



Technical Brief

NVIDIA ForceWare Multimedia Application

A Networked Approach for Storing
and Viewing Broadcasted
Television Programs





Bringing Television to PC Networks

PC users have long expressed interest in viewing television programming on their desktop and notebook PCs. However, system throughput, networking bandwidth, and other technical challenges kept affordable solutions out of reach. Now, PCs and networks provide an increasing range of multimedia experiences, such as streaming timeshifted television broadcasts or archiving video over the network. There are two limiting cost factors, though, for bringing television to applicable displays—duplicating the broadcast reception and installing adequate storage space on every PC desktop.

NVIDIA, a market leader in developing advanced graphics processing units (GPUs) and media and communications processors (MCPs), overcomes the storage obstacle with its networked approach for delivering television to PCs. With the personal video recorder (PVR) technology provided by the NVIDIA® ForceWare™ Multimedia application, PC users can access timeshifted and stored television programs from a video server anywhere on the local network.

This approach lets users view programs on computer displays instead of the traditional television screen. Recording and playback functions—once limited to videocassette recorders (VCRs) or expensive set-top devices—now can be merged onto the network, eliminating the need for duplicate hardware for multiple users. And on huge networks, multiple video servers give users access to a large, constantly updated library of stored programs and content.

This paper provides an overview of the NVIDIA implementation, server functionality, and user capabilities for this latest advancement in the multimedia PC experience.

The NVIDIA Implementation

The ForceWare Multimedia PVR solution provides these features:

- ❑ Flexible allocation of storage for program buffering and recording
- ❑ Efficient use of networking resources
- ❑ Maximum configuration flexibility
- ❑ Full control over content sharing
- ❑ Easy-to-use interfaces
- ❑ Full-function monitoring capabilities

Content Storage

A circular buffer that consists of ten files on the hard disk is used to store and view live programs. The buffer supports timeshifting for performing the virtual rewind, fast-forward, and pause operations on content.

Here's a typical scenario of a viewer using a buffer large enough for ten hours of content, with four hours of stored programs:

- ❑ If the viewer watches live television, six hours of buffer space would be available.
- ❑ If the viewer watches one channel for six continuous hours, the buffer would be full and the viewer could “rewind” to the show broadcast six hours earlier.
- ❑ If the viewer changes channels during the six hours, the buffer would continue to fill—but with a stream of video from the different channel.

Also, users can control the storage location of the timeshift and record buffer. Each buffer can be specified as a set amount of total disk space (megabytes) or can be limited to the size required to store a designated amount of content (as measured in program viewing hours). The size of the timeshift buffer is easily adjusted to free up storage space for other higher priority applications, or to increase the allocated storage space for recorded programs.

To make sure users maintain complete control of their system, the user can password-protect any content and the command functions for the server. This lets parents impose parental control for television viewing on networks in the home.

Server Broadcasting and Client Connections

The ForceWare Multimedia application ensures that network resources are used efficiently, and that television viewing doesn't overload networks experiencing limited bandwidth or heavy traffic. To accomplish this, ForceWare Multimedia utilizes these capabilities:

- ❑ Multicasting
 - Servers regularly use multicasting to broadcast the status and availability of content, but do not broadcast the actual content list. Multicasting techniques minimize the network overhead for communicating this information between servers and clients.
- ❑ Distributed Component Object Model (DCOM)
 - Domain/workgroup content broadcasting applies DCOM concepts to provide a solution that is transparent across the network. Clients can only access servers in the same domain.

Controlling Access and Content

A server/client privilege model builds in multiple control functions to the server component of the ForceWare Multimedia application.

- ❑ The client PC cannot initialize a connection to a server PC unless
 - The server PC is not acting as a firewall.
 - All server and client PCs are connected to other computers through a router or hub.
 - Microsoft Windows sharing is enabled.
 - Sharing through the ForceWare Multimedia application is enabled.
 - Sharing for each piece of content (timeshifted TV and recorded TV) is enabled.
- ❑ Designate shared/private content: The server PC can control which content, and how much content, is made available to the network—whether the content is live or recorded. Users can block inappropriate channels or programs, or restrict viewing to certain hours of the day.
- ❑ Designate parental restrictions: Children can be blocked from viewing inappropriate content, based on the industry ratings for each broadcasted program.
- ❑ Disable all sharing from the server: Servers can discontinue broadcasting their availability if the local user requires maximum system performance and resources for local tasks.
- ❑ Disconnect clients: Servers can disconnect a client any time to free up system resources, if needed.

User Interface

The ForceWare Multimedia application provides an intuitive user interface (UI), including an electronic programming guide (EPG) for convenient program selection (Figures 1 and 2).



Figure 1. The ForceWare Multimedia Intuitive Interface

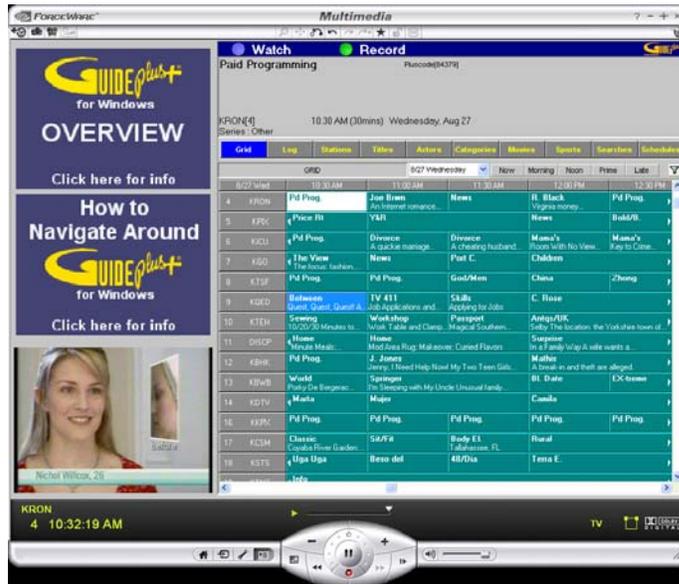


Figure 2. The ForceWare Multimedia Electronic Programming Guide

Monitoring Functions

The server UI streamlines tasks for monitoring and controlling the allocation and use of server resources. Each client request results in a notification to the server interface. This lets the user on the server system monitor the activity in real time by quickly glancing at the monitoring display (Figure 3).



Figure 3. Easy-to-Use Interface Simplifies Viewing and Using Resources on the Video Server PC

Using ForceWare Multimedia

The ForceWare Multimedia application brings television viewing and VCR-like storing capabilities to entire networks of PC users. Designated video servers—PCs whose graphics boards include integrated television (TV) tuners or standalone television tuners, plus adequate disk storage space for storing television programs—receive requests from clients that wish to view or download programs.

Timeshifted television can be streamed to a requesting client, or future programs can be added to a recording list. Users can designate the amount of disk space for storing recorded programs on the server, which gives them complete control over the resource utilization. Similarly, using permission levels restricts access by unauthorized users, and limits program viewing based on user-specified parameters. Or, permission levels disable sharing on the video server if the PC is required for higher priority tasks.

Also, networks can be configured to provide clients with access to multiple video servers, making television programs easily accessible over the network—just like printers and other shared devices, but without requiring installation of a TV tuner at the client (Figure 4).



Figure 4. One Configuration of a Server and Clients

Client PC Capabilities

From within a window, or in full-screen mode, PC users can view timeshifted or stored television programs on their desktop or notebook systems. ForceWare Multimedia includes client capabilities for the following activities.

- ❑ Channel surfing and viewing live programs: Clients can connect to an available video server on the network for viewing live broadcasts.
- ❑ Pause/rewind/fast-forward of live programs: The server automatically buffers live television in a timeshift buffer, letting clients pause a live show or rewind and replay a portion of the current show. In addition, the client can fast-forward and skip forward/backward in “n” seconds.
- ❑ Electronic program guide (EPG): Similar to some digital cable and satellite television service providers, ForceWare Multimedia provides an electronic program guide that lets users change channels on the server by using the EPG. Clients and servers have their own Gemstar EPG client that captures show information.
- ❑ Mobile content: Content can be synchronized and downloaded to the client PC hard disk, letting users take TV programs on their notebooks when they are going to be away from the local network. Show data is sent during the synchronization, so users still have access to the show name, description, and air date.
- ❑ Exclude servers: In a domain or workgroup with many servers, a client can exclude servers to limit the content the client is interested in seeing. This capability helps speed up locating the content.

Server Functionality

On the local network, video servers equipped with ForceWare Multimedia server technology can perform the following tasks.

- ❑ Deliver live and recorded television: A client request initiates server streaming or downloading timeshifted or stored programs.
- ❑ Scheduling program recordings: Users can record shows for future viewing. Requested programs are put into the recording list on a server that has that timeslot unreserved. Users can stream a recorded program and pause, fast-forward, or rewind at any point during viewing. Selections can be made manually (such as Channel 2, 11:00 A.M, every Tuesday, and every 30 minutes) or using the EPG. In either case, all show data is stored with the recording in the media library.
- ❑ Monitor the system: With the integrated ForceWare Multimedia UI, the user of the video server PC can easily monitor and control the resource utilization and impact of server tasks on overall system performance.
- ❑ Protect content: Stored or timeshifted programs can be designated for unrestricted viewing, or limited to a subset of the shows. Without restrictions, all stored content on the server can be viewed or downloaded by any client on the network.
- ❑ Go offline: Servers can be designated as unavailable for requests from ForceWare Multimedia clients on the network.

Summary

The ForceWare Multimedia application is a new approach for enabling PC users to view television content on their computer displays. The networked server/client model maximizes the sharing of television receiver hardware, and eliminates the need for televisions, VCRs, and intelligent set-top recording/playback devices for viewers.

With comprehensive control functions and intuitive user interfaces, ForceWare Multimedia provides a complete viewing solution that can be tuned to meet the requirements of any family or other networked group of users. The ForceWare Multimedia application let users gain even more value from their local area networks.



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