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Connected by Media

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Advertising campaigns and highly popular government programs have for many years trumpeted the need to get people connected to the Internet. That meant solving the technological and sociological issues involved in providing network access to the population and turning them into regular users. The message echoes today in a slightly muted form. Except in developing parts of the world, getting people connected is no longer a major challenge. The challenge today is to create and support experiences that users continue to value.

The recent drop in the overheated valuations of networking-oriented businesses serves as a useful reminder that people don't really care about being connected to the Internet per se. They use the Internet to connect to other people or things. In the case of connecting to people, a valuable question to ask might be, How can connected applications identify communities, support their activities, and evolve to meet their needs? With respect to things, let's consider the increasingly popular situation in which those things are multimedia content. In particular, let's think about how multimedia content might be the glue that connects, defines, and supports communities.

Irrespective of views on intellectual property issues or business models, even a cursory reading of recent events makes it undeniable that the Web is becoming a remarkably effective—if not yet efficient—multimedia content distribution platform. While this may not have been a design goal earlier, it's now a significant driving force in the evolution of network technology, user services, and access devices.

Given media content, people, and the Internet, there are three sorts of connectedness pairings to consider:

- *People-to-people*. Since the 1980s there have been media-related Usenet groups and chat rooms, although these tend to be disconnected from the related media. The good exceptions include Web sites like CNN.com, which lets users engage in live chat regarding streaming video on the same site.

- *People-to-media*. This sort of connectedness can be about distribution mechanisms or include recommendations (such as people who liked this recording also like…).

- *Media-to-media*. What happens when my media get together with yours? Can agents or similar processes create added value? This area is speculative but may become a valuable way of supporting people-to-people and people-to-media.

Evolution

An assumption made by many in the media business—although certainly not by Web pioneers—was that all the desirable content online could be aggregated onto a relatively small number of servers (at least relative to the number of clients). This notion shows up in many aspects of the system design; examples include the much greater inbound versus outbound bandwidth provided to consumers in typical home broadband systems and the ability of edge services like Akamai's EdgeSuite to alleviate server and routing bottlenecks. The peer-to-peer model in current vogue doesn't match these assumptions, and even some proposals for multicast-type distributions suggest significant lateral transfer of data cached at or near clients so as to ease server load and network congestion.

Whether centralized or decentralized, many of the most popular Web sites or applications involve developing communities and supporting their sharing activities. However, most of these also involve cataloging and exchanging things that originated elsewhere. Just as one-to-many media-content distribution is evolving into many-to-many media sharing, the evolution can continue into community creation of new sorts of shared material, not just sharing of content that others
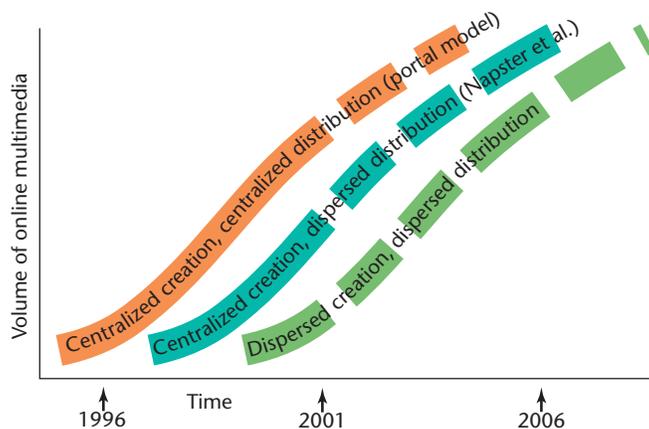
Figure 1. The evolution of multimedia content on the Internet, as consumers increasingly become involved in creation and distribution.

Figure 2. Individeo, a Web-based application that lets collaborating filmmakers create and share video narratives online and exchange ideas and feedback.

created for traditional media distribution. Whether because consumers will recognize that technology has given them more control over multimedia material or because the development of specialized communities will create demand for equally specialized content that mass distribution channels aren't providing, many-to-many content generation and sharing will gradually develop (Figure 1).

Consumers becoming producers: successes

A notable success in Internet media sharing is the niche domain of online participatory fan culture, which is now the focus of serious study.[1] Fans of mass-culture works such as the Star Wars films have appropriated elements as the basis for their own works—whether by literally reusing media snippets or by shooting new video that borrows the iconography and mythology. While fan culture is hardly new (think Trekkies), the new-found ability to generate near-professional-quality video and audio with consumer equipment and to distribute the results to large numbers of like-minded people who provide thoughtful feedback lets such online communities prosper.

The most mature technology for group media creation is sharing works with text and still images, which is in many ways analogous to the workflow at a traditional print publication. A good example is Pluto, a system developed at the MIT Media Laboratory to support collaborative Web publishing, which several communities—most notably children and the elderly—have used to engage in editorial decision-making conversations and journalistic apprenticeship while assembling online publications.[2] When the medium is temporally dynamic rather than static, the degrees of freedom are necessarily greater, but systems are beginning to arise for shared multimedia creation. Work in the Interactive Cinema group at the MIT Media Laboratory headed by Glorianna Davenport addresses the design of tools that support collaborative video production by online groups of filmmakers. These groups can contribute source material, experiment with editing and sequencing pieces by drawing from the pool of contributed content, and comment on one another's creations (see Figure 2).[3] Rocket Network (http://www.rocketnetwork.com) has developed a system with which online musicians can simultaneously access audio session files, allowing collaboration by geographically dispersed groups of musicians or producers. Although Rocket's system is aimed at professionals, we can easily imagine a consumer garage-band version.

Consumers becoming producers: challenges

As promising as these efforts are, participation remains hard, or at least time-consuming. Before large numbers of people use them, media creation and sharing environments must become less complicated and detached from everyday activities. They should integrate into other parts of life in a seamless, context-aware, and self-maintaining way. FanCast (http://www.fancast.com), for instance, lets anyone with a microphone and connected PC host a live talk show or provide running commentary on sports events broadcast on television. Copyright issues preclude direct links between the video and the audio, so the viewer interface is a bit unwieldy. (In essence, you have to coordinate selecting a channel on the TV and accessing the corresponding commentary on a PC Web brows-

er.) I suspect that for sufficiently compelling content, people will put up with that problem until circumstances permit a more integrated solution.

An even simpler (and automatic) form of media sharing under development is one that's still considered the Holy Grail of personal video recorder hackery. Numerous hobbyists have modified personal video recorders (PVRs) to add Ethernet connections and have reverse-engineered the file system, so that one Internet-connected PVR can access video files recorded by another. Even if we can't do that yet, we might at least more easily be able to share viewing schedules so that, for example, I know what my colleagues at the office will be discussing at the cofffee machine tomorrow morning

MediaConnector, a new project by the Broadercasting Special Interest Group at the MIT Media Laboratory, seeks to build a framework with which it becomes easy for content to drive the community's formation, or for a community to use their content to support their sense of connectedness. To give a concrete example, consider digital cameras that record metadata including time, position, and heading, perhaps even from time to time when users aren't taking pictures with them. If enough people carry such cameras, uploading my pictures and metadata to a server can pay back interest. If I am a member of an ad-hoc community (for example, a tour group or a group of wedding guests), then I can automatically receive other pictures taken at the same time as mine but from different viewpoints. I could also retrieve pictures taken at a time I was there but not using my camera (maybe even pictures with me in them). I could alternatively become connected with someone else because of our pictures. For example, if I take a summer vacation photo of a mountain range and wonder what it looks like in winter, I might be able to find a picture from the same vantage point six months earlier. The MediaConnector framework provides analogous functions for other types of media.

Some of the technical challenges posed by a wide-scale deployment of shared consumer-created multimedia are clear, if not necessarily straightforward to solve. Indeed, much of the work will involve making media servers maintainable by ordinary users with

■ security that supports various access services among rapidly changing communities, while requiring minimal setup and maintenance by users;

■ hardware and connectivity of sufficient capacity cheap enough that all communities can benefit; and

■ **a** network infrastructure that won't degrade when there is significant multimedia traffic among the end users.

Other issues, however, are less obvious and will involve as much research as engineering. We'll need

■ agents for managing storage, understanding and locating content, and creating and maintaining interpersonal connections;

■ interfaces to make media creation and access easier (and ultimately, so much a part of everyday life that the interface disappears); and

■ tools with enough intelligence to enable easy creation of material that others will find valuable, and with the ability to grow as the creator's skills develop.

Conclusion
Although some people might feel that the demise of Napster and other such enterprises is the end of an exciting time in the online multimedia world, I regard the sort of media sharing that took place there as just a step toward developing richer authoring and sharing environments. Many opportunities await—new business models, new forms of Internet infrastructure and applications, and millions of new online content contributors—as we develop multimedia creation situations for ordinary folks and build systems that support their communities.   **MM**

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