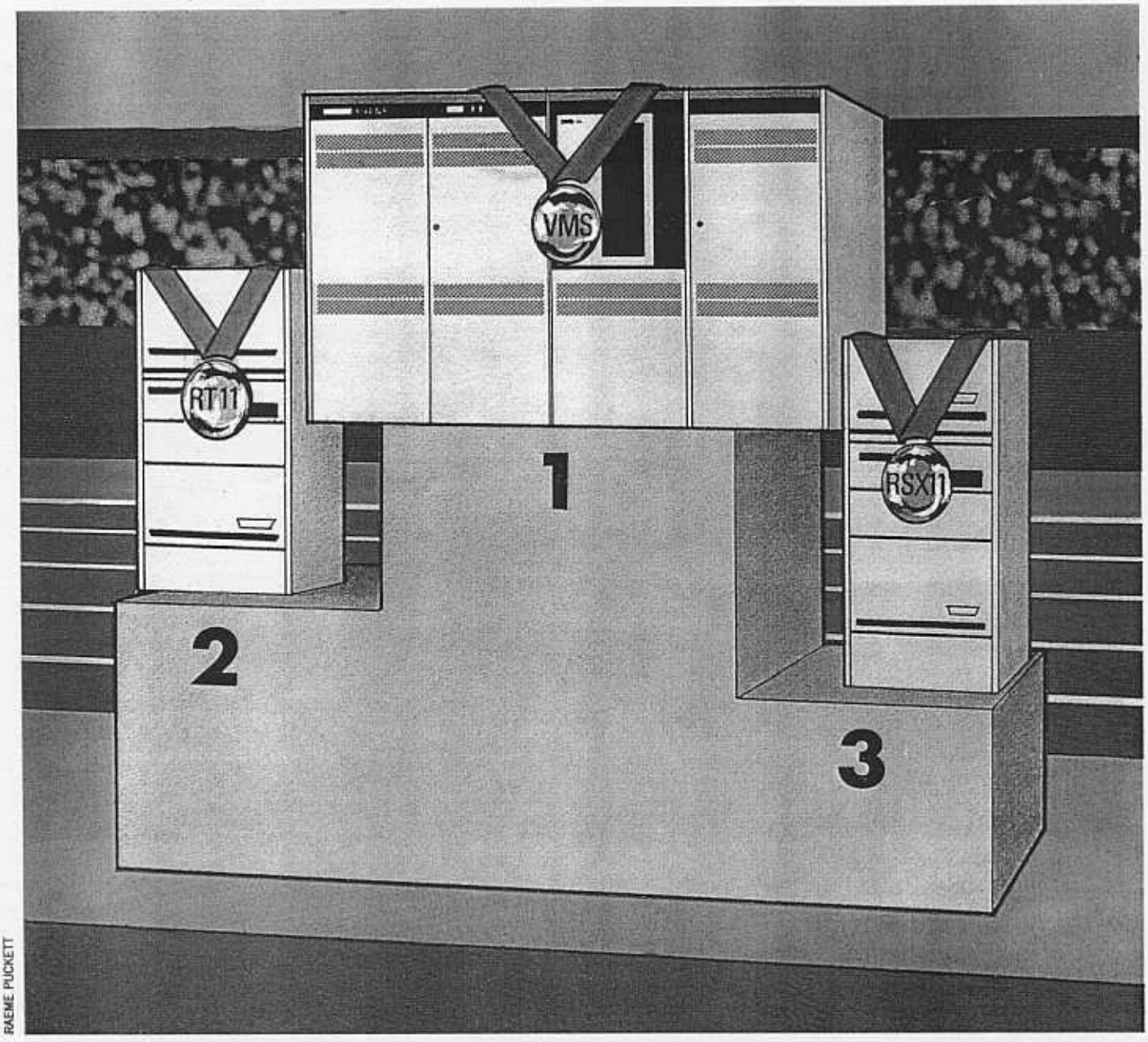
RT-11: a system whose time has come

Ian Hammond argues that RT-11 has now been re-instated as a major Dec operating system. He points to the relative decline of RSX and the rise of VMS, Unix and the remarkably flexible RT-11

TIMELESS—RT-11—the 10 year best-seller from Digital—this is how Dec presented RT-11 at Decus in Las Vegas. RT-11's sales success is undisputed—Dec have sold more copies of this system than any other.

RT-11's birth was unplanned. Dec originally released a system called Dos for the PDP-11. Dos was too big for small systems and too small for big systems. Dec needed a real-time system for its traditional users and needed it fast. RT-11 was put together to meet that goal. Its development was accelerated by basing it on OS-8, the premier system for the PDP-8 and the initial RT-11 development group included OS-8 developers.

Basing RT-11 on OS-8 meant that the system design was basically mature on day one. This has always been an advantage of RT-11. The only real architectural weaknesses of the initial design were based on the typical configuration at the time: an 8K word ▶



RAEME PUCKETT

machine with Dectapes. There was a lot of optimisation to keep the monitor small and at the same time avoid too much spinning of Dectapes.

Version 1 of RT-11 was a spartan sports car—fast but uncomfortable and you drove very close to the road. Cynics have stated that it met the 'small, fast and easy to use goals' as follows: the documentation and error messages were very small; the system was very fast to crash; and it was very easy to use in that there wasn't a whole lot you could do with it.

It was with version two that RT-11 became a powerful, usable system, V2 added seating for a second passenger (a foreground job) and many new utilities. The documentation was good (and included flow-charts of the system). RT-11 V2 quickly established itself as a reliable workhorse.

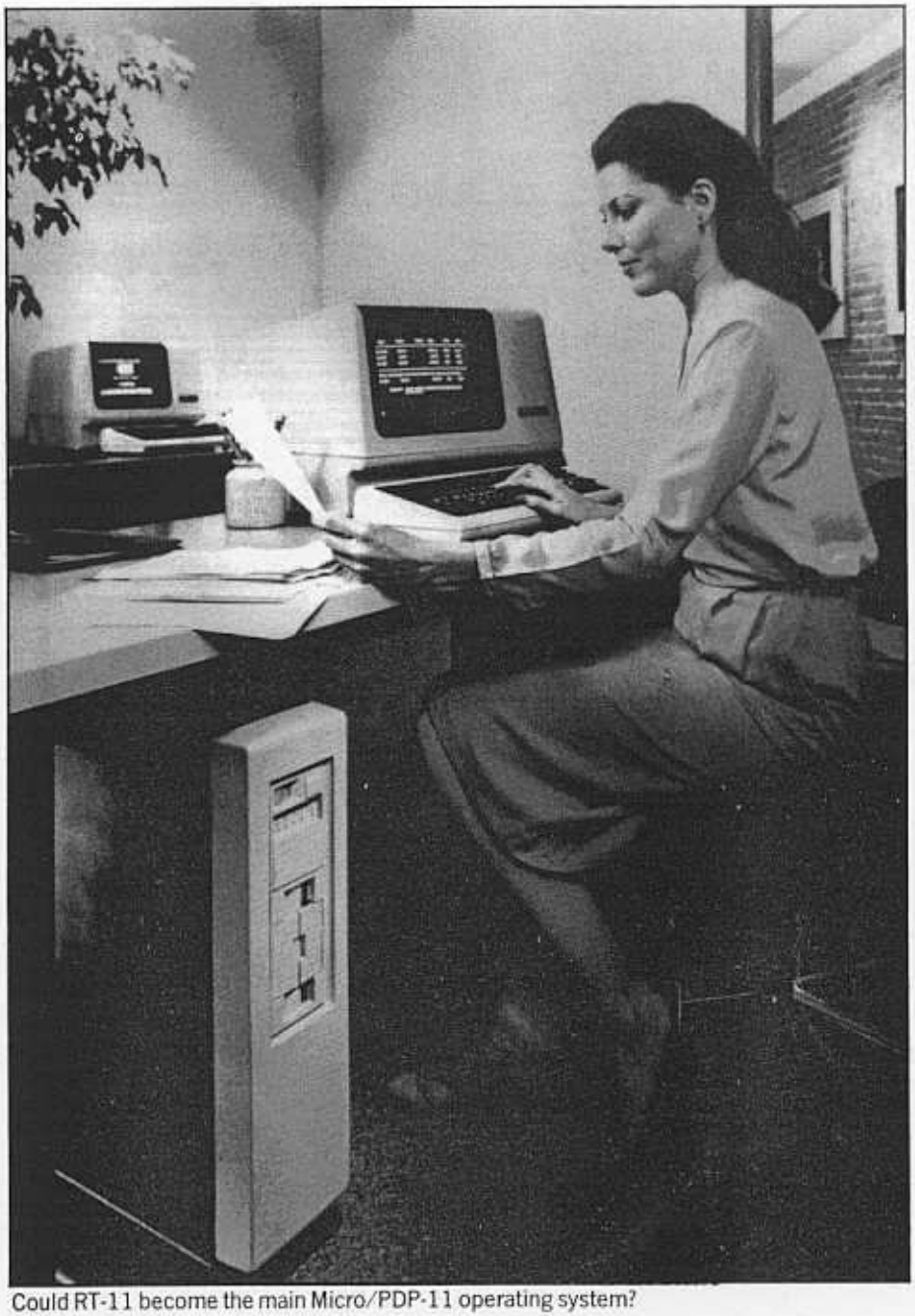
V2 was popular both inside and outside of Dec. The V3 development group more or less had a blank cheque, and they wrote some big numbers on it. RT-11 added full DCL, command files, extended memory, time-out, error-logging, sysgen, help, escape-sequence support and more. V3 was both the best and worst release. DCL turned RT-11 into a new system. But adding a DCL interpreter to the existing V1 architecture was an almost impossible task, and the system was shipped with some incredible bugs.

● NEW RELEASES

V4 cleaned it up. Escape-sequence support was thrown out because it didn't work at all. Dir, help and some other utilities were completely rewritten. Support was added for up to nine jobs. In particular, the V4 documentation was excellent. The group were most embarrassed by an empty binder they shipped with V3 that was never filled: it was intended for the software support manual. The V4 software support manual more than made up for the omission and won a technical writers' prize. V4 was so solid that months would go by without a reported bug in the software dispatch.

We were worried about V5: the odd-numbered releases had established a bad reputation. But V4 had established RT-11 rules for new releases. V5 maintained them with a fully transparent upgrade to V4. Described as a 'stabilisation release', V5 in fact added a lot of new features: ind, user-defined commands, a command line-editor, virtual discs, a virtual memory disc and more.

V5.1 of RT-11 is about to be released. This so-called maintenance release is really a new version: it adds support for the Professional, includes a spooler and some communications support more appropriate to RT-11 than Decnet.



Could RT-11 become the main Micro/PDP-11 operating system?

Putting RT-11 on the Pro brings RT-11 back home. RT-11 and OS-8 were really designed for the world's first personal computers. Did I hear someone say 'What about CP/M?' Well, an experienced RT-11 and CP/M user puts it simply: CP/M is like V1 of RT, with half the utilities.

● SMALL, FAST AND EASY-TO-USE

RT-11's goals were and are to be 'small, fast and easy-to-use'. RT-11 can still be used as a small system: it will boot in 16K words of memory, but it can also access up to four megabytes and will support up to eight jobs.

Despite some huge additions, RT-11 remains fast. Unix users simply don't believe the speed of interactive editing on an RT-11 system, even if they see it. If you want a fast game of space-invaders, you use RT. RT-11's speed is crucial to real-time applications: it delivers interrupts directly and can schedule completion routines (ASTS) without waiting for executive operations to complete. However, it would be a mistake to think of RT-11 as primarily a 'real-time' system.

What do people mean when they say RT-11 is easy-to-use? Device handlers are a good example. At a recent UK Decus meeting there was an RT-11 session on the difficulties of writing a device handler. In fact, an audience survey showed there were very few difficulties: 80 per cent of the attendees had already written one device handler, and most of the remainder had simply had no requirement to do ▶

so. RT-11's simple, highly appropriate structures make programming tasks previously reserved for gurus available to all competent users. Also, RT-11's excellent documentation turns beginners into competent programmers very quickly.

The Professional implementation of RT-11 shows the 'easy-to-use' approach. When Dec released PO/S, an RSX-11M+ subset, it was full of differences to standard M+. The RT-11 Pro implementation is simply 'GORT'—good old RT. You use the standard RT-11 distribution kit for the Pro. When the system boots, RT-11 notes it's a Pro and loads some additional software. All existing standard software will run immediately. No sysgen, recoding or recompiling are required.

The keywords 'small' and 'easy-to-use' do not imply a trivial simpleton. The RT-11 operating system may be small, but it is in no way minimal—VMS 'wish-lists' often include this or that RT-11 feature. Small systems leave lots of time and space for large applications and RT-11 has some monsters. The term 'easy-to-use' should be interpreted as 'simple' rather than 'simplistic'. RT-11 developers have to do more work, rather than less, to make the system easy-to-use.

In the 'mythical man month', Fredrick Brooks reviews the difficulties of implementing OS/360 (which he managed). In a project that at one point employed 1000 people, he comes to the conclusion that 'fostering a total-system, user-oriented attitude may well be the most important function of the programming manager'. RT-11 has always had that attitude and discipline.

RT-11 is an industry standard. Dec supplies an RT-11 environment under RSTS and RTEM, an emulator that runs under RSX and VMS. Dec has produced a number of subset RT-11 environments with Remote, run-time RT and MRRT.

The subsets were all produced for specific hardware so that Dec sales could have packages to sell. Run-time RT was for the PDT-11. MRRT was for the TU58 version of the VT103. Remote, believe it or not, was for the LSI-11. When Remote was released, Dec told us they would never put full operating systems on the LSI. The subsets have not had a happy time. Run-time RT survived principally because it was the cheapest RT-11 license available. Remote did not reach version 2.

It is difficult to understand why Dec has not produced a multiuser version of RT-11. Digital's policy is that 'RT-11 is a single-user system'. However, with the emulators listed above you can get a multiuser RT-11 environment under RSTS, RSX and VMS. The only system that does not support multiuser RT-11 is RT-11 itself.

This market hole has left room for add-on suppliers: HSC's RT-11 emulator for Unix, S&H's multiuser TSX-plus and Hammond Software's multiuser Share-eleven, multiprocessor Star-eleven, and VRT, a Vax/VMS RT-11 AME.

Both Dec and the add-on suppliers have released layered products based on RT-11 and for RT-11. Languages, real-time, database, commercial, graphics, wordprocessing, games, software tools, etc. RT-11 turns up everywhere: inside dedicated hardware boxes, booting 780s, processing image pictures from Saturn or running the Decus program update service. RT-11 systems can be as small as a TU58 or run with 600 megabytes of mass-storage. In multi-user systems or support, typically threee or four users, but can handle up to a hundred. Like the PDP-11 itself, RT-11 supports an exceptionally large performance range: it is the only system that supports every PDP-11 processor. And, like the PDP-11, RT-11 is ubiquitous.

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● POLITICS

RT-11's political fortunes within Dec have waxed and waned. During V2 and V3, the system was a hit. Between V3 and V4 things changed, and the end was prophesised, Dec concentrated on RSX sales and attempted to dissuade potential RT customers.

Dec's policy is for its major sales force to sell packaged systems. Thus, when new hardware is released, there is pressure on engineering to produce a package that the sales force can use. In certain cases, this leads to the hasty construction of some system. RT-11's ease-of-use has made it a natural choice as a base for such systems. Clearly, products based on sales policy rather than market demand are doomed. But RT-11 also catches the flak when these products fail. Products like Remote for the LSI. RT-squared for the PDT and MRRT for the VT103/TU58 have not helped RT-11.

It is difficult for an outsider to judge corporate political pressures. It is even more difficult for insiders to talk about them. However, I believe that Dec's lethargy with their best selling operating system derives from the basic hardware orientation of the company: Dec still views software as an add-on. Single-user systems do not sell as much hardware. But it still remains unexplained why Digital did not release a mulituser RT-11 that would have sold more hardware.

There is a bloody history of sibling rivalry between RT-11 and RSX-11. During the days of the RSX empire, RT-11 was shut up in the cellar. Vax now reigns, RSX is fading and RT-11 has been released. RT-11 will own more and more of the PDP-11 territory in the coming years.

RT-11's position has improved in the past year for a number of reasons. Firstly, RSX sales seem to be falling (Vax/VMS + Unix poach mostly on RSX territory), secondly, the big profit scare seems to have made Dec more pragmatic: their best selling operating system has won here. Thirdly, PO/S has not been successful. Eighteen months ago the company announced they would never release RT for the Professional. Four months ago they did.

The announcement of RT-11 for the Pro is important. It means not only new markets for RT-11, but it also indicates that RT-11 is a part of Dec's future.

● GOOD-TIME SYSTEM

RT-11 users do not turn up in large numbers to Decus. They don't need to. They can solve most of their problems as they arise without help (Hammond's rule is that the size of a Decus Special Interest Group is inversely related to the quality of the product).

What do RT-11 users miss on other systems? First, the speed: RT-11 users do not expect any delays—particularly with the terminal cursor. Second, the aesthetics: when I work with VMS I am pained by the poor terminal formatting and the amateur inconsistencies in command language. Third, the documentation: you can read the RT-11 source if you want to—but you don't have to. Real programmers do not survive on RSX or VMS without the micro-fiches.

These preferences of RT-11 users are not mere fancies. Software manufacturers typically rate productivity under RT at two to ten times that of RSX. RT-11 users get more work done because they get their work done faster. ●

Ian Hammond is widely recognised as a non-Dec RT expert. His company Hammond Software, continues to produce related operating system products.