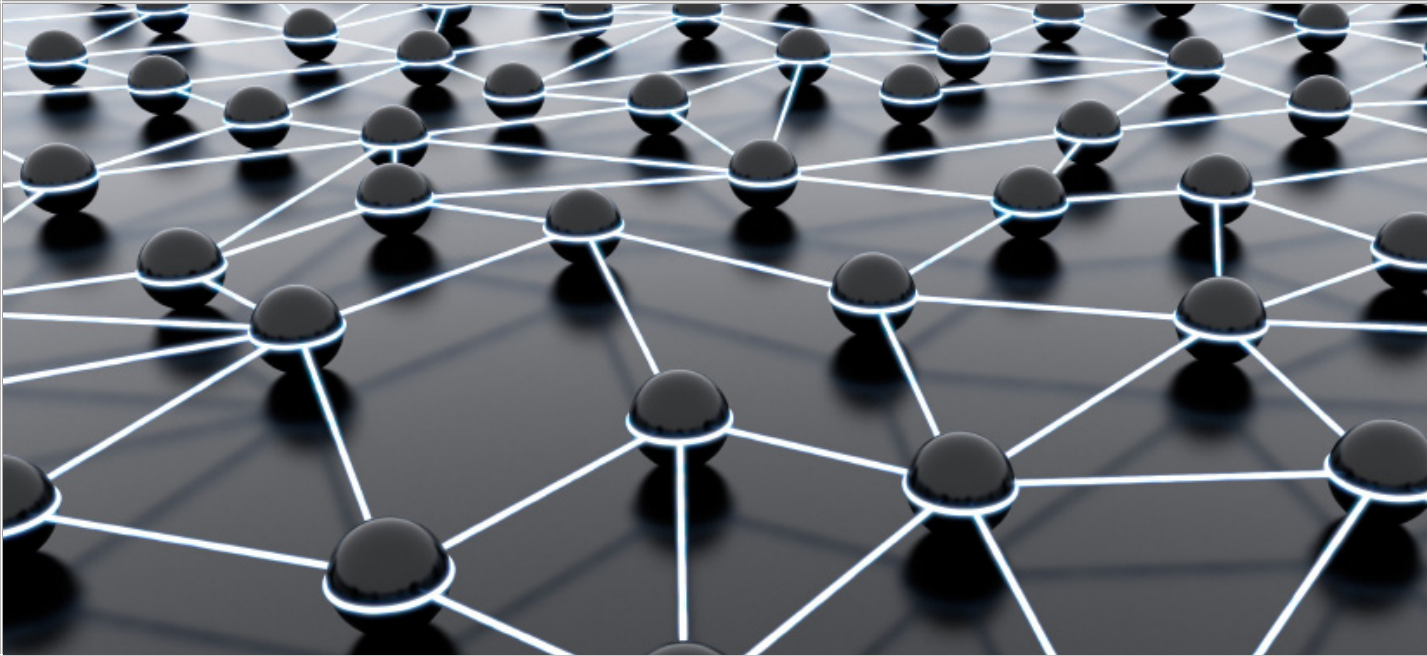


The Future of Smart Services Delivery

WHITE PAPER



Driving Service Delivery & Customer Support Convergence

Harbor Research was recently given the opportunity to examine prototypes of GBots™, software from Pacific Controls that creates a refreshingly new approach for equipment and systems support. Pacific Controls' technology sidesteps the current marketplace noise and clutter surrounding device connectivity by deploying smart software agents - GBots™ - as an integral element of their Galaxy™ service delivery platform, thus viewing customer equipment service and system support concerns as a challenge that can be addressed by a single, scalable solution. In so doing, the company is defining the future of smart systems for buildings, energy and infrastructure.

The term “convergence” implies unification, but you wouldn’t know it from today’s so-called “smart” building systems technology—a fragmented landscape full of narrow point-solutions and software/platform incompatibility. Amid all the confusion, a new family of software tools from Pacific Controls finally takes a comprehensive approach to managed services and equipment health for building and energy systems. Gbots™ are unobtrusive automated tools for customer support integrated into Pacific Controls’ Galaxy™ services delivery platform. These new technologies will drive next generation equipment maintenance and customer service, enabling early fault detection and real-time predictive and self-healing systems. Ultimately, Pacific Controls’ approach treats management concerns about building systems—from comfort and convenience to performance and security—as a unified challenge that can be addressed by a single, scalable solution. In taking this perspective, Pacific Controls has raised the bar for smart services delivery.

THE FUTURE THAT HAS NEVER HAPPENED

Visions of “Smart Buildings” have been in abundant supply for decades now. Buckminster Fuller, the famous creator of the geodesic dome (among many other things), was writing about intelligent homes and buildings as early as the 1930s. The “automated intelligent building” has been an obsession since at least the 1960s. The software industry has a term for such promises: vaporware. In the typical building of today, smart devices and equipment systems have not reached their full potential. In many respects, the value of integration today is not worth much more than it was twenty years ago.

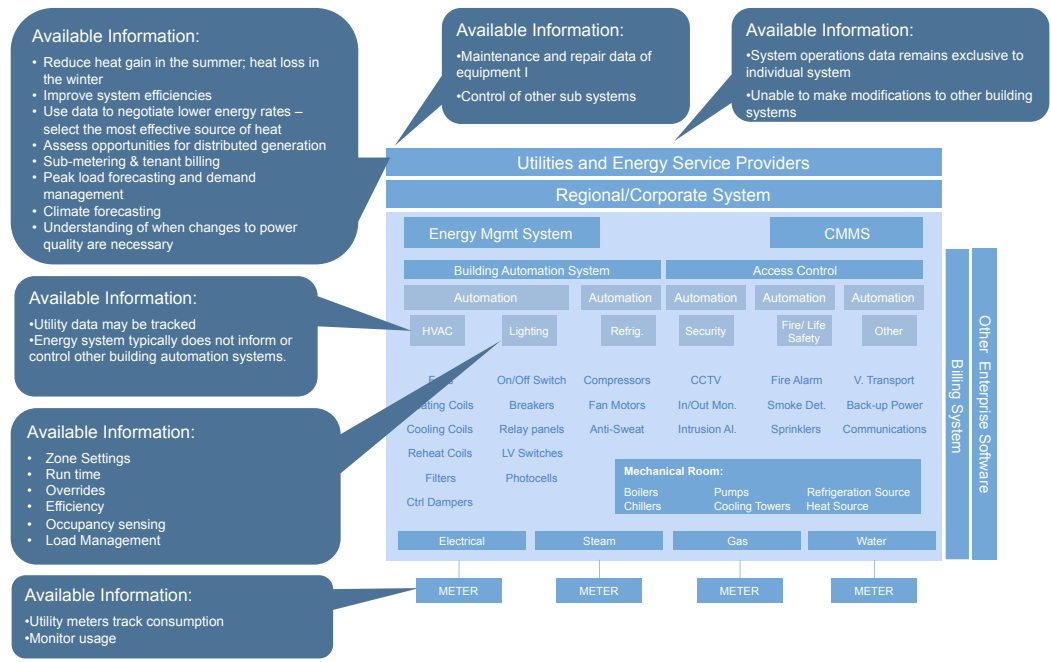
Industry participants consequently now view the “intelligent building” as more of a marketing slogan for over promising on what technology can deliver to buildings and infrastructure. For many building owners, the phrase “building automation” has become so problematic that it now provokes skepticism rather than visions of innovation. Yes, we’ve had a long history of futurism, but to date progress has been incremental at best.

It is clear that customers seeking to invest in intelligent building technology are demanding wider integration of systems within a building, particularly the integration of IT and control systems. This goal has become acute with the emergence of energy within facilities as a key cost driver and sustainability concern.

PACIFIC CONTROLS & GALAXY GBOTS: SMART SYSTEMS THAT WORK

This white paper is about a fundamentally different way of approaching intelligent building technology: as a smart managed service. It was provoked by the forthcoming introduction of Galaxy Gbots from Pacific Controls that Harbor Research recently had the opportunity to examine in prototype.

Figure 1: Facilities Information Integration Challenges



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.

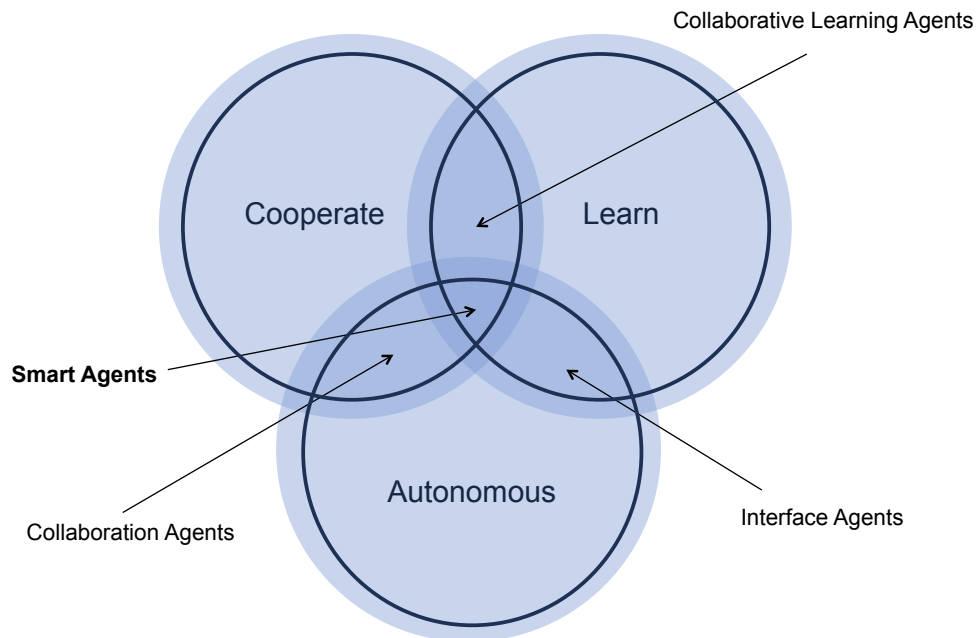
WE’VE HAD A LONG HISTORY OF SMART BUILDING FUTURISM BUT UNTIL NOW, ALMOST NOTHING REAL HAS COME OF IT

What preys upon building owners’ and managers’ peace of mind? What aspects of their infrastructure and equipment systems do they really worry about most? What technology would they embrace if it could ease those worries? These are the issues that drove the development of Pacific Controls’ new offering.

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The goal is to help facility owners and managers achieve system simplicity and high uptime. It is largely driven by the fact that most buildings these days have smaller staffs with less technical ability. The objective is to fix problems remotely, or if that is impossible, to efficiently dispatch a service technician to the right place at the right time, with the required expertise and tools.

Figure 2: Embedded Self-Learning Software Agents For Systems & Equipment Support



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. We believe this is a significant step-function change in the way systems will be designed, deployed, managed and supported in the future.

TECHNOLOGY LOVES ATTENTION

Some things that look easy turn out to be hard. That’s part of the strange saga of networked buildings that never quite achieve their goals. But some things that should be kept simple are allowed to get unnecessarily complex, and that’s the other part of the story.

The drive to develop technology can inspire grandiose visions that make simple thinking seem somehow embarrassing or not worthwhile. That’s understandable in science fiction or in futuristic views of technology innovation. But it’s not a good thing when developing

real-world technology to deliver actual value in applied products and systems. Good product and platform development should always spring from genuine empathy with customer needs, not merely from a desire to create new markets.

What happens when you want remote awareness of your HVAC systems, your security systems, your lighting systems, open windows, or burst pipes? Would you want separate connections and proprietary interfaces for all these things? How many user manuals do you want to read? How many systems do you want to be trained to use?

Over the decades, the seductive images of intelligent buildings have become part of public mythology. The “smart building” has to be a facility that “does things for you” in dramatic, futuristic ways. And so, for the last 30 years, the integrated building and energy management story has been expected to run before it ever learned to crawl. Not surprisingly, it has failed to meet that expectation.

HERE WE GO AGAIN

Now that energy has evolved as a key driver in building systems, the smarter building is once again a hot topic. The underlying thinking, however, is not much different than it has been in the past.

Today’s discussions of next-generation building networks and systems seem to focus on anything but the challenges that building owners and managers really face. Conventional building controls technologies and existing IT systems are limited in their potential to impact a building owner’s cost, reliability and performance goals largely because they require an army of specialists to deploy and another army of specialists to maintain. Because of these challenges, an important, but often overlooked characteristic required by customers is to have new building systems that are delivered as a managed service.

**SMART ENERGY IS MAKING
SMART BUILDINGS A HOT TOPIC
AGAIN, BUT THE THINKING IS
NOT MUCH DIFFERENT THAN IN
THE PAST**

New energy and building infrastructure technologies are aimed at perfectly valid applications and they will develop as control and IT architectures evolve to support them. But focusing on technology more than delivered value is misguided at best.

As lower cost, easier to apply technologies continue to move into the market new services models are required to deliver their value. Technology advancements need to engender new systems *and* new services. Correctly balanced, technology and new service delivery modes can help customers reach their goals of increased operating efficiency, reduced costs,

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automated system upgrades, and more efficient O&M. Achieving this critical balance is the challenge that Pacific Controls’ managed services and enterprise delivery platform is aimed squarely at solving.

Pacific Controls describes its new Galaxy platform capabilities as an *“end to end platform and managed service that proactively monitors assets, providing transparency into how the facility performs, where critical faults lie, and where opportunities exist to significantly reduce operational expenses.”*

GBOTS ARE ABOUT “INVISIBLE” AUTOMATED SUPPORT

For smart infrastructure applications, the significant feature of device networking is its “always-on” characteristic -- not the “gee-whiz” factor (such as streaming high-definition video over the Internet) but precisely the opposite: the great convenience and service offered by its near-invisibility.

Figure 3: Characteristics Of Agents & Gbots

Characteristics	Description
An agent is a computer system or program	That are capable of flexible autonomous action in dynamic, unpredictable environments
Software agents are autonomous, problem-solving computational entities	They often interact, cooperate and coordinate complex business processes and adapt to changing conditions on the fly
Gbots are software tools that live directly on or model the behavior of smart devices	In the building and energy domain, these devices could include electric meters, HVAC equipment and related subsystems or components
Gbots fix problems remotely	If that is impossible, they will efficiently dispatch a service technician to the right place at the right time, with the required expertise and tools

As network technology continues to be embedded deeper into the very fabric of a building, virtually any electronic product or device can automatically send a periodic signal about its status, with no human intervention or understanding needed. This may not be a dramatic application of intelligence and connectivity, but it is indisputably a highly useful one.

In the long run, such “invisible” machine-to-machine (M2M) applications will be much more important to customer support than traditional “break-fix” and intrusive services that require human attention to deliver full value. This is where Gbots comes into play.

The Galaxy Gbot technology consists of a range of intelligent, self-learning software agents that are installed in target devices and equipment. The “bots” are able to:

- Sense conditions such as temperature and electrical current to enable equipment health.
- Switch system parameters automatically based on customer preferences.
- Feed analytics tools with system performance and behavior data to determine immediate and future actions.
- Identify issues within a system by doing root cause analysis and troubleshooting to resolve them.

**GBOTS ARE “SELF-LEARNING”
SOFTWARE AGENTS INSTALLED
IN SYSTEMS TO AUTO DIAGNOSE
& RESOLVE PROBLEMS WITHOUT
UNNECESSARY HUMAN
INTERVENTION**

Systems and equipment intelligence is “the connected building” done right. It uses seamless computing and communications to provide real-time information about critical assets and systems.

SOUND LIKE SCIENCE FICTION? WE THINK NOT

In 1950, Alan Turing published his famous article “Computing Machinery and Intelligence” which proposed what is now called the Turing test as a criterion of intelligence. This criterion depends on the ability of a computer program to impersonate a human sufficiently well that the judge is unable to distinguish reliably between the program and a real human.

Stories of artificial helpers and companions and attempts to create them have a long history. In 1921, Czech writer Karel Čapek introduced the word “robot.” In 1942, Isaac Asimov coined the word “robotics.” In 1948, Norbert Wiener formulated the principles of cybernetics, the basis of practical applied robotics. Fully autonomous robots only appeared in the second half of the 20th century. The first digitally operated and programmable robot, the Unimate, was installed in 1961 to lift hot pieces of metal from a die casting machine and stack them.

Today, robotics have transcended to the Internet and the Web. They are employed invisibly in a variety of tasks such as finding the best price for a plane ticket, computing a person’s credit score or examining your desktop computer to see if the latest updates have been installed.

Gbots are software agents that act as the new “first line of response” to solving equipment and systems problems. Their primary goal is to manage and optimize assets and to make critical

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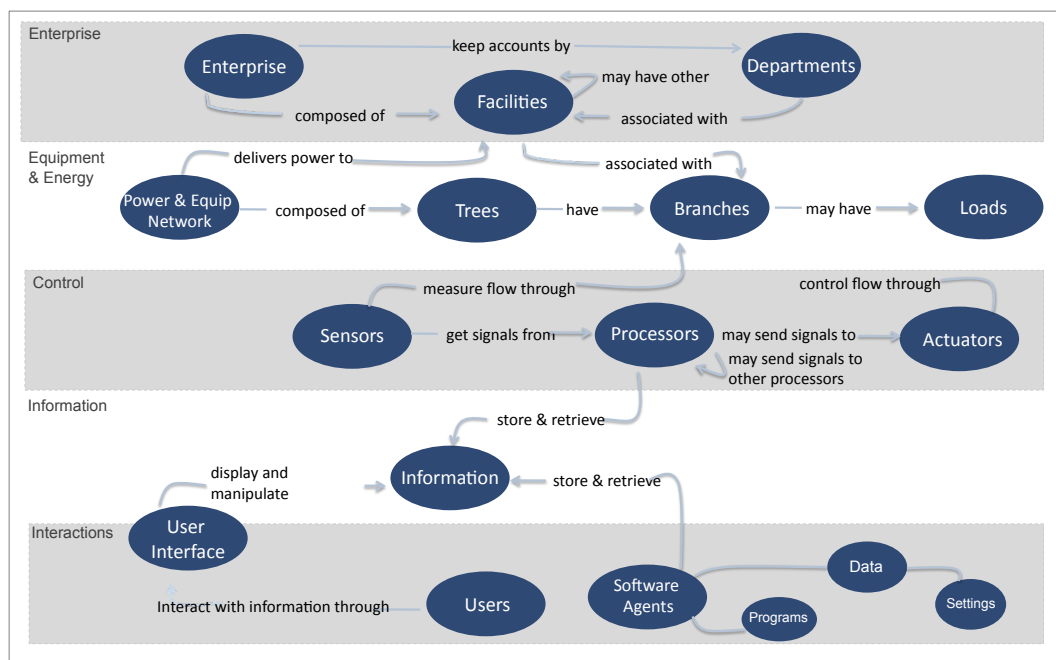
**SMART NETWORKED DEVICES
OF THE FUTURE WILL BE
PORTALS INTO NEXT
GENERATION CUSTOMER
SUPPORT SERVICES**

sensed data available to the system to auto diagnose and resolve problems without unnecessary human intervention.

What Pacific Controls is anticipating is obviously dependent upon manufacturers continuing to outfit their products and equipment with intelligence and connectivity. Given that this OEM activity has begun, and will increase exponentially during this decade, the advent of tools to automate support is a natural progression.

Gbots is the beginning of a new generation of smart systems technology that will provide customers with elegant and unobtrusive—sometimes even invisible—portals into networked customer support services. Before the end of this decade, many manufacturers will use smart, networked products to drive enormous growth with next-generation services.

Figure 4: Agent Technology Is Based On Dynamic Models of Facilities & Energy



ULTIMATE VALUE

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 equipment repair and support.

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. In Pacific Controls' case, this translates into system optimization, extraordinary customer intimacy about end product usage via connectivity, and "enterprise automation."

"PEACE OF MIND" SYSTEMS TECHNOLOGY

Another term to describe integrating automated customer support tools into a services delivery platform might simply be "Peace of Mind technology." Well-designed "Peace of Mind" technology for next generation building systems should:

- Be inexpensive and easy to deploy.
- Be intuitive to use (excellent user experience and industrial design).
- Add adequate "smartness" to existing equipment and systems without a wasteful, bewildering array of features.
- Be modular and easy to extend throughout the infrastructure over time.
- Be extensible (new sensors work with the existing system, preserving buyer investment).
- Offer varying degrees of remote control where desired.
- Deliver value transparently, in the background, without requiring full owner or user attention.

**PACIFIC CONTROLS' GALAXY
PLATFORM & SOFTWARE
AGENTS ARE LITERALLY
EMBEDDING INTELLIGENCE
INTO THE FABRIC OF BUILDINGS
& INFRASTRUCTURE**

Galaxy Gbots are not gadgetry; most of the time, you don't even know they're there. What they are is an excellent example of the valuable applications of smart systems and machine-to-machine technology that can be implemented now, even without the re-design of existing products and services. In the building and energy systems market, this possibility offers both immediate and future opportunity.

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THE MARKET NEEDS NEW END-TO-END SOLUTIONS THAT PROACTIVELY MONITOR SYSTEMS & AUTOMATICALLY RESPOND TO USERS' NEEDS & PERFORMANCE OBJECTIVES

EMBEDDING INTELLIGENCE & THE INTERNET INTO THE REAL WORLD

If this is such a good idea, why hasn't it been done before? In short, enabling complex, multi-vendor systems with analytics and intelligence is extremely difficult -- many organizations have tried. Pacific Controls' software agents literally and physically leverage the intelligence product manufacturers are building into their products, making something like a "smart building" much easier to contemplate than ever before. The building itself is literally on the Internet and the Internet is in the fabric of the building. Pacific Controls provides a more universal alternative to the many existing techniques for leveraging embedded data in ordinary electro-mechanical devices for monitoring and remote management - their technology enables analytics capabilities for component OEMs and equipment builders for both new and existing machines. Other technologies can be adapted and optimized for a special purpose but none are reaching for the ability to leverage the data and information "trapped" in most products today to the extent Pacific Controls' approach does.

What is the potential scale of this opportunity? We strongly believe that the Smart System platform and managed services market opportunity is reaching a critical mass; there is now substantially greater recognition of diagnostic, prognostic and automation impact than there was even 2 years ago. This represents a whole new generation of technology innovation that will enable significant market growth. We expect to see the market potential for smart systems and services delivery platforms to reach \$50 billion by 2015 with system automation tools comprising as much as \$15 billion of the total service delivery platform opportunity.

GETTING THERE FIRST

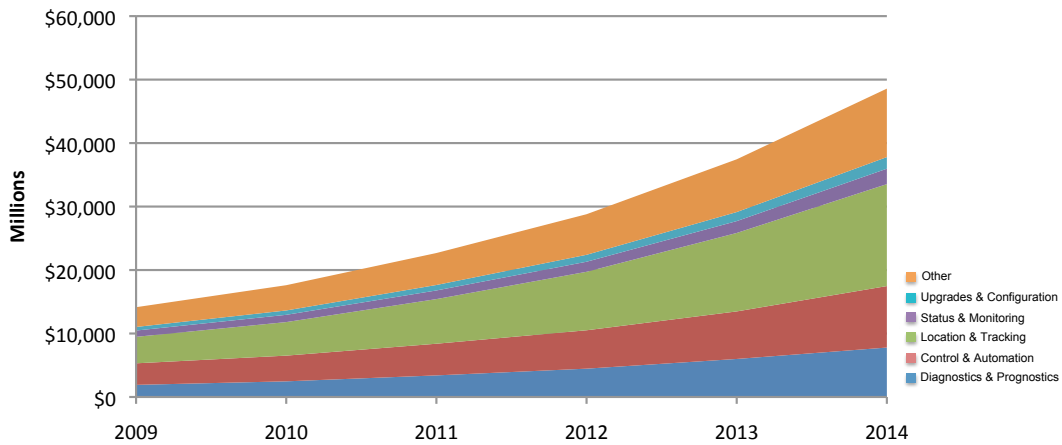
In this decade, networked smart devices will transform life more than any computing development since the PC. But many companies find it difficult to envision the impact, and they are reluctant to embrace an embryonic development in the face of technological and competitive uncertainties. Even companies that understand M2M, and know that it will radically change their business models, are waiting for the phenomenon to "shake out" or "get safe."

This posture is a major mistake. We believe that the risk of staying out is now greater than the risk of getting in. Networking changes everything, and the first-mover advantages in many markets will be close to incalculable.

Once smart systems begin to be adopted in a market, it will create significant barriers to vendor-switching because suppliers will become deeply involved in adopter operations

and in their customers' lives. While we don't believe there will be a single "winner takes all" player in the smart systems arena, we do believe that early action will obstruct entry by the laggards and will enable companies to effectively own segments of markets.

Figure 5: Smart Systems & Services Delivery Platform Opportunity



In a volatile environment of rapidly evolving technologies and opportunities, strong leadership will require having the vision and courage to act in defining new markets and models. Pacific Controls' first-mover advantage is notably strengthened by the flexibility of Galaxy Gbots. The tools deliver real value today, but were also conceived as a foundation for rapid development of new functionality. The company intends to have the evolution of Gbots driven by customers needs, not by internal top-down decisions.

Visions of some fantastic future? Not anymore. To date, business has had the sketchiest of information about its own goings on—partial pictures, isolated snapshots, fleeting, blurry, outdated glimpses. With Gbots, Pacific Controls makes a powerful bid to move from the traditional world of building systems to smart enterprise and smart infrastructure systems. Galaxy and Gbots are Pacific Controls' new beachhead in truly smart sustainable systems.

About Harbor Research, Inc.
Founded in 1983, 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.