

Achieving Connected Home Architectural Simplicity

A Case For Gaming Devices And Applications

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Abstract—Home networking mandates today multitude of devices to communicate seamlessly which is very difficult because of existing network and device nature. This paper argues on the basic tenet of communication, the IPC mechanism to be standardized to a considerable scale. Bringing standardization will enhance the innovation in device interoperability and latency reduction instead of focus shifting towards resolving the issues surrounding these. A case for gaming devices and application integration which leads to innovation is discussed in this paper.

I. INTRODUCTION

Most of the devices today connect in point to point fashion over variety of networks like Cable, Telephony, and Wireless over Wi-Fi, fixed telephone over a last mile cable, IPTV and cellular over GSM/GPRS depending upon the technology it supports and the reason for its existence. Convergence is bringing the devices together, but the mechanism to interconnect devices today is rather difficult.

II. INTERDEVICE COMMUNICATION ISSUES

A typical home network in a simplified way looks something like this. For a device that wants to talk to another device like a multiplayer network game, even within the home, the “payload” needs to go all the way up to the network cloud for decision and then communicate.

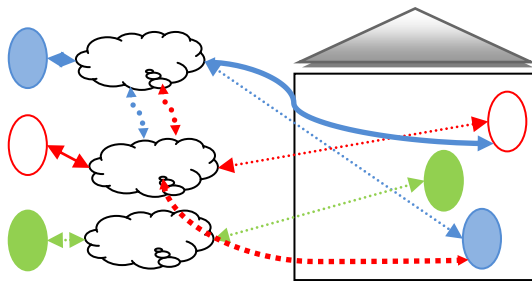


Fig. 1. Various Networks applications like game consoles interact to various devices crossing interoperable networks in an inefficient method

Various considerations add up to the inefficiencies. Few important ones that create that are:

A. Network Interoperability

Services offered by different operators are not interoperable. This issue is largely handled by technology and

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protocol convergence.

B. Application Interoperability

Applications are tightly coupled by the network hence there are issues in interoperating the applications. Take the case, gaming applications. They are tied to device capabilities and the application support on device. Most of the applications that are existing today are device or network specific. A simple way that the interoperability is achieved is via the protocols. That led to several complexities.

C. Device and protocol Interoperability

Towards achieving a common application platform and customizations, various protocols like SOAP, XML and other standards like TR-069[1] are gaining popularity mainly to solve control and feature interoperability issue. Listed below is a protocol versus supportability constraints

TABLE 1 SERVICE PROVIDER VS INTER DEVICE COMMUNICATION CONSTRAINTS

Service Provider	Control Protocol	Device	Issue
Cable	SNMP	Residential Gateways	Web manageability, Consumer Access, Open application environment, Usefulness of application for home user, Interworking applications
DSL	TR Protocols	Gateways	Usefulness of application for home user, Interoperability of applications with other type of networks, Interworking applications
Mobile	Various	Smart Phones	Closed environment
WiFi	WiFi	Wifi Devices	Isolated Home User control
Video	Proprietary	STB	Minimal application control
Energy	Not available	“smart” grid devices	Not available today

III. INTEROPERABLE APPLICATION ENVIRONMENT

In the near future, in a connected application environment the requirement is that any application control can be asked by any service provider connected to any device providing any feature. For example a gaming application from a gaming portal provider to be rendered on a smart phone requires application to be controlled and delivered seamlessly. The support for multiple devices cannot be preplanned with the network architectures and the device architectures explode in multiple forms. An example approach which is very successful is providing a home gateway kind of device which co-ordinate multiple networking end points.

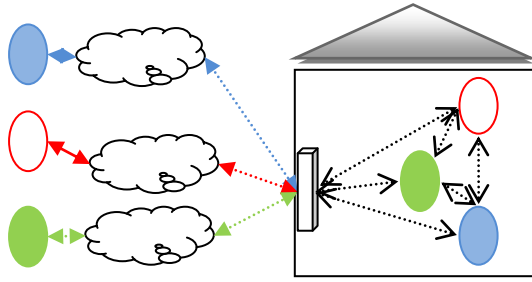


Fig. 2. Home Gateway scenario trying to collaborate the networks

In future, a home network hub that provides this should be able to interact with the device directly and seamlessly by fetching information about, say a smart phone, in a standardized way.

Another example is a gaming device which would interact with a motion control that has to fetch information from the device and supply it to any “smart” application running on the internet cloud without intervening proprietary protocols. The requirement mainly translates into a solution to achieve a scenario where only control information between the components has to travel to the network. Now most of these are in the mercy of a specific platform and application support [2]. This makes convergence of devices to achieve common functionality impossible.

IV. DATA CONVERGENCE

In a current and next generation application architectures most of the data required right from hardware capability to application specific capability will be required at all the layers by different applications between devices. This is achieved by querying data, say using XML [3] from an application to an internal device “daemon” to provide a “register” value and shipping it across to a query response system. This causes delay in addition to back and forth communication over the network.

The issues that are causing this to happen are un-standardized method of fetching data; Security policy; User device capability; Application capability; inter processor communication incapability; inter process communication incapability.

V. GAMING INNOVATION –A CASE

In the above context, we can see that there are several constraints in migration of the existing gaming platforms to a cloud based gaming architecture with more intelligent endpoints in the next generation home networking scenarios. Latency is the topmost issue which is approached by home grown solutions. There is also “unprecedented demand on network infrastructure” [4]. Making pipes bigger and software and hardware fine tuning are not a scalable approach. Most of the popular gaming infrastructure is associated with monolithic hardware but this is undergoing change because of arrival of multitude of endpoint devices at home. Another reason that is driving this is the fundamental network

architecture in migrating towards a gateway based endpoint in a home networking environment.

A gaming application requiring a device hardware specific parameter has to communicate with other “daemon” or a hardware register for fetching, packaging to standardized format to transport back into a network using some very slow standard protocol or proprietary protocols. This will be consumed after undergoing multiple translations then consumed by a similar “daemon” [5]. The proposed approach is to make this more robust by making these devices support a common API mechanism between IPC engines of all connected devices. This will greatly enhance and reduce the time spent on packaging the data and translating for various functional modules either within the same device or to a different device. Instead of the approach as in Figure 3, a standard API mechanism of IPC between connected home devices as proposed below in Figure 4, greatly reduces the interoperability problems that exist today in a connected home network. A sequence of IPC chaining can be made possible quite effectively between devices. There is home grown method right now for example, the open source dbus kind of architectures. But such solutions have severe constraints

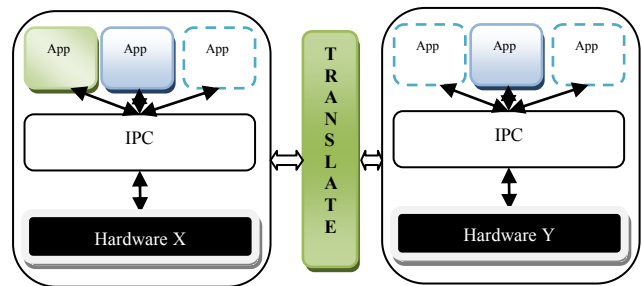


Fig. 3.

There are several considerations that need to be made to provide a unified, secure mechanism for the APIs to interact. Few of the important ones are described below.

Secure Applications: Communication between each interoperable device should be authenticated by effective mechanism. This need not be handled at the network server application. A standardized method can be achieved which can be hosted on an intelligent home gateway like an “authentication module”. Also another approach is by standardizing the underlying communication infrastructure.

Pre-Registration: Applications that are trying to communicate to each other have to register via a central mechanism to associate and communicate over this logical shared medium.

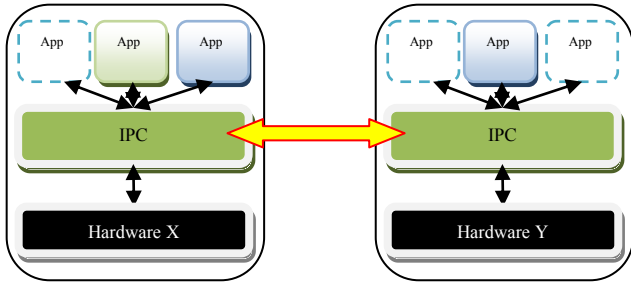


Fig. 4. Standardized IPC mechanism helps reduce translations

Internal containment: Relevant partitioning in data security could be provided at an architectural and structural level so that unnecessary exposure to unwanted applications is highly restricted.

Publish and subscribe: Each application registering and subscribing could also provide such interfaces for the consumers and should be robust enough to recover from unresponsive IPC calls.

VI. LATENCY IMPROVEMENT

Cloud gaming servers uses a server on the network to simulate the gaming experience to make the processing between components faster. This also involves a thin client which interfaces with the customer device. This architecture is going to be more prevalent as the gaming consoles move towards generic platforms like handheld devices and smart phones. In this scenario every gaming action has to be traversing the network to reach the cloud server. Several architectural improvements can be made with the above design instead of traversing up the packet to a cloud server to interact. Thin clients can be improved in case of multiple devices interacting, like a multiplayer gaming inside a home.

On a standardized IPC mechanism like the one shown above security is uncompromised; high speed decision making can be improved and opens up several opportunities for application innovation.

Cloud portals can easily push the high performance endpoints, like thin server, and enable network gaming within home self contained and customized for the users at home. Also remote monitoring and monetizing the same via several methods drives up several opportunities within game marketing.

VII. CURRENT SOLUTIONS AND FURTHER STUDY

Various industry bodies are approaching the interconnection of devices by their own approach focused to solve the issues on their domain. Home gateway initiatives [6] approach solves the issues of the network specific bodies they represent. There are mechanisms that are converging towards a bottom-up approach like open source solutions like d-bus[7] and Multi-Core API[8] but as of today they are too narrow and is not solving the application convergence directly but can be further developed.

From the perspective of gaming application developers and the service providers the key advantages are

- 1) To provide a unified application environment.
- 2) To drive innovation for open application environment
- 3) To enhance the customer value addition.
- 4) From the perspective of a home user
- 5) Customized application
- 6) Better manageability
- 7) Unified device capability
- 8) Seamless experience

From a connected home user perspective the key take away are

- 1) To achieve ease of use of device
- 2) Unified interface to devices
- 3) Innovating solutions and applications
- 4) Speed and cost

VIII. CONCLUSION

The application intercommunication can be overly simplified by standardization thus, the focus will be on innovative application like multi device, multiplayer gaming rather than on solving layered packing and translation module “fixes”.

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