Random Access Memory (RAM)

- Sends/Receives data quickly between CPU
- This is way quicker than using just the HDD
- RAM holds temporary data used by any open application or active / running process
- Multiple types of RAM, which have different Speeds, power consumption and technology.

Types of RAM

SDRAM

- Synchronous DRAM
  ^ This basically means it’s tied to the system clock speed
- Made available in 1996
- This type of RAM is found on a DIMM (Dual Inline Memory Module)
- Comes in various pin sizes, most common being:
  - Desktop Size: 168 pin
  - Laptop Size(s): 68 Pin and 144 Pin

Micro-DIMM

- Size of 172 Pins
- Small in size

SO-DIMM

- Small – outline DIMM
- Common forms of 72 PIN, 144 PIN, 200 PIN.

Note: Apart from 32 bit 72 pin SO-DIMM RAM all memory is 64 BIT since the Pentium processor. Also, is it just me or is it fucking hot here.... Damn Irish summers ;)}
**RAM – Random Access Memory**

**Jamie Tees**

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**RDRAM**

- Rambus DRAM
- Handles speeds up to 1066 MHz
- Stick of RDRAM is known as RIMM memory
  - 184 pin for desktops
  - 160 pin SO-RIMM for laptops
- Has speeds of:
  - 600 MHz
  - 700 MHz
  - 800 MHz
  - 1066 MHz
- Needs to be terminated properly by using CRIMM (Continuity RIMM).
- RIMM is 64 bit capable
- RDRAM had dual channel architecture
- Only worked with Pentium 4 systems using Intel made MCC’s (Memory Chip Controller)

**DDR SDRAM**

- Double Data Rate SDRAM
- Basically copied RAMBUS by doubling the throughput of SDRAM and the need to have two identical sticks of DDR and must snap into the paired slots.
- Not as fast as RDRAM though.
- Types of RAM:
  - 184 pin desktop version
  - 200 pin SO-DIMMS or 172 pin micro – DIMMS for Laptops
- DDR was adopted as main form of RAM

<table>
<thead>
<tr>
<th>Clock Speed</th>
<th>DDR Speed Rating</th>
<th>PC Speed Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 MHz</td>
<td>DDR 200</td>
<td>PC 1600</td>
</tr>
<tr>
<td>133 MHz</td>
<td>DDR 266</td>
<td>PC 2100</td>
</tr>
<tr>
<td>166 MHz</td>
<td>DDR 333</td>
<td>PC 2700</td>
</tr>
<tr>
<td>200 MHz</td>
<td>DDR 400</td>
<td>PC 3200</td>
</tr>
<tr>
<td>217 MHz</td>
<td>DDR 433</td>
<td>PC 3500</td>
</tr>
<tr>
<td>233 MHz</td>
<td>DDR 466</td>
<td>PC 3700</td>
</tr>
<tr>
<td>250 MHz</td>
<td>DDR 500</td>
<td>PC 4000</td>
</tr>
<tr>
<td>275 MHz</td>
<td>DDR 550</td>
<td>PC 4400</td>
</tr>
<tr>
<td>300 MHz</td>
<td>DDR 600</td>
<td>PC 4800</td>
</tr>
</tbody>
</table>

**Say wha?** How do we get the DDR speed rating and PC Speed rating?

1) The DDR Speed is got by multiplying by 2, since DDR stands for Double Data Rate.
2) The PC Speed rating of DDR SDRAM is got by multiplying by 8. This is because 8 bytes is the width of all DDR SDRAM sticks.
RAM – Random Access Memory
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**DDR2**

- Types of RAM:
  - 240 pin DIMM for desktop
  - 200 PIN SO-DIMM for laptop
- Speed increase by doubling the clock on the input / output circuits.
  ^ This does not speed up the core RAM. (Where data is actually held) But the I/O Speed.

<table>
<thead>
<tr>
<th>Core RAM Speed</th>
<th>DDR I/O Speed</th>
<th>Speed Rating</th>
<th>PC Speed Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 MHz</td>
<td>200 MHz</td>
<td>DDR2-400</td>
<td>PC2-3200</td>
</tr>
<tr>
<td>133 MHz</td>
<td>266 MHz</td>
<td>DDR2-533</td>
<td>PC2-4200</td>
</tr>
<tr>
<td>166 MHz</td>
<td>333 MHz</td>
<td>DDR2-667</td>
<td>PC2-5300</td>
</tr>
<tr>
<td>200 MHz</td>
<td>400 MHz</td>
<td>DDR2-800</td>
<td>PC2-6400</td>
</tr>
<tr>
<td>250 MHz</td>
<td>500 MHz</td>
<td>DDR2-1000</td>
<td>PC2-8000</td>
</tr>
</tbody>
</table>

**Say wha again?** How do we get the DDR2, I/O Speed, speed rating and PC Speed rating?

1) The DDR2 I/O Speed is got by multiplying by 2, this is because they doubled the clock for the input / output circuits.
2) The DDR2 Speed rating is then multiplied by 2, since DDR stands for Double Data Rate.
3) The PC Speed rating of DDR2 is got by multiplying by 8. This is because 8 bytes is the width of all DDR2 sticks.

*You make pizza’s with flour and water. Just thought I’d mention that ?!*

**DDR3**

- Higher Speeds, 30% Less power consumption
- Types of RAM:
  - SO-DIMM 204 PIN for laptops
  - 240 Pin DIMM
- Doesn’t fit in DDR or DDR2, as normal.
- Doubles the buffer of DDR2 from 4 bits to 8 bits giving more bandwidth.
- Adds a feature called XMP (Extended Memory Profile)
  ^ Enables a power user to easily over clock their memory
- Use High Density chips which could lead to 16 GB DDR3 modules
- DDR3 supports triple channel memory if the chipset supports it
  ^ Currently only supported by the Intel LGLA 1366 platform. AMD doesn’t support this feature at all as of now.
RAM – Random Access Memory
Jamie Tees

<table>
<thead>
<tr>
<th>Core RAM Speed</th>
<th>DDR I/O Speed</th>
<th>Speed Rating</th>
<th>PC Speed Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 MHz</td>
<td>400 MHz</td>
<td>DDR3-800</td>
<td>PC3-6400</td>
</tr>
<tr>
<td>133 MHz</td>
<td>533 MHz</td>
<td>DDR3-1066</td>
<td>PC3-8500</td>
</tr>
<tr>
<td>166 MHz</td>
<td>667 MHz</td>
<td>DDR3-1333</td>
<td>PC3-10667</td>
</tr>
<tr>
<td>200 MHz</td>
<td>800 MHz</td>
<td>DDR3-1600</td>
<td>PC3-12800</td>
</tr>
<tr>
<td>233 MHz</td>
<td>933 MHz</td>
<td>DDR3-1866</td>
<td>PC3-14900</td>
</tr>
<tr>
<td>266 MHz</td>
<td>10066 MHz</td>
<td>DDR3-2133</td>
<td>PC3-17000</td>
</tr>
</tbody>
</table>

Ugh... Say wha again, again? How do we get the DDR3, I/O Speed, speed rating and PC Speed rating?

1) The DDR3 I/O Speed is got by multiplying by 4, this is because they doubled the clock again for the input / output circuits from DDR2. This speed increase is from the buffer size increase. ^This enables DDR3 to grab twice as much data as DDR2 in a clock cycle.
2) The DDR3 Speed rating is then multiplied by 2, since DDR stands for Double Data Rate.
3) The PC Speed rating of DDR3 is got by multiplying by 8. This is because 8 bytes is the width of all DDR3 sticks.

Different RAM Variations

Double-Sided DIMMS

- Every RAM stick starting from FPM SIMM’s to DDR3 SDRAM comes in two types, single-sided and double-sided RAM. As their name implies, single-sided sticks have chips on one side, double sided have chips on both sides.

Latency

- LAGGGG!! As we’d say if we were having high latency in a game of COD or Halo.
- On a more serious note. A lower latency means it’ll take the RAM less time to respond.
- Lower Latency ram can be found by the term CL2 or Low Latency ^CL stands for clock cycle delays. The CL2 means that memory is delayed 2 clock cycles before delivering the requested data.
- Make sure when choosing RAM that your motherboard will support certain CL types. Getting a higher stick for a motherboard that will only support Low Latency RAM may cause the PC to bluescreen, be slow, or not work at all.
Parity and ECC

- Mainly used in the creation of Pizza, oh, sorry I mean: Mainly used in servers. (I want pizza)
- Parity RAM could only error detect and wouldn’t always detect an error.
  ^ Parity could NOT correct errors.
- ECC stands for Error checking and Correction
- ECC RAM is always slower than normal Non-ECC RAM.
- Are normally in 72 bit versions, extra 8 bit for ECC.
- ECC normally will only function on high-end systems, before installing (if actually required) check your motherboard manual.

Bored yet? No.. Okay, I’ll continue.

Page File and Knowing When You Need RAM

Page File and Virtual Memory

Windows uses a small part of your HDD for a thing called a page file. This is what’s known as a RAM cache.

- Only normally used if your RAM is low because there is a lot of open programs.
- When the RAM is low, it swaps inactive programs to the Pagefile and keeps the active programs in the RAM.
- Default and recommend page file is 1.5 times the RAM installed in the computer.
- The page file is also known as virtual memory.
  ^ Note, when windows alerts you with a notification saying your virtual memory is running out it normally mean’s (I’m melting the HDD, I need a RAM upgrade stat). This may only occur once while using the computer, but if you see it constantly pop up. RAM Upgrade that PC!

Windows system RAM recommendations

- Microsoft sets the bare minimum on RAM requirements normally.
  ^ This is to get the maximum number of users to upgrade.
- If you are using a lot of your RAM when you press CTRL – Shift – ESC, and click on Performance. It might be time to upgrade your RAM. Especially if this is happening all the time

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Minimum System RAM</th>
<th>Reasonable Minimum</th>
<th>Solid Performance</th>
<th>Power User</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows XP</td>
<td>64 MB</td>
<td>256 MB</td>
<td>1 GB</td>
<td>2 GB</td>
</tr>
<tr>
<td>Windows Vista</td>
<td>1GB (32 Bit) / 2 GB (64 Bit)</td>
<td>2 GB</td>
<td>4 GB</td>
<td>8GB</td>
</tr>
<tr>
<td>Windows 7</td>
<td>1GB (32 Bit) / 2 GB (64 Bit)</td>
<td>4 GB</td>
<td>8GB</td>
<td></td>
</tr>
</tbody>
</table>
Ready Boost

- Only possible on Windows Vista and Windows 7
- Uses flash drive as dedicated virtual memory
- Flash memory is faster than typical HDD read/write speeds.
- Windows 7 can handle up to 8 flash devices for Ready Boost
- Windows Vista can handle up to 1 maximum
- Recommended if using Ready Boost to use 1 – 3x the system RAM for ready boost.

RAM installing & getting the right RAM.

- For the best RAM upgrade make sure:
  - You have the optimum capacity of RAM to install
  - Get the correct RAM for your motherboard
  - Use same speed RAM for all the RAM installed
  - Use lower latency RAM if your motherboard supports it
- You can mix and match RAM, but for the best stability try and keep RAM uniform.
- Try not to mix speeds. It can cause issues with the system. Many modern motherboards provide some flexibility for this but it’s good practice to use the same speed RAM for the best performance.
- Installing DIMM’s And RIMMS:
  - Make sure you touch metal or use some anti-static equipment.
  - Don’t touch the chips or the contacts, try to only touch the sides of the RAM
  - Check the notch so you push it in the right way around.
  - Push it firmly into position by pushing straight down on both sides of the RAM, the two sides of the RAM socket should clip the RAM into position.

Serial Presence Detect (SPD)

- Thanks to SPD Motherboards should detect and auto setup any DIMM or RIMM that get’s installed.
- SPD is normally the smallest chip on the RAM
Troubleshooting RAM

Issues with RAM shows up in a variety of ways.

- Parity errors
- ECC error messages
- System Lockups
- Page Faults
- Many other error screens in windows
  ^ Often can indicate bad RAM but could be something unrelated.

You can get two different types of parity errors:

- Real:
  o Errors that are simple errors that the MCC detects from the parity or ECC chips (If you have that form of RAM)
  o Shows up in an error report as a Parity error at xxxx:xxxxxxxx
    ^ This is is a hexadecimal value. Write this down if this happens, if it happens more than once with the same value then it does indicate a bad RAM stick

- Phantom:
  o Phantom Parity errors show up on systems that do not have parity or ECC memory
  o If windows generates parity errors with different addresses you most likely do not have bad RAM
  o Phantom Errors can occur for many reasons:
    - Software Problems
    - Heat / Dust
    - Solar Flares
    - Fluctuations in the force ← Seriously the force is real....

Other types of errors:

- System Lockup / Page Fault
  o Normally happens hand in hand.
  o System lockup would be when the computer crashes and can’t be used.
  o Page Fault may not be RAM but other memory also, if a page fault does occur copy the hexadecimal digits, if they repeat chances are high that it’s RAM. If it is different each time it is likely that it’s something else.

- Big red button, Panic Putton. NMI (non-maskable interrupt) or as we call it mainly BSoD, NMI’s normally show when he dreaded BSoD does.
  o Happens when a little electron hits the big red button and the OS has to shut down certain functions.
  o Might not be RAM, at time’s it’s buggy programming, bad drivers, bad PSU etc.
  o Check the hexadecimal code and if it’s the same address each time chances are it’s RAM, if not test the PSU and software *(in my personal view)*
Think you have bad RAM?

- If your on Windows 7, it has a built in memory diagnostics tool.
- If on another OS use Memtest86 from www.memtest86.com

Okay, that’s enough about RAM to get through the exam as far as I can tell.