# Part One

Technology Trends

1

Convergence

Convergence means different things to different people depending on the context. However, for the purpose of this book, we define four kinds of convergence: (i) industry convergence, (ii) device convergence, (iii) network convergence and (iv) service convergence.

1.1   Industry Convergence

The telephone (telecommunication) industry, the television (media/broadcast) industry and the Internet industry once existed separately with specialized infrastructure to deliver their respective services. For example, the telecom (voice) industry was built on specialized circuit-switched network technology, a multibillion dollar telecom switch and equipment industry, to deliver "telephony" or "voice" services to consumers [1, 3]. Consumers wrote a check to a telephone company, such as AT&T, for the monthly telephony service they received from it. The television (media/broadcast) industry used specialized broadcast network technology to deliver television (video broadcast) services to consumers. As with the telephony service, consumers made a monthly payment to a cable/satellite/television service provider, such as Comcast or DirectTV, for television services. Broadband access to the Internet was also offered as an independent service by broadband service providers, such as AOL, and consumers paid them for Internet (data) services.

However, with technological advances, these apparently independent industries are converging and are contending in the same digital content distribution space (Figure 1.1) [2]. There are two major reasons behind this transition. First, analog content is being replaced with digital content. As a result, content, no matter what industry it belongs to, is converted from analog to digital and then packaged into small units called packets. Second, the network infrastructure is converging into a common packet-switched Internet protocol (IP)-based network technology, which is capable of carrying packets in an efficient manner. Naturally, all content, voice, video and data, are being transported over the common network. Telephony has become an "application" on the Internet (voice over IP). Television is also becoming an "application" on the Internet (Internet television) and the Internet itself, which used to be non-friendly to real-time traffic, is also morphing to support real-time traffic, preserving quality of service. As a result, the challenges being faced by these industries are almost identical, except
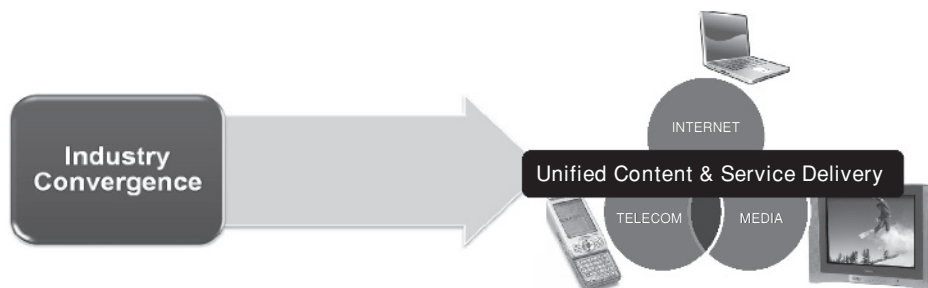
Telecom industry, Broadcast industry, and Internet industry are overlapping
in the Digital Content Distribution space leading to new Business Models

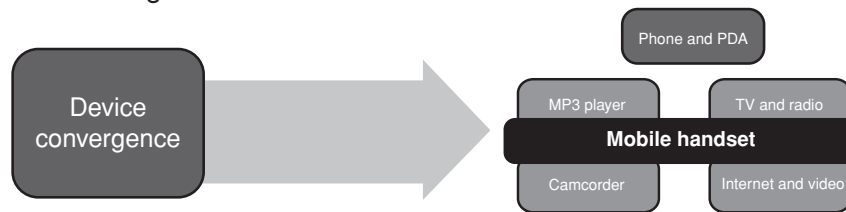|	*Before*	*Now and Future*
Telecom (Voice)	Specialized Circuit-switched Network for Voice	Voice is an Application on the Internet
Broadcast (Television)	Specialized Broadcast Network for Television	Television is an Application on the Internet
Internet (Data)	Packet-switched Network designed for non Real-time Applications: Email & Web	Network enhanced to support Real-time Applications: Voice & Video

Figure 1.1   Industry convergence.

for whatever business challenges they have specific to their domain. Moreover, each of these
industries is expanding the boundaries of its business, thereby treading in so-called unfamiliar
territory. This is leading to challenges but also to opportunities that we discuss in detail in later
parts of the book.

1.2 Device Convergence

Consumer electronics and communications functionality are converging onto consumer de-
vices. For example, laptops are being equipped with microphone, speakers, cameras and
other consumer electronics to enable new capabilities like telephony and video conferencing
(using Skype [5], Yahoo! Messenger [6], GTalk [7] etc.) across the Internet in addition to
the traditional applications, such as Web surfing, instant messaging and e-mail. What used to
be just a mobile phone a few years ago is today a camera, a video recorder, an MP3 player,
an AM/FM radio, an electronic organizer, a gaming controller, a phone, a device for surfing
the Web, a device for sending instant messages, and in some cases, a device for watching
television (Figure 1.2). Consumers' ownership of such powerful handheld devices opens the
door for communications service providers (CSPs) to deliver a variety of content embodied
in text, images, audio and video to the end user. However, the fact that an end user can store
the delivered multimedia content and share it with the rest of the world with a single push of
a button may lead to unprecedented illegal sharing of content, making it content owners'
worst nightmare. Thus the benefits of convergence come with challenges of security
and privacy.

Device convergence

Devices are becoming *multifunctional* and hence more and more powerful

	Before	***Now and Future***
Laptop	Used for *Web* and *Email*	Used for Web and Email + *voice, video*
Mobile phone	Used for making *phone* calls	Used for phone + *Web, Email, IM, camera, video, MP3 player, AM/FM radio, PDA* etc.

Figure 1.2   Device convergence.

1.3   Network Convergence

Network infrastructures used by the telephone (telecommunication) industry, the television (media/broadcast) industry and the Internet industry have traditionally been very different. The telecommunications industry has been using circuit-switched network elements; the television industry has been using broadcast network equipment and the Internet industry has been using packet-switched network elements. Packet-switched networks have been built using different technologies as well. For example, asynchronous transfer mode (ATM), frame relay (FR) and IP are all technologies that have been used and are still being used in CSPs' networks. One way of reducing capital expenses (capex) and operational expenses (opex) would be to choose a common technology for the network infrastructure. This would assist CSPs in their need to contain expenses by training and employing technical people skilled in only the chosen type of technology. The fact of the matter is, the CSPs are converging onto using only IP/MPLS-based networks for transport and IP multimedia subsystem (IMS)-based infrastructure for session/service and blended (voice, video, data) applications (Figure 1.3) . This transition in the industry to converge on to a common network for applications and services is referred to as network convergence and this has far-reaching consequences for the industry.

1.4   Service Convergence

Services offered by the telecommunications industry, the television industry, the Internet industry and the wireless services industry have been independent of one another. However, with the introduction of new technology enabling unified communications across these networks, consumers expect to access the same services (voice, e-mail, messaging and so forth) and content (Web, video, audio) anytime from anywhere using any device (laptop, TV set, cellphone) with consistent quality of experience (Figure 1.4) [4]. An example of service convergence
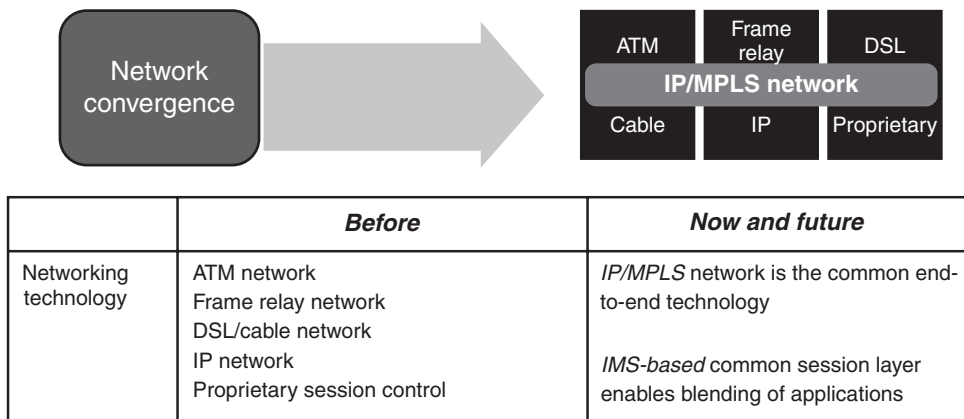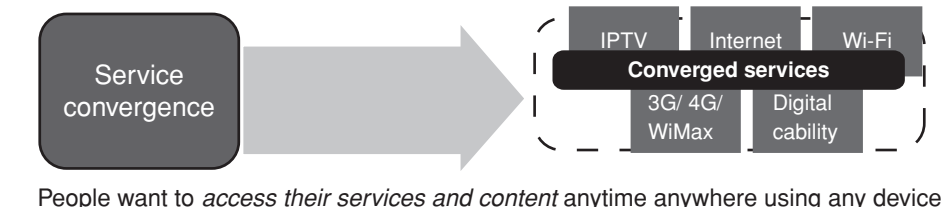
Network convergence

	Before	*Now and future*
Networking technology	ATM network Frame relay network DSL/cable network IP network Proprietary session control	*IP/MPLS* network is the common end-to-end technology *IMS-based* common session layer enables blending of applications

Figure 1.3   Network convergence.

Service convergence

People want to *access their services and content* anytime anywhere using any device

	Before	*Now and future*
Communication	*Voice* only from residential phones *Email* only from *Internet/PC* *Messaging* only by *SMS/mobile* *Separate Address Book* for residential phone, email and cell-phones	*Voice, Email, messaging from anywhere using any device* (cell-phone, laptop, TV) *Common address book* for communication *Seamless service mobility* from one network to another
Content	*Web* only on *internet/PC* *Video* only on *TV* set *Audio* only on *radio, CD player*	Web, video, audio on any device (laptop, TV set, cell-phone) from anywhere *Seamless content mobility* from one device/network to another

**Figure 1.4**   Service convergence.
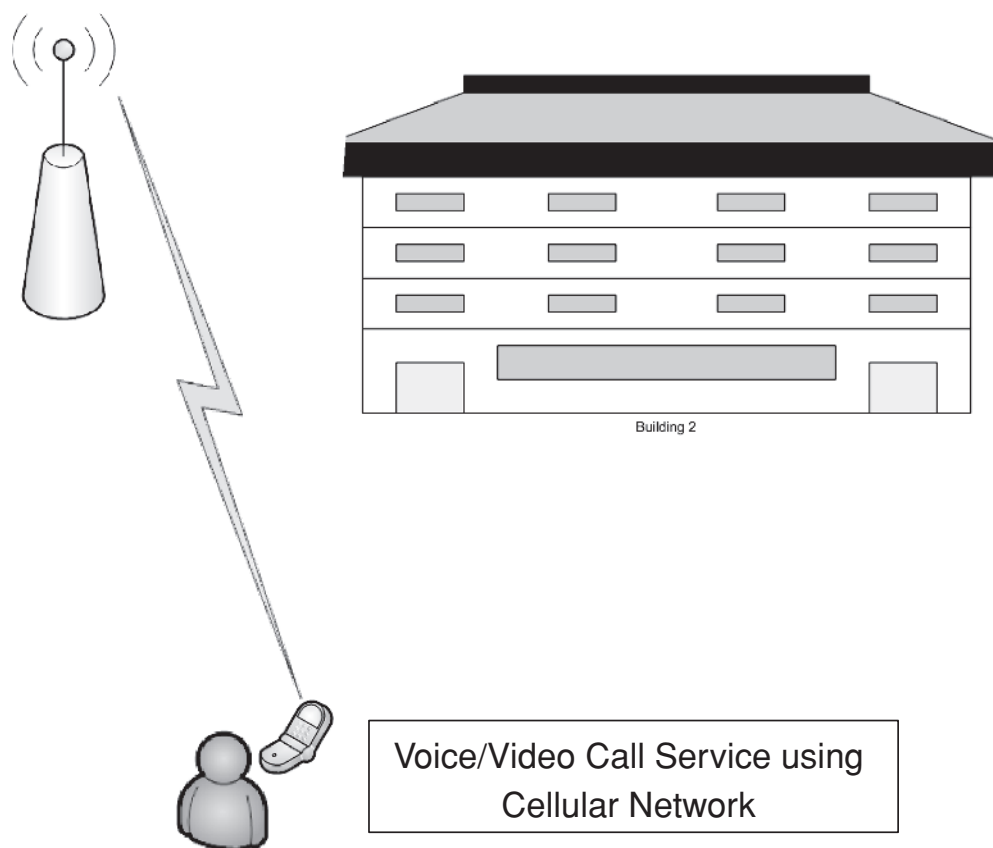
Figure 1.5   Voice/video call using cellular network.

would be for CSPs to offer a service that would enable their customers to take part in social networking using any device from anywhere. Moreover, customers not only expect to be able to use the services from anywhere using any device, but they also expect to move content/services seamlessly from network to network without compromising quality of experience.

For example, as shown in Figures 1.5 and 1.6, a phone call uses the cellular network when that is the only network available for connectivity and uses the WiFi network when that is available in addition to the cellular network. In fact, the transition from cellular network to WiFi network happens seamlessly without interrupting the phone call.

Figures 1.7 and 1.8 show how video being watched on a small-screen cellphone in a train is seamlessly transitioned to a large-screen TV set when the user enters home. This is an example of seamless mobility of content. While service convergence opens up unprecedented opportunities of offering novel value-added blended services for the CSPs, it also makes the content providers worried that what used to be *protected* content in their network may not be protected any more due to lack of a comprehensive security solution spanning multiple networks.
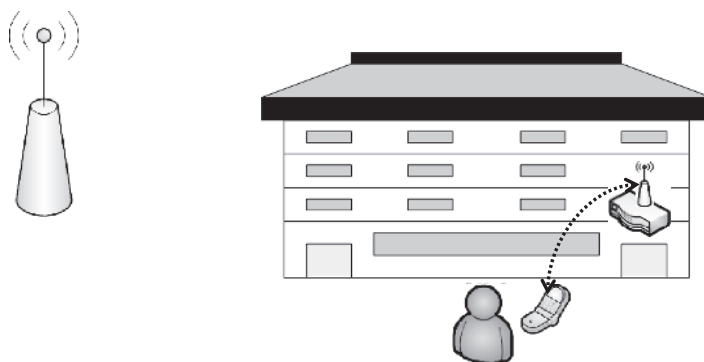
Voice/Video Call Service continues uninterrupted while the underlying network changes from cellular outdoors to wifi indoors
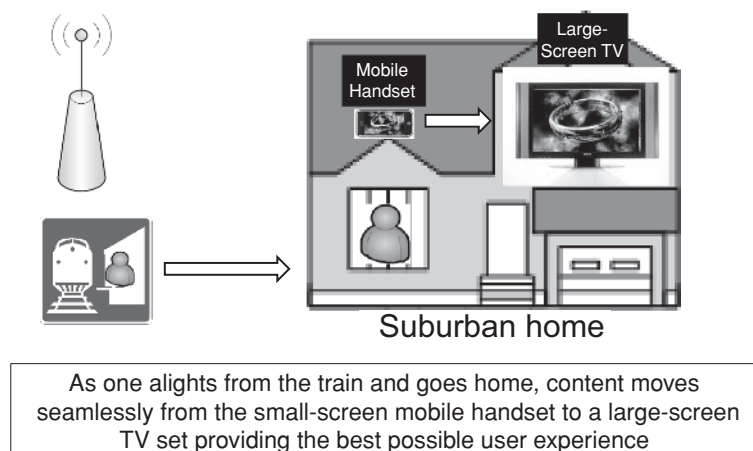
Figure 1.6   Voice/video call seamlessly moves to WiFi network.

Suburban home
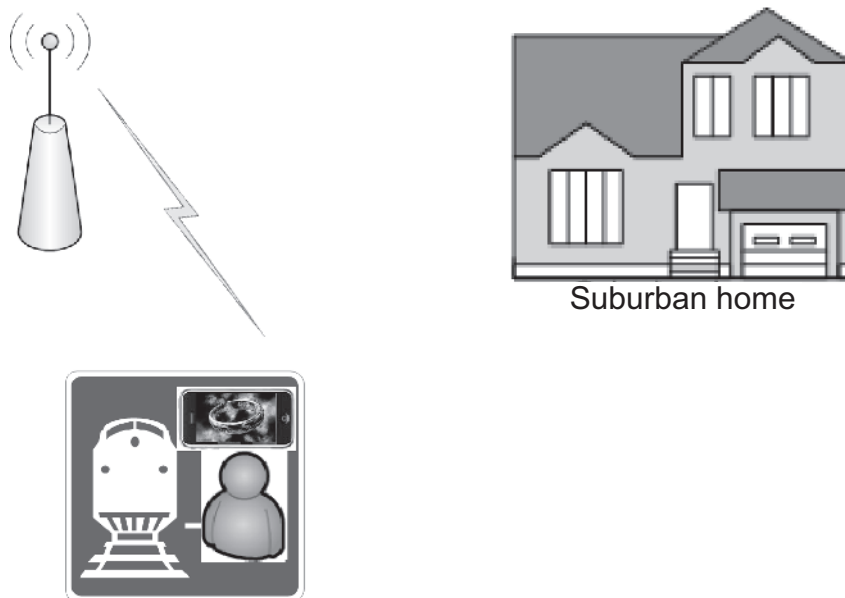
Watching a movie on a mobile handset while commuting on a train

Figure 1.7   Watching movie on mobile handset.

Figure 1.8 Movie transitions seamlessly from small screen of mobile handset to large screen of TV.

1.5 Summary

Digital convergence is already happening in the industry. With digitization of content, the distinction between voice, video, images and text is blurring as everything is being treated uniformly as data and transported over a common IP network as opposed to using specialized networks for transporting voice, video and data. Furthermore, everything is becoming an application on the IP network leading to overlapping of what used to be distinct industry segments, namely, telecom (voice), broadcast and media (video) and Internet (data). In order to provide access to these applications from anywhere and at any time, devices (PC/laptop, mobile handsets, TV sets) are becoming more and more powerful with multiple consumer electronic features being built into them, leading to what is known in the industry as device convergence. A case in point is a smart handset with features, such as, AM/FM radio, mobile TV, phone, browser, digital camera, video recorder, MP3 player, calendar, office applications and a host of other features. A variety of network technologies are converging into IP-based technology, leading to mixing and matching of applications and features in any service from the end-user perspective and lower capital expense (capex) and operational expense (opex) from the service provider perspective. *Service convergence* refers to the capability of end users to avail the same service regardless of the network over which it is accessed and the ability of end users to access the same content over multiple devices in a seamless manner. Digital convergence is leading to new applications and services that were not possible before and opening up new possibilities both from the service provider perspective as well as from the end-user standpoint.

References

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