A Point of Entry Interface
for 2-Way Broadband Information Delivery

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Abstract

Currently Cable is the dominant provider of Audio/Video entertainment services into the home. But, with the advent of video compression technologies, virtually every company and industry associated with computers and communication is targeting the delivery of A/V entertainment into the home as a future growth market.

The next 20 years are going to be very exciting and many new services will be provided to consumers, but steps need to be taken now to coordinate and standardize the hardware for distribution of information into and within the home. The problems associated with current Cable converters and Cable Ready TVs will seem insignificant when a multitude of information providers are all trying to use the same TV and VCR, and each provider is using a different interface.

This paper proposes a cost effective approach which combines the various distribution methods of external media into a single "Point of Entry" unit. The pluses and minuses of standardization are addressed and recommendations are presented as to what should be standardized and what level of standardization should be implemented. Also, the issues associated with the distribution of signals within the home is discussed presuming that compression, ATV, and multi-media are in the not too distant future.

A marketable interface needs to be cost effective, useful, and easy to use by the consumer. It must also be backward compatible and easily expandable. Methods for solving these problems are proposed.

1.0 Introduction

Addressable Converter Decoders, (ACDs), are typically used in Cable systems when a high proportion of premium channels exist, because it has proven to be a cost effective method of securing and delivering premium channels to Subscribers. But, the problems associated with ACDs are well known, even by the U.S. Congress which passed the Cable Act of 1992[1], as a measure taken for solving the consumer's problems associated with Consumer Electronics, (CE), equipment which is connected to a Cable system using ADCs.

As a result of this legislation several groups have been organized to make recommendations to the FCC as how to comply with the legislation. Two of these groups are the EIA/NCTA Joint Engineering Committee, (technical advisory group open to all), and the Cable-Consumer Electronics Compatibility Advisory Group, (made up of executives from Cable and Consumer Electronics). The primary mission of these two groups is to make recommendations to the FCC and Congress as to how Cable and Consumer Electronics can cooperate to comply with the current legislation.

The Cable legislation targets existing technology. But, there is currently a rapid development in technology and several Cable, Satellite, and telephone companies are now experimenting with and contemplating delivering hundreds of channels of Pay Per View programming to the consumers CE equipment in the near future.

Within the next five years, six important, technological developments which will most likely be introduced to the consumer are:

- 1.0 giga hertz channel capacity using fiber optics,
- High Definition Television,
- Digitally compressed video,
- high power satellites requiring only small dish antennas,
- broadband wired telephone services,
- local area mobile communications, (PCS).

The introduction of these technologies will radically change the way information is delivered to and used by the consumer. The changes, potentially, could make the consumer interface, to the network and CE equipment, unmanageable.

Most of these issues have been investigated by the FCC in their quest of the next generation of Advanced TV, (HDTV). Specifically the S2 subcommittee, (ATSC Specialist Group on Interoperability and Consumer Product Interface), of the ATSC Technology Group on Distribution (T3), has submitted their final report[2] which studied the issues relating to interoperability among the various media that may be employed to deliver Advanced TV (ATV) services to U.S. consumers and the resulting impact on the interface between consumer products and the various media.

The report is detailed and discusses all of the Cable/CE equipment interface issues raised in the Cable Act of 1992 and describes desirable attributes for achieving a good interface. Unfortunately, it was not the mission of the T3/S2 sub-committee to look at existing NTSC CE equipment, but it can be assumed that the basics of solving the problem for HDTV will also solve the problem for future NTSC equipment. For existing equipment, interim solutions are being sought. The period of pain, where we have to live with existing hardware, can be relatively short if a

cooperative effort, which is now taking place between the Consumer Electronics and the Cable industries, is successful. This effort should solve the existing problems, presented by the Cable Act of 1992, in a manner which is completely compatible with the solutions for interoperability and the consumer interface to HDTV, (which by the way will be digital).

2.0 The path to a solution

Any solution to the current problems of the consumer's interface to Cable needs to also consider what the home environment will look like five, ten, and fifteen years in the future.

The premise

1. Digital TV is coming,
2. Entertainment will be the major information revenue source,
3. There will be competition from multiple vendors, for the entertainment business.
4. Cooperation and Standardization is needed among participants.

Digital

With the advances in digital compression, virtually all of the HDTV proponents have elected a digital approach and these same techniques are currently being applied to both computer graphics and standard NTSC television. Couple these facts with the ability of digital circuits to get cheaper and more dense year by year, and it is inevitable that the future of home electronics will be digital and digital will be the transmission method of choice. Already Cable is planning to introduce compression of NTSC signals by 1994.

Entertainment

The average annual dollars spent per person in the U.S. for Cable, Home Video, and Records is $ 180.26[3]. If you have four

members in your family you would average $ 721.04 per year for entertainment products in your home.

Entertainment, is what consumers want and are willing to pay for. The demand and revenues for entertainment are more than other information services which are delivered to the consumer. If other information services[4], such as education, are to be financially successful, it would not hurt if they were also entertaining. Consumers appear to have no limit to their appetite for consuming entertainment, and they clearly want to consume large portions of entertainment information in their home.

Cable has been successful, because people want to be entertained and Cable provides a diversity of entertainment products that feed the consumer's appetite to be entertained.

Competition

It is Cable that is currently taking the heat from Congress and the Consumer, but with more networks and service providers gaining access to the Consumer's TVs and VCRs, the heat will intensify for others. Even now, Cable has indirect competition. Broadcast television, video cassette rental stores, video games, radio, recorded music, all compete for the consumer's time and dollars.

Right now other industries are investigating the delivery of entertainment to the home. The allure of being able to send digital pictures, sound, and data to the home cheaply has stirred several corporate giants in the, telephone industry, computer industry, and the aerospace industry, into looking at Cable for new services or with the intent of competing directly with Cable.

The environment is right for competition to flourish. The government wants it, our high tech industries want it, the tele-communication industries want it and now the only question is - will the consumer want to pay for it.

Cooperation and Standardization

Technology is not what makes consumers buy. The attraction to a Subscriber, (a consumer who buys a service), is the content of the programming and not the technology which delivers it. But, it is the technology which enables the consumer to have a greater diversity of entertainment and information services, delivered to their home.

As new technologies evolve, new services are provided, (radio, TV, Cable, satellite, VCRs, compression, ...), and the consumer consumes them all. One service does not appear to displace the other. For example; video tape rentals and VCRs did not stop the growth of Cable.

The new services, and compression will allow virtually an endless array, and will typically require greater participation by the consumer to select, order, and consume the new services. This means that there is a two-way transfer of information between the service provider and the consumer. CE equipment is typically designed "open loop", with no provision for consumer feedback. The amount of information required from the consumer to the service provider is minimal in most cases. It means, however, that for an effective interface to all of the equipment involved in the delivery of the programming, an integrated system approach is prescribed.

> An **integrated system approach** is prescribed to solve the consumer interface problems.

But, integrated system approaches require cooperation among the various industries and participants; and they require Standardization.

It is within our grasp to solve the problems plaguing consumers who have to deal with new technology interfacing with old technology. There is a price to be paid to do the job right, but if there are no unfair advantages, then all should benefit - even the consumer.

3.0 Enter the POET.

The current technological and business environment is reminiscent of the 60's and 70's when semi-conductors and micro-computers were emerging. Both of these industries were pioneered by start-up companies and ostensibly ignored by the large corporations. The apparent difference in today's situation is that both big business and government are intensely interested in the future of communication technologies to the home.

An approach which will effectively deal with the future needs to be an integrated solution which addresses the business, technological, and political aspects of future communications to the home. The proposed approach of a Point Of Entry Terminal[5], (POET), considers that future communication services to the home to be able to be integrated together. For example: if an Addressable Converter Decoder could know what channel a TV or VCR was tuned to and the ACD could command the TV or VCR to slave to a desired channel, then most of the consumer's interface problems could be solved, at little cost.

Point Of Entry assumptions

1. Multiple networks connected to the Subscriber's TV and VCR.
2. Increased demand for distribution to the individual, as opposed to the family.
3. Two-way interactive capability with the bandwidth into the home much greater than the bandwidth out of the home.

Physical elements of integrated approach:

1. External networks.
2. Interface between the External and Internal networks,(POET),
3. Internal distribution network, and
4. CE appliance, (ie. TV,VCR, etc.).

The Point Of Entry Terminal, (Figure 1), is the element located between the External service network and the consumer's Internal network and is referred to as the POET.
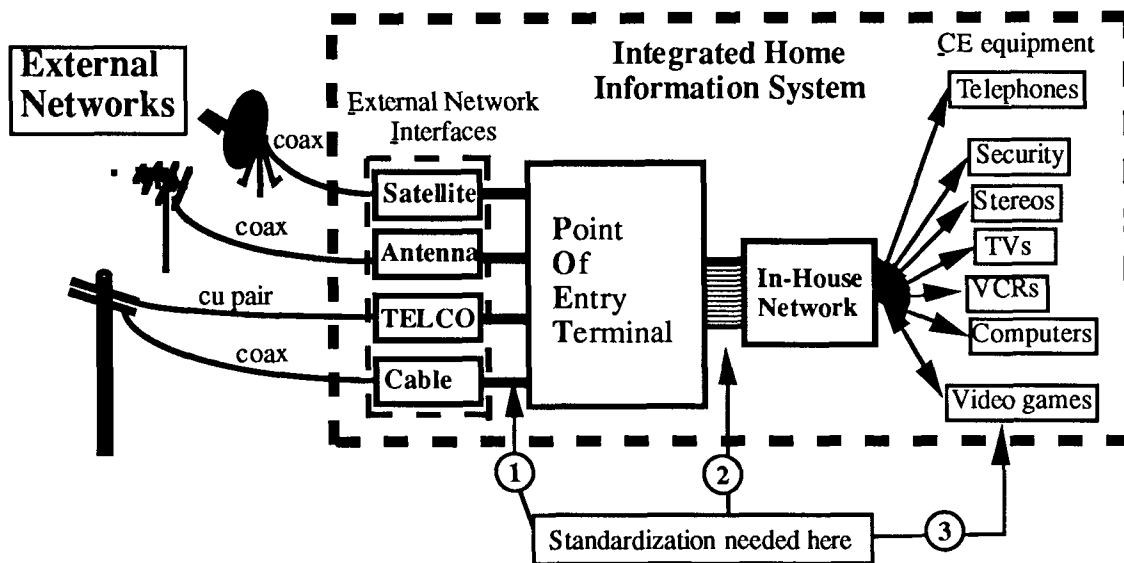

Figure 1. Home Communication System

4.0 Point Of Entry Terminal Requirements:

1. Secure external access to the home	a. The network provider needs easy access to their equipment, b. Access is in a secure external enclosure c. The enclosure is to be independent and secure from other network providers and the consumer.
2. A method of switching or multiplexing.	a. Individual programs or tiers can be selected from any network to any consumer device. b. The control of the switch/ mux needs to be standardized.
3. Two-way interactive communication between the user and the service provider.	a. Transmission into external network needs to be buffered from the consumer network; to prevent the consumer from causing harm to the external network. b. System is asymmetrical, with much more data required to the Subscriber than from the Subscriber.
4. Program security method.	a. Controlled by service/network provider b. Renewable if breached.
5. Compatibility to existing equipment.	a. Analog NTSC b. TVs, VCRs, c. Cable ACDs
6. Modular approach.	a. Consumers can change or upgrade system easily by themselves. b. Wiring to be minimized. c. Interoperability to be maintained.

5.0 In-home Distribution

The connection from the external network to the CE equipment will become more significant in the future of information delivery to and from the home. The traditional role of the in-home distribution network has been to bring the programs to the CE equipment. With the introduction of the remote control an added element was added to the network to control the operation of the CE equipment. Pay Per View, (PPV), programs on Cable have extended the needs of the in-home distribution network an addition step - PPV requires the Subscriber to send information to the Service provider .

The trend, for the consumption of information services in the home, is moving toward more variety and individual use, such as seen by personal audio, wireless and mobile telephones, personal computers, and small screen portable TVs. This individualization of in-home information will need even further enhancements to the distribution network.

And to fully realize an integrated approach to solving the consumer interface problem of the future, CE equipment will require a two-way data port which both talks and listens to the consumer's commands.

It is believed, by several engineers I have talked with, that the utility of the EIA CEBus[6], in the home, is to switch lights, send video from the VCR in the family room to a TV in the bedroom, and other tasks insignificant to the real importance of an in-home distribution network. That is, as an integrator of the home information environment.

One of the key problems of current and future interfaces is that, when working in a system, devices need to talk to each other. The VCR needs to know what the TV is doing and the Addressable Converter Decoder, (ACD), needs to know what the TV and VCR are doing. The problem of the in-home network is not just to distribute audio, video, and data throughout the home, but it is needed to fully integrate various elements of CE equipment into a 'user friendly' system.

Another problem is associated with passing broadband conditional access signals, in the clear, directly to the CE equipment. Service providers want to control their services and do not want to leave the interface to their service completely up to the CE manufacturers. It is important to service providers, how their service is presented to the consumer. The consumer buys directly, (in most cases), from the Service provider. As a result the Service provider has a vested interest in presenting their product in the best way possible. And as there will be many additional competitive alternatives open to the consumer in the future, the way the product is presented to the consumer will gain in importance. This is in contrast to the marketing and sales approach of CE equipment manufacturers who do not sell directly to the consumer, but use distributors and dealers instead. As a result they are not involved in the day-to-day decisions a consumer makes when selecting programming. And, although they wish to make the consumer's job as pleasant as possible when using their product, they have little or no concern for the Service supplier who supplies the consumer with the programs.

The driving force for an in-home distribution network should be the amount of interoperability it provides and it ability to provide a pleasing consumer product interface. Since HDTV and compressed NTSC are around the corner, serious consideration needs to be given to an in-home network which satisfies everyone - service provider, network provider, CE equipment provider, consumer, and let us not forget the Congress (which presumably represents the consumer).

6.0 Standardization is fundamental

There are pluses and minuses to standardization. If done during the period of rapid technological and new service advances, standardizing too early could stymie or curtail growth. But, without standardization each new service and technology wouldn't be compatible with any other and the consumer interface problem would be unwieldy. An additional complication is that service providers would not support standardization of program security

if it meant that they could not control the security and change it if they felt the security was being breached.

The major difficulty in the standardization process is that it crosses different business and special interest boundaries. Each industrial group has it own interests and in most cases its own standardization body. There is the EIA, SMPTE, ANSII, IEEE, Cable, etc. And each of these bodies wants the standards to reflect their position and in most cases there are significant conflicts. In an attempt to breach some of these conflicting interests several joint groups have been formed, such as the EIA/NCTA joint engineering committee. This committee established the standard for EIA 563, Multiport that had the potential to go a long way to relieving the problems associated with interfacing Consumer Electronics television receiving devices and Cable Addressable Conditional Access equipment. But, the standard provided a technical solution, and the management of three industries involved, (Cable system operators, Cable equipment manufacturers, and Consumer Electronic equipment manufacturers), did not want to make the mutual investments required to cause the solution to become established.

It might appear that mutual agreement between industries on standardized approaches is futile, considering that more industries are becoming involved every day, (Telcos, computer, satellite, etc.), if it were not for a particular sequence of events.

Specifically:

- The FCC is currently undergoing a standardization process for Advanced TV, which is expected to replace the current NTSC over the next 20 years.
- Congress has enacted the *Cable Act of 1992*, which was inspired by a lack of competition for cable and the inability of the Cable and CE industries to make their products easy to use by consumers.
- The current Administration, (Clinton/Gore), has made the U.S.

communication infra-structure a priority.
- The economic environment has caused major U.S. industrial corporations, such as IBM, to re-evaluate their current businesses and to look toward the new entertainment and consumer sectors.

Virtually all standards, except those mandated by the U.S. government, (such as the recent Closed Captioning standard), are voluntary standards observed by a specific industry or group within an industry. Currently there are too many special interest groups to have voluntary standards that work. The demise of EIA 563 (Multiport) is a good example. And if this point is not clear, it should be obvious that in the case of the current FCC standardization of HDTV that many more factors are involved, such as "in the national interest". And industries, such as the telecommunication and computer industries are financially and politically very powerful and it will surely be a significant part of any government mandated standards for the next generation of communication and consumer electronics.

In view of the above mentioned complications; when and where does it make sense to do standardization for a proper integrated interface between the service, networks, and the CE equipment ,
(see Figure 1)

Standardization locations for Home Communication System

1. Media entrance
2. Distribution network
3. CE equipment.

Media entrance

With several media and service providers available, in the future, it will be important that each supplier has physical access to their network interface, independent from all other suppliers, and that the interface is external to the domicile.

Distribution network

A person's home is their castle and they want flexibility in configuring information services in their own home. In systems of the future the consumer will want to select programs, or information, from a variety of sources. And the location of the source may not even be explicitly known to the user. The user would select a particular program from a library and the location of that item may be in the user's local data base, or in any one of the network services the user may have at their disposal such as - telephone network, Cable network, satellite, wireless, etc.

Consumer Electronics equipment

Consumers do not like being limited to one supplier and very much like going to a variety of stores to buy upgrades to their equipment. They also do not like having a complex installation procedure. In the case of a TV or VCR they would like to be able to, (in the best of all worlds), put the device anywhere they like and be able to use the device with no connections or extraneous installation procedure. We are a long way from the wireless devices, that don't even need power cords, but with existing technology the consumer should not have more than a few simple connections or insertion of a module into a slot, (or equally simple procedure).

It is because of the above mentioned pressures that industries that need to interface will have common relationships. And those that are able to work together at solving the consumer interface problem, will succeed in getting the consumer's dollar. It has been said that Cable is in a monopolistic position because of franchising. But, Consumer Electronics, (specifically TVs and VCRs); also has a monopolistic position because of the NTSC standard. But, consider that with the advent of digital transmission, that the whole genre of computer electronics is also available for audio and video. And if the proliferation of PCs into the home continues, PCs may be the dominant

display device and the picture is definitely superior to current consumer NTSC receivers. And you can believe that the information industries, such a computers, will play a significant role in any standardization issues of the future.

7.0 Proposed solution

Three key areas of standardization for future technologies and services are, (in order of importance) :

1. digital interface to the consumer television receiving devices
2. Point of entry interface between the media of the service provider and the in-home network
3. multiplexing, (or switching) method for selecting programs among services

These are not the only areas for standardization, but they are key in respect to how a consumer must interface to a diversity of future services.

The basic configuration shown in figure 1. has three basic elements: the *network interface,* the *Point Of Entry Terminal,* and the *consumer devices.*

The network interface is external to the domicile for easy access by the service provider who owns the network. The interface to the Point Of Entry Terminal is standardized both electrically and mechanically. It is designed in such a way that it can be either a part of the POET or separate.

The POET contains the common elements such as multiplexers, addressable controllers, transmitters , receivers, and modular interface equipment.

Existing consumer devices will require the use of external interface equipment. New consumer devices will have standardized interfaces "built in", for seamlessly interfacing.

8.0 Conclusion

Any long range solutions need to consider both the existing and future environments. Individual industries are unwilling to change their current balance, because they feel comfortable in a known environment. But, change is in the wind and opportunities are abundant. Unfortunately it is the large lethargic corporations and industries which are reluctant to change their *modus-operandi* : and succumb to change. Silicon Valley exist today , because large corporations were not willing to take advantage of the opportunities when semi-conductors and micro-computers first arrived.

It is easy for large corporations to relax and not venture into the unknown. After all they are protected by their monopolies and size. But, technology is advancing, and change is inevitable. And since the changes coming to the communication industry affects the entire nation and inter-relationships between nations, the large corporations have a great influence over the government and by their very nature they will oppose change to protect their own interests.

It may be that the conflicting political, financial, and business interests will inhibit a unified solution. But, the opportunity is there and with technology not willing to stand still, sooner or later an integrated approach will evolve and the eventual winners and losers in the struggle could be a surprise. And if the past is a harbinger of the future - the new corporate giants don't yet exist. The entrepreneurs of these new companies are probably, right now, working for some of the current leaders in the Consumer Electronics, Cable, Computer, and Telecommunication industries. They are working on great new technologies, but their employers, for what ever reasons, are not aggressive in pursuing the market. The researchers will get frustrated and venture off on their own.

CE equipment needs to make significant changes, along the lines of ANSI / EIA 563 (Multiport), if there is any hope of integrating the home information services of the future.

One of the missing ingredients of developing the Multiport standard was intimate contact between all of the interested parties, on a continuing basis. It will probably take another intrusion into the free market by the government, to be able to cause the interested parties to get serious about cooperating.

Standardization

The final report of T3/S2 recommends that "voluntary standards" be adopted by the various interested groups. There are two problems with this approach -

1. voluntary standards usually do not have a deadline and can go on for many years.

2. Voluntary standards are <u>voluntary</u> and there is no guarantee that the "other guy" is going to implement them, then they are doomed from the start. Re: Multiport

Therefore, it follows that if progress is to be made, then both HDTV and existing NTSC need mandatory standards if a totally integrated, interoperable, consumer friendly interface is to be achieved.

Acknowledgements

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1. *Cable Television Consumer Protection and Competition Act of 1992,* Enacted Oct. 5, 1992, commonly called the Cable Act of 1992.

2. Final Report from Specialist Group T3/S2, for the Members of ATSC Technology Group t-3, from the ATSC Specialist Group on Interoperability and Consumer Product Interface - T3/S2, Mr. Bernard J. Lechner - chairman, final report November 8, 1992.

3. Veronis Suhler & Associates, from Multichannel News, Nov. 30, 1992

4. *Technology not the key issue,* Gary Kim , Communications Engineering and Design, April 1993.

5. Draft report, *Techniques for Consumer-Friendly CATV Service Provisioning External to the Residence,* EIA/NCTA Joint Engineering Committee - working group II/1, December 23, 1992.

6. *EIA Home Automation System, (CEBus),* EIA/IS-60, October 1992, volumes 1 thru 4, Electronic Industries Association - Engineering Department.