

# I D C   E X E C U T I V E   B R I E F

## **Transcoding: The Future of the Video Market Depends on It**

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*By IdaRose Sylvester, Senior Research Analyst, Semiconductors*

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### **Introduction**

The growing variety of home, business, and mobile electronic devices is forcing content providers, network service providers, and end-user device manufacturers to tackle the problem of delivering large amounts of digital data in multiple formats. In addition, consumers are demanding that their content be easily accessible from and available on any media-playing product they have, whether in the home or on portable devices. The ability to seamlessly move any content on demand and in "real time" is made possible through a technology called transcoding. Being able to transcode any content in real time will be essential to the future of the video market.

This Executive Brief discusses the business drivers for transcoding, the emerging challenges of high-definition (HD) transcoding, and the opportunities for this strategically important technology. We conclude that without transcoding, the future of the video market, and the industry's ability to meet customer demands, may be in jeopardy.

### **What Is Transcoding?**

Service providers, content providers, and electronic device manufacturers alike must face the truth: Finally, video content really is king. Content can be sent, received, and experienced in a myriad of ways, which creates many challenges. And as the world moves toward high definition, the challenges increase dramatically. Transcoding is critical to help carry content over networks, delivering it to computers, televisions, and other specialty consumer electronics that carry content generated by a user, acquired from a service provider, or purchased from other sources.

Technically, transcoding is the coding and recoding of digital content from one compressed format to another to enable transmission over different media and playback over various devices. Multiple definitions of transcoding are used in the industry. IDC sees three main types:

- The conversion of one digital form to another digital form, such as from MPEG-2 or MPEG-4 to H.264 (This is what many in the industry first think of when they hear the phrase "transcoding.")
- Transrating of content — changing the bit rate to meet the requirements of the network or a device
- Transcoding of resolution — the downgrading of HD content to standard definition (SD) or lesser resolution (While upscaling of content is possible, it is not considered as critical as downscaling at this time.)

This research included interviews with service providers, content delivery service providers, software codec providers, set-top box (STB) manufacturers, network infrastructure equipment providers, and videoconferencing equipment providers. IDC discovered that the transcoding industry is evolving, with opportunities to deploy the technology at multiple points in the network and on site at consumer and business premises.

### **When Will Transcoding Matter?**

Today, service providers and electronics manufacturers are working on transcoding because they see it as a critical requirement, and something consumers will ultimately demand. Consumers are already demanding "content on the go," and they are starting to understand how difficult it can be to manage their digital content on multiple devices. They will ultimately demand content ubiquity, the seamless delivery of content to any device, at any time they demand it.

IDC believes transcoding will be most important to and therefore adopted first by telcos trying to deliver video over IPTV, along with other triple-play and custom-content services. Transcoding will save telcos critical bandwidth, extending their physical reach and breadth and quality of service offerings. Soon, incumbent service providers will need to adopt transcoding technologies.

Transcoding is being deployed today, and it is becoming a critical part of the network infrastructure. Ultimately, the real driver for transcoding and the content delivery that enables it is the consumer. Consumers will demand services such as HD programming and programming on demand — as well as content available to them anytime, anywhere — and they will seek this content both from traditional and non-traditional sources. Transcoding enables new delivery services and content ubiquity.

Research shows that transcoding adoption might vary globally. For example, IPTV is already spreading in Europe, especially in France and Italy. Asia has by far the largest full-scale rollouts, with a half million subscribers in Hong Kong serviced by PCCW. While the United States is behind, major U.S. telcos are starting to move quickly in the IPTV world.

## **Business Drivers for Transcoding**

Currently, one of the biggest business drivers for transcoding is the increase in HD content, a trend happening in most regions of the world. As a result, the number of service providers offering HD content is rising quickly. And the need for cost-effective yet high-quality transmission of HD content will grow significantly. Service providers — incumbents as well as new entrants — will push HD content in an effort to attract and maintain customers. In fact, in 2007, IDC anticipates that at least 1,500 local and 150 national channels will be offered in HD in the United States alone. As the number of installed HDTVs rapidly increases in the next four years, from several million today to nearly 100 million in 2010, consumers will demand more HD content, creating a strong push-pull market for HD content.

Bandwidth constraint is another business driver for the transcoding market and something that carriers, especially telcos rolling out IPTV services, need to address with transcoding. Transcoding will be necessary to compress the data to fit bandwidth-limited pipes. Providing HD content is critical for telcos who wish to lure customers away from incumbents. When HD content becomes pervasive, cable and satellite providers, which still have enough bandwidth today, will not be able to deliver all their channels in HD without transcoding.

Other business drivers are the multitude of formats consumer devices can have and the challenge of managing content for each specific device. For instance, while analog TV programming has had the same format for 50 years, digital programming has 18 formats today. Simultaneously, the number of devices (all with unique format requirements) capable of displaying content has increased to include HDTVs, PCs, PMPs, cell phones, and other devices.

Consumers are also getting video content from multiple sources, with traditional broadcast content coexisting with Internet, IPTV, and user-generated content. Taking into account international broadcast standards, multiple codecs (some of which are proprietary for a certain device), display resolutions across multiple devices in the home or business, and variable resolutions and bit rates of broadcast content, one realizes that giving the user ubiquitous access to content anywhere on any device is a major technical challenge.

Very popular, non-traditional video content providers, such as YouTube, Yahoo! Video, and GUBA, add another wrinkle to the problem. Each of them wants to make available — and accept from their users — multiple video formats, including various HD formats. This requires transcoding, both to save disc storage for the provider

and to offer their customers easy access to content in multiple formats. And if video content providers lose the net-neutrality fight, their bandwidth costs for providing content, especially HD content, will skyrocket, requiring them to find a more efficient way to use bandwidth. Transcoding is the obvious solution in that case.

While these challenges seem like potential market barriers, the truth is they also represent opportunities for transcoding. Being able to transcode HD content offers transmission efficiencies and a way to cut costs. Others will look to HD transcoding as a way to increase customer "stickiness" by improving service or by being able to provide more HD content. HD transcoding will therefore be something service providers must have to meet the needs of a growing HD-hungry population. Customers won't ask for it by name, but they will demand what HD transcoding makes possible — high-quality content whenever and wherever they want.

## Use Cases for Transcoding

IDC believes that transcoding will become prevalent in three main locations, with no one segment dramatically ahead of the next: in the network, in the home, and in the business.

- **In the network**, HD transcoding will enable carriers, particularly telcos, to dramatically increase the amount of content that they can deliver, allowing up to a 50% savings in bandwidth. It will also extend the physical distance of the local loop by 30–50%. With more bandwidth, customers can view multiple HD channels in multiple rooms. Content providers can also manipulate bandwidth to suit the purpose. For example, a premium sporting event can be enhanced by being broadcast in the highest resolution format and most appropriate bit rate, while a shopping channel can be broadcast in lower resolution and bit rate. Also, there are multiple locations in the network for HD transcoding. First, network operators are taking in content from national stations and other sources at the central headend. Regional headends and the edges of the network are where carriers are pulling in local and perhaps custom programming. Each of these locations is ideal for some form of HD transcoding to reduce bandwidth demands and to prepare the content for delivery in multiple formats to the home.
- **In the home**, HD transcoding will be used primarily in two ways. First, the technology could save storage space. An HD DVD player or an HD STB with PVR functionality will use substantial disc space quickly. This can be a nightmare for multi-tuner PVRs that are recording two HD channels at a time and storing multiple programs. No service provider wants to, or can afford to, provide a consumer with adequate storage. As a result, HD transcoding of some sort must occur in the home. In addition, transcoding in the home could make content more useful. Consumers will want their content available to multiple devices. It is here where transcoding will include bit rate, resolution, and codec/format changes to make the data usable everywhere. Because consumers have so many different devices with different requirements, many industry

experts believe the home is one of the best places for transcoding, rather than burdening the delivery network or service provider. One opportunity would be for a service provider to offer an STB or a gateway that provides "transcoding services" instead of asking customers to purchase content in multiple formats. Another option is having consumer devices, such as PMPs and cell phones, actually transcode. For example, consumers who wish to take content from their STBs and leave with it on their portable devices may want the content immediately rather than wait for the STBs to transcode to the right format. Having the portable device transcode the content allows for a more flexible, instant gratification experience.

- **In the business**, there are many opportunities specifically for HD transcoding across multiple applications. First, HD videoconferencing will make the experience "real," as long as transcoding can solve screen resolution and format differences in real time without content degradation (such as jitter or packet loss). In addition, with the dramatic upswing in the security market, HD transcoding could improve the usefulness of video surveillance by making images so clear that judgments about risk can be made more accurately by man or machine. Other critical and emerging applications, such as telemedicine and tele-education, will be enabled by HD and therefore be a market for HD transcoding. Another application might include broadcast transcoding of HD content. For example, most television cameras capture images in HD MPEG-2; by transcoding it before transmission, companies can cut equipment costs while providing a better image. Also, HD transcoding would be ideal for military applications in the field because it can enable high-quality images to be sent over a variety of media in a variety of formats without resolution loss.

## Challenges and Potential Solutions

IDC research shows that few technologies are in place for effective transcoding, especially HD transcoding. A CPU on a PC generally doesn't have enough computing power to perform real-time transcoding while running other applications, nor is it suited for the array of evolving codecs. Today's STB chip solutions will need more processing power to complete the transcoding process as well.

Because transcoding is an extremely computationally intensive operation, requiring a full decode of the incoming video stream, video filtering/image processing, and a full encode to the output format (and there can be several desired output formats that need to be supported), having a dedicated transcoding processor to offload the task from the core processor can make sense in a PC or any dedicated media-processing device such as an STB. HD transcoding is particularly challenging because the amount of data that needs to be processed is significantly greater than that required for standard definition. In fact, leading-edge PC processors cannot decode a 1080i stream in real time without a hardware accelerator of some sort, and

even non-real-time transcoding can be a significant drain on system resources.

Transcoding, from a nuts-and-bolts perspective, is difficult to do because of the processing power and multiple codec support required, and these factors are magnified in significance many times for HD streams. However, there is also an "art" to transcoding, in that parameters must be set in real time with every video stream to optimize bit rate, resolution, and quality, and the algorithms needed to do this are extremely complex.

Because standards and technology are moving targets, fixed, hard-wired solutions are not the best answer. Many vendors are now looking to leverage digital signal processing technology to provide flexibility, utilizing a combination of hard-wired and programmable processing elements for maximum performance. Digital signal processors (DSPs) are highly customizable at deployment, allowing service providers and OEMs to get a customized solution upon service launch or product deployment. DSPs are excellent workhorses once in the field because they can do the algorithmically difficult task of managing many formats, based on ever-changing network or consumer needs. Because of their highly flexible architectures, DSPs are also future-proof because providers can make software upgrades in the field as standards evolve or as new services are required. Combining a DSP with a hard-wired accelerator maximizes flexibility while providing the necessary heavy lifting required to do real-time transcoding.

Importantly, DSPs provide flexible processing power. A chip on the customer premises — for example, in a gateway or an STB — must handle multiple streams (HD and SD) to enable multi-room systems and new features, including digital recording and picture in picture. DSPs can provide the power efficiency, robustness, and price/performance ratio required in future STB, gateway, and other CPE designs, without compromising on the new features that will be offered in these devices. Programmable DSPs are also flexible enough to be upgraded as technology and devices change, unlike hard-wired solutions, and are more readily deployable. This allows content providers to deliver quick time to market to customers anxious for new services, whereas custom hard-wired solutions require a huge design effort for each new application.

### **Is HD Transcoding Really a Big Deal?**

Telcos cannot deliver competitive IPTV without delivering HD content, which requires the more complex HD transcoding, and incumbents will need more bandwidth in the near term, too. Transcoding saves telcos critical bandwidth on broadcast content, extending their physical reach and quality-of-service offerings. Soon, incumbent service providers will need to adopt transcoding technologies because HD programming will constrict their bandwidth. Transcoding helps all service providers manage the quality of their offerings.

In the mobile world, operators in Korea, parts of Europe, and Japan are most likely to be first movers with HD to the handset, and transcoding will be needed to manage the variable bit rate of the mobile network and resolution requirements of mobile devices.

With respect to digital HD services, geographies not historically served with solid analog SD infrastructure, such as China, India, and South America, are installing the best services and tend to get the infrastructure "right" from the beginning. There is no incumbent competition in many cases. Interestingly, IDC also sees rural telcos embracing HD transcoding. Historically, satellite owns rural areas, but local/small telcos are moving in, and HD content is a key selling feature for them.

The bottom line is that HD transcoding will be global, and the ability to transcode multiple formats of HD content will be critical. Global incumbents will want to offer HD channels in the near term. The only application we see as being geographically constrained at first is HD transcoding for business. HD videoconference, surveillance, and other applications appear to have U.S.-centric demand and technology development today, although these are niche markets, and U.S.-only adoption will not dramatically alter the overall opportunity.

Because of the programmability and flexibility of a DSP, digital signal processing technology will be a popular way to solve this complex problem of dealing with and moving around multiple formats of HD content. IDC believes HD transcoding technology will be one of the hottest semiconductor applications over the next few years, solving technical issues in the network, in the home, and in connected devices.

## **Conclusion**

Transcoding is being adopted today, and for the next few years, we predict a strengthening adoption rate. Key takeaways include the following:

- Service providers will adopt transcoding to save bandwidth and storage space or to simply provide more content in real time — especially high-definition content — to consumers.
- Telco IPTV service providers will likely make the first move with HD transcoding, with incumbent service providers and device OEMs right behind.
- HD video is becoming pervasive, along with the challenges inherent in digital HD content. Transcoding will be required to meet these challenges. It will need to happen in multiple places in the service provider network and on customer premises. In the future, some mobile devices might also transcode.

- There will be a strong need for the ability to transcode multiple formats. DSPs will be a popular semiconductor solution for transcoding of multiple formats and for the more complex task of transcoding HD content.
- Value will be measured by several factors, including the reduction in spending on new infrastructure, the ability to reach more customers with better services, the ability to provide "sticky" HD broadcast and HD services, and ultimately, the ability to sell the concept of ubiquity as part of the service offering.

While the industry is still developing, one thing is clear: Transcoding will be an integral part of the many solutions for digital content delivery and represents significant opportunity.

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