Improving Computer Performance



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Moore's Law



Number of transistors on a microchip doubles every 18 months.

- Predictions based on Moore's Law
 - Processing power (speed) doubles every 18 months.
 - Storage capacity of RAM and hard disk increases exponentially.
 - Computer price is decreasing



Bottlenecks







AFTER

Bottlenecks



Bottlenecks (critical element)

- Bottleneck is a step within a series of steps that takes the longest time to complete.
- Time required to perform a task consisting of several steps may be delayed by the bottleneck step.



Bottlenecks (continued)

- Typical bottlenecks:Cache
 - RAM
 - I/O (Information transfer, bus, hard drive)
 - Video card (particularly for 3-D gaming)

Bottlenecks (continued)

- <u>To speed up performance of a system:</u>
 - Use <u>profiling tools</u> to measure each section's time taken to complete to determine the bottleneck steps
 - Improve upon the bottleneck steps
- VTune
- CodeAnalyst
- AQtime

Vtune Performance Analyzer





Throughput and Latency

- Throughput (пропускная способность) the rate at which data flows through the system
- For example, a computer might execute 500 million instructions per second



Throughput and Latency

- Latency (access time) time required to complete an individual operation
- For example, it might take five seconds to launch an application, or two minutes to reboot the entire system.





Image is a 1 MB file
Throughput 10 megabits per second
Latency to display the image will be at least 0.8 seconds.



Throughput and Latency





- If you are selecting a provider for your Web server's network connection, you will be more concerned with?
- A) ThroughputB) Latency



If you are a user of the same web server, you will certainly be concerned with....?

A) ThroughputB) Latency

Data Compression

- Storing data in a format that requires less space than usual
- When data is compressed, the file size shrinks.
- Amount of shrinkage is referred as *compression ratio*

 $Compression Ratio = \frac{Uncompressed Size}{Compressed Size}$

Data Compression

Codec (Compressor and Decompressor) hardware or software used to compress and decompress



Disk Compression

- Shrinks the files and places it in a special volume on the hard disk.
- Disk volume is a disk or an area of a disk which has a unique name and is treated as a hard disk.
- Use storage space more efficiently

Disk Compression

Безопасность	Предыдущие версии	Квота	aacjaan
Общие Се	ервис Оборудование	Доступ	feature?
SY:	STEM		
Тип:	Локальный диск		
Файловая систем	ia: NTFS		
Занято:	75 178 590 208 байт	70,0 ГБ	
Свободно:	25 924 055 040 байт	24,1 ГБ	
Емкость:	101 102 645 248 байт	94,1 ГБ	
	Диск С:	Очистка диска	
🔲 Сжать этот дис	ж для экономии места		Lets you t
Разрешить инд диске в дополн	ексировать содержимое фа нение к свойствам файла	йлов на этом	allow a di

Disk Compression (continued)

Advantages :

- Gain storage space without any additional hardware.
- Under optimal circumstances, the hard disk capacity is doubled.

Disadvantages:

 File error in the compressed volume means the loss of all the data in that volume

File Compression

- Shrinks one or more into single smaller file.
- Compressed file cannot be used until it is uncompressed.
- WinZIP and WinRAR



Compressing a file is called *Zipping* Uncompressing a file is known as *Unzipping*



Text File Compression

Adaptive Pattern Substitution:

- Designed for compressing text files.
 - Scans the entire text,
 - Looks for patterns of two or more bytes,
 - Substitutes a byte pattern and make a dictionary entry for it.
- Effectiveness depends on the content of the document

Text File Compression

- Another type of compression scans and finds repeated words.
- Occurrences of the word is substituted with number and it acts as a pointer to the original occurrence

Text File Compression (continued)

I Don't Like the Dogs (But the Dogs Like Me) Dictionary: \$ Like @ Dogs #the

Compressed text:I Don't\$#@ (But #@\$Me)DictionaryCompression ratio:size44 / (22 + 17) = 44 / 39 \approx 1,13

Initial text size

New text size

Graphics File Compression

- Run Length Encoding is a technique that looks for patterns (i.e.)blocks of same color.
- Graphics file with .tif ,.gif, .pcx and .jpg contain bitmap images that have already been stored in compressed formats
- Graphics software used to open and save files contains codes required to compress and decompress them.

Graphics File Compression (continued)

- Compressed file Formats use
 - Lossy Compression
 - Lossless Compression

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Lossy compression

 Throws away some of the original data for the graphic
JPEG(Joint Photographic Experts Group)

Example of Lossy Compression



Original Lena Image (12KB size)



Lena Image, Compressed (85% less information, 1.8KB)



Lena Image, Highly Compressed (96% less information, 0.56KB)

Lossless compression

 Lossless Compression provides a way to reconstitute all of the original data in a graphics file.



Photoshop File (PSD.PDD)

- A Photoshop file
- File is both a vector image and also a raster
- Keep layers, layer masks and also the color like RGB
- Max 300,000 by 300,000 pixels per image



BMP (BMP.RLE.DIB)

- A raster type of file
- Made up of pixels
- Only uses RGB colors
- Cannot be used on WebPages
- Have a large file size



JPEG (JPG.JPEG.JPE)

- Raster file
- Can be used for WebPages
- A small file that can be uploaded on WebPages and it will be good quality
- Support lots of color like RGB and CMYK.



Video File Compression

- Used to display video on the PC by
 - Reducing number of frames displayed per second.
 - Number of frames per second affects the smoothness of the video.
 - High quality video displays 30 frames/sec and low quality 10-15/sec

Video File Compression (continued)

- Reducing the size of the video widow.
 - Displaying an image 1/4 of the screen requires only 1/4 of the data required to display on a screen.
 - Technique is termed <u>Intra frame Compression</u>
- Coding only the changes that take place one frame to next
 - Difference between frames are evaluated and the data changed are stored.
 - Technique is termed <u>motion compensation</u>

Motion compensation





Music File Compression

- MP3 is a popular format for music compression
- Type of lossy compression technique as it filters the data outside the human hearing.
- Maintains a high degree of sound quality.
- MP3 ripper software is used to convert songs from the CD to WAV files.