CHAPTER

8

The Challenges of Standardization: Toward the Next Generation Internet

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The mass distribution of video programming over IP networks promises a richer experience for viewers, with widely predicted increases in interactivity, choice, personalization, and the ability to micro pay for a la carte programming.[1] Whereas broadcasting was licensed, controlled, and tightly regulated by national governments (or even owned as a monopoly service), video-over-IP will be delivered by international market mechanisms with both relatively minimal direct legal restraint and little direct government strategic intervention. Standardizing video delivery to produce network economies of scale and scope will require international corporate coordination between the converging industries of broadcasting and video production, wired and wireless telecommunications, and computer hard- and software derived data communications. In this economic analysis of law, I consider the distribution of existing television broadcasting archive over IP-based networks. While new production can be designed for IP networks in technological, economic, and legal terms, I postulate that it is access to the mass of video archive which will create the critical mass of online programming that drives the "video Internet." My focus is on the development of legal regimes based on market mechanisms, which will lead into the online exploitation of broadcast video rights. Although my perspective is predominantly European,

[1] See Waterman (2001). The regulatory implications in the U.S. are examined in Compaine (2001).

the markets are developing globally, and U.S. and Canadian law and corporate strategy are analyzed where appropriate. The overwhelming conclusion is that the Internet's engineering development is driven by the security, competition, quality, and reliability imperatives in monetizing broadband data, of which video is the paradigm I adopt. This development is achieved through international standardization by industry bodies supported by governments, and is emerging in creation of quality of service (QoS) in the local loop: the "final mile" to the consumer over which infrastructure and IPR owners exert control. This can only be achieved over broadband networks (see Shelanski, 1999), which requires investment in upgrading backbone (the "middle mile"), local access, and home access infrastructures. The investment required creates local monopoly and duopoly (the "last mile" issue), typically of fixed wireline access by cable modem and Digital Subscriber Line copper wire,[2] though other technologies exist to offer broadband wireless access (overcoming the "last metre" problem via 3G mobile and "4G" wireless LANs). Broadband networks are driven by the use of services that will monetize the bandwidth available. Following a summary of the state of video-over-IP legal, policy, and market developments required in sections 1 and 2 of this chapter (see also Marsden, 2001b), I examine in turn:

- In Section 3, the recent state of broadband market and policy development.
- In Section 4, TV intellectual property rights (IPRs) in the online environment.
- In Sections 5 and 6, I conclude that rights holders in infrastructure and Internet Property Rights (IPRs) will drive the development of a secure broadband local loop for delivery of IP video, signaling at least a temporary end to the Internet's founding architectural principle of "end-to-end."

The development of markets in real property (local loop and radio spectrum) and video IPRs has been severely hampered by the failure to delimit and efficiently transfer property rights. It is not an exaggeration to state that the development of the concept of property rights, together with a consistent and measured examination of the public interest in regulating and assigning those rights, are the primary challenges for both governments and market actors. This is beyond even the extraordinary pace of technological innovation that is creating the space within which those rights will be exercised.[3] North (1990) and Williamson (1975) have demonstrated that

[2]See variously Carter Donahue (2001), Eisner Gillett and Lehr (2000), and Faulhaber (2001), for definition and the open access debate. In this contribution I briefly address the open access debate in fixed line, concentrating instead on wireless infrastructures.

[3]For the regulatory and business challenges, see Figueiredo and Spiller (2000).

property rights are the basis for transferable wealth and therefore economic development.[4] The latter, following Coase (1937), has shown that where transaction costs in property rights are sub-optimal, corporations will be formed, internalizing those rights within organizations. Failing property rights transfer, economies are reduced to barter, in which roughly equally valued goods and services are exchanged without monetization. This paradigm, that without property rights being efficiently assigned, monetization of transfers is inefficient where possible, and replaced by barter, is the situation pertaining in much of the broadband media market. This applies to traditional broadcasters and Hollywood studios, but also to the music industry, and to broadband infrastructure owners. Monetizing this "barter" economy will require rapid evolution from the current IP infrastructure, as well as from the traditional broadcast model.

1. EVOLUTION OF THE INTERNET: BEYOND END-TO-END

End-to-end was the guiding principle in founding the Internet (Saltzer, Reed, & Clark, 1984). Kahn and Cerf (1999) embraced an all-encompassing definition of "the Internet as a global information system, and included in the definition, is not only the underlying communications technology, but also higher-level protocols and end-user applications, the associated data structures and the means by which the information may be processed, manifested, or otherwise used."[5]

It is a packet-switching network, with no dedicated channels. It delivers all the packets sent onto one end of the network to the other end. It makes no distinction between video and other data signals. Like trucks on the road, the packets mix with all other traffic before meeting the other trucks in the fleet at the destination. The Internet acts as a "dumb" network delivering to an intelligent box, the Personal Computer (or other micro-processing device), which decodes and orders the packets to make an intelligible message from the data packets. Fundamentally, the Internet is the 1960s ARPANet, in its present Internet Protocol Version 4 (IPv4) form. IPv4 is the basic standard of the any-to-any environment that "accidentally" became the global TCP/IP standard for data, voice, graphics, and audio. The idea was that the system would not discriminate between packets of data or users: Anything sent from one end would reach the other. It relied on the intelligence in the system being distributed in PC terminals, where data packets would be decoded. As the size and complexity

[4]For an insightful application to telecoms regulation, see the public choice assessment of the U.S. constitution's protection of private property (Cherry & Wildman, 2000). An excellent property-rights-based treatment of regulatory arbitrage in Internet governance is that of Burk (1999). An early path-breaking treatment of comparative telecoms regimes is by Levy and Spiller (1994).

[5]For the history of the Internet, see Leiner et al. (n.d.).

of data packets was relatively similar from one user to the next in the early stages of email and text pages, and could be easily reassembled by PCs, the end-to-end principle became enshrined as the founding principle.

The increasing bandwidth of the modern Internet, allied to broadband connections and more powerful PCs, has permitted much greater diversity in data, including graphics, audio, and video. This increases the complexities of traffic management, with rich media packets traveling at the same pace as "spam" junk mail. The next-generation Internet, IPv6, is expected to permit prioritization of time-sensitive and higher revenue traffic, introducing hierarchy into the system. The fear of the early "netizens" is that the innovation which the information-sharing, non-encrypted, non-hierarchical, "free" Internet will be undermined. As Lemley and Lessig (2000) wrote in opposing the vertical integration of telcos with cable TV firms, they fear "the end of end-to-end" (see also Berkeley Law and Technology, 2001).

The rough and ready non-hierarchical protocol that served defense, academic, and "geek" users until the mass adoption of the Internet in 1995, will be fundamentally altered by the new IPv6 that is being developed, challenging the any-to-any nature of the Internet ("Upgrading the Internet," 2001). Both Vint Cerf and Dave Clarke, pioneers of the original Internet, see an inevitable evolution to priority on user-pays in a "rich media" Internet, where Application Service Providers (ASPs) and streaming media delivered over Content Delivery Networks (CDNs) will occupy much of the data traffic delivered over TCP/IP networks. Enron Broadband Services predicted the data traffic for 2005 as shown in Table 8.1 (see also Morel [2001]). This demonstrates that streaming media will be a critical, but by no means dominant, data type on the next-generation Internet. It

TABLE 8.1

Global Data Traffic on TCP-IP Networks 2005 (2000)

Data Type	*Percentage of Traffic 2005 (2000)*
Machine-to-Machine (e.g., file back-up; remote security)	45% (37%)
Peer-to-Peer (e.g., file and application transfer on request)	24%
Streaming Media (audio/video)	21%
Web pages	10%

does show, however, that Web pages will be a far less dominant artifact of the next-generation Internet. To deliver this future video and shared ASP will require greater security and prioritization of data on the Internet. If you pay more at the mini-tollbooths that will monitor and check data packets, you will be safer, faster, and better able to plan your journey, business, and life. That will introduce more control, which rightly worries Internet purists. It holds the hope that the one-to-many broadcast channel will be supplemented by the delivery of video over the Internet.

Predictions of streaming media revenues are less precise, as Fig. 8.1 demonstrates. Note that the vast majority of revenues in 2000 were audio, not video. Yankee Group predicts broadband PC penetration will reach one third of all Internet-connected households, and 25% of U.S. households, by 2004 (see Fig. 8.2). Even if this figure is considered high, it demonstrates the development of a mass broadband Internet market. European communications policy had no end-to-end tradition, with government control and censorship of communications, and a less individualist notion of freedom of information.[6] End-to-end via the Internet raised

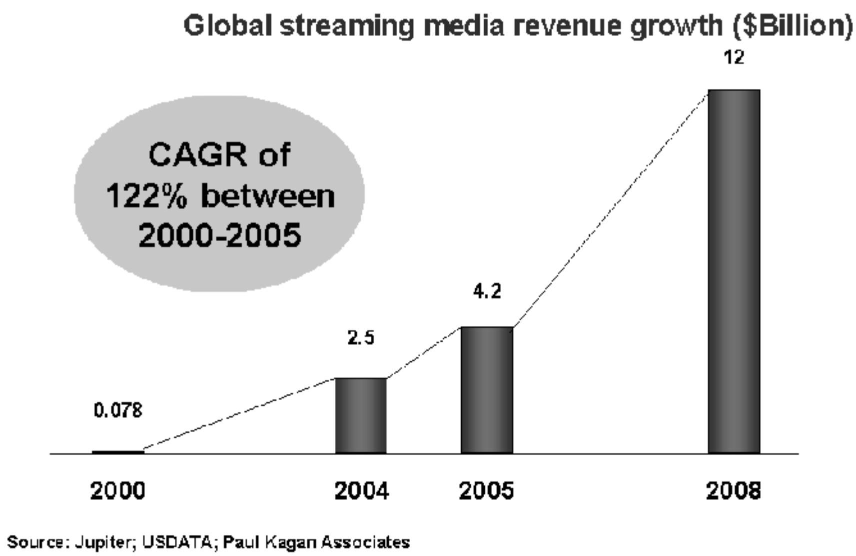

FIG. 8.1. Global streaming media revenues 2000–2008 ($b). Source: Jupiter; USDATA; Paul Kagan Associates.

[6]On the European regulatory legacy, see, for instance, Blackman and Nihoul (1998) and Marsden and Verhulst (1999).

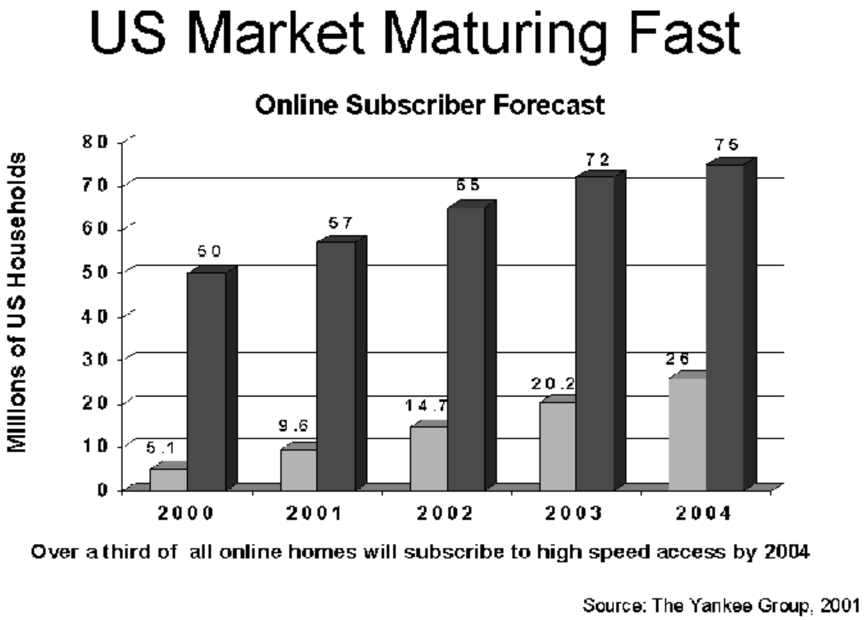

FIG. 8.2. U.S. broadband market maturing fast. Source: Yankee Group.

fears about the anarchic nature of cyberspace, even though far fewer Europeans were exposed to the Internet. With far less computer and Internet literacy, the result has been greater focus on regulating content (via filtering and classifying websites), protecting minors and privacy. The lack of installed PCs in European households (outside Scandinavia) and a concern with providing universal access to digital TV (DTV)—in part to free up spectrum—has resulted in the policy choice of Internet via DTV.[7] The global projections for DTV, and interactive DTV with a return path, are far higher than for broadband PC growth (see Fig. 8.3).

The end-to-end approach revolves around the standards-setting bodies that have developed dynamic consensual approaches on an industry-led basis. This approach, a radical departure from the government-led approaches of television and telecoms until the 1990s, permits far greater speed in setting standards, but with the obvious political economy pitfalls of dominant actors dominating standards bodies. Further, the resources necessary to influence the plethora of standards in converging media, telecoms, and IP environments on a global basis are available to only a few

[7]This creates huge problems of scarcity and access. In a voluminous literature, see, for instance, Cave and Cowie (1998), Cowie and Marsden (1999), and Flynn (2001). For updated analysis, see Marsden and Ariñe (2003).

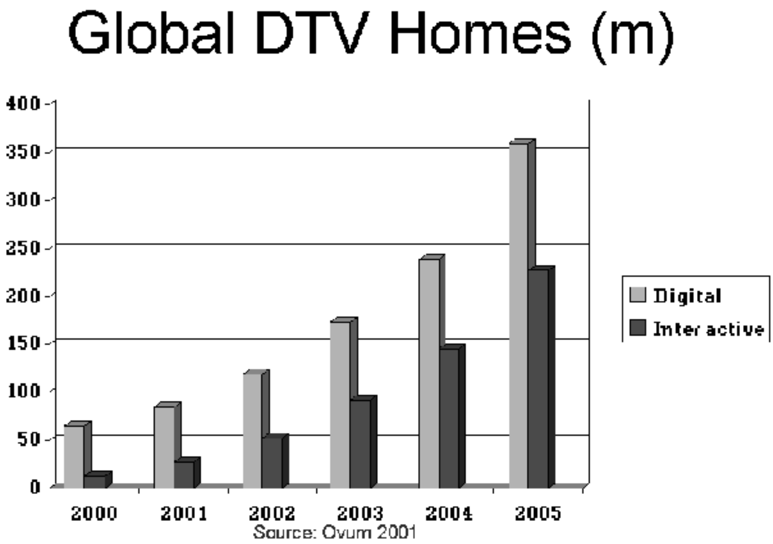

FIG. 8.3. Global DTV homes (m). Source: Ovum 2001

large multinational enterprises.[8] While organizations such as the IEEE (Institute of Electrical and Electronic Engineers) and IETF (Internet Engineering Taskforce) claim that individuals leave their corporate identity outside the negotiation of standards,[9] the reality is far different.[10]

2. THE START OF VIDEO-OVER-IP AS THE BEGINNING OF THE END OF BROADCASTING?

The choice of device is critical to "end-to-end." TV is one of the least end-to-end of communications technologies: It has no interactivity (no "return path"), so cannot be end-to-end unless supplemented by telephone connection.[11] Further, it is a "dumb box" with an intelligent stream:

[8]For problems in industry-led standard setting, see Lessig (1996b), Marsden (2001a), and Kahin and Abbate (1995).

[9]Excellent reviews of the literature are contained in Besen and Saloner (1989) and Noam (1989). See further David and Shurmer (1996) and McGowan (2000). On the IETF and IEEE specifically, see Gould (2000).

[10]On the possibilities of open standard setting, see Bar et al. (2000).

[11]This creates massive legal definitional problems; see Marsden and Verhulst (1999) and McGonagle (2001).

The technology delivers perfect pictures by allowing almost no data other than TV pictures over the network. This is the opposite of end-to-end. Television distribution networks are classic examples of proprietary engineered networks, with dedicated channels devoted to delivering a high bandwidth data stream in MPEG2 with total system integrity and no interference. Networks delivering TV channels deliver almost nothing else; data packets are sent in order like carriages coupled to a locomotive on a track. It is an intelligent stream delivered to a dumb box: the TV. The Internet is, in engineering terms, the exact opposite.

Analogue Television Broadcasting: One-to-Many

It has always been thought that TV signals (including enhanced DTV, which puts a layer of xML interactivity onto a 3-6Mb/Mbls) would require the equivalent of railway travel: dedicated channels for video signals. This is because they require so much bandwidth and contain so many packets. Early experiments in sending video packets by "truck," over the Internet, have been hampered by accidents at junctions on the network. When packets hop from one network onto another, they can be delayed or even lost at the junction; hence buffering and frame loss in the final picture delivered to the viewer.

Delivering TV by dedicated networks has its disadvantages: Choice is limited, flexibility is lost. Market researchers and advertising agencies have proven beyond all reasonable doubt that consumers want individual choice in programming (Arbitron/Coleman Research, 2000). Broadcast technology can't cope with choice; it is a network built for mass transit by trains, not individual trucks. Broadcasters have persuaded governments to introduce DTV. These "trains" are bigger (interactive TV can occupy up to 8Mb/s) but much more efficiently timetabled (multiplexing allows up to 6 channels to occupy the spectrum of a single analogue channel). They are more expensive for the consumer—government compulsory licence fees have increased overall in Europe to fund DTV—and in the case of pay-TV, much more expensive, with subscriptions at up to four times analogue licence fees.[12]

Starting Video-to-Many: Developing the Broadband Internet

For increasingly complex data such as voice and audio, TCP/IP packet switching is rapidly taking ground from switched circuit networks. For video, which has been considered too huge and delicate—like transporting bulk chemicals—it is both clearing the last mile, via tolls, and shrinking

[12]For a critique of the regulatory capture involved in such a move, see Marsden (2001b). On the theory of regulatory capture, see Moe Terry (1997). See also Marsden and Ariñe (2003).

the packets to make transport easier, which will let those of us who want to get off the train and drive ourselves to do so. Moreover, the trucks will need to be tracked as they move to ensure they don't get lost, taxed on their progress so that government takes its share, and reassembled seamlessly at their destination depot. It will also help if smaller loads can be delivered flexibly to individual customers: interactive services and advertising as well as on-demand programming. That needs the same network, but more intelligence at the depot. Instead of the terrible cart paths and narrow roads on which academics built the original Internet, new autobahns have recently been constructed by fibre-optic providers such as KPN Qwest and Level3. At the junctions, Content Delivery Network (CDN) companies such as Akamai have built new toll lanes, taking traffic quickly into the center of town (from where you make your way slowly down the last mile). Traffic is still slower than on the trains, but with huge advantages in freedom of choice. So, how to squeeze packets onto the Internet?

1. Widen the highways.
2. Compress the packets.
3. Track the packets automatically as they travel.
4. Deliver to households as efficiently if they were on motorways.
5. Decompress the packets between the depot and the viewers' houses, and reassemble in perfect coordination at the destination.
6. Persuade the viewer to pay at least as much to receive the packet by IP rather than broadcast networks, by offering greater flexibility.

Finally, the vested interests on the trains, switched networks, will need to be persuaded to accept robust competition. That also means persuading government, via content filtering and anti-piracy, to stop moral hazards being used to prevent the market from developing. Table 8.2 presents ways in which networks determine interactivity and efficiency.

Before examining in section 4 the IPR issues in adapting current packets of video to the Internet, I first examine in some depth the wired and wireless attempts to bridge the "middle mile," "last mile," and "last metre" (or yard).

3. BROADBAND BOTTLENECKS: THE "MIDDLE MILE," "LAST MILE," AND "LAST METRE"

The lack of legal certainty in assigning property rights is restricting the growth of a broadband Internet, and leading to a localized, Balkanized "walled garden" private network approach: back to the future. In such a fragmented future, should it continue, the issue of open access to those private networks will become critical. The global information infrastructure is becoming increasingly regional, national, and local, a process

TABLE 8.2
How Networks Determine Interactivity and Efficiency

Network Properties	*Broadcast*	*Video Over IP*	*Infrastructure Improvements Needed*
Bandwidth	High 3–6Mb/s	ADSL: 512Kb/s+ POTS: 56/33k	"Last Mile" DSL, Cable, 3G 500–10,000kb/s
Two-way Interactivity?	Very limited in MPEG2	ADSL: High Satellite: Low	High Bandwidth Return Path
Packet Size	Huge	Low And Reducing	MPEG4 Standardized 2001
Monitoring	NA—closed network	Low But Increasing	Digital Rights Management
Reassembly	NA	Good And Improving	Improved IPv6 Internet
Delivery	Consistent	Poor But Improving	"Middle Mile" Hops Between CDNs
Cost	Low	High But Decreasing	Virtuous Scale Economies Circle

which streaming video will accelerate due to the huge (probably insuperable) technical and legal challenges it represents to any global broadband solution. Without a more legally certain international allocation of property rights, the old national legal restrictions will continue to apply to profitable mainstream operators, with the global public Internet a source of piracy, romance, and buccaneering on the high seas beyond the reach of national legal certainties. Delivering a regulatory and market proposition to make the highways affordable to businesses and then to consumers (possibly all consumers, eventually) is a huge challenge, especially in the final mile and final metre delivery to households. Government spectrum auctions have thus far proved an inefficient digital alternative to the analog of building a national highway system, but the technology is expanding choice so fast that the market may deliver with minimal government interference beyond unbundling the local loop.[13]

[13]As an example of market innovation, see, for instance, the IEEE 802.11a wireless local area network (WLAN) standard that can deliver 54Mb/s from a base station which could cost less (much less) than $1,000. See also Croxford and Marsden (2001).

"Middle Mile" Bottlenecks

The solution to the global Internet dilemma is in two parts: delivering content efficiently, in terms of speed and cost, and securing it from unauthorized use. The CDN solution is well known, using broadband backbone speeds and local hosting on proprietary networks—effectively avoiding the Internet wherever possible. It can be argued that "thinking local" works better using local closed telecom networks in each national geography to deliver content close to the user. By choosing the public IP "cloud" as a global solution, CDNs such as Akamai have to overcome the Internet's latency "middle mile" problem. The Internet is a network of networks; content delivered over the WWW has to "hop" from network to network, slowing it down at each hop. Both Digital Island, with its international backbone minimizing hops, and Akamai, with servers placed in each national geography, and often multiple networks within that geography, try to combat the "middle mile." They do this by cutting down the number of hops, ideally to two, onto their proprietary networks, and then onto the local partner's network to the home or business end-user. Unfortunately, there is always a "hop" or two too many to deliver at maximum efficiency. Those "hops" mean delays. Market surveys (for instance, Yankee Group) reveal that broadband has transformed the consumer Internet browsing experience, cutting out dial-up delays. While CDN solutions speed up delivery, they nevertheless require patience in broadband consumers whose raison d'etre on the broadband Internet is impatience. This wouldn't matter if there were no other way to access video as fast as Digital Island and Akamai. Unfortunately, there is; cable and satellite DTV.

Pay-TV avoids delays—technically termed *latency*—by using a satellite or proprietary fiber-optic cable to directly feed a local "head-end" or consumer dish, totally circumventing the "hops" over the WWW. Of course, this solution presupposes that video packets access the local network, where the gatekeepers—including Time Warner cable and your local telephone company—have no general economic incentive to carry these huge unwieldy and often revenue-losing packets to the end-user. As a result of the unsustainability of this revenue model in the investment climate of the summer of 2001, the leading global CDNs were taken over by backbone operators: Digital Island by Cable & Wireless, iBeam by Williams Broadband. To incentivize local loop gatekeepers, IPR owners have increasingly decided to cut deals direct for locally cached content rather than hopping over the Internet on CDNs. Consider first government incentives to encourage broadband local loop investment.

"Last Mile" Bottlenecks

The gatekeepers face two massive property rights challenges, which have become especially profound in the European market: third generation

(3G) wireless spectrum rights and local loop unbundling (LLU). Globalization of the telecoms industry creates tensions between national regulators.[14] This is most obvious in policing of the electromagnetic spectrum, where a scarce resource must be shared and new services planned so that technical interference is minimized. However, national regulatory differentials have caused chaos in the auction of 3G licences for mobile telephony.[15] The failure to coordinate a common standard for the European 3G auctions is one of the twin tragedies of member-state regulation of telecoms in 2000. The other is the continued failure to develop alternative local loop broadband services, by divesting the telco of its cable TV division in advance of the 1998 local loop liberalization to permit upgrading of services from analogue to digital.[16] A partial answer has been to "unbundle the local loop" by co-locating rival operators' switching equipment in local telephone exchanges, permitting them to use the higher bandwidth element in the copper wire lines for Digital Subscriber Line (DSL) services. With the combination of competitive infrastructure being least advanced and regulators most advanced, LLU has been a partial success.[17] This "managed competition" to the incumbent creates huge regulatory distortions of market valuations.

Competition is seen to be emerging in broadband via these two routes. The regulator is opening access to the assets of the telco—wedded to "midband" 128Kb/s Integrated Service Digital Networks (ISDN) previously. The telco rationally fears that DSL would cannibalize ISDN revenues. Whereas previously, mobile was held to be the most potentially profitable market followed by local loop, the effect of auctioning 3G and regulating broadband local loops has contributed to the decision by some European telcos to divest their mobile divisions. The experience appears to have made fixed returns fluctuate wildly in the sector. Regulators need to ensure that basic network integrity survives, that 3G networks are built on time, and that rival DSL operators do not leave the

[14]For critical commentary, see, for instance, Naftel and Spiwak (2001), Laffont and Tirole (2000), and Marsden (2000). A comprehensive and complete analysis is offered by Larouche (1998).

[15]This was caused by the high cost of the UK and German auctions, the low cost of the French and Swedish "beauty contest" auctions, and the "middle way" in Holland and Spain. Regulatory chairmen Martin Kurth of German RegTP and Jens Arnbak of Dutch OPTA have described how mobile auctions had caused the cost of capital to rise for national telcos.

[16]The extent to which liberalization has involved hugely increased regulation is demonstrated by the 2001 legislative program (Commission of the European Communities, 1999).

[17]A useful measure of local loop competition is supplied by the Competition Scorecard maintained by the European Competitive Telecommunications Association (ECTA) at http://www.ecta.org

market, driven out by regulatory uncertainty in assigning a new property rights settlement. The property rights shambles proves the poverty of regulatory zeal, with spectacularly high mobile auction prices, intransigent telco (and cable) management, and national regulation of LLU, which have delayed broadband roll-out.

The possibilities of alternative wireless access are considered in the following section, to illustrate the problems that can arise in creating an "open" alternative standard for IP transmission to the local loop.

"Last Metre" Bottlenecks: Wireless Local Area Networks (WLANS)

Providing in-building wireless broadband networks is now feasible for both corporate and consumer premises, removing the need for multiple cables, and fixed line Internet access. Until recently, chipsets were unable to practically reassemble wireless broadband multiplexed signals, but Moore's law has overcome that microprocessor problem such that Calgary-based WiLAN predicts 155Mb/s download speeds by 2003. These capacities are far superior to 3G mobile telephony, which is expected to achieve only 2Mb/s from each base station. It is suggested that integrating 3G mobile with WLAN can help to achieve localized broadband in populous areas, with lower but still always-on packet-switched capability between these local "hotspots" of broadband. However, the engineering and standardization challenge of WLAN is considerable. As with 3G, it is complicated by rival U.S., European, and Japanese standards. WLANs operate in the 2.4GHz and 5.4-5.7GHz GHz bands, in the Industrial Scientific Medical frequencies, which are unregulated. Consequently, reception in potentially crowded and "noisy" (full of interference) spectrum requires sophisticated and standardized devices. The process by which devices are standardized differs according to market, but the major standards setting institutions are the IEEE for the United States, MMAC for Japan, and ETSI for the European Union (see Table 8.3).

United States: IEEE and 802.11. Standardization of WLAN in the United States is carried out by the IEEE, an engineering body that provides a self-regulatory solution. The standards family is 802.11, and the first-generation standard is 802.11b, from which upgrade to second-generation 802.11a will take place. The 802.11 working group's voluntary standard is certified by the Federal Communications Commission (FCC), the federal agency responsible for all U.S. communications. Previously committed only to domestic use DSSS-compliant standards in the 2.4GHz band, the FCC set an important precedent on May 11, 2001, by admitting that its rules were out of date and decided, subject to consultation, to accept WiLAN's W-OFDM standard as well (FCC, 2001). IEEE standard-setting sets precedents that the FCC tends to follow. On security and QoS issues required to

TABLE 8.3
Standards for WLANs

	European	*United States*
Standards Regulator	ERO - ETSI	FCC - IEEE
2.4GHz at 11/22Mb/s	Bluetooth; HiperLAN1	802.11b–WiFi; Home RF
5.4GHz at 55Mb/s	HiperLAN2	802.11a

monetize WLAN services, IEEE 802.11 Task Group E is now working on security, range, interference issues, through the Media Access Control layer (MAC) for 802.11 platforms.[18] At the time of writing, the 2.4GHz band is unregulated, but crowded and "noisy" as a result. Services are expected to migrate to 5MHz band.

HIPERLAN2: The European Answer to 802.11a. HiperLAN2 is the European upgrade from the basic functionality of HIPERLAN1, a standard that was overtaken by commercial development of Bluetooth.[19] In part, this is due to Bluetooth's slowness to market. It is not as expandable as 802.11b; hence the HiperLAN2 upgrade option, which is intended to outperform 802.11a. HiperLAN2 is claimed to offer greater interoperability with 3G mobile networks, given its different MAC layer developed on the telco ATM technology, rather than the IP evolution of 802.11.[20] The European Radiocommunications Committee (www.ero.dk) has recommended that 802.11a devices not be permitted in member states until dynamic frequency selection (DFS) is enabled in PC cards, thus equaling QoS of HiperLAN2.[21] If national authorities hold strictly to this, that is likely to prevent 802.11a roll-out until 2003, diminishing the threat to dominant equipment vendors' 3G network build-out. Such a decision not to permit co-existence would have prevented the market's decision to adopt Bluetooth rather than HIPERLAN1, and ultimately 802.11b globally. Jippii,

[18]The result is likely to be upgraded capability for 802.11b, such that it offers a basic version of 802.11a capability, but with less range and lower security. The IEEE MAC specification applies equally to both 802.11b and the next-generation 802.11a.

[19]Windows XP supports only WiFi: see http://www.zdnet.com/enterprise/stories/wireless/0,11928,5080760,00.html

[20]Implementation of the HiperLAN2 standard, Annex 1P of ERC Recommendation 70-03, was on March 21, 2001, complete in six countries (Cyprus, Estonia, Finland, Iceland, Norway and the UK) and planned in most others.

[21]See http://www.vnunet.com/News/1117516

the most advanced European operator in 2.4GHz roaming service, can upgrade to either HIPERLAN2 or 802.11a. Unless the technical argument is overwhelming, co-existence of standards is always preferable, where the market can decide which offers better value to the consumer.

Competitive Standard Setting

In the 3G standards battle, Grindley, Salant, and Waverman have emphasized the use of new voluntary trade association bodies setting non-mandatory standards, which would suggest IEEE flexibility before ETSI certainty. While acknowledging the potential this creates for free riders and market-led innovation to overtake the standards process, they consider that these risks also encourage more rapid decision-making.[22] Voluntary standard setting also permits co-existence of standards, and prevents a dormant standard being adopted, because the market judges rival standards and will in all likelihood choose a winner. The issue of its engineering integrity is relegated to a secondary consideration beside its ability to satisfy a timely market need. The 2.4GHz spectrum provides the ideal opportunity to experiment with unregulated commercial spectrum, combining as it does an existing unregulated resource with clear upgrade path to 5GHz, and the tradition of IP standards, where QoS and non-interference are the responsibility of manufacturers and operators acting in voluntary enlightened self-interest.

4. IPRS AND VIDEO-OVER-IP[23]

IPR has, if anything, an even less certain set of property rights than the "real" property of local loop, mobile, and WLAN networks. This chapter has shown that broadband networks make it possible to offer real video-on-demand (VOD). This development depends on releasing the IPRs in video properties for distribution over new media. There are two problems: The owners don't want to do it, and the rights don't exist.

The owners don't want to do it for reasons of bounded rationality. First, they are making supranormal returns already on their broadcast busi-

[22]As with 3G standard-setting, non-U.S. corporations fear that voting and technical assessment procedures are biased towards "home town" players in the U.S., and U.S. corporations fear the same in the European standardization process. See Grindley, Salant, and Waverman (1999).

[23]I am grateful for interviews given in the course of research in winter 2000–2001 by many sources, most of whom maintain commercial confidentiality. I gained great theoretical and practical insight from discussions with Pamela Samuelson and Mark Lemley from Boalt Hall School of Law, at the University of California at

(continued on next page)

nesses, as most video rights holders are broadcasters granted monopoly, or at least severely rationed, licences. The long-term prospect of increasing revenues via VOD over broadband connections is outweighed by the short- and medium-term prospects of sustaining advertising and pay-per-view revenues in the rationed broadcast space. The prospect of more perfect competition in broadband is therefore not at all appetizing. Martin Tobias (2000) has stated that it is "Capitalism 101" that you must offer IPRs both protection and monetization; the Internet offers neither. The Internet must be made: (a) faster—by localized caching in Content Delivery Networks (CDN); (b) safer from IPR piracy—by digital rights management (DRM); and (c) potentially more profitable—by content syndicators who take audio, text, and video from hundreds of suppliers and supply to thousands of websites. IPR owners, notably broadcasters, see a much better future in using proprietary networks to distribute their video product.[24] Sandelson (2001) has demonstrated that there is no satisfactory allocation of IPRs for Internet distribution of video, where the TV rights already allocated are national in scope but Internet distribution requires global rights. The answer increasingly employed is to use the guaranteed service quality and enhanced security of the "walled garden" broadband service providers' network, to avoid the public Internet altogether. These "walled gardens" have a very satisfactory legal status; they are cable networks. The private network ensures integrity of rights, video delivery, and allocation of property. Unfortunately, in most European countries, except Sweden which has 10Mb/s to the kerb, streaming video to a full-screen TV in VHS quality is not possible in the "mid-band" bit rates available, 512-1768Kb/s, in consumer offers. Only truly private networks leasing high bandwidth at 2.3Mb/s, such as the UK Video Networks, can so far offer this walled garden service. It appears that migration to broadband Video-on-Demand requires a leap of faith by both telcos and broadcasters. The legal framework will ensure that this broadband VOD, when it arrives, will be more the

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(continued) Berkeley, and conferences held at Berkeley in March 2001 and the NYU Law School (2000) *A Free Information Ecology in a Digital Environment Conference* on April 2, 2000. In Europe, I am grateful to Bernt Hugenholtz of the University of Amsterdam Institute for Information Law (IviR) and attendees at a Council of Europe sponsored seminar in June 2001. See Hugenholtz (2000). The London law firms of Denton Wilde Sapte, Olswangs, Harbuckle and Lewis, Clifford Chance, were all invaluable in confirming the fragmentary nature of video rights. Interviewees from the BBC, Independent Television Commission, Bazalgette Productions, BTOpenworld, Aardman Productions, Loudeye, and Producers' Alliance for Cinema and Television were all invaluable. Especial thanks go to Pete Ward of Anonymous broadband consultants. All errors and opinions remain my own.

[24]Audio differs in that most radio stations are advanced effectively syndicator-aggregators of music files, producing little or no original material of worth. TCP/IP technology already permits music file theft on a grand scale, via peer-to-peer networks such as Gnutella.

AOL-style "walled garden" than true open access: private cable, not public Internet. Any solution that fails to acknowledge and cultivate the rights holders' strategy is attempting to rewrite the entire history of video sales, not to offer a value proposition.

This section is made up of three parts. In the first, the rights strategy of the video industry is explained. In the second, Internet-based offerings are examined, together with the disjuncture between their offer and the broadcasters' preferred environment. In the final part, I explain the broadband local loop solution and its "fit" with rights-holder expectations. In conclusion, the essential elements of any rights strategy are revisited. It will be seen that rights-holders expect the value created in the private controlled broadcast environment to be maintained in the broadband environment. It is concluded that only a closed private network can currently offer rights-holders the integrity to:

- Extend their brand on-line.
- Enhance the service they provide to their viewers.
- Monetize the value dormant in their archive.

Video Industry Rights Strategy

The types of contracts that control video content are varied, but they revolve around one central factor. Before 1995, most content was not contracted for Internet or other forms of distribution. Primary broadcast rights for the national market were held by the broadcaster. Secondary rights, international broadcast, and distribution in forms other than broadcast, were individually negotiated. Tertiary rights to promotion, merchandising, and other forms of exploitation, were also a matter for negotiation. Some broadcasters became aware of multimedia at an early stage, and adopted the terminology "all media current or in future invented" to cover all forms of online distribution. An even more thorny ownership problem than primary, secondary, and tertiary rights to distribute on-line is third-party rights. A dramatic scene often involves a catalogue of third-party rights: two types of music (author and performer); producer; writer; actor. All these parties are represented by "collecting societies," a cartel formed to represent the individuals concerned. There is content which is off-limits, also self-identified by archives. This is typically archive with complex third-party rights (e.g., drama), and especially pre-1995 rights, where no platform is identified with broadband. The choice of distribution platform is critical.

The basic description of the TV rights legal framework demonstrates that every piece of content has a legacy of rights clearance. To reinvent the wheel is to seek global rights to compelling content with inadequate legal protection of property rights, or monetization to all parties of those rights: It is the Internet.

Internet Distribution of Video

Internet streaming video claimed to "change everything." That is correct in that there is:

- No recognized geographical market.
- No rights holder revenue proposition except by cannibalizing existing revenues.
- No accepted industry standard solution which prevents piracy.
- No means of ensuring VHS quality streaming to consumers.
- Limited personalization and data mining for rights holders' properties.

Given the cry that "music wants to be free" of the Napster/MP3 generation, the answer from the recording music majors has been unequivocal: It will have its own credit card. Internet distribution of professional media products will be encrypted, secure, and monetized. Broadband IP networks have permitted distribution of digital recordings, and the downloading and file-sharing of Gnutella, Napster, and MP3 have created an environment in which the music majors have found themselves forced to distribute. Andy Grove stated in June 2001 that the media industries were at "their most critical inflexion point of all time … they must decide the price point at which the majority of users will be honest" in paying for their products.

The video industry arm of these conglomerates has, unsurprisingly, adopted the same tactics as the music majors. Given the far greater technical complexity of video over audio, necessary to "capture the exponentially greater share of the individual's attention span," there is a short interval before the video industry reaches the "inflexion point" which university dormitories in U.S. college campuses forced on the audio industry in early 2000. Individuals have been prosecuted for cracking the DVD code off-line (*Universal Studios, Inc. v. Reimerdes,* 2000), and the gaming community is rapidly overtaking the video industry in creating effective codecs for secure video transfer. The standards community has gone far further in creating secure and high quality file transfer over IP networks for video. Rather than the relatively simple—and therefore easily cracked—MP3 format, the video industry has adopted increasingly high-end solutions. Streaming video increasingly adopts technologies based on MPEG4, with MPEG7 and MPEG21 emerging as the metadata standards that will create the "credit card" for individual content packets.

For IP-based streaming video syndicators and providers, QoS problems have thus far proven insurmountable. Three particularly merit-worthy attempts have been made to solve the QoS deadlock:

- Akamai is a partially distributed server architecture that aims to ensure higher QoS than the IP cloud without the investment available to provide a wholly private network. However good the server network, it cannot guarantee a VHS quality service. The engineering fact remains: The IP path is as fast as its slowest switch. If you do not control all switches (middle mile, last mile, and last metre), you cannot guarantee QoS.
- Loudeye aims to enhance the video experience by encoding and syndicating content—providing the credit card. The Loudeye Media Syndicator is a relatively sophisticated attempt to recreate the MPEG4/7 environment over the public IP network, providing a fairly high barrier for hackers. To eliminate IP theft of content, rights-holders know that they need to avoid the Internet altogether.
- Atom Films (merged with Shockwave) traded in content which is "designedly degraded." It is "optimized" for the Internet because it is poorer quality than VHS, and therefore viewable relatively easily at 300Kb/s, when that can be achieved. Their content consists of animation and short films, where creators accept the degraded product quality and viewing experience in the interest of branded global distribution. Other sites using degraded quality include adult, news (newsplayer.com), and rights-holders' promotional sites, where music and trailer promotional content is shown as teasers for the "main event" on TV, at the movies, or on VHS and DVD.

The Internet is thus being improved, security improved, and content "reduced to size." These all remain partial, hybrid answers to the basic conundrum: how to monetize archive over non-broadcast networks? The IP cloud cannot be the answer, as there is no recognized geographical market and its poor QoS risks cannibalizing existing revenues. Instead of adding value by monetizing content, it removes value by removing the key professional differentiator, editorial and production integrity.

Broadband Local Loop

The complexity of the rights process lends itself to three main conclusions:

- Isolate that content in which rights are resolved for TV.
- Construct a distribution platform with similar legal characteristics to TV.
- Select a distribution method that creates as compelling an experience as TV.

These are the key legacy characteristics of video IPR rights:

- Video rights are assigned according to legacy agreements.

TABLE 8.4

Summarizing Content Owners' Dilemmas and Local Loop Solution

Internet Rights Holder Dilemma	*Example*	*Narrowband Answer*	*Loss of Market Value*	*Solution*
International Internet rights quagmire.	Who owns the Olympics in Germany or Switzer-land?	Clear all international IP rights, or none at all—loss of control over rights territories.	Failure to release full value from rights; cannot be windowed and leveraged; "one sale equals all"	Broadband local loop as the new rights par-adigm: • Closed proprietary solution using state-of-the-art DRM • Permits local mar ket sub-licensing.
Plethora of rights third parties	UK: Writers' Guild; BPI; Mechanical Rights Soci-ety; BECTU; Equity; PACT; Musicians' Union.	Use only pre-cleared or promotional clips produced for marketing purposes.	Free con-tent sites pirating IPRs; proves value of experience but does not unlock value from archive.	Short format: • Permits repurposing of ex-isting content as "substitute" for trailers. • Negotiation with key broadcasters confirms solution.
No IP rights pre-1995	Assignment of rights completely omits on-demand network de-livery.	Use post-1995 rights: no classic content; rights inflation for modern properties.	All classic archive lost to IP; over-valua-tion of non-com-pelling newly created content.	Assign clearances to IPR holders: • Incentivized by PPV • Short format • International distri-bution • Eliminate residuals

(continued on next page)

QoS concerns prevents release of VHS and enhanced formats.	Film majors refuse to release sub-VHS buffered content; talent refuses to allow degraded delivery of product.	"Close to the edge" delivery using Akamai and others; MPEG4 permits greater compression.	Only low video grade content released: animation; pornography; audio; Shockwave.	• True edge delivery. • Allow rights holders to trust and release best-mastered content. • Virtuous circle of enhanced content and enhanced delivery.
Piracy concerns with public Internet.	DVD code cracked; MP3 solution for video now possible with DVD.	Watermarking (SDMI), DRM, standardization initiatives using BCDForum etc.	IPRs holders refuse to release content, editorial integrity offline – e.g. via DVD.	• Proprietary networks allow control of content delivery; • Localized server delivery ensures security akin to broadcasters' own closed networks.
Lack of customer information prevents true eCRM value in exposure of rights holder property.	Advertiser dollars diverted from authenticated brand-building experience in broadcast to "anarchic," identity-theft prone delivery over public IP.	Value in rights hidden; existing "rich media" advertising offers fractional value of true rich media.	Stakeholders refuse to "cannibalize" existing revenue sources for low-grade alternative despite consumer demand.	• Complete customer information retrieval. • Personalized advert delivery and personal content selection • Broadband content value exceeds broadcast on per-viewer basis.

Local loop works with this tradition—it buys based on traditional TV markets.

- Video rights are negotiated within distinct, generally national, territories.

Local loop is designed to assign national, and even local, territories.

- Video rights take no account of specific platforms.

Local loop is platform-neutral and a truly convergent solution, based on the most advanced screen for personalized entertainment as its first platform: the PC.

- Video demands high QoS and advanced anti-piracy protection.

Local loop offers VHS-equivalent streaming, with Digital Rights Management strategy.

Broadband local loop is not an Internet-based solution. It distributes via partner broadband networks an entirely private solution, with guaranteed QoS. With no public access, combined with advanced codecs developed for the video games industry and private network anti-piracy measures, broadband local loop ensures secure, reliable reception at VHS-quality. In some respects, it is better than VHS: It is hosted on the only digital screen in the household, the PC monitor; it is more secure than VHS tapes; it can be upgraded to DVD-quality over time. It can also ensure delivery to a single Point of Presence (POP), a local community, in the same way as cable television, permitting more discrete territories than satellite or terrestrial TV, or the Internet.

The choice of the PC as platform is also crucial. Broadband local loop can provide full-length programs over TV, directly competing with broadcasters' own classic archive channels. Home Choice (the Video Networks subsidiary) is competing with its suppliers on the same platform, "eating their lunch." In response, Hollywood studios have offered video-on-demand at prices that are non-competitive with Blockbuster, their preferred supplier, or Sky TV, the pay-TV operator. TV-on-demand cannot compete with the TV broadcasters and film studios' preferred distributors. Broadband local loop, by contrast, offers a method of monetizing selections from programs on a different platform to a richer, younger, more influential demographic, with the promise of far greater interaction, personalization, and e-commerce opportunities for rights holders. As the market gains consumer acceptance, users will create new submarkets based on genre to explore yet more of the archive and production capacities of broadcasters. This final point is critical: Local loop provides a new discrete revenue stream to rights holders. This provides both a promotional opportunity on the only proven e-commerce platform and a new discrete revenue window to rights holders, separate and complementary to existing broadcast and video sell-through windows. Local loop can granularize viewing to the individual clip level providing a further incentive: a level of market research and real-time market intelligence to rights holders, advertisers, and e-commerce partners never previously available. Local-loop rights strategy is a win-win game. The increased volume and quality of usage of local-loop broadband should help ensure that investments in broadband ISPs pay off, and further QoS, personalization, and content choice results, in a virtuous circle leading to the next generations of networks.

5. VIDEO-OVER-IP STRATEGY: COMPETITION AND COPYRIGHT

All innovative companies would logically prefer to monopolize their industry, while ensuring that upstream and downstream competition was sufficiently strong to create supply and demand efficiencies that would help to strengthen their hold on the most profitable link in the value chain. Achieving this goal has been critical to the success of Intel and Microsoft in the personal computer industry. Their respective domination of microprocessor chips and the Windows operating system has enabled them to secure huge margins on their core businesses. By sharing elements of the underlying code (but not the source code) with programmers and hardware manufacturers, they have ensured ruthless competition in PC manufacturing and software program development based on their platforms. They thus act as Wintel gatekeepers in the value chain, but also encourage innovation and competition in associated markets (see Lemley, 2000). Ensuring control of the gatekeeping function must not arouse the ire of the competition authorities. Intel has succeeded by largely confining itself to its core markets, and sharing code in a relatively non-discriminatory manner. Microsoft has entered downstream markets for applications running on its operating system, including the Internet browser market. What both achieved (though Microsoft's Supreme Court case outcome was uncertain at the time of writing) thus far is to convince competition authorities that the dynamism of their industries creates low barriers to entry and therefore that the lack of serious competition does not in itself indicate noncompetitive market conditions ("Guilty," 2001, *U.S. v. Microsoft Corp.,* 2000).[25] The entry of Linux and AMD to the operating system and microprocessor markets has helped to convince investigators that the potential for rapid erosion of the Wintel dominance exists.

Competition authorities appreciate that network markets combine this dynamism with plenty of opportunities for long-run dominance as consumers tend to rely on the standards of the dominant firm. As a result, especially in Europe, dominant communications actors have been significantly impeded in their search for dominance; Microsoft in its cable TV investments, AOL-Time Warner in its online music activities with Bertelsmann and EMI, Vivendi in its sale of pay-per-view movies of its new acquisition, Universal Studios. The new level of complexity in bottleneck analysis is the potential for perverse policy results arising from copyright and other IPRs. So long as markets can be isolated, copyright, government-sanctioned monopoly, is considered beneficial in creating innovation. Where various IPRs are bun-

[25]For commentary and a critique of Microsoft's defense, see, for instance, Lessig (1999a) and Liebowitz and Margolis (1999). For the European Union approach, see the recent decision by which Microsoft cable TV decoder investments were "neutralized" (Commission of the European Community, 2001).

dled together, in separate ownership, the creation of a bottleneck may be almost inevitable (Gifford & McGowan, 1999; Samuelson & Opsah,1999).[26] This was shown to be the case in all previous distribution media: the phonograph (record player), radio station, video recorder, audio cassette recorder. Peter Jaszi noted that:

> Section 111 of the 1976 Copyright Act cut the knot our courts had tied around cable television and unleashed a transformative force in the entertainment industry. Section 119 was introduced and extended in 1999 to provide a space for direct broadcast satellite technology. Compulsory licensing often has helped to open other promising channels for delivering content by breaking a decade's old standoff around performance rights and sound recordings.[27]

Compulsory licensing will be the eventual solution to the distribution of video programming online, and is already topping the policy debate in audio programming for streaming radio stations (Krebs, 2001). In Canada, greater progress has been made on compulsory licensing for video programming in the far larger broadband market per capita. Whereas Canadian webcaster ICraveTV was unable to prove its ability to prevent international reception of programming in 1999, and therefore lost its copyright arbitration and court case, JumpTV in 2001 is demonstrating far greater control over access to programming (Geist, 2000; JumpTV, 2001). As in other areas of video-over-IP, it appears that the more local the service, the greater the opportunity to work within existing regulation and property rights.

6. CONCLUSION: THE CHALLENGE FOR ANY-TO-ANY

For video-over-IP, the legal and regulatory issues arising in connection with government intervention is less about jurisdictional avoidance than global localization (see Reidenberg, 1999). "Information wants to be free," it was said in the early days of cyberspace. In the increasingly ubiquitous environment of the Internet in which commercial ISPs find themselves, information wants to be controlled by its owners and recipients. Building the Global Information Infrastructure is the largest engineering and capital development task ever faced. Video drives the future Internet because humans are visually literate far more than they can ever be intuitive consumers of text, graphics, or stand-alone audio. That future Internet is now being defined, by

[26]For a more general treatment, see Barton (1997).

[27]*Video on the Internet: Icravetv.com and Other Recent Developments in Webcasting: Hearing before the Subcommittee on Telecommunications, Trade, and Consumer Protection of the Committee on Commerce House of Representatives,* 106th Cong., 2d sess. 2 (2000) (testimony of Peter Jaszi, Professor of Law, Washington College of Law, American University). Retrieved from http://comnotes.house.gov/cchear/hearings106.nsf/a317d879d32c08c2852567d300539946/8d45454ad293f0db85256965006e67c1/$FILE/94.pdf

the standards bodies referred to in individual subsectors of the streaming video industry, but also by the Internet's future itself.

Those profoundly challenged by changing business models, notably broadcasters, copyright holders, and switched circuit telcos, will tell their governments and regulators to stop this market developing. In order for legacy property rights to be monetized, video-over-IP must initially be under national (even local loop) control. Critics are correct that this will curtail the end-to-end Internet until and unless it becomes standardized for profit-making rich-media applications. The development of property rights in broadband networks and services depends on such economic imperatives.

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