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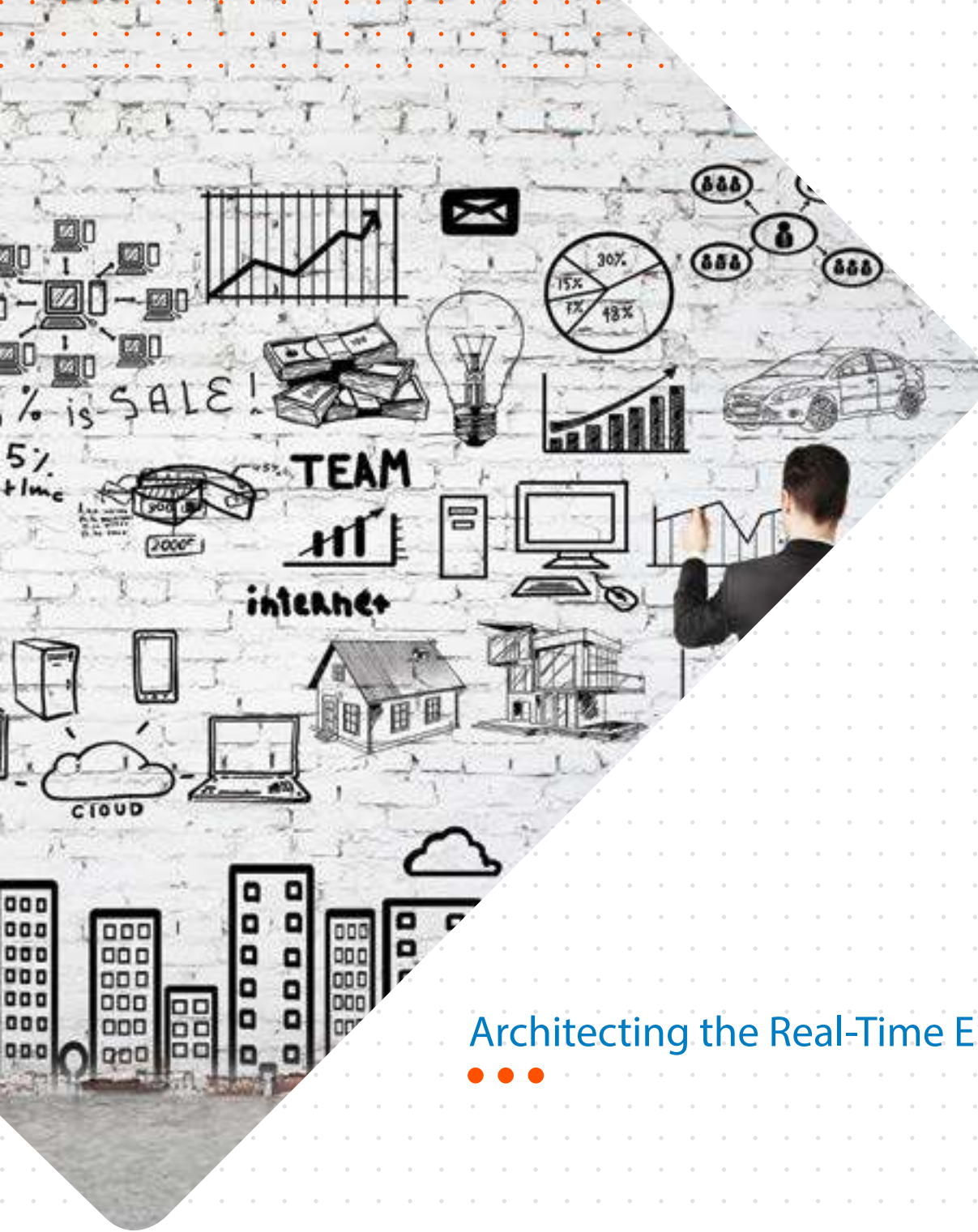
Architecting real time enterprise

Information Systems (Midlands State University)

Architecting the Real-Time Enterprise

Infosys
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Architecting the Real-Time Enterprise

Introduction

Enterprise value creation has far outlived the "back to basics" strategy. Today's businesses need to extend their focus beyond horizons in an effort to protect their existing revenues and at the same time build the future they wish by using emerging technologies.

While early adopters of emerging technologies are seen as pioneers, the other mainstream adopters have taken a cautious waiting approach before deciding to go for the plunge. The strategic use of technology as a differentiator has forced the decision-taking and business spends to the table of the CXO's, including CIOs/CTOs. CEO's need to have a clear understanding of the most effective way to leverage these emerging technologies and position this as a differentiator to their business.

The case for Real-Time Enterprise

Let's discuss a scenario:

A major holiday is approaching the week next and there seems to be a good amount of buzz in the retail stores all over the town. There is a well-known handmade chocolate of a certain brand whose demand is increasing unknown to the store managers.

The customer completes the transaction at the Point Of Sale (POS) and the basket has the handmade chocolate. As the customers are getting done with their transactions, there is an in-store processor, which looks at the rising data. It then transmits the detailed sales data to the relevant enterprise systems. The enterprise systems are monitoring each transaction closely to figure out the trends and one such event detects an increase in demand for the handmade chocolate in a specific sales region. The event quickly spawns business services that look at the inventory at the current store and other stores in the region and also at the next delivery schedule.

The business automation services will make a quick list of which stores need what replenishments along with this hand-made chocolate from the central warehouse. It also performs a complete analysis to make the delivery as efficient as possible. The delivery-vans, which have location-based service dashboards, leave the central warehouse to the respective grocery stores to deliver the replenishments. The location-tracker chalks a quick route of which retail stores to deliver, by making the entire journey not only to save fuel but also to save time.

Replenishments are delivered and the retail stores have not lost a single customer to its competitor. The handmade chocolates have found their homes and the Real-Time Enterprise systems have avoided another potential loss to sales even before anyone

at the store has noticed the demand for the chocolates.

The scenario shows that armed with a practical and a well-oiled RTE framework, an enterprise can hope to minimize being "blindsided by adverse developments - internal or external" as well as maximize their opportunities to improve their chances to continue to lead their market.

Framework for harnessing Real-Time Enterprise

Enterprises need to have a 3-step framework consisting of:

- "Sense" component that enables the enterprise to be informed of all external and internal information that is relevant.
- "Analyze" component that helps analyze the information, identify patterns, forecast and predict likely impacts and consequences.
- "Respond" component that determines the best possible response based on the analysis of the relevant information and executes the determined response.
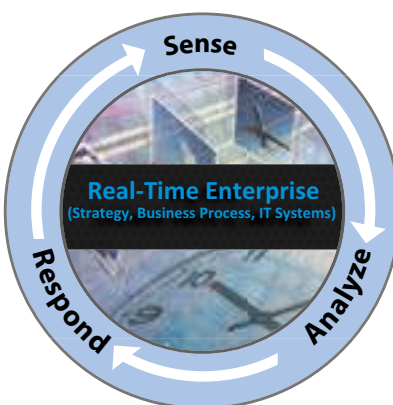
A bird's eye view of architecting the Real-Time Enterprise

The business and technology strategy is never a once-for-all event. Changing environment always forces for a review of the strategic objectives.

"Planning for the Real-Time Enterprise" section discusses the 'why' and 'how' of planning the enterprise management systems to cater to Real-Time strategy and requirements. Any process or event in the Enterprise Management Systems needs to process the data that gets generated. This data needs to be converted into information, which will give a decisive advantage to the organization implementing it. The information lifecycle churns information out of the data generated, which is discussed in the Information Lifecycle chapter.

In the sections "Implementing the Real-Time Enterprise", we explore various industry solutions with a definite focus on architecting the Real-Time Enterprise for that usecase. We will discuss the solution for the use case and highlight the challenges that each solution faces with specific success factors and benefits. This gives a better understanding of the profile of the situations that we can architect for a Real-Time implementation.

No case is complete without the complementing technologies and enablers. The section "Accelerating Real-Time Enterprise adoption" discusses the various horizontal options available to make a home run of the strategy that we visualized for the Real-Time Enterprise.

The sections are interleaved with viewpoints from Scott Anthony, Managing Director, Innosight; Natalie Scopelitis, Global Head of Consumer Online at Vodafone and S. Gopalakrishnan (Kris), Co-Chairman, Infosys.

S. Gopalakrishnan (Kris)

Co-Chairman, Infosys Limited

Kris is the President designate of the Confederation of Indian Industry (CII) and Member of United Nations Global Compact Board

How will you define a Real-Time Enterprise?

Real-Time Enterprise as a concept is a decade old!

Companies can respond to both internal and external changes in a reactive, proactive and predictive way. But companies who have good sense, analyze and respond capabilities through their people, process and systems are lot more proactive in predicting the changes and responding to it.

With the advent of Internet, Web 2.0, mobile and Internet of Things, the concept of Real-Time Enterprise is becoming even more pervasive.

It can be applied across the enterprise spectrum from strategy development to demand planning and from product or service development to customer support. Real-Time Enterprise is also relevant to the 21st century needs for sustainable development.

Based on your interaction with Global leaders, what are the forms of adoption that you are seeing?

Let me give you few examples.

A health care provider, can offer a patient centric and a cost effective mobile health care solution. Mobility based home monitoring devices capture and send patient data. Doctors can monitor the patients remotely and offer necessary proactive and preventive actions.

On an average 8 to 10% of retail sales are lost due to out-of-stock situations. Real-Time Monitoring and management platforms have solved this by integrating the POS to the complex processing systems, which captures sales data, analyzes this and sends a replenishment order to refill the store inventory when the stocks are in demand.

In the energy sector, with the new sources of energy like solar and wind - the electrical grids have to become smarter to manage the peak load for effective usage. Consumption patterns could be controlled based on variable price structure for home energy usage.

What are the challenges you see in the adoption of "Real-Time Enterprise"?

Technology tends to overshoot ahead of the enterprise capability before people and processes are ready to adopt. It is important for Real-Time use cases to have a business case with a defined ROI.

Increasingly enterprises are getting swamped with more and more data. This data deluge is going to continue and increase. Before an enterprise is getting into "Sense – Analyze – Respond" they need to focus on "What to sense?"

Legacy systems and processes are not capable to sense and handle these new forms of data. The changes and the cost factors need to be considered.

How do you see the connection between Real-Time Enterprise and Infosys strategic theme?

Digital Consumers, Emerging Economies, Sustainable Tomorrow, Smarter Organizations, New Commerce, Pervasive Computing, Healthcare Economy are the sources of invention for enterprises to harness and accelerate change.

Pervasive Computing and Smarter Organization enables Real-Time Enterprise capability of Sense, Analyze and Respond. Real-Time Enterprises are better positioned to service new age Digital Consumers. Sustainable Tomorrow has three pillars namely Social contract, Reducing resource intensity and Green innovation. Combine this with agility and speed, it becomes a 21st century competitive advantage.

Emerging Economies, New Commerce, Health Economy are all new growth opportunities across industries. Enterprise that are equipped to quickly understand and address these kind of society needs are better positioned to seize these opportunities.

So, Real-Time Enterprise is one of the key enabling technologies for Creating tomorrow's venture.

Planning for the Real-Time Enterprise

The Evolution

Real-Time computing was applied to Real-Time Operating Systems (RTOS) where the systems would receive a steady stream of data as in most aerospace, medical or automotive industries. The field of RTOS started to address these because systems such as UNIX or Windows were not real time due to their slower response time. Real-Time now has started to extend into the realm of applications, middleware and even business processes. This further broadens the definition of the term real-time and its applications into the enterprise areas.

The vision is to build-operate-reinvent businesses to real-time enterprises which would connect customers, partners, suppliers and employees with real-time business processes and emerging technologies to provide for better integration, interaction and agility.

The business drivers for adoption of Real-Time Enterprises are increased business agility and competitive advantage with a highly transparent customer satisfaction. From the IT perspective, the drivers are reduced cost of Application Integration and a highly configurable business processes. Migration in a phased manner by strategically focusing on specific job-to-be-done business processes to a Real-Time process can reduce significant upfront cost for an enterprise.

Planning for the Real-Time Enterprise

Real-Time Enterprise as a concept depicts how the concept weaves across so many IT and business functions enabling information integration which helps in informed decision making. It is all about the enterprise redesigning itself to bring in visible changes in the Sense, Analyze and Respond components.

The business strategy of the enterprise determines what needs to be sensed, what kind of the analysis is needed and what the responses need to be while the business processes, information and IT systems support the collection and analysis of information and in the execution of the response.

The sense component needs to capture the relevant internal and external information and changes in these conditions that are relevant for the enterprise. The external factors include the market conditions and changes in the market dynamics that are relevant, the competitive landscape, any new threats and opportunities, changes like acquisitions, the government and regulatory environment changes like compliance requirements, new laws that may affect the operating environment, customer experiences, brand perceptions, partner and customer feedback and information from social media. The internal factors include the performance of the various products and services, factors like the health of the internal systems, insights about the usage of the systems, feedback and ideas based on collective wisdom of employees etc

The analyze component helps identify the patterns, trends, correlations across the various external and internal inputs. It enables forecast and predict various potential scenarios, identify the probabilities and consequences with what-if analysis.

The respond component involves the identification of the response strategies which can range from ignoring some as irrelevant, to incremental changes in direction with reallocation of resources, to radical changes like exiting or entering new businesses or geographies. IT has a key role to play in allowing more response options and enabling fast execution of the chosen response strategy.

Characteristics of Real-Time Enterprise

The business and IT systems need to be architected to have the following six characteristics:

Agility: In order to meet the time-to-market requirements, the business processes should be automated as much as possible and IT systems should be architected so that the various layers like the infrastructure, platform and the application can be provisioned on-demand, elastic to meet the dynamic workloads. Virtualization and Service Orientation are two key technology strategies to be adopted.

Available Anywhere Anytime: The business processes need to enable customers, partners and employees to use, participate and be productive from anywhere and anytime. The IT systems should enable secure access to systems over multiple channels. With increasing adoption of mobile smart phones and tablet computers, leveraging these and enabling access through these devices is an important aspect that needs to be addressed.

Scalable: With increasing adoption of social media and pervasiveness of computing resulting in everyday devices like cars, house hold devices getting instrumented and connected to the internet, there is a deluge of data. Data is doubling every two years and there is more and more unstructured data getting generated. The next generation Enterprise IT and Information Management systems need to be able to deal with such large volumes and wide varieties of data. The IT systems also need to be leverage cloud computing technologies to be scalable and elastic to store, process and analyze billions of such interactions with connected smart devices.

Intelligent: IT systems should be designed to be continuously learning so that they adapt to changing conditions and usage patterns. They should be designed to leverage predictive analytics and machine learning capabilities.

Collaboration Driven: The business processes should be designed to leverage the collective wisdom of all the stakeholders and the IT systems should be designed for collaboration.

Low Latency: Change is rapid and there is increasing need for real time processing. There are architectural patterns like event driven architectures and technologies like complex event processing that enable near real time processing and responses. IT systems should be designed to leverage these strategies and technologies.

The table below provides a summary of the architecture strategy and technologies that enterprise IT systems should leverage

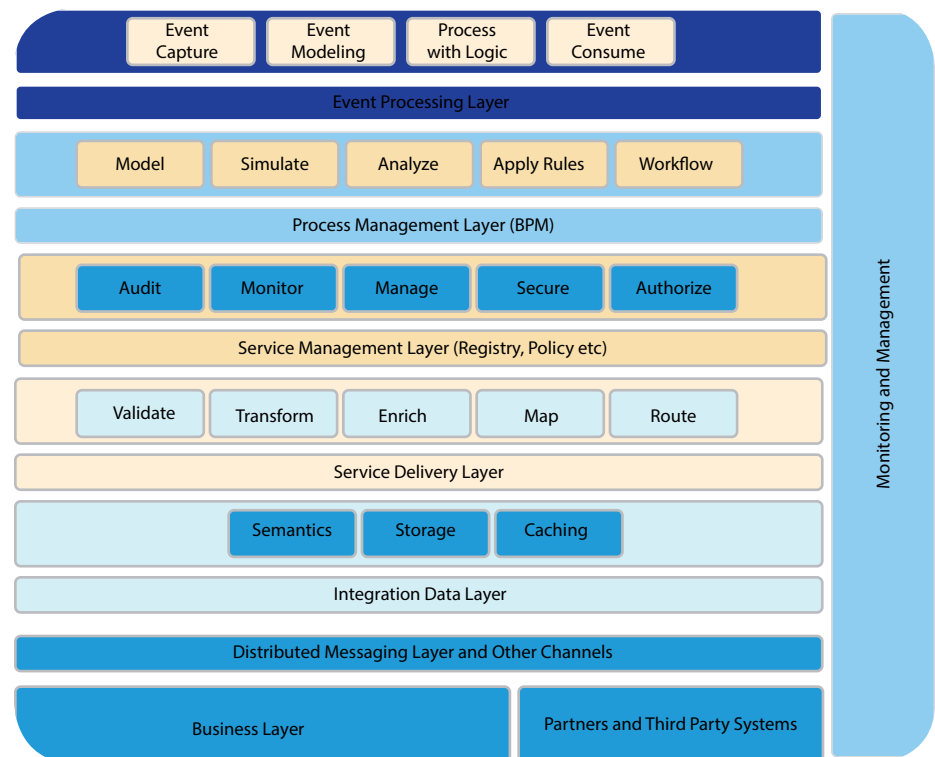| Characteristic	Architecture Strategy	Technologies
Agility	As A Service	Virtualization, Cloud Computing
Available Anywhere any time	Self-Service	Mobility, Internet
Scalable	Elastic, Commodity Servers based	Big Data Technologies, Cloud Platforms
Intelligent	Continuously learning	Machine Learning, predictive Analytics
Collaboration	Social	Enterprise Social Collaboration
Low Latency	Event Driven	CEP, In-memory

Getting Ready: Business Process and IT

Information technology (IT) in large organizations today can be viewed as a quilt of heavy enterprise software, generally called Enterprise Resource Planning (ERP), woven together in a manner specific to the goals of a specific enterprise. This aspect is the outcome of various factors, including requirements of specific capabilities, management direction and larger organization strategy. Large amount of time and resources are spent in managing IT systems, and often IT projects turnaround time range into several months. Newer approaches, such as Service Oriented Architecture (SOA), have been implemented to manage IT in a more transparent and predictable manner.

With the emerging change in scale and nature of processing, any strategy towards a real-time enterprise must begin with the acknowledgement that Real-Time Enterprise goals cannot be accomplished by simply rolling out another large scale IT project. Most ERP implementations have out of the box capabilities to notify major events and configure business services and processes. This is strength of existing IT systems, and a good RTE plan builds on that. Computational strategies, such as those of complex event processing and agent oriented collaboration, can be deployed to endow the enterprise with real-time capabilities.

The Enterprise Reference Architecture, including an event processing layer is shown below.

A brief description of the layers are described here:

Layer	Description
Business Layer, Partners and third party	This consists of existing custom built applications including CRM and ERP packaged applications, and older object-oriented system implementations. Partners and third parties are also a part of the logical enterprise.
Integration Data Layer	The integration data has capabilities to configure semantics (such as properties and relationships) within messaging data elements. The message configuration extends to persistence and caching aspects.
Distributed Messaging Layer and other channels	This layer forms the messaging backbone for the enterprise.
Service Delivery Layer	This layer should be thought of as the connectivity layer for all applications to enterprise. This layer has capabilities to validate, transform, enrich, map and route messages.
Service Management Layer	This layer provides the capabilities required to monitor, manage, and maintain QoS such as security, performance, and availability.
Process Management Layer	Compositions and choreographies of services exposed by Service Delivery Layer are defined in this layer.
Event Processing Layer	Provides capability to analyze technical and business event streams; particularly, in a temporal context (Such as contextualize these events by correlating events based on the repetition frequency, sequence of event within a time box, events with particular business attributes, events across time) to detect certain business condition and react by invoking business service or raising alerts for human intervention.
Monitoring and Management Layer	This is a layer of special components required to install, deploy, monitor and maintain components of the enterprise.

View Point

Scott Anthony

Managing Director at Innosight

Scott is an Influential author on Innovation in HBR and Harvard University Press

Scott, if IT enables a Real Time enterprise, how can enterprises invent for competitive advantage?

Broadly, one of our beliefs is that it is hard for any organization to invent faster than the market in which it competes. An organization can invent better than the market if they combine together the right behaviors with difficult-to-replicate assets. And a truly real-time enterprise can get the best of both worlds – doing what others can't do, at a pace that wasn't possible before.

How can attributes like Speed and Responsiveness be combined with other sources of invention?

Organizations need to change to take advantage of the data coming in. Data by itself is useless if the organization is not ready to utilize it better or faster than competition can. Think of it like having a fiber optic broadband connection coming to your home, but you have only a dial-up modem – you won't see any change in your speed!

To be truly responsive, my perspective is that the organization will need to rethink the way it is structured, how decisions get made and types of skills needed. Usually as speed becomes more critical, you need to reduce internal "hand offs" between teams, push decision-making lower down the organization by connecting the decision making and execution machines more strongly.

Based on the experiences from Innosight, when speed is not a constraint – how can corporates go about to unleash change?

Change could be both external, that is to disrupt the market place and internal, to improve the organization's responsiveness. The best organizations do both.

For instance, one large Telecom player that we've advised is using mountains of data that comes-in to micro-target markets with the ultimate aim of building a 'Customer segment of One'. This helps customers to build their plans and choose pricing based on their unique needs. To enable this, the organization has been reorganizing itself by giving local team access to the data, developing new marketing capabilities to enable real-time communication with their customers and overhauling their technical and billing systems.

Every view has another side – Quality deteriorates when Speed Accelerates! How can enterprises avoid this pitfall?

To avoid the pitfall, it is critical to strengthen the organization on 3 fronts – Systems, Governance and People Skills. Broadly, as the demand for speed increases, the role of senior organization will move towards direction-setting rather than command & control. The leaders will need to learn to 'let go' of some of their decision making powers.

We have found from our work in Innovation-driven organizations that their systems, governance and people skills are different, but also disciplined compared with the traditional organizations. The Innovators typically have cross-functional teams structured around client needs and incentives structured to encourage speed and responsiveness.

It is also important to note that quality is a relative term – rapid adaptation can provide something more attuned to market needs, which the customer can consider to be of greater quality.

Scott, One last question, Elephants cannot dance! How can large corporates gain by avoiding pain with this disruption?

It is critical for companies to first let the invention grow and strengthen before integrating it into the organization.

Our experience advising large companies is that any new idea is partially right and partially wrong. It takes a few iterations or "pivots" until they achieve their magic. So, for large corporates our advice is to 'learn fast, fail cheap' – test in a small scale (could be a single market, or business unit); hone the new systems and processes needed to be responsive; and only then deploy it across the organization.

Digital Oil Field

With the days of easy oil gone, escalating demand for fossil fuels along with volatile geo-political environment and an ageing workforce calls for immediate attention of Oil & Gas Operators to improve their asset management practices. To sustain and grow in the challenging operating and business environments, the impact of technology has increased manifold.

Over the past two decades, Operators have increasingly focused on identifying and addressing bottlenecks in Asset performance optimization through the development and deployment of advanced tools and technologies, either through in-house R&D or by establishing strategic alliances with Oil & Gas Service Providers.

Of late, a radical shift is taking place due to the realization that optimal value extraction of technology investments can be achieved only by moving away from siloed approach and enabling seamless integration and interoperation of the asset facilities, so that information flows readily across different functional disciplines within the organization to facilitate and enable collaboration. This is in a way reflected in technologies being tagged at a field level rather than at a well level, signaling the metamorphosis from Intelligent Wells to Intelligent or Digital Oilfields (DOF).

While many definitions and equivalent terminologies exist for DOF, the focus is on the underlying requirement of 'Connecting Field to Office' for

- Faster Decision Making

- Improved Oil Recovery

- Enhanced operational efficiency

Adoption of a Digital Oilfield approach enables improved asset performance & management by being proactive to events and activities and this has been made possible with the emergence and evolution of Real Time Monitoring solutions, enabled by visualization and collaboration features. Concepts like Collaboration Centers, Real Time Operation Centers (RTOC) have become mainstay in today's upstream oil and gas organization. However the challenge and opportunity for the industry is to find the most optimum technology solution maximizing the benefit for their business at an affordable cost. If this is achieved, the Oil & Gas industry will optimally produce without any compromise on Health, Safety & Environment.

Digital Oil Field (DOF) Perspective

Many of the upstream oil and gas companies including integrated oil & gas majors, National Oil Companies (NOCs), have already embarked on DOF as a transformation strategy to remain competitive, reduce overheads, realize continuous improvements and augment returns. However, proper due diligence is required before leveraging DOF as a strategy and has to be aligned to the business goals of the organization. DOF is not the magic wand for all the industry needs.

Oilfield Service providers and IT System integrators have developed offerings and are continuously innovating to realize the DOF vision of operators. But the

perspectives of the different types of organizations are shaped by their focus areas as depicted in the following table:

- Exploration & Production (E&P) operator companies focus on optimization of core E&P activities and monitor inter disciplinary functions through real time asset surveillance and management for informed decision making

	E&P Operator	Oilfield Services (OFS) Provider	IT System Integrator
Core System and Processes	✓	✓	✓
Cross System / Domain Workflow	✓		✓

- Oilfield services (OFS) companies strive to provide specific solutions spread across asset life cycle for providing a safer operating environment, reducing non-productive time and enhance reservoir deliverability e.g. Convenient and Qualified Measurement tools for Evaluation services, Versatile Completion services to operate in diverse asset profiles (unconventional, deep water, HPHT etc.), Artificial lift, Enhanced Oil Recovery (EOR) etc.

- Systems integrators typically focus on IT solution implementation and integration of disparate business systems, to enable seamless data flow and information delivery to support the core activities.

Real Time Information delivery in a Digital Oil Field

An illustrative layered representation of Digital Oilfield logical architecture is depicted below. Starting with the data integration layer, the data is progressively transformed into valuable information until it is delivered through the visualization layer. A DOF Technology Stack would typically include all or most of the layers detailed below;
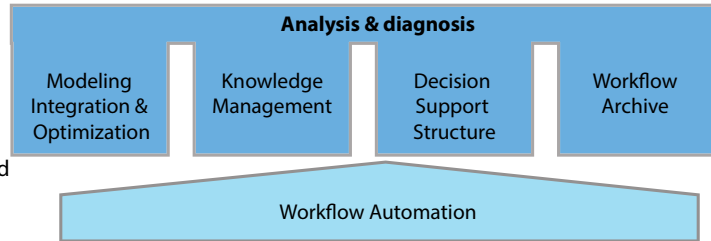
Visualization (Integration & Collaboration) layer

- Asset Performance awareness
- Cross Domain Integration for Enhanced Asset Mgmt.
- Collaborative Working Environment

Portal Integration	GIS Integration	Collaboration Centers	RTOC
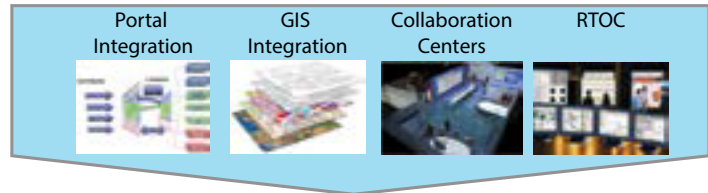
Business Process Mgmt. & Orchestration layer

- Smart Adaptive Workflows
- Schedule Automated Workflows
- Knowledge Management through capture and reuse
- Integrated Approach for faster processing and improved decision making

Analysis & diagnosis

Modeling Integration & Optimization	Knowledge Management	Decision Support Structure	Workflow Archive

Workflow Automation

Application Integration Layer

- Provide Interoperability
- provide fast alternative models

Models

Well Models

Network Models

Facility Models

Economic Models

Reservoir Models

Data Integration Layer

- Data acquisition & Processing
- Data Validation, Conditioning
- Assimilation

Data Center

Historian Data | Drilling Data | ERP Data | Well Data | Other Data
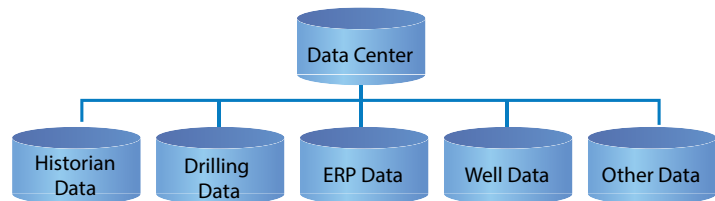
- **Data Integration:** data from various sources, including real time data, relational data, non- relational data may be federated for ad-hoc queries and/or consolidated using unique data reconciliation techniques.

- **Application Integration:** Seamless Service Oriented Architecture (SOA) based integration can be employed using standards like WITSML and PRODML can be leveraged;   systems with proprietary interfaces may require integration using native APIs.

- **BPM & Orchestration:** Automated and manual workflows across various systems help realize the business logic required for operations, analysis and diagnosis.

- **Visualization:** Integrated Real-Time visualization and collaboration

environments can be delivered either in a portal environment or through Real-time operation control rooms leveraging state of art multimedia technologies.

Real Time Information delivery is pivotal for the successful realization of several DOF application areas as illustrated below

Remote Operations Monitoring & Control

Emergency Response & Crisis Management

Real Time History Matching & Data Analytics

Real-Time Information Delivery

Visualization Dashboards for Asset KPI Monitoring

Online Collaboration & Knowledge Management

The role of DOF in realizing a Real Time Enterprise will be illustrated through 3 key scenarios where-in faster and effective decision making is enabled by real time information delivery, viz.,

- Real Time Production Wells and Facilities Monitoring

- Real Time Drilling and Work-over Monitoring

- Real Time Emergency Response and Crisis Management, especially for assets in remote challenging locations (for e.g. offshore platforms)

Real Time Production Wells and Facilities Monitoring

It is not unusual for Assets to be located in remote inhospitable locations with a skeletal staff presence onsite such that field crew visits are made on need basis to
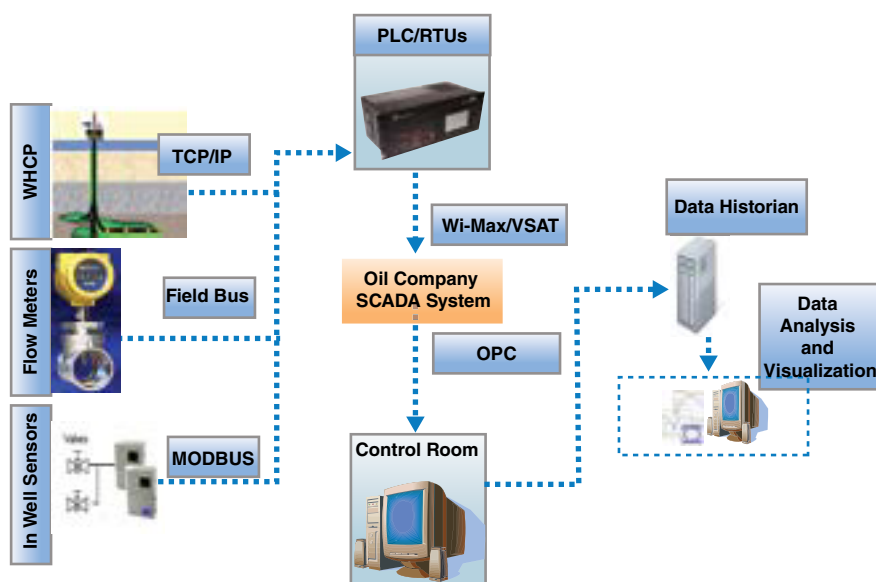
attend planned Operations & Maintenance activities or unplanned activities, for e.g. shut down of wells as part of an emergency procedure. For ensuring optimal work force utilization in such assets without compromising on asset performance, it became imperative to leverage Field instrumentation and ICT technology for automating operational activities to the extent possible.

Process control and automation form the basic building blocks for Field Instrumentation for real time supervision, control and acquisition of data. The critical elements includes sensors, transmitters to be controlled by logical interlocks and control devices (PLC/RTU) installed on the well and equipment. The status of well and equipment is further transmitted to control devices over communication channels (Wired or Wireless) to SCADA/DCS terminals and hence the status is monitored and controlled from control rooms. Long term planning and scheduling of domain centric field activities are done by Production and Reservoir Engineers through analysis and di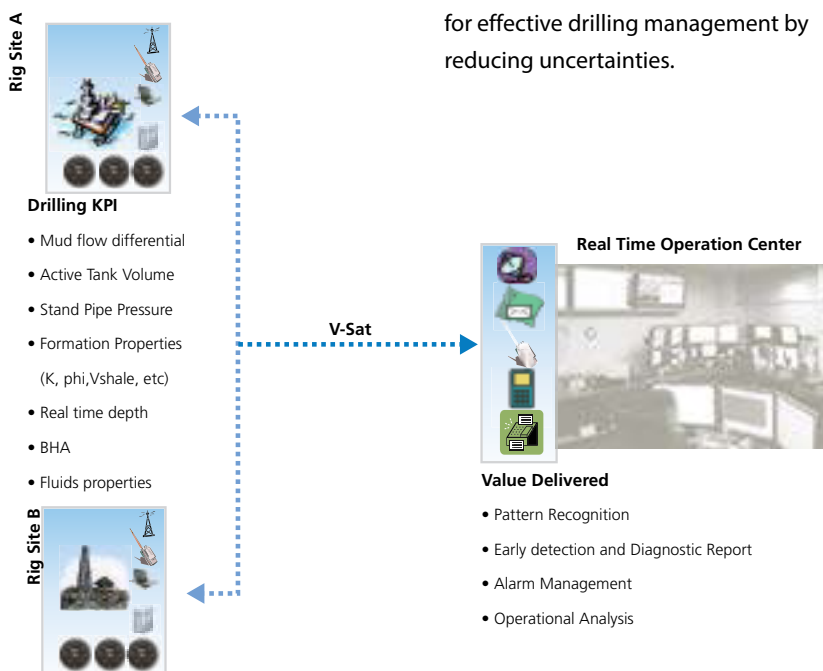agnosis of behavioral pattern and trend at the well, field and asset level. The data is acquired from field through SCADA/DCS in a near real time environment in a standard format (through data cleansing, aggregation). The data thus obtained can be archived in a Central Data Historian and leveraged for KPI monitoring and analytics. Typical production and reservoir surveillance use cases include production upset root cause analysis, equipment condition monitoring (ESP for e.g.), water cut, GOR, water flooding etc.
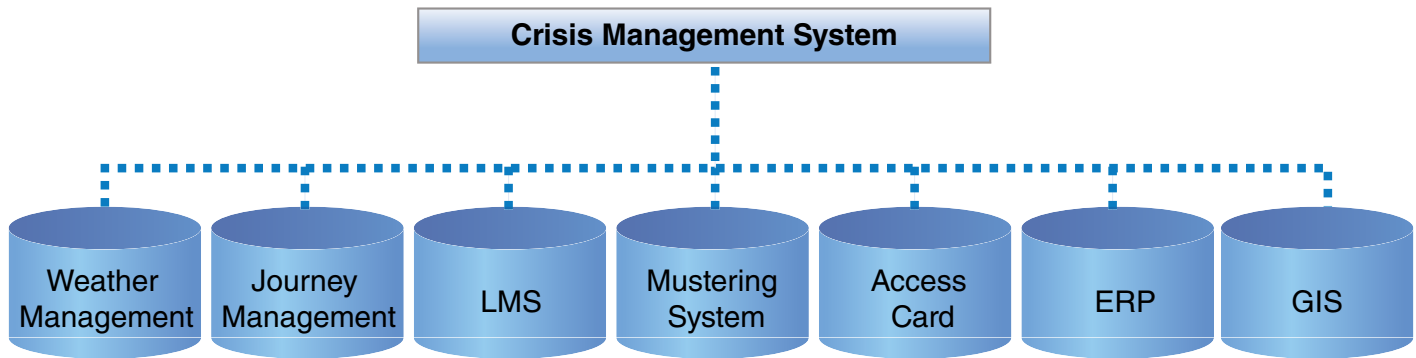
Real Time Drilling and Work-over Monitoring

The need for supervision of rig site activities and tracking progress is crucial given that it is a very busy environment where the work force tend to focus primarily on their activity and operate in a constrained environment with stringent timelines and limited skilled personnel availability. This calls for supervision by experts in a real time environment sitting remotely at a Real Time Operations Center (RTOC). A team of domain experts continuously monitor the parameters aiding safe drilling operations and report drilling progress. The RTOCs provide information for the experts to provide timely advice for any correction required for effective drilling management by reducing uncertainties.

Deep water wells will be the lifeline for the industry to replenish the exhausted reserves. The advent of technology has a profound influence in improving the efficiency and reach of drilling operations where multiple agencies are involved in a highly complex operating environment. At the drilling rig site, the OFS Company executes the services under the guidance of the operator. Major HSE incidents in the oil and gas industry that happened during the past decade further reemphasize the need of effective collaboration between various stakeholders working on an asset and decision support, as otherwise such events can adversely impact the concerned organizations and industry at various levels.

Rig Site A

Drilling KPI

- Mud flow differential
- Active Tank Volume
- Stand Pipe Pressure
- Formation Properties
  (K, phi,Vshale, etc)
- Real time depth
- BHA
- Fluids properties

Rig Site B

V-Sat

Real Time Operation Center

Value Delivered

- Pattern Recognition
- Early detection and Diagnostic Report
- Alarm Management
- Operational Analysis

Real Time Crisis Forecast and Management

Crisis Management System

| Weather Management | Journey Management | LMS | Mustering System | Access Card | ERP | GIS |

During the occurrence of unforeseen incidents like flood, cyclone, earthquake, etc., the primary importance of deploying the disaster recovery response and account for personnel can be addressed as follows:

- Assets are located in areas prone to bad weather have their own weather monitoring equipments. Visualizing the real time weather forecast data in a GIS enabled portal can vastly enhance the response effectiveness of operational personnel in the emergency response team.

- Also by integrating the system with GPS/GSM location awareness, the data in real time can be used to track personnel movement as a part of emergency response.

Challenges

There are several challenges that inhibit DOF adoption for achieving a Real Time Enterprise. The key ones include:

- **Standardization:** Oil & gas operators manage diverse asset profiles in their portfolio which inherently lead to several asset specific solutions and customizations. Many a times, data available within the enterprise cannot be made available in the right form due to niche products with proprietary interfaces.

- **Archival:** The Real-time data generated by the sensors and instruments in the field keeps growing exponentially, making the storage of this data is quite challenging.

- **Analytics:** When real time data is to be aggregated with non real time data like relational database, specialized tools and techniques have to be employed. Also given that real time data (when historized) is voluminous, optimizations would be required to perform analytics within a reasonable amount of time

- **Change Management:** Seamless integration of real time data streams with business applications may result in new optimized workflows which would require end user enablement for adoption. There may be resistance to change as well.

Success Factors and Best Practices

There are best practices that can be leveraged to overcome the DOF adoption challenges. The best practices and success factors that enable a successful realization of a Real Time Enterprise include:

- **Standards:** Ensuring integration based on standards like OPC and WITSML/ PRODML will be a key success factor for a successful implementation of real time information blocks in DOF. Strict controls should be implemented right from procurement stage to ensure that non standard native and proprietary interfaces are avoided.

- **Archival:** There is an increasing trend of several organizations attempting to embark on implementation of a centralized enterprise data historian which integrates with all control systems and local historians as a foundational element for implementing Analytics and Visualization.

- **Analytics:** It is essential to have an analytics framework implemented with tight integration with real time data. An asset hierarchy has to be defined which can be used by the analytics engine. Sophisticated tools can also perform root cause analysis of alarms and events generated by field instrumentation. Big data techniques can be explored for application in real time data management in addition to conventional approach.

- **Change Management:** Finally, the value of the DOF is not achieved in delivering a system built to specifications, but in operations and sustenance of the benefits that are realized. Organizational and process changes may be required to plan and incorporate procedures to maintain efficiently and continue to develop the delivered systems.

Conclusion

Real time information delivery is critical to success of any Digital Oilfield Implementation for an organization embarking on DOF journey. The identified bottlenecks can be removed only by having a defined strategy and implementation for managing, storing and processing of real time data and converting it into meaningful information so that it can leveraged for being proactive rather than reactive to events. Visualization is the proof of the pudding for a successful implementation of DOF real time infrastructure. It is desirable to have visualization components for real time based KPI dashboards integrated with a portal solution like SharePoint for ease of access and collaboration. Integration with GIS solutions enhances the user experience for visualizing the real time data. With the increasing adoption of real time information technologies, due attention also needs to be given for security aspects, in view of the incidents like the Stuxnet malware attack.

Finally the pace and extent of adoption of real time information technologies to achieve the DOF vision may depend on an organization's maturity, but the need for having a strategy for early adoption of real time information technologies aligned to the organization's business goals will be imperative for the organization's evolution into tomorrow's real time venture.
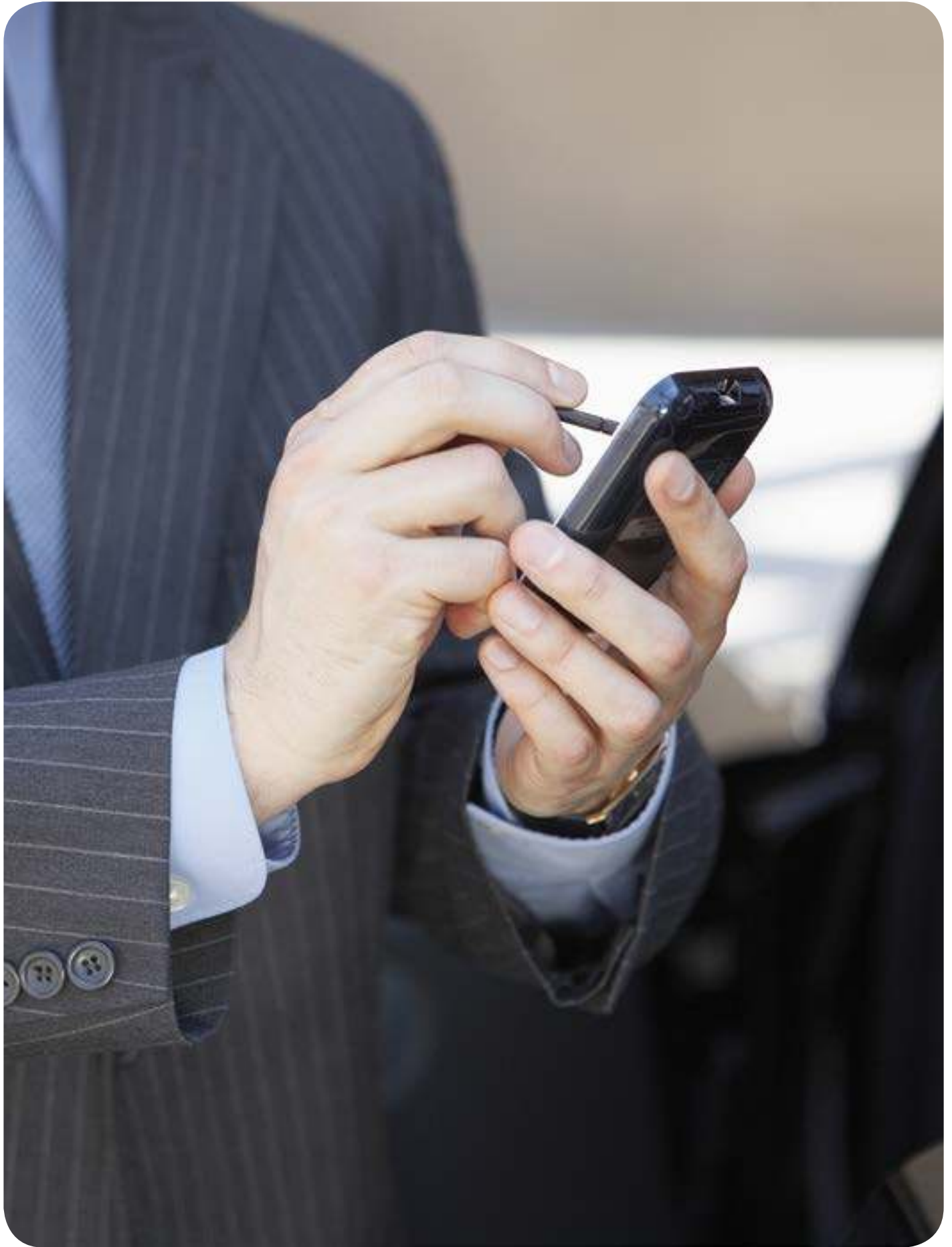
Dynamic Auto Insurance

Since the initial days of insurance, the insurers have been working hard to identify and measure risk characteristics that can predict the chances of loss. The insurer then can measure the cost associated with the loss and price their products. The parameters like driver's background, driving record, and vehicle information provides Insurance providers a fair depiction of level of risk. But with no real time data available, the insurers cannot dynamically price the product based on the driving behavior of the customer.

Dynamic pricing is an interesting strategy adopted in different industries today. Airlines price a ticket based on different factors such as the seating capacity, number of reservations made, time to departure and more to maximize revenue ensuring complete utilization of the airplanes. Wireless service providers provide discounts to the consumers on their calls based on different factors such as the network traffic, locale, time of the day etc.

This principle of dynamic pricing can also be adopted in auto insurance wherein insurance providers can harness behavioral data and miles driven data along with traditional parameters like garaging address, number of drivers, driver's age etc. Telematics powered by real time data analytics can enable insurance providers to offer policies that are personalized and priced in real time based on usage, driving behavior and external environment. This new approach helps attract and retain good drivers and enhances customer experience with more transparency and value added services.
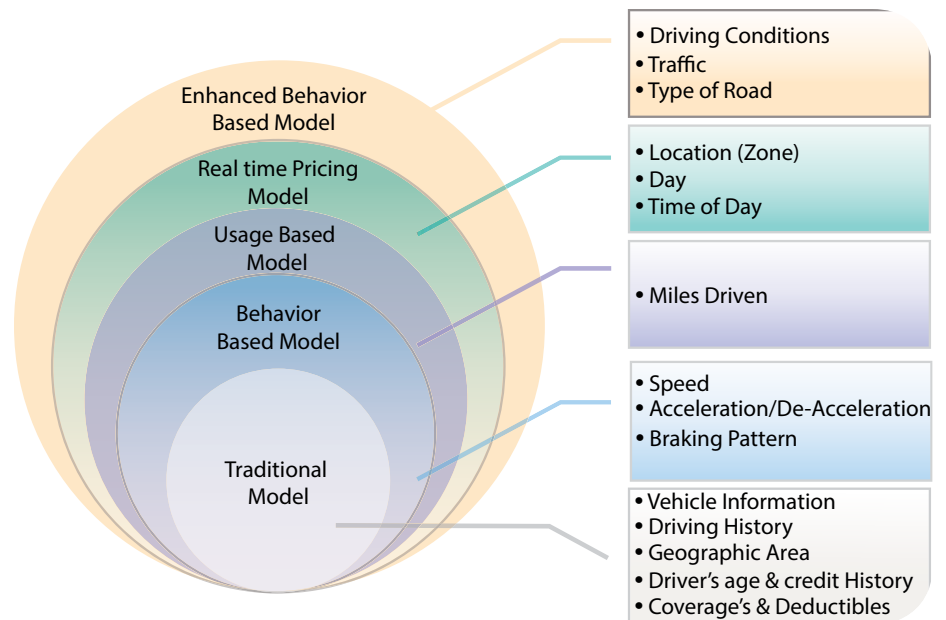
Real Time Policy Pricing

In traditional model, policies are priced based on certain parameters such as garaging address, number of drivers, driver's age etc. These parameters rated the risk factor of the driver at a generic level and not accurately on driving behavior.

Telematics enabled insurance providers to collect real time information on usage (miles driven) and driving behavior (acceleration/deceleration, speed, braking abruptness etc.). This information clubbed with the traditional factors enabled the insurance providers to offer policy pricing based on the driving behavior as well as the actual usage of the vehicle. In the past couple of years, some of the Insurance providers have started offering usage based pricing by harnessing behavioral data and miles driven data using telematics devices. Progressive Insurance has gone a step further to use time of driving for pricing. However, parameters like the terrain, location/zone, time of day, traffic, weather etc. are not considered for policy pricing. Also the Insurance providers still use the garaging address as the primary factor for rating the policy instead of rating based on where the car is being driven.

With telematics data, the insurers have an opportunity to not only price the policies on the garaged location but also price it according to where the vehicle is being driven. This provides a much sophisticated pricing which more accurately depicts the risk and the loss potential. Telematics powered by real time BIG Data Analytics can enable the insurance providers to provide a real time policy pricing. In addition the accuracy can be much more enhanced by observing the driving behavior depending on external factors like traffic and weather. Insurance providers can also perform more frequent risk assessment to re-adjust the base policy pricing. The insurers can decide to still apply the traditional factors at a higher interval (during policy renewal/ endorsements etc.) as that results into external report cost. Insurance providers can make use of this real time information in offering two variants of Usage based Insurance models:

- Enhanced Behavior Based Model
- Real time Pricing Model
- Usage Based Model
- Behavior Based Model
- Traditional Model

- • Driving Conditions
- • Traffic
- • Type of Road

- • Location (Zone)
- • Day
- • Time of Day

- • Miles Driven

- • Speed
- • Acceleration/De-Acceleration
- • Braking Pattern

- • Vehicle Information
- • Driving History
- • Geographic Area
- • Driver's age & credit History
- • Coverage's & Deductibles

- **Real Time Pricing Model:** Usage based insurance, also known as pay as you drive (PAYD) is a model wherein the policy pricing is primarily measured against time and distance travelled in addition to factors in the traditional model. Observing the location (zone) where the vehicle is being driven, Day and Time of day when the vehicle is being driven can assist in more accurate policy pricing. Insurance providers can define base policy pricing as they currently do with the PAYD model. Real time data about location/zone, day and time of day can induce variance on base pricing thus resulting in real time pricing. As an illustrative example, say the base price is 10 cents per mile. Driving in a similar risk zone during peak hour on weekday will have positive variance on pricing (12 cents/mile) but driving during off peak hour will have negative variance (9 cents/mile). Similarly driving during peak hours in higher risk zones will have much more positive variance on pricing (15-20 cents/mile) than driving in lower risk zones with lower variance(0-10 cents/mile). The insurers will need to have much more interaction with the customer so that the customer is aware of these variances in the policy pricing. It can be achieved either via mobile apps which sends alerts or via an online (Web, Mobile) channel which provides a user with the trip cost based on the routes taken. Such trip planners are currently provided by the public/private transit systems in the US.
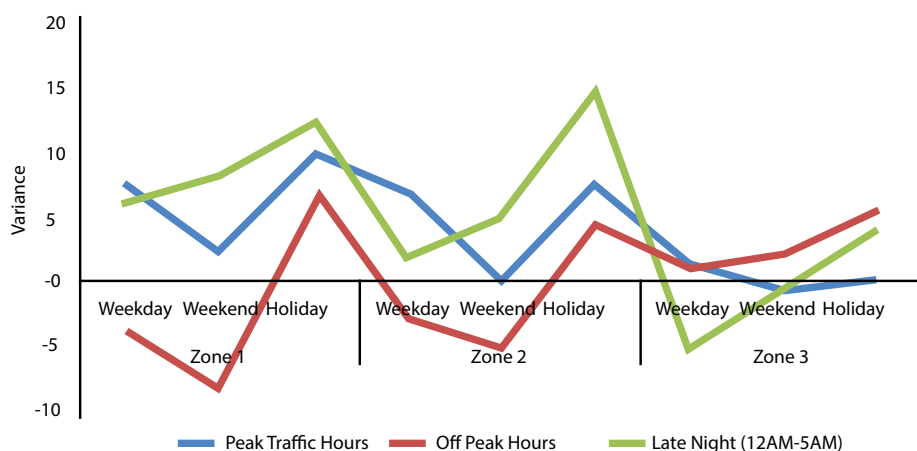
For Illustrative Purpose Only: Variance based on location/Zone and Time & Day.

- **Enhanced Behavior Based Model:** Observing the driving behavior depending on external factors like traffic, weather assists in enhanced depiction of level of risk and thus accurate policy pricing. Driving within speed limits has positive impact, but exceeding speed limits has variable negative impact based on weather & traffic. Impact of exceeding speed limit under severe weather conditions and high traffic will be more compared to under normal weather condition and low traffic. Similarly, smooth acceleration has positive impact but rapid acceleration has more negative impact under severe weather conditions and heavy traffic compared to under normal weather conditions and low traffic.
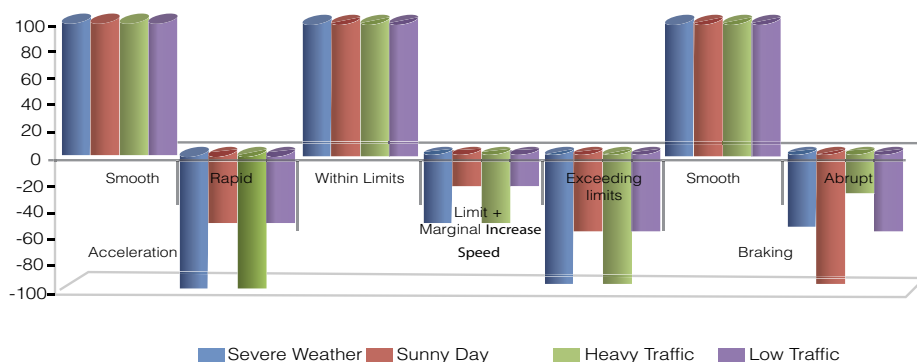
For Illustrative Purpose Only: Driving behavior considering weather & traffic

Solution

A telematics device is fitted in the vehicle to capture information about how the vehicle is being driven as well as the GPS location. This data is collected at an interval of 1-5 seconds and fed into a data hub. The data hub also has feed data about the external factors from various sources to create a holistic detail of the driving behavior of the driver. Once again the insurers can decide if they would want to consider the external factors to gather more accurate driving behavior or if they would like to go with just the telematics data.

This information can then be used to provide feedback to the customer, provide immediate response in case of emergency, as well as the policy pricing based on where the vehicle is being driven.

The key facets of implementing a system such as this will be:

- A high performance system for data computation and analytics
- A low latency communication channel
- Data from various sources

The pricing of the policy premium is subjected to various factors as mentioned earlier and empirical mathematical and computation models are applied to calculate the final price at particular instance.

For this operation to be real-time and dynamic and to cater to thousands of customers, it is necessary that the computation system is fast and robust. A High Performance Analytics and Computing engine which provides the ability to perform millions of operations in parallel taking advantage of the underlying hardware and software will help achieve this model.
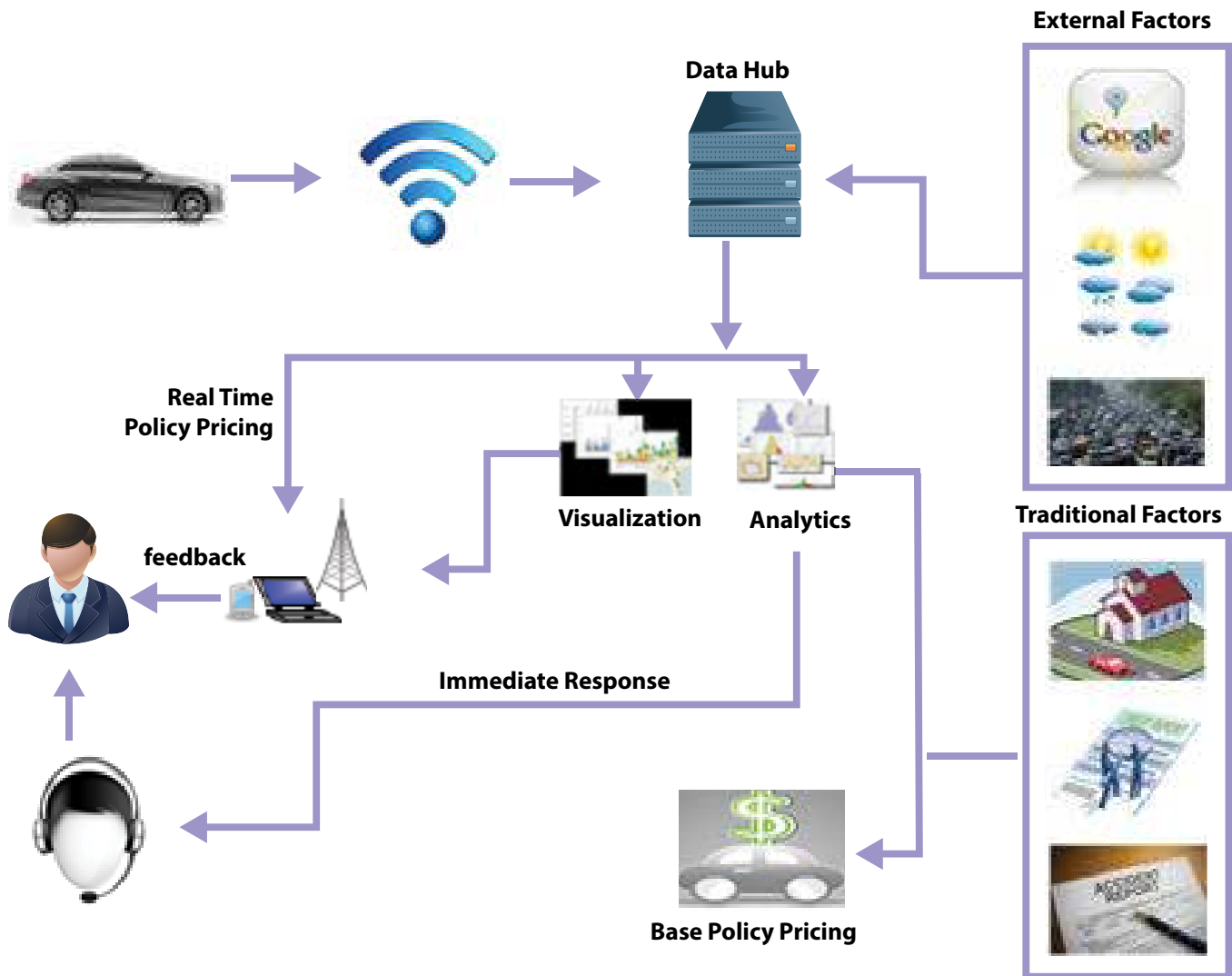
Data plays a primary role in a complex system such as this. Be it the telemetry data that is received from the vehicles or the weather and terrain data that is used in the scenario explained earlier, the magnitude of data will be huge scaling up to hundreds of terabytes or even petabytes. It is hence important to categorize and structure the data from these different sources in a central location.

The current day technology landscape provides opportunities to implement RTE solutions such as these.

The data analytics and computation engine can be implemented using a combination of High Performance Computing (HPC) and a high data availability solution such as a distributed file system or a cache. An engine such as this relies on the capability of both hardware and application software. One of the technologies in the forefront of this paradigm is Hadoop Software Library (HSL) and the associated Hadoop Distributed File System (HDFS). An open source initiative, Hadoop is widely used to address the needs of Big Data Analytics. While Hadoop is designed to scale to several thousands of machines, the application software is capable of providing high availability by itself. The Map/Reduce engine enables the large task of analysis/computation to be broken down into several small units of tasks which can be computed in parallel. The results from these several tasks and then logically combined (as necessary) to arrive at the final result.

There are certain other players in the market who provide the independent constituents of such a solution as COTS offerings i.e. the software to compute tasks across a distributed infrastructure and the software for distributed file systems or distributed cache. Some of the players who offer these solutions include IBM, Microsoft and Oracle. From an infrastructure perspective, a typical setup in this context would consist of clusters (or) grids over which the computation is distributed. This setup could be further provisioned with specialized processors (such as multicore chips) to boost the computational capability by several times.

Since a system such as this deals with large data sets and several thousands (or even millions) of computations at a given point
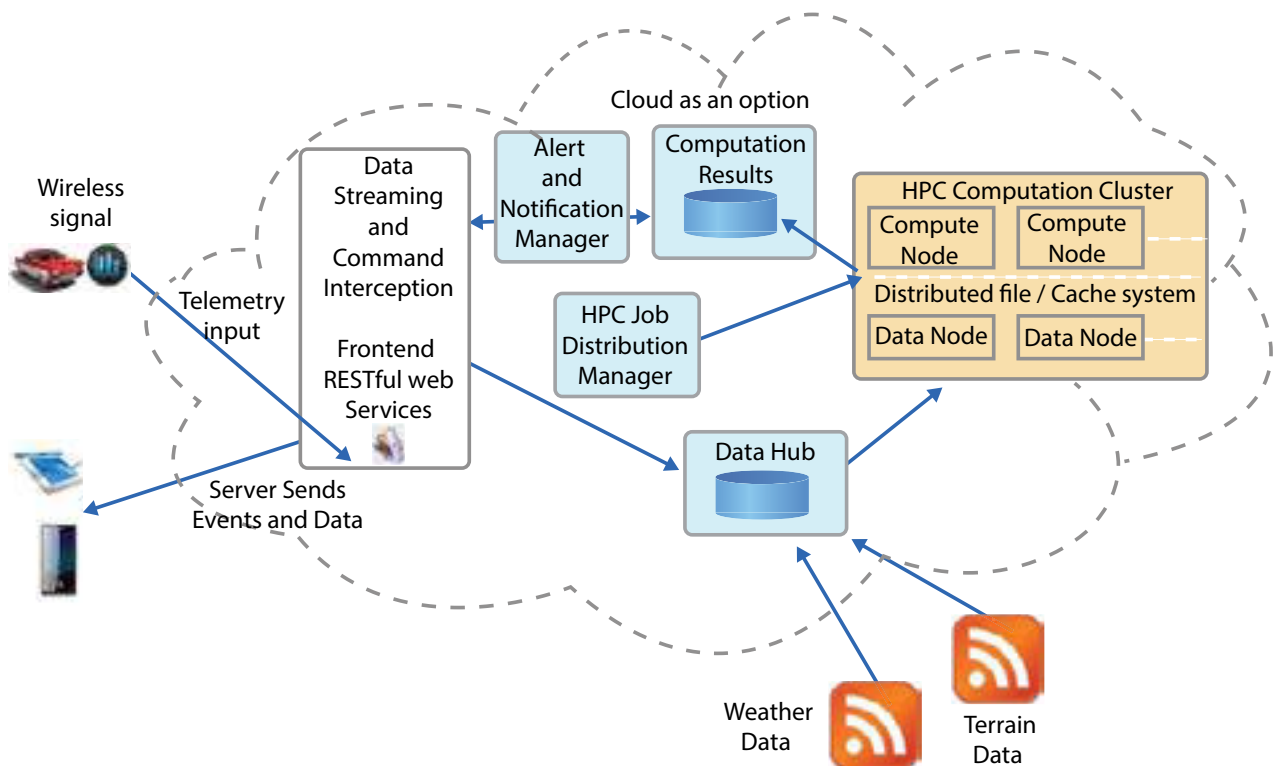
in time, provisioning infrastructure for the same will be a key decisive factor in implementing this solution given its cost implications. Cloud computing enables this scenario. "The Cloud" either with an IaaS (Infrastructure as a Service) or PaaS (Platform as a Service) offering can help provisioning infrastructure faster and providing the required scale with agility and elasticity. Moreover, the providers also offer this service on a per-use basis, which enables the IT managers to plan and assess the cost implications more effectively.

Challenges

The real time policy pricing based

insurance products must address various challenges. But the advantage to early adopters is simply too great to forgo. Below, we outline several key challenges:

- Data Management and Analysis of huge amount of data feed at real time
- Customer confidence on Data privacy
- Policy pricing transparency for each trip (before and after)
- Installation of Telematics device in vehicles
- Initial cost for the devices as well as the supporting infrastructure
- Federal/State regulations
- Approval from Department of

Insurance providers but it is also beneficial for the customers. The customer enjoys more focus from the insurance company and only has to pay when they are driving. They also get benefits for driving on the road with less traffic and roads that are safer for driving.

The insurers are able to attract and retain good drivers, help curtail the claim cost and manage their risk better. It enables brand differentiation.

Conclusion

While the RTE solution can be extremely beneficial, considering the challenges described earlier, it is important to build the solution in a phased manner and measure ROI after each phase. The following figure provides a roadmap which organizations can adopt to implement the RTE solution.

Choosing the right technology for the data analytics and computation engine is another important aspect of consideration in building this solution. It is important to ensure that a detailed and objective study is undertaken to assess the fitment of various technologies available in the market and choose the right one.

Performance being a primary attribute

Insurance for each state

From an IT implementation perspective, the challenges include:

- Provisioning distributed Infrastructure for the High Performance Computation (HPC) cluster
- Provisioning and managing a low latency communication system
- Ensuring proximity of data for computation
- Ensuring accuracy of computation and integrity of data used for computation as well as the result of the computation
- Maturity of the enterprise to embrace the solution

Even the society benefits from reduced accident frequency, pollution, traffic congestion and energy consumption.
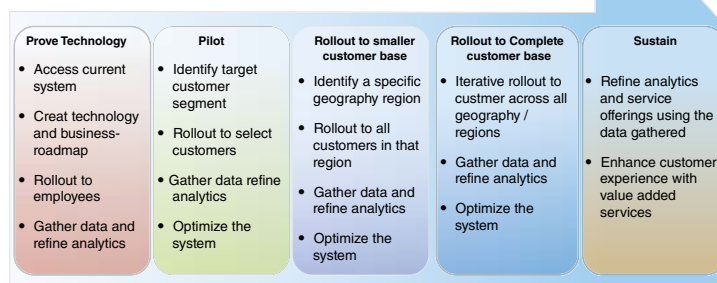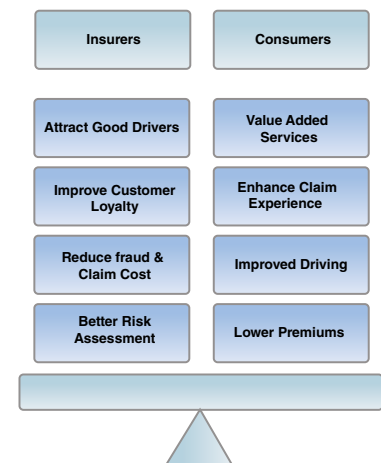
The insurance providers can also provide value added services to their customers like roadside assistance, provide driving feedback, alerts related to traffic, weather, vehicle condition/maintenance etc.

Success factors

- Attractive pricing for increased user adoption
- Transparency in policy pricing through various channels (Web, Mobile, Tablet, Customer Service)
- Effectiveness of real time data analytics
- Determine what driving behaviors are most strongly correlated with claim activity
- Determine what types of driver feedback are most effective at reducing risky behavior and/or claims

Benefits

The RTE solution not only benefits the

Insurers	Consumers
Attract Good Drivers	Value Added Services
Improve Customer Loyalty	Enhance Claim Experience
Reduce fraud & Claim Cost	Improved Driving
Better Risk Assessment	Lower Premiums

Prove Technology	Pilot	Rollout to smaller customer base	Rollout to Complete customer base	Sustain
• Access current system • Creat technology and business-roadmap • Rollout to employees • Gather data and refine analytics	• Identify target customer segment • Rollout to select customers • Gather data refine analytics • Optimize the system	• Identify a specific geography region • Rollout to all customers in that region • Gather data and refine analytics • Optimize the system	• Iterative rollout to custmer across all geography / regions • Gather data and refine analytics • Optimize the system	• Refine analytics and service offerings using the data gathered • Enhance customer experience with value added services

of an RTE solution, it is important to continuously measure the solution's performance and enhance it. This will

ensure judicious use of resources and also provides an opportunity to improve the solution to gain maximum benefits.

Telematics Service Delivery

Telematics in general, refers to the integration of computer systems with communications systems to provide valued services to the end user. Advances in mobility, wireless networks and GPS technologies along with emergence of m-commerce, social media, cloud technologies have revolutionized Telematics based service offerings with value propositions being leveraged across many verticals – manufacturing, insurance, health care, education etc. Some typical use cases of Telematics in the Manufacturing vertical are as follows:
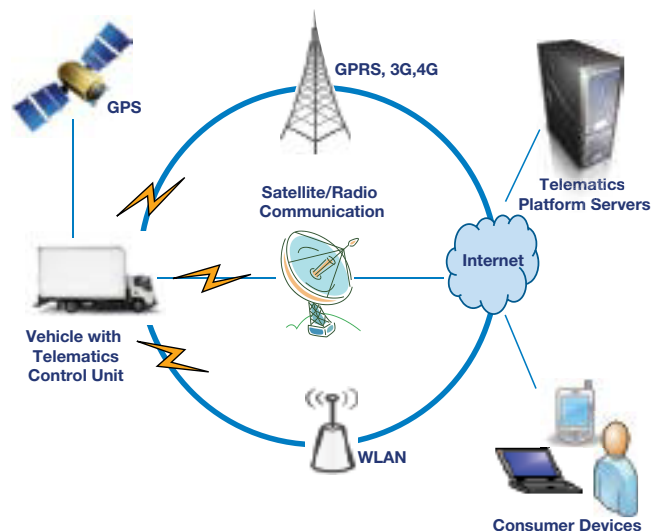
Domain	Use Cases	Business Value	Applicable For
Transportation & Logistics	• Asset tracking • Fleet management • Cargo monitoring	• Tracking assets in real time, service and warranty status. • Managing fleets, route optimization, therby improving efficiency and productivity. • Monitoring cargo for variations in temperature, pressure etc.	• Manufacturing companies • Fleet operators • Business partners
Automotive	• Vehicle diagnostics • Infotainment • Location based targeted advertising • Intelligent connected cars	• Diagnosing and troubleshooting issues remotely • Next gen navigation and location services over voice commands • Real time recommendations involving social media searches, user preferences etc • Personalized experience by having the vehicle know the driver and understand his driving patterns	• Vehicle owners • Advertisers • Consumer service providers • Insurance companies

Over time, the concept of Telematics has evolved to be associated with vehicle automation. The focus of automotive Telematics has shifted from just in-vehicle Telematics services that relied on onboard software packages (OEM proprietary), to a service based off-board approach where most computation occurs outside the vehicle over the internet. Marketing research firm, Frost & Sullivan, has bet on wide-spread Telematics deployment in proclaiming that "…in North America alone there are about 25 million commercial vehicles on the roads. Benefits such as increased productivity, reduced costs and enhanced safety and security are expected to result in over 30% of all trucks to be Telematics-enabled by 2012".

A complete Telematics system today is a collaboration of multiple technologies including Machine to Machine (M2M), Human Machine Interface (HMI), GPS, wireless (GPRS, 3G, LTE, Wi-Fi) and more. Real time vehicle data (GPS location, speed, fuel level, on-board diagnostics etc.) is captured by an onboard unit called the Telematics Control Unit (TCU) and transmitted wirelessly to servers hosting off-board Telematics services in remote locations. These Telematics solutions monitor and analyze data received from on-board units and third-party data providers (traffic data providers, for example) to generate meaningful insights and provide alerts, notifications and recommendations to stakeholders in real time. Today, such solutions (often cloud enabled) are designed as Service Delivery Platforms that can interface with enterprise systems (ERP, CRM), partner ecosystems and other third-party applications in a way that improves organizational responsiveness and reduces response time for partners and customers.

GPS

GPRS, 3G,4G

Telematics Platform Servers

Satellite/Radio Communication

Internet

Vehicle with Telematics Control Unit

WLAN

Consumer Devices

Solutions

A Real Time Enterprise Telematics solution analyzes huge amounts of data (from multiple sources) and delivers precise information to multiple stakeholders via relevant channels that enable stakeholders to take informed decisions anytime, anywhere. Integration with enterprise systems helps improve organizational responsiveness thus ensuring profitability in business. As the technology matures, there will be thousands of vehicles on the road sending data every few seconds which has to be received and processed by the Telematics platform. For example, Octo Telematics, a leading Telematics provider for automotive and motor insurance markets, receives and stores between 30-35 million positioning readings daily for more than 900,000 in-vehicle devices. This mandates the Telematics platform to have a real-time scalable architecture which can handle thousands of requests per second and be available 24x7.

The Telematics solution must have a real time nature from the following aspects,

- **Real Time Data Capture** – Vehicles transmit data (TCU, OBD, location data, cargo related data like temperature, pressure etc) in the form of data packets, every few seconds. The Telematics platform must be able to handle the large volume of data coming from thousands of vehicles.

- **Real Time Data Analysis** – Telematics platforms are required to analyze data in real time in order to provide insights.

- **Real Time Response** – Telematics platforms are required to provide recommendations and alerts to the stakeholders in real time via diverse channels.

- **Real Time Content Integration** – The Telematics platform must enable integration with enterprise systems and concerned 3rd parties to improve overall organizational responsiveness.

Real time enterprise solutions have to address important attributes of architecture like scalability, high availability and reliability as to remain responsive and updated.
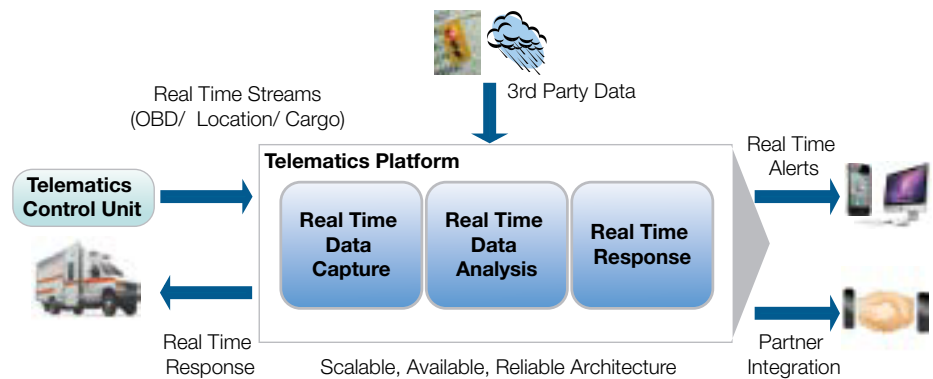
Functional Architecture

A typical Telematics Service Delivery Platform (SDP) is a composition of modules and components enabling a loosely coupled layered architecture, exposing technology neutral interfaces based on Service Oriented Architecture principles.

Interface Services expose Telematics Platform capabilities for interfacing with external systems. Business Services are categorized based on the grouping of services for specific business requirements. Integration Services allow the Telematics Platform to integrate with the hosting organization's partners that are part of the process chain. Platform Services are the core execution engines of the Telematics Platform. Enterprise Services enable the platform to integrate with the host organization's enterprise systems that benefit from the execution of an entire workflow.
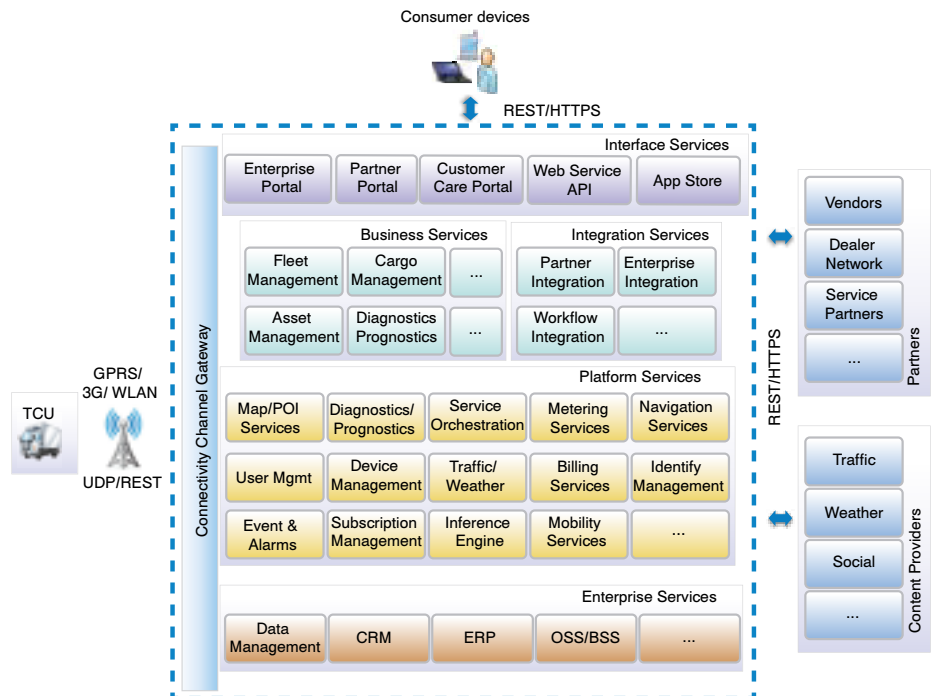
System Architecture

The system architecture is based on the recommendations of OSGi and NGTP. The Dispatcher, Service Handler, and Service Integrator blocks are as suggested in NGTP 2.0. Each component is internally composed of modularized services with technology neutral and stateless interfaces to enable loose coupling, along the lines of OSGi recommendations. The bi-directional Dispatcher receives asynchronous messages from the TCU and puts them in a message/event queue. The Dispatcher may use protocol adaptors to convert proprietary messages from legacy or other TCUs into an acceptable format. As data security is a major consideration, all communication is advised to be over HTTPS. The Service Handler processes messages from the event queue by decoding them, adding relevant customer/vehicle information and calling the appropriate service to process them. It may cache customer/vehicle information to improve performance.

The Service Integrator helps in data integration, service orchestration and enterprise integration to bring together services and data from different sources within and outside the organization. The Telematics Engine provides the core Telematics services. This includes rules based processing, big data analytics, recommendation engine, navigation and routing services etc. Apart from these there are common services like regulatory requirements as per location, security (authentication, authorization), logging, monitoring, auditing etc.

The above architecture can be referenced for deployment on either public, private clouds or custom on-premise solutions. Cloud computing is widely adopted today and offers high availability and reliability. With various proven features like messaging, queuing, alerts, automated/dynamic scaling, load balancers, real-time/batch monitoring, redundancy across regions and enhanced security
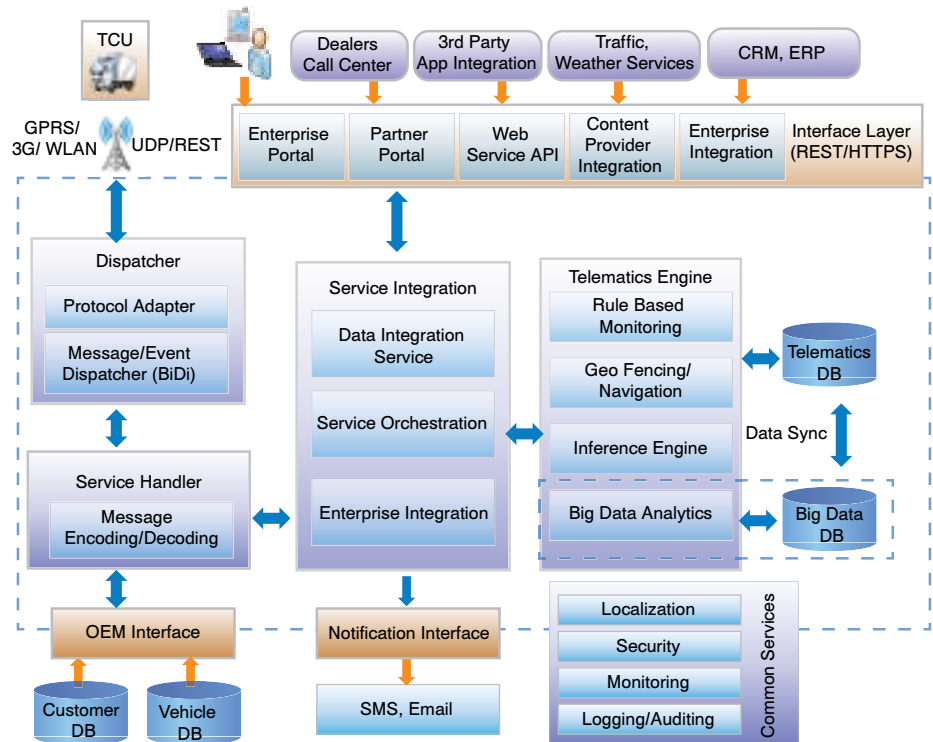
features, the cloud is an ideal choice for implementing the Telematics Enterprise Platform. But, when concerns around security, compliance and other specific requirements tend to weigh against deploying the solution on public clouds, the same features can be implemented on-premise too.

Challenges

Some of the key challenges are listed below,

- **Lack of standards** – There is no standard format for data transfer between vehicles and the Telematics platform. Even though standards like AEMP, NGTP etc exist, there is lack of industry wide acceptance. The Telematics platform has to provide adapters in order to support vehicles from different OEMs.

- **Data security** – Security concerns may deter adoption of public cloud infrastructure to store and maintain Telematics data.

- **Real-time Integration** – Overall solution responsiveness is often based on response of integrated enterprise

systems and content providers.

- **Unformed Market** – Despite vehicle OEMs competing to invent around telematics solution offerings, customers are often slow to appreciate advancements. Also, the inability of partners, content providers and OEM partners to keep up with demands of solution advancements, is a problem.

Success factors

The solution is based on modern open telematics standards like NGTP to enable the solution to be flexible to integration with diversified service sources.

- It encourages infrastructure elasticity and optimization based on market needs by encouraging componentized modules, technology neutral and stateless services (and thus cloud adoption).

- It supports multiple channels of interaction and information delivery (PCs, tablets, smartphones, SMS, email etc.)

- It considers adoption across geographies based on localized regulatory and security requirements.

Benefits and Best practices

Open standard based solution prevents lock-in to proprietary data formats and third party services thus providing options for alternatives based on economics and quality considerations.

- Adopting the cloud lowers upfront CAPEX and OPEX costs and enables to maintain the same level of business agility and responsiveness in times of infrastructure demands during variations in business needs (or on-field requirements like number of vehicles, messages etc.)

- Protocol & data adapters enable the Telematics solution to support a mixed fleet containing TCUs that follow diverse or legacy messaging protocols thus enabling fleet owners to easily adopt the solution.

- By combining inputs from various channels (vehicle OBD, location services, traffic updates, and weather updates) and analyzing them in real time using Big Data analysis, it is possible to provide instant recommendations to fleet managers so that they are immediately alerted in case some action has to be taken. By providing real time alerts and notifications on multiple end point channels, stake holders are empowered with information anytime, anywhere – thus allowing organizations to remain responsive and competitive.

- As fleet management is real time, it will enable customers to improve utilization of their vehicles.

Retail Promotion Optimization

The Retail Industry is highly competitive, customers are more aware, more demanding and more technology savvy. Today the customer is looking for more value for money while shopping.

In such a competitive and challenging environment it becomes important for retailers to have business agility, to sell products over multiple channels, ability to come up with right promotions and discount strategies and deliver them quickly, yet efficiently. To attract and retain customers they are not just giving simple discounts (like % off or $ off) but are becoming more innovative. They are coming up with a variety of promotions and offers like Multi –Level Promotions, Cross-sell or Up-sell Promotions, Channel-specific Promotions and Tender-specific Promotions

Most of the leading retailers, across the globe, have systems to manage and apply promotions. However, such systems may not be able to provide the agility that the business needs in modern era.

But at the same time most of CIOs/CTOs are trying to find to answers for questions like "Should I build or buy?" or what will be the ROI? Or will the system be scalable, flexible and so on. The proposed Multi-channel Promotion Platform tries to address these concerns. With in-built intelligence, multi-channel support, variety of promotion types and flexible platform it provides end-to-end solution to manage promotions in real time.

Nature of RTE Solutions

The RTE multi-channel promotion platform provides a complete end-to-end real-time enterprise solution for creating, managing and 'optimizing' promotions on multiple channels anytime across the globe. The various channels used for order capturing include retail stores, Websites, Mobile Applications, Catalogues, Click 'N' Collect, PoS, Kiosks, Interactive TV, In-Store Displays and Call Center.Lower cost of ownership and faster time to market are the two key benefits that the retailers can expect. Another major advantage for the retailer is the agility that they get.

The solution allows retailers to create a variety of promotions as mentioned below.

- Amount-off , Percent-off, Net Price on Items or on Net Transaction Value
- Multi –Level Promotions.
- Cross-sell or Up-sell Promotions
- Channel-specific promotions
- Tender-specific promotions
- Customer segment-specific promotions (gender/age/profession)
- Geography-specific promotions
- Single use or multiple use Promo Codes.
- Time-bound promotions (example: Happy hours) useful for perishable items.
- Promotions on particular day of a week to drive sales
- Online / Email / Mobile coupons or Discount vouchers

The Multi-channel promotion platform will be delivered as SaaS (Software as a Service) product over the cloud for scalability, availability and reliability as well as on-premise as an enterprise solution. Retailer would have an option to choose the promotions they want to use from the above and pay accordingly. There would different payment plan from which Retailer can choose the best suitable for them. Retailer would also have an option to buy the entire solution for their on-premise Deployment and private use.

The RTE multi-channel promotion solution would comprise of the following core components:

- Set of consumable and secured 'Services' (SOAP / RESTful Web-Services)
- Accessible through multiple channels
- Set of online portals for the users to perform necessary actions like creating / managing of promotions, administration.
- Variety of Analytics tools to choose from.
- Set of adapters for quick integrations
- Inbuilt Support for Internationalization
- Support to help integrate, customize as per customer needs.

The complete solution would be a collection of multiple integrated modules / components that would work in tandem to deliver the end result.

The components can be categorized into following three modules:

Applications: These will be a collection of Web /Mobile applications that can be used for administrative, managerial and tasks to manage promotions and system configuration. There will be administrator application, billing application, reporting tool, dashboard and a Promotion Management tool. Promotion management tool will be used primarily by the business users to create, and manage promotions. Only authenticated and authorized users would be able to use these applications.

System Administrators
Support staff
Managers/Employees

Customers

Admin/support Interfaces

Multi-channel Customer Touchpoints

Utility / Convenience Apps

Account / Profile Management	Dashboard
Billing	ReportingTool
Customer Care Portal	Administration Tool
Self Care Portal	Help & e-Learning Portal

Core Modules

Promotion Tool

Promotion Optimization Engine (POE)
- POE
- Profit logic
- Intelligence Engine

Promo Web Services
- PromoDetails
- Validate
- Calculate

Promotion Store

Calculation Engine

Integration Modules

In Bound Adapter
- Item
- Sales
- Inventory
- Price
- Security

Out Bound Adapter
- Promo Data
- Promo Codes
- Reports
- Campaigns

Upload / Download tools

Database

Core Modules: The core modules would include the services and components which would be responsible to apply the approved promotions and calculate discounts in real time manner. The request to calculate discount may come from any channel. The client would invoke the secured web-services to perform discount calculation. The client would provide the SKU, Quantity, price and promo code (if present) as input for the discount calculations.

- **Promotion Optimization Engine:** The core module would also contain Promotion Optimization Engine (POE) an optional feature. This will take Sales history, inventory and price as input to suggest the optimal discounts. The engine will also provide a variety of products and algorithms for customer

to select from and customer will also have the flexibility to switch from one to another. The system will also allow the customer to configure/setup their own algorithms or standards.

- **Intelligence Engine:** The Intelligence Engine would be self-triggered Decision Support System (DSS) component which drives on the set of business rules and decides in proposing priorities for different promotions, channels, promotion types, predicative metrics, etc. so that decision makers and business users can decide quickly. The component will also provide the intelligent reporting and alerts/triggers/reminders for various decision making activities and processes.

Integration Modules: Promotion and discount management system is an integral part of checkout functionality. And it needs to have access to organization data related to its item hierarchy, item master, pricing, promotions, etc. The solution comes with a set of services and adapters which would help in seamless integration with IT infrastructure, which could make use of a variety of platforms, technologies and tools. Retailers could choose the one which suits them best.

Apart from these there would be some utility components like email module, help and training module, self-care and customer care modules. With all these modules and components the multi-channel promotion platform provides complete end-to-end solution to manage Promotions and discounts for any Retailer.

System Architecture

The multi-channel promotion platform can be conceptualized as having a Multi-layered and Service-oriented architecture consisting of the Presentation Layer (Channels), Business Services Layer (Core platform services and Platform foundation services), Integration Layer (Inbound/ Outbound Adapters), Cross-cutting Components (System Management) and Database Layer. In addition to these there would be channel interfaces, partner services, integration services, etc. All the layers and services would be loosely coupled.

System mgmt.

- Security
- Monitoring
- i18n
- Logging
- Multi Currency
- Exception Handling

Channels (Web, Mobile, Etc.)

- Presentation Layer (View)
- Business Controllers
- Business Service
- Persistence Layer

Services

- Facade | Decorations
- Business Service
- Persistence Layer

Engine

- Business Service
- Persistence Layer

Out Bound Adapter

- Adapters (DL Messaging Web Service Legacy)
- Decorators
- Consolidator
- Business Service
- Proxy layer

In Bound Adapter

- Messaging Adapter | Legacy Adapter
- Messaging Adapter | web-Service Adapter
- Consolidator
- Business Service
- Proxy layer

Platform Foundation

| Foundational Service | Utility Service | Persistence layer | i18n Framework |

Core Platform (Services)

| Security | Encryption | Configuration | Admin | Muilt-Tenancy |
| Provisioning | Time based Billing | Transaction Based Billing | Licensing | Feature Enablement |

Data base

Customers | Items | Billing | User/Roles | CRM | Promotions | Reference | Miscellaneous

Challenges

- Choice of technologies and platforms which are scalable and provide high performance, high throughput with high availability is the first challenge in implementing such business critical solution.

- Apart from this, ensuring security/ privacy of customer data should be of utmost concern in this solution's implementation. In a scenario wherein customer information crosses enterprise boundary, especially when cloud platform is leveraged by IT systems, adequate security measures need to be built into the solution.

- Multi-channel promotion platform is based on a multi-tenant architecture with due focus on isolation of data. However, regular audits and other steps in-accordance with local laws need to be taken to ensure compliance. More over this kind of multi-tenant system needs to be smart enough to work in scenario where different billing plans, without impacting the performance.
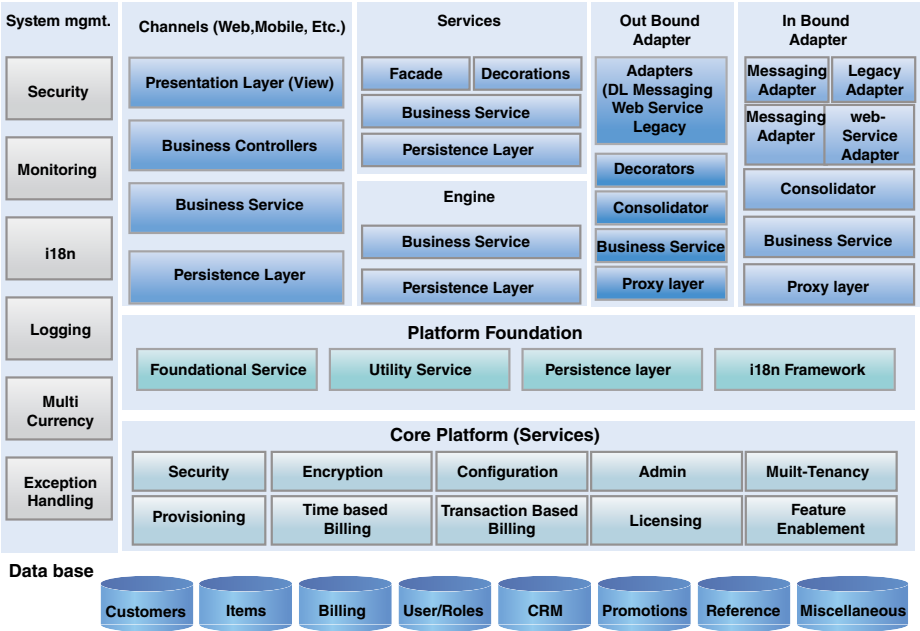
- Dealing with diverse and non-uniform data (related to items, sales, inventory) as maintained by different retailers would be another challenge. To make the system highly configurable, with flexible adapters to work with heterogeneous platforms and technologies would add to the complexity.

Success factors

As retailers are looking for ways to reduce cost, the ability to provide lower cost of ownership provided by the solution would be an important factor. Analytics provided by the solution is the USP and hence its efficiency would be a key factor. Retailers should be able to see increase in sales because of data provided by analytics, reports and optimum promotions as suggested by Promotion Optimization Engine. The benefit should be clearly reflected in the dollar value in terms of cost savings and increase in sales because of better promotion management across channels and geographies.

Another key aspect for the success of this solution is its adaptability. Some kind of solutions may already exist in retailers today. The ease with which retailers and business users could switch from legacy systems to this solution would become important.

The IT management on the other hand would look for the ease of integration of the solution with their existing infrastructure without much of the effort and investment.

Benefits

Business agility, flexibility, scalability, faster time to market, access to best in class analytical ability, scope for customization and lower cost of ownership are some of the key benefits that retailer should be able to realize from this solution.

Location Aware Field Service

Telecom industry has to introduce multiple changes in recent times due to increase in digital consumers and also face the economic down turn globally at the same time. It became a prime necessity to introduce new capabilities in the areas which can impact the consumers and enterprises at large scale. Increase in digitization means that consumers are looking for more bandwidth, speed, reliability in the delivery of information and better customer service.

Digital Customers today expect a very customized, localized, contextual and faster response to any service request raised by them.Location Intelligence of both the Customer and the Service personnel will help business to provide the optimized and efficient service to the subscriber and at the same time manage the field personnel dispatching dynamically. Location Based Services is very popular today in the areas of navigation, travel, campaigns, offer, etc.

Key aspect of making it popular is the fact that location of a person or an asset can be retrieved at real time today and the same factor when applied to a field force management; it becomes a visual dashboard for the administrators or managers to look at geographic map and monitor the service operations. It improves the decision making capability of the management.

Nature of RTE Solution

Telco can use the LBS to mobilize the Field Force deployed for servicing different clients. By using the location of service engineer, next set of tasks can be smartly allocated. Also the time taken to service the tickets can be more accurate and monitored closely. Service Engineer can also look for the assistance in the vicinity if needed.

Field Service Support and Smart Scheduling

Above diagram explains how Location Intelligence helps the service delivery process. There are 3 key entities which participate in servicing the customer. They are Service Administrator, Service Personnel and Customer.

Service Administrator

- Service Administrator looks at the list of the Service Requests on the Map which are shown based on the location from where the request is generated.

- List of Field Service Representatives along with their most recent location are also shown on the Map.

- Service Administrator Assigns the request based on the proximity and availability of the service personnel.

This step can be further automated depending on the business rules.

Service Personnel

- Service personnel receive the alert for the request assigned to him manually or through automation.

- Any collateral such as customer info, product info, etc. needed are also pushed to his device.

- Service personnel start time and end time is logged using his location based on his entry and exit from the service area.

- If for any reason, he finds it difficult or needs assistance to resolve the issue, he can look for the co-personnel in the vicinity on his map and call for help.
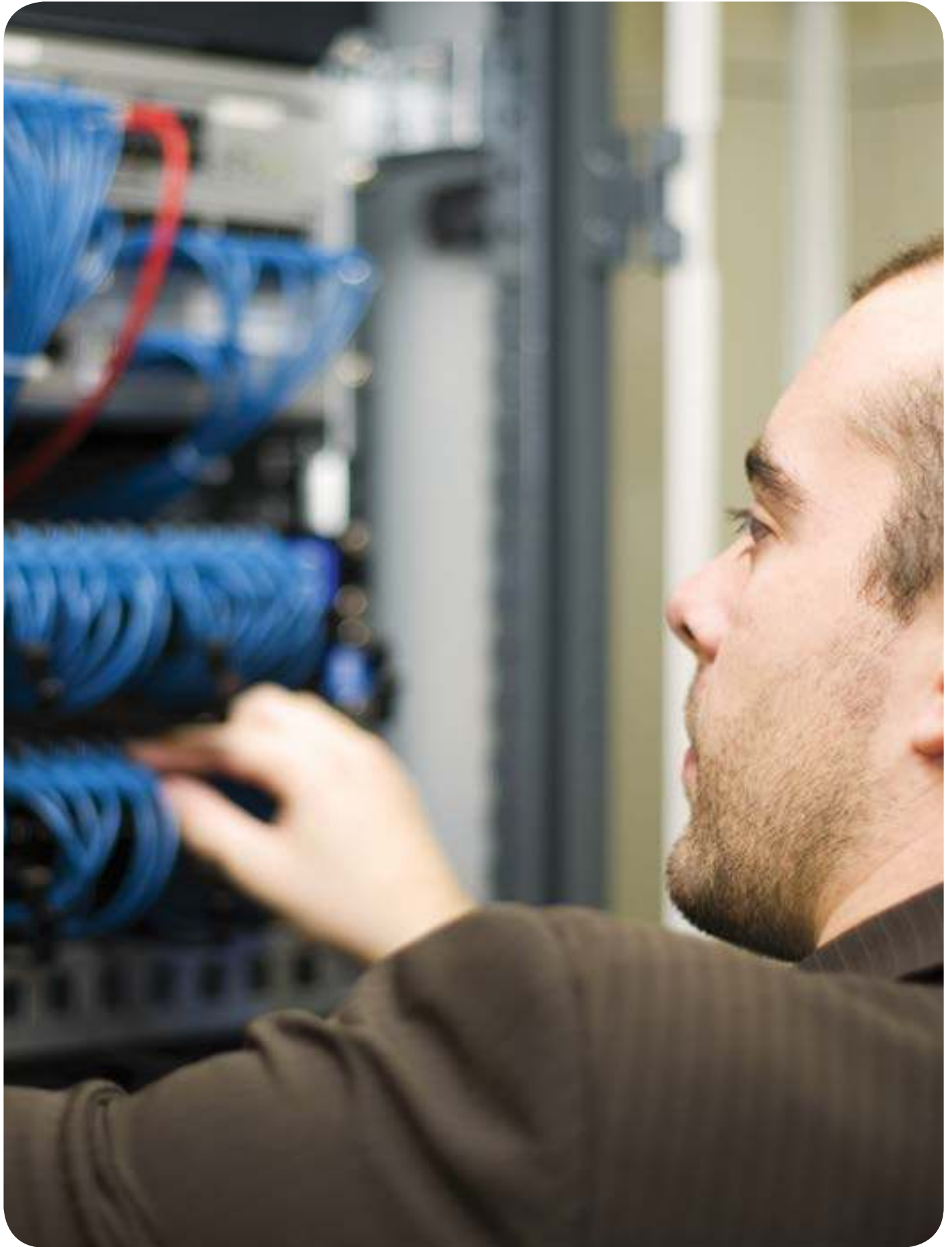
Customer

- Customer makes a request through web, mobile or a phone. Location of the customer gets registered in the request.

- Customer gets the timely service for the complaints.

- This solution can be further combined with the IVR solution in which a call center gets the visual representation of the caller on the geo map. It provides the ability to give a personalized and localized service to the caller.

Solution
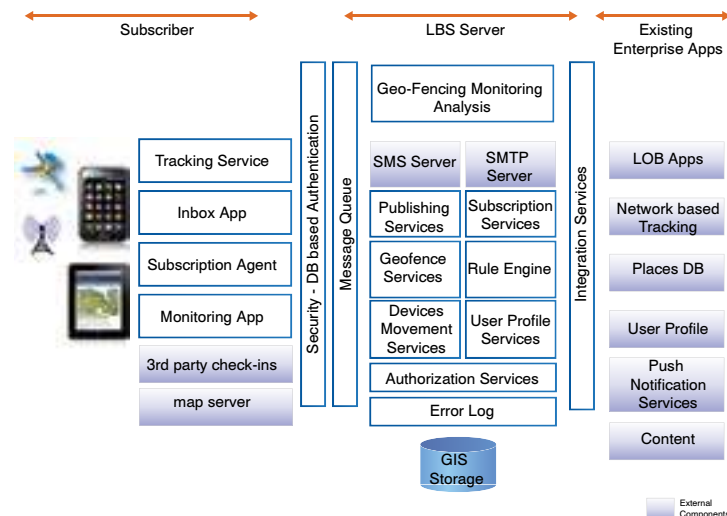
Key components to be considered for deploying location based services to the field engineers

Components	Features
Geo-Fencing and POI	Ability to define the custom geo-fence of different shapes like circle, polygon, line. Ability to associate POIs in the geo-fences
Tracking	Ability to track the user or an object. Different modes of tracking using A-GPS, Cell-Id, Wi-Fi, Bluetooth, etc.
Publishing Engine	Ability to define the publishing rules for a given geo-fence/POI and the user profile Ability to schedule the rules as per business requirements. Support different channels of publishing such as SMS, Email, Notification, etc.
Subscription Model	Ability for the user to subscribe for a specific geo-fence or POI or an object within a geo-fence
User Experience	Ability to provide end user application on multiple platforms.
Privacy Regulations	Take the user consent for tracking. Let the user define scope of tracking, for example in a fence, for POI or a specific time period. User can also control when to start and stop tracking.
Integration with LOB applications	Build the plug and play components so that not all are needed to be deployed. Expose services for the components. Provide integration through both message queue and services.
Multi-tenancy	Same platform can be shared by different merchants. Each should be able to define its own geo-fence, publishing rules, content, tracking modes, etc.

Key success factors

Some of the key factors that will define success of LBS for a Telco Provider

- Cost-Efficiency in managing the Field Force.

- Scalability in providing the re-use of the LBS platform for multiple purposes like Emergency Services, Fleet Tracking Services, etc.

- Ease of integration with existing business applications

- Increase in Ability to broker relationship with multiple vendors and bring them onboard to provide value added services to subscribers

- Flexibility in adapting to new business models and provide the same infrastructure to cater to the needs of the location as a service.

Business Value

- Enhance customer engagement and customer experience.

- Enable employees to be more productive, responsive and engaged.

- Improve Service quality

- Optimize workforce and get real-time tracking information.

- Reduction in the time wastage between the calls.

- Improve the visibility and forecast.

Challenges

- Privacy Issues: "Tracking & Tracing" is the key aspect of delivering a location based service to the user. The immense potential of using geo-location to provide the value added services, gather business analytics, do market segmentation, etc. is causing flurry of LBS services being launched in the market. Along with all the value provided by LBS, there are lots of privacy concerns around its usage. The fact that user movements can be tracked by someone is raising lot of privacy concerns among the people in different segments. There are many regulations coming into place at the state level which requires special considerations to be given to the "Location" attribute of a person. For better acceptability and establishing trust with the consumer of the services, privacy controls availability are the key to success of any location based services.

- Location Precision Requirements: Depending on the business use-case, precision of finding the location of the user can vary from 1 m to 100 m. In case of indoors, accuracy level needed is very high and will require use of additional hardware inside the building to provide high precision. Success of the LBS Service will depend on how precisely it can calculate the location

- Real Time positioning and publishing: Location Based Services typically will involve huge volume of subscribers and tracking them in millions with real time information will be a challenge. At the same time, the relevant information should also be published instantly.

Patient Centric Health Care

Patient centric mobile health care solutions are intended to remotely monitor the patient and provide patient data to relevant stake holders in healthcare ecosystem. This patient data collected and distributed by mobile application can make the entire healthcare ecosystem more efficient and productive. In addition to remote patient care it is also cost effective for the patient. After device implant is done for remote monitoring, the frequency of follow-up visits to the hospital may be reduced as doctor can view patient data remotely between visits.

The mobile patient care solution can automatically initiate data transfer based on predefined alert/event conditions and at intervals as determined by the physician.

The event driven mechanism reduces the risk involved in remote patient monitoring as the doctor can respond to alerts in a timely manner. Patient centric mobile applications send alerts to doctor and also streams data to a central repository from where the data is processed and sent to relevant stakeholders.

Nature of RTE Mobile Solutions

Let us start the discussion with implantable devices that collect patient data. The patient requiring these kinds of implants are mostly old people who need continuous monitoring at reduced cost. Every physical visit is costly as compared with home monitoring. In Mobile Home Monitoring Solution, the implant device

sends data to the Patient Health Care Assistant application, which is running on the mobile and can be carried by the patient to wherever he/she goes. The mobile also serves as a framework for communication between the patient and the health care professional.

This way the health care professional will be able to send feedback and health tips to the patient and the patient can call up the pharmacy or doctor to get updates on health status and prescription drugs. Transmission mechanisms like Bluetooth can be used for data exchange between implant and mobile device. The data from mobile device is then securely transmitted to data servers where the information is processed and published.
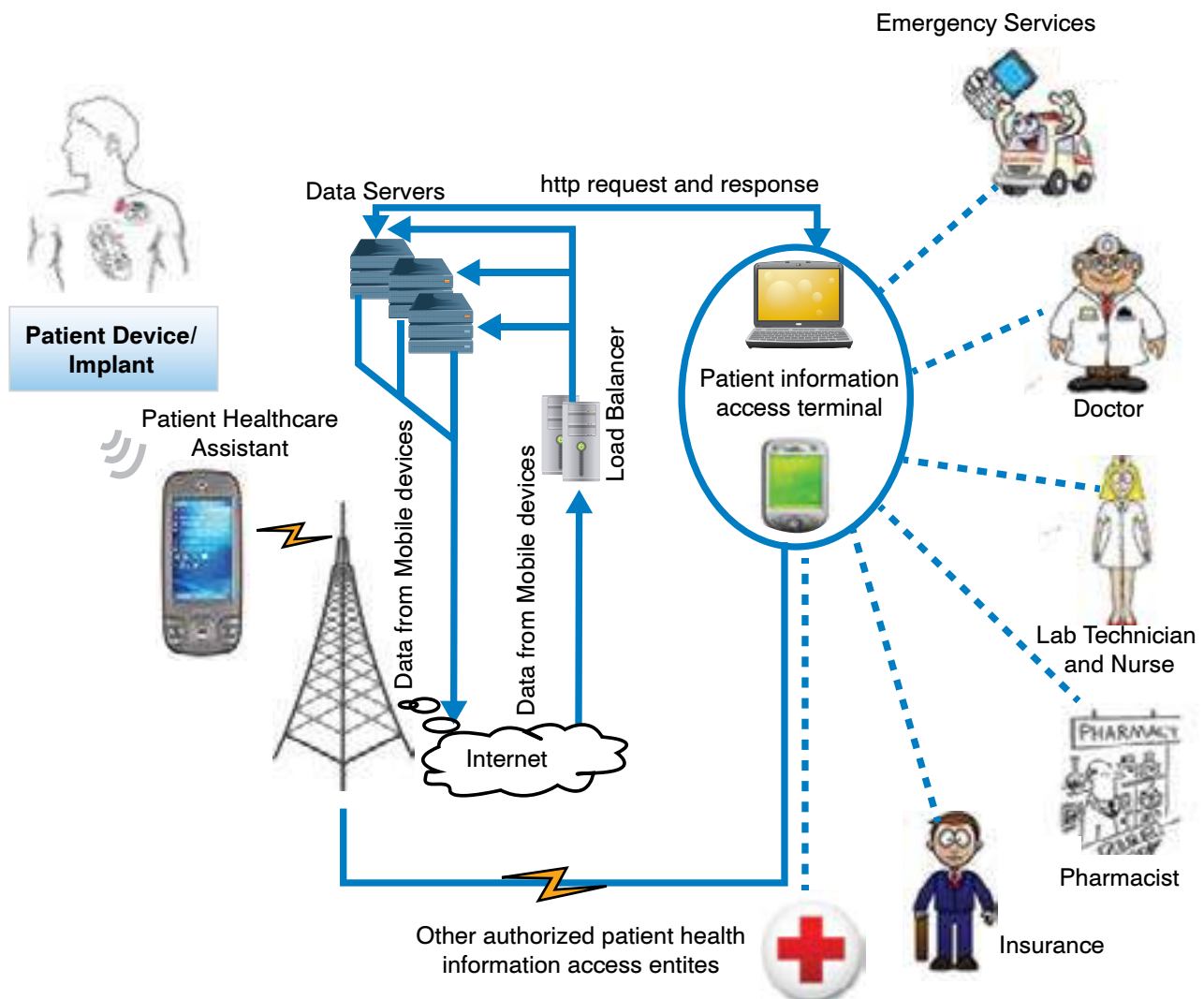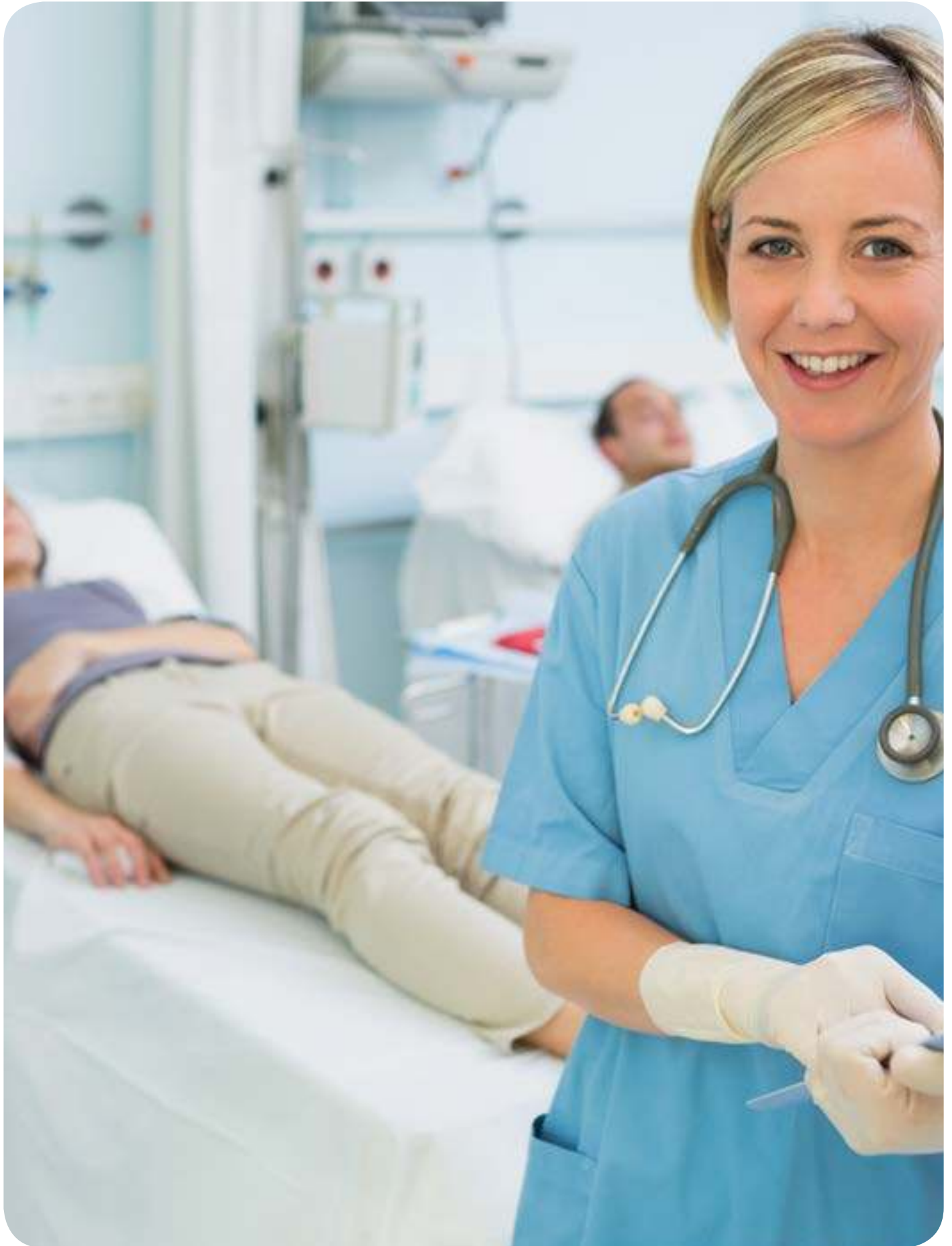
Different health care professionals get different view of the patient data based on their roles and access permissions. Doctors can subscribe for viewing the patient data on his/her smart phone and getting notifications when the attributes in the data have specific value or crosses a predefined threshold. This functionality can be offered as a solution that can be seen by the doctor on smart phones. The healthcare app on patient's handset can alert emergency services in getting an ambulance during emergency and messaging the nearest hospital to be prepared to handle the emergency.

The patient healthcare app can also be designed to sync with lab services in getting results of the check-up done on the patient during last hospital/lab visit. It can also send vital information to the nurse log book to schedule and plan next visit. The mobile application can send prescription information to pharmacist and also collect alerts when it is ready for pick-up.

These mobile applications can also share vital data to insurance companies to validate the check-ups performed on the patients at the hospital. Thus it can be seen that patient centric mobile applications can make a big difference in making the entire healthcare ecosystem more efficient.

Business Value and Technology benefits

Home monitoring solutions are evolving rapidly with new capabilities introduced to better serve the patients. The main issue with home monitoring is the assumption that the doctor will be able to view the patient information at the right time to take a corrective action. With mobile home monitoring solution, the health risk is reduced with 24/7 monitoring. This improves the health care offered to the patient and reduces the effort of the doctor who is assured to get inputs from the event engine when an alarm able situation is observed. The logical evolution of home monitoring has shown a shift from the patient initiating data transfer from home monitoring device, to the device automatically sending data to server at regular intervals. The data collected is also distributed for best utilization of data and reducing cycle time. Also intelligent event driven apps will be lifesaving, in addition to offering higher process efficiency across healthcare ecosystem.

Challenges

The heart of the next generation of patient care mobile apps is the event driven engine that has the processing and action handling logic for working on the patient data and deciding what action to take when a specific event occurs. This event engine resides in the backend server. Events are identified from the patient health data sent from mobile device and fed to the event driven engine. The event engine processes the events and identifies actions to be performed.
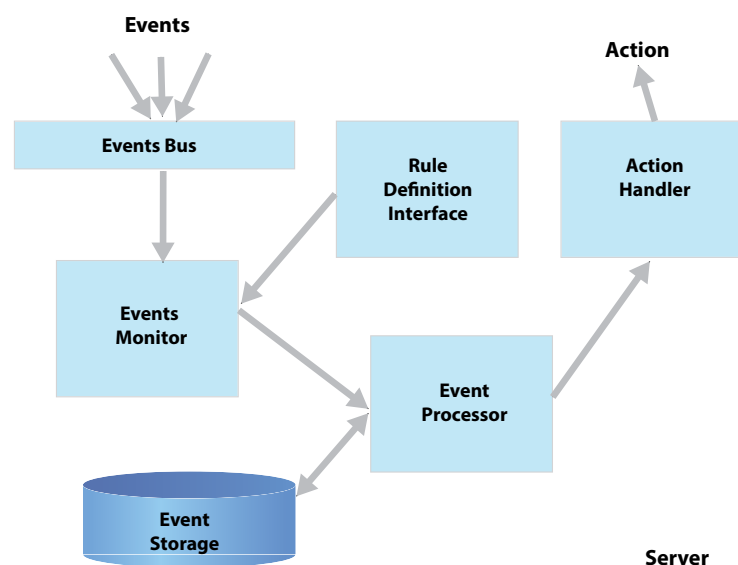
Implementing Intelligence in patient centric mobile applications

The solution for event handling consists of the following components:

- **Event Bus:** The Information Management(IM) Server receives events from multiple IM clients. Use of an event bus as a collection framework for events is to leverage the advantages of Service Oriented Architecture based setup, where events can be handled

without dependency on the event formats.

- **Event Monitor:** The event monitor looks out for specific event headers/identifiers based on external rule definition. When an event of concern is identified on the Event bus by matching with a rule criterion, the event is sent to the processor.

- **Rule definition interface:** Monitoring of specific events can be defined in the

xml interface. This module provides input to the event monitor which will capture the event whenever it occurs.

- **Event Processor:** For the events forwarded to the processor by the event monitor, if the rule being matched needs more logs/events to do processing, then the event is stored in the event storage. If the event needs an action that requires dynamic decision making then the required processing

is performed by event handler and parameters required for triggering a specific action is given to the action handler.

- **Event Storage:** For simple event processing the event processor can directly work on the data in the event. For stream and complex event processing, event storage component would be useful as a repository that can be referenced in matching and taking decisions that spans over multiple events occurring at different intervals of time.

- **Action Handler:** The action handler in event driven engine can handle different types of rules and the processing algorithm can be different based on the parameter the doctor wants to manage.

Best practices

The best practice would be to ensure that the right scenarios are selected for event handling and messaging across heath care ecosystem. Few use cases are discussed to show the need for event handling in patient centric mobile applications.

- **Predictive behavior on possibility of organ failure:** After device implant, the mobile device collects valuable data about the functioning of specific organ in the patient. This information is sent to the doctor who checks his patient's health data. The doctor will not be able to continuously monitor the data and in most cases the data might be viewed over a period of few days to a week or more based on the medical history of the patient. This leaves a major gap that issues occur between the time intervals of the doctor checking the results, may not be taken care properly.

- **Possibility of device failure to address medical condition:** Implant devices do not always function well. The monitoring system does provide data on the effectiveness of implant;

however it does not ensure that the doctor gets to check the information at the right time. It is quite impossible for the doctor to check the value of a monitoring attribute of one of the patient continuously as this will hinder him from working on anything else. Event driven engine work on predefined rules to create reports on device performance and notify the doctor when any deviations or threshold cross occurs. This helps to give timely care to the patient and alert emergency services if required.

The use cases are handled on a generic basis and there can be multiple scenarios that can be derived based on the stakeholder in healthcare industry that would use the specific data from patient centric mobile application.

Real Time Settlements

The post trade clearing and settlements form one of the most complex batch systems in the capital market world. The present day clearing and settlement takes about 3 days in US and 2 days in India. These SLAs are fixed due to both business and technology reasons. However the benefits are not equal to all the parties due to the trade-off between time-to-market and cost and that forms the driver for the solution explained. As a first step, let us look at existing post-trade processing. The present day post-trade clearing and settlement process goes through a standard process, specific to a country and has many players. The high-level view of overall process is described in figure below. This is for rolling settlements only.

The post-trade processing takes 2-3 days because of both business and technology drivers. Therefore a combination of business renovation and technical solution is needed to address this.
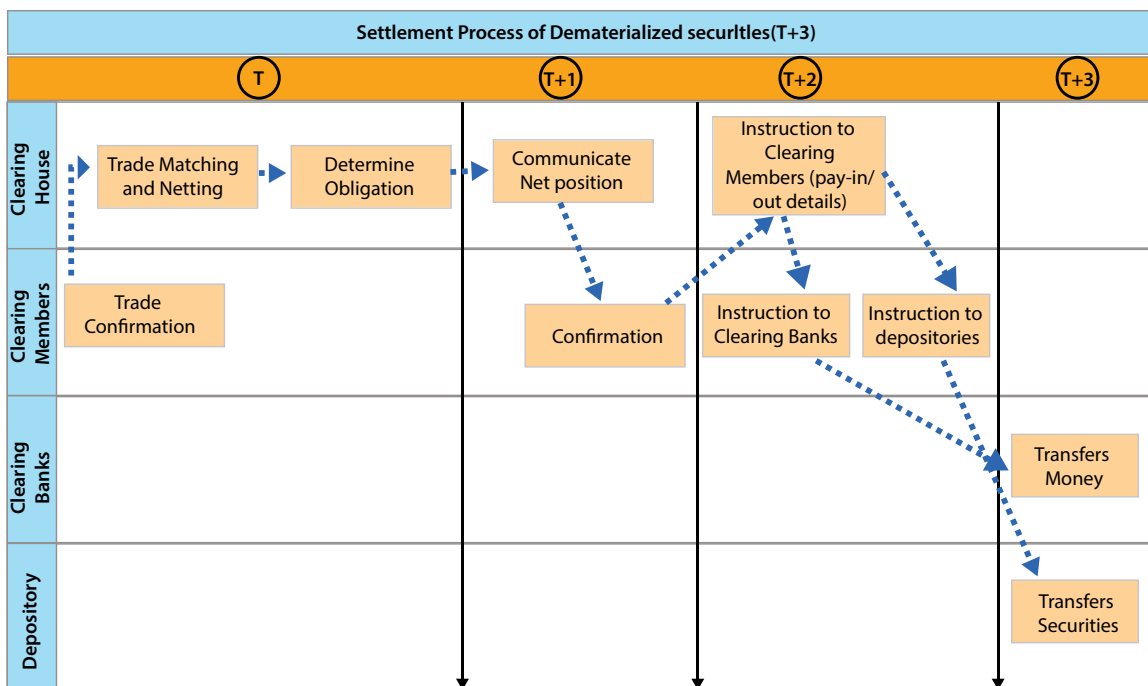

The table below describes the drivers for the solution and how the solution addresses them.

Drivers	How to Address
Trade confirmations happen as end of day batch. The reason here is to enable more netting, which will reduce brokerage fee. On the other hand, more frequent netting implies more real-time, but higher brokerage costs	It is better to have multiple SLAs support so that all scenarios can be supported.
Complexity of netting calculations affect scalability	Bilateral netting with the concept of hierarchy of Clearing participants with regular brokers coming as part of Custodians and smaller custodians coming via larger Custodians
Disparate systems in each organization makes the entire process to work like 2-phase commit with clearing house acting as transaction manager	A multi-tenant SAAS module for each Custodian and Clearing House functions ensures uniformity
Brokers are not liable to act on obligations in a timely manner	Brokers now come via custodians
Clearing House functionality	Clearing House is automated and distributed to many custodians
Clearing House	This organization ensures that all trade settlements are met and addresses the obligations and risks.

Thus the post-trade processing is one of the areas where Real-time Enterprise solutions can be applied. The focus of this implementation is to present the future state view of Trade and Settlement process by reducing the SLA to same day (end of day) adopting Real-time Enterprises concepts.
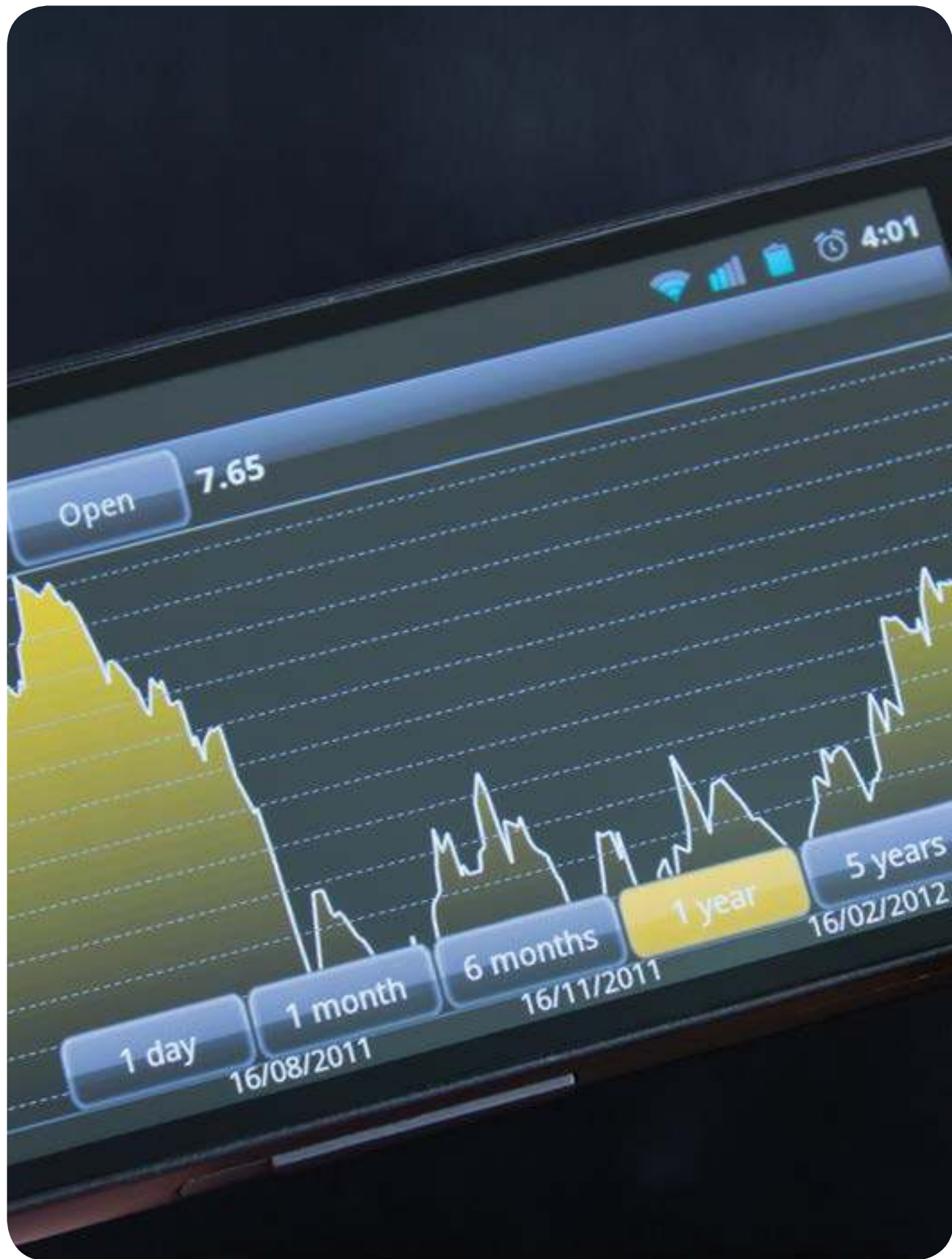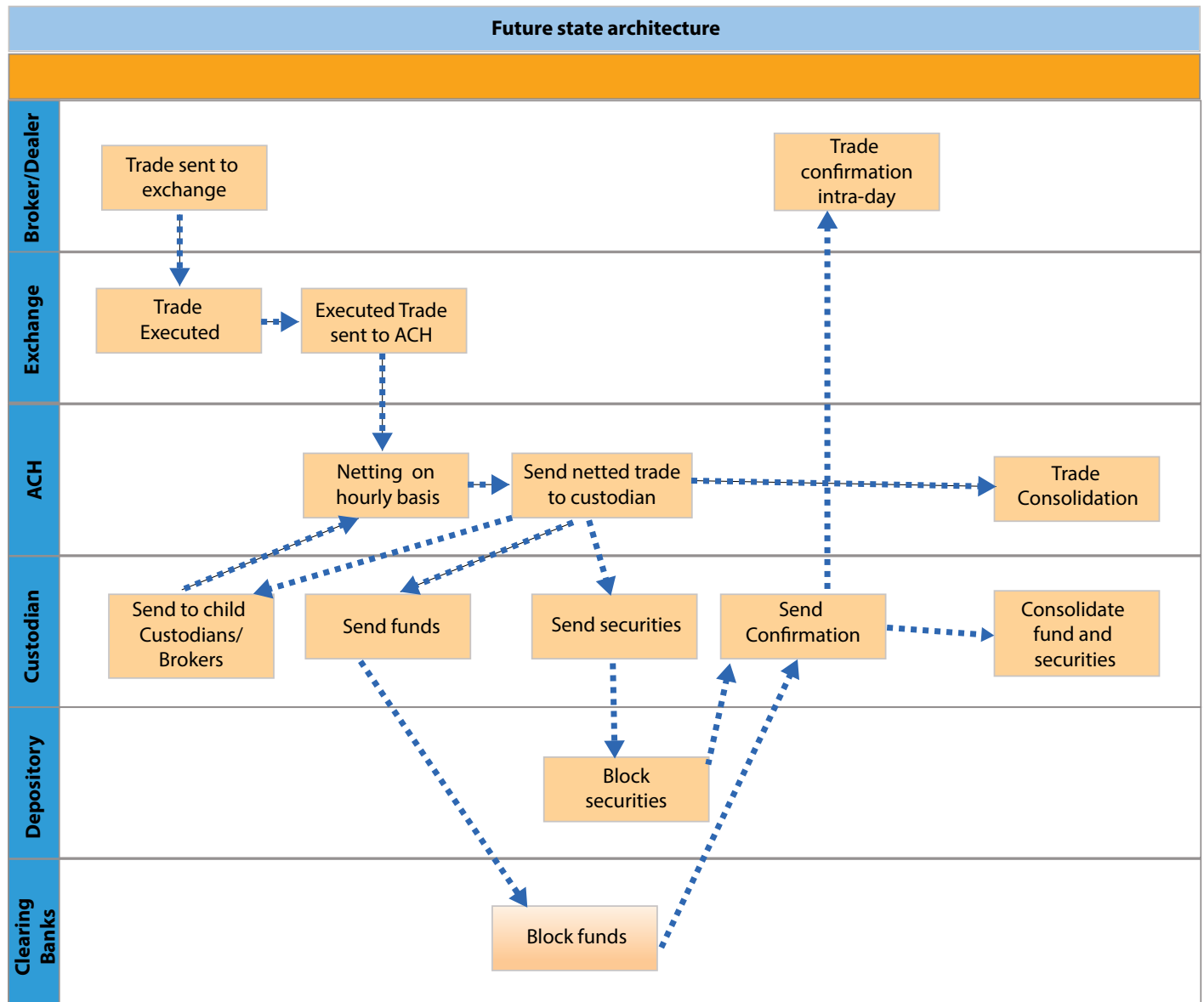
Nature of RTE solutions

The RTE part of the solution for post-trade processing involves making the entire post-trade clearing and settlement as a Business process as a Service which every custodian will use. The RTE solution also exposes integration components for depository services as well as Clearing Bank. In addition, netting is accomplished using Big Data implementations. Therefore in the RTE solution:
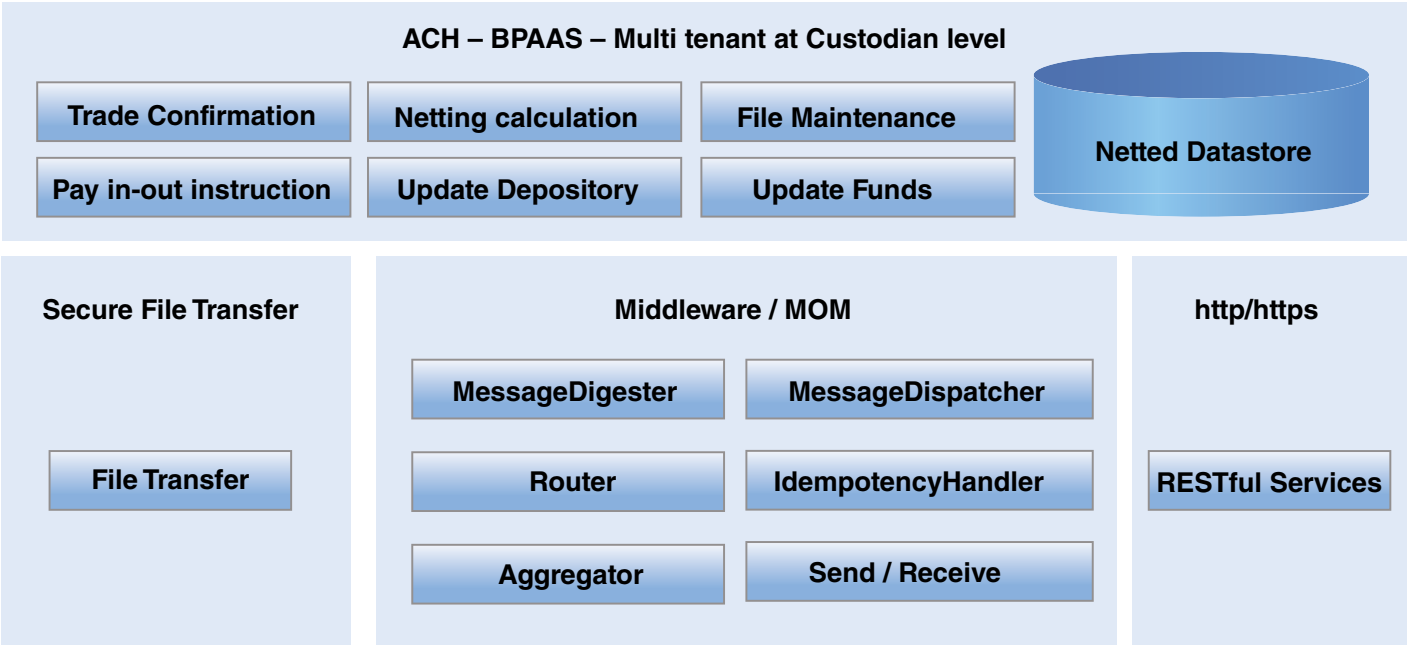
- The clearing house and clearing participant functionality automated.

- The netting confirmation happens hourly.

- The clearing participant has a hierarchy.

- The entire process is orchestrated as a Business Process as Service.

The proposed functional view of intra-day trade confirmation is as given below:

Future state architecture

Broker/Dealer	Trade sent to exchange				Trade confirmation intra-day		
Exchange		Trade Executed	Executed Trade sent to ACH				
ACH			Netting on hourly basis	Send netted trade to custodian			Trade Consolidation
Custodian	Send to child Custodians/ Brokers	Send funds	Send securities	Send Confirmation			Consolidate fund and securities
Depository			Block securities				
Clearing Banks		Block funds					

The conceptual technical solution is as below:

ACH – BPAAS – Multi tenant at Custodian level

- Trade Confirmation
- Netting calculation
- File Maintenance
- Pay in-out instruction
- Update Depository
- Update Funds

Netted Datastore

Secure File Transfer

- File Transfer

Middleware / MOM

- MessageDigester
- MessageDispatcher
- Router
- IdempotencyHandler
- Aggregator
- Send / Receive

http/https

- RESTful Services

The exchange sends the executed trade details to Automated Clearing House via a durable message using an asynchronous request-reply pattern. The data is continuously netted and on hourly basis, data is moved to the netted data store. The netted data then is transferred to the depository service and clearing bank respectively using Secure File Transfer. The netted data store ideally can be a columnar database.

Benefits

The solution has varied benefits for different parties.

Custodians: The custodians are biggest beneficiaries of this. They are poised to have the biggest say in the proceedings in exchange and also their business is poised to grow from the following

- Once trade cycle is reduced, more trade could happen which increases brokerage fees.

- Custodians can act as Clearing Houses for regular brokers, so a minimum charge can be applied.

Clearing House: The Clearing House has been setup to mitigate risks and ensure obligations. To that effect, this will be a

separate party. Custodians already take care of risks associated with clearing bank and depository services. The benefits derived for clearing house are

- Reduction in risk

- Better tracking with clear separation of responsibilities

Entity

The trade happens faster so the entities have more opportunities to perform trade. More trade implies more movements and therefore overall better for economy.

View Point

Natalie Scopelitis
Global Head of Consumer Online at Vodafone

Natalie has rich experience in Online Technology, end to end Customer Experience and web usability.

Natalie, can you briefly tell us about Vodafone Online - Scale & Complexity?

Vodafone Group Online has a presence in 19 different markets worldwide. Our group creates, delivers and supports common Online components across these markets.

This is a large and complex operation – we have to take into account that we have multiple hosting models (some local and some central & SaaS) and we are supporting numerous versions of software across the markets. There is a high degree of integration complexity with each market having different software stacks.

Apart from the various software deployments across the markets we also offer a highly specialised Online Optimisation service and also have an invention process through which we trial cutting edge technologies and new products.

Today's Digital Consumer expects a "fast" experience. How does Vodafone address these business challenges and opportunities?

For us, "fast" manifests itself in two ways:

Customers expect a "fast" user experience. We have an in-house User Experience team. Our focus is on the speed of the end-to-end user experience – not just the web experience. We run real user testing through our labs that allow us to gain valuable customer insights. Our Website Optimisation team works across all the Vodafone market websites to achieve a

page load average performance of up to 5 seconds.

The second aspect of "fast" that is important for us is our time-to-market. We deliver our solutions by building "core components" that can be re-used across our markets. Rather than building the same functionality nineteen times, we build it once. As a result over the past couple of years we have delivered close to 100 deployments across the Vodafone operating countries.

How IT and Architecture are enabling this real time enterprise transformation needs?

Our architecture function is key to identifying areas of convergence between different markets and other work-streams within the group (e.g. cross channel). The architecture team often lead initiatives that go beyond the online space. Finally, our architecture function ensures that we deliver a service that is consistent for our customers across the markets. We use our IT function to drive speed, invention and continuous improvements. We not only target improvements in the technology stack, but have a holistic approach covering operational and transformational concerns.

We have an established methodology for evaluating new technologies and ensuring that they are fit for purpose across markets and also take into account our in-market restrictions.

What are the un-addressed Technology & Operation challenges and gaps?

At present, our components' capabilities are in functional silos. Our rapid expansion has meant that we have over ten components. We are now beginning to look at the end to end customer experience and the quality of the user journey. We are working on delivering a template for a coherent customer experience that ties together the touch points that a customer might have with Vodafone.

24*7 is good for 400 Million Plus consumers, but poses challenges for the teams and executives delivering and owning such solutions. How do you and your team balance work and life?

We try not to lose sight of the fact that what we do is a hard and big job. We have to be careful about being reasonable with the team. We work flexible hours – considering that the team members put in a lot of their personal time into travel to meet our counterparts in the local markets.

A big part of our success revolves around our relationships built with our colleagues in the markets. When we meet, we tend to get together, enjoy ourselves, get quality time and build a positive relationship – all very rewarding.

Data Driven Enterprises

Data present in various IT systems is an important asset for enterprises. Data driven enterprises implement processes and systems that make optimum use of this data by making it available to various business processes in a timely and reliable manner. This enables multiple business processes and provides a big competitive advantage to them. Being data driven is an important enabler for the Real time enterprises.

Characteristics

Key characteristics of the data driven real time enterprises are:

- Timely access to data – Data should be available in real or near real time as required by the business processes

- Data accessibility – Data should be accessible to all business processes and people through varied channels

- Accuracy of data – Data should be accurate and reliable

- Relevancy of the data – Data should be relevant to the operational processes and should be in the required form (raw data or insights)

- Bi-directional flow of information between operational and analytics systems

Challenges

There are a number of business scenarios that need data from multiple sources and at latencies ranging from sub seconds to a few seconds, minutes or hours depending upon the business needs. Some examples:

- Real time product recommendations and web-site personalization for the e-commerce customers based on the past history of customer interactions with the web site

- Fraud detection for the financial transactions by matching with the prior existing patterns

- Promotions optimizations based on the real time sales and promotion performance information

- Location based offers for the consumers

- Product pricing optimization based on the real time sales information

- Supply chain optimizations based on the real time feedback

- Customer service optimizations by creating a near real time profile of customer

- Equipment failure detection

Enabling these scenarios result in multiple business benefits e.g. more satisfied customers, higher sales, lower costs and faster product launches etc. There are several challenges that enterprises may have to overcome before they can make optimum use of their data and become truly data driven. Following are some examples:

- Diverse data sources – Multiple systems, multiple devices generating data, multiple technologies

- Volume of data – Large number of data elements generated at a very fast pace

- Variety of data – Structured (transaction data) and unstructured data (social media, customer mails, docs etc.)

- Data extraction in real or near real time without impacting the source systems. Integrating, filtering and data quality checking in real time

- Fast load and query at the same time in analytical systems and delivery

through multiple channels (e.g. email, SMS, messaging, web services, desktop, tablets, smart phones etc.)

- Complex data analysis - Aggregating, Mining and Forecasting

- High availability of analytical systems – Real-Time need for insights

Enablers

Following are the key enablers for the data driven real time enterprises:

Real time data integration – Allows data extraction from various operational systems, cleaning, integration, filtering and availability to various operational processes or analytical systems in real or near real time as required by the business.

Real time data warehouses – Real time warehouses allow analysis of the operational data at very low latencies ranging from sub seconds to a few seconds, minutes or hours depending upon business needs. These are one of the most important enabler for the Data Driven Enterprises.

Below diagram depicts the key steps involved in real time data integration and data warehousing:
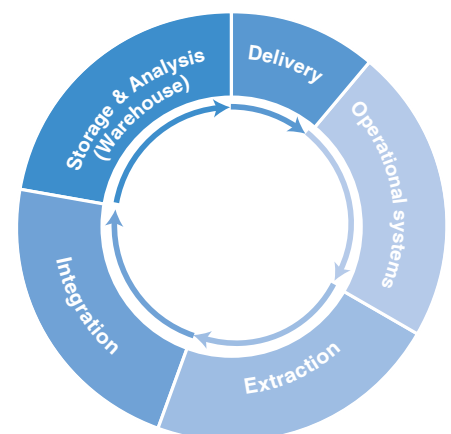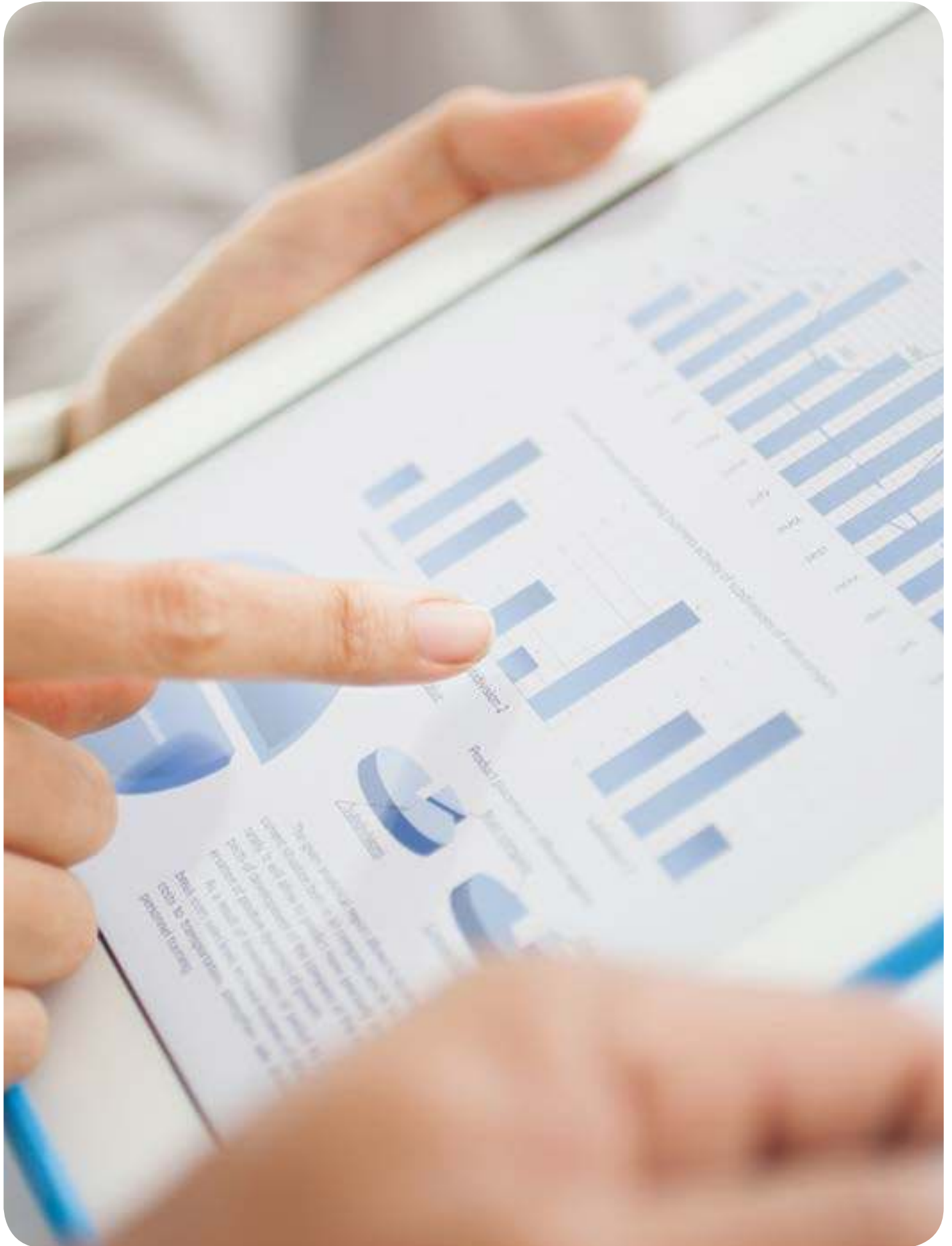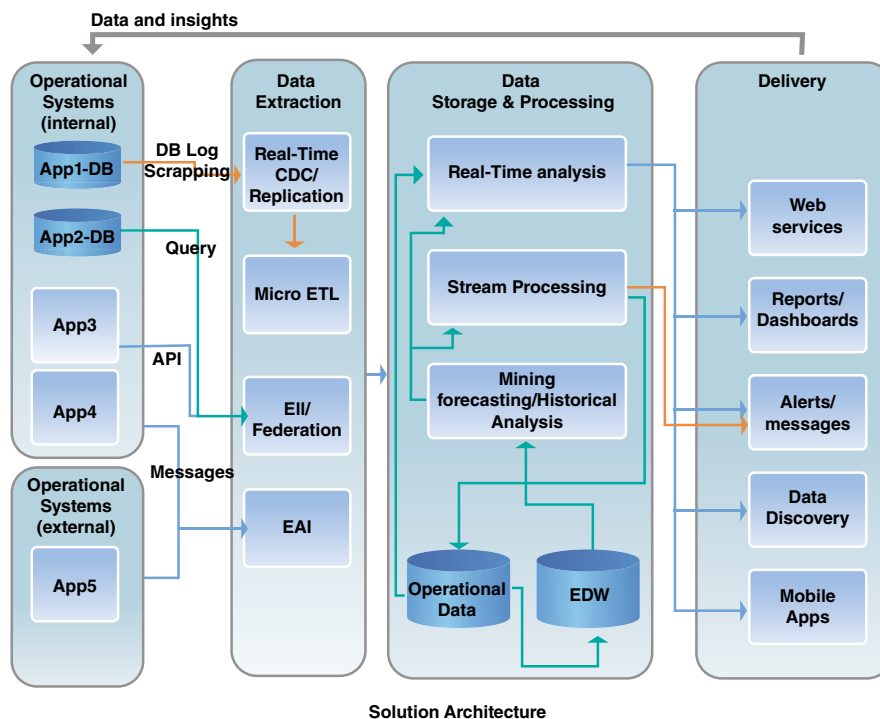
Architecture patterns & technologies

This figure below depicts the typical solution architecture for real time data integration and data warehousing, its key components and the technologies that support these components.

Solution Architecture

Data Sourcing & Integration

There are several technologies that enable real time data capture from the source systems. These differ in terms of the speed of data capture and their impact on the source systems. Some of the key technologies available are:

- Change Data Capture / Real time Data replication – Change Data Capture (CDC) represents the set of patterns that identify the changes that have occurred over a period of time. This helps in processing only the changed data, which is usually smaller when compared to the entire data and thus help in processing the data in real time. There are several techniques that provide CDC that include timestamps on source data, database triggers and database log scrapping. CDC solutions are proven solutions that ensure better performance for the subsequent ETL processes. Data can also be loaded to the operational data warehouses directly.

- Real time Data replication – Replication provides data extraction and publishing in real time with minimal impact to the source operational systems and minimal latency. There are several categories of replication tools that support heterogeneous data sources, big data specific requirements, multi-directional data movement and API based replication. It also supports variety of data sources and targets including files and FTP locations. Replication is the second most data integration tool, only next to ETL, in the enterprises. It is a proven technology and one of the critical components for real time technologies.

- Message publishing (EAI) – Enterprise Application Integration technologies provide a middleware, which facilitates the communication between multiple systems with the Business Intelligence systems. EAI used in the BI, usually includes a messaging and queuing application which supports the real time publishing of the business events occurring within the enterprise, that can be subscribed by the BI applications.

- Low latency ETL micro batches (ETL) – Executed on faster frequency and speed. It is difficult to extract data from source systems only using the ETL, hence it is often combined with CDC techniques to extract data from the source systems in real time. Can also work with other extraction mechanisms (e.g. messages, services and replication).

- Data federation (EII) – Data federation fetches the data from multiple sources in real-time. There is no data integration being done but the disparate data sources are transparently mapped and connected. The data sources can be geographically distributed. It can also use the APIs to access the data. Sometimes this is also called the data virtualization.

Choosing the right technology would depend upon the data requirements of the business scenarios an organization is trying to implement. E.g. data volumes, frequency, data integrity and transformation requirements.

Data Quality

Data Quality (DQ) is often used in batches in the Operational and Data Warehousing environment.However for real time data integration, data quality needs to be applied in real time.

The important functions of real time DQ include Standardization, Validation, Profiling, Matching, Identification, Monitoring, Classification and Augmentation. These functions are embedded or utilized in real time data integration so that it becomes robust. Real time DQ rules can be defined to address the data usage and privacy requirements such as HIPAA, SOX.
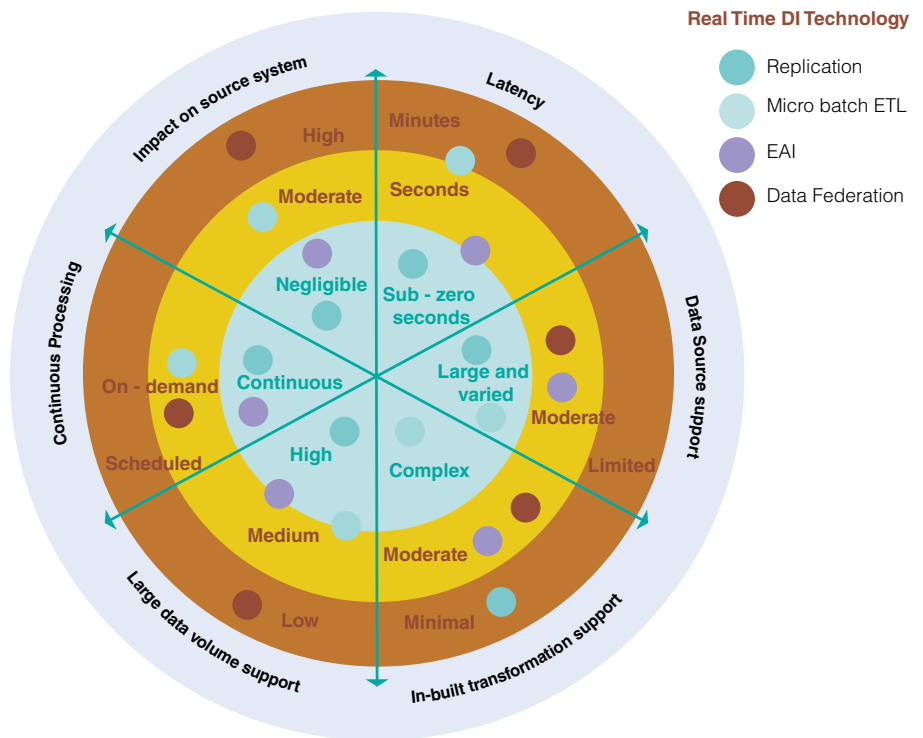
Data Storage and Analysis

Data Storage

Enterprise Data Warehouse (EDW) – This contains the historical data which is used for data mining, forecasting and trend analysis. In some scenarios if EDW can handle mixed workloads of real time and historical data it can also store the real time operational data.

Operational Data Store – It stores the integrated real time operational data loaded through one of the data integration methods. It only stores the current data and augments the historical data stored in the EDW.

Data Analysis

Data Mining, Forecasting and historical analysis – This component provides traditional business analytics capabilities required by the business. These analysis are made available as on-demand services or pre-calculated values so that these can be accessed in the real time to provide historical context to the real time data. This would include techniques like OLAP, analytical models etc.

Real Time DI Technology

- Replication
- Micro batch ETL
- EAI
- Data Federation

Circular diagram segments:
Impact on source system — High, Moderate, Negligible
Latency — Minutes, Seconds, Sub - zero seconds
Data Source support — Large and varied, Moderate, Limited
In-built transformation support — Complex, Moderate, Minimal
Large data volume support — High, Medium, Low
Continuous Processing — Continuous, On - demand, Scheduled

Stream analysis, Complex Event Processing (CEP) – Complex Event Processing is continuous and incremental processing of event streams from multiple systems for zero latency response times (e.g. fraud detection, fault detection etc). Real time events are compared against the historical data patterns extracted from the EDW. The data processing performance is optimized by the use of techniques such as in-memory caching and aggregation over time windows.

Real time/On demand data processing – Data analysis is made available through a set of services which can be invoked by the consumers depending upon the operational need. These services extract the real time data through data federation or from operational data store. They combine the real time analysis with the historical analysis, patterns, extracted from the EDW through data analysis and mining services.

Data Storage & Processing Technologies

DW appliances or analytic DBMS are the new class of database management systems which are specifically built by the vendors for managing the data for analytics and data warehousing. These are designed for handling complex analytical queries on a large amount of data while giving the faster performance for queries and data load. These database systems mostly support structured data and SQL based data access.

Some of the key techniques used in analytics database management systems are -

- **Columnar Databases** – Data is stored by table columns instead of traditional row based approach. It allows for huge compression and much faster access.

- **MPP systems (share nothing architecture)** – Involves multiple nodes

working in parallel to process the queries. Each node has its own data and processing engine. Data is equally distributed based on some algorithm.

- **Intelligent chip based DBs** – Some intelligence is built into the storage chips so that data doesn't have to be brought outside the DB.

- **In memory DBs** – Data is cached into the memory and I/Os are reduced to bare minimum. Supports fast data refreshes and faster data access.

- **In DB analytics** – Analytics algorithms are executed inside the DB. Helps in very fast data processing as data doesn't have to be moved outside the database.

- Solid state drives for increased IO.

- **Hadoop/HDFS and NoSQL databases** – These are suitable for processing unstructured data and doing complex analytical processing. It can be used for building very scalable and cost effective solutions.

Data is stored on a distributed file system (HDFS) or NoSQL databases. NoSQL databases can be categorized as document stores, key value stores, graph databases and BigTable etc.

These are not suitable for zero latency scenarios and interactive analysis of data. However this can be fixed to some extent by caching the data.

Data delivery

Following techniques help with the delivery of the real time insights to various processes and people.

- **SOA based analytics** – Access to the analytics is made through web services. suitable for embedding analytics in the operational systems.

- **Real time Reports/Dashboards** – On demand or very frequent refresh of the reports/dashboards can enable executives to take decisions based on the real time data.

- **Alerts (Emails, SMS, messages)** – Any anomaly detected during the analysis should be sent across to the relevant system or person who can take immediate action to resolve the issue.

Real time analytical systems should interface with the messaging systems which can deliver alerts through emails, SMS or Messages.

- **Mobile apps** – Create mobile apps to support analysis through mobile devices (Smart phones, Tablets). As mobile devices are becoming ubiquitous, it is imperative for the enterprises to enable real time data analysis available through these devices. This can be achieved through the Native apps or HTML5 based apps.

- **Data discovery** – Interactive and advanced visualization to help in the real time analysis of data. It also addresses the self-service BI needs of the business users. The enabling technologies for Data discovery include the in-memory analytics, dynamic and automated data modeling and transparent data federation (through the real time data processing component described earlier).

4C – Social Media Enablers

Social technologies are changing the way enterprises are reacting to various business events both within and outside the enterprise. From proof of concept to achieving significant impact these technologies are creating a significant impact in the way enterprises interact with their employees, customers and partners. Enterprises can leverage the advantages of social media to enable the Real Time Enterprise, using the 4C strategy - Content, Communication, Community, and Collaboration. The 4Cs strategy should be devised keeping mobility in mind to enable real-time availability and deepen the impact.

Content: Refers to both user-generated content and content published by enterprises. Widely available tools and technologies enable users to generate content - video, audio and images - and facilitate the participative process. A company's social media strategy must empower consumers, partners and employees to create and consume content in a user friendly way.

Communication: Enterprises must have a clear strategy on the varied channels through which they want to communicate with their employees, partners and consumers. Blogs are an effective means of communication where enterprises can have key stakeholders register their thoughts on some key issues and strategies. Direct internal and external communication of key messages by the senior management can have a significant impact on stakeholders.

Community: A powerful means of bringing together likeminded people on a single platform where they can connect with each other and collaborate on common themes. Community establishes sense of belonging and engenders a trust factor among members which helps in the sharing of knowledge and enables co-creation. Support communities are a excellent way of enabling self and peer support among customers, which reduces the cost of support significantly.

Collaboration: Tools provide a means for diverse teams to work together effectively to achieve a common goal. Wiki is a classic example of the effectiveness of collaboration where more than 3 million articles are created and updated successfully by people from all around the world. Effective utilization of collaboration tools improves team productivity and enhances output quality.

Content
- Videos
- Photos
- Pervasive Widgets
- Brochures
- Trainings

Communication
- Blogs
- Events
- Chats
- Podcasts
- Social Alerts

Collaboration
- Wikis
- Discussion Forums
- Reviews & Ratings
- Surveys
- Polls

Community
- Employees
- Consumers Engagement
- Partners
- Customer Services
- Partner connect

How social technologies enables Real-Time Enterprise

Social technologies helps enterprises to be more agile and increase responsiveness by providing the right data, to the right people at the right time, to help them taking the right decision based on the context. As every enterprise trying to expand their global foot print, the teams need to interact and collaborate are spread across different countries and time zones. From connecting directly with their end customers, engaging with the employees to collaborating with the partners, social media provides a significant value proposition that enterprises can leverage.
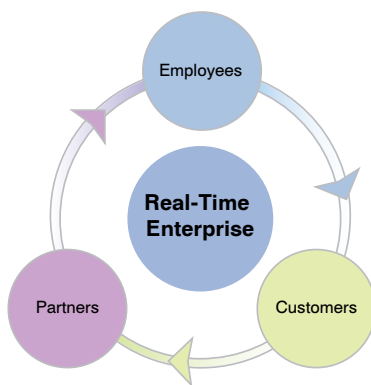
Employees:

- Remove information silos within the organization to enable free flow of ideas and information in real time.

- Activities, actions, and communications contextualized to individuals, in real time and enabled through mobile for people on the go.

- Break down cross cultural barriers to drive collaboration, improve productivity and increase invention by connecting people.

Customers:

- Understand customer sentiments by sensing and analyzing the conversations happening in various social channels and quickly respond to those.

- Accelerate awareness regarding the products and services, to specific or larger segments in terms of reach,

relevance and time.

- Enhance customer engagement and improve customer experience, peer-to-peer collaboration and multi-channel interactions.

Partners:

- Connect the partners and engage with them to reach out with product information and get real-time feedback.

- Enhance Collaboration and manage Co-creation with partners to improve innovation in products and services.

- Reduce the Go-to-market timings for the products and services by leveraging social media channels to co-create and test invention with customers.

Social Maturity Model for achieving Real Time Enterprise

There is a significant increase in the adoption of social technologies, but each enterprise is in different maturity levels in terms of planning, rollout and adoption. Enterprises need to be clear on where they are in the journey, to define a clear plan to reach their ultimate goal of achieving Real-Time Enterprise through social technologies.
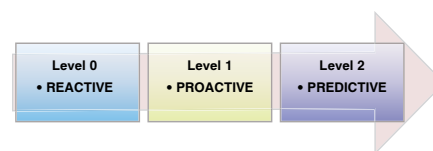
The following are indicative guidelines to understand the various levels of maturity:

Level 0 - Reactive

- No consistent approach defined for social media across the organization.

- No governance and processes exist for social media usage within and outside enterprise.

- Different technologies & solutions used for various social media implementations.

- No Buy-in and support from senior

management on social media adoption and roll-out.

- There is no common group for anchoring social media related initiatives across the enterprise.

- Social Implementations are done in ad-hoc basis depending on the need.

Level 1 - Proactive

- Centralized Social Media group responsible for all the initiatives is identified, but finding it challenging to drive adoption.

- Individual groups convinced about social media and adoption happening in silos.

- Some products and technologies are standardized but still not consistent across the organization.

- Governance and processes exists but still in evolving stage and not adopted completely by various departments.

- No Mechanism available for looping the social media feedbacks as actionable initiatives within the organizations.

- No frameworks exist for measuring the success and ROI for different initiatives.

Level 2 - Predictive

- Organization structure in place for driving & managing various social media programs.

- Well defined social media strategy exists with governance and processes defined.

- Technology, Architecture and Roadmap in place for existing and new social media campaigns.

- Mechanism available for measuring the ROI on various social media initiatives.

- Complete Buy-in and support from senior management on social media initiatives.

- Well defined process exists for analysis of social media feedbacks and makes actionable initiatives

Gamification as a Catalyst

Introduction

Mechanisms like providing product feedback, marking products likes/ dislikes, recommending the product to communities (friends, social contacts, etc.), answering to questions on the forums are some of the things supported through social communities. At times, certain sites and communities are successful while most others had disappeared without making any significant impact. How does one ensure more and more social communities become self-sustaining? On forums, how does one ensure the questions are not left un-answered for days and weeks? And if answered, the answers to the questions are authentic and can be trusted and relied upon with highest degree?

The buyer of the product usually comes

back to the site and registers only if he or she has a negative impression, how do we ensure they are motivated to register a positive impression which helps spread the good word and in turn increase sales.

By nature human behavior seeks attention, recognition, and reward for its efforts. Somebody has said there are no free lunches in this world, and Gamification follows this principle by ensuring there is a reward (direct or indirect) mechanism established. Every user interaction is encouraged and is meant to happen naturally in the ecosystem.

Gamification in its simplest form is defined as applying game thinking to nongame contexts. All of us have grown up playing games and can easily associate with Game elements of competition, fun, excitement

and ways to learn from wins and losses. However, Gamification is much beyond just games and uses game principles for its cause.

Gamification registers, tracks and scores all business relevant transactions. Users are scored on a continuous basis based on their actions performed. The activity scoring rules are predefined in the system. Users are rewarded with meaningful badges on reaching a predefined milestone. Leaderboards are used to display high performing users with their scores, and levels. The hunger or passion to reach to specific milestones, establish a status in the virtual community and at the same time benefit from collective intelligence keeps the user engaged and drives participation for overall good.

Gamification as a catalyst for realizing RTE vision

Gamification can play a role of catalyst to help surmount following challenges essential to meet the objectives of Real time Enterprise:

- Speed/Latency
- Stakeholder engagement
- Service quality levels
- Improving business process driven user experience
- Employee engagement
- Crowd sourcing
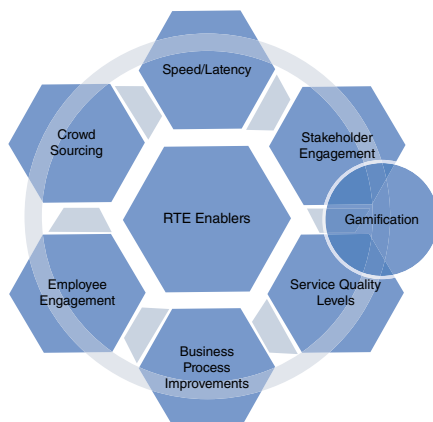
Latency in Enterprise

With every passing quarter, the latency in the enterprise is shrinking. The latency could be in the context of releasing new products or services, or capturing user feedback, or tweaking the go to market strategy or internal decision making. Time to respond is becoming critical in every aspect.

Quick response time (near zero latency) is the virtue of real time enterprises. Achieving quick response time is a function of several enterprise functions such as automation, efficiency, process

standardization, human efficiency, productivity, etc. Except Human efficiency and productivity, all the others are mechanized and already tuned to produce sub second response times. However a lot is desired in the area of achieving optimum human efficiency and productivity as it tends to vary with individual culture, motivation levels, behavioral dynamics and many other factors.

Gamification tactics geared towards improving user engagement, motivation, and productivity can help to significantly reduce the response time in an enterprise.

Influence	Tactics
User Motivation	Score for every participation. Provide ability to accumulate scores and convert the same into useful artifacts/coupons. Socialize recognition.
User Behavior	Set clear achievable objectives, reward desired behavior, Socialize/Evangelize success in the community.
User Productivity	Improve effectiveness of user learning through story based learning. Support with Visuals, quizzes to help users memorize concept. Encourage internal/external forums.

Defining contextualized challenges specific to user can help in improving user engagement and in turn productivity. Assigning points for performing key activities, tracking user scores and recognizing with badges on achieving specific milestones, socializing/evangelizing recognition for top performers/contributors helps in motivating users that further helps improve human efficiency and productivity.

Engaging with multiple stakeholders

Enterprises have become extremely complex with multiple internal and external stakeholders. The stakeholder could be customer, employee or partner organization. In a Real time Enterprise, engagement is the core of any relationship be it B2B, B2C or B2E (business to employee). Each stakeholder has different objectives, and drivers. Many a times, meeting a common enterprise goal needs dealing with conflicting stakeholder objectives. There are areas within enterprises where maximum timely participation, enthusiasm from all the participating stakeholders from across functional groups is needed to make things happen. Latency can get jeopardized if any of these relationships start de-functioning and is not managed meticulously. However having a dedicated public relations function to manage relationships with each of the business entity is also not feasible. In such a situation, it is important that "engagement" becomes ingrained in the fabric of the enterprise than an independent isolated function.

Challenges associated with seeking collaboration between multiple disparate groups or individuals always hit roadblocks due to lack of credit sharing or at times even due to lack of apportionment of credit mechanisms. Gamification can deal with this through the design of appropriate point systems, allowing users to trade points for mutual benefits.

Gamification can be applied to improve engagement with internal stakeholders such as employees or external stakeholders such as customers, or partners.

Following are the various enterprise business functions and the applicable Gamification use cases that can be useful to drive RTE.

Segment	Business Function	Gamification use cases
B2E (Business to Employee)	HR	Driving employee engagement, improving team culture.
	Finance	Rewarding based on saving costs, improving utilizations, etc.
	Research/ invention management	Creating idea banks with the help of enterprise workforce.
	Training & Development	Improving employee interest in education and training using Gamification, eLearning, certification programs & vocational training.
B2C (Business to Customer)	Sales	Rewarding sales, referrals, cross-sell, upsell opportunities.
	Marketing	Driving product marketing campaigns.
	Health and Wellness	Obesity programs, smoking cessation by driving user engagement and motivation.
	Financial Services	Simulated Trading platforms, Enabling financial literacy through virtual tours.
B2B (Business to Business)	Vendor management	Vendor SLA management.
	Partner Management	Partner onboarding.

Gamification for improving service quality levels

In the context of RTE, service quality levels cannot be allowed to let down at the cost of speed. How does one ensure the service quality is at a highest level?

Gamification can be used to improve customer services. This can be best described using the Gamification strategy that eBay is practicing. eBay uses game mechanics to improve sales and service levels. As a "seller" points and badges are used to identify top sellers on the site. As a "buyer", feedback mechanism encourages "seller" to give great customer service. A seller who is not able to deliver goods at promised standards will suffer from poor ratings and in turn ability to sell against the competition.

Gamification for improving end user experience with the business processes

Inefficient and poorly designed business processes can become critical bottleneck towards achieving the RTE objective.

In most of the enterprises, majority of application systems and business process have been written more than a decade earlier and have become legacy and in turn mundane. Users of these applications have been deprived from innovative user experiences of touch and gestures which otherwise they experience on their tablets, or smart phone devices. This creates a significant expectation gap in the external and internal world causing severe frustration to the employees. By redesigning some of selective enterprise business processes and applications, in more exciting and user friendly manner based on Gamification principles,helps in

overcoming stress of the user/employee and improves productivity.

Insurance giant Allstate leveraged employee ideation platform where every employee can put their idea. This can be voted up or down by fellow employees. One such idea around claim settlement attracted large number of employee's feedback towards improving the mundane process of claims. Acting on this idea by senior management, not only helped relive stress for the employees but also save about $18 million a year in adjuster's time.

Gamification for improving Employee engagement

Amongst all stakeholders, Employee is the most important in achieving the objective of real time enterprise. Experience of an employee in terms of understanding of various systems and functions in the enterprise plays a key role in achieving necessary latency. Apart from products which customers can experience, employees are the key touch points with customers and drive the onus for sales, service and customer satisfaction. Active participation of an employee is essential for continuous invention. Engaged employees are over 40% more productive, earn over 20% more revenue and are almost 90% less likely to leave. The problem is that only one in three – thirty percent – of your employees are engaged.

In today's enterprises, there is no effective framework to measure and track employee achievements. Total experience, educational qualification alone may not help in arriving at true employee capital. Employee's accrued achievement in the form of trainings undergone, trainings conducted, innovative ideas contributed,

and issues resolved etc. in the enterprise over the years is important and should be captured. It is important that enterprises place mechanisms in place to track and measure its employee achievements not for a year but for an entire employee life time.

Using Gamification techniques to measure and track employee achievements can help build employee profile in the form of accumulated points, badges, and trophies. These points/badges can then be traded amongst employees that can make a win-win for employee and employer. E.g. 100 accumulated points can be redeemed for one paid leave, or an employee can gift other employee certain points based on his help in a specific initiative. Simple mechanisms like these can help strengthen employee loyalty to the organization and also help improve individual motivation levels.

Ability to be elastic – through leveraging Crowd sourcing

With "X" available resources in an enterprise, how can an enterprise aim for 100X or 1000X efforts by leveraging external entities without any significant impact to the bottom-line? One of the critical needs of RTE is to create and deal with increasing scale, ability to quickly ramp up and ramp down the resources, in turn means leveraging crowd sourcing as needed. Leveraging crowd sourcing techniques lets enterprises to be slim by reducing fixed costs and having variable cost structure based on outputs/results. Online virtual user communities built around product and services are deciding the fate of organization like never before. Customer's role has changed from being just a consumer to a stakeholder who

participates in envisioning, defining, designing, to influencing creation of various products and services. Enterprises which could successfully establish a dialogue and engage with its user base and respond better to their needs are being continuously rewarded with higher market share.

In a consumer centric world it is not only important to acquire a customer but also build and retain the relationships. In other words, consumer should be engaged. However keeping anybody engaged is not an easy job at all especially in the world of trillion choices and distractions with every passing minute. While Social sites have done initial work of building communities and connecting them with enterprises, the onus is with enterprises to nurture and sustain these communities and use it for their benefits. Individual's aspiration, desire to be recognized in the community can be met through establishing various

expert levels and encouraging participant to achieve those as they contribute to the collective goal. As individuals strive to attain those goals, system design should encourage them at each step by setting difficult but achievable milestones, rewarding points for meaningful activities. As they climb a specific milestone, recognize them by giving special badges. Flash their achievements, display on leaderboards, and provide nice goodies.

Gamification Initiatives – key considerations

Some of the important things while considering Gamification within an enterprise are:

- For intra-enterprise scenarios, Gaming philosophy and design must align with the Organizational Culture.

- Gamification must suit to individual user interest and context driven, hence understanding the psychology,

motivational and behavioral aspects of your user segments is very essential for the success of any Gamification initiative.

- Gamification should have the ability to track, measure, and reward every interaction.

- Gamified app. user experience should be immersive and should generate nothing less than WOW!! Gamification of any existing application should be non-intrusive and seamless which means the user should be able to carry out his usual activities, tasks without additional overheads.

- Finally, Gamification shouldn't become an overhead but enabler.

Real-Time Assurance Platform

Until recently, enterprises were striving for customer experience by providing and delivering services on-time. In today's challenging world, just delivering services on-time is not adequate. Services need to be delivered in real-time. Various business scenarios, transactions, configuration, change requests, status updates, need to be real-time for an enterprise to achieve a richer experience for their consumers. With the penetration of smart phones and tablets, and customer portals providing information on the consumer's services anytime in the day, anywhere in the world, it is imperative that enterprises provide this 'real time experience' to their clients.

Earlier, enterprises emphasised on 'providing' and 'delivering' customer services, and then, immediately 'monetising' the services provided. Now, the focus is changing to 'real-time assurance' of customer services. The importance of sustaining and maintaining the services delivered is very high, and the enterprises should realise this. Customer contracts include service-level agreements and operational-level agreements, which makes it imperative that enterprises evolve their assurance platforms to real-time assurance platform.

A real-time assurance platform acts as an accelerator for real-time enterprises. Proactive identification of faults and triggering fault resolution activities combined with predictive anticipation of possible outages empowers enterprises to meet service-level agreements and operational-level agreements.

Real-Time Assurance Platform

Enterprises are changing to employ new methods of collaboration and agile in order to provide differentiating services to their customers. This means there are multiple parties / stakeholders in an enterprise now. Partners, suppliers, B2B customers are now

an important aspect of enterprises. Below diagram shows the different facets of an enterprise:
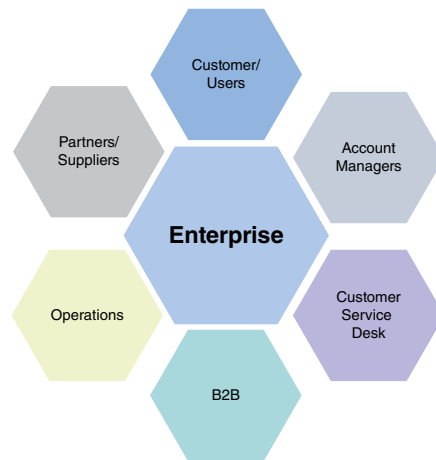
In order to make information available to various stakeholders, at real-time, we require a 'Unified Portal'. It is a portal that provides a single and complete view to a customer, for all their interaction needs with an enterprise. It provides a view into their account information, order information, service information, ticket information and billing information. The portal provides a 360 degree view of the customer's services. Existing and potential customers interact with the Portal to read and download product catalogue, product definition and overview. Unified Portal view – Access to a secure integrated portal, via a standard internet connection irrespective of location. Accessible on smartphones and tablets.

- **Service Inventory** – A view of all services in a single location, with complete service hierarchy details and additional service specific attributes. From this view, the customer can perform various service related transactions, like create a ticket, view tickets related to a given service, use tools for network analysis and also run service performance reports. Customers can also interact

with proactive issues, which are automatically created monitoring systems at the infrastructure layer. Updates to tickets, from operational teams, suppliers or partners on a particular ticket will be available to the customer as a real time update. Complete transparency to the customer by providing full visibility of all tickets
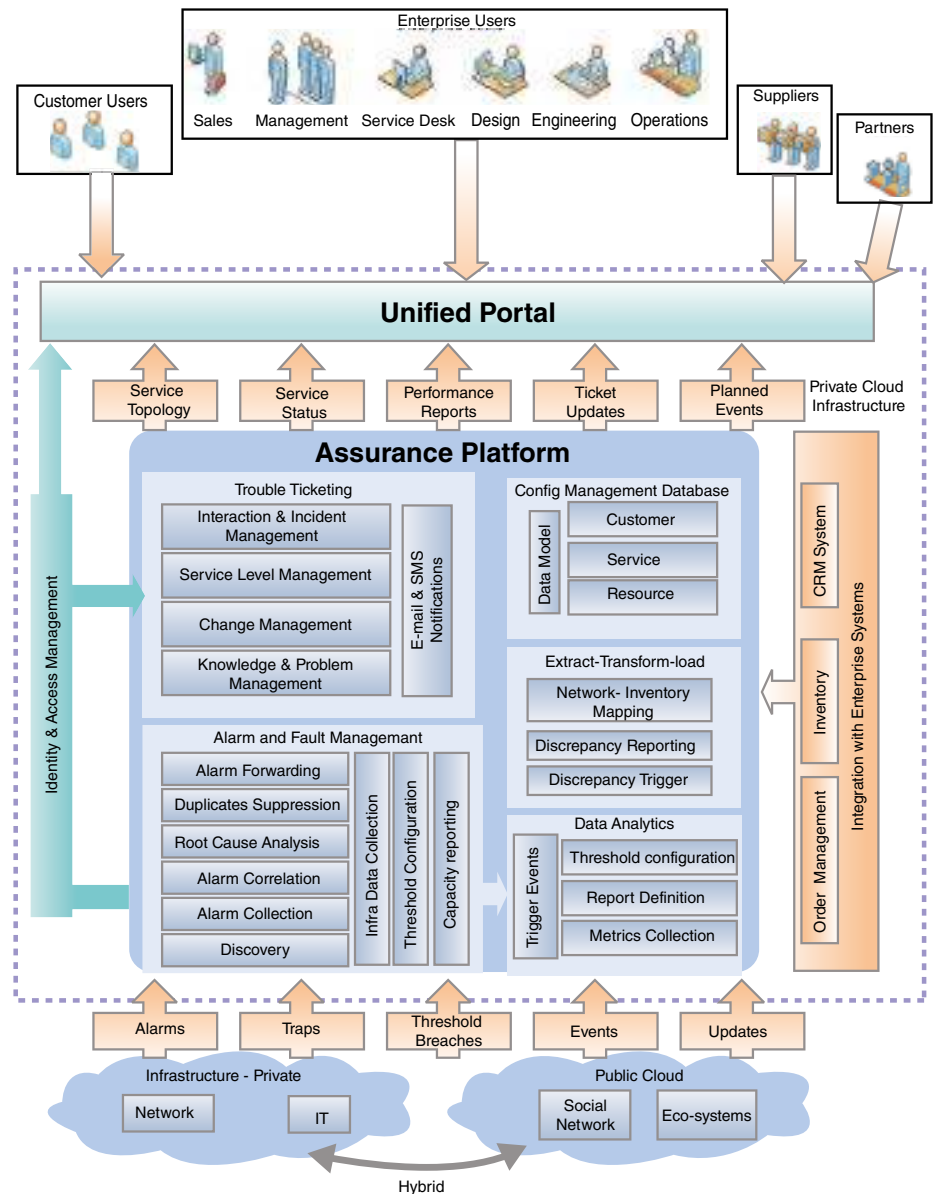
- **Reports** – Direct access to traffic and performance reports are available to the customer. This helps capacity planners and maintenance teams to check network utilisation and historical trends. The customer is empowered to validate that his services are provided within the SLAs agreed.

- **Customer Inventory** – A view of all customer contact and site information, with ability to manage customer details. Admin user function to manage customer user accounts to the portal.

- **Order Status view** – A view of all open customer orders, their status and estimated order completion dates.

- **Billing details view** – A view of billing preferences, all previous invoices, historic payments, and ability to raise disputes on bills.

- **Real Time Communication** – The Portal enables bi-directional real time updates between an enterprise and their customers. Communication could be in the form of broadcast messages, progress on issues, requests for information, planned work related updates, or any other communications necessary to ensure enhanced customer experience.

- **Planned Work Notification** – When a planned work is known to directly affect a customer's services, the Portal will deliver e-mail and SMS

notifications to customers. Customers will have a user preference to opt in or out of these notifications. Customers could choose to interact on the planned work and communicate directly with internal field operations staff. A planned work ticket will be created and used to manage the lifecycle of the work, from planning, to commencement, and completion.

- **Account team contacts** – Easy access to up-to-date contact details of the relevant Account team, including escalation contacts, if required.

- **Service history** – Easy access to historical ticketing information.

- **Email & SMS notifications** – Automated email notification when interactions are updated. Automated escalation notifications sent via SMS. Notifications can be configured by the customer at a per service level.

- **Topology/Utilisation Maps** – Visibility of the topology view of customers' services. The view displays service status and utilisation at each location on a geo map.

- **Supported by Information Technology Infrastructure Library (ITIL) aligned business processes** – Alignment with ITIL standards of Service Management, with the processes and facilities required to support these standards.

Enterprise users, like Service Desk users, Account Managers, Operations, Suppliers, Partners, etc., access the Unified Portal to see the customer's view-point. And also access internal systems, by single-sign-on. Based on various roles and responsibilities, different access privileges will provided to different internal systems and components. Customers also have an option to interact via a B2B interface.

Diagram labels:

Enterprise Users
Customer Users | Sales | Management | Service Desk | Design | Engineering | Operations | Suppliers | Partners

Unified Portal

Service Topology | Service Status | Performance Reports | Ticket Updates | Planned Events | Private Cloud Infrastructure

Assurance Platform

Identity & Access Management

Trouble Ticketing
- Interaction & Incident Management
- Service Level Management
- Change Management
- Knowledge & Problem Management

E-mail & SMS Notifications

Config Management Database
Data Model
- Customer
- Service
- Resource

CRM System

Integration with Enterprise Systems

Extract-Transform-load
- Network- Inventory Mapping
- Discrepancy Reporting
- Discrepancy Trigger

Inventory

Alarm and Fault Managemant
- Alarm Forwarding
- Duplicates Suppression
- Root Cause Analysis
- Alarm Correlation
- Alarm Collection
- Discovery

Infra Data Collection | Threshold Configuration | Capacity reporting

Trigger Events

Data Analytics
- Threshold configuration
- Report Definition
- Metrics Collection

Order Management

Alarms | Traps | Threshold Breaches | Events | Updates

Infrastructure - Private
Network | IT

Public Cloud
Social Network | Eco-systems

Hybrid

Functional View of a Real-Time Assurance Platform

User Community and Portal Views: The Unified Portal would cater to different types of users, and provide appropriate views of the portal, depending on roles and access privileges.

- **Customer** – The customer user is the most important user and the portal is designed and built for providing a horde of features.

- **Internal User** – Different user groups internal to the enterprise will have specific views designed to address their daily activities and responsibilities. User groups include: Sales , Account Management, Service Desk, Network Operations, IT Operations, Design & Engineering, Field Services.

- **Partner and Supplier** – Global service offerings often include partnering with regional providers and/or utilizing

supplier services. Enabling partner and supplier functions on the portal makes interfacing and communications quicker.

Unified Portal: The Unified Portal is the 'experience' layer for the different users, where each portlet brings a facet of the customer's information, available to the customer at real-time, anytime anywhere.

- **Service Inventory, Status and Topology** – The customer has a view of all their active services and their status. The topology and map view gives a visual representation of their services which is very useful for global service offering.

- **Service Incidents** – Issues or faults with their status and details, which includes latest updates on issue resolution from partners and suppliers.

- **Performance Reports** – Service Performance and utilization reports which help customer monitor their services, service-level and operational-level objectives.

- **Proactive Incidents** – Faults that are proactively triggered by the network or infrastructure monitoring systems, enables the customer to have a first-hand view of issues on their services.

- **Planned Outage Events** – Keeping the customer informed of planned outages, and its progress during implementation.

- **Partner and Supplier Support** – Enables quicker updates from partners and suppliers, and helps provide a real-time view of issue resolution progress from outside the enterprise.

Trouble Ticketing: The 'heart' of the assurance platform, is the trouble ticketing system. Managing customer complaints effectively, proactively informing customer on faults, and predictively preventing potential faults from occurring – these are three most important aspects of real-time assurance.

- **Interaction and Incident Management** – Interactions are customer initiated issues. The service desk addresses customer concerns, and if essential, escalates the issue to an incident for the operations to investigate further to resolve the problem. Incidents are escalated customer issues, proactive faults identified by the management system or predictive incidents raised by threshold breaches. Predictive incidents help fix a fault or address capacity issues, even before the customer service is impacted.

- **Change Management** – Provides the workflow and management of planned outages and helps co-ordinate between different internal enterprise groups.

- **Service Level Management** – As customer contracts are based on SLAs and OLAs, it is imperative that the assurance platform provides a mechanism for their management. It empowers enterprises to improve adherence to customer contracts.

- **Knowledge and Problem Management** – Known issue resolutions become knowledge assets and frequently repeating issues become larger problems. Management of knowledge assets and workflow to

address problems empower enterprises to gradually reduce customer complaints.

- **SMS & E-mail Notifications** – Keeping the customer informed on issues and their resolution facilitates real-time assurance. Keeping the customer and internal stakeholders informed improves visibility and transparency, directly improving customer experience.

Extract-Transform-Load

- **Network – Inventory Mapping** – Integration with the Operational Support Systems stack to inherit the customer – service – resource representation. This is key for service-impact analysis which is the heart of proactive real-time assurance.

- **Discrepancy Reporting and Trigger** – Data accuracy is very important to accurate service-impact analysis. Discrepancy reporting identifies inconsistencies in data in the Operational Support Systems stack and the trigger helps enterprises fix such data inaccuracies.

Configuration Management Database – A central data repository which is loaded with customer – service – resource data from the Operational Support Systems stack and provides required data to all assurance components, including the Unified Portal.

Alarm & Fault Management

- **Discovery** – Automatic discovery of network and IT infrastructure elements.

- **Alarm Collection** – Collect alarms from infrastructure, apply business rules.

- **Alarm Correlation and Root Cause Analysis** – Correlate alarms and perform root cause analysis based on pre-configured network and business rules.

- **Duplicates Suppression** – Suppress duplicate alarms, such as flapping alarms, spikes and repeating alarms.

- **Alarm Forwarding** – Forward alarm to create a proactive incident; Alarms are forwarded based on rules that identify service affecting alarms.

- **Infrastructure Data Collection and Threshold Configuration** – Polling infrastructure for specific valuable data which could be compared against threshold values to create predictive incidents.

- **Capacity Reporting** – Reports that help in planning and increasing capacity.

Data Analytics

- **Metrics Collection** – Collect raw data from the network and infrastructure, processing data by applying business rules and aggregating data, and preparing data for the reports.

- **Reports Definition** – Define reports for optimal presentation of collected data.

- **Threshold Configuration and Trigger** – Metrics collected are to be compared against threshold values to create predictive incidents.

Identity and Access Management – The key requests from an IdAM system are authentication and authorisation, management of users, user groups and user roles, single sign-on to multiple internal components and sub-systems, integration with one or many active directories for seamless login for enterprise users.

B2B e-Bond Interface – The unified portal provides an interface for people. This also provides for customer enterprises which have their own Operational Support Systems stack and would want to integrate using a generic API.

Private Cloud Infrastructure – The entire solution stack built on a private cloud infrastructure, could potentially make the solution a SAaaS (Service Assurance as a Service) offering.
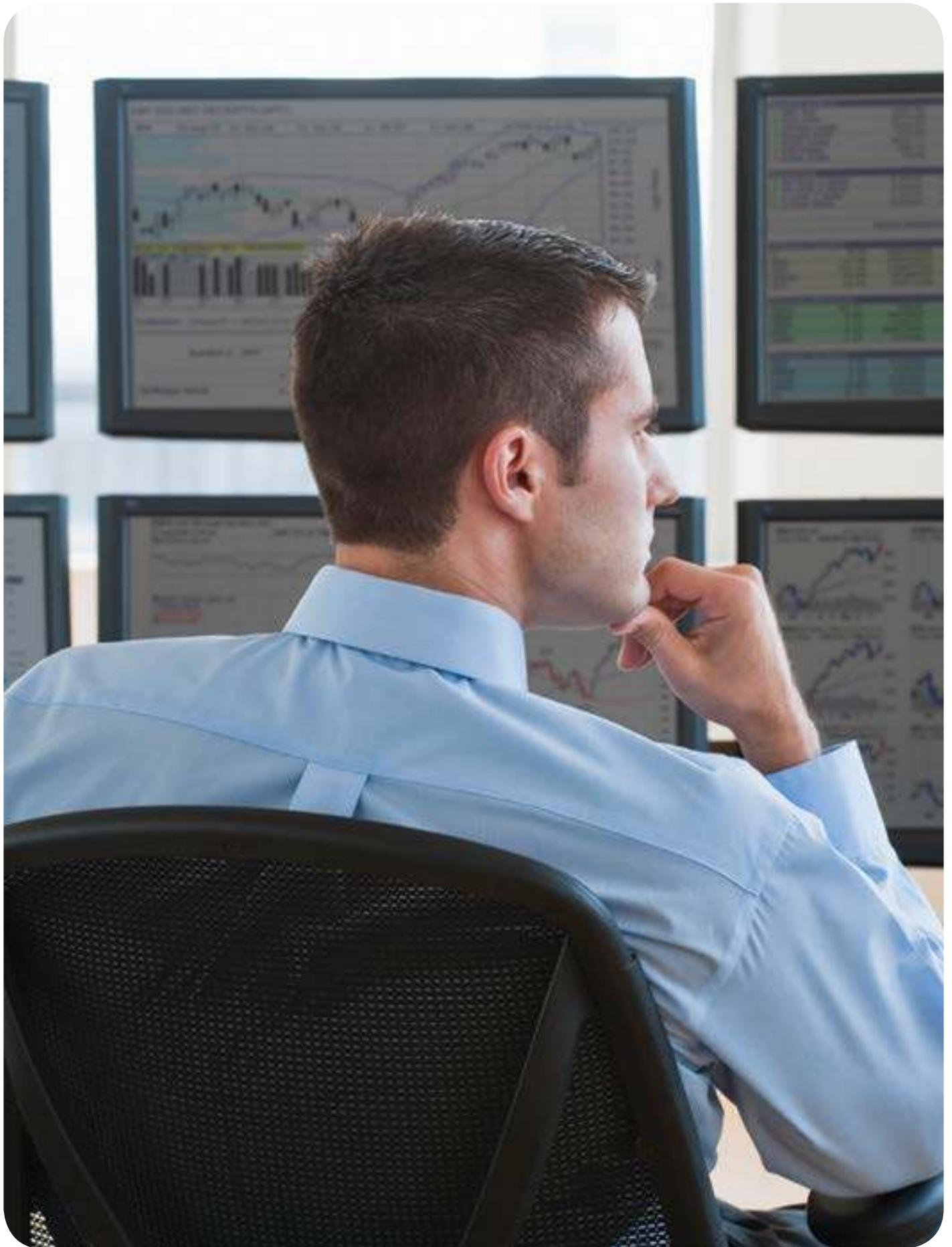
Command Center for Global Supply Chain

Supply chain operations are increasingly becoming complex as enterprises expand their global horizons. Enterprises are often blamed for not using the technology adequately for efficiently managing supply chain operations. There is a strong desire for real time interactions across manufacturers, suppliers, transporters, distributors, and retailers to bring agility to the complex global supply chain networks.

The command center will help to operate fast paced and agile demand-to-deliver business cycles across complex global supply chain networks. The command center brings a range of advanced communication, collaboration, telepresence, mobility, telematics & remote sensing technologies for efficiently managing global supply chain operations. It will bring the next generation experience to the control room with touch & large screens, gesture control, speech recognition and remote control capabilities.

Global Supply Chain Anxieties

The short product life cycles, diverse supply sources, multiple distribution channels and unexpected external events like natural calamities, legal and compliance issues drive the need for optimizing the complex supply chain networks.

- **Global Manufacturing:** Labor cost arbitrage, follow-the-sun, international tax benefits and global delivery model has led enterprises to setup multiple plants across several countries. Accurate production planning & demand forecasting alignment is the key for inventory optimization.

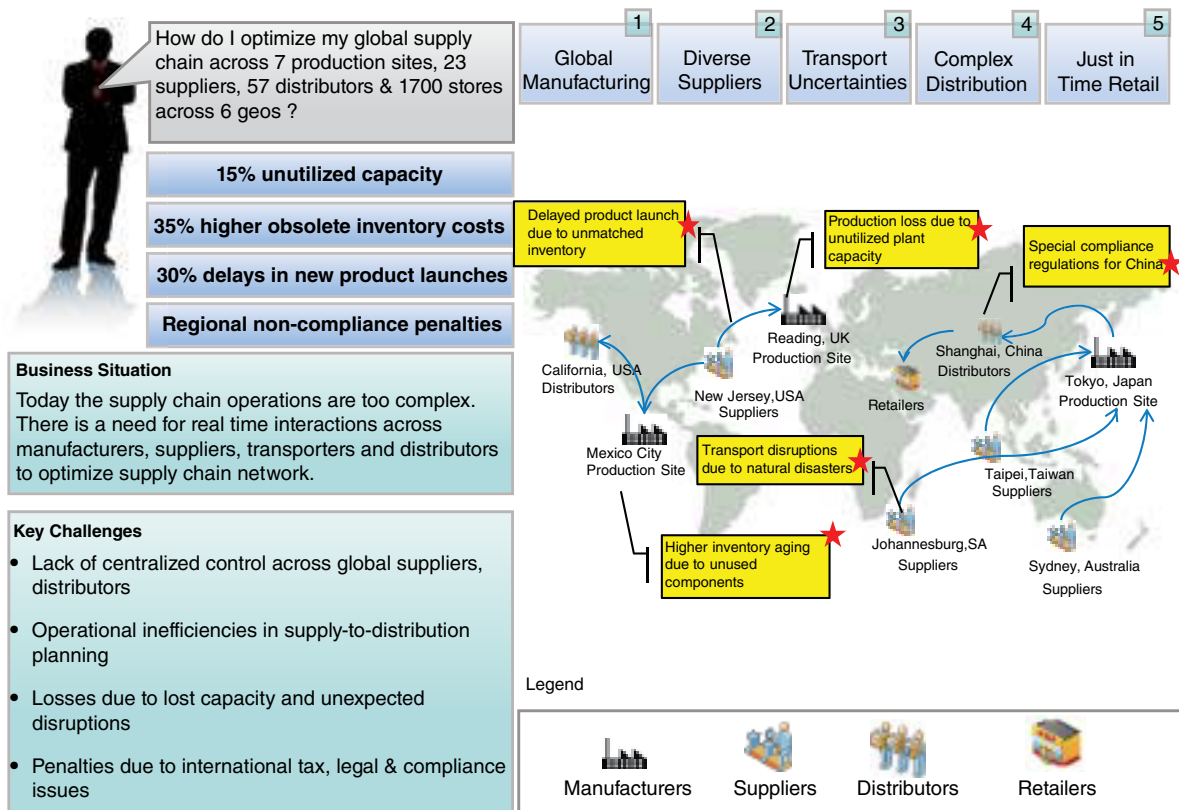- **Diverse Suppliers:** Typically large aero, auto or hi-tech enterprises have several hundred to thousand suppliers across number of countries. Real time collaboration is the key to avoid delays in new product launches, to avoid stock-outs and production losses due to unutilized capacity.

- **Multiple Distribution Channels:** Large retail, hi-tech enterprises have multiple distribution channels and complex transportation & logistics arrangements. Extremely careful planning is essential to enhance logistic costs & delivery time to achieve Just-In-Time (JIT) demand-supply balance.

- **Disruptions in Transportation & Logistics:** Natural disasters, transportation & logistics disruptions and other unexpected situations demand real time risk management & dynamic alternate delivery models to maintain the brand value.

- **Small Opportunity Window for Retail:** Typically retail demand has very small window of opportunity. It drives the need for aggressive just-in-time inventory cycles across the entire supply chain network, spanning several countries.
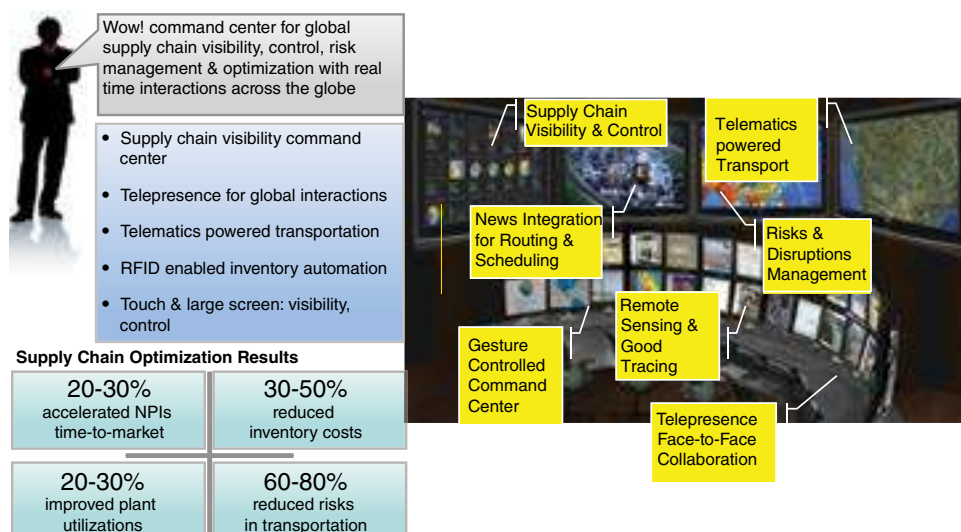
How do I optimize my global supply chain across 7 production sites, 23 suppliers, 57 distributors & 1700 stores across 6 geos ?

1	2	3	4	5
Global Manufacturing	Diverse Suppliers	Transport Uncertainties	Complex Distribution	Just in Time Retail

15% unutilized capacity

35% higher obsolete inventory costs

30% delays in new product launches

Regional non-compliance penalties

Business Situation

Today the supply chain operations are too complex. There is a need for real time interactions across manufacturers, suppliers, transporters and distributors to optimize supply chain network.

Key Challenges

- Lack of centralized control across global suppliers, distributors
- Operational inefficiencies in supply-to-distribution planning
- Losses due to lost capacity and unexpected disruptions
- Penalties due to international tax, legal & compliance issues

Map callouts:
- Delayed product launch due to unmatched inventory
- Production loss due to unutilized plant capacity
- Special compliance regulations for China
- Transport disruptions due to natural disasters
- Higher inventory aging due to unused components

Map labels:
- California, USA Distributors
- Reading, UK Production Site
- New Jersey, USA Suppliers
- Shanghai, China Distributors
- Tokyo, Japan Production Site
- Retailers
- Mexico City Production Site
- Taipei, Taiwan Suppliers
- Johannesburg, SA Suppliers
- Sydney, Australia Suppliers

Legend

Manufacturers	Suppliers	Distributors	Retailers

Nature of RTE Solutions

The global supply chain command center brings efficiency and next generation technology experience across several business process areas:

Domain	Business Process	RTE Technology Levers	Business Value
Manufacturing	• Global Procurement • Just-in-time Inventory • Material Logistics • Operations Management	• Command center for supply chain visibility • Real time collaboration with global partners • Remote sensing, RFID for inventory tracing • Live video feeds for material logistics	• Improved plant utilization • Reduced inventory costs
Logistics & Transportation	• Transportation Planning • Routing & Scheduling • Risk Management • Disruption Management	• Face-to-face collaboration for scheduling • Telematics & GPS powered carrier tracking • Real time routing, re-routing & monitoring • Live News integration for unexpected events	• Optimized logistics costs • Reduced lead time to deliver
Retail & Distribution	• Sales Forecasting • Demand percolation • Fulfillment	• RFID & bar-code for real time tracking • Telephony, SMS & IVR for customer service • Gesture control & touch screen catalogs • PoS Analytics through apps integration • Location based services for demand shaping	• Retained brand value • Customer loyalty

Illustration below brings the various technology pieces together to conceptualize a command center:

Wow! command center for global supply chain visibility, control, risk management & optimization with real time interactions across the globe

- Supply chain visibility command center
- Telepresence for global interactions
- Telematics powered transportation
- RFID enabled inventory automation
- Touch & large screen: visibility, control

Supply Chain Optimization Results

20-30% accelerated NPIs time-to-market	30-50% reduced inventory costs
20-30% improved plant utilizations	60-80% reduced risks in transportation

Supply Chain Visibility & Control

Telematics powered Transport

News Integration for Routing & Scheduling

Risks & Disruptions Management

Remote Sensing & Good Tracing

Gesture Controlled Command Center

Telepresence Face-to-Face Collaboration

The following solution building blocks will help build the integrated global command center:

Solution Building Block	How will it improve business process?
Command Center • Touch Screen • Gesture Control • Speech Recognition	Next generation command center experience for global supply chain improves visibility & control across network. Similarly control room facilitates real time global production planning.
Collaboration • Telepresence • Video conferencing • Audio Conferencing	Same room experience facilitates efficient collaboration during procurement planning, transportation & distribution planning. Real time collaboration significantly reduces delivery costs and cycle time .
Telematics • GPS • Location Based Services • Map Integration	Accurate location tracking results in transportation optimization while carrier routing, re-routing and monitoring. Efficient monitoring of transport situation & disruptions help meet delivery commitments.
Remote Sensing • RFID • Barcodes	Remote sensing networks facilitates stock automation, real time goods tracking, warehouse optimization which helps in reducing inventory costs.
Telephony • SMS, IVR • Click-to-call	Spontaneous alerts & notifications across supply chain network for higher responsiveness, collaboration and agility.
News Integration • News Feeds • RSS Feeds	Live and real time information on natural disasters and unexpected events help to efficiently manage supply chain risks.
Ecosystem Integration & Analytics	A 360-degree view of supply chain operations across global network with real time analytics for decision control.

Manifestations of Command Center

Global Manufacturing Command Center:
The manufacturing command center brings together the same room experience while dealing with various key aspects of manufacturing like production planning, inventory tracking and tracing, multiple shop floors co-ordination, remote plant monitoring and control, collaborative communication between the stakeholders of production processes etc. Agility in manufacturing processes can be achieved when the point-of-use or point-of-sale data is quickly transformed across the supply chain network. Holistic view of the production process provides better control over plant and resources utilization and results in reduction of inventory costs, production wastage, losses due to parts obsolescence and over-head costs.

Global Supply Chain Command Center:
The supply chain command center facilitates face-to-face communication at real time to communicate effectively with the supply chain partners in the network. It helps to collaborate, beyond the tactical exchange of data, to address the supply, logistics and distribution problems across the value chain. In the advent of operational risks, man-made risks or natural disasters, quick reaction and effective collaboration help to resolve the crisis. Command center gives the edge that is needed to meet these challenges that include parties like suppliers, customers, logistics service providers, transporters or outsourcing partners. It also resolves the issue about the market clamoring for a better system in resolving issues with discrete applications spread across geographies. Proactive early warnings and alerts enables strategic decision making required for integrated enterprise procurement and distribution process with accurate, timely and complete information.

The following are different schematics illustrate the above manifestations in different business scenarios:

Global Supplier Collaboration

Transportation & Logistics

Production Planning & Control

Disruptions & Risk Management

Success factors

The command center for global supply chain is an innovative but complex heterogeneous technology led solution. However, to effectively gain benefits of the solution, the enterprises will have to get the multiple aspects right:

- **Selecting the right technology service providers:** Most of the technologies used for developing a command center experience are niche & discrete, multiple technology providers offer different types of solutions, choosing the right technology partner to build an integrated view is the key.

- **Re-engineering the inefficient processes:** The command center adoption will impact the existing manual and workflow-based processes. These processes will have to be re-engineered for automation, face-to-face global collaboration, and real time tracking & tracing.

- **Overall Ecosystem Integration:** The command center brings 360-degree views of end-to-end business processes across several domains. It requires a new application ecosystem, integrated with real-time technologies as identified in the earlier section.

- **Overall Organizational Change Management:** The real-time enterprise processes will bring multiple changes across the board - people, process and technology. It will require top-down push and management commitment to implement such a strategic change.

Benefits

The command center for global supply chain will deliver following benefits across business processes:

The command center brings an innovative experience for managing global operations, completely changing the day in a life, for the user. The real time view of data, face-to-face global collaboration and telematics powered automation brings a very different level of efficiency to day-today interactions.

Focus Area	Biz Processes	Benefits Delivered
Supply Chain Network Optimization	Supply	- Facilitates real time collaboration across global stakeholders - Accurate production planning, scheduling aligned to demand - Reduced lead time and cycle time for supply - Reduced defects, rework efforts and increased compliance
	Manufacturing	- End-to-end supply chain visibility & control - Reduced supply chain cost with inventory optimization - Improved plant capacity utilization - Accelerated New Product Introductions (NPIs)
	Logistics	- Real time shipment tracking for better delivery performance - Reduced cycle time and logistics costs - Real time logistics shocks & shifts management - Proactive risks and disruptions management - Real time alerts & notifications for unexpected events
	Demand	- Accurate forecasting, planning and distribution - Real-time view of demand Vs. distribution - Price protection and efficient serviceability

Challenges

Some of the current challenges faced by the industry are:

- **Organizational, geographical and system boundaries:** The fragmented supply chain brings a challenge to develop a real time solution spanning across multiple parties, several countries.

- **Incremental local improvements Vs. disruptive global optimization:** Enterprises focus more on local issues and improvements rather than high-impact & high-value global optimizations.

- **Rigid & inflexible existing supply chain systems and processes:** The current supply chains systems are not agile & flexible to bring modern innovative practices for high-end optimization.

- **Discrete infrastructure & heterogeneous system across supply chain network:** The existing infrastructure & systems pose a challenge to implement integrated, scalable and global ecosystem.

- **Complex international laws, standards and compliance measures:** The standards, regulations, laws and stakeholders keep changing to provide an out-of-the-box global solution.

Best practices

The command centers for global supply chain operations help maximize the business value of global supply chain networks. The following are the key best practices while implementing the solution:

- **Focus on global optimization strategies than incremental local improvements:** Maximize the business value of global networks through disruptive & large scale improvements.

- **Effectively collaborate across global stakeholders:** Eliminate the supply chain inefficiencies through effective collaboration across manufacturers, suppliers, distributors and transporters.

- **Leverage real time technologies:** Bring along the business and IT transformation through global command center, powered by real-time technologies.

- **Proactively manage risk & disruptions:** Reduce losses through proactive risk assessment and disruptions management through real time tracking & tracing, alerts and notifications.

- **Bring a next generation experience for business operations:** Modernize the business processes and end user experience through next-gen touch-and-feel technology inventions.

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Architecting the Real-Time Enterprise, discusses the strategy and requirements that go into architecting an enterprise from the Real-Time perspective. It explores various industry solutions and provides an insight into the various challenges, success factors and benefits while taking into focus the characteristics of Real-Time Enterprises.

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