Innovation

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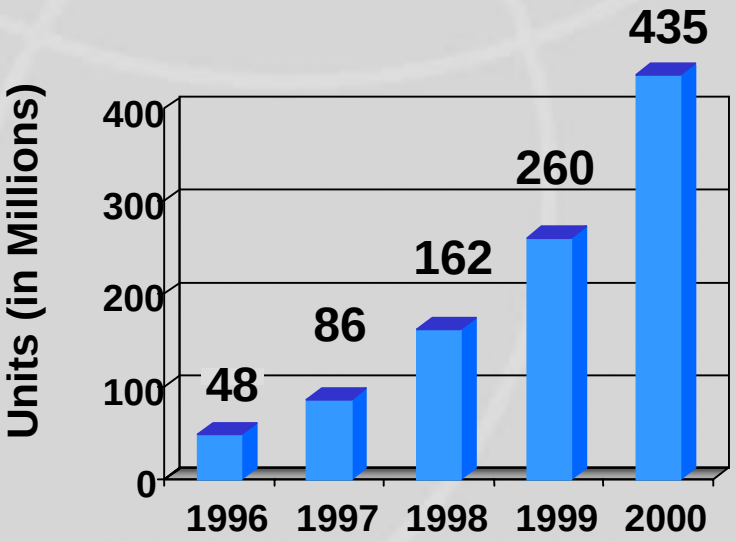
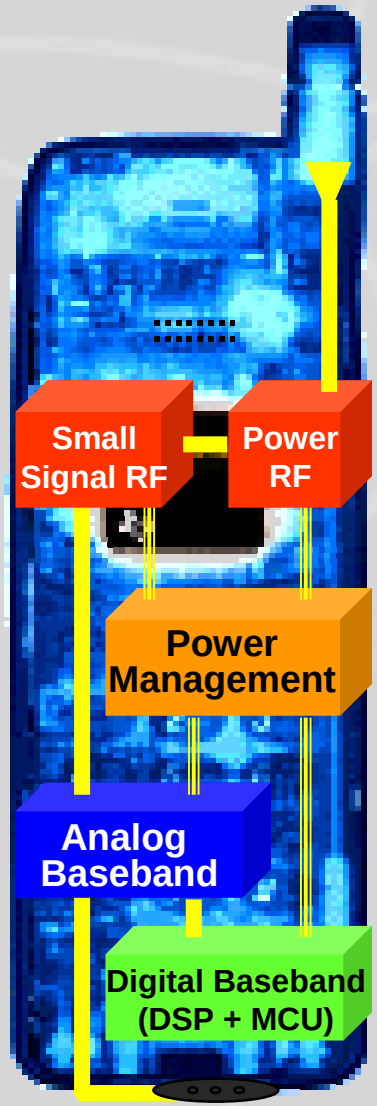
Cellular Phone: An Example

Digital Cellular Market
(Phones Shipped)





DSP and Analog Drive Internet Age

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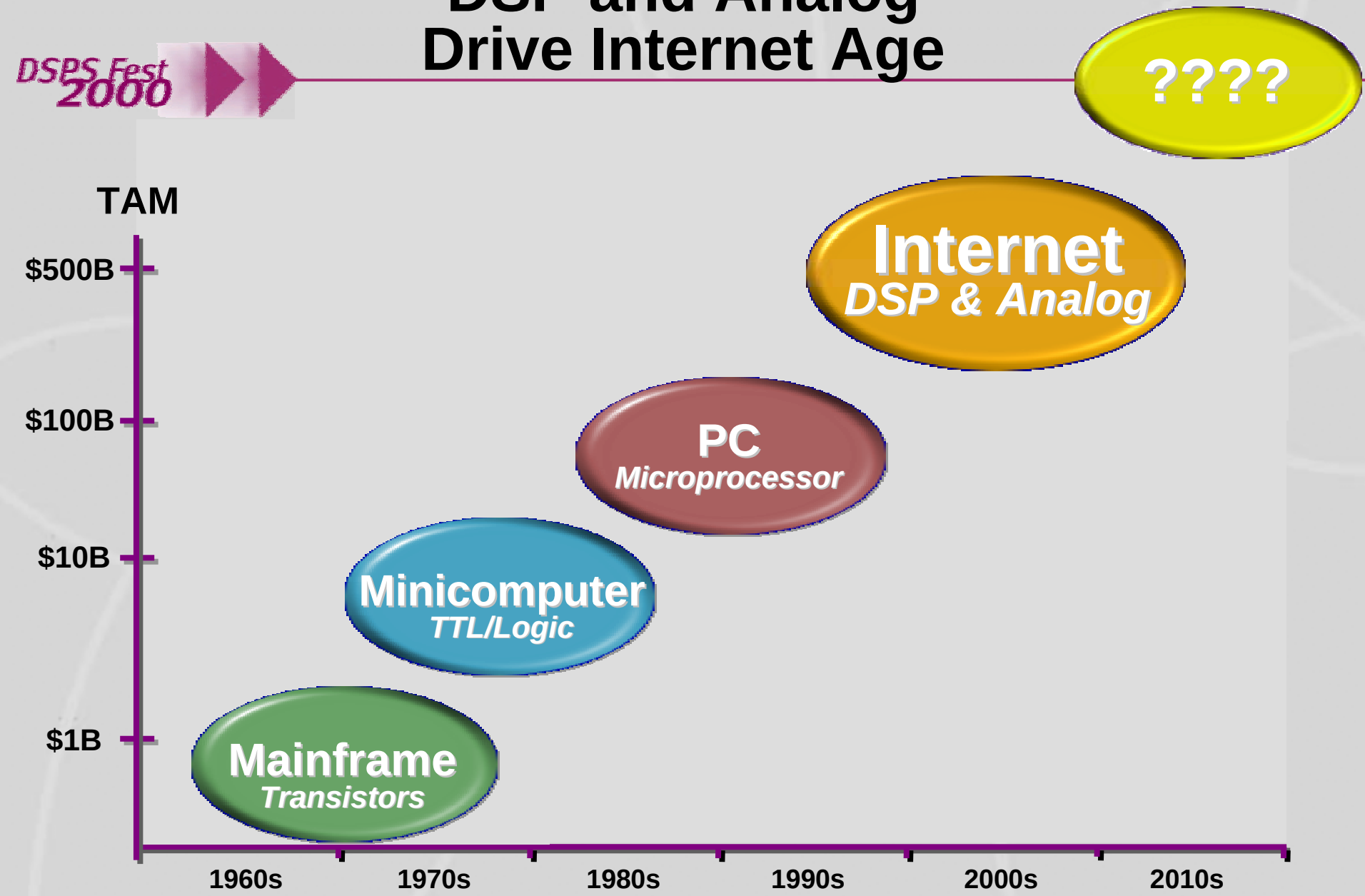

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Two Decades of Integration

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TYPICAL DEVICE CAPABILITIES

	1980	1990	2000	2010
Die size (mm)	50	50	50	5
Technology (uM)	3	0.8	0.1	0.02
MIPS	5	40	5,000	50,000
MHz	20	80	1,000	10,000
RAM (bytes)	256	2K	32K	1M
Price	$150.00	$15.00	$5.00	$0.15
Power (mW/MIPS)	250	12.5	0.1	0.001
Transistors	50K	500K	5M	50M
Wafer size	3"	6"	12"	12"

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Power Dissipation Trends

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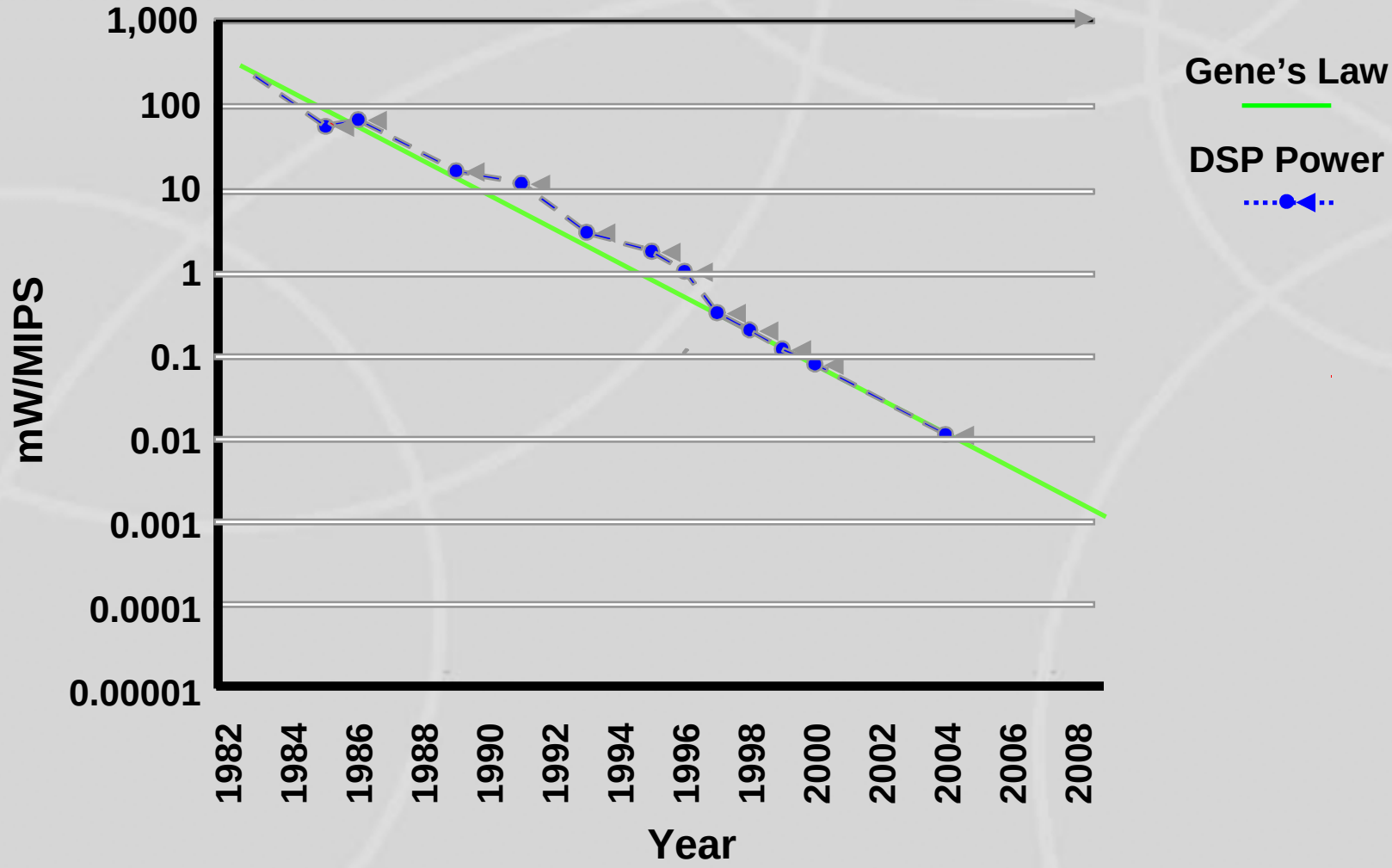

The Question of Size

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- Device size has become a **non-issue** as a result of process technology
  - **CPUs are** close to or at 1mm in die size and **shrinking**
  - ASIC gate density is **100K gates** per mm or greater
  - Memories continue to shrink
- **Systems** are getting **more complex**

BUT

- **Human Factors** are not shrinking
  - **Hand helds** and **Desktops** are still the same basic size
- **Keyboards** and **Displays** still need to be large enough to use

SO

- Most products do not need the whole system on one chip
- The system can be broken into **major sub-systems**, e.g.
  - Analog
  - Digital

The Value of Time

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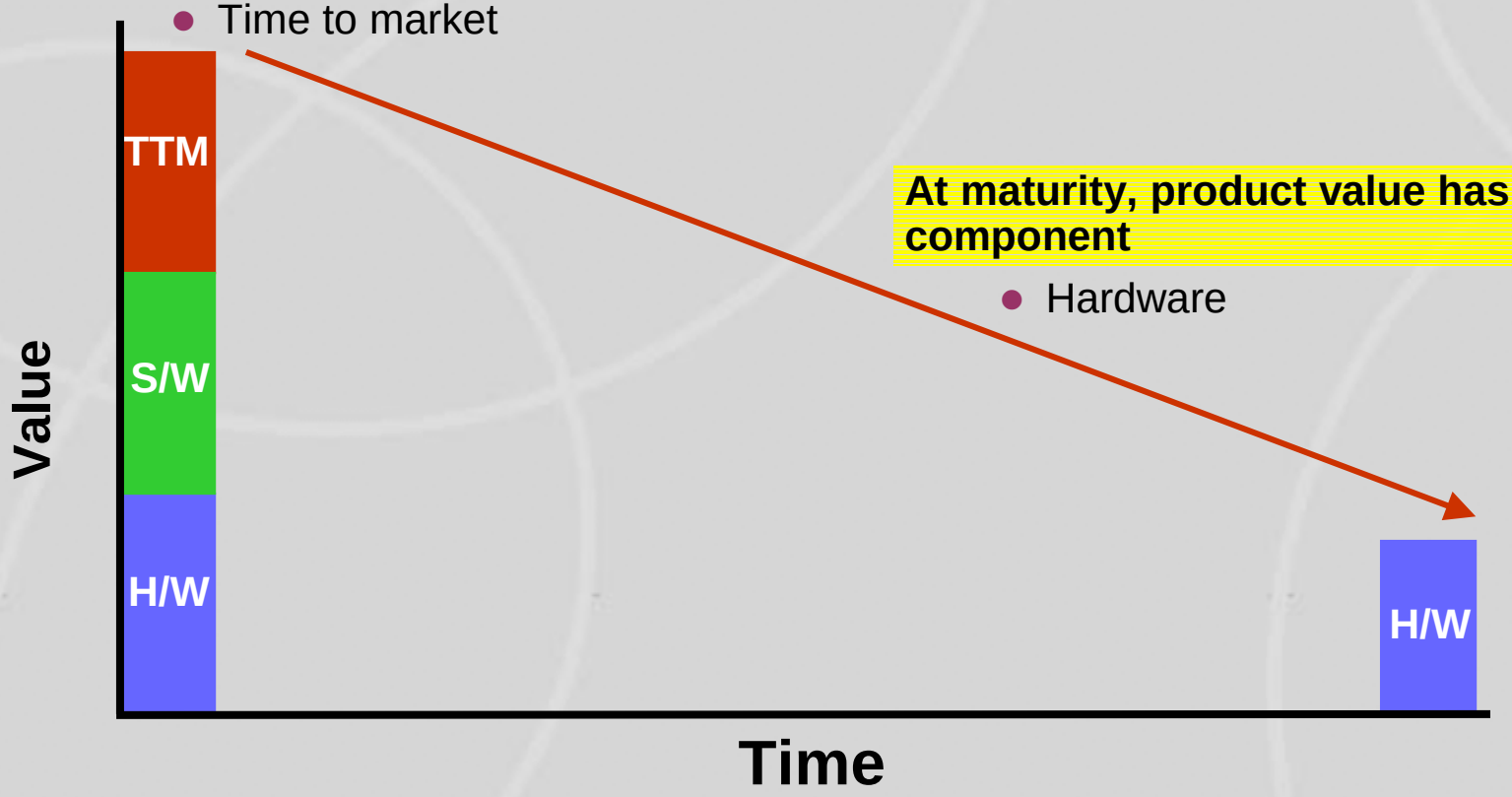
At introduction, value has three components

- Hardware
- Software
- Time to market



At maturity, product value has only one component

- Hardware

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The Value of Complexity

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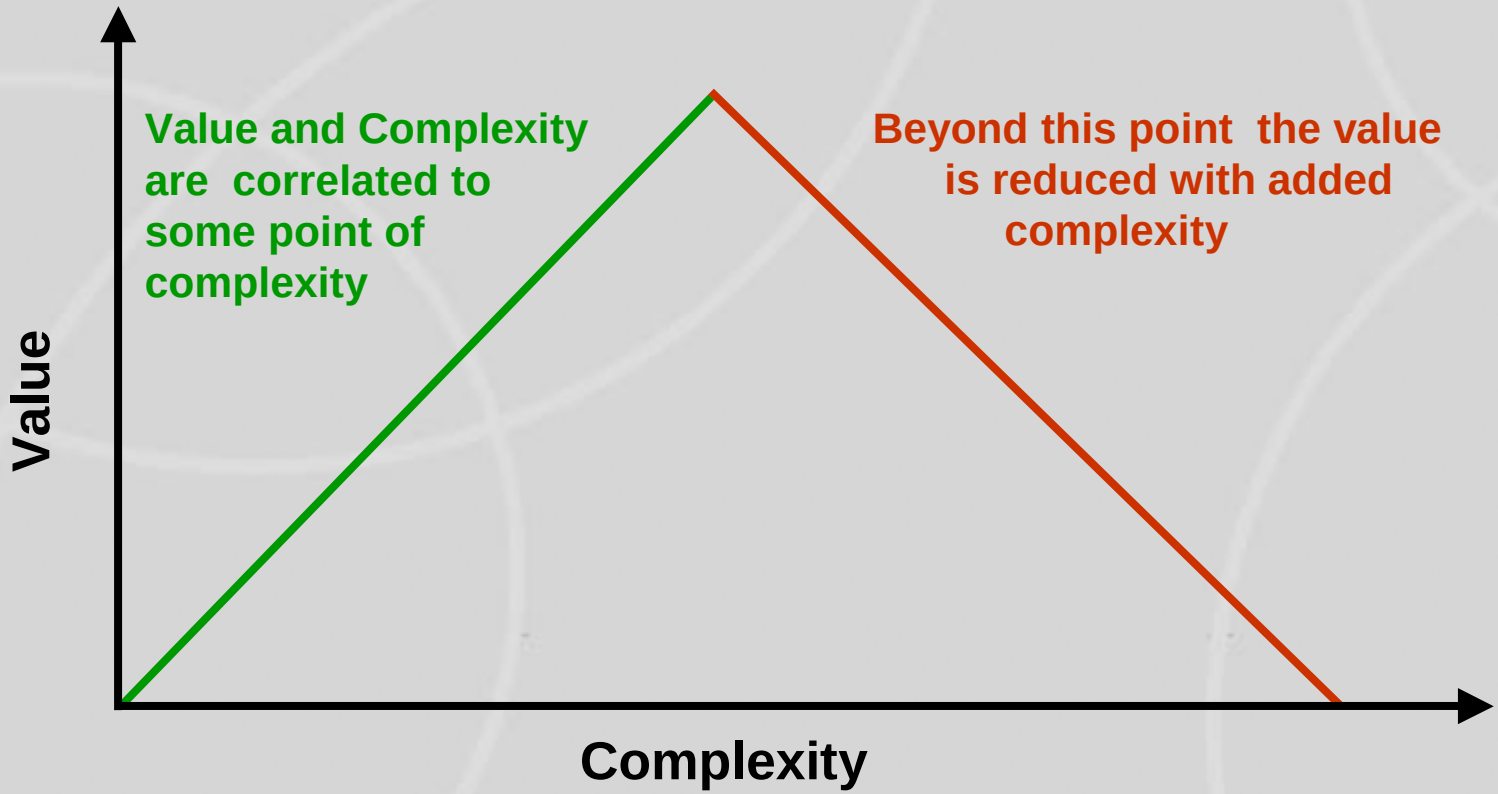

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Three Vectors of Value

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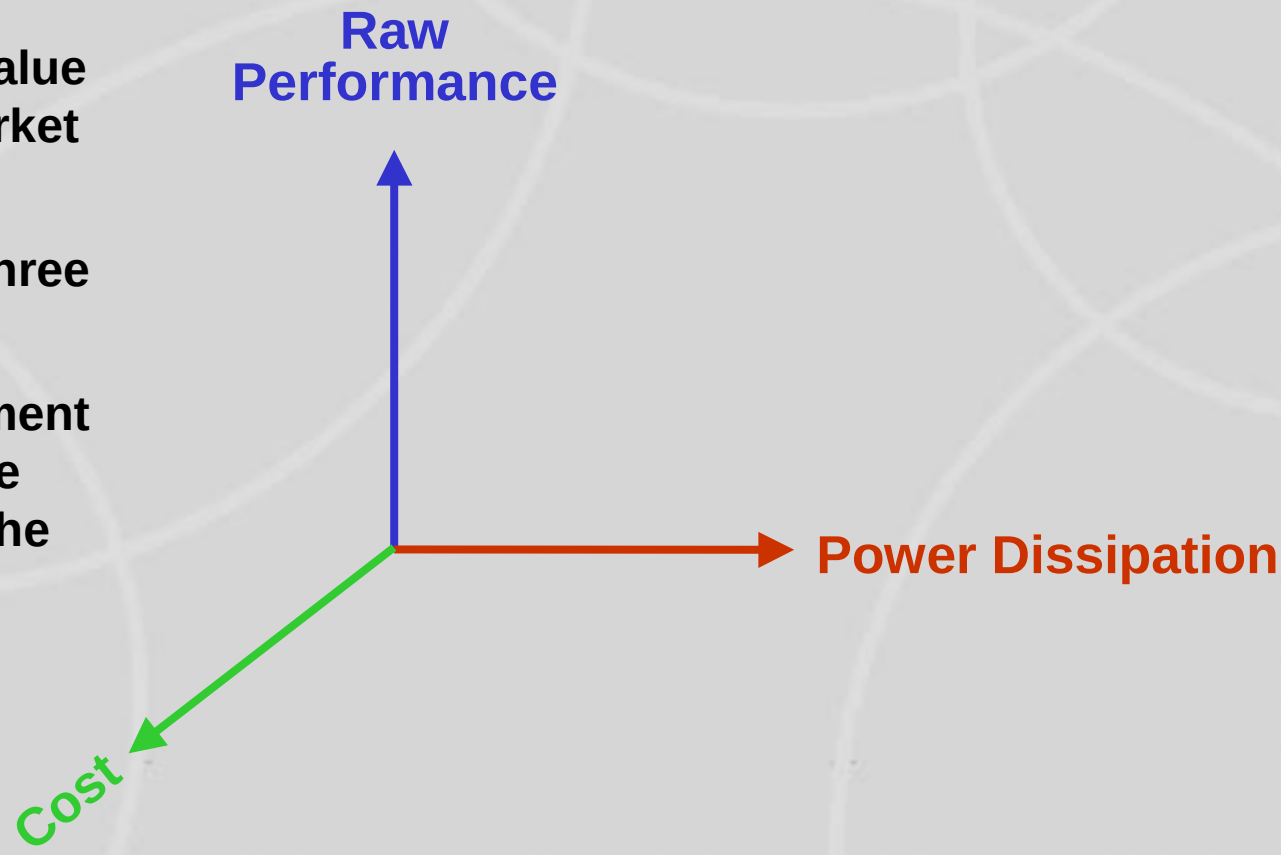
- Each vector of value creates new market opportunities
- SOC affects all three vectors
- Each end equipment requires a unique combination of the three



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A Different Look at Programmability

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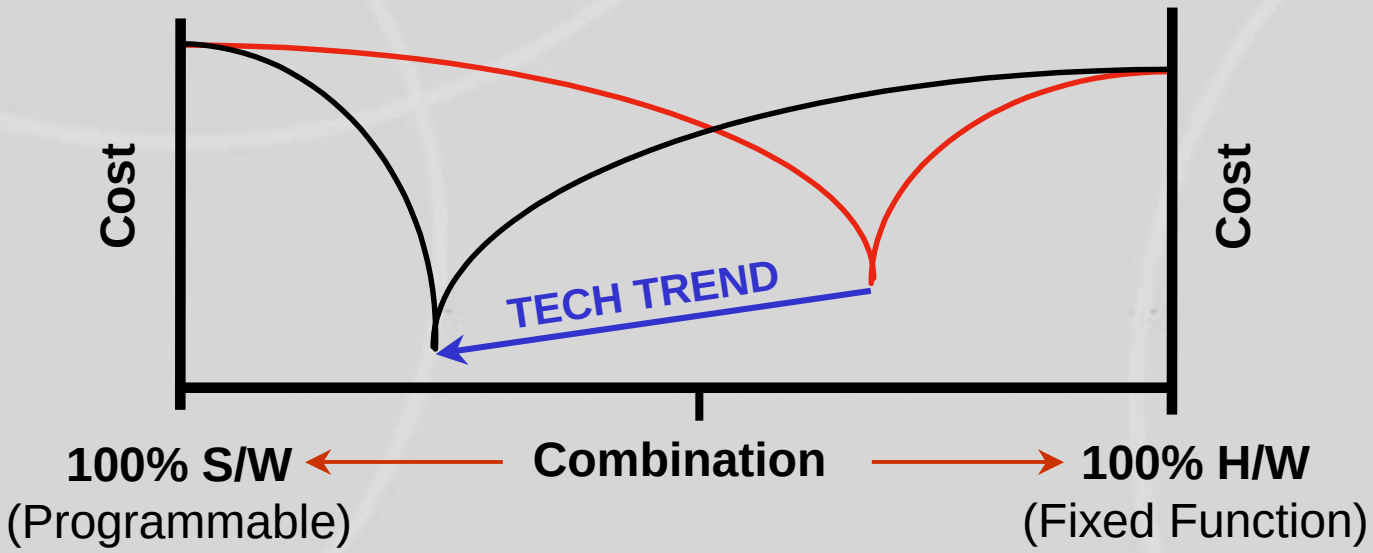
A **combination** of software and hardware always gives the **lowest cost** system design.

- **Cost** can be defined as:
  - Financial
  - Power Dissipation
  - NRE
  - Time to market
  - Mfg cost
  - Weight
  - Opportunity cost
  - Size



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What is an Innovation?

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- Doing something that has never been done before
- Improving something with new ideas
- Using something in a new way
- Solving an old problem in a new way
- Combining two old ideas to create a new one

Necessary Skills to Innovate

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- Laziness
- Vision
- Problem solving
- Willingness to take risk
- Curiosity

Turning Innovation into IP

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- Innovations are important
- IP comes in the form of
  - Copyrights
  - Trademarks
  - Trade Secrets
  - etc.