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System 7: Virtual Memory and Largest Unused Block (9/93)

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Security:       Everyone
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TOPIC ---

My Macintosh has 4MB of RAM, and I set it to 24-bit addressing mode with
13MB of virtual memory. I see the following distribution of RAM according
to "About This Macintosh."

```
Built-in memory        4,096K
Total memory          13,312K
System Software        1,577K
Largest Unused Block   7,319K
```

System Software added to Largest Unused Block equals 8,896K. This leaves
4,416K missing.

When I set the Macintosh to 32-bit mode, I see the following distribution
of RAM:

```
Built-in memory        4,096K
Total memory          13,312K
System Software        1,577K
Largest Unused Block  11,712K
```

System Software plus Largest Unused Block equals 13,289K.

Why does there appear to be more memory available with 32-bit addressing
turned on?

DISCUSSION --

Virtual memory in 24-bit addressing mode fragments the memory available
when you set the memory size to greater than 8MB. Virtual memory in 32-bit
addressing doesn't face this limitation. The following examples show how

this happens.

24-Bit Addressing

Setting your Macintosh to 24-bit addressing mode makes 16MB available to
the computer. Here's what the memory map looks like in 24-bit mode:

```
MB          Function
--          --------
1-8         Physical & Virtual RAM
9           ROM
10-15       NuBus slots
16          I/O
```

When you set virtual memory greater than 8MB, the location of ROM in the
memory map fragments the free memory. So the largest block available will
always be 8MB minus memory any running applications use, until you exceed
8MB. After exceeding 8MB, the largest available blocks are the memory
mapped into NuBus slot space.

The memory available to applications (application heap) includes the first
8 megabytes, plus any memory the NuBus cards (10-15) aren't using that has
been mapped as memory by virtual memory. This is where the RAM available
under virtual memory becomes fragmented. In the example of RAM
distribution for 24-bit addressing, 11,735K of RAM is really available for
the application heap even though the Largest Unused Block shows as only
7,319K.

32-Bit Addressing

Setting the Macintosh to 32-bit mode prevents fragmenting available memory
because it maps ROM and I/O to the top of the memory map. This makes 1GB
available to the computer. Here's what the memory map looks like in 32-bit
mode:

```
Memory      Function
------      --------
1GB         Physical & Virtual RAM
256MB       ROM
2.5GB       NuBus slots
256MB       I/O
```

Virtual memory in 32-bit mode only accesses the 1GB RAM memory space. This
leaves the memory space between system heap and ROM available.   The
application heap is a contiguous block in the top thousand megabytes of the
memory map. In the example for 32-bit addressing, the Largest Unused Block
(11,712K) is equal to the total RAM available for the application heap.

Article Change History:
23 September 1993 - Reviewed for technical accuracy.
22 January 1993 - Expanded information about 32-bit addressing.

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