The Intelligent Enterprise in Government

Discovery and Adaptation: Applying a reusable, adaptive computing infrastructure to harness and manage an organization’s core intelligence
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1. Introduction

In their innovative treatise, “The Rise of the Intelligent Enterprise,” Kemal Delic and Umeshwar Dayal say that organizations of the future will increasingly resemble naturalborn, organic systems in their ability to sense, learn, and evolve.

They make the case that today’s enterprises exist in a highly changing, competitive environment, in which the basic objective, like natural systems, is to thrive and endure. In the case of organizations, thriving means economic, political, or ideological success. Today’s organizations can deploy sophisticated technology, which can significantly increase complexity. In order to deal with the ever-increasing amount of data in the information age, enterprises need to transform themselves to respond to environmental change, much as biological systems do. This is the meaning of becoming a truly intelligent enterprise – to have a heightened sense of awareness, an enhanced capability to learn, and, most importantly of all, the ability to adapt.

Increasing an organization’s agility and intelligence density – the collection of its depth and breadth of knowledge at a point of true accessibility – is key to an organization becoming an intelligent enterprise. Agility and intelligence density are dependent upon having a computing infrastructure that facilitates discovery and situational awareness – an infrastructure that allows an organization to quickly adapt to changes, both internal and external, based on measured learning.

The pillars of discovery for the intelligent enterprise are automation, integration, and optimization, with a particular emphasis on adaptation. Additionally, the intelligent enterprise infers a level of intelligence, awareness, capacity, and even intuition applied across technology by a dedicated staff of business professionals. Technology is simply a tool that assists talented people to win.

**Discovery** – the ability of an organization to effectively tap into its historical and realtime knowledge base – is essential in law enforcement, homeland security, defense, and intelligence. But discovery has become an increasingly daunting challenge due to the sheer volume, velocity, and variety of information flowing through government enterprises. This challenge is often compounded by the absence of complete and accurate information. Government organizations too frequently lack the capability to share information or to integrate people, processes, systems, and data across their extended enterprise. Discovered
intelligence is only as good as the ability to deliver it to the organization’s real-time, operational environment (people and systems) in a timely manner.

A critical factor in discovery is metric-based learning – setting precise goals or priorities for outcomes and measuring final results against those goals. How is the effective use of intelligence being measured, learned from, and fed back into the operational environment? Without these measurements and feedback, it is difficult for an organization to truly know the progress it is making towards accomplishing its mission.

This paper takes a deeper look into discovery and adaptation, examining how organizations can overcome challenges by applying a reusable, adaptive computing infrastructure to harness and manage their core intelligence. The discussion that follows will provide concrete examples of how TIBCO’s government and commercial clients are addressing the challenges of becoming intelligent enterprises. TIBCO’s innovative approach provides analysts and decision-makers with real-time operational intelligence, utilizing event-driven service-oriented architecture (SOA), business process management (BPM), and complex event processing (CEP) technology.

2. Discovery and Adaptation: A Deeper Look

In order to survive, it is essential for living things to discover stimuli affecting their environment (past and present) and adapt quickly. It was surmised in “The Rise of the Intelligent Enterprise” that engineered organizations of the future will resemble living systems, with adaptation being the key behavior.
There is indeed a strong correlation between living systems and human organizations. They both exist in an evolving environment under changing circumstances. Survival is based on their ability to understand events and information within their environments and to adapt to mitigate threats or capitalize on opportunity. They also exhibit some ability to learn from their experience.

While a government organization's survival may not be literally at stake, the success of its mission or the safety of its constituents is certainly affected by its ability or inability to discover and adapt. And timeliness is crucial. The timeliness with which intelligence is discovered and acted upon is the factor that determines whether proactive or reactive measures are taken. In some instances, such as preventing a terrorist assault, catastrophe can result from the inability to rapidly discover intelligence within an organization's historical and real-time information base. The time between an event and the resulting decision and response must be compressed. As the old adage states, "an ounce of prevention is worth a pound of cure."

Traditional passive discovery techniques involve using an Extract, Transform, Load (ETL) process, a data warehouse that holds massive amounts of historical data, and some business intelligence (BI) tools for analytical reasoning. These techniques have proven to be valuable, and there are numerous success stories of intelligence discovered through passive means leading to benefits. But are techniques driven simply by historical data enough?

Complex event processing (CEP) provides a framework for event-driven discovery. An event is an occurrence – be it a visa application, an airline flight taken, a bank account opened, a meeting of suspect individuals in a remote locale, or even a milestone change in the time of day. CEP can maintain a relationship between discrete, granular real-time events from various IT and operational layers and correlate those events with historical context from the data warehouse. CEP, by fusing real-time event analysis with historical data, allows organizations to identify patterns and significantly reduce the time between an event and a response. CEP offers predictive analysis in operations.

It has been noted that some South Pacific islanders are able to discern that a tsunami is about to occur, long before there is any technological warning. Their ability to predict is tied to their knowledge of historical events and conditions, fused with current environmental conditions and events. They actually have a virtual array of distributed sensors – their dogs. Dogs and other animals can have
an innate sense of impending environmental change. By recognizing in current
time the village dogs’ odd behavior, and by drawing upon historical reference and
taking quick action based on this, the islanders survive a tidal wave. Having the
“sensory” advantage provided by the dogs is not nearly as important as knowing
what to do with that advantage, and how to interpret what the warning is about.

Applied to business, this power to predict is what TIBCO refers to as Predictive
Business™. By applying the principles and technologies of Predictive Business,
seemingly insignificant events can be correlated, interpreted, and processed so
that government organizations can anticipate and proactively address threats and
opportunities. In the case of law enforcement and homeland security, the power
to predict enables authorities to proactively address threats, potentially avoiding
strikes from criminals and terrorists and exposing complex fraud or finances
supporting their activities.

Figure 2. Correlating
real-time events and
historical knowledge gives
organizations the power to
predict.

Through its innovative service-oriented architecture (SOA), business process
management (BPM), and complex event processing (CEP) technology, TIBCO
is helping organizations to fully harness their assets and core intellect, rapidly
integrate and share critical information, and automate core processes.

TIBCO BusinessEvents™ is CEP software that allows organizations to discover and
understand the stimuli (events and information) affecting their business, “as it is
happening.” By fusing this capability with an organization’s historical knowledge,
TIBCO creates the ability to adapt and identify predictable patterns, discover
causalities, and spot anomalies. BusinessEvents is model-driven (with rules, events,
state-of-play monitoring, and scorecards that call for graduated attention and
action), and is therefore highly adaptable.
3. Challenges: Laying the Groundwork for Predictive Business

Recommendation #5 in the WMD Commission Report to the President states: “The Intelligence Community must develop and integrate into regular use new tools that can assist analysts in filtering and correlating the vast quantities of information that threaten to overwhelm the analytic process. Moreover, data from all sources of information should be processed and correlated community-wide before being conveyed to analysts.”

Before government organizations can realize the benefits of Predictive Business, certain challenges must be overcome in areas of information overload, integration, information sharing, process automation, and business optimization.

INFORMATION OVERLOAD
The volume, speed, and types of information flowing to and from government organizations are ever increasing. One of the key challenges of discovery is how to handle information overload. Analysts, officers, and caseworkers provide the core intellect of government organizations; however they are often overwhelmed by huge and complex workloads.

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Analysts are a valuable asset in short supply, and they’re inundated with the volume of information they need to slice and dice in order to find correlations. According to intelligence community estimates, analysts scan, on average, 200 to 300 documents in two hours each day. For analysts to move beyond a focus on individual documents, and instead “connect the dots” among a wide variety of documents, the typical analyst would need a full workday just for the basic function of monitoring new data.

TIBCO’s Analyst Discovery System is a real-time discovery solution, based on TIBCO BusinessEvents, that addresses this challenge. The Analyst Discovery System provides a powerful correlation engine that finds connections between both structured and unstructured documents as they flow into the organization. Through robust visualization capabilities, the analyst then selects sources of information and indicates the degrees of separation by which the correlation engine should filter connected documents. By automating certain common correlations among incoming documents, the analyst is freed to concentrate on high probability correlations. This provides a manageable, strategic workload for the analyst, while ensuring the best use of resources and that nothing is missed.
INTEGRATION
Integration of people, processes, systems, and data across the extended value chain is at the core of most IT infrastructures. It is remarkable, however, that these infrastructures typically are rigidly developed for a single initiative, project, and/or software application. The intelligent enterprise requires an adaptive infrastructure supporting all enterprise initiatives. The key to adaptability is to minimize the amount of custom coding, have common access to data regardless of the software application on which it resides, and employ a design-configure-deploy methodology that leverages reusable services.

This is the approach that large-scale TIBCO clients such as Union Pacific Railroad and the U.S. Citizenship and Immigration Services agency (USCIS) have employed. With a pliable infrastructure, these clients can quickly integrate new systems, scale to meet enterprise demand; participate in information sharing initiatives, and deploy innovative technologies (such as CEP). This optimizes their operational and discovery capabilities.

At USCIS, a new agency formed in 2003, the executive leadership addressed the challenge of integrating a wide variety of isolated legacy software applications with TIBCO’s integration technology. Using TIBCO’s enterprise service bus (ESB), the agency was able to rapidly integrate disparate information systems. Bridging the various software applications in which information is stored gives caseworkers a consolidated view of immigration applications. USCIS implemented a reusable, adaptable framework that spans enterprise-wide initiatives. Agency employees do not have to login to multiple systems to know the status of a visa or citizenship application, thus saving time and eliminating erroneous assumptions. The information is presented through a rich internet application developed with TIBCO General Interface™, an Ajax RIA framework that provides robust desktop application capabilities through a web browser.
INFORMATION SHARING

The need for intelligent enterprise capabilities in government has never been more evident than today. Directives for increased information and intelligence sharing are being urgently issued at every level of government. The National Commission on Terrorist Attacks Upon the United States (commonly known as the 9/11 Commission) identified the breakdown of information sharing as a critical factor contributing to the failure to prevent the September 11, 2001 attacks on the United States.

Maximizing the intelligence value of government information requires a collaborative effort across multiple departments and agencies, at all levels of government, along with cooperation from the private sector and allied governments. Government as a whole must become a more intelligent enterprise. The first step in achieving a collaborative intelligence capability is to establish the ability to quickly and efficiently share information.

SOA has gained acceptance as a way to unlock the business value of an enterprise’s IT infrastructure. SOA permits architects to break down monolithic applications into discrete services, which then can be reused in a variety of applications. By exposing information and transactions as services, in an abstracted, standards-based manner, an SOA provides a foundation for new classes of business applications. These are composite applications, assembled from a mix of existing and new service logic, as opposed to being built entirely
from scratch. TIBCO’s ESB enables these composite applications, acting as a communication layer across different software applications and eliminating the need to replace legacy systems or do extensive custom coding. This enables government organizations to deploy new services faster, at lower cost.

SOA is seen as a primary enabler of information sharing. It provides a uniform, scalable way to access organizational data and tap into information fusion centers, such as those being developed between the law enforcement and intelligence communities. SOA provides both data flexibility through web services and delivery through the ESB technology. The ESB can also provide a mechanism by which events are supplied for CEP. The sum of this creates an event-driven SOA, which provides the basis for the infrastructure of the intelligent enterprise. By deploying an event-driven SOA, government organizations will be better equipped to adapt quickly to changes and become truly intelligent enterprises.

**AUTOMATION**

The intelligent enterprise will automate its core business processes at an enterprise level. Eliminating process inefficiencies across islands of automation plays a key role in improving performance and greatly aids in discovery as well.

In its Smart Identity Card System (SMARTICS), the Hong Kong Immigration Department is using TIBCO’s BPM offering, TIBCO iProcess™ Suite, to automate border control. This system helps to lower labor-intensive screening and speeds processing at border sites.

It facilitates the collection, analysis, and dissemination of information on who is entering and exiting Hong Kong, whether through airports, seaport, or border crossings. In 2004, Hong Kong International Airport was able to clear more than 99% of its 66,000 daily passengers within 15 minutes using the TIBCO-powered SMARTICS. For other harbor and land checkpoints, which carry more illegal immigration risk, the Immigration Department has been able to clear 99% of the 490,000 daily visitors through these channels within just 30 minutes. These far exceed the goals originally established for SMARTICS.
TIBCO iProcess Suite is a complete BPM suite for modeling, automating, measuring, and adapting business processes. Its flexibility allowed for major enhancements to SMARTICS, permitting citizens to use a single identity card across all government activities, from the libraries to healthcare and even for driver’s licenses. In addition to the high security and intelligence that the system provides for immigration purposes, SMARTICS is the foundation for Hong Kong’s advanced e-government initiatives.

OPTIMIZATION
How do organizations get the most out of their IT infrastructure? TIBCO clients are using CEP and business activity monitoring software to optimize their infrastructures and maximize performance. Whether it’s applying CEP for job and grid control in the processing of intelligence information packets, utilizing CEP for entity and incident correlation across law enforcement agencies at local, state, and federal level, or using BAM to monitor real-time vehicle movement for highway patrol response – the common thread is reducing the time between events and action by authorities.

Recently, TIBCO utilized TIBCO BusinessEvents software to develop a prototype for a major national intelligence organization. The challenge was how to effectively distribute a vast number of disparate jobs across a grid of machines and optimize correlation and discovery of intelligence. This highly complex task involved jobs varying in processing times and in the algorithms that would execute job processing. Having tried several other approaches to this challenge that had failed, the intelligence agency turned to TIBCO’s expertise in facilitating vast-scale information sharing and real-time analysis. Based on a CEP framework...
provided by BusinessEvents, TIBCO successfully orchestrated the processing and analysis of 65 million jobs in a single day. The CEP correlation engine controls the job flow based on job properties, controlling optimization of the grid based on jobs queued, CPU, and resource utilization. The intelligence organization is now in the process of applying the TIBCO technology to other intelligence challenges.

4. Conclusion: Event-Driven Discovery and Adaptation

Most discovery solutions today are passive, database-centric, and based solely on historical data. Certainly, passive discovery solutions do provide value to law enforcement, national security, and intelligence communities. But is this approach enough in the modern age, where a myriad of information and events are available to be tapped? Are we willing to leave real-time operational assets such as sensors, field agents, and current data flows out of the intelligence mix?

In some areas, such as counter-terrorism or critical infrastructure protection, organizations can’t afford to take a passive, singular approach to intelligence. Where there is a heightened security threat, a higher level of discovery and adaptation is required. The way to do this is to couple correlation and analysis of the real-time event stream with mining of the historical context. This can be viewed as an event-driven approach.

The idea is to process multiple events within the overall “event cloud,” and identify those events that are meaningful and connected to security concerns.
Techniques employed in an event-driven approach to intelligence include: detection of complex patterns common to seemingly random events; correlation and abstraction of event occurrences; and establishing hierarchies and relationships between events, for instance causality, organization membership, or milestone timings.

Monitoring and understanding the events and patterns occurring across systems and operations are a prerequisite for an organization to become an intelligent enterprise – one which can respond quickly to threats and opportunity. Events must be analyzed within the context of timing and location, while being correlated and fused with historical knowledge. A rules-based, model-driven approach to monitoring, measuring, and correlating events ensures a flexible, adaptable means for response or correction by the end-user. This essentially defines the value of complex event processing.

Marrying this event-driven approach with the traditional historical approach to discovery will enable government organizations to transform themselves from reactive to predictive intelligent enterprises.

5. About TIBCO

TIBCO Software Inc. (NASDAQ: TIBX) is a provider of infrastructure software for companies to use on-premise or as part of cloud computing environments. Whether it’s optimizing claims, processing trades, cross-selling products based on real-time customer behavior, or averting a crisis before it happens, TIBCO provides companies the two-second advantage™ – the ability to capture the right information at the right time and act on it preemptively for a competitive advantage. More than 4,000 customers worldwide rely on TIBCO to manage information, decisions, processes and applications in real time. Learn more at www.tibco.com