Adoption and Diffusion of Digital Cable as Complementary Infrastructure for Content and Information Services

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ABSTRACT

In this paper, we analyze the adoption and diffusion of digital cable for content and information services with a focus on the United States. The cable industry, traditionally a major segment of the video content services industry, is confronted with infrastructure alternatives. Satellite services gain increasing market and profit share on the content platform. New technologies such as Digital Video Recorders cause shifts along the value chain. Concerning information services, the recently enhanced cable infrastructure in the US has allowed cable operators, also known as 'Multi Service Operators' (MSOs) to compete with 'Incumbent Local Exchange Carriers' (ILECs) in the market for broadband Internet access and advanced information services. This RIP analyzes MSOs in both markets and finally assesses MSOs concerning their future role in both competitive arenas.

Keywords

Infrastructure, digital cable, content services, information services

INTRODUCTION: DIGITAL CABLE IN THE UNITED STATES

More than 95% of 106.5 million households in the US have a physical connection to a cable system (Kagan World Media, 2002). Almost 70% of these households (72 million) subscribe to analogue and digital cable-based video content services. By 2002, the US cable industry (with 308 national cable networks) had consolidated to the point that five main cable operators (distributors) - so called 'Multiple System Operators' (MSOs) - dominated the market, serving more than 70% (about 50 million) of the 72 million subscribers. A major concentration activity occurred in November 2002, when Comcast - at that time number '3' in the market - acquired AT&T Broadband, then number '1'.

Most MSOs, including the 'Top Five' (Comcast Corp, Time Warner Cable, Charter Communications, Cox Communications, Adelphia Communications), use a so-called 'Hybrid Fiber / Coax' (HFC) architecture for which a rather massive roll-out began in 1998-1999; by the end of 2001 about 75% were completed. They apply fiber optic transmission technology to replace upstream coaxial trunk and feeder lines while, downstream, the incumbent / existing coaxial feeder and drop lines remain intact. Thus, by replacing coax with fiber optic lines upstream, MSOs achieved improved signal reliability and picture quality. The HFC architecture also permits MSOs to install modules that activate a reverse path, allowing customers to send data or voice signals from their home to the head-end. Such a reverse path or feedback channel, for example, allows users to push the 'Buy' button in the context of pay-per-view applications. Furthermore, this new architecture offers a significant increase in channel capacity and thus offers high-speed Internet access (through cable modems) or cable delivered telephone service.

Finally, back in 2000, MSOs began to replace analogue set-top converters with digital home communication terminals which employed compression technology to significantly increase channel capacity. Compared to analogue set-top boxes, the digital home communication terminals offer substantial improvement of sound and picture quality and broaden the usable transmitting capacities due to compression techniques (factor: 4 to 12). Regarding the necessary digital TV receiver, major consumer electronic companies and MSOs agreed, during the 4th quarter of 2002, on plug and play-standards in rather vague terms. The broad roll-out started in the first half of 2002 and by the end of that year more than 60% of the 'Top 100' cable markets were connected. These digital home communication terminals offer - in addition to Interactive Program Guides (IPGs) - other enhanced TV services such as the capacity and the functionality of Digital Video Recorders (DVRs) and Video on Demand (VoD).

The combination of fiber optics, amplifier upgrades, and compression technologies laid the foundation for cable operators to offer 'video-on-demand' (VoD) and a further variety of interactive multimedia services. By the end of 2002, most major companies had moved VoD beyond technical trials and offered it as a commercial product in selected markets.

RESEARCH GOAL AND APPROACH

Treatment of technological change in economic literature can be traced back to Schumpeter (1942). His ideas on the process of technical change comprise the three phases of invention, innovation and diffusion. Invention describes the development of a new product or process whereas innovation stands for the commercialization of an invention. If users subsequently adopt an innovation, it gains market share named 'diffusion'. Adoption and diffusion rates increase due to network externalities (e.g. Katz and Shapiro, 1986) and learning-by-using (Cabe, 1991). In economics, the effects of technological change on productivity growth are frequently tackled by applying the Solow residual as proxy variable (e.g. Mankiw, Romer and Weil, 1992; Solow, 1970, 1988) or by a variable representing inputs or outputs of the R&D process (Griliches, 1979). In the field of management and IS, we commonly investigate technology diffusion (e.g. Rogers, 1995) with a focus on competitive positions and industry structure or from an individual / organizational perspective (Technology Acceptance Model - TAM, e.g. Davis, 1989; individual Web Usage, e.g. Carey, 2004).

Having defined the traditionally content-oriented industry value chain for digital cable (see Figure 1), our goal has been to better understand the interrelated factors causing the adoption of digital cable and therewith industry change with regard to content services and information services. Based on the data available to us, we propose the following framework for investigation (see Figure 2).

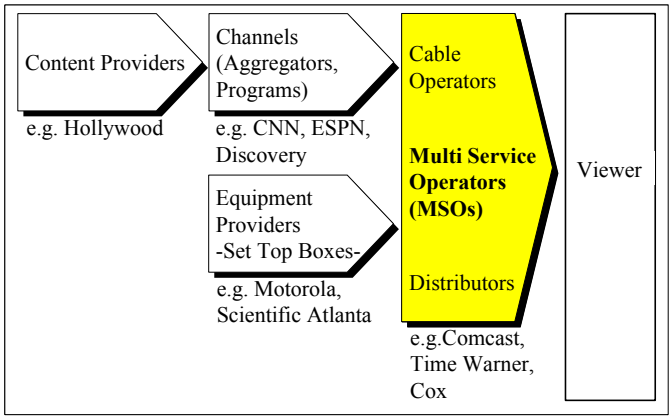

Figure 1. Digital Cable - Content-Oriented Industry Value Chain

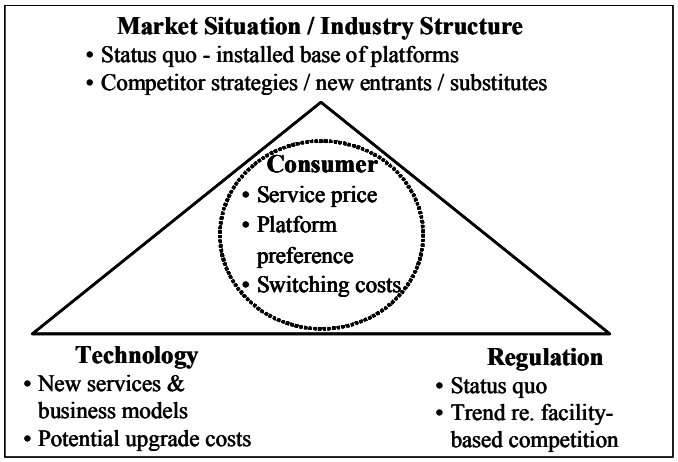

Figure 2. Framework for Investigation

MULTIPLE SYSTEM OPERATORS AS INCUMBENTS IN THE MARKET FOR VIDEO CONTENT SERVICES

In spite of technological improvements such as improved broadband connectivity to the home and augmented storage capacity, MSOs increasingly face competition from satellite operators in the market to provide video content services. This is especially true for analogue cable services.

In 2002, almost 25% of all US subscribers obtained video content services from some company other than their local cable operator. Direct Broadcast Satellite (DBS) accounted for almost 20 million customers by the end of 2002. The few satellite players are big. DirecTV, recently acquired by NewsCorporation, is the largest satellite player with more than 12 million subscribers (as of end 2003). This is more than all but two cable operators account for. The number '2' in the DBS market, EchoStar, with 8,5 million subscribers (May 2003) serves more customers than all but three MSOs (Echostar, 2003; and own calculations). Until mid-2003, the MSOs - when facing competition from satellite operators - have been willing to sacrifice market share rather than engage in a price war. Further, as News Corporation bought DirecTV, it is expected that Digital Video Recorders (DVRs) would be placed in most satellite boxes which would force cable companies into significant investments.

Competition for the cable industry also arises from facilities-based broadband[1] companies such as RCN, Knology or WideOpenWest, even if most over-builders have left the market or are on the brink of failure. Finally, competition has emerged from telecom operators such as Qwest, which delivers video content in the metropolitan Phoenix area based on VDSL technology. Qwest has expanded their VDSL television in Phoenix, AZ, and offers 199 channels over DSL to some 300,000 potential homes in the region, though only 40,000 subscribers in Phoenix and Denver are actually signed up for the service. However, many telcos have reduced their ambitious VDSL plans due to the excessive cost of deploying the technology. Even Qwest has admitted to a 'low probability' that they will expand the VDSL video service into other markets.

A transformation of the video content services industry that has already taken ground is the substitutability of each of the three distribution technologies, broadcast, cable, and satellite for video content service delivery. As cable companies began to consolidate, broadcasters began to lose the competitive advantage of reaching national audiences. This trend has been accelerated by the fact that a substantial majority of US households subscribe to either cable or satellite. People do not generally select the programs they watch based on the source. Their choices are dictated by the preferences for certain types of programs.

Further, the digitalization of all sorts of content has facilitated the process of Internet-based distribution. As a source of entertainment, the Internet indirectly competes with television-based video programming. Nevertheless, it challenges the legal issues of copyright protection and license granting. So far, the furor over DVDs created a similar outcome over the legality of swapping content as Napster did. The Digital Millennium Copyright Act (DMCA) stopped a significant amount of files exchanges, but does not specifically address DVRs and the legal implications of their technical features.

Obviously, the revenue split among (a) content distributors such as broadcasters, cable operators, and digital satellite providers, (b) program providers (channels), (c) Hollywood studios and (d) advertisers needs to be realigned and recalculated as a consequence of new technologies impacting the video content services market place.

MULTIPLE SYSTEM OPERATORS AS FIRST MOVERS IN THE MARKET FOR HIGH SPEED INTERNET ACCESS

Being challenged by other players and other technologies in their traditional field of video content provision, cable operators have responded by offering information services[2], especially high-speed Internet access and cable telephony service.

They took early leadership in making the market for high-speed Internet access the fastest-growing sector for most cable companies. By December 2002, the cable industry had invested more than US$ 70 billion in private capital to provide advanced digital services to consumers. An estimated US$ 14.6 billion was invested in 2002 alone. These figures equate to more than US$ 1,000 per subscriber in upgraded cable systems. As a result, more than 85 million households were passed by

1 'Broadband' is used as the generic term for high-speed access to the Internet, referring to connections capable of at least 200 kbps both upstream and downstream. Since many residential customers subscribe to high-speed services which are slower than 200 kbps in the return path, we do not differentiate between 'broadband' and 'high-speed' (one-way broadband) connections.

2 In a Declaratory Ruling adopted on March 14, 2002, the FCC concluded that cable modem service is properly classified as an interstate information service and is therefore subject to FCC jurisdiction. … cable modem service is not a 'cable service' as defined by the Communications Act; … cable modem service does not contain a separate 'telecommunications service' offering and therefore is not subject to common carrier regulation (www.fcc.gov/Bureaus/Cable/News_Releases/2002/nrcb0201.html, visited 2004-05-10).

activated two-way plant, allowing for the deployment of interactive, cable modem and telephone services (Kagan World Media, 2002).

This investment has been challenging. Excite@Home, the previously leading broadband access provider and backbone for cable modems, invested over US$ 9 billion in high-speed networks, and served 4.1 million subscribers when it dissolved in late 2001.

Nevertheless, by the end of 2003, digital cable modem customers topped 22.2 million. Also at year-end, US cable companies served more than 2.5 million residential subscribers for local cable telephone service (National Cable & Telecommunications Association, 2004).

Even though MSOs have been the first movers, but their position remains influenced by the roll-out of DSL and the evolving legislative framework in the US:

Notably, the deployment of cable modem services triggered a nation wide *roll-out of DSL offerings*. The four major ILECs, BellSouth, Qwest, SBC Communications and Verizon, offer DSL and accounted for more than five million customers in the 3rd Quarter of 2002. However, the combination of necessary investments in technology, market demand, and regulatory setting has not been always beneficial to DSL providers. Among the well-publicized bankruptcies are Northpoint Communications, Rhythms, and Covad, the three leading wholesaler providers of DSL networks in the United States.

The *regulatory environment* also influenced the competitive situation. While cable companies have largely escaped 'open access' rules mandating that they share their high-speed Internet access networks with independent Internet Service Providers (ISPs), legacy voice systems were subject to sharing requirements. Local telephone companies had to offer total resale, or unbundled network elements, to competitors at regulated wholesale rates.

Particularly two decisions taken by the US Congress previous to the FCC's Triennial Review of 2003 have had an impact on the competitive situation. In 1992, the US Congress required that vertically integrated MSOs, such as AOL Time Warner, make their programming services available to competitors at fair terms. The 1996 Telecommunications Act kept this requirement, but apart from it more or less deregulated the cable industry. It was said that cable regulation would expire in 1999. Most barriers for telecommunication and cable companies to enter each others markets were removed.

Nevertheless, by 2002, most ILECs had reduced their original plans to enter into competition with cable companies by 'overbuilding' cable operators' networks with their own HFC infrastructures for three main reasons (for a similar argument see also Eisenmann and Lutz 2002):

- Compared to the cable operators' networks, ILECs faced a cost disadvantage by having to build HFCs from scratch. ILECs mostly lacked coaxial cables for the last mile between their fiber nodes and customers' homes. Their existing twisted copper lines were designed to carry narrowband voice transmissions but were not sufficient for transmitting video signals.
- Increasing competition between ILECs and cable operators would lead to price cuts to end users paired with increasing programming and marketing costs.
- The 1996 Telecommunications Act had granted Regional Bell Operating Companies (RBOCs) permission to offer long distance services as soon as they fulfilled the requirement imposed on them to cooperate with competitive local exchange carriers wishing to leverage RBOCs' facilities. In spite of declining long distance prices, decent gross margins still tempted ILECs to enter the long distance market before tackling the seemingly risky and obviously expensive video market.

However, in light of the FCC Triennial Review of February 2003 which eliminates the asymmetrical regulatory treatment of DSL and the cable modem platform (the former previously treated as a telecom service, the latter not), ILECs could find new arguments to expand their content offerings. Specifically, ILECs offering DSL services were freed of the sometimes cumbersome common carrier rules. Further, they were freed from making DSL available on an unbundled basis. Those points should influence ILECs decisions whether or not to 'overbuild' cable operators' networks with their own HFC infrastructures.

ASSESSMENT: FUTURE ROLE OF MULTIPLE SERVICE OPERATORS IN BOTH COMPETIITVE ARENAS

On the one hand, we see MSOs loosing ground in the video content services industry mainly due to satellite based offerings and due to shifts along the value chain resulting from new technologies such as DVRs (for a more detailed discussion about the impact of DVRs, see e.g. Loebbecke, MacInnes and Staudinger, 2003). On the other hand, MSOs seem to be well prepared to successfully compete in the market for high speed Internet access. Both trends significantly change the competitive battle field for MSOs.

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