Teknema Divulges Internals of Net Box

Startup's Internet Appliance for Home Use is Similar to Oracle, Acorn Designs

by Jim Turley

Another small Silicon Valley startup has thrown its hat into the Internet terminal ring. Teknema (Menlo Park, Calif.) has developed a basic Web browser with less than $150 in components that goes on sale later this year. The box, dubbed Easy Rider, is very easy to build yet provides e-mail and Web-browsing capabilities.

In stark contrast to Oracle, which has so far refused to divulge detailed technical specifications of its much-touted NC, Teknema is only too happy to reveal the internal workings of its design.

Teknema (Greek for *brilliant idea*) has a nonexclusive agreement with one unnamed American customer for worldwide distribution of Easy Rider. The licensee is expected to announce its product late this summer, with delivery and service in time for Christmas. The system will include a fairly conventional 20-button remote control, with an option for a wireless keyboard.

Basic System Has Simple Bill of Materials

The basic Easy Rider motherboard is barely larger than a well-equipped calculator. As Figure 1 shows, the hardware consists of little more than an ARM7500 *(see* **081506.PDF** *)*, a 512K PROM, a 128K flash device, a 90-ns DRAM SIMM, and a simple RGB-to-NTSC converter from Analog Devices. All told, the bill of materials for the Easy Rider, including 4M of DRAM, comes to less than $100, plus the cost of a communications interface.

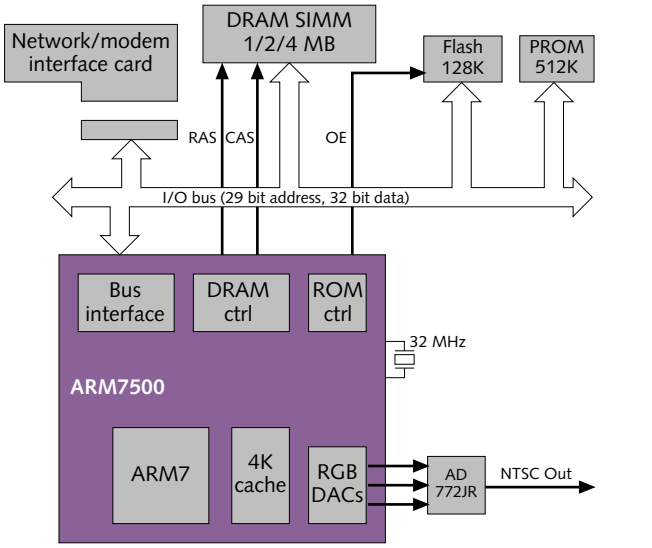

Figure 1. Teknema's Easy Rider Internet terminal consists of little more than an ARM7500, 4M of DRAM, and a PC network card.

The network interface is not a fixed part of the system. Instead, Teknema relies on the processor's ISA interface to connect to commodity PC modem or network cards. A 14.4-kbps modem retails for less than $40; Ethernet cards can be had for $25. With the addition of an AC adapter, a modem, and a colorful plastic box, the total material cost amounts to less than $150, somewhat less than the cost of similar systems from Acorn, Diba, or Oracle.

DRAM Dedicated to Frame Buffer, Web Content

The system executes partially from the ROM and partially from either the flash or the DRAM. With DRAMs now cheaper than flash memory, the current version reduces cost by copying some application code from flash to DRAM for execution, although execute-in-place is also supported. The total memory footprint is less than 500K, including the Teknema browser application, the rudimentary operating system, and a handful of fonts. Even in the current version, very little code is executed from DRAM, leaving nearly all of it free for buffering Web pages and decompressing graphics.

Storing the application in flash allows the browser software to be updated remotely as Teknema (or a service provider) makes enhancements to the application. Executing code directly from flash, although supported, requires a more expensive type of flash chip. Instead, the basic Teknema design copies the application code from slower, less expensive flash memory to DRAM, reducing cost and still allowing downloadable updates.

The 7500's 4K unified cache makes executing from low-cost ROMs feasible. Teknema claims a 90% cache hit rate, so faster ROM or DRAM were both unattractive price/performance tradeoffs. The DRAM also acts as the system's frame buffer, a UMA-style approach dictated by the design of the 7500.

With no disk drive, the Easy Rider depends entirely on its DRAM to cache Web pages and store images. Memory size is somewhat arbitrary—with more DRAM, the system can recall recently visited sites from memory without downloading them a second time, much as disk-based browsers do. Less memory results in less persistence and somewhat slower decoding time.

Software History Pays Off in Memory Shrink

Teknema's background is in software development. The company began selling its Web browser for PCs in April of 1995—coincident with the rise of Netscape's Navigator. Undeterred, Teknema turned its attention to developing a low-cost hardware platform as a delivery mechanism for its browser software.

Teknema licensed its browser to European Internet service providers (ISPs) such as UK Online and Italy's Video Online, which still use Teknema's software as their own front end and drum up trial subscriptions by binding diskettes into magazines and bulk mailings, much as America Online does in the United States.

For Easy Rider, Teknema developed a small kernel of hardware-specific software to manage basic system services. Teknema considers the term "operating system" too pretentious for its kernel, which simply replaces those functions that used to be provided by Windows on the PC platform.

The browser's small memory footprint, honed by the need to distribute it on a single diskette, paid off again when the company moved its focus to a low-cost hardware platform. The current revision of the Easy Rider uses a single 4M SIMM, nearly all of which is available for buffering and decoding Web pages. A 2M version also works, although scrolling through larger, image-laden pages takes a bit longer. The company maintains that, after some font- and code-compression tricks, a workable system might be built using only 1M of DRAM. While such an endeavor may be technically satisfying, it seems pointless in light of the current pricing for DRAMs.

Java Support Slated for Future

One potential weakness in Teknema's current implementation is its inability to run Java. Running Java applets with the resources of a 32-MHz ARM7500 and 4M of DRAM would tax most users' patience, so the browser application does not support it. The company feels Java is better suited for business environments, where "thin clients" can download their applications from a departmental server. Inexpensive Internet access, not the promulgation of Java, is the guiding principle behind the development of Easy Rider.

The company is not dogmatic about eliminating disks from its systems. While most new users might initially be unwilling to pay a premium for local storage, Teknema foresees that some may find disks convenient and want to move up to a disk-based system. Unlike other Internet appliance companies, Teknema is not on any particular crusade but is only supplying the weapons.

Teknema Holding On to ARM

The company originally selected the ARM7500 because of its peripheral mix and because some of Teknema's principals hail from ARM7500 vendor VLSI Technology. The company is evaluating the upcoming 7500FE, which Cirrus Logic is building to Oracle's specifications, but has no immediate plans to switch to the enhanced part. The 7500FE's EDO interface confers no significant advantage and, except for better Java support, the floating-point unit adds only cost.

For the near term, Teknema is far more interested in StrongArm. With the improved integer performance and the MAC unit in Digital's StrongArm-110 *(see* **100201.PDF** *)*, Teknema intends to implement a software-only modem, eliminating a significant hardware cost, and add Java support. Digital's $29 price for the 100-MHz StrongArm is only a few dollars higher than VLSI's price for the 7500; however, the 7500 includes all the necessary system logic. Digital's roadmap includes a StrongArm-1500 that presumably duplicates many of the features found on the 7500 around a StrongArm core. That device is still several months away, and its price is uncertain.

For More Information

Teknema (Menlo Park, Calif.) will begin shipping its Easy Rider Internet appliance to licensed OEMs this summer; units are expected to go on sale in September. For more information, contact Teknema at 415.833.7910, fax 415.833.7919, or visit the Web at *www.teknema.com.*

Success Depends On Business Approach

Like nearby Diba *(see* **100804.PDF***)*, Teknema has deliberately made its system a single-function device rather than a general-purpose machine. In addition to Easy Rider, the company is also working on variations that integrate into a VGA monitor or act as a value-added modem. Unlike Diba, Teknema develops both hardware and software, and its products rely on computer-like graphical menus instead of dedicated buttons for navigating through system functions. Teknema will not manufacture the Easy Rider hardware nor its follow-on products. The company relies on licensing companies to distribute the system and provide network access and service to subscribers.

With a total component cost of about $150, such licensees could follow the business model of cellular telephones or video games: distributing the hardware at or below cost and reaping the profits from monthly connect charges, cooperative advertising, or royalties.

Home video games have already begun the assault on this market. Sega's $199 plug-in for its popular $199 Saturn game player amounts to a $398 (retail) Web terminal with a 28.8-kbps modem and an obvious secondary capability.

In the case of a home unit connected to a television and used one-handed with a simple remote control, the opportunities for advertising are great, from placing advertisements on a subscriber's home page to auctioning off buttons on the remote control itself. Single-click access to Yahoo or Toyota may be a valuable commodity if devices like Easy Rider ever become commonplace.

Teknema's Easy Rider is perhaps the least expensive Internet terminal yet developed, and one that already has the backing of at least one firm. By the end of this year, after the system has begun shipping, the company will get the first real feedback on its approach. And the industry will start to see whether the concept of home Internet terminals is, in fact, a valid one. M