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IBM: Working Towards a Smarter Connected Home

Stratecast Analysis by
Mike Jude, Ph.D.

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Introduction[1]

From on-demand entertainment to home monitoring and energy management applications, the vision of a smart home that enriches and simplifies consumers' lives, after years of experiments, is about to become reality. Consumers increasingly are asking for it; smart devices, from TVs to web cams and refrigerators, are becoming available at little extra cost; and the network infrastructure is ready. And the final hurdle—complexity—is about to be overcome by cloud technology.

The connected home, at its most simplistic, is merely a set of interconnected services and devices in the consumer's household. Reduced to this level, it is clear that having all of these various parts enabled to communicate with each other is the most fundamental requirement on which to build more complex blended services. Yet, achieving this has been almost ridiculously difficult; and no wonder!

The typical consumer home is a mash-up of different components and services that were never really intended to operate together. Internet services generally do not talk to television sets, washers and dryers do not talk to security systems, and practically nothing talks to the lowly home telephone. The result is that the home is characterized by many discrete services and an increasingly complex problem of integration. Is it any surprise, then, that consumers have expressed a fear of complexity; and why this fear is beginning to define a barrier to adoption of additional communication services and consumer electronics?

Is it any wonder, then, that consumers have expressed a fear of complexity; and why this fear is beginning to define a barrier to adoption of additional communication services and consumer electronics?

While there are many approaches developing in the market to solving these problems, what is needed is an approach to device and service interconnection in the home that addresses the lack of standards. To date, in spite of the fact that there have been some very innovative attempts to standardize the communication space within the home, the delivery of services has largely been left up to service providers; most of whom have not been interested in collaborating on standardized service delivery.

Stratecast has been watching the evolving need for service integration for a while, and has developed a reference architecture for a service delivery platform that Communication Services Providers (CSPs) can use to integrate various service offerings, and deliver them in a consistent way to the consumer. Although there has been a significant amount of market interest in this architecture, to date, much of the implementation has been in the form of proofs-of-concept and pilots. The market participants still need to work out their roles, and evaluate how specific architecture details affect the costs of building and operating smart home services.

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[1] In preparing this report, Stratecast conducted interviews with:

- IBM – Scott Burnett, Director - Global Consumer Electronics Industry

Please note that the insights and opinions expressed in this assessment are those of Stratecast and have been developed through the Stratecast research and analysis process. These expressed insights and opinions do not necessarily reflect the views of the company executives interviewed.

Now, however, IBM has proposed a new way to look at connected home services; one that leverages a cloud-based platform. Very much like the Stratecast reference architecture, the delivery and management of services are consolidated over a common IP connection to the consumer's home. Integration of services, because it takes place in the cloud, avoids the complexity that results when consumers are expected to integrate smart home components at the residence.

This approach is likely to completely change the dialogue about how a connected home is defined, and will facilitate the abstraction of the residential dwelling that Stratecast calls the Home Space or "home in the cloud." In this paper, we examine the connected home in terms of its requirement for integrated service offerings, and IBM's approach to meeting that requirement. This paper will be of interest to network operators, CSPs, consumer electronics manufacturers, and those in the value chain who provide technology solutions.[2]

Connected Home Essentials

As noted in previous Stratecast studies, the connected home is fundamentally about abstracting primary home functionality into the network. In a sense, it is a "home in the cloud," providing access to such things as utilities, communication services and security management, wherever the consumer has a broadband network connection (See Figure 1).

Figure 1: Home in the Cloud

Source: Stratecast

This home in the cloud is not really in the cloud, of course. It is a collection of intelligent devices and communication service offerings that allow applications to remotely access various home functions. In fact, whatever integration of services that actually occurs often does so, not in the cloud, but in the home itself. For example, individuals desiring to access NetFlix on their home television must configure the television to talk to the home Wi-Fi network, and then must manage a

[2] Interested readers can find more from IBM at: http://www-03.ibm.com/press/us/en/pressrelease/38652.wss and http://www-03.ibm.com/press/us/en/pressrelease/38651.wss

collection of remote controls to actually watch the NetFlix offering.[3] While technically integrated at the television set, the Internet-delivered content does not always work well with other content sources that feed the television: DVD, VCR, DVR, etc. Using intelligence in the cloud to configure the home network, and the devices connecting to it, will go a long way to simplify this task.

This metaphor for the home in the cloud is not really in the cloud, of course. It is a collection of intelligent devices and communication service offerings that allow applications to access various home functions remotely.

CSPs understand the value of integration—and with good reason: indications are that consumers increasingly view integration as a significant source of value. However, what CSPs do not appreciate is that consumer value perception is not driven solely by the communication service package offered by a single provider. Instead, consumers fundamentally want everything to work seamlessly. Rather than having to juggle a pile of remote controls, ideally the consumer would prefer to have a single interface to everything…including the kitchen sink. This will enable content services leveraging multiple devices in the home, such as entertainment systems or home monitoring and security solutions. At the same time, this approach also creates the opportunity for common customer relations management services through the cloud, where, initially, there can be automated services or self-help services for consumers. Ultimately, users will want the freedom to connect directly through any device to service agents in the cloud.

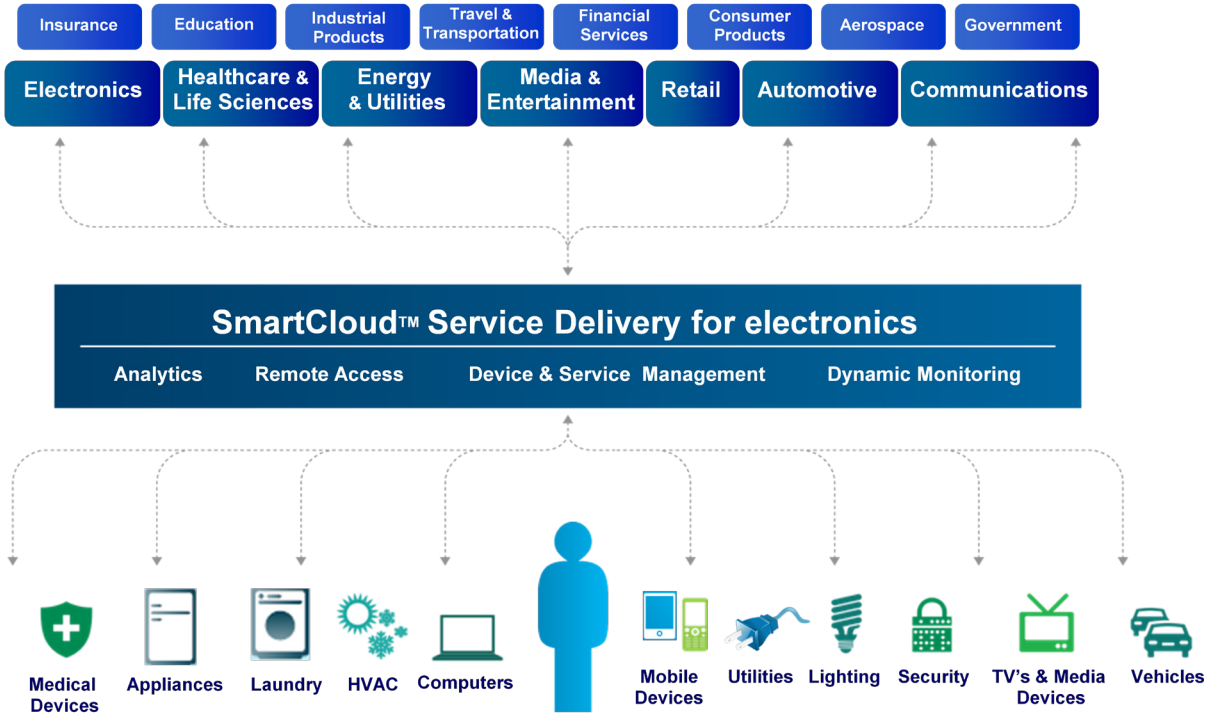
Value is not perceived in the discrete; it is perceived in the entirety of the service environment. This is the beauty of the connected home: everything connects. However, this is hard to do with the myriad of different integration approaches within the marketplace. What is really required is a common point of integration that everything can connect to. What is needed is a common service platform.

The Need for a Common Service Platform

It is easy to see why a common service platform would be a good idea. Rather than having each device attempt to connect with all the other devices and services in the home, there would be a single point of integration that accommodates any device, regardless of the communication protocols or command interface that might be in use. As illustrated in Figure 2 below, translation and integration among the devices and services would be conducted at the logical level in the cloud, rather than through patch panels and connectors in the consumer's home. As it may not be possible for all devices in the home to connect directly to the cloud, there can be a home gateway in the home for aggregating communications and applications, and supporting user interaction devices common to many devices in the home. As this home gateway is managed from the cloud, it can be viewed as a representation, or cache, of the cloud in the home, invisible to the consumer.

[3] For anyone who has tried this, it is truly a juggling act. The author once watched his brother in law spend nearly a half hour setting up a television to show a two minute YouTube video. The author, of course, could have done it faster, but given the desire to preserve family relationships, opted not to make waves.

Figure 2: Integration in the Cloud



Source: IBM

This approach begs the question of how exactly it would be accomplished. As discussed in other Stratecast reports, there are signs that devices like set top boxes (STBs) and home routers are evolving into gateways that will manage more than television feeds or data access.[4] However, this is a limited solution. At the very best these approaches only provide a single point of access and control for physical devices. This is an essential function, to be sure, but it does not address logical integration of services and features. To use a simple analogy: while the market is poised to deliver all of the fixings for a pepperoni pizza, complete with the pizza pan to cook it in, it has yet to deliver a complete pizza. Consumers want a complete pizza, topped with everything.

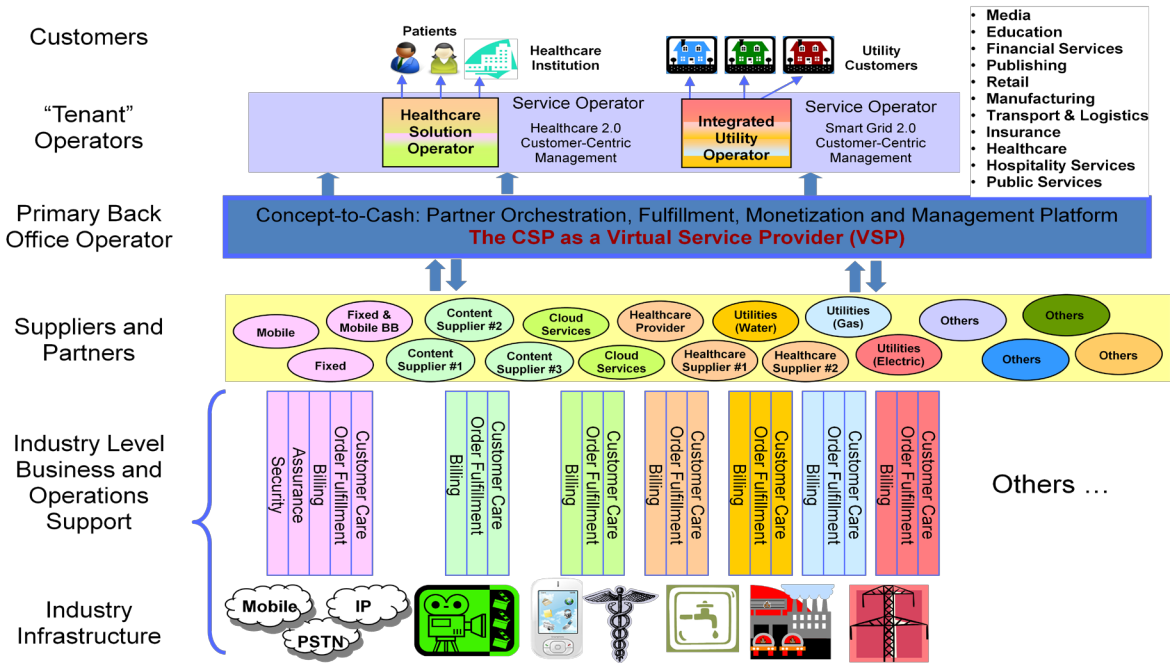
IBM views the smarter home cloud services model as an adjunct to its general cloud services architecture; one that is extremely beneficial to the consumer space as well.

This requires a fundamentally different approach to concept-to-cash process; one that would pre-integrate services and deliver them to the consumer. As Figure 3 below shows, Stratecast has developed a reference architecture that radically changes the integration discussion, by removing the overhead from the user, and, instead, making it a significant value proposition for the CSP.[5]

[4] For more on these topics, see CH 1-4: *Home Networking: The Big-Bang Theory of the Connected Home*, September 2011.

[5] Interested readers are referred to: SPIE 2012-08: *Cross-Industry 2.0: An Enterprise Model for CSP Customer Solutions That Goes Well Beyond SaaS*, March 2012.

Figure 3: Business Support System Orchestration for Customer and Supplier/Partner Support



Source: Stratecast

As shown, service providers would deliver services to a CSP, which would then integrate and deliver the resulting service stream to the consumer. In the case of video services, this could include both subscription and over the top (OTT) video streams. Integrated services could also span security services, branded Internet access services, Yellow Pages, etc. In effect, service integration would occur in the cloud rather than the home—the "cloud in the home" would literally be in the cloud.

It is clear that such an approach would simplify life for the consumer. Rather than worry about how services interconnect and how to bundle them together, the service integration would be assured by the CSP.

It is clear that such an approach would simplify life for the consumer. Rather than worry about how services interconnect and how to bundle them together, the service integration would be assured by the CSP. The skeptic, at this point, would ask whether such an architecture is really available.

An IBM Vision for the Smarter Home

The answer is that cloud-based service integration and delivery is becoming a reality fairly quickly. IBM has developed an approach to service creation and provision that, in many respects, mirrors the Stratecast reference architecture. This approach, as shown in Figure 4 below, provides a common service platform in the cloud that integrates service offerings from potentially multiple vendors, which are delivered to consumers over broadband connections. It is especially interesting that IBM, just as in the Stratecast model, pays considerable attention to the problems of monetization of the services; a non-trivial consideration.

As announced in August, Vodafone demonstrated its collaboration with IBM to implement this architecture for the management of smart appliances in the consumer home. The new services will

enable consumers to monitor and manage smart appliances over any network connection. This is but the first of many services that could be delivered using this approach; and the intent is clearly to expand beyond the smart home service model (utility focused) to the connected home service model (content focused) over time.

> ***"Integrating the smart home functions in the cloud removes complexity for the consumer. This way, the smart home can really simplify and enrich people's lives, while the complexity is managed professionally and efficiently."***
>
> – Martin Kienzle, Ph.D., Electronics Industry Leader, IBM Research

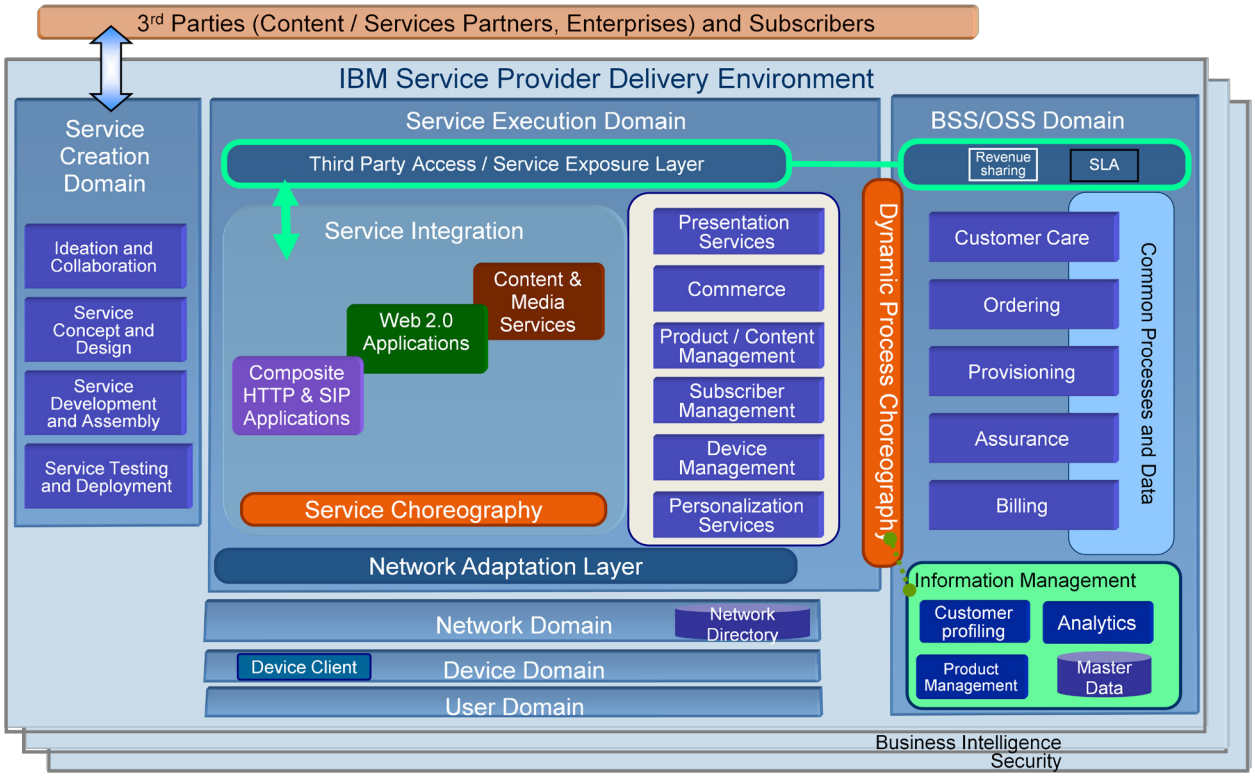
In another implementation, IBM is providing Smart TV, Internet services in the cloud. It is also contracting with TP Vision for the Philips Smart TV platform, which will deliver greater interactive experiences to millions of TV viewers in more than 30 countries in Europe, as well as Brazil and Argentina. The service architecture supports the Smart TV Alliance, of which IBM is also a member.

This Smart TV cloud service illustrates an important variant of smarter home services: an over-the-top (OTT) service. Vertically integrated services, sometimes also referred to as Machine-to-Machine (M2M) services, focus on the communication network as a control point, and build integrated application services on top of it. OTT services are vertically segmented. They assume the presence of a broadband network, wired or wireless, and build an application service infrastructure on top, independent of the underlying network, to the largest degree possible.

The IBM vision of the smarter home supports both vertically integrated and over-the-top services by explicitly representing and managing the various layers, such as the network layer, the management and application layers

Finally, the IBM approach places a great emphasis on the value that can be derived based on the data obtained from the connected home. Big Data Analytics can improve the services for the consumers, and create additional value for the service providers.

Figure 4: IBM Smart Home Cloud Architecture



Source: IBM

IBM views the smart home cloud services model as an adjunct to the company's general cloud services architecture; one that is extremely beneficial to the consumer space as well. CSPs that are currently struggling with a cloud approach to the consumer space finally have at least one vendor who is ready to deliver technology to address this increasing need for consumer service integration.

An Industry Call to Action

IBM is clearly focused on the right problem for the consumer space. Yet, the industry, as a whole, seems rather laissez faire about the problems of integration. This is to be expected since integration is currently seen as a competitive differentiator: that is, if one's products or services integrate only with one's own product line, then that is considered good and a reason for consumers to buy only one brand (see Apple and its data connectors). Yet, it is true that the value perception of consumers is not for particular devices or services, but in the totality of the utility continuum. In other words, consumers behave along the lines of "if it doesn't work with what I have already, I won't buy it!"

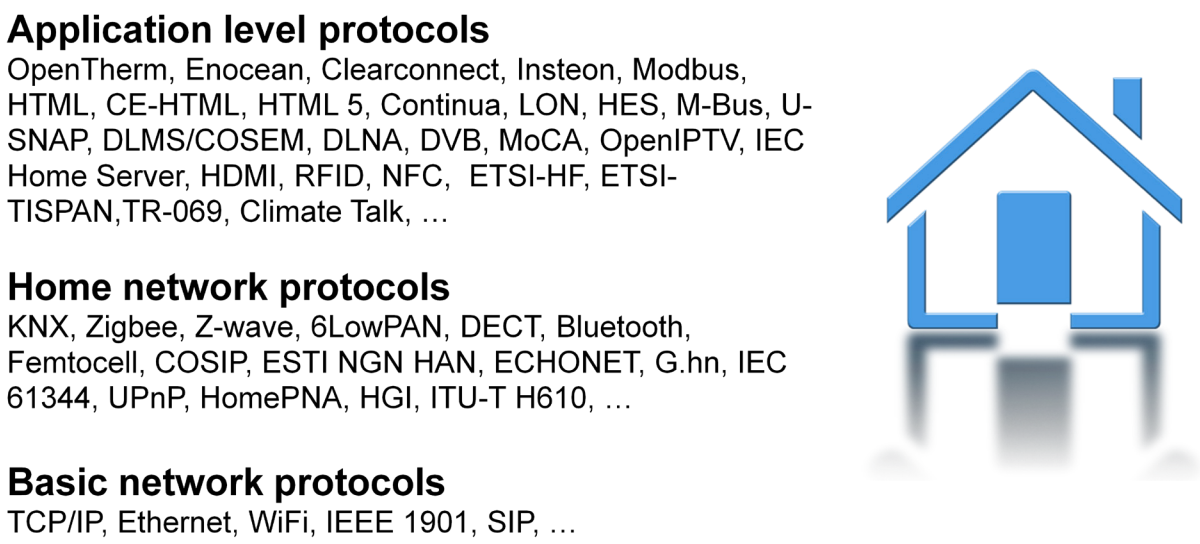
> ***"With the convergence of the internet with smart devices, the smarter home is about to become the next open application platform, similar to what has happened on mobile devices. Companies are looking for innovative cloud service capabilities to enable a new market."***
>
> – Scott Burnett, Director, Consumer Electronics, IBM Electronics Industry

This argues for a set of widely supported standards or a standard approach to service delivery. IBM, by facilitating a wide variety of standard interfaces and communication protocols, has gone a long

way to addressing this industry need. However, more needs to be done. The broad range of networking and application requirements, the large number of application domains, and the different industries engaged in smarter home initiatives has, over time, led to a very large number of 'standards', many of which have overlapping features and are incompatible with one another. Smart home ecosystems require the capability to accommodate and manage this diversity at all system levels, from the networking level to the control and the application levels. A gateway can be a great resource for protocol and format aggregation and abstraction, enabling common services and applications on top of this diversity. Figure 5 shows an incomplete list of protocols and standards involved in the smarter home ecosystem.

Just considering what goes on in the residential living space itself, the connected home is currently a rather loose collection of standards and interfaces. Ideally, this should evolve to a single common interface, supported by a single set of standards for telemetry and data interchange.

Figure 5: Interconnection Universe



Source: IBM

Yet, as the diagram shows, there are many ways to connect and communicate with intelligent devices. Although a cloud-based schema allows for translation among various devices and services, ultimately, it is less efficient than an architecture where every device essentially speaks the same language. Just as the power is available from only one kind of power outlet, communications should be available from a single standard interface.[6]

It bears noting that the IEEE is doing a yeomen's job in grappling with the problems of a consistent interface for the smart home. The IEEE 1901 standard provides a means for interconnection among devices that share a power system. However, this standard only provides a data interface and has not

[6] Two—if you count a three phase plug. It, of course, goes without saying that different parts of the world have different types of power outlets; however, the author believes that this needn't detract the market from considering a single communication interface that satisfies any requirement.

been optimized to deliver content. One imagines that a successor to the 1901 standard might also consider the special needs of, for example, distributed video.

Nevertheless, while a standard set of interfaces and communication standards would allow for the simplification of the cabling environment in the home, logical standardization for interconnection would also benefit the market as a whole. A standard approach to a cloud-based services platform, where logical interconnection could take place, would finally give the market a common platform and delivery mechanism for developing connected home offerings. Furthermore, this standards-based approach to interconnection would seamlessly blend various logical elements in the cloud to deliver a truly integrated cloud in the home.

Stratecast
The Last Word

The connected home is, ideally, a radical simplification of the consumer communication, entertainment and telemetric experience. A truly integrated connected home makes the adoption of new service offerings and new consumer electronics as simple as plugging in a new device or selecting a new service on an Internet portal. **Yet, this is not now the case.** The connected home is currently a mash-up of disparate pieces that the consumer is expected to figure out for him or herself.

It is no wonder that this expectation of consumer expertise is now limiting advanced service offerings and many consumer goods to the technically acute individual. This attitude, while it has served the industry well to date, will increasingly serve to limit industry growth and opportunity.

It is said that the time for a standard is when an industry or market starts tripping over its own feet. **This is likely now the case as various forms of communications services and devices begin to preempt each other and force consumers to completely change their home infrastructure, or avoid adopting new technology altogether.**

While it is possible to envision a time when all intelligent electronics speak the same language at the interface, it is harder to envision how these various devices will interconnect to build the next generation of connected home services. **What is needed is a standardized way of building and delivering logically integrated service offerings that require nothing more complex from the consumer than point and click.**

Stratecast has seen this need and has developed a reference architecture for simplifying the definition and delivery of integrated services; delivered from any service provider using a common, operator-provided platform. This approach places integration in the cloud and enables not only service definition, but the essential back office functions like billing and metering.

IBM, with its Smart Cloud platform, has developed an approach which instantiates many of the features specified in the Stratecast reference architecture. IBM's recent announcements involving the provision of such a platform to TP Vision and with Vodafone, for the control of smart devices, demonstrate the potential of cloud-based consolidation and integration. IBM's platform supports both vertically integrated smart home solutions, as well as over-the-top solutions.

However, more needs to be done. **The industry should push for a common data interface and cable schema for the home, combined with a common cloud-based service architecture.** Only when such a platform is available will the next generation of innovation be possible, and will the home in the cloud be an achievable reality for consumers.

Mike Jude, Ph.D.

Program Manager – Consumer Communication Services and Connected Home
Stratecast | Frost & Sullivan
mjude@stratecast.com

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