SYSmark® 2007

An Overview of SYSmark 2007 Preview

May 2008
Revision 1.0

About BAPCo:

A non-profit consortium, the Business Applications Performance Corporation's (BAPCo) charter is to develop and distribute a set of objective performance benchmarks based on popular computer applications and industry standard operating systems.

BAPCo and its current members include: AMD, Apple, ARCintuition, Atheros Communications, CNET, Compal, Dell, Hewlett-Packard, Intel, Lenovo, Microsoft, NVIDIA, Sony, Toshiba, VIA Technologies, VNU Business Publications Limited (UK), ZDNet and Ziff Davis Media. BAPCo is a non-profit consortium with a charter to develop and distribute a set of objective performance benchmarks based on popular computer applications and industry standard operating systems.

Table of Contents:

1.0   Introduction

BAPCo is a non-profit consortium with a charter to develop and distribute a set of objective performance benchmarks based on popular computer applications and industry standard operating systems.

SYSmark® 2007 Preview is the latest revision of the benchmark used to characterize the performance of a business client, now with support for Microsoft Windows Vista*. It builds upon BAPCo's extensive work in building benchmarks to evaluate platform technologies.

SYSmark 2007 Preview contains a variety of workloads that represent a range of activities that a desktop worker may encounter.

Benchmarks designed by BAPCo are the result of cooperative development between industry leading companies from a variety of disciplines including publications, testing labs, PC manufacturers, and semiconductor manufacturing. BAPCo's array of members represents the breadth of the computing industry and harnesses a consortium of knowledge to better reflect today's and tomorrow's emerging business trends.

This document describes the methodologies deployed in the development of SYSmark 2007 Preview. For detailed instructions on how to install and run SYSmark 2007 Preview, please refer to the documentation provided on the DVD-ROM and/or the BAPCo web site (www.bapco.com).

2.0   Development Methodology

BAPCo follows a development cycle in which it applies its standard development methodologies to a set of parameters driven by usage categories, usage models within the categories, software market segment indicators and technical feasibility. These parameters, along with the application of logical and physical workload characteristics, determine the composition of workloads in SYSmark.

The benchmark development process begins with identification of business usage categories of personal computers. Various usage models are then brought together as user interactions for each of the scenarios.

BAPCo domain experts and members join together in multiple development sessions to collaborate and develop the workload. BAPCo developers then implement the workload while satisfying benchmarking constraints to ensure correct implementation, relevant and objective workloads and feasible distribution of the benchmark.

The SYSmark 2007 Preview workload development process aims to produce representative application workloads for the benchmark. Each application workload consists of three elements: the input data set, operations performed on the input data set and the generated output. An example of generated output would be an image generated through an iterative process of steps to create a desired appearance. These three elements of the workload are used to represent the workflow of a typical user skilled in each given application.

2.1 Identifying Usage Categories

BAPCo has identified four distinct business usage scenarios for SYSmark 2007 Preview:

- **E-Learning:** Tasks executed in the development of an on-line teaching facility. Integrates rich image, video, and audio content in a web page for presentation of learning materials using programs predominantly from Adobe cumulating in the creation of an Adobe Flash file.

- **Video Creation:** Executes the creation of a video using special effects and images from multiple sources. Content is created for both online streaming transfer and high-resolution download viewing.

- **Office Productivity:** Models data analysis as performed with common office applications. Communication, data processing, project management, and file manipulation comprise this scenario.

- **3D Modeling:** Tasks to develop an architectural presentation of a prospective construction project. A flyby animation is created and photorealistic image of the completed building.

2.2 Applications and Document types

BAPCo identified the following applications and representative document types that the applications would operated on for each of the four scenarios.

Application	Version	Document Type
Video Creation		
Adobe* After Effects*	7.0	Special effects to be added to movies
Adobe* Photoshop*	CS2	Images, manipulated, compressed
Sony* Vegas*	7.0	Digital Movie
Microsoft Windows Media Encoder	9 Series	Compressed soundtracks and videos
Adobe* Illustrator*	CS2	Images manipulated

Table 1 - SYSmark 2007 Preview – Video Creation Applications

Application	Version	Document Type
E-Learning		
Microsoft* PowerPoint*	2003	Presentation
Adobe* Photoshop*	CS2	Images, manipulated, compressed
Adobe* Flash	8	Vector Graphics, Animation
Adobe* Illustrator*	CS2	Images manipulated

Table 2 - SYSmark 2007 Preview – E-Learning Applications

Application	Version	Document Type
Productivity		
Microsoft* Project*	2003	Project management
Microsoft* Excel*	2003	Calculation sheets
Microsoft* Outlook*	2003	Emails, calendars, scheduler
Microsoft* PowerPoint*	2003	Slide presentations
Microsoft* Word*	2003	Formatted text documents
WinZip Computing WinZip	Pro 10.0	Compressed Archives

Table 3 - SYSmark 2007 Preview - Office Productivity Applications

Application	Version	Document Type
3D Modeling		
Autodesk* 3ds max*	8.0	3D rendered images, 3D vector scenes/models
SketchUp*	5	3D scene

Table 4 - SYSmark 2007 - Preview 3D Applications

Application versions of the applications are summarized in Appendix A.

2.3   Description of the Scenarios

E-Learning
The user views a presentation directing the production of a web based interactive training tool. The user edits a variety of images, in bitmap and vector graphics formats, making visual quality changes, resizing and saving to new formats for use in the training material. The user creates a PDF file of a group of images, and an image is converted from bitmap to vector graphics format. The user completes the training tool by importing the edited images, as well as previously created audio and video clips. The user publishes the resulting tool in a web compatible format.

Video Creation
A user processes a variety of content to create a video. The user edits a group of images, making visual quality changes, resizing and saving them to new formats. The user encodes multiple videos for use in creating a final composite video. All of the separate pieces are assembled, creating a final uncompressed video. From this uncompressed video, two versions with different amounts of compression are created. One, targeted for downloading, with less compression, the other targeted for streaming, with more compression.

Productivity
The user opens a file and searches, the document for a keyword. The user continues the search in an e-mail application. The user archives the entire inbox, before sending a new e-mail.   The user opens spreadsheets to perform iterative data analysis.   While performing this analysis, documents and email data are compressed into a single file. Opening a presentation, the user imports slides from another presentation along with a spreadsheet. Returning to the spreadsheet, the user organizes the data and formats the data for readability.   The user opens a project management tool, performing data management tasks before creating a web format based copy of the schedule.

3D Modeling
The user opens a 3D model, rendering it out to a high-resolution image. The user opens an architectural scene, exporting the scene to a different 3D modeling format. The user then renders an animated flyby of the scene.

2.4 Constructing the Workload

BAPCo found general behavioral trends common to many usage categories. When constructing the workloads, these characteristics were included to make the workloads more realistic.

Switching between applications
Business users frequently have several applications operating at the same time. For example, a professional often has many components of Microsoft Office 2003 (e.g. Word, Excel, or PowerPoint) open at the same time and switches back and forth between these components. Thus, the workloads defined by BAPCo include opening and leaving applications open while work is being done in another application.

Concurrent execution
In addition to switching between applications, it was observed that often a user would be actively working with one application while another application was performing work in the background. For example, a user could have file compression occurring in the background while documents in the foreground were displayed.

Paced Input
It was observed that business users do not send their user inputs in bursts. Input is instead provided with pauses between some of the operations (e.g. the user reviews the results of his request before proceeding with the next operation). Some of the input operations are paced to reflect this real-world functionality.

2.5 Automation and Workload Integration

The final step in creating SYSmark 2007 Preview is translating the workload into an automated benchmark. SYSmark 2007 Preview emulates a user interacting with the computer through deterministic delays and paced input. These commands are converted into scripts which are used by the benchmark to control each of the individual applications included in SYSmark 2007 Preview.

To ensure the benchmark is deterministic, BAPCo uses a framework to install applications, run the scripts, record and display the performance results (for screen shots of the applications running through the framework, see Appendix C.) The measurement methodology used by the framework is explained in section 3.0.

The fundamental performance unit in SYSmark 2007 Preview is *response time.* Response time, in the context of SYSmark 2007 Preview, is defined as the time it takes the computer to complete a task that has been initiated by the automated script. The task can be initiated by a mouse click or a keystroke from the keyboard. The completion of the task is automatically captured by the framework.

For example, the response time for the PDF Presentation command in Photoshop CS2 is the time measured between selecting the "Save PDF" button in the Save PDF dialog and the elapsed time in which Photoshop CS2 brings up the completion dialog message. In SYSmark 2007 Preview, only the response time of individual operations is included in the performance metric.

3.0 SYSmark 2007 Preview Scoring Methodology

SYSmark 2007 Preview adds the individual response times of all operations within a scenario (e.g. E-Learning, see section 2.1) and uses the total response time to compare against those from the calibration system which is used to generate a baseline. The scoring methodology reflects BAPCo's decision to reward the responsiveness of a system.

Tables 1 through 4 illustrate the applications that constitute the four scenarios (E-Learning, Video Creation, Office Productivity, and 3D Modeling) which comprise SYSmark 2007 Preview.

Scenario Rating
Each of the four scenarios has a rating calculated by taking the sum of duration of operations that constitute that scenario and then comparing it with the equivalent sum of the duration of operations on the calibration system (see section 3.1). The scenario rating is calculated by dividing the sum of the duration of operations in that scenario on the calibration system by the sum of the duration of operations on the test system and multiplying by 100. The result is then rounded to the nearest integer.

SYSmark 2007 Preview Overall Rating
The SYSmark 2007 Preview overall rating is calculated by taking the geometric mean of the four scenario ratings (E-Learning, Video Creation, Office Productivity, and 3D Modeling). The SYSmark 2007 Preview rating is rounded to the nearest integer.

3.1 Calibration System

Each time SYSmark 2007 Preview is executed on a PC, it calculates a performance rating for each of the four scenarios. For example, a SYSmark 2007 Preview rating of 100 indicates the test system has a performance equal to that of the calibration platform. A rating of 200 indicates the test system has twice the SYSmark 2007 Preview performance of the calibration platform.

The SYSmark 2007 Preview calibration platform has the following configuration:

CPU	
Manufacturer	Intel
Model	Core 2 Duo E6300
Speed	1.86 GHz
Stepping	B2
Motherboard	
Manufacturer	Intel
Model	DP965LT
Revision	206
BIOS Version	1577 (11/15/2006)
BIOS Settings	Load Optimal Settings, change memory timing
INF Version	8.1.1.1010
Audio Driver	5.10.5208 (without Audio Studio or Legacy)
LAN Driver	11.1
Host Management Driver	2.1.22.1026
Memory	
Manufacturer	Micron
Model	16HTF6464AY-667B4
Type	DDR2 5300
Size	2 x 512 MB (1 GB total memory)
Speed	667 Mhz
Latency	5-5-5-15 (using manual timing in BIOS)
Video Card	
Manufacturer	Nvidia
Model	7100GS
Memory	128 MB
Driver	ForceWare 93.71
Revision	A1
Hard Drive	
Manufacturer	Maxtor
Model	DiamondMax 20 7200.10
Size	160 GB
RPMS	7200
Cache	8 MB
Interface	SATA2
Firmware	3.AAJ
Optical Drive	
Manufacturer	Sony
Model	AW-Q170A
Type	Dual Layer DVD±RW Writer
Floppy Drive	
None	
Power Supply	
Manufacturer	Sparkle Power
Model	FSP550-60PLG
Power	550 Watts
Case	
Manufacturer	Antec
Model	SLK3000B
Operating System	
Manufacturer	Microsoft
Version	Windows XP Pro w/SP2 (32 bit)
Build	2600
DirectX Version	9.0c
OS Options	
Display Resolution	1280x1024, 60 Hz
System Restore	Off
Windows Update	Off
Screen Saver	Off
Power Management	Off

Please note that minimum requirements are listed in appendix A and differ from the calibration system.

4.0 System Characteristics of SYSmark 2007 Preview

The characteristics of SYSmark 2007 Preview are examined with respect to the different system components. These components include the CPU frequency, main memory, disk I/O, video card and display resolution. For each of these studies only one system component (e.g. CPU frequency) is varied. All the other system components are held constant.

4.1 CPU Frequency

The CPU frequency of a system is changed from 2.40 to 2.93 GHz. The data in Table 3 illustrates that the 3D modeling scenarios scales close to CPU frequency. The Video Creation scenario is least affected by frequency changes.

CPU Frequency(GHz)	2.40 (Intel Core 2 Duo processor E6600)	2.67 (Intel Core 2 Duo processor E6700)	2.93 (Intel Core 2 Extreme processor X6800)
Frequency	baseline	11 %	22 %
SYSmark® 2007 Preview Rating	**baseline**	**9 %**	**16 %**
E-Learning	baseline	9 %	16 %
Video Creation	baseline	6 %	9 %
Office Productivity	baseline	10 %	17%
3D Modeling	baseline	11 %	20 %

Table 3: SYSmark 2007 Preview - CPU Frequency Sensitivity (i975BX2 motherboard, 2 GB DDR 800 memory, Maxtor 300GB, 1024x768 video resolution, ATI X1900 video card, Windows Vista)

4.2 Main Memory

Main memory of a system is changed from 1 GB to 2 GB to 4 GB. Table 4 illustrates that Video Creation is the most sensitive, changing by up to 19% when moving from 1 GB to 4 GB. 3D Modeling is the least susceptible to memory size changes.

Main Memory (MB)	1 GB	2 GB	4 GB
SYSmark® 2007 Preview Rating	**baseline**	**8 %**	**11 %**
E-Learning	baseline	8%	13 %
Video Creation	baseline	18 %	19 %
Office Productivity	baseline	5 %	9 %
3D Modeling	baseline	1 %	1 %

Table 4: SYSmark 2007 Preview - Main Memory Sensitivity (Intel Core 2 Extreme processor X6800 (2.93 GHz), i965WH motherboard, Maxtor 300GB, 1024x768 video resolution, ATI X1900 video card, Windows Vista)

4.3 Disk IO

The disk drive is changed as demonstrated below. Table 5 illustrates that the 3D Creation group is the least affected component with a rating increase of only 2%. The Video Creation and Office Productivity module are most affected by IO changes.

Hard Drive Sensitivity	160 GB Seagate 150MB/s External Transfer Rate (8MB cache, 7200 RPM)	300 GB Maxtor 300GB 1.5GB/s External Transfer Rate (16 MB Cache, 7200 RPM NCQ)	74 GB WD Raptor 74GB 1.5GB/s ETS (16 MB cache, 10,000 RPM, NCQ)
SYSmark® 2007 Preview	baseline	7 %	10 %
E-Learning	baseline	1 %	1 %
Video Creation	baseline	14 %	21 %
Office Productivity	baseline	17 %	19 %
3D Modeling	baseline	-1 %	2 %

Table 5: SYSmark 2004 - Disk IO Sensitivity (Intel Core 2 Extreme processor X6800 (2.93 GHz), i975BX2 motherboard, 2 GB DDR 800 memory, Maxtor 300 disk drive, 1024x768 video resolution, ATI X1900 video card Windows Vista)

4.4 Video Graphics sub system

Table 6 illustrates ratings on a system with integrated graphics and a discrete card. E-Learning is the most sensitive with an 11% improvement, while 3D modeling did not demonstrate any sensitivity to video graphics. Overall SYSmark 2007 Preview shows a 4% improvement.

Video Display	Integrated (i965G)	ATI X1900 (512 MB)
SYSmark® 2004 Rating	Baseline	4 %
E-Learning	Baseline	11 %
Video Creation	Baseline	4 %
Office Productivity	Baseline	2 %
3D Modeling	Baseline	0 %

Table 6: SYSmark 2007 Preview - Video Graphics sub system Sensitivity (Intel Core 2 Duo processor E6700 (2.66 GHz), i965WH motherboard, 1 GB memory, Maxtor 300 disk drive, 1028x768, Windows Vista)

5.0 Conclusion

SYSmark® 2007 Preview is the latest revision of the benchmark used to characterize the performance of a business client, now with support for Microsoft Windows Vista*. It builds upon BAPCo's extensive work in building benchmarks to evaluate platform technologies.

SYSmark 2007 Preview contains a variety of workloads that represent a range of activities that a desktop worker may encounter.

Benchmarks designed by BAPCo are the result of cooperative development between industry leading companies from a variety of disciplines including publications, testing labs, PC manufacturers, and semiconductor manufacturing. BAPCo's array of members represents the breadth of the computing industry and harnesses a consortium of knowledge to better reflect today's and tomorrow's emerging business trends.

These factors, amongst other numerous enhancements, affirm SYSmark® 2007 Preview as the premier business client benchmark and extend the BAPCo family of business benchmarks, which have been widely accepted by IT Managers, PC OEMs, media and analysts worldwide.

APPENDIX A: Application Program Versions

- Adobe® After Effects® 7
- Adobe® Illustrator® CS2
- Adobe® Photoshop® CS2
- Autodesk® 3ds Max® 8
- Adobe® Flash 8
- Microsoft® Excel 2003 SP2
- Microsoft® Outlook 2003 SP2
- Microsoft® PowerPoint 2003 SP2
- Microsoft® Word 2003 SP2
- Microsoft® Project 2003 SP2
- Microsoft® Windows Media™ Encoder 9 series
- Sony® Vegas 7
- SketchUp 5
- WinZip® 10.0

BAPCo's SYSmark 2007 supports Windows® Vista™ and Windows® XP (Professional and Home) with Service Pack 2. SYSmark 2007 Preview requires 1 GB system RAM, an Intel® Pentium® 4 processor 2.8 GHz or AMD Athlon® 64 2800+ processor, 30 GB free hard disk space and a DVD-ROM drive.

APPENDIX B: Proportional Application Contribution to the Score as Measured on the Calibration System

Application contributions to each group are determined not by the physical time that is spent in the application but by response time of each application. Response time, in the context of SYSmark 2007 Preview, is defined as the time it takes the system to complete a task that has been initiated by the user. The application contribution will change on different systems.

Note: Due to system implementation differences, the figures below are accurate for the calibration system only; the response times and distributions will vary somewhat from system to system. It is appropriate, though, to study the calibration system's behavior so as to allow a more complete understanding of the SYSmark 2007 Preview benchmark.

| Scenario	Application	Proportional Contribution
E-Learning	Adobe Flash	52 %
	Adobe Photoshop CS2	28 %
	Adobe Illustrator CS2	20 %
	Microsoft PowerPoint	< 1 %
Video Creation	Windows Media Encoder 9.0	41 %
	Adobe After Effects 6.5	27 %
	Sony Vegas 6	18 %
	Adobe Photoshop CS2	9 %
	Adobe Illustrator CS2	5 %
Office Productivity	Microsoft Excel	48 %
	Microsoft Outlook	28 %
	WinZip 10	18 %
	Microsoft Word	3 %
	Microsoft Project	2 %
	Microsoft PowerPoint	< 1 %
3D Modeling	Google SketchUp	54 %
	3D Studio Max	46 %

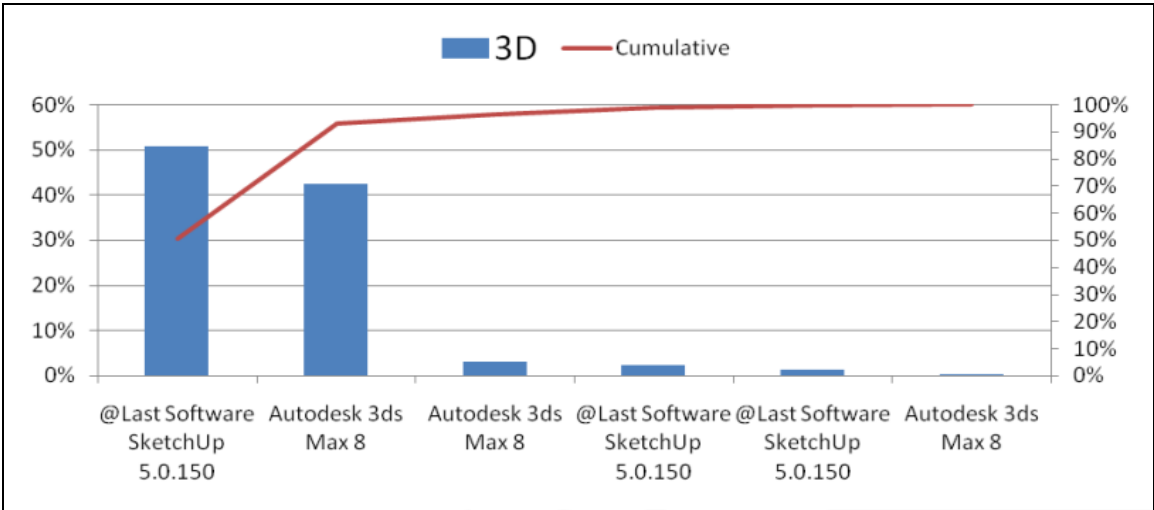**Table B: Application Contribution on Calibration System**
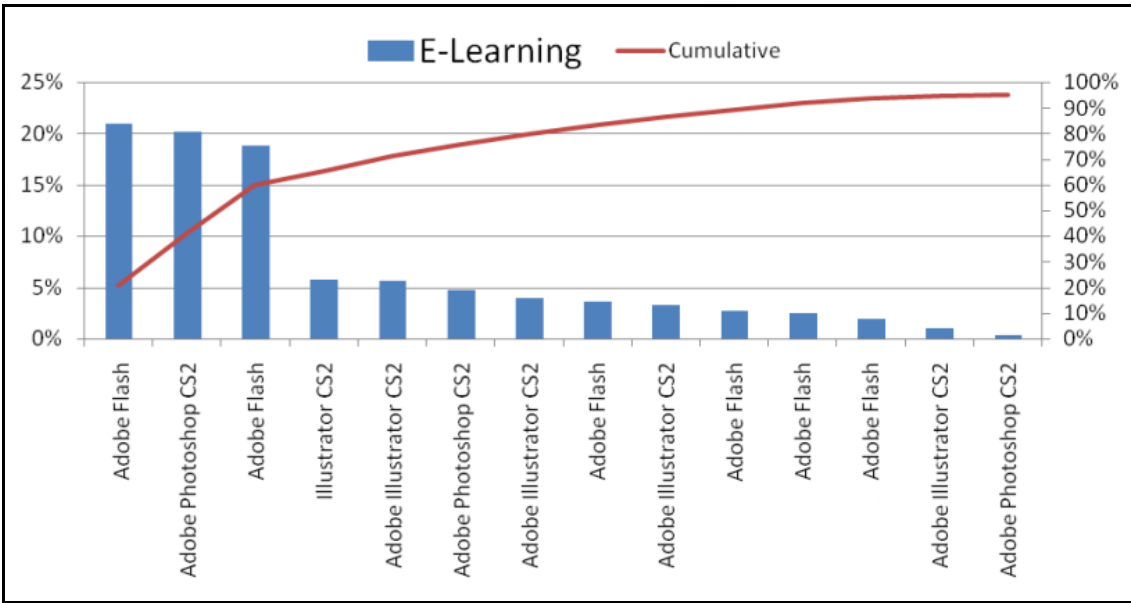
Graph A: Partial Graph of Individual Task contribution on Calibration System in E-Learning Scenario (to 95th Percentile)
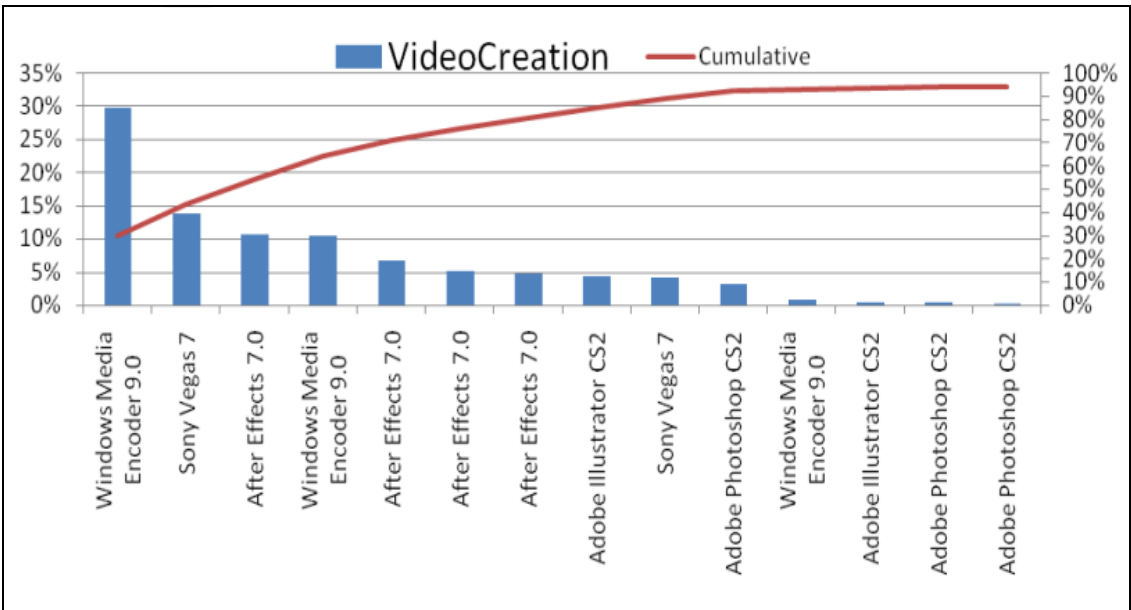
Graph B: Partial Graph of Individual Task contribution on Calibration System in Video Creation Scenario (to 94th Percentile)
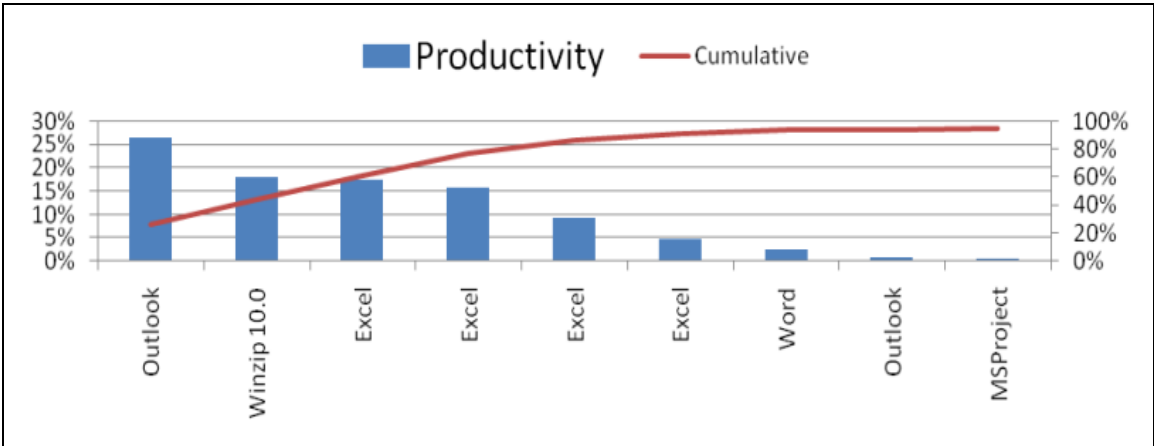
Graph C: Partial Graph of Individual Task contribution on Calibration System in Productivity Scenario (to 95th Percentile)

Graph D: Complete Graph of Individual Task contribution on Calibration System in 3D Modeling Scenario

APPENDIX C: SYSmark 2007 Preview Screenshots

Note: Screenshots may depict a specific version of SYSmark which may differ to from your install version. Please check www.bapco.com for patches to ensure that you are using the latest version of the benchmark.

Figure C-1: User Interface
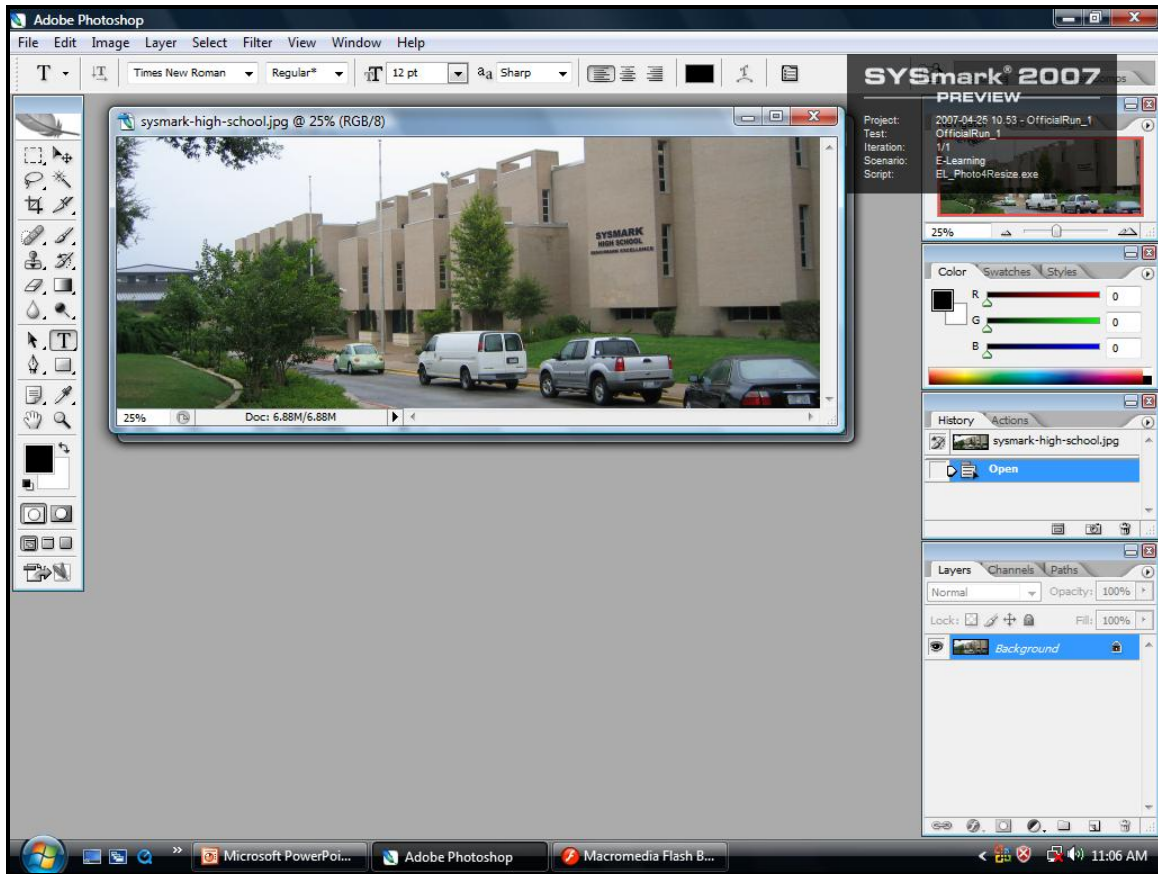
Figure C-2: E-Learning Scenario
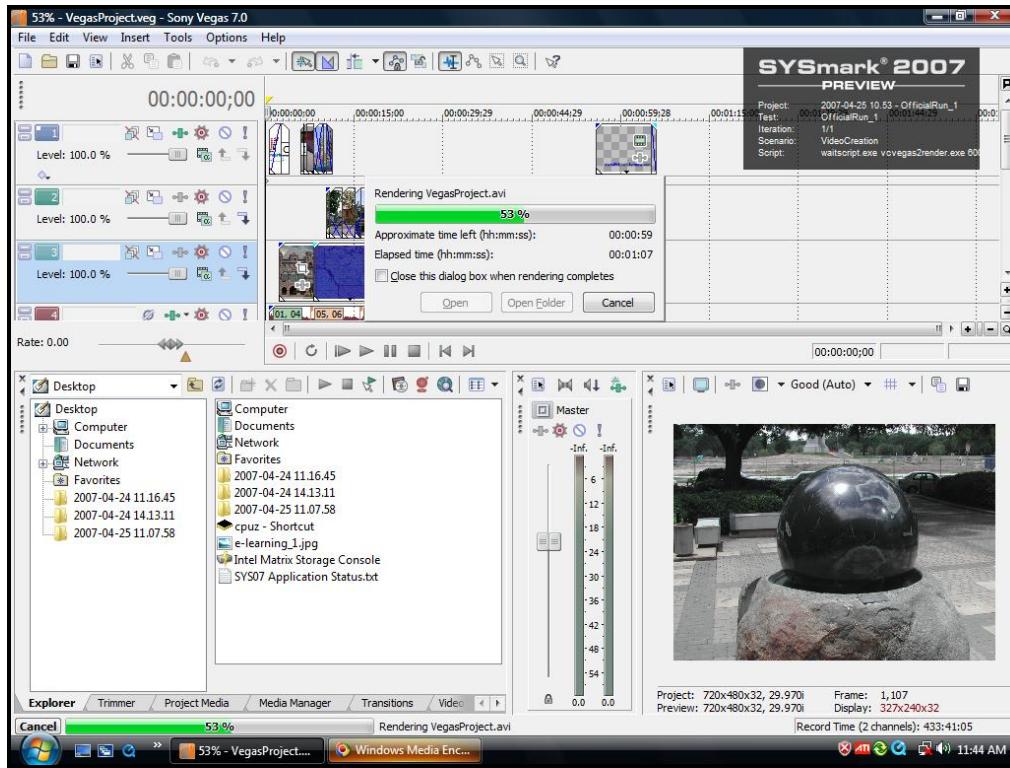
Figure C-3: Video Creation Scenario
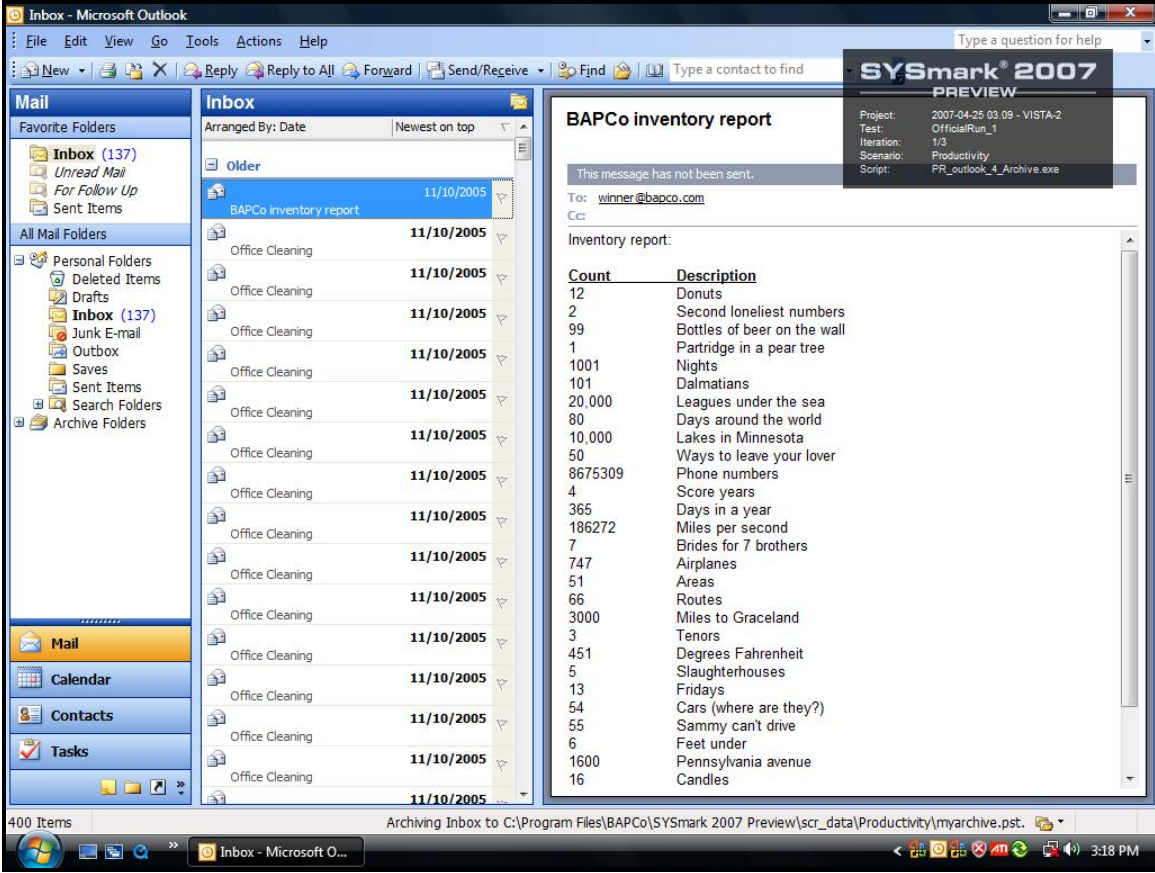
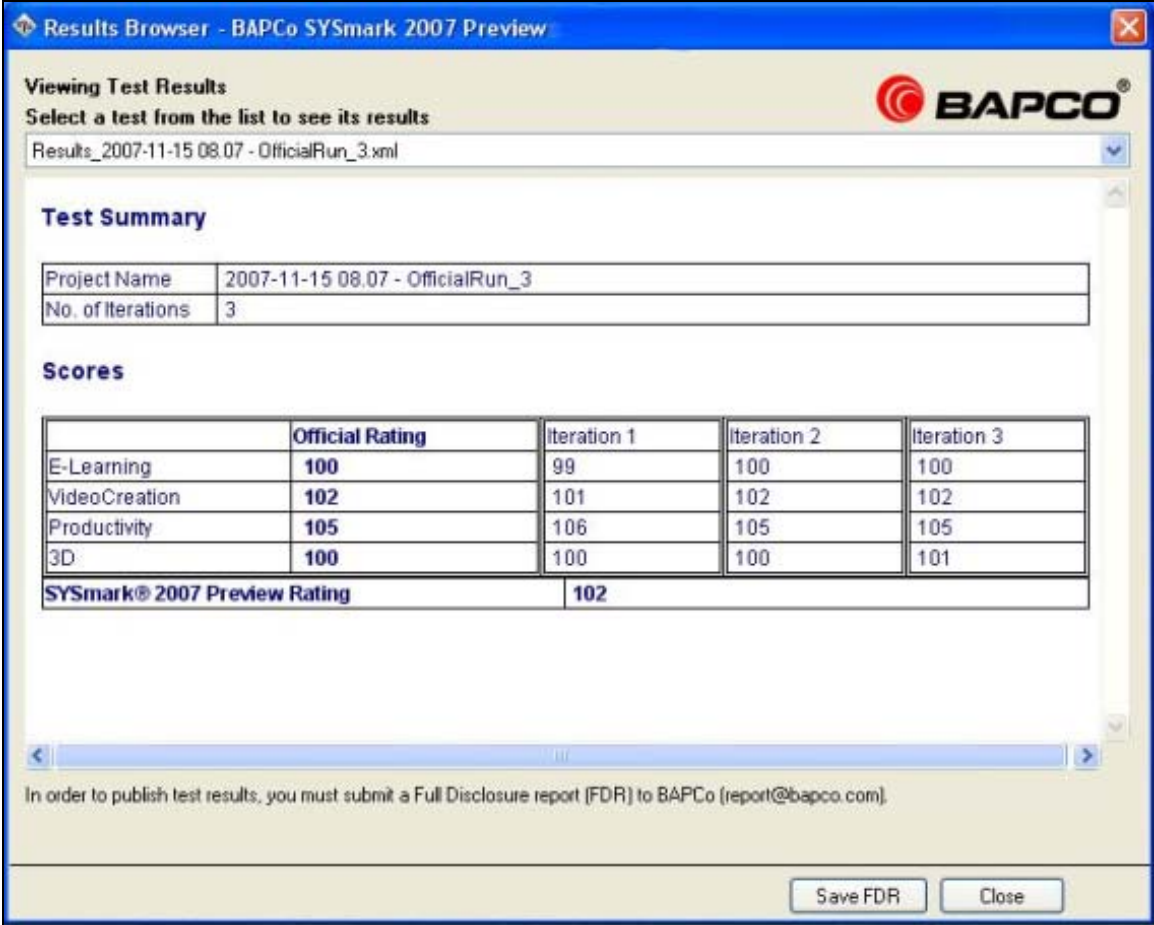**Figure C-4: Office Productivity Scenario**

Figure C-5: 3D Scenario

Figure C-6: Results Browser