Reality Aware Systems – The “SKYNET” Concept

An InSync Software, Inc

Whitepaper

Reality Aware Systems

Before venturing into politics and commandeering the 5th largest economy in the world, Arnold Schwarzenegger was probably known best for his role as a futuristic cyborg in the Terminator movies. In these movies existed a computer system called Skynet. Syknet had become aware of the physical world and eventually overthrew its creators. Skynet no longer relied on human intervention to tell it what was happening and what to do, rather it was able to sense environmental changes and react in an intelligent way.

In a not so sinister way (honestly), today's enterprise systems are on the verge of automating their actions based upon their awareness of physical reality. In recent years, with the rise of RFID, sensor-based computing is becoming mainstream at the enterprise level. Early deployments were based on WalMart and DoD mandates, the 1,600 pound gorillas mandating RFID compliance. The initial applications of RFID technologies that received attention were not generating a significant benefit outside of the fact that it kept suppliers on the good side of the gorillas. Today the landscape of RFID applications has changed. Deployments are no longer driven by mandates, its common sense Return on Investment (ROI). Inventory Visibility, Supply Chain Collaboration, and Asset Management are the key terms that are now being associated with RFID solutions.

Electronic sensors for executing process logic are used in industry to automate manufacturing processes. Robotic systems with tactile feedback worked tirelessly at manufacturing cars. Temperature sensors were used to control equipment that managed complex chemical processes. Analogous to manufacturing automation of the '80s and '90s, supply chains are increasingly using sensors to provide tactile feedback into systems so they too can act autonomously. Real-world awareness of enterprise systems allows the automation of processes where assets traverse geographic, business, and system boundaries.

The use of sensors in the larger business network enables systems to interpret reality and execute complex processes in an intelligent manner. The benefits revolve largely around improved visibility and automation of business processes that have a high susceptibility to human error. Today's RFID implementations are increasingly focused on using RFID and sensors to track assets and automate the command and control of business processes. Companies that have done this successfully are enjoying ROI primarily due to process efficiency and automation. The premise is similar to the "Skynet" concept at work - having systems aware of the physical reality and reacting intelligently.

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Supply Chains have evolved over time to efficiently manage product development, manufacturing, and delivery.
When optimized, they provide significant competitive advantage and extended manufacturing capability. When they fail, it usually results in a significant impact to the business ecosystem. As supply chains became increasingly disparate, many relied upon person-to-person communications to manage daily activities. Technology matured to provide for system-to-system communication to help scale business processes. Planning, execution, and transactional closure are some of the process steps automated by using eBusiness constructs. Once deployed, they provide for the first level of efficiency gained through the coordination of systems engaged in the supply chain. The next layer of issues arises as data disconnects and latency becomes apparent. Collaborating on incorrect data causes tumultuous waves of excess and shortages. To reduce these risks, higher inventories and cost of coordination results as companies attempt to smooth out the impact.

Let’s take the following example to highlight the key issues.

On Tuesday morning, a Production Supervisor is waiting for a shipment that is needed for 1st shift on the following Monday morning. She looks into the MPS and understands that the plan was that the material will arrive on Thursday. It doesn’t arrive. She calls the supplier and the Supply Chain Manager to intervene. A call to the supplier is arranged for Friday morning, but by that time, the supplier is shut down for the weekend as the facility is in Taiwan. Frantically, looking through the eBusiness messages, they notice that the material shipped and proceeded to track down the logistics provider. After further research, the provider discovers that the shipment’s actual ship date was 3 days later than what was noted in the message received from the supplier. The carrier confirms that they took custody and that it may have sat on the shipping dock for some time. At 2AM on Monday morning, the supervisor places the final desperate call to her receiving dock to see if the shipment has arrived. Having no confidence, time has run out and she makes the difficult decision to shut down first shift. Moreover, her customer is disappointed when informed of the delay.

This is a common scenario that highlights the costs associated with the lack of physical visibility in an extended asset-based process. Outside of the immediate impact to the end customer, the internal effort spent on managing the issue reduces overall efficiency.

At best, many integrated supply chains have taken the steps to connect through eBusiness messaging such as EDI or RosettaNet. Using a variety of messages and transactions, a level of

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automation has been achieved. However, the messaging architecture is dependant on triggers within the system. Keyboard entries, system triggers, and B2B gateways are relied upon to represent the reality. What has physically occurred may be completely disconnected from the data that is represented in the system. When multiplied across the hundreds of companies and thousands of items, the daunting task of determining the true state of an asset becomes apparent.

Sensor Devices: The Nerve Endings. Software: The Brain.

As in most manufacturing automation, there are a variety of sensors engaged in controlling a robotic function. For example, a motion sensor cannot act independently of a limit switch. It doing so, it has limited information and can crash into adjoining objects. Similarly, RFID alone cannot provide the complete view of the business activity. RFID provides the identification with the association to an active or passive tag. As the tag is read by devices, contextual information is gathered. This includes the timing of the event, location, direction, and environmental condition. Combined with backend system data related to the asset, a powerful collection of information is known in real time. This information is logically structured as a specific event. Being able to collect this information, collate it, and attach it to a systemic event is a central theme to ecosystem wide automation. Some basic examples of events used in current deployments identify shipments, geospatial tracking, inventory updates, and work process completion. A real-world event along with its context information may be shared across the ecosystem participants that are interested in this activity. Using this event information, transactions in enterprise systems may be triggered, updating automatically where before a human entry was required.

Systems that use sensory events for execution are ones that become aware of their physical surroundings.

With a depth of realty that is made visible through sensors and software, averting potential issues, planning activities, and reducing human intervention are the results. For our intrepid Production Supervisor, this solution would have provided the predictive view into a potential future outcome. As the materials missed their expected points along the material path, the early visibility would have alerted the parties concerned of an impending delay. Recommendations of alternate actions may have been taken well in advance averting the customer issue. Lower inventory levels and faster turnovers is the net effect across the ecosystem. As a secondary benefit, the automation of transactions reduces the labor burden for physical data entry, validation, and expediting. Overall, the efficiencies gained results in a significant ROI for all partners engaged in the material process. This has been proven out in many industry verticals as evidenced by the number of case studies

highlighting deployments.

Deployment: Perception vs. Reality

In a business ecosystem, the complexity in implementing a sensory network seems daunting. It is not. The first level of perceived complexity is that a common data format is not standardized. Note also that this was one of the early issues for barcode adoption. Similar to the earlier barcode dilemma, the sensory and RFID standards gap is being bridged. Common standards for identification, events communication, and systems integration are being developed with proven results. Standards bodies such as EPCglobal, ISO/IEC, AIAG, CEN and others have developed workable standards that have become widely adopted and used in production environments. With the extension of standardized mechanism for managing event information and exchange, the pieces of technology needed to collaborate effectively have fallen into place.

The next set of perceived complexity is the sensory hardware deployment. Sensory hardware is rapidly evolving to the point where most will currently plug and play into existing intranet infrastructures. As with other networked devices, the ability to manage, command, and read data becomes simplified. In a recent case of RFID deployment, an Electronics Manufacturer was able to connect their logistics process with an outsourced Partner in Taiwan. A kit of RFID readers and antennas along with connectivity software was sent. The Partner was able to install the “Shipping Zone” independently giving the Manufacturer visibility of physical shipments. Boxed finished goods are sensed as they move off the dock and noted to the Manufacturer in an event message. Other Partners with similar existing infrastructure can to connect processes in a similar manner. These events with contextual information are shared with the Manufacturer whereby the expectation of a delivery is created in the “Receiving Zone.” Such illustrative examples are becoming commonplace.

Further advances in technologies such as Services Oriented Architecture (SOA) and Web2.0 provide for a rich user experience where mash-ups of data and functions blur the boundaries of the traditional system based processes. Rich Internet Application functions make the management of complex business processes akin to a gaming experience.

With the market cost of hardware, tags, and solutions declining, processes that seemed economically unachievable just a few years ago are breaking through the financial barrier. The features and functions of tags and hardware continue to increase, improving the value proposition. The first movers that adopt within their industry continue to benefit as the cost of extending their

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solutions decreases. Proportionately, the ability to scale the extended process and its associated benefit grows with the number of connections.

Getting Smarter Everyday

The cycle of economic progress will always demand better, faster, and cheaper. Manufacturing and supply chain ecosystems are living proof of the forces driving innovation in management technologies. Striving to provide enterprise systems with the human sensing and intelligence capability has been the dream of most process owners. Technologies such as RFID and sensor-based computing are key enablers that are pushing the envelope of process control across system, geographic, and business boundaries. For most, getting over the psychological barrier that has been created around RFID is critical. Once breached, one understands the larger implication of the process that is to be deployed and the place for the technologies selected. In most cases, it’s not just RFID. It’s about collaboration across the business ecosystem and sharing a common physical reality to provide economic benefit. At some point Skynet may be the end result. That’s another topic of discussion.

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