



DMSO 2000

**Can we build a
simulator for
\$299.95?**

**...and what about the
database?**

**...and will it do
useful training?**

The real question is:

*How do we make sure we
win if we have to use force?*

Modeling and Simulation

- ***The goal:* To train with ever more complex equipment and situations**
- ***The attraction:* to do this as cheaply and effectively as possible**

Some Thoughts About Modeling and Simulation

Simulation-based training is at four levels....

**Large-scale
exercises**

**Linked
(Small Unit)**

Operator

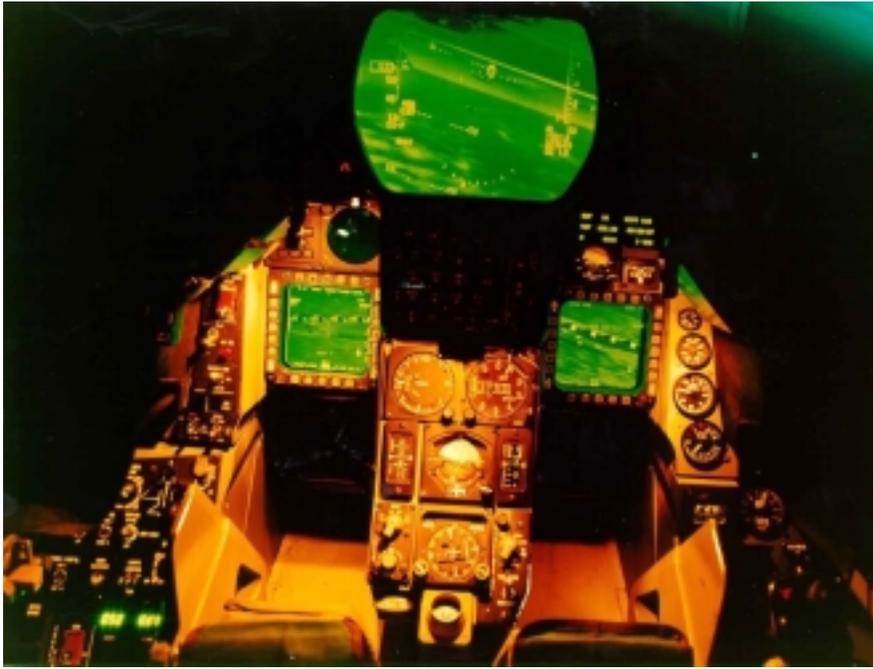
**Role-playing
(Constructive)**

**....with increasing fidelity
to the physical world**

Rule One

The cost of a simulation increases in proportion to the physical reality

The reason for this is that mechanical systems and software do not follow Moore's Law



An F-16 with a full sensor suite is more expensive to simulate....

...than a motorcycle



Rule Two

*The lower the cost of a computing device,
the harder it is to program*

**The reason is that higher-level tools are
absent and the programmer writes direct to
the hardware**

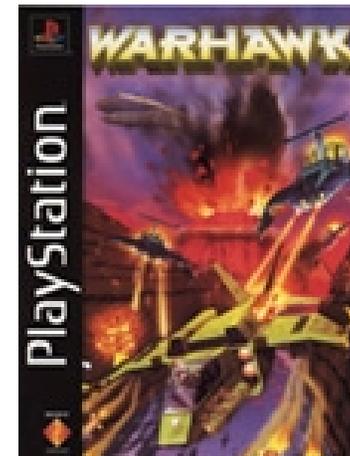
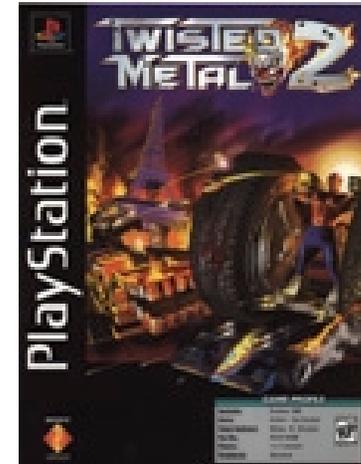
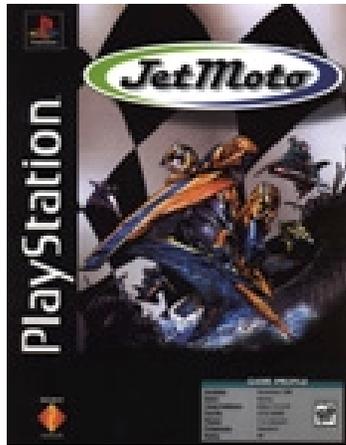


Sony PlayStation 2

**“It is no secret that PS2
is hard to program”**

**--Shinji Mikami,
President Capcom**

Example: SingleTrac



Rule Three

Complexity requires communication

**The parts or players in a more complex system
must coordinate with each other**

Requirements to Communicate

- **Common protocols at all levels**
 - Communication/network
 - Representation of objects and materials
 - Relationship among objects
 - Description of behaviors
- **Essentially, these requirements imply standards**
- **And of course--*Bandwidth***

Rule Four

The cost of a model of the real world (the database) increases with the size and fidelity of the area needed but decreases with the amount of hardware available

More hardware allows better tools and less hand-tuning

“Asked if PlayStation 2 games cost over \$4 million to make, Inafune smiles and says he has spent double-digit millions on his.”

Some observers believe that a top-of-the-line game with Hollywood production values may cost over \$50 million in the near future

Cost to Acquire Raw Data

	Resolution (m)	\$/square km	M\$ for US
Classified Source	0.25	480.00	4,320
IKONOS Pan	1	100.00	900
IKONOS MS	4	50.00	450
SPOT New	10	1.25	11
LandSat	30	0.13	1



100 KB JPEG



10 KB JPEG

Some Issues with Databases

- **Standardization is continuing to arrive (slowly)**
- **But databases can still be expensive to build, depending on the use**
 - Moderate resolution terrain drape (good at high altitude)
 - Higher resolution terrain drape (needed up close, but much more demanding and expensive)
 - Features are still hard to get right and not nearly as automated as terrain

Rule Five

Costs tend to come down with volume, and volume tends to go up with standardization

**This was the essential insight of both
Henry Ford and Bill Gates**

**So how do we achieve
standards and reduce costs?**

Standards can emerge in several ways

- **Commercial dominance by a major high-volume player (e.g. Intel, Microsoft)**
- **Making it free but good (the web)**
- **Government funding of a really useful thing (TCP/IP)**
- **Standards committees (slow)**
- **Edict (rarely works with technology)**

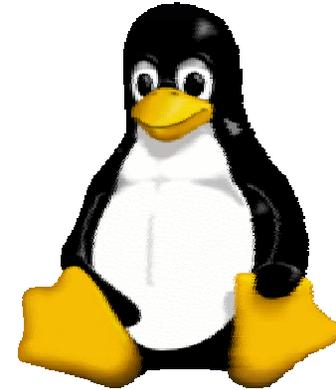
Microsoft—A Brief Digression

- **Microsoft is just the latest in a series of American organizations that have set standards in technology (AT&T, IBM, DARPA, Intel)**
- **You don't have to like Microsoft to see that having an American organization set the standard has advantages for America**

Microsoft—A Digression (cont.)

- **The real value of Microsoft may not be innovation, but rather standardization**
- **The real danger to Microsoft is not the US Government, but 10,000 plaintiff lawyers (this is different than any prior antitrust suit)**
- **In the past, major antitrust actions have often accompanied major stock market declines**
 - Northern Pacific Railroad, 1901
 - Standard Oil, 1906
 - RCA, 1930

What About Linux?



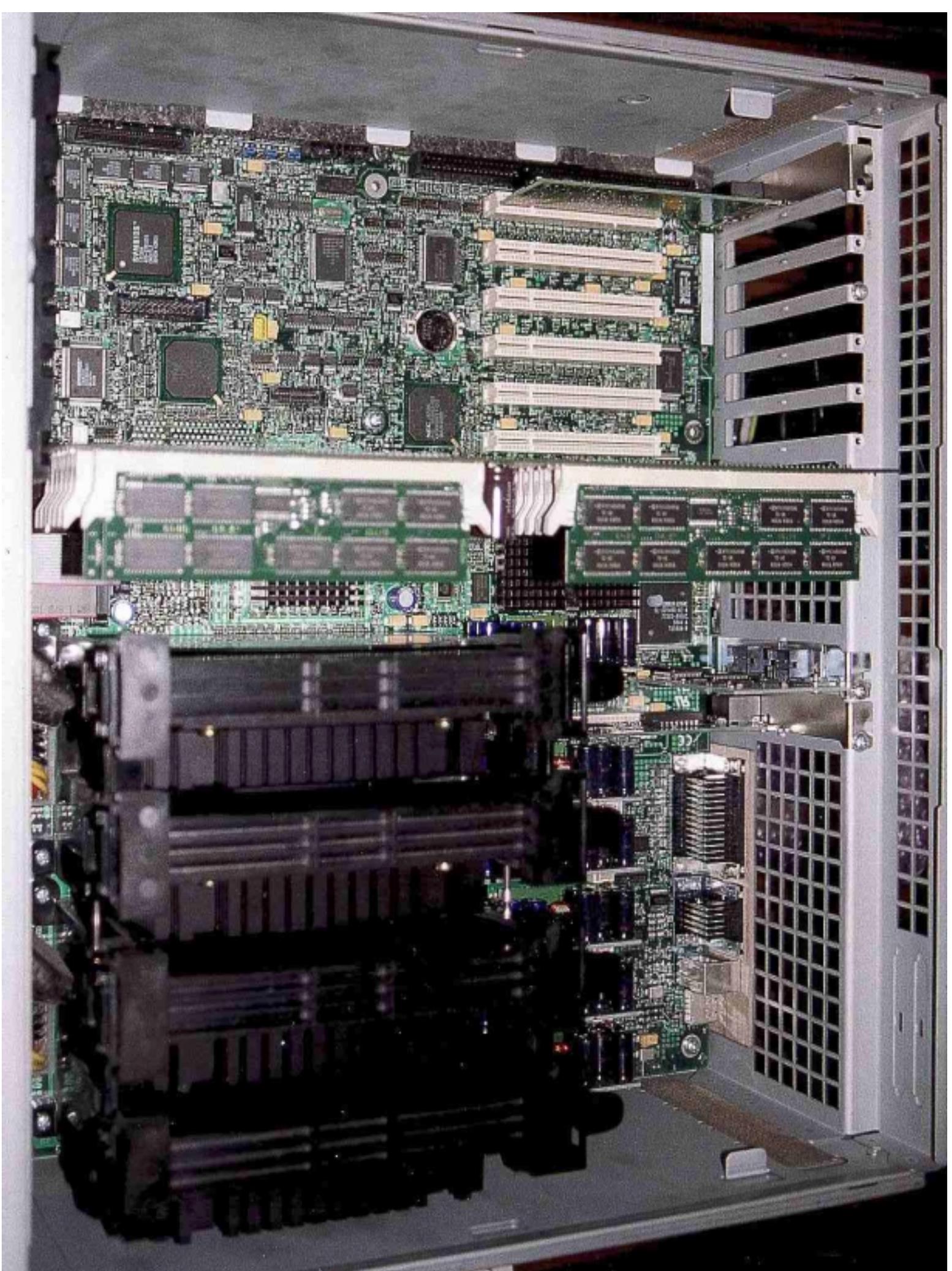
- **Linux is essentially UNIX**
- **The problem with UNIX is that there never was just one**
- **It appears likely that Linux will also have many variations**
- **Will probably see greatest use in embedded systems and real-time control**

Some Ways to Standardize

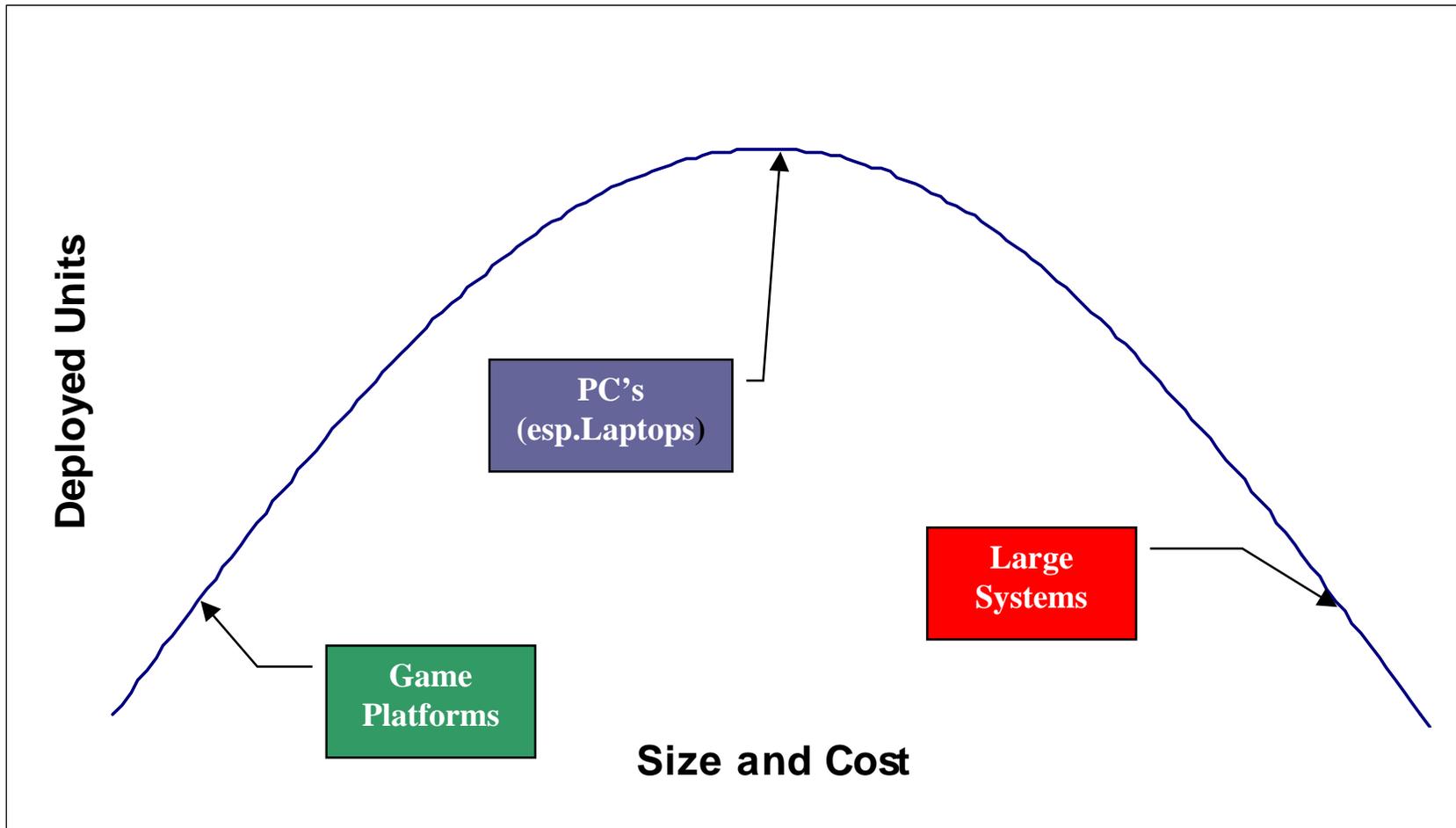
- **Do what the dominant player does (Microsoft)**
- **Create libraries of many desired objects and make them freely available (models, 3D source data, behaviors, tools, entire databases, etc.)**
 - Solicit improvements to be put in the library
 - A variation on the open-source movement
- **Continue to fund innovation through proven pathways (DARPA, Universities)**

What About COTS?

- **Use of COTS components can be a part of the solution—but commercial acquisitions are not a panacea**
- **Military needs are often not the same as commercial needs—neither in weapons nor simulators**
- **The problem is that purely military markets for M&S are small relative to commercial markets such as games, and product cycles are short**



Hardware—Best Standard



A Vision

A Vision

- **A laptop issued to most military personnel**
- **Standard database formats and freely available tools to generate rapid databases**
- **High-speed communication links**
- **Simulation gaming software for various training exercises**
- **Visualization tools on the laptop**
- **Networks of cockpits/cabs for hands-on simulation**