Enabling Process Intelligence Through Process Mining & Analytics
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By Sandy Kemsley

To be successful in today’s increasingly transparent and competitive business world, organizations need to provide visibility into business processes while optimizing their use of internal resources to improve business performance. Accomplishing these goals requires powerful data collection and analytical tools to gain actionable insights into business processes, systems and data.

This paper discusses how the combination of process mining and process analytics creates the ability to discover and monitor business processes that span multiple systems and organizational silos. This level of process intelligence provides visualization of these heterogeneous business processes for both internal and external audiences, while identifying problem areas and allowing for adaptive process optimization.

Using these techniques to improve process intelligence is key to optimizing processes, since they provide an evidence-based model of the end-to-end process plus real-time measurement of the process. Business process professionals should be considering such process intelligence techniques as an integral part of their process improvement efforts.

Process Mining For Discovery And Optimization

Every organization has business processes at its core, although very few of those processes are managed in an end-to-end fashion by seamless information systems. Instead, processes are typically executed using a variety of information systems including off-the-shelf business process management systems (BPMS), enterprise resource planning (ERP) systems, product lifecycle management (PLM) systems, relational database applications and custom-built enterprise transaction systems.

Some of these systems may be connected by middleware information buses, but many processes are also highly dependent on manual procedures to transfer information between systems and to perform significant portions of the work within the process. The end-to-end business processes are often not well-understood or documented because they are embedded within these information systems and the complex interactions between them, hence have no common monitoring interface or process model.

What the constituent information systems have in common, however, are event logs: every transactional system generates information about the actions that it has performed, in order to allow for roll-back and auditing, and stores that data in one or more tables or files that form the system’s event log.

Process mining analyzes the event information from all systems contributing to a single business process, and automatically constructs a model of the process as it exists by correlating the events for each process instance so that each of its activities can be traced through and between all of the systems that impacted that instance. Each unique instance will produce a process model that traces its activities; combining this information for many instances will result in an overall end-to-end process model for that business process, typically showing a few well-travelled default paths through the model plus the numerous exception paths that have occurred.

It’s important to note that using process mining for process discovery is vastly different from

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creating process models using manual process discovery methods: process mining produces an evidence-based model that is a historical aggregate of the actual process, whereas manual analysis produces a model of someone’s observation of the process, or their opinion on what the model should be. Manual process discovery is a time-consuming and expensive task, requiring observations of and interviews with the workers involved, then analysis and modeling of the results. In contrast, since process mining is performed using logs generated from information systems, it consumes considerably fewer human resources and does not require access to the process workers. There’s still room in any organization for both, since manual process discovery captures all of the manual activities that don’t cause an event to be logged in any system, and also captures the participants’ views on process inefficiencies.

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Process mining can be used for more than discovery of the process model, or flow diagram: it can pinpoint process bottlenecks, rework and inefficiencies, prompting changes to both manual procedures and the information systems that make up the business process. It can identify differences in business processes between business units or other data dimensions in order to understand anomalies. It can also be an important first step in radical process redesign or when implementing a BPMS that involves integrating a number of existing complex systems.

Process Analytics For Visualization And Taking Action

Process analytics has been an integral functionality of BPMS for many years: the ability to visualize and analyze information about processes as they execute in order to provide actionable information. The techniques and tools of business intelligence (BI) are well-understood by most organizations, and process analytics puts a process-centric spin on that: since processes are both time- and task-oriented, different views are required beyond standard BI dashboards to properly visualize the flow of work over time as well as the process data.

Real-time monitoring of process performance may include simple dashboards showing aggregate information, such as a chart of how many process instances are waiting at each step in the process at this time; more complex interfaces that allow the operator to drill into a specific instance; or generate real-time alerts at certain thresholds to allow people to take corrective action. Historical process analysis can measure how well a process is performing relative to its goals or service level agreement, as well as identify trends in work types and volumes.

These types of process visualization support manual decision-making based on the current state of a process instance or collection of process instances – for example, an operator viewing a process dashboard may manually reallocate staff when a work...
When a queue reaches a specific level—the underlying data and events can also cause automated conditions and actions to execute. For example, a collection of processes with the same customer information may indicate a potential fraud situation, and automatically start a new process instance to investigate it. This type of event analysis and automated action may be considered as a form of complex event processing (CEP), although CEP often deals with higher-velocity data streams directly from transactional systems rather than BPMS events.

**Mining And Analytics For More Intelligent Processes**

Process analytics as a function of a BPMS is useful, but combining process mining and process analytics outside the context of a BPMS increases that capability significantly. Instead of just analyzing the events within the BPMS, mining and analytics together can tap into knowledge of the underlying models of business processes spanning heterogeneous information systems, visualizing and taking action on events from live instances of those processes.

This creates a cycle of collecting and analyzing process execution data from the processes running in a variety of systems, aggregating these into a common analytics environment, then using the results of the analysis to identify and correct problems in specific process instance as well as root causes of bottlenecks in the underlying processes. In most business processes, where process models are implicit within systems and procedures, process mining must precede any analytics in order to develop explicit process models to act as an analytical framework; then, the instrumentation in place for automated process discovery will continue to feed into the analytics in real time during process execution.

An emerging capability is predictive process analytics, since the time-oriented nature of processes lends itself to the ability to project forward from a point in time for a specific process instance while it is still in flight, predict whether its milestones will complete on time, and automatically take corrective action if required. If these processes are automated using a BPMS or other system with an agile process and rules model, the predictive process analytics can feed back to dynamically optimize the process model relative to the process goals. This takes the concept of continuous process improvement to a new level, where the process is continuously improving itself through these self-adjusting mechanisms.

Even in situations where process models are not defined in advance, such as adaptive case management (ACM), patterns in the tasks manually added to prior cases can be analyzed and used to guide a case worker’s actions by suggesting next steps and providing what-if analysis of potential paths. These patterns can also be analyzed to identify reusable process segments that exist within unstructured case work.

These more advanced capabilities are moving into the mainstream: Gartner is reshaping its BPMS research category into intelligent business process management suites (iBPMS), “targeted at organizations that want to optimize their agility, and to respond to changing conditions intelligently and swiftly.” Driven by organizations’ need to intelligently manage operations in real time, iBPMS include process mining, implicit process management (managing processes that are embedded within systems and manual procedures), event-driven analytics and automated constraint-based optimization.

**Process Intelligence Use Case**

A typical financial services or insurance use case arises when multiple systems are involved in processing a complex customer transaction:

- The original transaction—a bank account opening, or an insurance claim—is performed on a legacy transaction processing system
- If the legacy system encounters a problem requiring human intervention or otherwise beyond its capabilities, it launches a problem escalation process instance in a BPMS
If the customer detects a problem, their inbound call is logged in a CRM system, which in turn launches a problem escalation process instance. The process instance in the BPMS may resubmit the transaction to the legacy system for reprocessing, or update the CRM to trigger an outbound call to the customer.

Because the work is performed across three different systems, there is no complete view of an individual transaction from end to end, hampering operational visibility and the ability to provide proactive customer service. Furthermore, although the problem escalation process model is explicit in the BPMS, the processes within the legacy system and the CRM system are implicit, so the end-to-end process model is not visible.

Process mining can trace multiple process instances across all three systems, cross-referencing them using key fields such as transaction ID, to create a process model that spans the entire business process. Once this model is in place as a framework for process analytics, process mining can continue to feed real-time information about process instances into the analytics framework, allowing a single process instance to be tracked as it moves between the legacy, BPM and CRM systems.

This use case illustrates the value of process intelligence via process mining and analytics in generating a true end-to-end model of the business process across heterogeneous systems, then tracking process performance as it moves through those systems. In addition to the process performance monitoring value, this provides valuable insights for detecting potential areas for process improvement.

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