Intel® 830M Chipset Dynamic Video Memory Technology

White Paper

November 2001

Document Number: 298638-001

Contents

Tables

Revision History

Revision.	Description	Date
-001	• Initial Release.	November 2001

1 Introduction

This document describes the Memory Allocation and Usage Model for the Intel® 830M chipset with the PV 10.x Display Drivers. This document assumes that the reader already has an understanding of the feature set of the Intel 830M chipset.

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2 Overview

2.1 Dynamic Video Memory Technology

The Intel® 830M chipset features two modes of operation pertaining to its handling of video memory. The Intel® 830M chipset supports the Rambus* memory system and can be used as a dedicated Graphics Controller-Local for the RDRAM* device, hereon referred to as Local Memory (also known as Local Video Memory or LVM). If this memory sub-system is not present, then Intel® 830M chipset will allocate memory as is described in this document. If Local Memory is present in the system, no memory is pre-allocated or allocated from system memory. This document describes the method of memory allocation where Operating System, Application and Graphics Memory come from the one unified System Memory pool known as Unified Memory Architecture (UMA).

Dynamic Video Memory Technology (DVMT) is an enhancement of the UMA concept, wherein the optimum amount of Memory is allocated for balanced Graphics and System performance, through Direct AGP known as Non-Local Video Memory (NLVM), and a highly efficient memory utilization scheme. DVMT ensures the most efficient use of available memory – regardless of frame buffer or main memory sizing – for maximum 2D/3D Graphics performance. DVMT dynamically responds to system requirements, and applications demands, by allocating the proper amount of display, texturing and buffer memory after the operating system has booted. For example, a 3D application when launched may require more vertex buffer memory to enhance the complexity of objects, or more texture memory to enhance the richness of the 3D environment. The operating system views the integrated Graphics driver as an application, which uses Direct AGP to request allocation of additional memory for 3D applications, and returns the memory to the Operating System when no longer required.

2.2 Legacy VGA/SVGA Memory

While DVMT is a unique architecture, that can use a variable amount of the system memory, for Graphics and System Operation, adjusting the balance on-demand. The 830M chipset also supports the selection of three different sizes of pre-allocated memory: 512 KB, 1MB or 8MB. This amount is chosen via the system BIOS setup as a setup option. This pre-allocated memory selection is supplied for legacy VGA and SVGA Graphics support and compatibility.

Upon boot, the System BIOS will pre-allocate the amount selected (512 KB, 1MB, or 8MB) from the top of the main system memory, and this will be dedicated for VGA/SVGA Graphics. Example of when VGA Graphics Memory is needed includes usage for High-Resolution Games and Applications run from a DOS or Legacy Operating System, where there is no Intel DVMT Graphics Driver loaded. Once the operating system boots this pre-allocated memory is not seen, and is not visible by the operating system. The Intel 830M Integrated Graphics device will treat this memory as a true dedicated frame buffer. If an operating system is booted with an Intel Graphics Driver loaded, the Graphics driver will then reclaim the pre-allocated memory for use, but the operating system may never use this memory, and it is not available to Applications except as Graphics Memory.

Note: The BIOS pre-allocates memory that the OS is not aware of, nor is the OS capable of reclaiming this memory. The Intel DVMT Graphics Driver allocates by requesting memory, from the OS, through OS supported memory allocation methods.

3 DVMT 2.0 Graphics Memory Footprint

Upon boot, the System BIOS examines if Local Memory is present, or if Legacy Graphics Memory is indicated via the BIOS Setup option. If Local Memory is present and enabled, then no additional system memory will be allocated.

Upon operating system initialization, the PV 10.x Graphics Drivers will also determine if Local Memory is available or if not. If Local Memory is present then no additional system memory is allocated, except as may be requested by Application that require Non-Local Video Memory allocation as is normally done for AGP Graphics Adapters. If Local Video Memory not available the driver determines the size of memory needed and will make additional Non-Local Video Memory requests to achieve the amount needed for the Display and Application graphics memory operational footprint.

3.1 Factors in Footprint Variance

The Intel® 830M chipset UMA memory footprint is determined using several factors. It varies widely depending on several key factors. The key factors are system resources and system activity. Unlike the Intel® 81x family the 830M chipset memory footprint is not static. It will vary in size as system requirements and demands vary. For example, when running a DVD in a window on the desktop then memory is needed for the DVD and the background desktop, but when running a DVD full screen then the desktop frame-buffer may be discarded, or allowed to be paged back to disk. This is the most efficient memory utilization.

A DVD is just one of many activities that could effect memory allocation. This section will describe some of the factors that aid in the request made to the OS for page locked memory. The OS does not always grant Graphics driver's memory request.

3.2 Base Allocations

Part of the Graphics memory allocation is independent on system activity. These are base allocations that the driver request at the time it loads. For the 830M chipset platform, the driver allocates 204 KB for the command ring buffer and cursor/context buffer memory on all operating systems.

Once loaded, the operating system and Graphics driver allocates the buffers that the driver needs for performing Graphics operations. The total Graphics footprint allocates memory for commands, the frame buffer (resolution), the Z-buffer, GDI data and off-screen memory.

When Local Memory is not installed, and all Graphics Memory is being allocated from system memory, the total DVMT Graphics footprint in system memory is capped to an upper-limit ensuring the best usability and performance of the OS, Applications and Graphics. For systems with 64MB, the upper limit is 8MB. For systems containing memory between 128MB and

255MB of system memory, the limit is 32MB for graphics memory. For systems containing 256MB and above, the limit is 48MB for graphics memory. Systems between 64MB and 127MB are not supported by the 830M chipset platform utilizing internal graphics. See Table 1for all graphics memory allocations.

Table 1 - Graphics Memory Allocations

System Memory	Maximum Memory Allocated for Graphics
64 MB	8 MB
64 MB – 127 MB	Not Supported; Not Validated
128 MB – 255 MB	32 MB
256 MB – Max Memory	48 MB

In the following scenarios formulas will be given to help calculate what the driver may request for Graphics memory.

Note: The driver utilizes pre-allocated memory before it makes request to the OS and the memory calculated below is in addition to the 204 KB that is allocated once the driver is loaded.

Table 2 - Acronym Definition

Abbreviation	Definition
PDTH	Primary Desktop Height
PDTW	Primary Desktop Width
PDTCD	Primary Desktop Color Depth (Bytes)
SDTH	Secondary Desktop Height
SDTW	Secondary Desktop Width
SDTCD	Secondary Desktop Color Depth (Bytes)
DVDH	DVD Height
DVDW	DVD Width
DVDCD	DVD Color Depth (Bytes)
GH	Game Height
GW	Game Width
GCD	Game Color Depth (Bytes)

3.3 Desktop (Shell/User-Interface only) Memory Requirements

Table 3 – Desktop Only Memory Usage

Idle Desktop Scenario	Formula	Comments
Single Pipe Idle Desktop	(PDTH x PDTW x PDTCD)	
Dual Pipe Idle Desktop	(PDTH x PDTW x PDTCD) + (SDTH x SDTW x SDTCD)	This takes into account both desktops.

3.4 DVD Scenarios

Table 4 - DVD Memory Usage

DVD Scenario	Formula	Comments
Single Pipe DVD in Window	(PDTH x PDTW x PDTCD) + (DVDH x DVDW x DVDCD)	This takes into account the desktop and DVD that is playing.
Single Pipe Full Screen DVD	(DVDH x DVDW x DVDCD)	We can discard the desktop because it cannot be seen.
Dual Pipe DVD in Window	(PDTH x PDTW x PDTCD) + (DVDH x DVDW x DVDCD) + (SDTH x SDTW x SDTCD)	This takes into account both desktops and the DVD.
Dual Pipe Full Screen DVD	(DVDH x DVDW x DVDCD) + (SDTH x SDTW x SDTCD)	The primary desktop can be discarded because the DVD is full screen.

3.5 3D Game Scenarios (3D Applications)

Table 5 - 3D Game (3D Applications) Memory Usage

Game Scenario	Formula	Comments
Single Pipe Game in Window	(PDTH x PDTW x PDTCD) + 4*(GH x GW x GCD)	This takes into account the desktop and the game that is being played. Note: The game could be triple buffered and utilize the Z/W buffer. That is why there is a 4X multiplier.
Single Pipe Full Screen Game	4*(GH x GW x GCD)	We can discard the desktop because it cannot be seen.
Dual Pipe Game in Window	(PDTH x PDTW x PDTCD) + 4*(GH x GW x GCD) + (SDTH x SDTW x SDTCD)	This takes into account both desktops and the Game.
Dual Pipe Full Screen DVD	4*(GH x GW x GCD) + (SDTH x SDTW x SDTCD)	The primary desktop can be discarded because the Game is full screen.

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4 Reported Video Memory

In systems using an Intel Direct AGP chipset, such as when using the Intel® 830M chipset with PV 10.x Display Drivers, end users will be presented with various messages/displays concerning "video memory size". This section describes the messages displayed by the operating system, video BIOS and driver.

4.1 Video BIOS POST message

Users may first be presented with "video memory size" messaging in the video BIOS "splash" or "boot" message. This message displays the amount of main system memory that will be used solely for video BIOS purposes. DOS, for example, will use only this memory for display. Video BIOS will use either 512 KB, 1MB or 8MB based on system BIOS settings. From the operating system perspective, this memory is logically removed from the system so that it is invisible (for example, a 128MB system using an 8MB setting in system BIOS will report 120MB of TOTAL system memory). This is the pre-allocated memory already mentioned in section 2.2.

4.2 System BIOS POST message

During POST, some system BIOS displays the amount of Local Memory installed in the system. This will be either 16MB or 32MB if Local Memory is installed.

4.3 Microsoft* Windows NT* 4.0, Windows* 2000, and Windows* XP Operating System "Display Adapter" Property Page

Microsoft* Windows NT* 4.0, Windows* 2000 and Windows* XP operating systems contain a standard display property page that is displayed when the "Adapter" tab (with NO icon) is selected. This page displays the maximum amount of local, frame-buffer memory possible by the Graphics device. This page will display only the Local Memory installed. For example, if the Intel 830M chipset design has 16 MB of Local Video Memory (RDRAM* memory) on the motherboard then this property page would show 16 MB. If there is no local memory installed then this page will report the pre-allocated memory.