

This is a primitive, early Cray Research module. This is what we started the company with, the CRAY-1 with 5/4 gates and you all know what they look like. But I'm putting it up here because it takes 2 hands to hold it. It's a sizable product. We don't do these anymore. Here's the way the cabinets look. The numbers here are interesting for reference. I'll put them all together with a couple of charts at the end. The clock period is significant--12.5 nanoseconds, we only built single processors in those days, 80 MIPS, 160 MFLOPS.

Here's the CRAY-2 module and again, it was a significant reduction in volume and it was a significant reduction in clock period--from 12.5 to 4 nanoseconds. The circuitry is still silicon, we have 16-gate arrays instead of 5/4 gates and there was a factor of almost an order of magnitude in the number of modules in a processor. There are only 30 modules in a processor here versus a couple hundred in the CRAY-1.

Here is a CRAY-2 tank and I want you to notice the person there because we used the same person standing next to the CRAY-3 computer in a following slide so it gives you some size perspective.

Now we have 4 processors, 480 MIPS, 1,800 MFLOPS in a hardware sense, and we have liquid immersion cooling for the first time. Here's the CRAY-3 module which again is down by an order of magnitude in volume, in fact quite a bit more. There are 4 modules in a CPU instead of 30, they're only a quarter inch thick and they're only half as long. I think if you multiply those out you get a rather huge number--probably 27. The level of integration has gone up. It's still not catching up with silicon, and it may never, but it's moving along. We've gone up to 200 to 400 gates in the range of what we have in our integrated circuits, and perhaps more importantly, the number of logic levels per clock period compared to the CRAY-2 is up. We're getting back close to the CRAY-1/X-MP number of levels of logic. What this means in the computer is we can issue instructions every clock period instead of every other, memory is higher by a factor of 2, a lot of good things which end up giving you the statistics you want to see at the end.

Here's the CRAY-3 processor and as you can see it's significantly lower and not nearly as big around. That's 30" in diameter. If one looks further it's even more impressive because the whole computer is in that glass portion at the top which is 4 inches deep, so the computer is 4 inches by an annular ring. If you compute the volume it's less than one cubic foot. This has 16 processors instead of 4, and it has 512 million words of memory, all in less than a cubic