COE 718 – Lecture 1 - Design Considerations

Topics

- Design challenges for embedded systems
- Understanding design tradeoffs
- Non-recurring cost and unit cost metrics

Design Challenges

- Design Goal:
  - An implementation that realizes the desired functionality
  - Example: A/C system that functions
- Generally there are simultaneous design metrics which tradeoff

Design metrics

- Design metric is a feature of an implementation that can be measured and evaluated
- In general, engineering systems have 3 common metrics
  - Speed
  - Quality
  - Cost

Design metrics

Common Design Metrics in Embedded Systems

- Non Recurring Engineering (NRE) costs
  - One time initial cost of designing a system
- Unit Cost:
  - the cost of manufacturing copies
  - Includes labour and raw material
- Size
  - Space system occupies
- Performance
  - Application dependent
  - Measured by time taken to due computation or throughput

Common Design Metrics in Embedded Systems

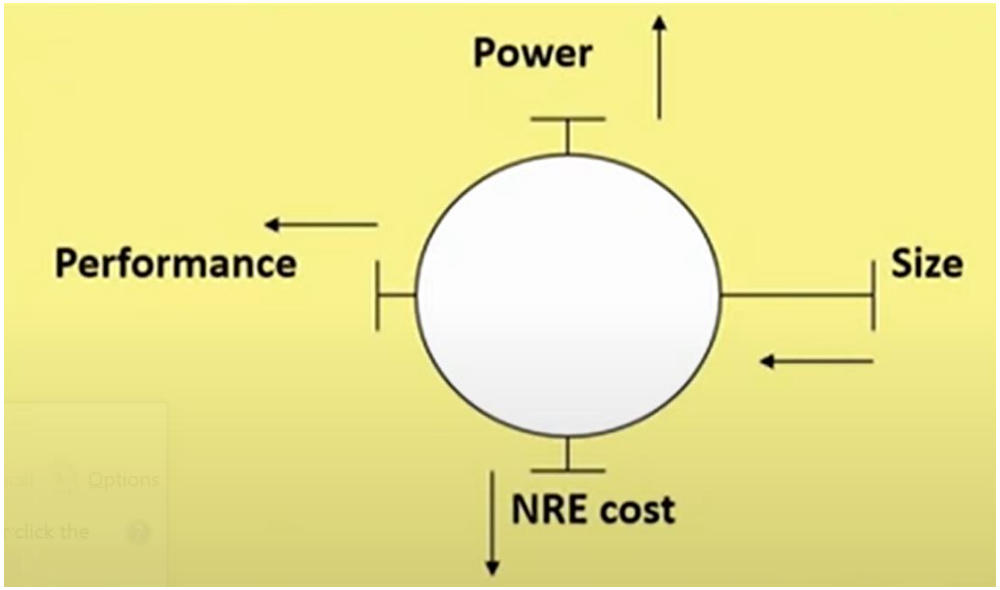
- Power
- Flexibility:
  - They system was designed for some application
  - Can you modify it for some other applications
  - The second design will have lower cost (NRE)
- Maintainability:
  - Are older systems adaptable to newer features
  - Example: Bluetooth addition

Common Design Metrics in Embedded Systems

- Time-to-prototype:
  - How much time it takes build a working version
- Time-to-market
  - How much time it takes for a prototype to be released to the market
- Safety:
  - Any adverse environment factors

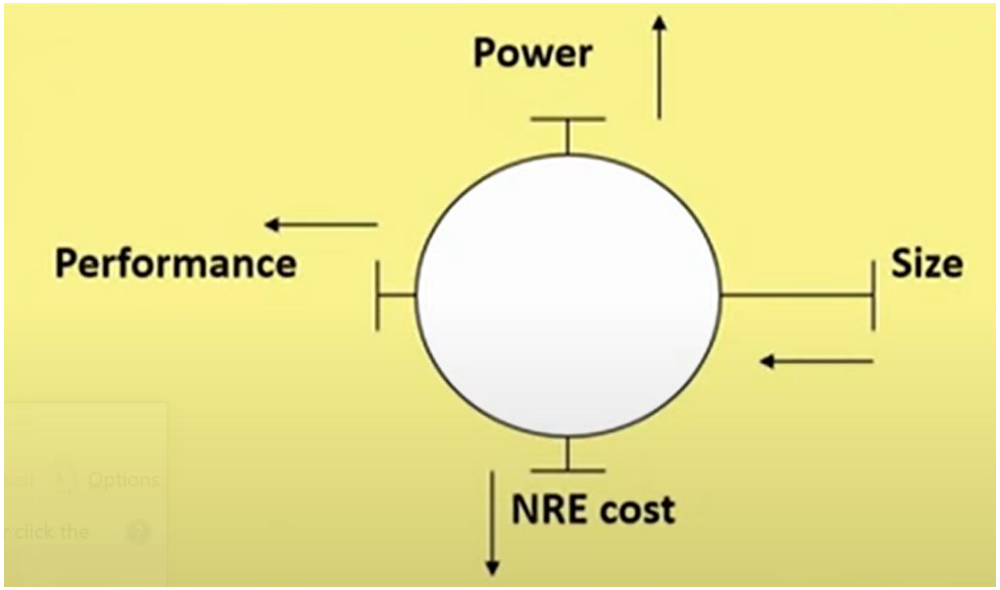
Design Tradeoffs

- Many design metrics trade off against each other
  - Improving one may degrade another



Design Tradeoffs

- You must always take a holistic approach and may take multiple iterations
- Example - ultrabooks



Hardware-Software Co-Design

- Traditionally hardware and software designs were separate
- Example – Intel hardware designers and Microsoft software
- Hardware experts don't need to know much about software
- Software engineers need to know a bit about the hardware but not much

Hardware-Software Co-Design

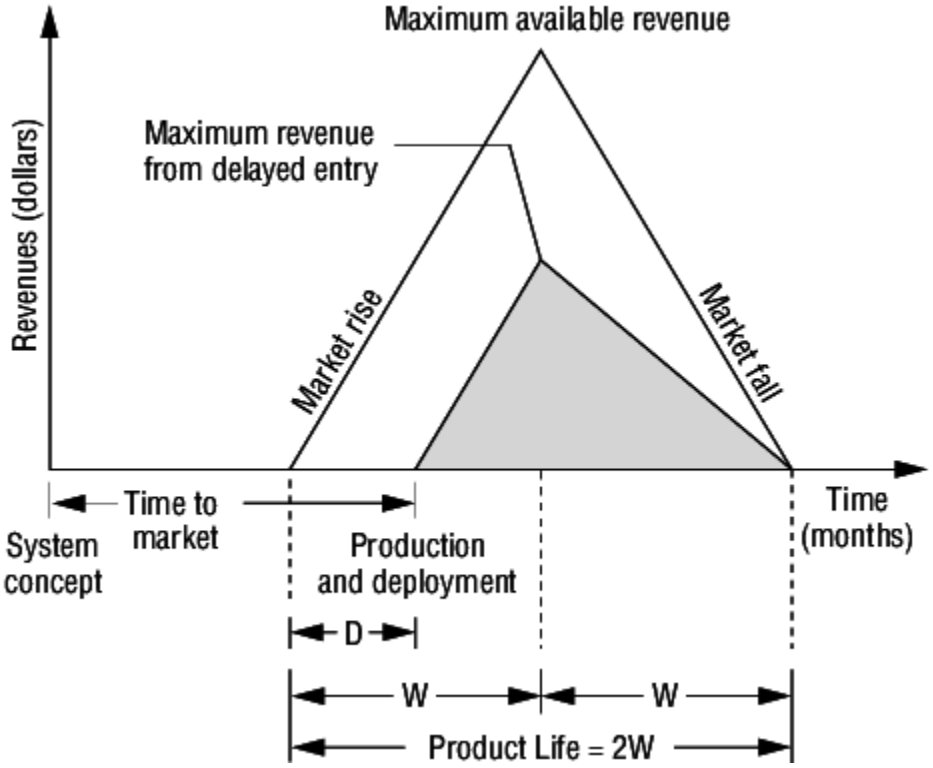
- When designing an embedded system, due to all the constraints, both hardware and software expertise is needed
- Hardware engineers decide on type of processors, I/O interfaces, analog ports, digital ports, PWM ports etc
- Software engineers identify which parts to implement in software and which can be done in hardware
- This is called Hardware/Software codesign

Time-to-market Design Metric

- Very crucial design metric
- A company's ultimate goal is to generate profits
- So marketing becomes the most important criteria
  - Quality is secondary!
- Many companies compromise on quality in order to bring the product to the market earlier

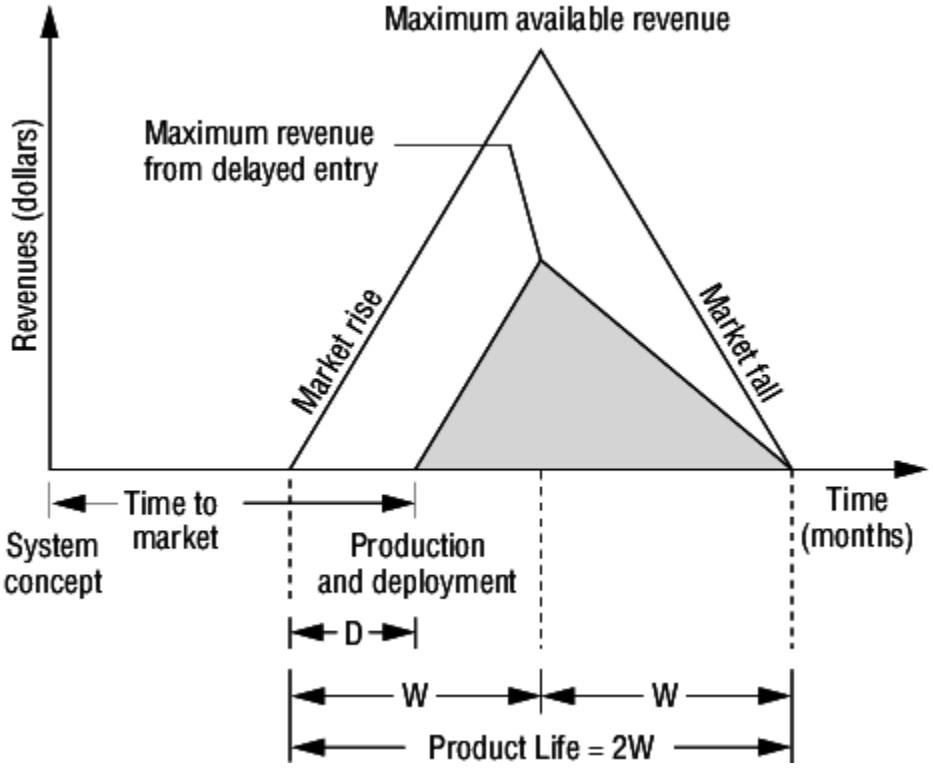
Time-to-market Design Metric

- Starting from the point a product design starts, there is a Market Window



Time-to-market Design Metric

- Any delay results in lost in revenue



Loss due to Delayed Market Entry

- Calculate the cost of delayed production