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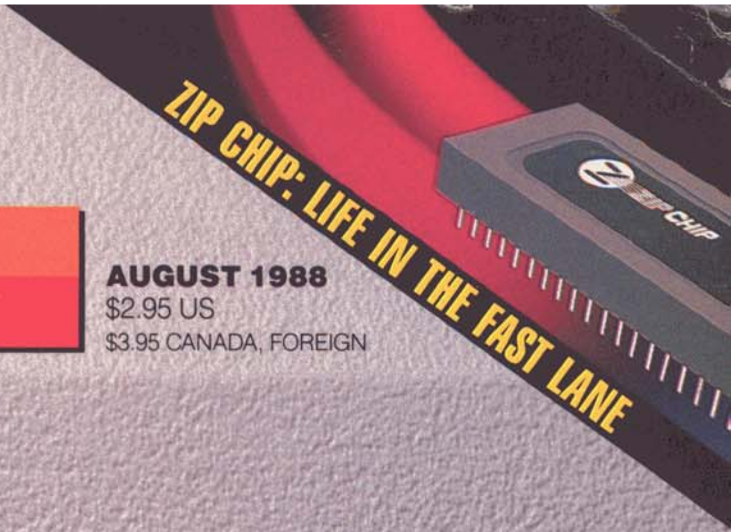


ZIP CHIP: LIFE IN THE FAST LANE

SWITCHING BETWEEN TWO WORLDS

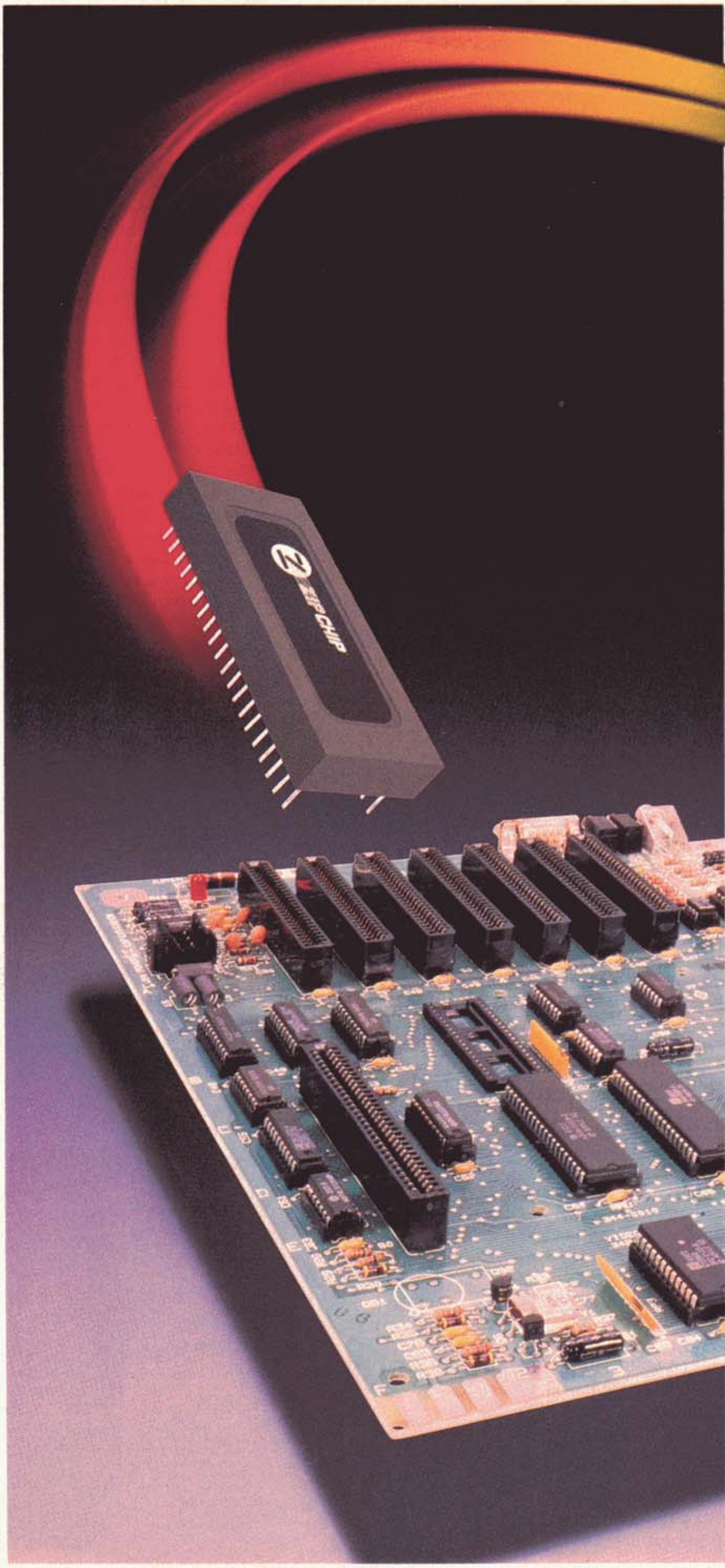
Bringing MS-DOS to the Apple II and Vice Versa

PC TRANSPORTER
ENVOY BOARD
TRACKSTAR & CORDATA MATCHPOINT-PC

KURTA TABLET
Graphics input for the IIGS

COMPUTER VIRUSES
An ounce of prevention . . .

FINGERPRINT GSi
From screen to printout with a single touch



HARDWARE BY MICHAEL FISCHER

Z

The Zip Chip is an accelerator chip that replaces the 65C02 microprocessor in your Apple II with a 65C02 that is capable of running programs at up to four times normal speed. This product is exciting, particularly for IIc users, who have never been able to use accelerator cards designed for the IIe. The Zip Chip also works with the II Plus and IIe but not the IIGS.

Later in this article, I'll explain how the Zip Chip works, but for now let's take a look at what we're most interested in: just how much faster software runs with a Zip Chip installed.

(Throughout this article, the term *Apple II* refers to the Apple II Plus, IIe, and IIc—but not the Apple IIGS. The term 65C02 also refers to the 6502 microprocessor of the Apple II Plus and the original IIe, unless the context indicates otherwise.)

Speed Tests

The accompanying sidebar "Life in the Fast Lane" shows the results of some speed tests I ran with Applesoft BASIC, comparing a normal-speed Apple IIe with (1) the Zip Chip in an Apple IIe, (2) a normal-speed Apple IIe equipped with a TransWarp accelerator card, and (3) a IIGS running at fast speed. In all cases, I timed the operations by using a stopwatch, and I rounded the results to the nearest tenth of a second. The computer carried out

PHOTOGRAPHY BY TOM SKRIVAN

A new accelerator moves your Apple II Plus, IIe, or IIc into the fast lane.

IP CHIP

each of these operations 1000 times in a FOR . . . NEXT loop.

I found the least improvement in operations that did significant text-screen manipulation. Printing a string to the screen improved by a factor of less than 1.3 with the Zip Chip. This result is not too surprising, since the Zip Chip slows down to normal speed to perform memory-writing operations; it accelerates only read operations. The GS does accelerate write operations, so its times are significantly faster.

Just slightly better was the write to disk operation. The speedup was just 1.5 times. By contrast, creating 1000 random numbers showed a speed improvement of 3 times.

Other operations in Applesoft showed speed improvements of 2.6 to 3.5 times. As you can see, some of the best improvements occurred in the low- and high-resolution-graphics operations.

AppleWorks Improvements

The sidebar also shows the results of comparative operations the computer performed with AppleWorks. The word-processing module's Replace operations were more than three times as fast with the Zip Chip. The database sorts were nearly as dramatically faster, although the alphabetic sort was slightly slower than the numeric sort.

I also ran two different AppleWorks spreadsheet operations. In one case, dividing a cell by a constant, the speed improved by a factor of 4, the maximum theoretical improvement with the Zip Chip. The speed for taking an average of seven cells improved by a factor of 3.2.

As you might expect, disk-intensive operations showed less improvement. The Zip Chip did not significantly decrease the time for loading a word-processing document or a spreadsheet. The database, by contrast, loaded 1.5 times faster under Zip Chip, probably a result of the processing that is necessary after you load a data file into AppleWorks.

The Zip Chip is capable of running programs at up to four times normal speed.

Zip vs. TransWarp

The comparison of the Zip Chip with the TransWarp accelerator card is interesting. In AppleWorks operations, the Zip Chip appeared significantly faster in loading a database file and replacing text in a word-processing file. The other time differences in the AppleWorks tests are not significant.

As you can see in the Applesoft tests, the TransWarp is faster in BASIC string manipulation and printing to the Apple II screen. The Zip Chip is faster in disk operations and graphics manipulation, however.

Now that we've confirmed that using a Zip Chip does often result in increased speed, let's see how the chip works.

In a normal Apple II, the microprocessor runs at one megahertz, or 1 million cycles per second. Each operation of the 65C02 takes at least 2 cycles, with a few taking as many as 7. The average instruction takes between 3 and 4 cycles, permitting the 65C02 to perform 250,000 to 333,333 operations per second.

This speed is fast from a human perspective, but many chips run faster. The 8088 in an old-style, plain IBM PC runs at about 4 million cycles per second, the 68000 in a Macintosh SE runs at 7.83 million cycles per second, the Macintosh II's 68020 runs at 15.7 million cycles per second, and even the 65816 in an Apple IIGS runs at 2.8 million cycles per second at fast speed.

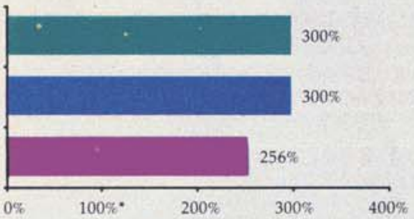
Of course, clock speed isn't everything. The 65C02 is much more efficient in using its cycles than is a 68000 or 8088. Thus, a 65C02 can perform more instructions per second than a 68000 or 8088 running at the same number of cycles per second.

LIFE IN THE FAST LANE

These charts show how fast the Zip Chip, TransWarp, and Apple IIGS (in the fast mode) perform, compared to a standard base: the Apple IIe running at a clock speed of 1 MHz. The percentages indicate the performance of the products relative to the base IIe speed. A value of 100% indicates performance of the benchmark at the same speed as the standard base, 200% indicates a performance two times as fast, and so on. Note that the Applesoft operations were repeated 1000 times in a simple FOR . . . NEXT loop.

Applesoft Operations

Create 1000 random numbers

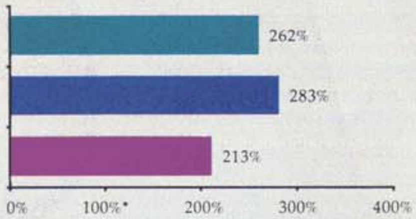


*Base = 6.9 seconds

Write 1000 random numbers to disk

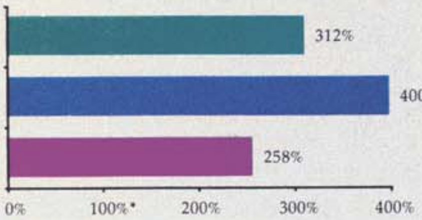
*Base = 22.3 seconds

Convert string to ASCII value



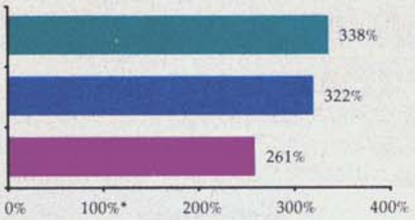
*Base = 3.4 seconds

Create string from numeric value



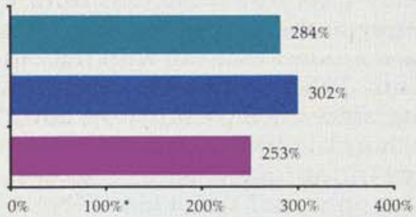
*Base = 10.3 seconds

Perform cosine operation



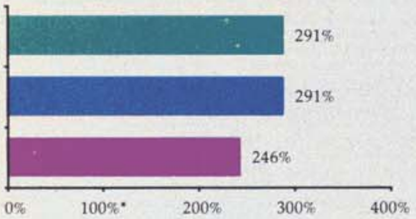
*Base = 27.4 seconds

Assign value to string and perform garbage collection at end



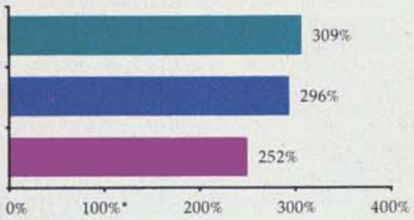
*Base = 13.9 seconds

Perform GOSUB operation



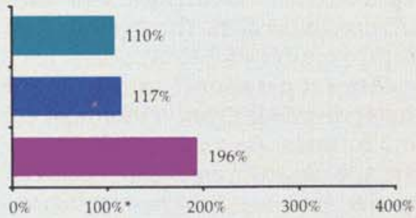
*Base = 3.2 seconds

Poke a value to memory



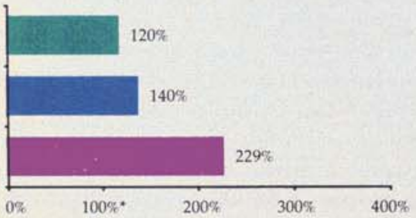
*Base = 6.8 seconds

Home the cursor, 80-column screen



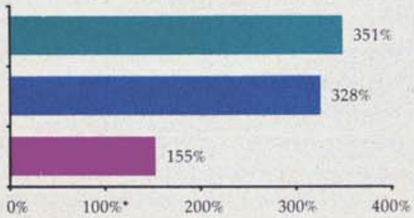
*Base = 35.6 seconds

Print a string to the 80-column screen



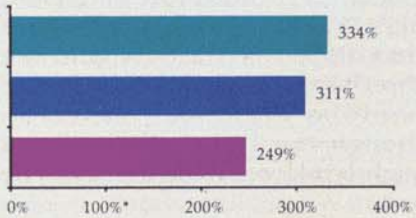
*Base = 40.5 seconds

Draw a square in low-resolution graphics

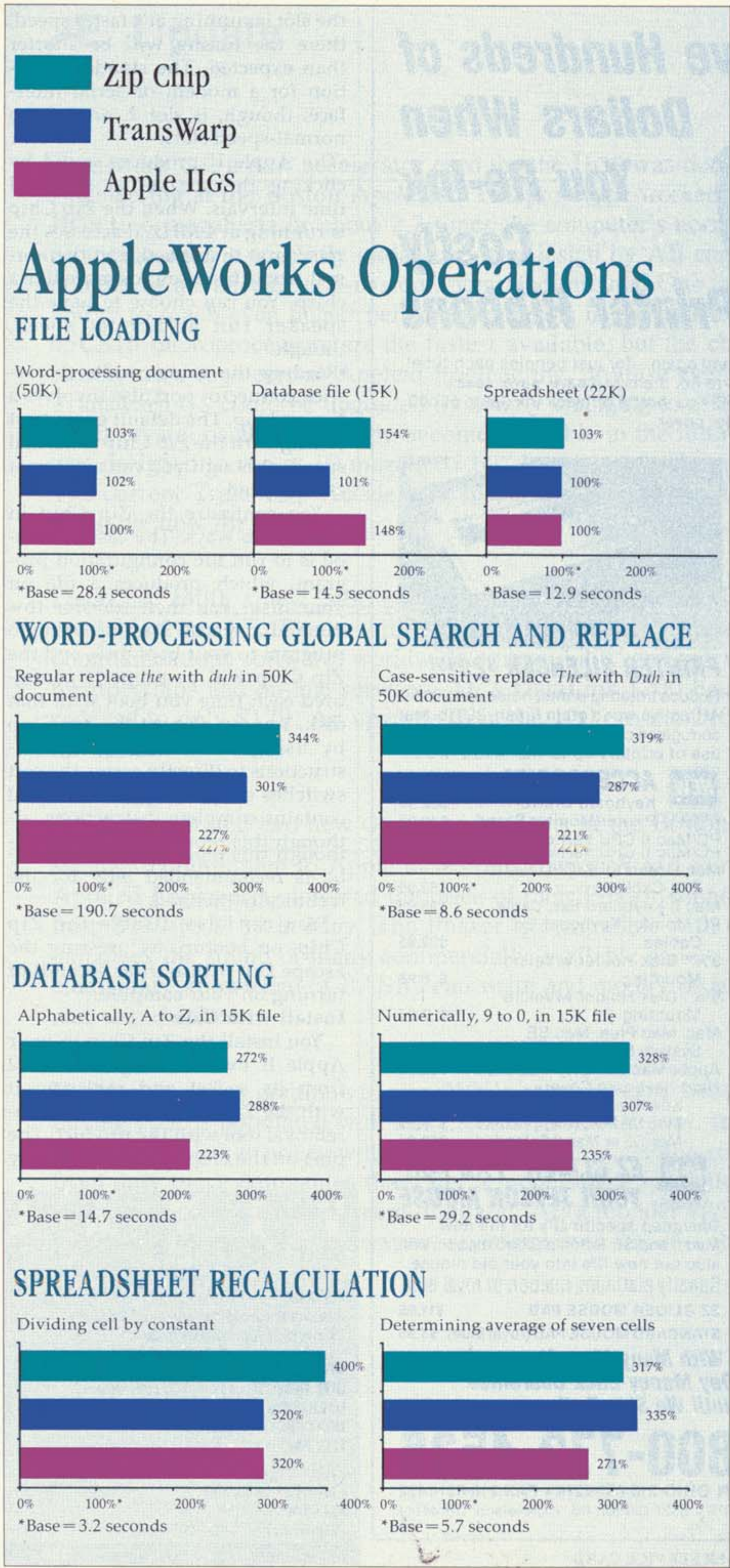


*Base = 213.5 seconds

Draw a square in high-resolution graphics



*Base = 307.4 seconds



The 65C02 in the Zip Chip runs at at top speed of 4 megahertz, or 4 million cycles per second, but this speed is useful only if you are using random-access memory that is fast enough to handle the speed of the chip. RAM may seem to be instantaneous in its operation, but reading a value from or writing it to RAM actually does take a finite amount of time. Unfortunately, faster memory costs considerably more than slower memory.

The Zip Chip has 16 kilobytes of fast memory, called cache memory, built into it, because the standard Apple II memory isn't fast enough for the Zip Chip. As a value is read from main memory at the slower 1-MHz speed, it is stored in the cache memory so that the next time the Zip Chip has to read this value, it can do so from cache memory at its faster speed. Half of the 16K of fast memory in the Zip Chip keeps track of the actual locations of the values in the other half of the fast memory. Write operations always go to regular memory at normal speed.

The Zip Chip actually runs at 18 different speeds, ranging from .667 MHz to 4.0 MHz. The main use you are likely to make of these variations is in arcade-style games. You can play at a slow, easy pace (such as .667 or .750 megahertz); at medium speeds; or up to an almost unplayable 4 megahertz. See the description later in this article of how to configure for various speeds.

Speed Bumps

When you speed up your Apple II, you must be careful about what you speed up and what you keep at normal speed.

•Normal floppy-disk drives must run at 1 MHz. The Zip Chip is preconfigured to run slots 2, 5, 6, and 7 at normal speed and the other slots at fast speed. (Slots 5 and 6 are generally where you put disk controllers for floppy-disk drives on the Apple II.) As long as you have a drive controller in one of those slots, you will be able to boot the Zip Chip configuration disk. Otherwise, you must either move the drive controller to one of those slots or understand how to reconfigure the Zip Chip, using the technical information in the manual.

•Some modems and serial-interface cards depend on timing loops for performing certain functions. If the slot is running at a faster speed, then, the timing will be shorter than expected. The standard location for a modem or serial interface, though, is slot 2, one of the normal-speed slots.

•The Apple II produces sound by clicking the speaker at specified time intervals. When the Zip Chip is running at 4 MHz, it accesses the speaker at that speed, and the normal Apple beep sounds more like a chirp. You can choose to have the speaker run at normal speed, though.

•Reading the game-paddle or joystick connector port also involves a timing loop. The default game-port setting with the Zip Chip is normal speed, although you can also use it at fast speed.

You configure the Zip Chip in one of two ways: The easier method is to run the configuration program, which produces a file on your disk. You then transfer this file and a special start-up or hello program to your boot disk, and the Zip Chip will be properly configured each time you boot with that disk. You can also set the Zip Chip by using machine-language instructions to directly access the soft switches on the chip. The manual contains complete instructions, although this more ambitious method is recommended only for the technically inclined.

You can also disable the Zip Chip, on bootup, by pressing the Escape key within three seconds of turning on your computer.

Install with Care

You install the Zip Chip in your Apple II by removing the 65C02 from its socket and replacing it with the Zip Chip. You get a chip-removal tool with the product. The pins on the chip I tested were very

VITAL STATISTICS

ZIP CHIP
A replacement chip for the Apple II's 6502/65C02 microprocessor that increases its speed

CPU: *Apple II Plus, IIe, or IIc*
DISK DRIVES: *one 5¼-inch (for utility software)*
OPERATING SYSTEM: *DOS 3.3 or ProDOS*
COPY PROTECTION: *no*
LIST PRICE: *$179*

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