Deconstructing Television: Delivery, Content, and Policy

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Heritage

In 1949 the two IEEE Broadcasting Groups first met[i]. (It also happens to be the year I was born.) It wasn't until 1983 that they were reorganized as separate Consumer Electronics and Broadcast Technology societies.

Television (TV) is a carefully engineered marvel of technology. We can't separate the business of television from the technology. A limited number of channels gave a small number of broadcasters a chance to beam (or cast) their signal to a millions of viewers all organized around a programming grid with each show having a designated weekly slot – continuing the model used for broadcast radio. Over the years the technology of television has continued to refine that broadcast model.

Today we live in a world defined by software with "television" being just one way we are able to use the generic building blocks – the CPUs, video screens and digital connectivity. One consequence of software is that we create solutions outside the channels that define today's technology and business of television. This concept of accepting best efforts rather than depending on channel providers has given us today's Internet.

Yet millions of people still watch television programming on television sets. Our public policies and business models are still largely defined by the same rules that applied in1949. While there have been many changes over the years as UHF channels created more capacity and cable TV providers took advantage of their control of the medium to innovate.

More recently we've seen the rise of streaming services on the Internet such as Netflix and Hulu as well as new video sources such as YouTube.

Despite all this the world of television is fundamentally unchanged. Many People still think of their television sets as something apart from the monitors they use with their computers though, in a sense, a television is just an all-in-one computer with limited capabilities. These limits become obvious during a recent tiff between Verizon and Fox about how much Fox would charge Verizon to carry some of its channels. This kind of flap is all-too-common. I find it strange and even offensive that someone in the middle would decide what I could watch. It's like being told which web pages would be available to me.

Although my TV has a tuner that can receive the broadcast channel directly it's not integrated with the cable model. In the 1960's we had a similar situation with VHF and UHF channels. I remember this because my father manufactured tuners that would allow people to watch UHF channels on their older VHF televisions. The FCC responded by requiring that all channels be available on TV sets sold in the US with uniform tuning.

Television seems to have gone in the opposite direction with a plethora of video sources available via tuners, HDMI connectors and other inputs as TV set manufacturers simply add each new capability onto an increasingly complex box. Perhaps they hope that the sheer number of options would create the perception of value rather than simply adding to the confusion.

It's time to step back and deconstruct television so that we can move on.

Hardware

The Screen

Today we can watch video on a generic monitor, typically an LCD monitor backlit with LEDs. We don't depend on precisely matching the imaging camera with the display and no longer depend on the accidental properties of phosphorous to maintain a stable image.

We can take essentially any video stream and adapt it for any display. If it's a video stream we can smooth it out while presenting sharp edges for digital signals. Today some of those decisions are made for us by the manufacturer. If a device is a "television" then it comes with video-oriented signal processing and interpolation.

Thanks to the technologies developed for video games, today's video processors are very powerful. Rather than building a separate chip for each purpose we can use software to adapt to the different needs. The video streams themselves can be tagged as the kind of processing that is appropriate.

HDMI wiring is a major improvement over earlier cables in that we have a single connector that carries multiple channels of audio as well as video and it even has a data channel (an Ethernet).

While this is a major improvement over old connectors we still have a cable for each pair of sources and screens. To make this easier most televisions have multiple HDMI connectors (as well as legacy connectors for older video sources). Today there is also support for streaming via Wi-Fi and Ethernet (via DLNA).

This is one step short of embracing the simplicity of the Internet. In effect the HDMI is a 10 gigabit network medium so why not just treat the video stream as content on a packet network just like we do with voice over IP?

We already have such a protocol – Display Port – which uses packets to carry the video stream over any transport including a designated Display Port cable which is similar to the HDMI cable except that it supports multiple displays..

Controls

The remote control is at the center of today's television. Or, more to the point, the remote controls because we find ourselves confronted by a pile of controls as each device has its own controller because each manufacturer is focused on the task at hand. The controllers themselves tend to use infrared signals because that was the technology of choice in the 1970's.

There has been some use of Bluetooth and there have been some applications that run on Smartphones such as Verizon's FiOS application but Verizon has done little make them more than adjuncts to the existing set top boxes and the FiOS business model.

What we need are protocols and APIs (software interfaces) to separate the particulars of the devices from the task at hand. This would allow us to build or buy an application that allows the doorbell camera to show visitors in a window on the screen while we can continue to watch the news.

Putting it together

Anyone can build a television by simply putting a screen together with input sources. One reason we don't see more DIY television is that the FCC has defined a particular configuration and there is a whole delivery system (AKA a channel) built around it and the expectations of what a television is.

Computer monitors too have built in assumptions and lack some of the processing necessary to product a good video image.

A component TV would need different "smarts" from today's devices. It would need to be able to process packets for both traditional video and for computer displays. Having additional smarts for managing the device and windowing would be an option but those smarts would need to be accessible to software so that a connected device (such as a computer or an app on a handheld mobile device) could control the screen. We can have a standalone device – the successor to today's remote control.

This would be less of a transition than a rebirth of video presentation and would open up possibilities for screens in many shapes and forms. These would be interactive screens supporting various ways of interacting including touch, visual gestures or ... well that's something we're going to have to learn once the industry starts exploring the possibilities.

The Business of TV

The business of TV had been defined by the constraints of the limited number of channels and the programming grid. This is why television shows are called programs. We now use the term "content" which is a more generic term for what it is people are viewing or listening to or sharing. Each of these words has a legacy of meaning.

Distribution: Cable and OTA

Over the Air

Television started out as a business of using broad swaths of radio spectrum to cast content to a broad audience. If two broadcasters used the same frequency band the receivers of the day would be unable to sort out the signals so the FCC instituted the practice of regulating the use of transmitters and frequency allocation.

We continue to accept such policies as if they were necessitated by physics even though technology has advanced. We call this confusion "interference" which makes it seem like physics when it is merely a result of using weak algorithms understanding meaning.[ii]. And we continue to auction off "spectrum" as if the meaning was contained within frequency bands even though today, as we've seen with the Internet, the meaning is no longer confined to such paths and circuits. We see this with Voice over IP – the conversation takes place outside the network and the network operators aren't even aware that there is a conversation in progress.

TV signaling required allocating a broadband of spectrum. With such a limitation there was only capacity for a few stations. Many of these were affiliated with networks that depended on larger audiences to generate advertising revenues.

From the beginning the FCC was concerned with assuring that our communications infrastructure was financially viable. Thus it granted AT&T monopoly control over much of telecommunications. This extended to concerns about the content and financial viability of the TV industry.

Without a direct relationship between the broadcasters and the viewers there was no way to charge for the content. So indirect funding or sponsorship (advertising) became the norm. The viewers considered this "Free TV" but, in reality, it was just funded indirectly.

Cable

Cable started out as relaying the broadcast content but, over time, the owners of the cable figured out how to take advantage of their control of the channels. We saw the rise of cable-only content as with HBO. Unlike free TV one had to subscribe to a cable provider to get access to this additional content. Part of that subscription fee went to pay for basic cable channels in the same way that one subscribes to a newspaper rather than just individual stories.

The cable business lived in the shadow of the broadcast TV business with a provider owning channels used to provide programming within a scheduling grid. Just as the FCC licensed frequencies in given areas the cable companies get franchises from cities to deliver content within the cities and are under mandate to make "must-carry" arrangements with local stations (aka: content providers.) The business model is heavily intertwined with FCC must-carry (local content) regulations and agreements with content providers.

Even though the Internet has shown that we no longer need a special infrastructure for video content the combination of regulations and legal agreement has slowed change. But change is happening anyway.

The thicket of regulations and legal agreements has slowed the transition away from the broadcast model but change is happening anyway as money is now made by using the physical plant rather than owning it.

This is why Comcast bought NBC Universal and Time-Warner spun out Time-Warner Cable. Over-the-air broadcasters and cable providers have cautiously made their content available directly over the Internet. In order to watch HBO one has had to have a cable subscription.

Cable without the Cable

Just as we associate music with the business of "radio" I expect that we're going to continue to use the term "cable" for a bundle of content even as HBO has announced they are planning to make their content available directly. At CES in 2015 sling.com announced the availability of some of the "basic cable" channels over the Internet.

The term "cable" has been extended to any means of delivering the bundle of content we associated with cable providers such as "HBO" and "ESPN" even when the content is delivered by satellite, fiber or the Internet.

Over the air broadcasters can now have a direct relationship with the viewers. CBS has announced a digital subscription service that takes advantage of this opportunity.

As Hulu and YouTube demonstrate, there is still a business in providing content paid for by advertisers and other means. There is also value in passive "lean back" viewing where a third party makes content available. We see this in music with Pandora, Spotify and others. Despite the ability to view content on demand people still largely choose to watch ~~what~~ shows when they are made available (AKA, broadcast).

What is less obvious is the need ~~to~~ for over-the-air with its myriad of limitations.

Broadband?

I add the question mark because the word itself is a source of much confusion since it is a term for a technology that became associated with a business model and then became a synonym for The Internet.

The business of "cable" started out with communities sharing a single antenna relaying the wireless broadband signal via a common cable so it was natural to call the business itself broadband. Over time the term was used to any "Fat Pipe" or high capacity connection from a carrier. Telephone companies used the term "BISDN" or Broadband ISDN for their high capacity digital services.

The business of broadband was based on carriers charging for the use of their pipes. Because the carriers owned all the wires (as well as wireless bands) any attempt to connect to the rest of the world had to go through their broadband pipes. That included the Internet which came to be called "broadband".

The term is a bit of a contranym, a word that is its own antonym, because the powerful idea of the Internet is that we can focus on the relationship is between the two end points and the intermediaries don't matter. That's just the opposite of the cable business where intermediaries are in control as when Verizon decides whether to allow me to watch Fox TV.

The Business of Connectivity

Bits are bits – we can carry content over any packet medium. There is no significant differentiation and there is no longer a necessary relationship between the particulars of the physical transport and the technology. We need to take a fresh look at the business of the physical infrastructure (AKA broadband) apart from the business of providing content (also known as broadband).

At the simplest level carrying packets is a natural monopoly like electricity so it doesn't make sense to have more than one infrastructure. But unlike electricity we are transporting packets that are just numbers and have no intrinsic value so there is nothing to sell. Rather than using electric distribution as our model we need to consider the wires and radios more like streets and sidewalks – common facilities owned by the community as a whole.

This may not be obvious now because today one has no choice. Wired connections are all owned by providers who require subscriptions and cable content requires a subscription. The small number of providers controlling the broadband connections and cable subscriptions creates a de facto cartel under the aegis of the FCC which has played the role of assuring an orderly marketplace for the broadcasters.

Creating virtual wires by licensing radio frequencies extends this control over our very ability to communicate even though the rationale for allocating frequency bands no longer makes sense now that we have packet technologies. For shorter hops (as with Wi-Fi) we can use techniques such as spread spectrum to avoid the problems associated with single frequency signaling.

Yet, as we've seen, change is happening anyway. Once you can assume connectivity it doesn't matter if we get broadcast content over the air or over a packet connection if we want to watch traditional content, AKA, television. But with the Internet we have essentially unlimited choice and a two-way connection that enables all sorts of customization and new services as well as liberating us from the limitations of the programming grid.

This may not be obvious as Comcast attempts to acquire the cable facilities that Time-Warner has spun out. But that effort has to be viewed in the context of an infrastructure owned by competing pipe providers. There is no intrinsic value in owning the facilities. As building owners and then cities make facilities available as common infrastructure Comcast will continue its shift into the content business and will no longer need the costs of maintaining its own infrastructure.

After "Cable"

Once we no longer have the constraint of each provider having its own dedicated pipe we can expect to see all sorts of new experiments. We'll have a connected infrastructure available to all rather than being limited to content that is profitable to an owner to the exclusion of other users.

Traditional content will still be available though with new business models. While it may make sense to subscribe to HBO by itself most people will likely opt for aggregating a cable of packages because such bundles would be less expensive than a la carte. Those bundles may also include the equivalent of today's basic cable's sports and informative programming.

It's less clear how basic cable product will fare once they have to compete on their own for the customers' dollars. Perhaps they will continue as part of packaged offerings. The situation is similar to the challenge newspapers face as news gets disaggregated.

Looking Ahead

In the Meantime
There is a lot of opportunity for intermediate fixes such as implementing a great application that can replace the remote control with a far better user experience such as just typing in the name of a program (or content) you want to view rather than going through the complex process of "typing" on a classic remote control.

Efforts like Google TV attempted to address some of the issues but such incremental approaches have made little headway. For now we have Google, Apple, Roku, Amazon each providing their own devices that connect directly to the HDMI connectors.

We can also put a lot of effort into improving the unidirectional over-the-air broadcasting standards. In fact we spent an amazing amount of effort to obsolete all the analog televisions in the name of digital broadcasting. Yet with all that effort it resulted in being a digital veneer which kept the fundamental isochronous open-loop signaling approach.

The best-efforts approach of the Internet is a fundamentally different concept that doesn't depend on every element of a distribution system to cooperate. More to the point it doesn't empower each intermediary to demand payment for its cooperation whether in the guise of a subscription or other fees.

Imagine if we'd taken all the cost and effort of that digital transition and instead assured universal connectivity with today's television being just one of the ways we could use connectivity. We would have all been much better off with a world of opportunity for innovations we can't even imagine.

Public Policy
Today's policy debates are framed in terms of the pipe model. In that model we need the FCC to enforce common carrier policies (AKA network neutrality) to assure that pipe owners don't take advantage of their control. Yet the very business model of broadband is premised on the assumption they get an advantage over their competitors by owning facilities. The problem is that this competition includes users who provide services like Netflix.

Network neutrality isn't sufficient to address this inherent conflict. The alternative – common infrastructure – avoids this contradiction and aligns incentives. This is a powerful dynamic which will drive change. As we start to assume a common infrastructure we'll see new stakeholders who take advantage of the new opportunities.

Traditional over the air broadcasting will seem too constraining and owning frequency bands will have little value when there is so much capacity available for exchanging packets using wires (and fibers) for reaching over distances and unlicensed wireless technologies for shorter distances.

Post-Broadcast Standards
Many of today's standards are framed in terms of a world in which we assume isochronous delivery of content through well-defined channels with an infrastructure that "understands" all the formats so that the elements along the delivery chain can all work together.

The world of best efforts packet transport is very different. While we can continue to send existing content we are no longer constrained by intermediaries. Adding new formats and aspect ratios is a matter of making the appropriate codecs available. Differences in capacity can be handled by adapting dynamically or caching or cleverness.

This is not all about technology. There are a lot of property rights issues associated with content so techniques like streaming will continue to be used to control what can be done with the content. There will also be creativity as the line between video games and prepared content will begin to blur and we'll see content generated dynamically and, perhaps interactively.

We may continue to use words like television or we may adopt a different vocabulary in the same way that we now refer to programs as content. Today's television programs are long form content compared to the short form on sites such as YouTube.

Connectivity and the Internet
Today many people think of the Internet as something you access like web sites. As our understanding of connectivity improves that perception will change. HDMI, USB, Bluetooth will be normalized to packet transports (as I wrote in my July 2014 column (http://rmf.vc/IEEECE201407).

The real message of this column is that television itself is becoming just another way we use this common infrastructure. And the Internet is really the technique that makes this possible. It isn't a place or a thing – just a way we use our common infrastructure to communicate without having a provider in the middle.

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[i] According to http://www.ieeeghn.org/wiki/index.php/IEEE_Broadcast_Technology_Society_History

[ii] http://www.salon.com/2003/03/12/spectrum/