the case fragments to be fully contextualized. While other companies support ad-hoc workflow invocation, they do so in a “fire-and-forget” way, failing to maintain the new case fragment’s context with regard to the overall system, at which point a significant degree of control is lost.

A predictive analysis capability is also available to the user, enabling SPP to spot repetitive patterns in the performance data. Together, these features support the self-optimization capability of the system, where SPP monitors the performance of the system at runtime and facilitates self-modification of running processes to enhance execution efficiency and ensure adherence to Service Level Agreements.

9. Process Lifecycle

SPP comprehensively supports the process lifecycle from modeling, simulation, deployment, optimization, modification, and distribution. The product supports version control both at design time and runtime. All design time process maps have unique identifiers, and version numbers increment during both internal design updates and when released as a complete process map. SPP implements strict access control over who can modify and update process models. The solution maintains all previous major and minor versions of a process model, and supports the deployment of both older and newer versions at the same time if desired.

Singularity provides a range of automated supports for the versioning, documentation, storage, and safe distribution of processes, reflecting our view of processes as corporate assets.

SPP includes a shared process library to support the sharing and distribution of commonly used processes. Among the capabilities provided to support “process asset management,” SPP includes an automated facility to support the safe sharing of processes by “anonymizing” or stripping out implementation specific details from the process, yet still providing a useful map.

The Singularity Process Platform can trigger an event whenever an analyst, business staffer or IT staffer saves and releases a process map on which he is working. This event can itself be configured to trigger another process, e.g. a “Process Release Management and Approval Process,” to ensure that a number of approvals have been gathered before the release of a new map can be completed. Customers can configure these release processes – for example, routing the model to the process owner before confirming formal release, thus ensuring changes are not deployed into the live environment without the proper authority. These features support the better management of a company’s process assets, ensuring policy and procedure are complied with, as well as supporting sophisticated governance of key business assets.

Singularity has a “pilot versioning” capability, allowing two versions of the same process to run simultaneously. This supports the scenario where a modified version of a business process is piloted in one department, while other employees continue to use the original.

SPP includes a Self Documentation facility that dynamically generates information about the process design. Depending on selections made by the designer, this can include general information about process map and detailed information about work queue definitions, resources, activities, and associated parameters. The output is available in Microsoft Word, HTML, or XML formats.
10. Monitoring, Measurement, and Management Information

The combination of events and process variables enables a rich set of functionality for process monitoring. Time periods for individual activities are defined during process design (Timeouts). Process designers can also set monitoring points at any step in a process, specifying the event flags raised. Performance and event data is gathered at runtime. The related business data is also captured and can be subsequently analyzed. All of these data are then available for reporting in real-time.

Browser-based monitoring provides comprehensive Business Activity Monitoring (BAM) functionality for monitoring processes and viewing performance data. It includes a configurable dashboard and a set of user-definable reports to display real-time and historic performance information.

![Example browser-based dashboard](image)

**Figure 13.** Example browser-based dashboard

Customers can configure the process monitoring functions of SPP to track a wide variety of business indicators, such as resource utilization, capacity availability, delivery cycle times, cost of execution, etc. It provides real-time performance visibility, including the throughput of systems and the productivity of process participants. This information can be used to identify process inefficiencies, performance bottlenecks, and potential solutions.

In regard to alerting and exception-handling capability, SPP can be configured to trigger alerts or entirely new processes when pre-defined thresholds are reached. The Event manager sub-component monitors for specific events (such as an activity duration overrun) and responds to them in one of two ways – by launching a process (such as a “compensating” process, to correct an error) or by completing an activity that has been in a wait state for the particular event. For example, when a backlog of customer cases reaches a specific level, or any other exception happens, the system can raise an alert or trigger a new process (to take corrective action).

The event manager functionality of the BAM component is designed to support monitoring of external third party applications and services (not just inside the BPM platform). It takes event feeds...
from external applications via Web Services, .NET, or DB triggers. This allows a holistic view of business operations across the entire organization. Indeed, the BAM component is available as an independent application from the SPP platform.

![Image of Singularity Process Platform](image.png)

Figure 14. The latest “drag and drop” interface for simpler report generation

Singularity has also added a new Report Builder to SPP to enable customers to easily create custom reports using a graphical ‘drag-and-drop’ interface. The Report Builder retrieves all process performance data and makes it readily available for analysis and action, enabling customers to access crucial business and process information as quickly and efficiently as possible.

11. Templates and Frameworks

Singularity has introduced a range of highly customized process frameworks called “Accelerators” that encapsulate domain expertise. Singularity’s Process Accelerators allow customers to achieve measurable impact by deploying improved processes in less than 90 days, using their “ASAP” agile methodology for process deployment. The Accelerators provide solutions to highly specific problems: Examples include the KYC Compliance Accelerator for Capital Markets, the Planning Application Management Accelerator for Government, and the WLR3 Accelerator for Telecommunications. Cross-industry Accelerators include Case Management, Invoice Processing, and New Account Opening. Each Accelerator is based on the core Singularity Process Platform, but is provided with additional process map definitions, pre-designed web interface screens, integration to the most important third party enterprise applications, and a range of solution-specific reports, representing the insight and experience Singularity has gained from repeatedly solving these problems for other customers. Combined with our unique high-speed ASAP delivery methodology, Singularity can provide measurable ROI to customers within 90 days or less.
12. Vendor

Singularity employs 230 staff and serves customers globally from offices in London, New York, Singapore, Ireland and India.

Singularity’s flagship Business Process Management product is the Singularity Process Platform (SPP), which was first launched in 2000 and is currently at version 4.4, with new revisions being made available on a quarterly release cycle. Singularity also provides a range of industry-specific “Process Accelerators” to the Capital Markets, Telecommunications, and Government sectors. Singularity has over 300 customers, including the majority of the world’s leading Capital Markets firms, 80% of UK local government bodies and some of the world’s largest telecommunications firms. Singularity’s partners include Microsoft, IBM and Oracle.

13. Costs

Singularity’s standard pricing model for implementation of its core BPM product is based on CPU and Server usage, the numbers of process participants, and process throughput. Standard and Enterprise level pricing schemes cater for varying levels of client commitment to SPP. Beyond small “Proof of Concept” implementations, which price in the $40,000 to $75,000 range, typical client investments are in the $100,000 to $150,000 range for initial process implementations. Maintenance is 20% annually.

LiveAgility, Singularity’s SaaS product built upon SPP technology, was developed and released in early-2010 to meet the needs of those customers, especially SMEs and smaller organizations, with limited I.T support and budget, and which prefer a low-cost subscription model. Subscription is priced at $35/€30/£25 per person per month, following an initial 30-day free trial period.
## Singularity: Singularity Process Platform, Ver. 4.4

<table>
<thead>
<tr>
<th><strong>Overview</strong></th>
<th>Microsoft-oriented BPM Suite, deploys on .NET. Service Oriented Architecture (all components are callable as services); Native Web Services support</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BPM Engine</strong></td>
<td>Set of modular components—potentially supporting multiple engines distributed across multiple nodes; Event-driven execution</td>
</tr>
<tr>
<td><strong>User Interface</strong></td>
<td>Browser-based work queue and dashboard; Microsoft SharePoint Portal</td>
</tr>
<tr>
<td><strong>Scalability</strong></td>
<td>Leverages the .NET container for transaction support, scalability, clustering, &amp; failover capabilities; Stateless, multi-threaded engine</td>
</tr>
<tr>
<td><strong>Processing Modeling</strong></td>
<td>Collaborative graphical process modeling environment; Built-in support for complex routing; Visio integration</td>
</tr>
<tr>
<td><strong>Sub-processes</strong></td>
<td>Supports embedded sub-processes &amp; independent process objects, invoked either synchronously or asynchronously; Process Library for re-use; Chaining</td>
</tr>
<tr>
<td><strong>Shared Data Space</strong></td>
<td>Local process &amp; global variables; Supports arrays; Categories; native WSDL support</td>
</tr>
<tr>
<td><strong>Forms</strong></td>
<td>Integrated Forms generator; HTML &amp; Portlet support, SharePoint Web Parts; XML forms; Custom forms supported via web services and APIs, third party forms</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>Duration, due-date, etc., at node &amp; process level; Runtime monitoring of time elapsed per activity and process; Administrative job scheduling and business calendar; Overdue alerts and escalation (triggering new processes if need be)</td>
</tr>
<tr>
<td><strong>Simulation</strong></td>
<td>Self-Optimization facility – dynamic reconfiguration, triggering alternate processes, dynamic reallocation of resources to meet performance levels; Integrated process simulator; simulate using live, historical or test data; Export to Excel</td>
</tr>
<tr>
<td><strong>Business Rules</strong></td>
<td>Built-in rules management and decision support; sophisticated routing resolution; escalation processes at using exceptions and event triggers</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>Integration through Web Services, .NET, and COM+; rich API set; Integrates directly to SharePoint, BizTalk, Live Communication Server, Visio, Office, etc</td>
</tr>
<tr>
<td><strong>Organizational Structure</strong></td>
<td>Import Active Directory, LDAP directories; Reflect human and system resources and multiple hierarchies; skill based and security-based routing</td>
</tr>
<tr>
<td><strong>Process Adaptability</strong></td>
<td>Runtime process adaptability, including dynamic changes to priorities, due dates, resource routing and actual structure of the process, as well as dynamic invocation of processes; multiple versions of processes can run simultaneously</td>
</tr>
<tr>
<td>Process Lifecycle</td>
<td>Shared process library; Process release triggers “Release approval” process; Pilot versioning; Documentation generation facility; Audit support</td>
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<tr>
<td>Monitoring &amp; Measurement</td>
<td>SPP provides user-configurable BAM facility; displays real-time and historical performance data; Event manager monitors and collects data, triggers events causing runtime engine to invoke escalation processes, etc</td>
</tr>
<tr>
<td>Templates &amp; Frameworks</td>
<td>Detailed Process Frameworks (“Accelerators”) for Capital Markets, Telecommunications (WLR3), and Government</td>
</tr>
<tr>
<td>Vendor</td>
<td>Singularity (212) 946 2685; <a href="http://www.singularitylive.com">www.singularitylive.com</a></td>
</tr>
<tr>
<td>Cost</td>
<td>Entry-level systems from $40k, typical initial projects $100k</td>
</tr>
</tbody>
</table>
Authors

Earlier versions of the BPTrends Reports were co-authored by Derek Myers and by Curt Hall. We think both of these authors for their contributions to the current version of this report.