Gordon Bell, 53, is a legendary figure around the halls of DEC, even though he last worked there four years ago. As head of DEC’s engineering effort in the 1970s, Bell formulated the company’s VAX strategy and shepherded its introduction and implementation. That strategy remains the foundation of DEC’s product line and marketing efforts. The company insists this strategy is flexible and durable enough to take DEC into the next decade and beyond.

Computerworld Extra asked Bell, now assistant director for the Computer and Information Science and Engineering (CISE) Directorate at the National Science Foundation in Washington, D.C., to consider the future of VAX.

What is the origin and essence of VAX? VAX came from a tiny task force I led in April 1975. The idea was to create a new computer family to be “culturally compatible” with the successful PDP-11. Its principal design goals were to be compatible with key operating systems and languages; to have a much larger address space than any existing computer; to be efficient at implementing high-level languages, including Fortran, C (for Unix) and Cobol; to be implementable over a wide range of sizes; and simply to be the highest performance computer in its class when first implemented.

In December 1978, after the VAX-11/780 had achieved immediate success, the company adopted the VAX strategy to provide a VAX homogeneous computing environment for a range of interconnected computers.

A user could compute in any of three styles from a cluster of large machines behaving as a single system, distributed traditional minicomputers and distributed clusters of workstations. The strategy also specified compatibility with other DEC computers and intercommunication with other standards and products.

Why has VAX been so successful? The concept was incredibly simple, and hence everyone [customers and the company] could understand and support it. Also, the three-level computing hierarchy was right... even IBM discovered and endorsed it by the early 1980s. VAX provided the best, and only, totally compatible, single-interconnection environment.

This required a range of computers, from VAX on a chip to the highest performance computers that could be built.

VAX gave DEC a product monopoly, since no other manufacturer has anything like this capability. It specifically exploited the fact that most manufacturers had a menagerie of product lines designed to segment the user base, fill product size and application gaps or help the manufacturer’s organization.

Recently, IBM started to provide similar capabilities by having [IBM] 370-compatible minis and a plug-in card for a PC. But this is not enough because they have several operating systems, a worse problem than having multiple hardware architectures.

Also, given the complexity of the IBM architecture, including the I/O and operating systems, it’s probably hard to make the architecture serve the wide range of users at this point in its life.

Did things happen pretty much according to your VAX strategy? Largely yes, although it wasn’t as trivial or simple to do as one would think. Ethernet, an essential component, was questioned by various internal DEC committees, even after the whole system was working. Having adopted a VAX strategy in 1978, the company in 1980 decided it had to enter the PC market with a trilogy of non-VAX PCs, which only loosely fit the strategy. VAX was too large to build as a workstation until 1983 to ’84.

At the same time, the high-end implementation of VAX — Venus [the 8600] — was more than two years late as engineers hit the complexity wall and essentially forgot the recipe of how to design computers. These two events accounted for DEC’s poor financial performance in the early ’80s.

Do you see anything that could challenge the VAX strategy yet? No. In 1978, I thought the only possible threat was Unix, because it provides compatibility at a higher level, somewhat like VAX. I imagined that innovative or small companies would develop Unix systems for interconnecting environments by the mid-’80s. Now I’ll push that back three to five years.

A critical hole is in the PC space where

Microsoft Corp.’s MS-DOS is similar to Unix, but isn’t compatible. Unix needs to evolve in range, human interface and applications. Having AT&T control it doesn’t help — it has to truly be a public standard. The government support of Unix [Posix] still could have an impact.

Also, I don’t see a single large computer company coming up with anything like VAX because of the cost and commitments of preserving their code museums for running old programs.

How far can DEC go with the VAX architecture? I don’t believe all the capabilities in the architecture, as constrained by its addressing, have been exploited yet. DEC still has uniqueness.

Critics point out that even if clustered, the architecture will sooner or later blow out. What do you think? Here, history is a good guide. Every architecture has sooner or later either run into a limit or been inappropriate to the technology. With the

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BEYOND VAX
FROM PAGE 80

The perception of the IBM 380, which had an inherent 32-bit address to get it to the 1990s, history also
tells us that companies try to evolve their architectures for too
long. They end up with 100% of their user base market but a
decaying share of the enti-
tire market. Eventually, even
that market declines as users de-
sert the obsolete machines.

A major computer architecture
revolution lasts about a decade.
I believe it is hard to design an
optimum architecture that lasts
much longer. While VAX may
top out, it should be a fine base
for evolution.

What will the topping out
of the VAX mean to the thousands of VAX
developers and users? More
than that, what will it mean
to DEC’s single-archi-
tecture prescription?

Again, let me rely on history. VAX was a major new hardware
architecture, yet the evolution from the
PDP-11, yet it preserved pro-
gramming interfaces, languages and
data bases. The same con-
ccept could be recouped even if
DEC changes the underlying
hardware architecture. The pro-
gram and data base interface must be preserved, it should be transparent if users
adhere to certain VAX and VMS
standards.

It’s probably important to de-
fine VAX or VMS, compatibility and
whether a new, basic hard-
ware architecture could be used to
implement this environment that
is, without object com-
patibility. The problem is much
easier than with the PDP-11 or
or with the 370 because VMS is a
single interface which subsumes
the network but includes the
operating language, DEC-20
and various languages. Fortunately,
neatly all programs are written in
a high-level language today and
would be compatible.

Can DEC engineers de-
velop a totally new archi-
tecture for the ‘90s and be-
yond that will play on DEC and
some new base architecture from
existing machines?

Companies with different under-
lying hardware architectures provide existing proof of VMS
user-level compatibility. Cer-
tainly DEC should be able to do
this, too.

Are the engineers at work on
such a scheme now, and
if so, what is the best
guess as to what it is?
I hope so, because it is essential.
The key is to identify the crucial
limits of VAX and to eliminate
them. Again, it might have goals
similar to those we used to cre-
ate VAX in the first place. The
only goal I would add to the origi-
nal VAX set would be the inde-
pendence of the Instruction Set
Processor hardware architec-
tures. Just as VAX added new di-
ensions of comparison, a new architecture also must add those
dimensions of comparison.

I won’t predict the new plan
would address parallelism of all forms and performance for the scientif-
ic and engineering community, including the ability to colabo-
rate effectively on the computer
using high-speed interconnects.
It would handle large scientific
and engineering data bases.

A radical view of data integri-
ty can be understood by the
improvements in the cost of
ownership and availability di-
ensions are quite possible. In
addition, DEC could address the
market that wants the power of a
VAX in the first place but don’t want to become
system programmers or adminis-
trators. This would mean any
compatibility with MS-DOS and
functions per second could be
get a small handful. This approach
would provide at least one or two
non-"me-too" products. More-
over, it gets the price into the
$10,000 per MIPS range vs. the
$100,000 per MIPS range of the
typical of the large mainframe.
These ridiculous prices aren’t
sustainable except for large
mainframes, where users are
forced to buy huge code muse-
ums — and someday the users
may get smart.

What markets would such
a machine address?

DEC seems emasced with the commercial and transaction pro-
cessing markets. Multis are the
loc [Cray Research,
puts the MIPS per
chip.

By ganging them
and still be in the instruction set
of VAX and to eliminate
the limits of VAX and to eliminate
the limits of VAX and to eliminate
IBM’s. There are two basic measures of
performance: total processing
capacity and the number of
jobs run in a day. For the former,
which is a measure of the
mean time between failures,
there are no other
standards.

The speed of a uniprocessor
sells more than the VAX or the 370 is
correlated with the clock speed.

A high-end machine with a
40- to 60-MHz clock could prob-
ably be built and still be in the
market place with a power of
two to three times the current
clocks.

Note that the current [IBM]
3080 uses about a 60-MHz
clock, and the Cray XMP clock is
almost twice as fast, although
both have roughly the same
scalar speed. Clock speed isn’t al-
ways a good indicator.

Could you retrospectively
benchmark a VAX II architec-
ture by 1986, marking
now and delivery in ’88
— a decade after the 780.

Would VAX II be reduced
instruction set computing,
in RISC-based?

Probably.

What other big issues face
DEC in the future?

1. Thinking VAX is the end, not
simply the best thing around to-
day, is an enormous hurdle.
While nothing is yet in the mar-
tketplace to challenge it, several
new systems do and will. This
thinking leads to arrogance,
by itself . . . or by relying on the
and IBM applications being
converted to VAX just because
VAX is better than the 360. Radically
new applications should be
sought that build on the environ-
ment and do things no other en-
vironment can support.

2. Being enamored with the
commercial interests and not at-
tending to the scientific and en-
gineering base, especially in the
universities. The commercial
market tolerates high prices for
higher performance, but they
are unique. The technical mar-
tketplace is far more demanding
on products.

5. Responsive, efficient and
creative manufacturing still ap-
pear to be nonexistent. While
DEC is probably no worse than
the average, it’s not adequate to
compete in the ‘90s when the
Japanese and others arrive.

That’s a big set of worries.
Are you optimistic?

Certainly. They are making lots of
money, have lots of cash and
evergreen. All they need
is a challenge. The plethora
of new startups certainly provides that.

THE VAX FAMILY

In the past year, DEC has introduced seven
VAXs (performance figures are based on the VAX-11/780 as
corresponding to DEC does not use MIPS)

Jan. ’87
Jan. ’86
Aug. 86
Nov. ’85
Aug. ’86
Oct. ’84
Aug. ’86
March ’87
Aug. ’86
Jan. ’86
Aug. ’86
March ’86
1977
Feb. ’87
May ’85
Feb. ’87

VAX 8700
VAX 8700
VAX 8700
VAX 8650
VAX 8650
VAX 8650
VAX 8650
VAX 8650
VAX 8650
VAX 8650
VAX 8650
VAX 8650
VAX 11/780
Microvax II
Microvax II
VAXstation 2000

0      12     24     36     48     60

* Millions of Instructions per second

INFORMATION PROVIDED BY DEC
CHART

By ganging them and match-
ing them to a memory, one
VAX can get the most power in a single
system at a small fraction of the
cost of an emitter-coupled logic-
based computer with a few
ex-
per-
cer-
formance
pro-
cessor
cap-
ability, but they
provide
100-MIPS-level performance and substantially
better price/performance for the
user than the current "model"
approach.

In addition, consistently com-
petitive competitive servers are
needed, which would run techni-
cal work in the [Cray Research,
long run, a multi might do the job,
but for now, the vector multi-
processor is the main line . . . in
effect, another Crayette.

What is the largest uni-
processor VAX that can be
built?

The speed of a uniprocessor,
such as the VAX or the 370 is
correlated with the clock speed.

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tending to the scientific and en-
gineering base, especially in the
universities. The commercial
market tolerates high prices for
higher performance, but they
are unique. The technical mar-
tketplace is far more demanding
on products.

4. Poor presence on the desk,
and even picking MS-DOS and
[Intel Corp.’s] 80286 or 80386
to implement. I don’t see what
another clone brings to the mar-
tketplace; certainly not price
and performance. Service revenue can be
obtained simply by going into that segment of the service busi-
ness. Integration with the Apple
Macintosh is also important.

5. Responsive, efficient and
creative manufacturing still ap-
pear to be nonexistent. While
DEC is probably no worse than
the average, it’s not adequate to
compete in the ‘90s when the
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money, have lots of cash and
evergreen. All they need
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VAX gave DEC a monopoly in
much the same way that the 360
gave IBM a monopoly by the
70s that only lasted a
dec; DEC should compare its
products with the best small
companies, not old-line sup-
pliers.