Macintosh Family: MIPS Ratings (10/96)

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TOPIC ---

Are there any MIPS specifications for Apple hardware?

DISCUSSION --

IMPORTANT: Resellers PLEASE include all disclaimers when passing this
information to a customer.

Measuring MIPS is, at best, an inaccurate art. All the reference manuals
we consulted stated that a MIPS rating can be misleading. MIPS (Million
Instructions Per Second) is a measurement of CPU (Central Processing Unit)
speed.

From Motorola's 68020/68030 Performance Report:

> "Benchmarking microprocessors is much like water-witching.
> Everyone wants to use the results but are skeptical of the
> 900-methods. From the user's point of view, the best benchmark to
> use in making a decision on a given microprocessor is to run the
> code which will be run in the final application. This, however,
> is usually difficult at best, and expensive and time consuming at
> least. Since running the actual code is usually not feasible,
> most users and all microprocessor manufacturers turn to either
> synthetic benchmarks - ones that simulate real-world conditions -
> or small standard benchmark programs which are designed to
> indicate real-world performance. Not everyone can agree on what
> simulates real conditions; thus, there are numerous benchmark
> programs available, each written to test some aspect of
> performance that the writer is interested in testing."

Another issue that causes MIPS ratings to be suspect is that not all
instructions take the same amount of time. A single instruction can take
from 2 to over 200 machine cycles. The MC68020, for example, runs at a
sustained rate of 2 to 3 MIPS, with occasional bursts of 8 MIPS.

Several other factors may enter into the process of obtaining the MIPS
rating:

- Instruction in cache and cache enabled
- Instruction data size
- Addressing mode used -- Extensions folder words and indirect
- Memory port size
- Memory speed -- variable wait states
- Operand misalignment
- Prefetch sequence -- even or odd, word alignment of op word
- Instruction overlap

If a program is written to test the MIPS, other issues surface:

- Which instruction is used? The best instruction to make the MIPS rating
  look good would be the fastest executing instruction in the CPU set.

- What is the best program structure to use? Two choices, a loop or a
  straight line. A straight line program will take more space but is, by
  far, the fastest. The straight line program executes only the fast
  instructions without executing any looping instructions.

For the these reasons, Apple hasn't published MIPS ratings. However, the press
has designated some ratings for our products. Using their formula

    MIPS = MHz/ICC/Memd
          (clock speed/instruction cycle count/*memory system delay)

provides the following MIPS ratings:

    Macintosh Classic   0.7
    Macintosh Plus   0.7
    Macintosh SE   0.7
    Macintosh Portable   1.3
    Macintosh PowerBook 100   1.3
    Macintosh II   2.6 **
    Macintosh LC   2.6 **
    Macintosh Color Classic   3.9
    Performa 405   3.9 ***
    Performa 410   3.9 ***
    Performa 430   3.9 ***
    Macintosh IIcx   3.9 **
    Macintosh IIx   3.9 **
    Macintosh LC II   3.9 **
    Macintosh SE/30   3.9 **
    Performa 400   3.9 **
    Macintosh Classic II   3.9 **   ***
    Macintosh PowerBook 140   3.9 **   ***
    Performa 200   3.9 **   ***
    Macintosh IIvi(Int'l)   4.3 **   ***
    Macintosh IIsi   5.0 **   ***
    Macintosh LC 520   6.3 ***
    Macintosh LC III   6.3 ***
    Performa 450   6.3 ***
    PowerBook 145B   6.3

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     Macintosh IIci               6.3 **   ***
     Macintosh PowerBook 145      6.3 **   ***
     Macintosh PowerBook 160      6.3 **   ***
     Macintosh PowerBook 170      6.3 **   ***
     PowerBook Duo 210            6.3 **   ***
     Performa 600                 6.5 **   ***
     Macintosh IIvx               7.0 **   ***
     Performa 460                 8.3 ***
     Performa 466                 8.3 ***
     Performa 467                 8.3 ***
     Performa 550                 8.3
     PowerBook 165                8.3
     Macintosh PowerBook 165c     8.3 **   ***
     Macintosh PowerBook 180      8.3 **   ***
     Macintosh PowerBook 180c     8.3 **   ***
     PowerBook Duo 230            8.3 **   ***
     PowerBook Duo 250            8.3 **   ***
     PowerBook Duo 270c           8.3 **   ***
     Macintosh IIfx              10.0 **   ***
     WorkGroup Server 60         17.6 ***
     Macintosh Centris 610       17.6 ****
     Macintosh Centris 660av     22.0 ***
     Macintosh LC 475            22.0
     Macintosh Quadra 605        22.0 ***
     Macintosh Quadra 610        22.0 *** ****
     Macintosh Quadra 660av      22.0 ***
     Performa 475                22.0
     Performa 476                22.0
     Macintosh Centris 650       22.0 ****
     Macintosh Quadra 610        22.0 ****
     Macintosh Quadra 700        22.0 ****
     Macintosh Quadra 900        22.0 ****
     Macintosh Quadra 650        29.0 ***
     WorkGroup Server 80         29.0 ***
     WorkGroup Server 95         29.0 ***
     Macintohs Quadra 650        29.0 ****
     Macintosh Quadra 800        29.0 ****
     Macintosh Quadra 950        29.0 ****
     Macintosh Quadra 840av      35.0 ***
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     Power Macintosh computers: IBM and Motorola do not publish MIPs ratings for
the PowerPC line of processors. Instead, they have adopted the SPEC benchmark
suites to evaluate their PowerPC processors. This information is available in
the Tech Info Library using the search string "SPEC ratings and PowerPC" to
locate the following articles:
PowerPC: SPEC ratings for 604 & 620 chips
PowerPC: SPEC ratings for 604 & 620 chips
PowerPC: SPEC ratings for 601, 601+, and 602

For additional information about SPEC ratings, access the SPEC Web site at
http://www.specbench.org/. For information about PowerPC processors, contact
Motorolla at http://www.mot.com/SPS/PowerPC/ or IBM at
http://www.chips.ibm.com/products/ppc/index.html.

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  * NOTE: The majority of our systems operate with a variable number of wait
          states.  See the Tech Info article on Wait States and Macintosh.
          The article is titled: "RAM Speed and CPU Speed: How They're
          Related".

 ** NOTE: This figure has been adjusted to reflect the improved efficiency
          of the 68020, 68030, and 68040.

*** NOTE: This figure doesn't reflect performance degradation due to the
          use of internal video, or increases provided by an optional
          cache card.

**** NOTE: Rating from Motorola.
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Using variable wait states, the rating for the Macintosh IIsi could be
anywhere from 3.3 to 10 MIPs. The values shown above are based on nominal
wait states of 2 for each computer.

Again, we stress that MIPs calculation is very misleading. Any
presentation of these numbers should be accompanied by a disclaimer.


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Article Change History:
22 Oct 1996 - Added SPEC ratings information.
31 May 1994 - Included title of wait state article.
29 Mar 1994 - Updated to include ratings for numerous Macintosh and
                   Performa models.
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