15.912 Technology Strategy
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S-Curves

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eInk Update (1)

- 2000 initial public offering (IPO) in weak market creates cash flow problem
- Large signage runs into problems:
  - Network problems getting information to signs
  - Cost of network lines greater than cost of signs
- Strategy Shift to focus on PDAs and eBooks
  - Partners with Phillips to jointly develop Matrix display
  - Sony signs as 1st eBook customer, but product delayed
  - …due to inconsistent technical performance.
  - CEO Iuliano resigns in 2004.
- Intel Capital steps in, provides cash to complete Sony deal, but pushes R&D towards color displays.
- Sony's eBook released in 2005, but lacks exciting content…

eInk Update (2)

- Lexar now uses eInk in its JumpDrive

**Lexar JumpDrive®
Mercury**

- Sony's Portable Reader System relies on eInk technology

**Sony®
Portable Reader System
PRS-500**

- Motorola uses a Matrix eInk display for its low cost Motofone

**Motorola®
Motofone**

  - great standby time
  - outside viewable

  …but none of these products is hugely successful

eInk blockbuster? Amazon Kindle

- Amazon commits to making much of their book database available.
- Product also uses wireless richly:
  - Reviews
  - Email
  - Discussion forums
- Amazon restricts eBooks on laptops (piracy concern)…so far
- Running Linux for easy extension…
  - Amazon's convergence play?
  - e.g., xBox & MSFT
- SOLD OUT!!!

Effective strategies answer three key questions:

How will we *Create* value?

How will we *Deliver* value?

How will we *Capture* value?
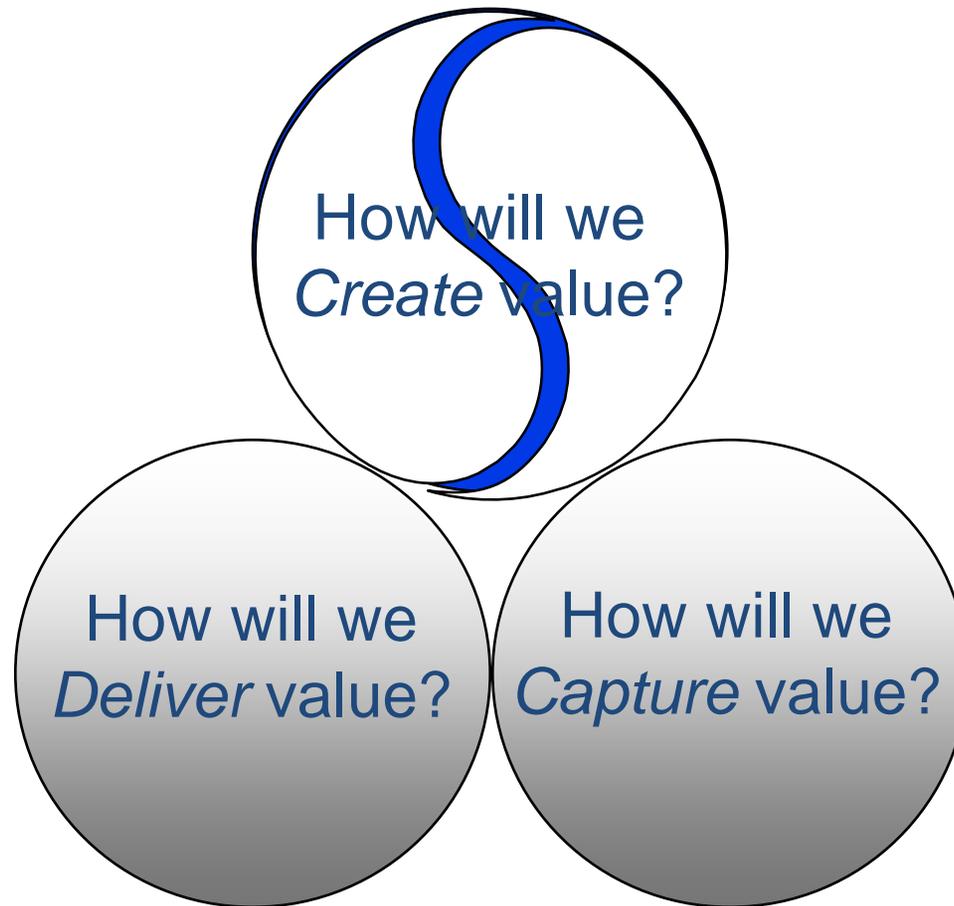
Value Creation: Yin & Yang of Technology, Markets, and Organizations

How will we *Create* value?

How will we *Deliver* value?

How will we *Capture* value?
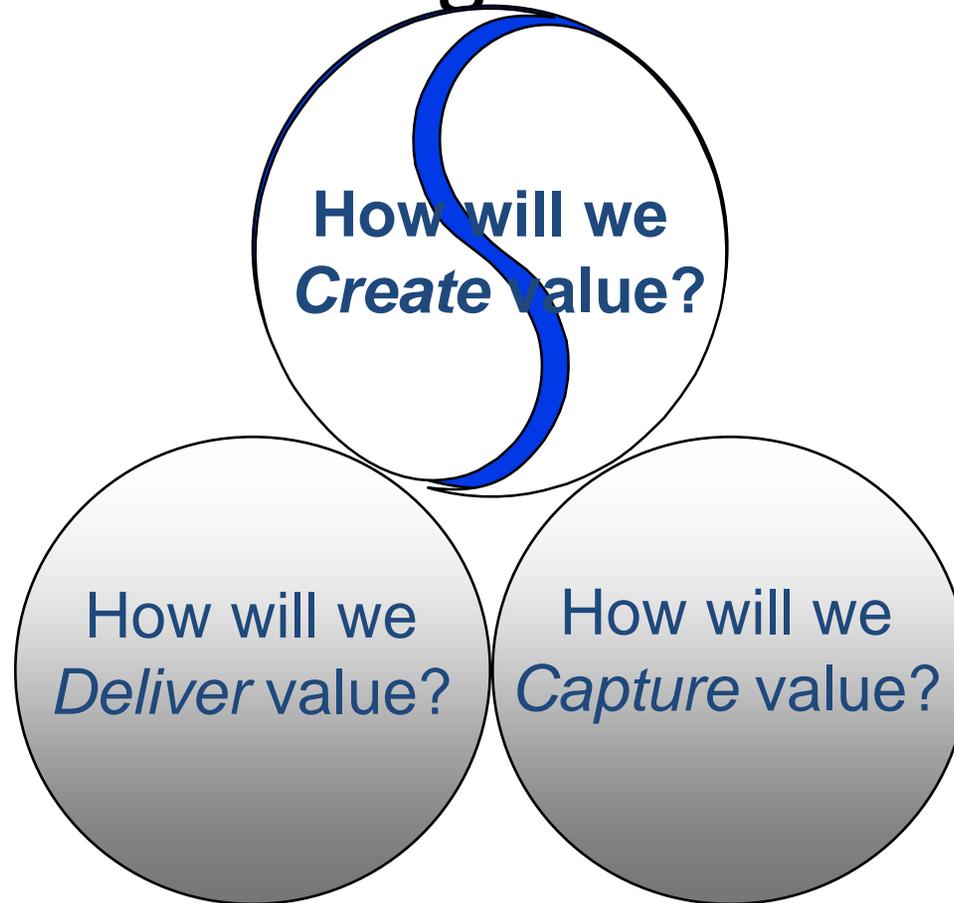
Effective strategies tackle 3 key questions:

- How will we create value?
  - **How will the technology evolve?**
  - How will the market change?
  - How do we organize effectively?

- How will we capture value?
  - How do we compete to gain sustainable competitive advantage?
  - How should we compete if standards are important?

- How will we deliver value?
  - How should we execute the strategy?
  - How do we make strategic decisions and take decisive action?

Do all good things come to an end?
# Technological exhaustion

Physical limit?

Performance

Performance is ultimately constrained
by physical limits

E.g.:
Sailing ships & the power of the wind
Copper wire & transmission capability
Semiconductors & the speed of the electron
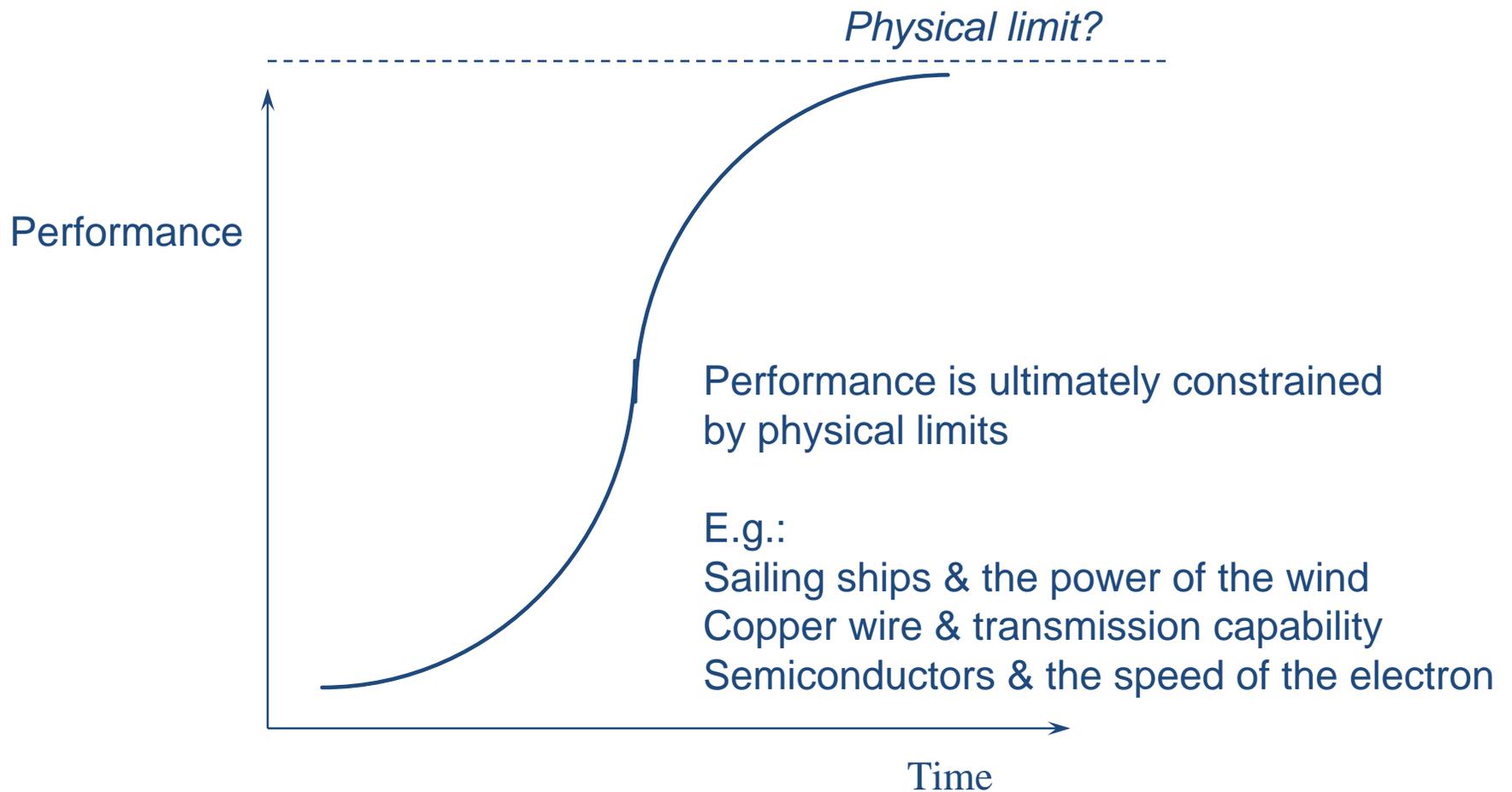
Time

S-Curve

Performance = Data Transmission Rate (bit per second)
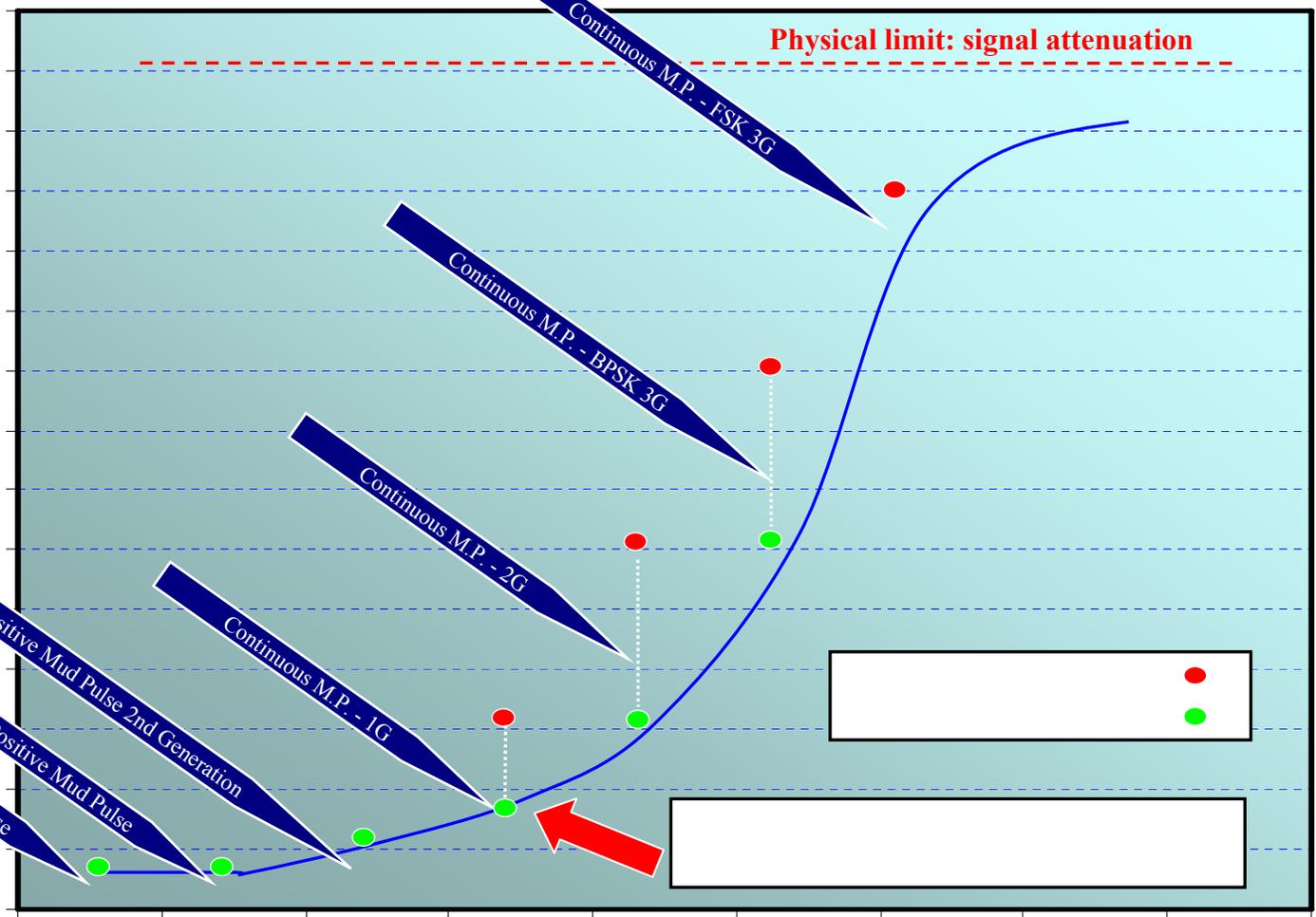
R&D Effort (measured in Generations = +/- 3 years)

Physical limit: signal attenuation

Continuous M.P. - FSK 3G

Continuous M.P - BPSK 3G

Continuous M.P. - 2G

Continuous M.P. - 1G

Positive Mud Pulse 2nd Generation

Positive Mud Pulse

Negative Mud Pulse

Improvements in Modem Speed
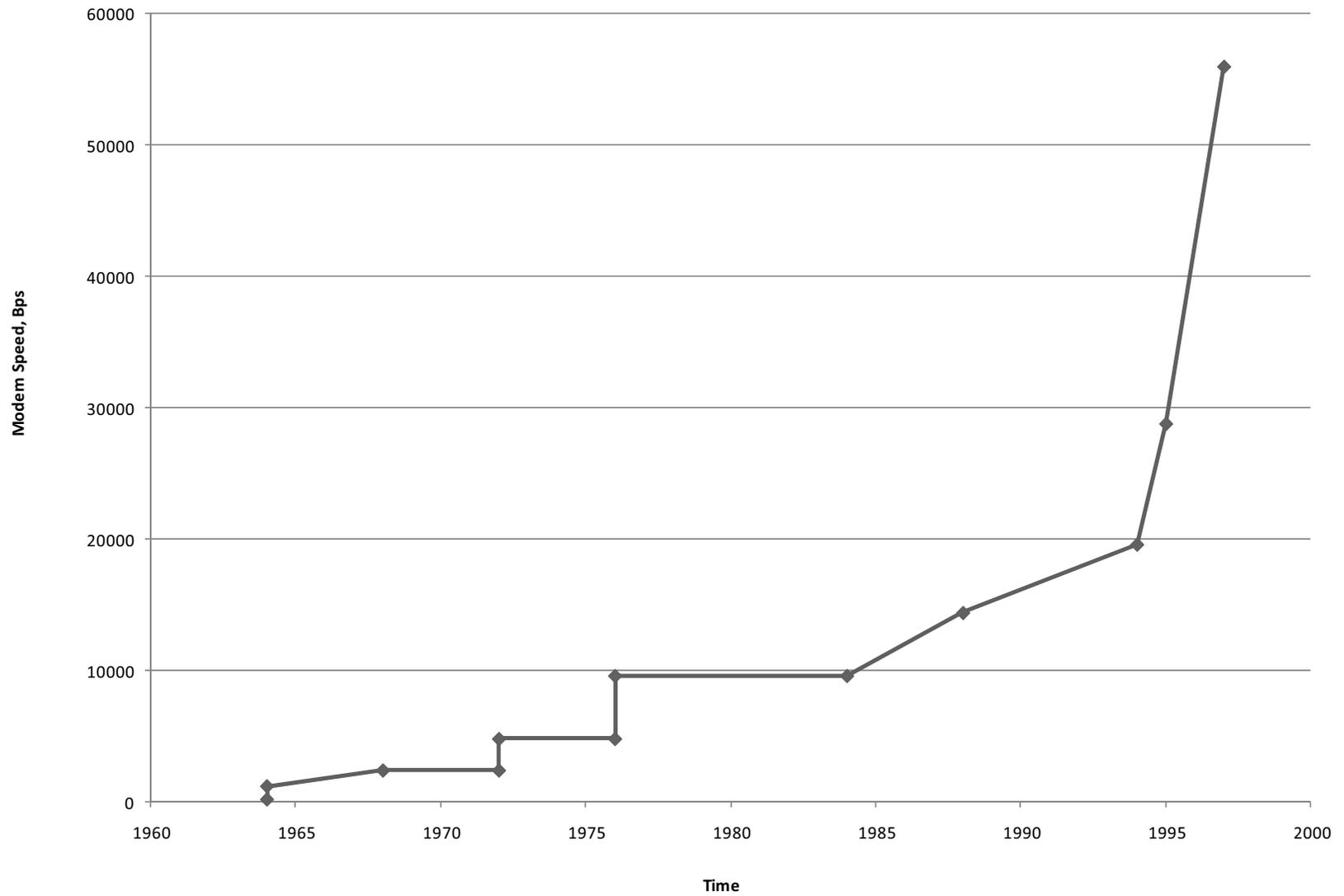
Semiconductor Performance: Minimum Line Width over Time
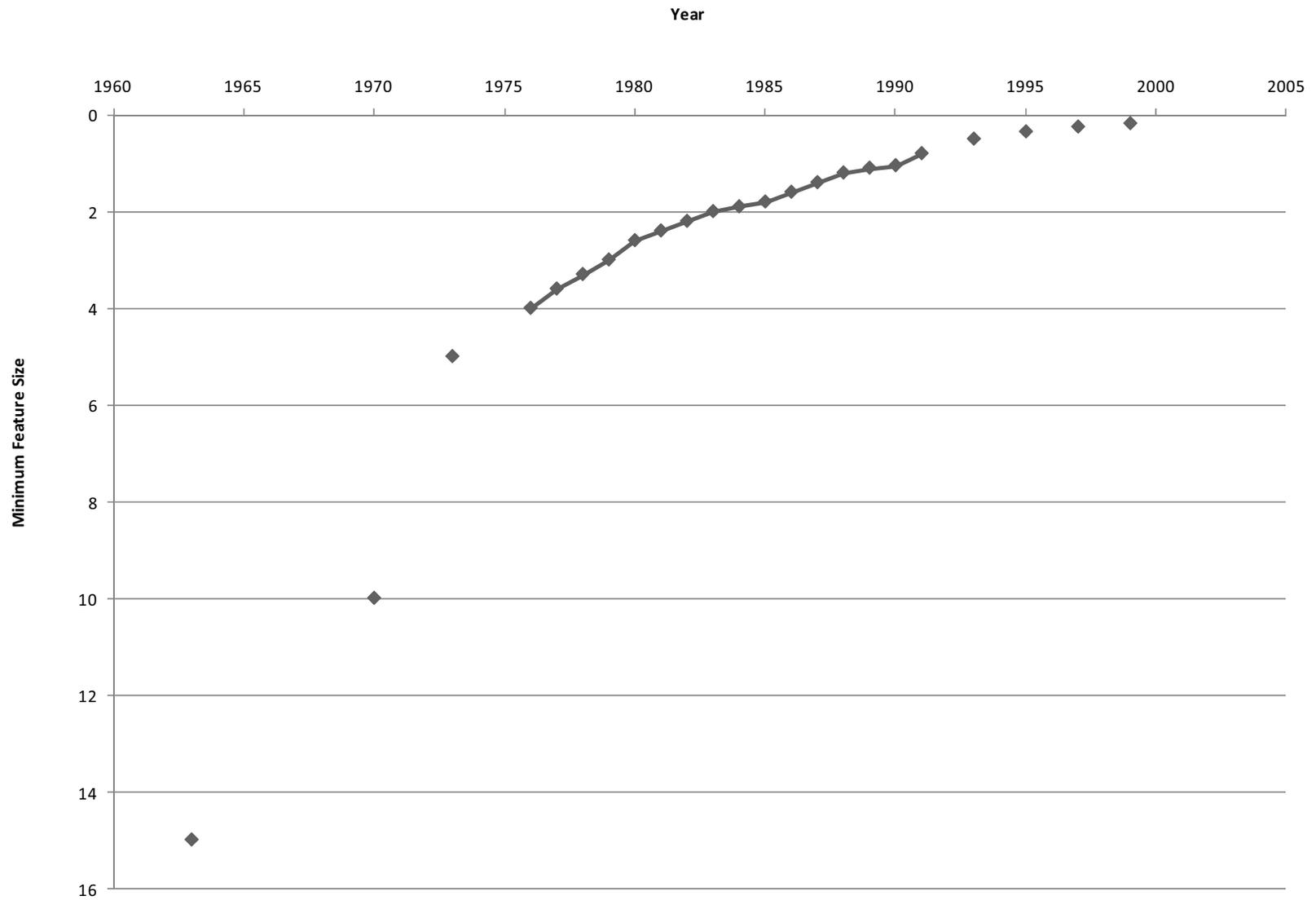
Modeling the returns to *effort* vs. *time*

Performance

Effort

Performance may be a <u>non linear</u> function of effort expended: in mature industries more and more effort may lead to less and less progress, while progress in emerging industries may be "surprisingly" fast
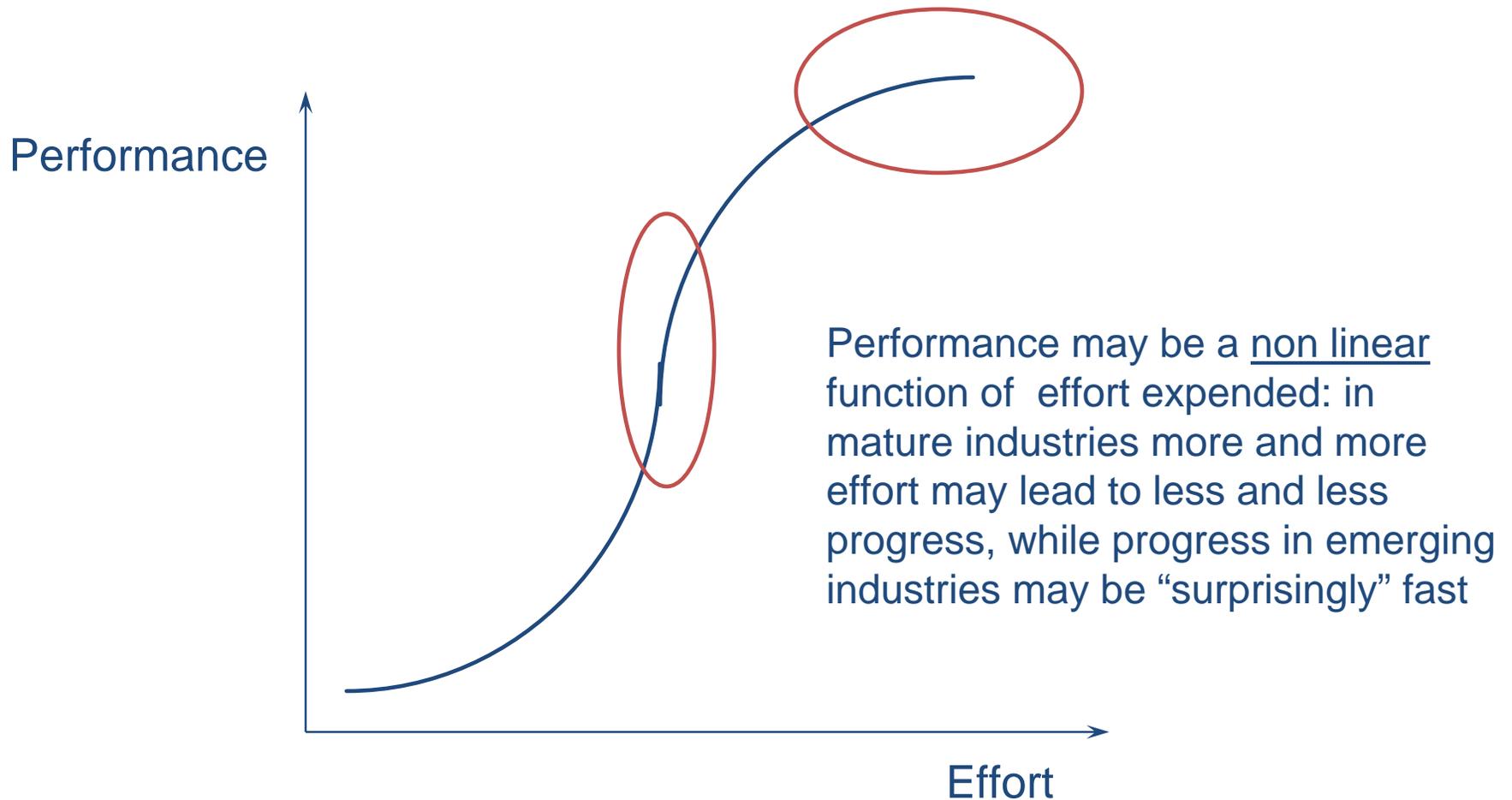
Issues in Trend Extrapolation

- Which parameter shall I predict?
- Do all good things come to an end?
- Exploring the difference between progress as a result of the passage of time, and progress as the result of returns to effort
- Predicted Limits are not necessary Real Limits…

The Unexpectedly Long Old Age of Optical Photolithography

Source: Henderson, 1995.
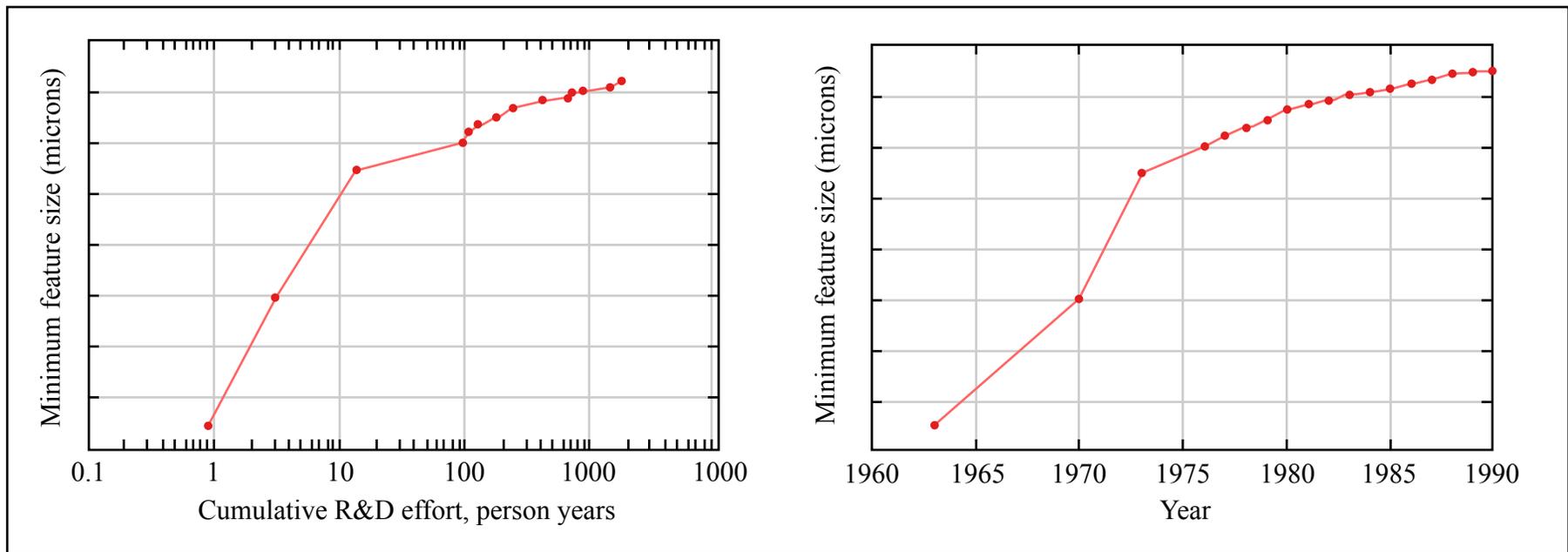
S-Curves, Real and Imaginary
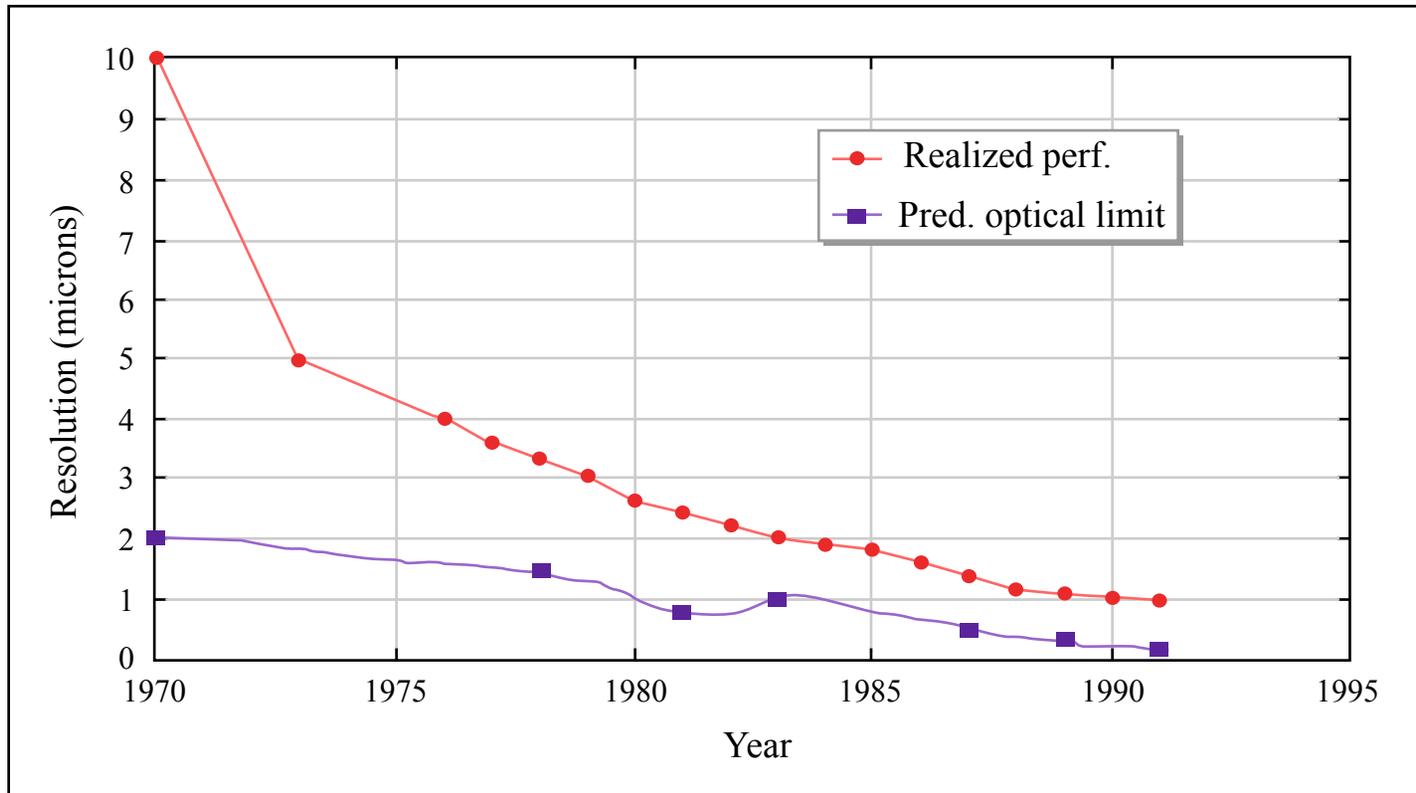
Image by MIT OpenCourseWare.

Source: Henderson, 1995.

Reflections on the S Curve

- Which unit of analysis?
    - Technology? Product? Firm? Industry?
- Which dimension of performance on the y-axis?
- Effort vs. time on the x-axis?
- Can performance limits be predicted or only known after the fact?
- How certain can you be of your location on the S-curve?
    - Some proxies do exist:
        - Monitoring returns to effort over time
        - Recognizing Discontinuities and moves to new S-curves
- S-curves are a heuristic for generating strategic discussion about technological limits and growth

Implications of the S-curve

- Technological performance is a function of effort, NOT time

- R&D is often less productive when focused on either early prototypes or mature technologies

- Managing the transitions between S-curves is a critical strategic task: sticking with an old S-curve can be disastrous

Why S-curves really matter: Transitions often challenge existing organizations severely

Alignment Equipment

Firm	Contact	Proximity	Scanners	Step & Repeat I	Step & Repeat II
Cobilt	44		< 1		
Kasper	17	8		7	
Canon		67	21	9	
Perkin-Elmer			78	10	< 1
GCA				55	12
Nikon					70
Total	61	75	99+	81	82+

Source: Henderson & Clark, 1990.

Share of deflated cumulative sales (%) 1962-1986, by generation, for the leading optical photolithographic alignment equipment manufacturers.

Why S-curves really matter: Transitions often challenge existing organizations severely

In their days, these firms were on the cover of *FORTUNE*. They were making more money than one can think is possible. And where are they now?

So to some degree, technology strategy is going to be about maintaining balance between what you do well now, and what you might do well in the future.

Maybe sometimes it makes sense not to make the move. In this industry, it turns out not to have been the case. These firms thought they understood what the next generation was going to be like. They invested quite heavily, and they did not succeed. We are going to talk about the role of blindness, arrogance, stupidity, changing workforce, incentives. The difference between announcing to the world *"of course, we're big on step-aligners,"* and actually delivering on that promise is enormous. We will study why this "thinking-doing gap" is often present later in the course.

Let me stress something. It may seem that this course is all going to be about big firms that cannot act like small ones, but you run into analogous problems with small firms trying to grow. They are very good in the era of ferment, but during take-off, when there is a need to reconfigure the firm, a lot of new ventures do not survive. We will be talking about that problem as well.

For Next Session:

- ## How does Apple create Value?
  - What is your recommended next step for the iPod/iTunes business?
    - Think about S-curves underlying their business
    - Think about their different markets

- ## First "Two pager" due Session 3
  - Find a couple of teammates, choose an industry, sketch out the relevant S curves
  - Use the forum to find team mates if you haven't already
  - Hard copy to your TA…