

# Reverse the Search:

Making It Easier to Find, Play, Mobilize and Share  
Your Digital Information and Entertainment.

## **CONTENTS**

- 3** Executive Summary
- 4** Setting the Stage for Tomorrow's Capabilities
- 4** Content Experiences: The Possibilities
- 5** Enabling Technologies
- 6** Motorola Technology Initiatives
- 9** Looking Forward

# Executive Summary

The Internet age is providing tremendous flexibility over how, when and where we interact with entertainment and information. Music, photos, news, documents, video and films now exist in digital form. Many mobile phones, PDA's, music players, automobiles and personal computers can create, play, send and receive digital information on-demand.

However, the technologies we use today to interact with this digital content are still in their earliest development stages. Truth is, we are just beginning to tap into the freedoms of sharing, consuming and creating content. Transferring and accessing entertainment and information between devices is still limited by significant physical, technical and legal barriers. The highly competitive digital media market has left the industry in a state of fragmentation. The digital landscape is saturated with different media delivery architectures. These push (broadcast TV) and pull (the Internet) delivery methods can have different encoding formats. MPEG-2, MPEG-4, MP3 use different network topologies and/or competing digital rights management (DRM) systems and still require active, and sometimes complex, participation by the user.

Now consider where we could be:

If human-to-device, device-to-device and device-to-networks communications were less restrictive, we could mobilize content as we (and the copyright laws) see fit. Utilizing wireless networks, users would be free from cable-synching to get the latest music or video on their device. Intelligence in the device and networks would eliminate user-initiated file formatting. Technologies that enable personalized content would allow users to spend more time enjoying digital entertainment and less time searching and navigating through it. In fact, the device would learn what content is frequently used and automatically retrieve similar content. It would appear automatically as needed. Finally, users would share and socialize around their information and entertainment – enabling the music, video and voice to compliment a conversation, rather than each being a stand-alone experience.

The ability to have fully portable, accessible and personalized content is a cornerstone of Motorola's vision of Seamless Mobility. The goal is to create easy, uninterrupted access to what people value most; communication, information and entertainment. As new Motorola technologies come to market, people will be able to seamlessly experience, create and share their content anytime, and anywhere, across multiple devices. With mobile devices, set-top boxes, wireless and home networking technologies in its portfolio, Motorola is in a unique position to leverage an installed base into a global ecosystem, thus moving the industry towards seamless and personalized interactions.

This document explains the progression and the enabling technologies required for users to more easily find, play, mobilize and share their digital information and entertainment.

Future revenue streams for network operators and service providers hinge on understanding customers and providing them with experiences that are unique to their personal preferences.

#### **TAG, YOU'RE IT!**

Technologies that enable users to personalize and socialize around their content will create exciting new ways to communicate. Working with Yahoo! Research Berkeley, Motorola's Applications Research team developed a prototype application for ZoneTag, a location based service for Yahoo Flickr. The ZoneTag Motorola Client allows users to upload photos to the popular photo-sharing web site. If ZoneTag knows your location, it can suggest likely "tags" for your photos such as city, state, zip code — or even places of interest or events nearby. So, with just a few clicks, you can easily tag your photos and then share them with the world around you. The ZoneTag Motorola Client also allows you to view photos that were taken near you. Learn more at [www.motorola.com/zonetag](http://www.motorola.com/zonetag)

## Setting the Stage for Tomorrow's Capabilities

The increase in processing power, storage capacity, advanced applications and device intelligence are already empowering a new generation of devices. Data bandwidth, both wired and wireless, and access technologies are also increasing on all fronts. Leveraging these exciting developments, Motorola's research is working to help move the industry beyond delivering individual pieces of content to delivering personalized, aggregated and related content that can be consumed across an ecosystem of devices, networks and environments.

Progress in this area is vital as future revenue streams for network operators and service providers hinge on understanding customers and providing them with experiences that are unique to their personal preferences. As more players enter the mobile media market, the ability to deliver specialized content and services will be the key to increasing customer loyalty and average revenue-per-user.

## Content Experiences: The Possibilities

### **Today – The portable content experience**

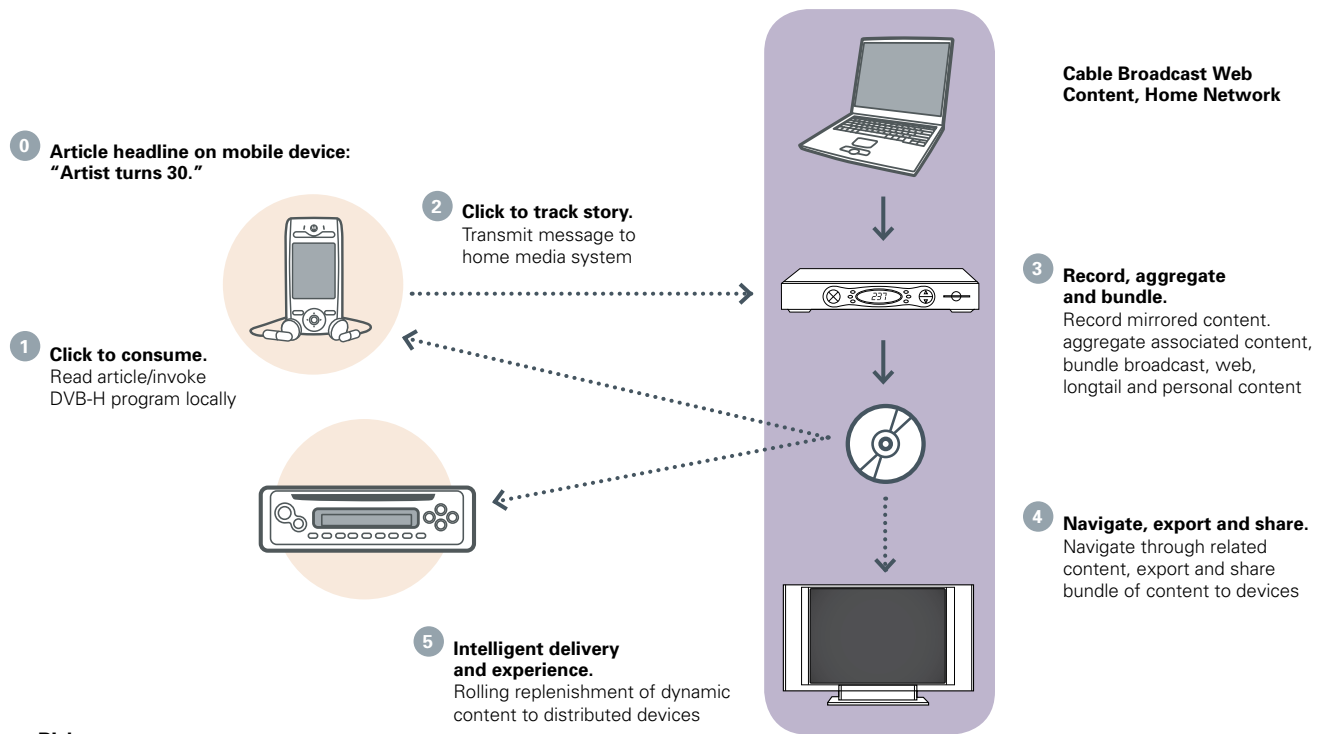
Users today have greater control and more options as to when, how and where they consume their digital and audio content. Commonly known as "synch-and-go", today a user can dock a mobile device to a PC or a TV set-top box and synchronize music, pictures, and video for mobile use. The ability to watch something that originated on another device, at any time, and in any location is often referred to as device-shifting, time-shifting and space-shifting.

Already today, these capabilities are available in Motorola products such the Motorola Q™ as well included within innovative applications such as ZoneTag (See Sidebar).

### **Tomorrow – The personalized content experience**

Beyond simply mobilizing media, soon devices will be able to detect user interests, aggregate related commercial content specific to those interests and intelligently deliver that to the user's device through wireless networks.

Learned behavior regarding a user's preferences on a mobile device will be communicated to their home media system (controlled by their Internet-enabled set-top box), which will query for web content over the home's high-speed connection, analyze the TV's electronic service guide and search home media storage. The result will be a rich media bundle available for instant access when the user next uses the home media system. Alternatively, the system could perform a content sync back to the mobile device using a range of wireless technologies (See Figure 1).



**Figure 1. Tomorrow. Rich content can be delivered within the context of a storyline. It can start with an article read on a mobile device — a musician’s interview as an example. The user’s interest triggers the mobile device to send a message to the home DVR that will search over a high-speed connection for related content such as a TV interview with the musician, an Internet listing of upcoming performances and personal media such as MP3 files. This media bundle is then presented to the user on a home media system or the content can be downloaded back to the mobile device.**

## The Future – The shared and social content experience

Removing the barriers between localized, device-centric content to improve interaction experiences requires research in areas of personalization, content analysis and association, intelligent delivery and rights management. In the future, technologies will enable people to share and socialize around their content with family, friends and colleagues from multiple locations. Individuals will be able to view sporting events, television shows and movies as well as play games or listen to music with other connected users. Social-TV and collaborative mobile gaming, as two examples, will re-create some of the aspects of shared experiences virtually, through the convergence of home media, communications and computing.

## Enabling Technologies

### Personalization Models

Many in the industry now refer to the mobile phone as “the device formerly known” as the mobile phone, simply because of the growing capabilities of these devices (music playback, cameras, business card readers, GPS navigation, etc.). The next step in the evolution of these devices is to personalize the capabilities and content to the habits and preferences of the users.

Motorola sees three key personalization models emerging to enhance user experiences with mobile and fixed communications devices: user interaction personalization, content personalization, and applications and service personalization.

User interaction personalization ensures that a user can always experience their preferred interaction behavior with a device, application or service. Content personalization means meeting a user’s expectations by anticipating the content a user may want. Application or service personalization adapts services to user goals according to context. This type of

personalization is one way service providers are differentiating their offerings by tailoring their services to the specific wants and needs of their customers.

These technologies will work on behalf of the user by discreetly and unobtrusively gathering information based on awareness of the user's preferences, situation and choice of device.<sup>1</sup>

### **Content Analysis & Association**

Improving the user experience requires that intelligence be built into networks and devices that assess content attributes, correlates content with similar characteristics and addresses technical and legal boundaries between devices, networks and media formats. Only then can true integrated content access across devices be possible. Content analysis and association enables the formation of a story line around a topic or person of interest. In our musician's interview example, if you are interested in the artist's music, media analysis and association has the potential to inform you about every aspect of his/her career, concert schedule, interviews and articles about him and give you the opportunity to access any or all of these pieces of information (See Figure 1).

### **Intelligent Delivery & Experience**

Once content associations are made, the next step is to develop the delivery mechanisms that are smart enough to provide a story experience across devices. These mechanisms should be flexible and adaptive enough to recognize content type, network and device options and user preferences, and then deliver accordingly. Thus video or audio may go to the device that is most appropriate for use (e.g., a movie would be transmitted to a home theater rather than a cell phone) or to the device that is closest to the user (e.g., if the user is traveling and carrying a laptop PC, the movie would be sent there).

### **Information Management and Digital Rights Management**

In order for users to adopt solutions that can enhance and make the content experience more enjoyable, security features must not detract from their ease of use. Today, there are several proprietary DRM platforms in use. The challenge is to create an interoperable DRM scheme that enables users to access content from any provider without the use of it being blocked by multiple DRM solutions. To be appealing and accepted, import/export must be neutral in terms of technology and licensing, without the licensed user having to mitigate new security concepts and incur duplicate fees. Technologies must be developed and adopted that allow digital content providers and the community of users to arrive at balance between unencumbered legal access and copyright protection.

## **Motorola Technology Initiatives**

Motorola's Applications Research Lab is focused on enabling users to find, enjoy and interact with content and services that they want in all environments: home, mobile, work and leisure. Mobilizing and aggregating information and entertainment includes work in personalization, media analysis and association, secure and intelligent content delivery and managing resources that can be constrained on mobile devices including bandwidth, battery life and storage.

### **New Directions in Personalization**

Motorola's SCREEN3 is a technology that provides intuitive access to preferred news and information to a mobile device. Information regarding items of a user's preference is cached to the device whenever it's idle. This information forms a scrolling "ticker" on the phone's home screen, which provides headline information. If more information is desired, single clicks can bring users to more detailed information and images. In this way, Motorola increases the relevance of information offered to users, and enables content providers the ability to better

<sup>1</sup> For more information regarding personalization read Motorola's Position Paper "Personalization: Reducing Complexity for an Easier, More Intuitive User Experience" at [http://www.motorola.com/mot/doc/6/6462\\_MotDoc.pdf](http://www.motorola.com/mot/doc/6/6462_MotDoc.pdf)

target offers. Motorola Labs has shown demonstrations of mobile SCREEN3 selections transferred from a mobile device to a home digital video recorder (DVR), extending the mobile personalization preferences to the home viewing experience.

Motorola is also working on personalization technologies for a solution that will combine Internet, television, DVD and security-monitoring into a single device. These personalization engines will allow service providers to collect and distribute media bundles to consumers providing signature experiences in a Motorola ecosystem.

Motorola is also heavily involved with the Multimedia Semantic Syndication for Enhanced News Services Project; a service that will aggregate information from multiple European news sources to provide news on the day's events from several perspectives. Users will receive personalized, syndicated summaries of information that is of interest to them. Motorola engineers are developing the local personalization portion of the project. The service will provide tools for large and small content providers to make their content accessible via semantic web technologies, thereby increasing the opportunities to fully exploit valuable content assets, while opening up access to valuable information for European citizens.

In the area of human interaction personalization, Motorola's Human Interaction Research Lab has developed an Intelligent User Interaction (iUI) framework. iUI is a multi-device software platform that supports multimodal, goal-oriented interaction. It aims to be a standard for simple, intuitive user interfaces for increasingly complex functionality. It offers interaction (handwriting recognition, speech recognition, keypad input) then adapts to context and to knowledge about the user based on interaction patterns. iUI includes semantic interpretation of speech and text input, handwriting recognition, touch input and visual and voice output.

### **New Directions in Content Analysis and Association**

Intelligent, autonomic content analysis and association makes it possible to categorize and cross-reference content by subject matter while adapting content delivery according to context. Motorola is developing integrated transcoding and access technologies that will allow a mobile user to access a video clip stored on a home device in a format suitable for mobile devices. In addition, patterns of user behavior on a mobile device will trigger a recording of associated content on a home device for use at a later time. This level of flexibility requires an architecture that includes a media adaptation framework, which is the basis for content to be context-aware and rendered on different devices. The framework that accomplishes this harmonizes metadata that is then fed to a decision engine that can select and configure adaptation tools.

Motorola is also coordinating the aceMedia project, a global consortium that brings together the collective expertise of multimedia and intelligence technology experts to drive research of next-generation networked media management tools. This research will assist in the development of search, indexing, cataloging and adaptation technologies that will allow content to be more easily accessed by next-generation fixed and mobile platforms. The intent is to make content more relevant to the user; automate annotation at all levels, and add functionality to ease content creation, transmission, search, access and re-use. aceMedia will enable new intelligent content applications such as personalized search of video and image media, personalized content adaptation across mobile, PC and TV environments, and personalized privacy policies enabling users to maintain privacy of their personal content when sharing with social networks.

### **New Directions in Intelligent Delivery and Experience**

Enabling users to control how, when, and where they consume content requires creating a single architecture that can deliver different types of content for multiple uses in various situations. This includes creating the illusion of personal media stores that are infinite and pervasively available to the user, at a reasonable cost, while also providing the basis for suitable revenues to the provider.

## WHOLE HOME MEDIA

Pause, rewind, and stop live programming - from any screen in your home. Transfer shows from the DVR to any screen in the house - without missing a beat. Follow-Me TV is one part of Motorola's Whole Home Media Solution. Through pioneering technology, users are able to transfer recorded shows from a Motorola digital video recorder (DVR) set-top directly to a Motorola mobile phone, constructing their own multimedia networks. Whether on the go or stuck at an airport, users can move a show to a compatible mobile device for mobile viewing. Or they can use their mobile phones to act as a remote control, scheduling DVR recordings from anywhere and at anytime.

Motorola's Whole Home Media Solution (WHMS) allows users to transparently access stored digital entertainment - whether high-definition video on a DVR, music on a computer, or pictures on a digital camera - from any connected device in the home. With Motorola's WHMS, users can control where, when and on what devices they become informed, connected, and entertained.

Motorola's Liquid Media is a set of software technologies that allow digital content to be searched, accessed, and moved freely between devices. Liquid Media allows video and audio content to follow its user, morphing between formats to fit the playback environment. The first Liquid Media prototype debuted in 2004 and showed how video could be seamlessly transferred from mobile phone screens to an automobile's Internet radio to home television and back to a phone in real-time, without missing a play. Inside the home, Liquid Media is using Universal Plug and Play (UPnP) and other specifications certified by the Digital Living Network Alliance (DLNA), as well as Bluetooth wireless technologies, Wi-Fi, and the soon-to-be-available Ultrawide Band (UWB) for wireless media communication between devices. An early success of this can be seen in Motorola's Follow-Me TV offering. Follow-Me TV allows users access to all of their favorite digital media when and where they want it. Sports highlights can go with you from the kitchen to the bedroom. Television shows can be programmed to record and watched from a user's mobile device without the necessity of drivers, specific operating systems or programming languages from a single vendor (See Sidebar: Whole Home Media). And with the ease of use afforded by wireless home networks, Liquid Media can improve the consumer's experience dramatically as compared to today's "synch and go" model.

An extension of Liquid Media is Motorola's "Cache and Carry" technology that caches desired media onto mobile devices using wireless networks. Cache and Carry can replenish a users content over wireless and Wi-Fi networks based on user-defined rules (e.g., what has been previously viewed or not accessed over a certain period of time can be replaced by newer, more relevant content), thus giving the user a perceived infinite amount of storage capabilities.

## New Directions in Information Management and Digital Rights Management

As secure networking technologies and standards continue to emerge, Liquid Media and Cache and Carry technologies will enable a users' content to flow seamlessly in and out of their homes. However, rendering content across multiple platforms, on an open, wired/ wireless, IP-based network raises a host of problems that have yet to be resolved. Who owns the content? Does the end user have permission to play it anywhere, on any device? How is multi-platform revenue tracked for content owners? Can the user copy content for personal use? For distribution to a friend?

Motorola is collaborating with digital rights management groups like the Coral Consortium to help create agreements that will make content-sharing transparent and seamless. Currently, Motorola is developing the software necessary for translating content and rights between multiple devices and partnering with media providers to resolve the digital rights questions inherent in fully portable music, movies, and TV programs. Digital rights management combined with security technologies from Motorola Labs are now part of standards being adopted in both the cable (Cable Labs) and cellular industries (OMA).

Motorola is also developing technology solutions based on the movement of content around a group of devices it calls the "family domain." Typically, digital rights management systems are able to share content between devices in a home domain, but only if the devices use the same DRM system. By establishing a Domain Authority (DA) server that installs a common DRM private key on each of the user's devices, monitoring and controlling all DRM transactions is possible. A secure perimeter is established and devices inside the domain have full access to the content associated with the key. Instead of dealing with media providers on a play-by-play basis, users can ensure the initial membership of their devices within the family domain. The family domain is a trusted system and all devices within the system are allowed to use the protected media.

This family domain description is a best-case scenario that can only be realized if there is cooperation between digital content providers and collective support for secure, licensed import/export of content within a domain. Motorola is investing heavily to develop the business ecosystem and underlying technology to enable sane and interoperable DRM by creating the means to move content across DRM domains.

## Looking Forward

Making the consumption of content easier, more enjoyable and more ubiquitous for the user is at the heart of Motorola's Seamless Mobility efforts. As devices get smarter, broadband becomes faster and more readily available and the amount of available digital content grows, Motorola understands that ARPU will not be derived solely in providing content and bandwidth alone, but rather in providing experiences that are unique for each customer. Applications will need to run on multiple devices and across networks. Services will need to be accessible and user preferences will need to be transportable between devices and across networks. This requires bridging gaps between personal, business, mobile and automotive environments. Working with business partners, network operators and service providers alike, Motorola will help enable unique content experiences for users of mobile devices, services and technologies.

The prospects for a world where technology works on behalf of the user to make content easier to find, play, move across devices and share with friends, family and colleagues are looking better everyday.



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