

## **Architecting for Next Generation Smarter Application**

**December 3, 2013**

**Aravind Ajad Yarra and Hari Kishan Burle**

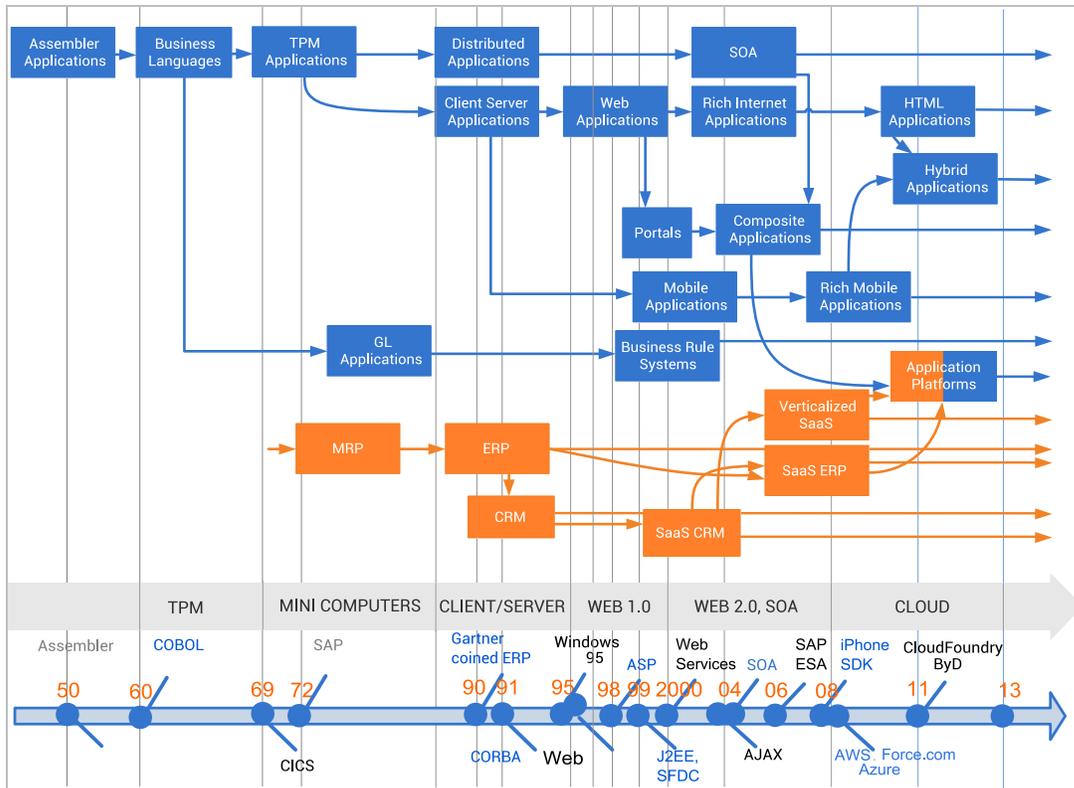
### **Abstract:**

Big shifts in technologies such as mobile, cloud and analytics are driving significant changes in the way applications are architected, deployed, used and maintained. Consumer applications are establishing new benchmarks in usability and capability. Businesses are compelled to adopt trends set by consumer applications. This is not necessarily bad news. If anything, the changes offer new opportunities to enterprises to rethink traditional application architecture practices and build what are known as 'Smarter Applications'. These applications are always on, available on multiple devices, provide real-time alerts and notifications, are contextual, elastic, intuitive and adaptive. This article discusses the key attributes of Smarter Applications. It also helps examine your organization's preparedness to adopt Smarter Applications across the business.

### **Today's Big Shift in Technologies: Driving Disruption**

Enterprise applications have been in a constant state of evolution, influenced by business dynamics. Now, immensely powerful vectors in the form of mobile, cloud and analytics and changing user behavior are driving a revolution. Analysts such as Gartner call the intersection of these big shift technologies a 'Nexus of Forces'. These forces are disrupting application architecture and delivery. Across industries, IT is being compelled to rethink traditional architecture practices.

We have already witnessed an evolution in application architecture: transaction processing monitors in the '60s, mini computers in the '70s, client/servers in the early '90s, the web in the late '90s, service-oriented architecture in the early 2000s and virtualization, cloud and mobility in the latter part (see Figure 1).



**Beyond technology (Figure 1):** Shifts in technology have manifested themselves as changes in enterprise applications.

Now, the Nexus of Forces is creating a tectonic shift. The question is: how prepared are you to address the changes? More importantly, how prepared are you to leverage the opportunities being created by a generation of 'Smarter Applications'?

### Consumer Behavior Driving the Future

Historically, users have first seen state-of-the-art technologies emerge in enterprise environments. This is no longer the case. The tables have been turned. Consumers are adopting bleeding edge technologies, even shaping them, long before enterprises embrace them. Consumer applications are setting the benchmarks in usability. They

are pushing the capability envelope (see Figure 2).



**Raising the bar (Figure 2):** The key to smarter applications is predicting end-user behavior

Consumers expect information to be delivered on their device of choice when they need it. They expect personalization, customization and localization. They want to move seamlessly from one device to another without degrading, interrupting or changing the experience. Providers of consumer applications such as Netflix, Amazon, Google, Facebook, YouTube and Twitter are finding ways to do this. They are in the lead with solutions to scalability, high variability, agility and security.

With businesses increasingly going global, the pressure to scale, respond to employee preferences and deliver secure services is going to grow. How can businesses accelerate the learning process? Can they do it by predicting end user behavior and its impact on technology?

Examining some fundamental shifts that we are now – as consumers – familiar with provides helpful pointers into the emerging constructs of Smarter Applications:

- **Always-on:** *With the growth in connectivity, consumers expect applications to be always on.*
  - Implication: Enterprise applications cannot afford downtime, even during upgrades or changes in infrastructure.
- **Multi-screen:** *With rising multi-screen adoption (laptops, tablets, PCs, mobiles, game consoles, e-readers etc.) by consumers, applications are available across devices.*
  - Implication: Enterprise applications must work across devices and platforms, adding to technical complexity and costs.

- **Pull to Push:** *Consumers expect information to be pushed to them in real time, when it is relevant on the device of their choice.*
  - Implication: Push notification and real-time alerts are new to enterprise applications. Delivering them across multiple screens that have a variety of form factors and operating systems adds to the complexity.
- **Elastic:** *Consumer expectations of response times from applications on the Internet have shrunk from five seconds in the '90s to sub-seconds today.*
  - Implication: With unpredictable business volumes on the Internet, enterprise applications (and the related technology stack of databases, hardware and application servers) need to scale up/ down instantaneously to meet demand/ save costs, requiring elastic architecture.
- **Intuitive:** *Consumers are breaking down the barriers in communicating with machines using touch, voice and gesture.*
  - Implication: Enterprise applications need to provide the same natural and intuitive user experience that enables touch, voice and gesture, adding to a growing feature list.
- **Contextual:** *Consumers don't want to deal with a flood of information, preferring to have their data curated in order to save time.*
  - Implication: Enterprise applications will need to understand the user's context, environment, situation, location etc. to deliver data and actionable insights that are useful at that moment. This means digging into very large datasets in real time.

## Technology Shift Driving the Future

Until some years ago, the infrastructure required by enterprise applications was relatively simple. Today, big shift technologies such as mobile, cloud, Big Data and analytics are causing major disruptions. The impact of these developments is being felt across the entire technology stack of databases, hardware and applications servers. How can businesses assess and leverage these new technologies? How can they be turned into competitive advantage?

Examining how traditional tools and processes are being replaced by more agile and flexible technologies sheds light on the shape Smarter Applications are likely to take:

- **Open Source:** *There is a steady shift towards open source technologies. These technologies were traditionally developed by independent individuals and expert communities. Now, several open source technologies are sponsored by enterprises as well (e.g. Facebook's sponsorship of Cassandra), or part of full stack vendor systems (e.g. VMware's Pivotal initiative).*
  - Implication: The underlying technology for applications is becoming more agile, demanding that enterprise application developers be adaptive.
- **Agile / Lightweight:** *Agile technology stacks (see Figure 3) and processes such as Extreme Programming (XP) and Scrum combined with new engineering methods have significantly improved time-to-market.*
  - Implication: The technology stack across the layers of application must lower footprint and embrace agile tenets natively, using dynamic

languages and open interfaces making it easy to learn, develop and automate.

	mature	cutting edge
Web Client	HTML JavaScript AJAX Gadgets JQuery	HTML5 CSS3 LESS
Mobile Client	WinMo Blackberry iOS Android SUP	Cordova Sensatouch
Web MVC	Spring MVC Portlets JSF GWT	Grails Play Node.js
App Framework	Java EE .NET Spring	Akka
Caching	DynaCache Memcached Ehcache	Coherence Hazelcast
Messaging	MQ JMS	AMQP
Protocol	RMI HTTP JMS SOAP	REST JSON OData
Service Broker	WebSphereESB ServiceMix	CastIron Layer7 ql.io
Process Mgmt	Oracle BPM IBM/Lombardi	Pega Appian Kissflow
Languages	C C++ Java C#	Javascript Groovy Scala Clojure
Tools	Eclipse VSTS SVN ANT Maven	Jenkins GIT Graddle Chef
Platform	vcloud AWS Azure	OpenStack CloudFoundry
Security	SSL OAM WAF	PingFederate OpenID OAuth
Search	Autonomy FAST	Lucene Solr Nutch
Content Mgmt	Interwoven Fatwire Alfresco	Drupal
Analytics	BO OBIEE Omniture Tealeaf	Qlikview Hadoop Splunk
Data Store	Oracle MySQL	Cassandra MongoDB NuoDb

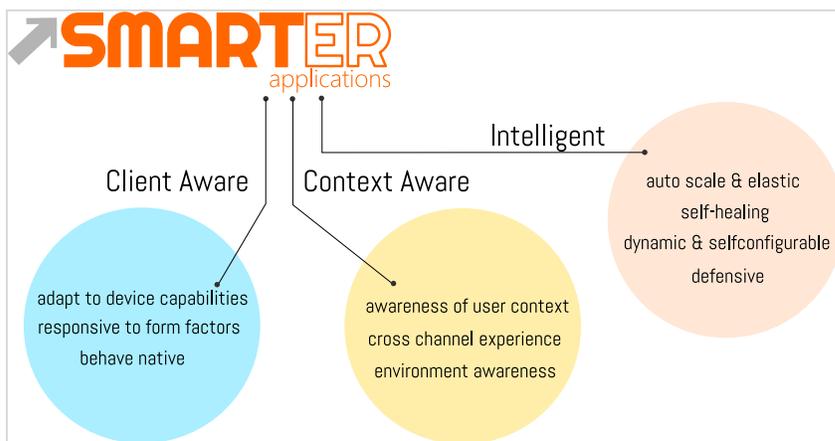
**Agile technology stacks (Figure 3):** Enabling enterprises to significantly improve time-to-market.

### Defining ‘Smarter Applications’

We can say with certainty that the next generation of applications must have unprecedented capabilities to meet user expectations, address business needs and leverage technology shifts. We think of these as being ‘Smarter Applications’.

### Attributes of Smarter Applications

We know that ‘Smarter Applications’ will be driven by the changing user behavior and be molded by big shift technologies. Translated this means that applications will have to know the user (Client aware), the user’s environment (Context aware) and must be always on regardless of channel (Intelligent) and secure (see Figure 4).



**Attributes of Smarter Applications (Figure 4):** Ability to morph and reshape using awareness and intelligence

**Client Aware:** Smarter Applications understand client capabilities and adapt to those capabilities. For example they understand browser resolutions and device form factors; or they understand whether a device is touch enabled. Accordingly the application changes the user interface and client side behavior. They understand the processing capabilities of a device and accordingly shift the processing from client to server or vice versa. They are aware of network connectivity and can store data offline and automatically synchronize when the network is online.

**Context Aware:** Smarter Applications stay relevant by understanding user preferences and end goals. For example they can unify user interactions with an application across channels. They let the user initiate the transaction in one channel and continue in another from where they left. They understand the user's context (eg: is the user in a meeting? on the road?) and thus determine what information to provide the user for better decision-making.

**Intelligent:** Smarter Applications are intelligent so they scale to multiple servers when required to optimize load. They can sense component failures and self-heal. They understand the run-time environment and can self-configure. They are defensive and can protect themselves from attacks. They recognize application data access patterns and cache data accordingly for faster retrieval. They are smart enough to know which applications to connect and collaborate with.

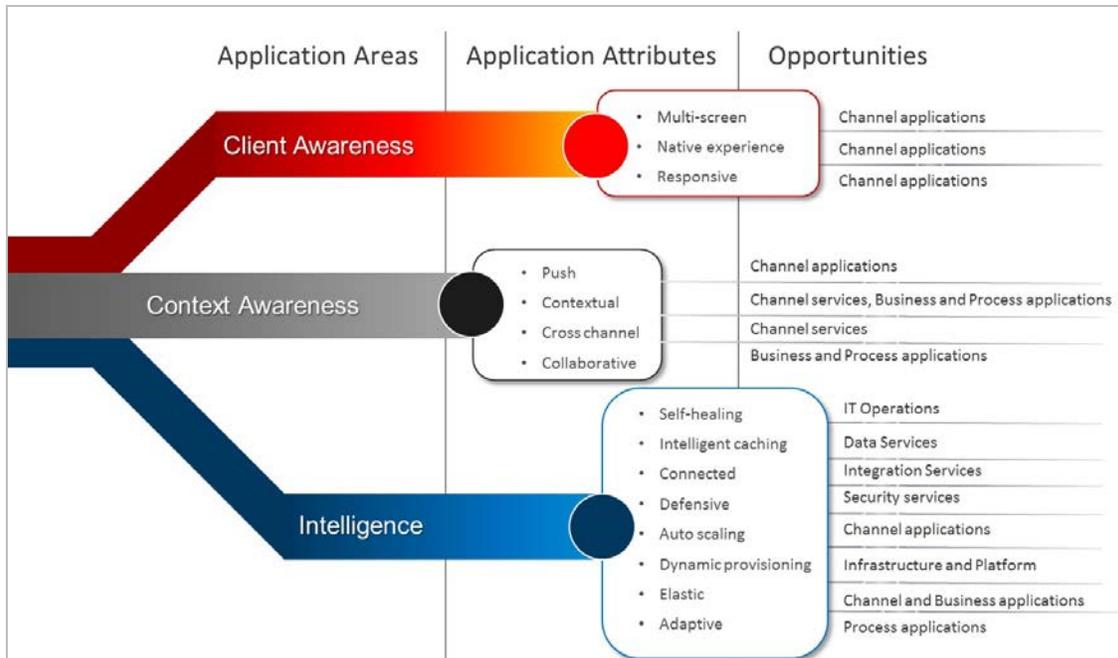
### **Delivering Smarter Applications**

It should be evident that the path to Smarter Applications requires a major shift in approach, planning and effort related to architecture patterns and practices, technology stacks, application frameworks and tools. It also requires a considerable amount of learning and effort by architecture practitioners. The task is made more challenging since methods, frameworks, patterns and accelerators to jump start the effort are in their infancy.

It stands to reason therefore that before embarking on the Smarter Applications journey, enterprises identify opportunities where the benefits will lead to immediate value before building architectural capability.

### **Identifying Opportunities for Value Creation**

The enterprise application landscape is quite broad. It is easy to get lost when identifying opportunities where Smarter Applications are most relevant. A representative view of the application areas most commonly seen in enterprises is shown in Figure 5. The attributes of Smarter Applications within these areas can direct the organization to key opportunities. It must be noted that Smarter Applications are relevant across the application landscape, including channels such as partners, sales, service and commerce; they are relevant to the middle office and business processes; to the integration and orchestration layer; to IT operations and monitoring; to enterprise data sources; and to core enterprise applications.



**Identifying Opportunities (Figure 5):** The Smarter Applications value map to early returns

## The Path to Success: Essential Architecture Themes for Smarter Applications

Establishing architecture capability that covers areas across the enterprise involves multiple architecture themes. Each of these themes have to focus on building new architecture capabilities such as best practices, patterns and recipes, frameworks and accelerators and shared platform services.

What are the essential architecture themes that enable your enterprise to deliver Smarter Applications? We believe there are 7 such themes:

1. **Always On:** As discussed earlier, always-on applications must be able to handle high concurrent volumes, detect user presence and activity across channels and push data using the right messaging platform on to the user's device of choice.
  - o Key to success: A set of shared services that are designed to be continuously available and which can absorb the burden of these challenges.
2. **Smarter Clients:** Web applications with limited UI capabilities, constant page refreshes and excessive dependencies on server connectivity and high latency don't result in the best experience. Smart clients push the UI experience forward by intelligent handling of disruptions in connectivity, variations in device form factors and capabilities and complexity in integrating cloud services.
  - o Key to success: Frameworks that include storage & sync to handle the disruption in connectivity by storing data within clients and intelligently sync it back to the server when connectivity is restored; seamless client/cloud computing that understands the client and other environmental capabilities and accordingly moves business logic seamlessly between client and cloud services; Responsive Design that detects device

capabilities to the appropriate UI to optimize the experience for the device.

3. **Contextual Delivery:** Delivering applications in context requires real-time data processing from disparate sources that provide contextual information (CRM, systems of record, sensors, channel activity, etc.).
  - Key to success: A shared platform that can be used by applications across the enterprise to deliver contextual services with components that include a Connector Framework to pull and connect data from multiple sources in real-time or in batches; Event Processing Pipeline that uses real-time events, enterprise data and custom logic to build context; and a flexible Context Store, a storage mechanism without the constraints of pre-defined data models that applications query to deliver context-relevant services.
4. **Elastic Architectures:** The common approach to scalability is to add bigger machines. However with the advent of public and private clouds, application scalability has to be rethought. The key challenges in delivering elastic architectures are managing application state, handling high concurrency and volumes of data, managing failure in elastic computing environments and recovering without intervention.
  - Key to success: A toolkit of architecture patterns and foundation components to build applications that comprise State Offloading allowing applications to offload centralized state management that scales using elastic memory infrastructure; Parallelization allowing applications to parallelize computing workload and scale; Application and Data Partitioning Patterns across computing nodes; and fault tolerance frameworks allowing applications to handle service faults.
5. **Adaptive Process Architectures:** Smarter process applications have to be adaptive to the environment and provide better human interaction.
  - Key to success: Adaptive process flows require processes to be constantly monitored, and the history of process-run-data to be analyzed to gain intelligence. This means provisioning a tool-kit to work with process management systems and enhance process application capabilities. Key components of such a toolkit would be a contextual routing mechanism, a contextual work assignment mechanism that leverages user context, past work and user profiles to identify the right worker for a task and assign it accordingly; and a social process collaboration framework that enables process applications to collaborate based on dynamically created interest graphs.
6. **Intelligent Data Services:** Data drives intelligence. Enterprise data stores are spread across heterogeneous systems (and are in a variety of not-easily-usable formats), making data availability for applications a challenge.
  - Key to success: Develop a framework and a shared platform to deliver enterprise data as a service. The components that would make up this platform are Intelligent-Caching that understands access patterns and caches data accordingly to provide responsive access; a real-time parallel processing framework that leverages elastic infrastructure and makes data available to applications in a canonical form; and a service enablement framework that delivers data as a service and provides a service oriented view of data to applications.

7. Application Platform: An end-to-end platform spanning the entire application lifecycle is the chief enabler for delivering Smarter Applications.
  - o Key to success: Create a shared enterprise-wide platform that caters to agile application delivery. Such a platform has multiple components that include Platform as a Service to simplify platform provisioning and application deployment; API Broker for a simplified mechanism to discover and access enterprise services leveraging Open API; Federated Authentication that provides a common access mechanism that can integrate with applications across the enterprise; and an Enterprise App Store that provides a method for users to search, download, review and rate applications while it tracks application usage for billing.

## Conclusion

Luckily the change ahead is recognizable. The time is right for Smarter Applications that meet user and business expectation. Requirements for the future of effective application architecture are evident.

Our efforts to create assets that solve the problems pertaining to next generation applications are providing insights into how organizations must rethink their application architecture strategies. These new strategies are not easy to define. Neither are they easy to adopt. However, our 7 architectural themes (above) help to suggest a path to the future. These themes are critical to your Smarter Application development initiatives. Following them should reduce time to market and improve your chances of success.

## About the Authors

**Hari Kishan Burle**, *Vice President, Global Head Enterprise Architecture, Business Application Services, Wipro*

Hari heads the Enterprise Architecture (EA) practice. He has been with Wipro for over 19 years in various technical and leadership roles. The EA practice is part of the Business Application Services (BAS) division and helps translate IT strategies to execution, with a special focus on the evolving the role of Architecture as a Function in enterprises and the influence of emerging technologies on Application Architectures. Hari's special interest is in emerging trends and their impact on architecture for Business Applications resulting in 'Smarter Applications'. In his prior roles Hari managed the Enterprise Business Integration and Mobility practices. He was also instrumental in incubating capabilities and solutions for Cloud, SaaS and sustainability.

---

**Aravind Ajad Yarra**, *Lead Architect, Enterprise Architecture, Business Application Services, Wipro*

Aravind is the Practice Lead and Lead Architect focusing on Application Architectures leveraging emerging technologies. In his current role Aravind has been assisting Wipro's customers adopt emerging technologies. In his past roles he worked as an architect for several complex transformational programs across the Banking, Capital

Markets and Insurance industries. Aravind has been with Wipro for 15 years. His current area of interest is building next generation Smarter Applications.