PACIFIC CONTROLS

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Galaxy 2021
PLATFORM OF PLATFORMS

Galaxy 2021 Computing Beyond M2M

PACIFIC CONTROLS ROAD MAP FOR SMART PERVASIVE SYSTEMS

How networked computing and the physical world are merging to transform civilization

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THE BIT, THE BYTE, AND LATER THE PACKET MADE POSSIBLE THE ENTIRE ENTERPRISE OF DIGITAL COMPUTING AND GLOBAL NETWORKING. UNTIL THE WORLD AGREED UPON THESE BASIC CONCEPTS, IT WAS NOT POSSIBLE TO MOVE FORWARD. THE NEXT GREAT STEP IN INFORMATION AND COMMUNICATIONS TECHNOLOGIES-COMPLETELY FLUID INFORMATION AND FULLY INTEROPERATING MACHINES AND DEVICES-REQUIRES AN EQUALLY SIMPLE, FLEXIBLE, AND UNIVERSAL ABSTRACTION SCHEMA THAT WILL MAKE INFORMATION ITSELF TRULY PORTABLE IN BOTH PHYSICAL AND VIRTUAL SPACE, AND AMONG ANY CONCEIVABLE INFORMATION DEVICES AND SYSTEMS. FOR THE INTERNET OF THINGS TO REALLY TAKE OFF, RADICAL NEW THINKING ABOUT INFORMATION TECHNOLOGY MUST BEGIN AT THE MOST BASIC LEVELS, WITH NEW CONCEPTIONS ABOUT HOW DEVICES, INFORMATION, PEOPLE AND SYSTEMS WILL INTERACT FUNDAMENTAL UNIT OF INFORMATION ITSELF.

INTRODUCTION

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For quite a few years now, Harbor Research has focused most of its research and consulting on what we call “Smart Systems”-the convergence of pervasive or embedded computing with the packet-switching “network of networks” called the Internet.

These days, many people refer to this phenomenon as “the Internet of Things.” We prefer “Smart Systems” over other terms in common use-notably “M2M,” which usually stands for “machine-to-machine”-because it captures the profound enormity of the phenomenon - something much greater in scope than just machine connectivity.

Whatever we chose to call it -- “Smart Systems” or “Pervasive Computing” or “The Internet of Things” - we are referring to digital microprocessors and sensors embedded in everyday objects. But even this makes too many assumptions about what the smart systems phenomenon will be. Encoded information in physical objects is also smart-even without intrinsic computing ability. Seen in this way, a printed bar code, a house key, or even the pages of a technical manual can have the status of an “information device” on a network. For that matter, all of these characterizations do not even begin to address the humanmachine dimension of collaboration.

But very few people are thinking about smart connected systems on that level. Current IT and telecom technologists are operating with outdated models of data, networking and information management that were conceived in the mainframe and client-server eras and cannot serve the needs of a truly connected world. “Smart Systems” should automatically be understood as “real-time networked information and computation,” but it isn’t.

We have now entered the age when everyday objects will communicate with, and control, other objects over a global data network-24/7/365. It’s not “the future,” it’s now-this year, next year-and thus it is vitally important that business leaders understand this phenomenon, its effects on their business, and what they should do right now to position themselves for opportunities that are literally just around the corner.

Before delving into the new thinking that makes this story possible, let’s talk about why it’s necessary at all. The IT and telecom sectors have failed to re-evaluate their relationship to advancing technology and to their constituents. The business and technology paradigms to which these industries cling today are far too limiting, too cumbersome and too expensive to foster and sustain new growth. From a Telco perspective, today’s discussions of M2M systems focus almost exclusively on communications -- the “pipe” -- and very little on the information value.

From an IT perspective, today’s corporate IT function is a direct descendent of the company mainframe, and works on the same “batched computing” model—an archival model, yielding a historian’s perspective. Information about events is collected, stored, queried, analyzed, and reported upon. But all after the fact.

That’s a very different thing from feeding the real-time inputs of billions of tiny “state machines” into systems that continually compare machine-state to sets of rules and then do something on that basis. In short, for connected devices to mean anything in business, the prevailing Telco and corporate IT models have to change.

The next cycle of technology and systems development in the smart connected systems arena is supposed to be setting the stage for a multi-year wave of growth based on the convergence of innovations in software architectures; back-room data center operations; wireless and broadband communications; and smaller, more powerful client devices connected to personal, local and wide-area networks. But is it?

M2M & IT technology only tell part of the story

M2M AND REMOTE SERVICES FALL SHORT

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M2M applications have evolved in a context where applications such as remote monitoring and support for equipment have been tied closely to equipment services contracts.

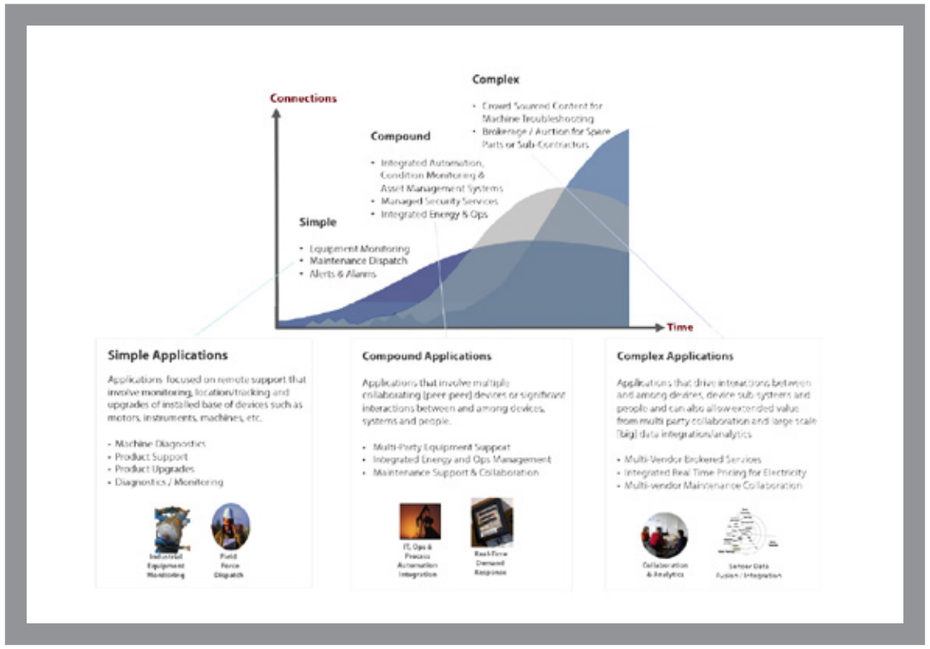
To date, remote services and M2M systems have largely been focused on simple remote diagnostics and simple tracking/ location services – in large part because of technical complexities and business model challenges (see below).

Existing technology has proven cumbersome and costly to apply with many conflicting protocols and incomplete component-based solutions. The challenges of developing applications and integrating diverse devices onto networks in an interoperable manner have been big adoption hurdles. The inability of today's popular enterprise IT systems to interoperate with distributed heterogeneous device environments is an obstacle that we are finally overcoming.

Return from simple applications, while extremely valuable, is limited to the manufacturer's service delivery efficiency. Contrary to what current market offerings depict, however, the value of connectivity does not have to end with just simple applications focused on a single class of device or machine.

As technologies mature and open standards become the norm, applications based on deeper, peer-to-peer interactions between devices, systems and people will drive more compound and dynamic value streams. This opens up new collaborative business model opportunities that have the potential to drive much greater value for the customer.

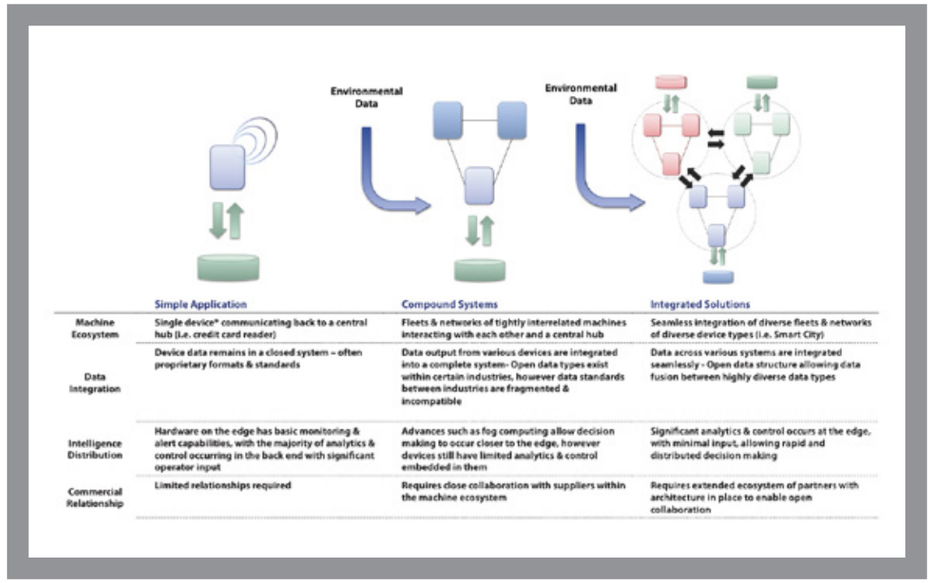
The value of smart systems does not end with just simple applications



Simple, Compound, Complex Applications For Smart Systems

These new business model opportunities are much closer in many respects to consumer- driven models like Apple or Google and can provide many lessons for the “cloistered” equipment manufacturers in B2B arenas. The business benefits of large scale open collaboration in the B2B arena are just beginning to be recognized. Moving from “Simple” to “Compound” applications involves multiple collaborating systems with significant interactions between and among devices, systems and people. No longer is the focus solely on the product supplier’s ability to deliver support for their product efficiently. Rather, value is brought to the customer through business process automation and optimization. Simple applications largely focused on the product manufacturer’s own value chain. They are simple “hub and spoke” remote support. While there is value in these models, there are significant untapped opportunities for providing new value for the users and customers.

As tech matures, applications based on deeper peer-to-peer interactions between devices, systems and people will drive compound value



	Simple Application	Compound Systems	Integrated Solutions
Machine Ecosystem	Single device* communicating back to a central hub (i.e. credit card reader)	Fleets & networks of tightly interrelated machines interacting with each other and a central hub	Seamless integration of diverse fleets & networks of diverse device types (i.e. Smart City)
Data Integration	Device data remains in a closed system – often proprietary formats & standards	Data output from various devices are integrated into a complete system- Open data types exist within certain industries, however data standards between industries are fragmented & incompatible	Data across various systems are integrated seamlessly - Open data structure allowing data fusion between highly diverse data types
Intelligence Distribution	Hardware on the edge has basic monitoring & alert capabilities, with the majority of analytics & control occurring in the back end with significant operator input	Advances such as fog computing allow decision making to occur closer to the edge, however devices still have limited analytics & control embedded in them	Significant analytics & control occurs at the edge, with minimal input, allowing rapid and distributed decision making
Commercial Relationship	Limited relationships required	Requires close collaboration with suppliers within the machine ecosystem	Requires extended ecosystem of partners with architecture in place to enable open collaboration

Moving to Compound and Complex Systems Value is Progressive

Instead, Smart System’s true potential lies in the integration of diverse machines, information systems and people—its ability to connect billions upon billions of smart sensors, devices, and ordinary products into a “digital nervous system” that will smoothly interact with individuals and the physical world. The nature of compound and complex systems applications is just beginning to be understood where the information value generated by these capabilities positions players to take on significant additional tasks for the customer in the future, such as:

- Managing and automating a customer’s spare parts inventory and service delivery chain for maintenance processes providing vastly improved levels of service and responsiveness;
- Providing the customer’s first line support staff, the machine builders’ service technicians and other third party support personnel with complete access to a unified machine maintenance record that captures all of the machine’s performance data, history and knowledge about the status of the equipment, enabling faster and more effective maintenance processes;
- Analyzing the history of the equipment in use against diverse data sources such as weather patterns and peak usage requirements to optimize its performance;
- Providing entirely new services to the customer, such as “security as a service,” where security and privacy for all devices, machines, networks and data is provided as a managed service.

Manufacturers often miss new opportunities because traditional manufacturer company cultures have all too often defined services as subservient to the product, as no more than a “bootstrap” business with little up-front investment or innovation.

Even those companies that have built remote services offerings have tended to only focus on their device, their machine and their value chain – missing the opportunity to more openly collaborate with partners and customers and provide integration for a much broader scope of systems within the customer’s operations.

Customers are looking to equipment manufacturers not just for high-quality equipment, but also for help in optimizing their ability to supply consistent and high-quality products and services to their customers. This evolution will allow manufacturers to tie their revenue and pricing models directly to the benefits they provide.

Taken one step further, applications that drive interactions between and among devices, sub-systems and people across enterprise and public sector systems will potentially allow extending and expanding values from third party collaboration and large scale data integration and analytics that, while complex, will drive the highest possible value from smart systems.

If you place this evolution into a much larger context – say how the Internet of Things will impact our planet’s resources – the potential impacts become even more profound.

Smart pervasive systems will enable businesses to create significant new customer value

THE FUTURE OF INFORMATION SYSTEMS

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This paper is about an important new perspective on smart systems. This perspective does not just come from our own thinking. It is from some very clever people who are thinking about the scope and on the scale that Smart Systems deserves: Pacific Controls and their new Galaxy 2021 platform architecture.

What are they developing?

- The required architecture and technologies to inform a radically new view of information interactions and services; and,
- the corresponding emerging business models these technologies will inform.

Pacific Controls demonstrates that for the first time in the evolution of networked businesses, IT and OT systems must be viewed in closer proximity. The two thrusts need to be mutually supportive without inhibiting one or the other. However, trying to coordinate and leverage the respective roles of classic information technology and operations technology architecture often creates contention. Pacific Controls has come to see the continuously evolving relationship between these two worlds as fertile ground for innovation. They need to be interwoven and mutually supportive. In fact, we believe success in either increasingly goes to the company that effectively utilizes the combined potential of both.

In our years of work on the Internet of Things phenomenon and its real-world effects on business, we have not encountered very many compelling visions about the complete integration of things, people, systems and real-time real-world inputs. The world today, for the most part, lacks a group of coordinated innovators that understand that the tools we are working with to make products “smart” on networks were not designed to handle the scope and diversity of interactions they are being enabled to accomplish.

“Smart Pervasive Systems” really means the future of information, and that means the future of civilization. It will require a remarkably agile global network that could comfortably scale to trillions of nodes some of them hardware, some software clouds, some purely data, many of them coming into and out of existence or changing location constantly. Just think of every man, woman, child or businesss on the earth each having their own cloud. Obviously, such a complex system cannot be “designed” in any ordinary sense. Certainly, it cannot be really be designed “top-down.”

And yet smarter systems and the Internet of Things must be designed in some sense. Such pervasive systems will easily be the biggest technical achievement in the history of humanity. Its closest predecessor is the global financial economy—with which, in fact, it will share vital characteristics.

Some basic design principles must be put in place to guide the growth of a vast, distributed technological organism that must remain organized as it evolves according to a logic all its own. It demands that we design not only devices and networks but also information itself in ways not addressed by current IT.

The Internet of Infinite Interactions -- between and among “Things” and “People” -- requires much more than simple incremental improvements in today’s technologies to be fully realized. The challenge is much more than a simple patch, Band-Aid, or new flavor of what we already do.

What’s required is a true shift in thinking about how devices, people and physical systems will be integrated and how they will interact. We need an approach that is not about leveraging aging IT technology into a new application context; its about looking forward to a single, unified architecture and platform for the nearly infinite interactions to which any PERSON or any THING can contribute.

What will this require? A vision that looks toward the creation of more universal means to integrate and manage disparate data, to which anyone can contribute, and which liberates information by abandoning traditional relational databasing and the client-server computing models that have us so deceptively ”trapped” today.

In short, Pacific Control’s Galaxy 2021 architecture and platform.

Smart pervasive systems really means the future of information, and that means the future of civilization

ENABLING SMART PERVASIVE SYSTEMS

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When it comes to preparing for the global information economy of the 21st century, most people assume that "the IT and telco technologists are taking care of it." They take it on faith that the best possible designs for the future of connected things, people, systems and information will emerge from large corporations and centralized authorities. But those are big, unfounded assumptions. In fact, most of today's entrenched players are showing little appetite for radical departures from current practice. Yet current practice will not serve the needs of a genuinely connected world. What are the major obstacles that need to be overcome?

Flexible, Scalable Systems: IT professionals rarely talk these days about the need for ever-evolving information services that can be made available anywhere, anytime, for any kind of information. Instead, they talk about web services, enterprise apps and now cloud computing. The Web stores information in one of two basic ways: utterly unstructured, or far too rigidly structured. The unstructured way gives us typical static Web pages, blog postings, etc., in which the basic unit of information is large, free-form, and lacking any fundamental identity. The overly structured way involves the use of relational database tables that impose rigid, pre-ordained schemas on stored information. These schemas, designed by database administrators in advance, are not at all agile or easily extensible. Making even trivial changes to these schemas is a cumbersome, expensive process that affects all the data inside them. Just as importantly, they make deep, inflexible assumptions about the meaning and context of the data they store. Both of these approaches to data-structure enforce severe limitations on the functions you want most in a global, pervasive-era information system: scalability, interoperability and seamless integration of real-time or event-driven data. The client-server model underlying the Web greatly compounds the problem.

Optimizing All Assets

Tangible And Intangible: New software technologies and applications need to help organizations address the key challenge of optimizing the value of their balance sheets, allowing them to move beyond just financial assets and liabilities to their physical assets and liabilities (like electric grids or hospitals) and then to their intangible assets and liabilities (like a skilled workforce). The task of optimizing the value of financial assets, physical assets and people assets requires new technologies that will integrate diverse asset information in unprecedented ways to solve more complex business problems.

Leveraging Distributed Intelligence

For all its sophistication, many of today's M2M systems are a direct descendent of the traditional cellular telephony model where each device acts in a "hub and spoke" mode. The inability of today's popular enterprise systems to interoperate and perform well with distributed heterogeneous device environments is a significant obstacle. The many "nodes" of a network may not be very "smart" in themselves, but if they are networked in a way that allows them to connect effortlessly and interoperate seamlessly, they begin to give rise to complex, system-wide behavior. This allows an entirely new order of intelligence to emerge from the system as a whole—an intelligence that could not have been predicted by looking at any of the nodes individually. What's required is to shift the focus from simple device monitoring to a model where device data is aggregated into new applications to achieve true systems intelligence.

Automated Development

When telephones first came into existence, all calls were routed through switchboards and had to be connected by a live operator. It was long ago forecast that if telephone traffic continued to grow in this way, soon everybody in the world would have to be a switchboard operator. Of course that has not happened, because automation was built into the systems to handle common tasks like connecting calls. We are quickly approaching analogous circumstances with the proliferation of smart connected devices. Each new device requires too much customization and maintenance just to perform the same basic tasks. We must develop software and methods to automate development and facilitate re-use, or risk constraining the growth of this market.

The tools we are working with today to make products "smart" were not designed to handle the scope of new capabilities, the diversity of devices and the massive volume of datapoints generated from device interactions. These challenges are diluting the ability of engineering organizations to efficiently and

Current practices and technologies will not serve the needs of a genuinely connected world

THE IOT REQUIRES A RADICAL DEPARTURE FROM CURRENT THINKING

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Effectively manage development. The fragmented nature of software offerings available today make it extremely difficult, if not impossible, to leverage design and engineering work across different platforms and devices.

Customers expect evolving software tools to be functional, ubiquitous, and easy-touse. Within this construct, however, the first two expectations run counter to the third. In order to achieve all three, a new approach is required -- a unified development and management framework for smart connected devices and systems.

Pacific Controls has articulated a smart pervasive systems vision and road map with its Galaxy 2021 platform architecture . Their approach is a radical departure from current thinking...

- The architecture required to inform an Internet of Things looks nothing like today's kludge diagrams of smart devices connected to clouds; it will inevitably evolve to a radically different peer-to-peer architecture.
- As the architecture evolves, the definitions of its most basic elements that everyone is so anxious to quantify today (servers, devices, routers, hubs, etc.) will change radically.
- What most people who do not understand this evolution are missing is that you cannot accurately portray or quantify the future state of the Internet of Things by merely counting today's mess of architecture and systems elements. As the Internet of Things opportunity expands, the sensor and actuator devices will all become smart themselves and the connectivity between them (devices, for the most part, that have never been connected) will become more and more complex.

As the numbers of smart devices grow, the existing client-server hierarchy and the related "middle boxes" acting as hubs, controllers and interfaces will quickly start to blur. In this future-state, the need for any kind of traditional client-server architecture will become superfluous. In a future Internet of Things, the days of hierarchical models are numbered.

Now, imagine a future smart systems world where sensors and devices that were once connected by twisted pair, current loops or were hardwired become networked with all devices integrated onto one IPbased network (wired or wireless). In this new world, the "middle boxes" don't need traditional input/output (I/O) hardware or interfaces. They begin to look just like network computers running applications designed to interact with peer devices and carry out functions with their "herd" or "clusters" of smart sensors and devices.

We can readily imagine an application environment where there may be several system elements running applications which overlap sharing their sensors and actuators, some even 'sharing' a whole herd – a smart building application, for example, where the processor in an occupancy sensor is used to turn the lights on, change the heating or cooling profile or alert security.

In this evolving architecture, the network essentially flattens until the end-point devices are merely peers and a variety of applications reside on one or more network controllers which look for all intents and purposes like today's cellular router/ modems, industrial PCs or small "headless" high availability distributed servers.

In a smart systems application world designed to capture, log and analyze large vol umes of data from sensors, the process of taking raw data and filtering or distilling it into information will occur "locally." Local processing is required to reduce the otherwise untenable Internet traffic challenges that arise from connecting billions of devices. The notion that all these "things" and devices will produce streaming data that has to be processed in some cloud will simply not work. It makes more sense structurally and economically to execute these interactions in a more distributed architecture near the sensors and actuators where the application-context prevails.

This is the move we've all been waiting for - the shift to a truly distributed architecture because today's systems will not be able to scale and interact effectively where there are billions of nodes involved. In this portrayal, the distributed forms of computing will become peers in a network along with the sensors, actuators and controllers whether or not they have GUIs (headed) or not (headless). The computing elements will also become unified application platforms from which to provide services to devices and users where the applications run, where the data is turned into information, where storage takes place, and

This is the move we've all been waiting for - the shift to a truly distributed intelligent architecture

ENTER PACIFIC CONTROLS GALAXY 2021

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where the browsing of information ultimately takes place too – not in some server farm in a cloud data center. Even the mobile handsets we admire so much today are but a tiny class of user interface and communications devices in an Internet of Things world where there will be 100 times more “things” than humans.

In this future Smart Systems arena, the architecture and relationship structures between and among smart devices will become more or less flat. Hierarchy will disappear. Peer-to-peer will become the “norm” for interactions. From our view the movement towards peer-to-peer, and the view that many people hold that this is somehow novel, is ironic given that the Internet was originally designed for peer-to-peer interactions.

In our years of experience, we have all too often seen the unfortunate scenarios that managers create when uncertainty and complexity force them to rely on selective attention. Unfortunately, when this happens, selective attention naturally gravitates toward what’s readily available: past experience and uncertain assumptions. Today’s IT and telco infrastructure players are doing just this. By ignoring important trends simply because it’s difficult to perceive an alternative future, these managers are certainly leaving the door open for competition that will lead to their eventual obsolescence…which will make for a very interesting world to live in…

The next great step in IT and OT development—completely fluid information and fully interoperating devices, people and systems—requires a new generation of data and application integration platform technology that will make information itself truly portable in both physical and information space, and among any conceivable smart information devices and machines.

Technology advancements need to engender new system elements and new services. Correctly balanced, technology and new service delivery modes can help customers reach their goals of increased operating efficiency, reduced costs, automated system upgrades, and more efficient operations. Achieving this critical balance is the challenge that Pacific Controls’ Galaxy managed services and enterprise delivery platform is aimed squarely at solving.

Galaxy 2021 is an end to end platform for managed services that proactively monitors assets, providing transparency into how critical “real world” systems are performing (buildings, smart grid assets, etc.), where critical faults lie, and where opportunities exist to significantly reduce operational expenses.

Some basic design principles must be put in place to guide the development of smart systems

Galaxy is also a “Platform of Platforms.” It is intended to reduce a significant percentage of the complexities of application development, management and delivery. The challenges of networking smart devices, developing M2M applications, integrating complex IT systems and unifying services delivery in a coherent and cost-effective manner have been big hurdles to adoption that Pacific Controls and its Galaxy platform are finally addressing. Here are examples of Pacific’s platform, integration and application management innovations:

Software Defined Machines:

Capturing the real value of smart connected devices goes much further than providing simple connectivity, and databasing. For example, real pervasive managed services will allow networked, embedded devices to execute remote applications as if those applications were part of the internal operating system. Devices will need to host intelligent software components that communicate to other devices directly (peer-to-peer) or to logical collections of devices (peer-togroup) in any programming language, over any network and do so autonomously. This is a big leap from where we are today. The bit, the byte, and later the packet made possible the entire enterprise of digital computing and global networking. Until the world agreed upon these basic concepts, it was not possible to move forward. The next great step in ICT—completely fluid information and fully interoperating machines, people and systems—requires an equally simple, flexible, and universal abstraction that will make information itself truly portable in both physical and information space, and among any conceivable devices or machines. This is where a new generation of of software tools and integration technology that Pacific Controls has develoed within its Galaxy platform will drive new device to systems innovation.

Analytics and Awareness:

“Real-time awareness” and the Internet of Things is driving the deployment of new analytic tools to address “big data” opportunities. Analyzing and storing the massive amounts of data that will be received is only possible with extensible and adaptable systems. Analytics technologies are the critical tools for deciding which alternative courses to pursue, automatically through the application of

knowledge and learning. To address big data opportunities seismic leaps will be necessary in the data flow and analytical inputs in a world of vastly expanded real-time awareness. The tools that we use for analyzing large volumes of data from the real physical world will have to evolve to be effective.

Why is this? The traditional approaches to data discovery and systems intelligence have three failings: they can’t provide a holistic view of these diverse data types; the types of intelligence tools available to users are, at best, arcane and typically limited in use to “specialists” and all of this still, for the most part, occurs in a “batched” not real time data warehouse.

We need new tools to liberate the intelligence in the world of connected things. Tools need to be able to conduct a search or query that acts on unstructured, transactional and real time data simultaneously. This would allow users to determine where deeper analytics or the creation of an ad hoc business process can add value.

Given the immature state of today’s real- world systems, most people have trouble grasping the power and importance these capabilities enable. The ability to detect patterns in data is the holy grail of smart systems and The Internet of Things because it allows not only patterns but a whole higher order of intelligence to emerge from large collections of ordinary data. The implications are obviously immense.

We need new platform tools to truly liberate information

The world needs an entirely new approach that avoids the confinements and limitations of the today’s differing data types and tools. That allows data to maintain their fundamental identity while bonding freely with other data. Facilitating discovery, based on data and information accessibility and cumulative systems intelligence is what Pacific Controls Galaxy platform is organized to do.

Intelligence and Automation:

Of all the new capabilities that Pacific Controls’ technology enables is the ability of systems to automatically learn from history; learning to detect hard-to-discern patterns from installed equipment data that supports the development of algorithms that automates various response and support scenarios.

Galaxy Gbots are a family of system management and customer support software tools -- autonomous software agents which observe and act upon device, equipment and systems behavior. Gbots are enabled by “self-learning” software agents installed in devices and equipment and implemented as a managed service. These agents or “bots” are able to sense conditions (e.g. electrical system overload protection), understand customer/user preferences (e.g. is the temperature too high) and ultimately identify issues within a system to repair or initiate actions to optimize its performance.

Galaxy Gbots are not about technological drama or “futurism.” It’s about matching feasible technology to real customer needs and delivering it in a manner that aligns with the industry’s behavior and needs. GBots are a significant step-function change in the way systems will be designed, deployed, managed and supported in the future.

The value of this type of capability is probably best exemplified by Amazon and Google. Amazon’s ability to recommend various books and publications to users based on profiling patterns and Google’s indexing of web and related content to drive advertising revenue underscore the new economic value of smart systems. Amazon stopped being a “store” and started being an intelligent entity that, to some very real degree, understood who you were and what you cared about. Google quickly transcended being a search engine and reached for an understanding of what the population found interesting and designed targeted advertising as an entirely new business model.

Next Gen Architecture:

The conversion of process applications to service-oriented architectures will allow process apps to be adapted to business scenarios, with specific components pushed down to intelligent devices where they can execute a specified action. For example, alerting a citizen on her smartphone to the updated arrival time of a bus that was stuck in traffic, notifying a doctor on a tablet device about the drug allergies of a patient he is about to see, or directing the thermostat in an individual home to raise the temperature by turning down the air conditioner by three degrees. Players will create solutions that combine elements of industry-specialized hardware devices, vertical industry software, and industry-focused wireless/wired networks with industry-oriented analytics to optimize business processes and performance both operationally as well as financially.

We are reaching a critical juncture where organizations will soon be crying out for a completely new approach

NEW ARCHITECTURES REQUIRE NEW BUSINESS MODELS

Effectively combining these elements has not been addressed by the existing players in the marketplace. The inability of today's popular enterprise IT services to interoperate and perform well with distributed smart device environments is an obstacle that integrated delivery platforms like Pacific Control's Galaxy are finally overcoming.

Though their business models are intermingling today, all of the major categories of suppliers in the "traditional" so-called M2M software arena have historically operated within well-established assumptions about product scope and business models. No one would characterize the existing players of being technology or business model innovators or disruptive in nature.

Radical new thinking about information technology must begin at the most basic levels, with new conceptions about the interactions of information with people, systems and devices. We think more about future proofing innovations by making the fewest possible assumptions about the nature of networked objects and the data they produce, carry or process - we need a much broader, all-encompassing view of information. Ultimately, this type of smart systems architecture will alter traditional business models and how new applications are realized.

Since all of this that we are describing is a radical departure from current offerings and business practices, and is driven by a very unique set of needs, it stands to reason that these types of solutions do not fall within the narrow specialties of the existing players. In fact, the architecture being described is probably best viewed as an entirely new market category. 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. The opportunity to lead in developing and shaping this market looks wide open.

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About Harbor Research

Founded in 1984, Harbor Research Inc. has more than twenty five years of experience in providing strategic consulting and research services that enable our clients to understand and capitalize on emergent and disruptive opportunities driven by information and communications technology. The firm has established a unique competence in developing business models and strategy for the convergence of pervasive computing, global networking and smart systems.