

Growth Strategy Insights

# FUTURE PERFECT

THEMATIC RESEARCH  
and TRENDS for 2019



Future Computing in a Post-Platform World

# THEMATIC RESEARCH and TRENDS for 2019

As we have in previous new years, we set about compiling the most important trends, forces and themes we observed in 2018 to explore their significance and outlook in 2019 and beyond. If, as many observers predicted a year back, 2018 was yet another year that was supposed to be the year that IoT evolved from hype to reality, it's difficult to conclusively say that's happened.

What trends and forces will drive new growth opportunities? What technology and innovation opportunities should players be considering? We tend to get tired of reading all the same lists of new tech trends each year..... AI, machine learning, autonomous this and that and so on.

Since, we all really know that the core technologies comprise only one dimension of how new innovations will get adopted and embraced, we feel it is more important to focus on critical core technology enablers in the context of broader business and market forces. Our analysis continues to point to several adoption challenges that are, for the most part, not well addressed primarily because of rigid business practices, protocols and cultures.

**M**ost business observers and technology innovators agree that the future of enterprises will be shaped by efficiently designed, pervasively connected systems. Increasing connectedness of owned and non-owned assets combined with open technologies will enable more fluid data sharing and interactions between and among systems, users, businesses and institutions. The opportunity lies in a new realm of services based upon the convergence of networked computing and large-scale data management with real time machine intelligence. The intersection of these trends – what we like to call Smart Systems or the Internet of Things, Data and People - should create unimagined new values. But will it?

Genuinely Smart Systems should re-think the whole relationship of people, machines, and devices to business systems. It must be built upon true, across-the-board digital automation, accomplished by enabling everyday electronic devices to communicate with and control each other, along with a whole new generation of information tools (“killer apps”) for managing rich, vast streams of meaningful data. The goal is to integrate people and devices into a new generation of systems that are self-sensing, self-controlling, and self-optimizing—automatically, without human intervention.

On the technology development and supply-side of the equation, the rigid and fragmented nature of software offerings available today make it extremely difficult and expensive to develop effective Smart Systems and IoT applications. On the adoption side of the equation, business culture is the primary inhibitor blocking effective use of new technologies.

## **CRITICAL CORE TECHNOLOGY DEVELOPMENTS**







When it comes to developing the required technologies to fuel smart systems and services adoption, most people assume that “the network and IT arms merchants” are taking care of it. They take it on faith that the best possible designs for future information architecture will emerge from large tech players. But those are big, unfounded assumptions. In fact, most entrenched entities are showing little appetite for radical departures from the legacy development paths they are on. Yet, these development paths will not serve the needs of a genuinely connected world.

So, what are the critical technology and innovation developments required to address this new era of computing and networks? Here briefly is a summary of what we believe are the critical core developments that have the potential to catalyze adoption:

- » Higher performance, higher quality and more reliable mission critical wireless networks that will enable smarter sensors, actuators, measurements and data fusion;
- » A new generation of “low code or no code” application development tools to leverage the rapidly growing communities of developers, systems integrators and value-added services providers;

- » More distributed [peer-to-peer] data and information architectures to inform data sharing and data fusion for analytics, AI and machine learning;
- » Easier and less costly data management, data transformation and analytics application development tools; and finally,
- » A new generation of integration and equipment management software that can enable free flowing data aggregation, data discovery, integration and collaborative [community-driven] development and massive re-use of software components.

So why is this all so hard to really get behind and make happen?

Exhibit: Critical Core Technologies To Enable Smart Systems and Services					
 Sensors, Actuators & Machine Data Fusion	 High-Performance Networks & Infrastructure	 Distributed Data and Information Architecture	 Data Management, Analytics & App Dev Tool	 Artificial Intelligence & Machine Learnin	 User Experience (UX/UI, AR, VR), Content Deliver & Interaction
<p>New sensor nets, and tools for sensor data fusion apps</p> <p>Real-time data aggregation and data mgmt tools for diverse sensor and device types</p> <p>Easier and less costly data management, transformation and analytics application development tools</p>	<p>Higher performance, high quality and more reliable mission critical wireless networks</p> <p>Enablement of more efficient resource sharing and improved service-level agreements</p> <p>Flexible configuration for low data volumes and very large scale of connections</p>	<p>Platforms that can simultaneously &amp; asynchronously act on any type of info from any device enabling real-time temporal, spatial and state-based processing</p> <p>Democratized data architecture for machines and equipment that enables new micro services from loosely-coupled devices and systems</p>	<p>Development tools and functions for diverse users and personas that enable data discovery, aggregation, integration and collaborative application development</p> <p>UX-based platform for application agnostic device data integration and app development</p>	<p>Machine learning development tools to build complex predictive models and algorithms</p> <p>New capabilities to turn data into contextualized awareness and knowledge</p> <p>Powerful new information automation and embedded decision support tools and processes</p>	<p>Emergent UI technologies, including AR/VR, wearables, and new user interaction tools</p> <p>New UX interactions between and among new UI devices, sensors and software services</p> <p>Powerful new services delivery schemas and new context and interaction-dependent experiences</p>

It's as if every established technology company and the insane array of [naïve] start-ups arrived to the "Internet of Things" opportunity claiming they could address this new opportunity with just the tools at hand; a giant bag of "pre-existing" conditions" none of which really anticipates IoT and Smart Systems tech developers, market developers' and users' toughest challenges. Interoperability, latency, database dependency and user complexity have not really been addressed by the majority of players who have entered this arena. Instead, we have this crazy story about so-called platforms that can solve everyone's challenges when so few of these stories

address real software development requirements. We need to move beyond today's confusion to a "post-platform" world supported by capable new tools and software.

## THE PROMISE OF "COMBINATORIAL" TECHNOLOGIES

Multiple parallel technology developments appear now to be increasingly reinforcing and accelerating one another. Cloud infrastructure resources are providing unprecedented computing scale. Mobile computing devices are extending the reach of computing. Machine learning and AI are bringing intelligence to diverse things. And, embedded systems and IoT technology are connecting and integrating a broad array of physical and digital applications.

Each of these technologies is powerful on their own, but creative combinations of these capabilities are multiplying their impacts. Human-connected devices and machine-connected IoT devices enable exponentially more data. The cloud then enables us to capture and analyze all that information through its computational capacity. Which, in turn, sets the stage for AI and machine learning tools to analyze and capture new insights. This sounds all very neat, tidy and linear, huh?

Even with these technologies converging, the three primary technical development communities supporting enterprises - the wireless carriers, the IT systems suppliers and the automation and control community - have failed to re-evaluate their relationship to these advancing technologies and to the evolving enterprise of the future. The technology and business paradigms to which these groups cling today are far too rigid, too cumbersome and too expensive to foster the data interactions and new collaborative business relationships we are discussing here.

## SECOND VERSE SAME AS THE FIRST

Some technologies when they arrive in the market can often appear to be innovative and new but, after closer examination, turn out to be simply extensions of existing technologies; players merely leveraging their "sunk" R&D investment by re-packaging and re-positioning.

From a technology standpoint, even though we are witnessing a re-centralizing movement driven by the adoption of cloud computing and storage (Amazon Web Services, Microsoft Azure, and Google Cloud, etc.), rapid decentralization of computing resources is a minimum requirement to extend and enhance the ways we share and interact with data to support new relationship structures and collaboration.

These advances require computing resources that are fully distributed, both for functional and for economic impacts (i.e. eliminating the latency involved in sending and receiving data from the cloud; reducing network costs by distributing computing resources; and, leveraging AI for language processing and image recognition at the edge to enable new real-time and context-dependent interactions between people and systems, to name a few examples).

Just as tides shift according to the gravitational pull of the moon, the distribution of computing resources needs to shift dramatically from a centralized to a more decentralized architecture to fully enable large scale interactions and collaboration. We don't need to re-visit mainframe computing, that chapter needs to be over and gone. Just as the extensible, technology-neutral nature of the Internet has allowed it to scale so dramatically and gracefully with minimal central administration, we need a similar approach to enabling the diverse interactions between systems, data, institutions and people.

## **NEW MARKET ROLES and BUSINESS MODES**

The dis-integration of traditional enterprises driven, in part, by the decades long wave of outsourcing, is restructuring businesses into three broad groups or roles: platform players, horizontally focused providers of outsourced professional services and, focused specialist product and service businesses -- “platforms” ...”professionals” and...”specialists.”

The influence and disruptiveness of platform business models (not to be confused with the earlier discussion of IoT software platforms) affect much of the enterprise world these days. Platform models can come in many types, including a de-facto standard such as Cisco's network operating system or Microsoft's Windows (or Azure today), or the immense scale of Facebook's user base enabled by social relationships and interactions. Platform business models that creatively combine elements of dis-intermediation, new relationships, shifting profit pools, new recurring services, customer transparency or other maneuvers are all disrupting existing business and operating models - just consider the scale and impact of technology-based platform models like Google, Uber, Apple and Amazon.







To date, most of the successful platform models are more “consumer” focused; fewer B2B markets have really embraced this type of model. However, we believe the model is spreading to new B2B opportunities including freight logistics, supply chains, genetic sequencing, asset management, energy services, customer relationship management and more. The growing influence and disruptiveness of platform models is forcing all businesses to think more carefully about which future role suits them (“platform” or “professional” or “specialist”) and which partners should be considered to form win-win partnerships with to maximize value for customers.

Since virtually all future enterprises will be informed by ecosystems and new value delivery networks, leaders are recognizing the era of going it alone or “flying solo” is over and the command-and-control alliance and partnering strategies of the past will not be effective in the complex, instantaneous, interwoven digital economy of the future.

## NEW RELATIONSHIPS, ECOSYSTEMS and “STRANGE BEDFELLOWS”

The innovation driven by digital, smart systems and IoT technologies coupled with diverse and changing relationships among players will likely lead to changes in market structure, shifts in the sources of profit and value creation and radically new business and operating models. Identifying and designing new business models along with developing the skills, capabilities, systems and organizational relationships they require will be critical to success.

**Exhibit: Core Technology Enablers Impact All Sectors of the Economy**

	 Healthcare	 Transportation	 Industrial & Manufacturing	 Energy & Utilities	 Buildings & Facilities	 Retail & Consumer
<b>Artificial Intelligence and Machine Learning Tools</b>	Test/scan reading and AI capable of diagnosing patients	Automation of driverless trucking fleets	Timeline to completion and sensing faults during production	Ability to balance grids, manage demand and provide services	Ability to optimize energy requirements and resource usage	Robo advisors for wealth and money management
<b>User Experience (UX/UI, AR, VR), Content Delivery and Interactions</b>	Real-time assisted diagnostics and consults	Safety systems in traffic & fleet management	Remote assisted services & machine support tutorials	Delivery of peer / local usage statistics and performance	New more intuitive may finding systems	New social interactions and learning
<b>Data, Analytics and Application Development / Developer Tools</b>	Telehealth and wearables app's for wellness	Ticketing analytics for demand and asset tracking/ scheduling	Workflow applications and predictive maintenance	Renewable energy production trends and predictions,	Building systems to leverage data across lighting, HVAC, fire alarms, detection	Identity services, security and privacy management
<b>Large Scale Distributed Data and Info Architecture</b>	Information access for professionals in local architectures	Internal vehicle info access coordinate with urban systems	Production equipment analytics to optimize and improve efficiency	Analytics on processes and equipment to optimize	Cross-leveraging data from various building and facility sources	Shared (peer-peer) services for media and entertainment
<b>High Performance Networks and Infrastructure</b>	Real-time patient data and medical application updates	Transport systems schedule & resources to fit demand cycles	Syncing global ops for collaboration and efficient mgmt	Power distribution automation and control	Building owners & tenants able to share data across facility	Streaming, responsive media and services
<b>Smart Sensors, Actuators and Device Data Management</b>	Medical staff and critical asset tracking and monitoring	Fleet tracking and carrying asset monitoring	Remote machine health and predictive maintenance & diagnostics	Substation monitoring and machine usage patterns	Integrated mechanical and energy sensors for multi-use	Creation of more context sensitive environments

Platform and professional outsourcing and services players will require huge scale, but focused product and services specialist players will be able to use that scale to thrive as well. “Everything as a service” will be available on demand, from a mix of horizontal (cross-industry) and vertical (industry-specific) outsourcers, with the latter often set up as joint ventures by industry participants. There will be ongoing battles at the seams between the three types of companies. Next generation platform models will become a material force for building community and increasing collaboration between and among players.

As the number and diversity of ecosystem stakeholders expands (users, sellers, supporters, benefactors, etc.), and the volume and nature of their interactions grows, the systems or “technology architecture” will need to become more closely coupled to the “business

architecture” to inform and enable new information-driven services. These two “architectures” must be tightly interwoven and mutually supportive without inhibiting one or the other.

The number and diversity of stakeholders, users, sellers and supporters interacting with these systems will evolve in a way that creates a “social system” comprised of new unfamiliar relationships - a phenomenon we call “strange bedfellows.” Leveraging new digital data value inherent in connected products and systems will require new infrastructure and enabling technologies that will, in turn, inform the formation of new and different market relationships and alliance networks comprised of complementary equipment and device OEMs as well as third party application developers and services providers. We believe that within this solution delivery social system [or ecosystem] players will need to understand new value adding “roles,” but also make conscious decisions about their evolving position in market delivery networks.

## **NEW RULES FOR A NEW ECONOMY**

Aligning and leveraging the respective roles of technology architecture and business architecture often creates contention, but we believe we are entering an era where success in either will increasingly go to the players that effectively utilize their combined potential.

While the above list of tools should contribute to OEM and end customer adoption of new Smart Systems and IoT technologies, our analysis points to several broader business challenges in realizing the full value of new enabling technology:

- » Challenges in OEMs with adopting new business, revenue and operating models;
- » Complex services delivery ecosystems that require new and different relationships and business-to-business protocols;
- » Anticipation of new and more diverse venture modes not widely adopted today;
- » Fragmented digital and IoT vendor landscape - particularly the lack of understanding of how these new more “distributed” and “participatory” systems will work within the currently rigid norms of the traditional IT and telecom technology development community; and,
- » Requirements for more vertically-focused solutions (based on these core “horizontal” technologies) from a new generation of developers where the work of individual developers can be more freely shared, re-used and extended.

Increasing connectedness and openness implies great opportunity but also great risk. In today’s business culture, the threat of commoditization, the possible dilution of brand identity and leverage, the possible loss of customer account and the challenges associated with security and privacy have grown into very large concerns that could severely inhibit open data sharing and large-scale collaboration.



Collectively, these core technologies have the potential to open up massive new business opportunities but only if the business world comes to recognize the need for new business strategies, new solution designs and different corporate cultures.

The technology and business solutions we are describing will have much less managerial hierarchy, command and control decision making or proprietary ownership of ideas; new data and information architectures will change the very nature of business relationships and collaboration. Businesses need to start thinking and acting very differently.

Smart Systems, IoT and new digital solutions are enabling radically new user and customer experiences. The opportunity is wide open to clever solution developers who understand how 'intelligent' products should be experienced and how 'networked' products foster diverse interactions between and among manufacturers, users, application developers, technology sourcing partners and channel participants in a networked context.

Ecosystems and value networks will be self-organized by people who are motivated to explore and develop ideas they care deeply about. Collaborative innovation will extend beyond ideas about new products and services to the very manner in which business is conducted.

## **NEW PLAYERS DRIVING NEW INNOVATIONS**

Since all that we are describing is a radical departure from current offerings and business practices and is driven by a very unique set of forces, it stands to reason that these types of solutions do not fall within the narrow specialties of most existing players. In fact, the innovation being described is probably best viewed as an entirely new chapter in the marketplace. This is particularly true given the disjointed patchwork of solutions presently in place and the apparent lack of vision from existing players of what's required in the future.

A hand full of start-ups are accelerating the pace of development in distributed computing, catching larger established rivals off-balance and threatening to effect fundamental shifts in technology markets. Players like Fathym, niolabs, PADI, Atomiton, SkyFoundry and more each year are demonstrating they really understand market developers' and users' toughest challenges. Their strategies reflect the increasing importance of the convergence of truly distributed computing and new information architectures with large-scale collaboration and ecosystems to empower users and developers to exploit the vast potential of Smart Systems.

Alliances, collaborative systems and distributed computing are hardly new but as developer communities embrace new software tools and computing architectures that leverage intelligent sensors, devices and assets, radical new modes of value creation are emerging. Only those who grasp the new rules of smart [distributed] systems and collaborative market creation can win key positions. The opportunity to lead in developing and shaping these opportunities looks wide open for creative players.

## ABOUT HARBOR RESEARCH

An internationally recognized strategy consulting, design and technology research firm, Harbor Research has predicted, tracked, and driven the development of Smart Systems, Services and the Internet of Things since our inception in 1984. While our history is long, our strategy is simple: create value for our clients by combining creative facilitation with rigorous analysis and systems-focused thinking. It is this mindset that has given us the privilege of working with leaders in some of the greatest companies in the world. In the same way that the market has flexed and grown over the years, our services and experience have evolved to better serve our clients. We work with clients in a variety of ways including strategy consulting, business model development, solution design services, advisory, research and content development and collaborative facilitation.

### THOUGHT LEADERSHIP

We provide our clients with rigorous analysis and unique insights to support the development of new growth strategies and solutions. Our research, content and modeling work provides an ideal context for discovery and ideation. We combine market intelligence with creative decision making forums in a mutually supportive mode.

### UNIQUE PROCESSES

There is no simple "linear" process to drive new smart systems innovation. Iterative, nonlinear methods are important because design innovation is a process of exploration and discovery. Our methods facilitate new thinking and unexpected concepts and ideas that drive tangible customer and market impact.

### VIBRANT COMMUNITY

Building new smart systems and digital growth ventures requires new and different modes of design, development and collaboration. We tap our community of innovators and thought leaders to help organizations push the boundaries of collaboration to include new and unfamiliar participants that help foster new insights and creative perspectives.

