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PROCESS WIND TUNNEL FOR IMPROVING BUSINESS PROCESS

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EXTENDED ABSTRACT

In this talk, we will introduce a simulation-based process improvement framework and methodology called the Process Wind Tunnel. We will describe this framework and introduce the underlying technologies namely process mapping and data collection, data wrangling, exploratory data analysis and visualization, process mining, discrete-event simulation optimization and solution implementation. We will discuss how Process Wind Tunnel framework was utilized to improve a critical business process namely, the post-execution trade settlement process. The work builds upon and generalizes the Lean Document Production solution (2008 Edelman finalist) for optimizing printshops to more general and complex business processes found within the insurance and financial services industry.

A complex business process typically requires multiple teams with different skills to coordinate their activities to deliver a service. The overall task is broken down into sub-tasks and a team is assigned to each sub-task. Each subtask takes inputs and delivers an output which is then consumed by another team who does the same. The service request thus flows from origin to the end until the service is delivered. As the business process complexity increases, the team that handles each sub-task gets siloed with communication with other teams occurring through interfaces. Thus while each team works effectively within the silo, the overall process tends to get more and more fragmented and the overall visibility into the end-to-end process gets less transparent. Thus inefficiencies creep into the process over time, making it difficult to diagnose and fix.

The world is in the midst of a data-explosion phenomenon. According to a Forbes article [6], "there are 2.5 quintillion bytes of data created each day" and "over the last two years alone 90 percent of the data in the world was generated". This trend is applicable to the world of business process where industry- standard and homegrown business applications are generating extensive amounts of data. These complex process datasets provide an opportunity that did not exist in the past for data discovery, analysis, modeling and optimization leveraging the latest advances in data science and computational technology and methods.

Complex engineering systems such as aircrafts utilize the concept of a wind tunnel where experiments are conducted to enhance the understanding of the performance of various design alternatives before actually committing to the final design. Building on the analogy of a wind tunnel, one can develop an environment that helps understand and study various options related to a complex business process. This would enable the use of real-world data in conjunction with end-to-end stochastic system models to provide a framework to predict, assess and optimize process structure, parameters and operational policies that comprehends real-world uncertainties and disturbances. Costly mistakes associated with poor execution and locally optimal performance can be avoided downstream and subsequent re-engineering costs on real-world processes can be minimized.

Some of the core technologies embedded in Process Wind Tunnel framework include:

Statistical analysis and visualization [4,5] techniques combined with fast data wrangling approaches have seen significant improvements (both in terms of algorithms and hardware-driven performance) in recent years. Software applications have evolved enabling data scientists to explore and analyze large and complex datasets with high levels of efficiency. Descriptive and predictive analytics methods have proliferated and are now part of many statistical analysis packages.

Process mining [2,8] works with vast amounts of event data recorded by process management systems to discover processes and then couples data-mining with process models to check conformance, detect deviations, support decision-making and recommend process redesign.

Simulation optimization [3] is a recent development that is leveraging the exponential growth in digital computational power to combine the two Operations Research/Management Science techniques namely stochastic simulation [1] and optimization to address complex large-scale real-world processes.

Modern scheduling [9] addresses disconnects between traditional analytic results and the needs of system designers where the idealized policies, metrics and models used by analytic researchers do not match those of real systems. This has provided multiple new insights, for example, it creates scheduling heuristics related to not only the mean response time but also their distribution. Such results have led to better understanding of how scheduling affects QoS (quality of service), which are often, governed by the tail of the response time distributions.

The Process Wind Tunnel project of analyzing, improving and optimizing the post-execution trade settlement process resulted in several benefits. It highlighted areas of concern and guided the team on where they should focus their attention in order to improve key process metrics such as matching rates and failed trades. It enabled the quantitative assessment of impact of streamlining and automation on resource utilization before performing targeted automation on several key steps of the end-to-end process. The cumulative impact was 20% improvement in labor utilization across the team thereby freeing up of resources to perform higher value-added work and reduction in errors and risks associated with manual processing. A key process metric, namely time-to-match was reduced by 54%. The development of an end-to-end data-driven view of the process also enabled more transparency and resulted in better knowledge capture and management.

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