

Design Implementation for the Long Term

IEEE Circuits & Systems Society
Long Island Chapter
Wednesday, September 16, 2009

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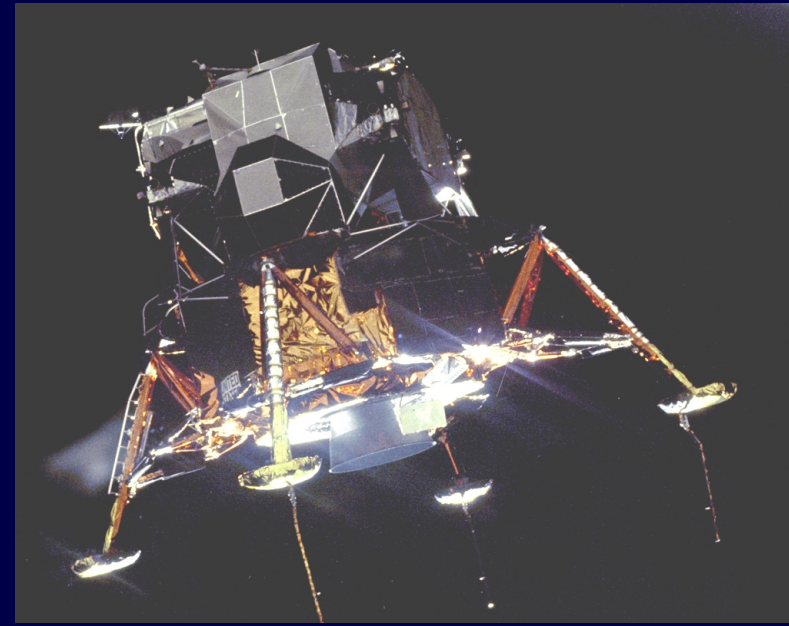
**As a courtesy to your
professional colleagues,
kindly take a moment and
set all personal electronic
devices on silent or vibrate.
Thank you!**

Introduction

- not aesthetics
- functionality
- performance
- long term costs

Aesthetics is misunderstood

- beauty is merely a shorthand
- true engineering meaning – efficiency
- examples:
 - 1930's "streamlining"
 - 1969 – LM
 - Arthur Clarke's Discovery



Electronic systems constraints

- packaging
- physics
- costs
 - NRE
 - short term
 - long term

Packaging

- space
- power
- heat dissipation
- input/output

Physics

- voltage
- amperage
- resistance
- capacitance

The long term

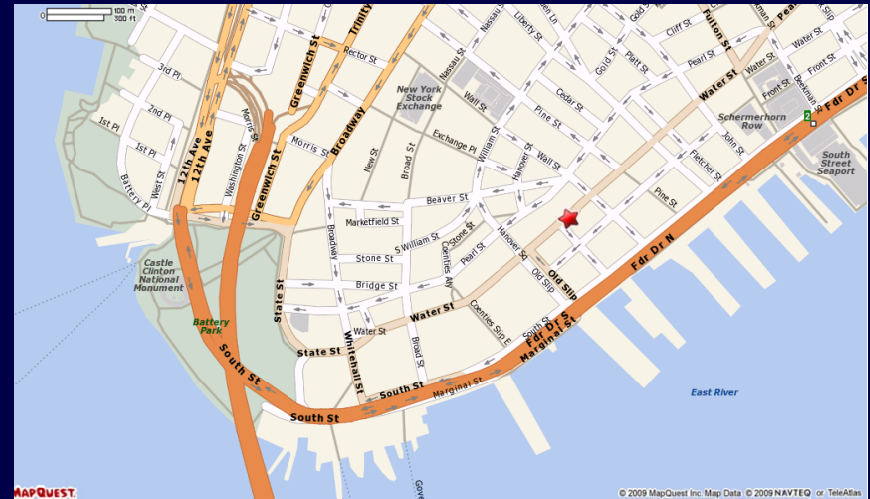
- long lifespan
- maintainability
- NRE amortization
- Manufacturing is expensive
 - lead time
 - design costs
 - parts inventory

There trade-offs are not unique

- electronics is merely a microcosm
- urban planning
 - medieval cities
 - New York City – the grid
 - suburban subdivisions

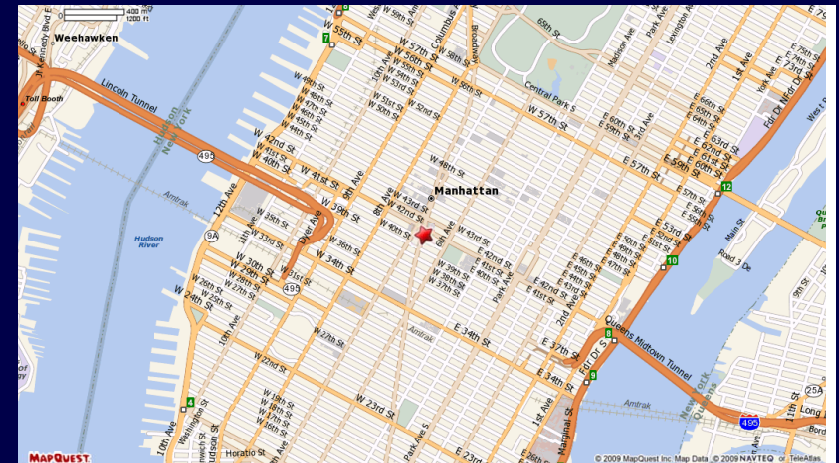
Medieval cities

- not planned
- provisioned for carts -- two horses
- narrow winding streets
 - occluded
 - no utilities
 - impassable today



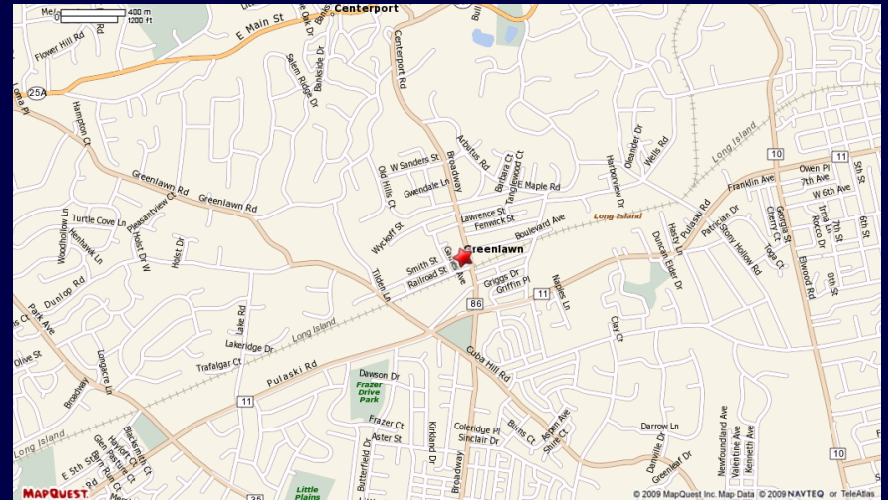
New York City – the Grid

- north of original New Amsterdam
- 200'+ blocks
- utilities pre-placed
- streets pre-provisioned
 - mapped to 60'
 - often opened to only 30'
 - reconfiguration within context



Suburbs – Capped Development

- irregular lots
- winding streets
- aesthetic with goals
 - no thru traffic
 - hard to upzone



Home design is another example

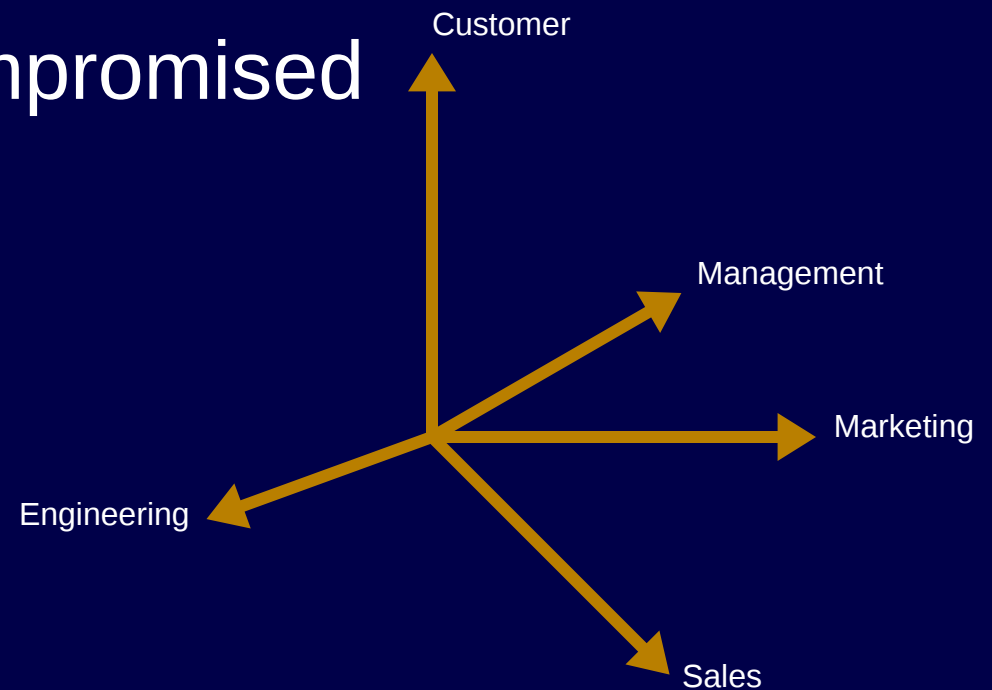
- disruptive expansion is expensive
- low cost of headroom
- insurance against uncertainty

Example: The Kitchen

- typical outlet is a duplex
- What is the tradeoff?
 - cost of 2" box v 4" box+reducer
 - cost of after the fact upgrade
 - cost of rewiring

Diverse interests:

- different groups
- different concerns
- profit easily lost
- schedule easily compromised



Different Participants see things differently

- The end-owner
- The contractor
- The accountant
- Who is left holding which bag?
 - After delivery - customer
 - During construction - contractor
 - If manufacturer - BOTH

Kitchen example

- One more outlet
 - break open wall
 - replace 2" box with 4" box
 - run new wire to panel

Well planned

- 3-conductor #10 to panel
- reduced 4" boxes
- cost: minimal < \$ 100
- savings: > \$ 2,000
 - How sure are you?
 - How often must bet pay off?

Circuit card analogies

- address lines
- memory capacity
- i/o bus capacity
- layout matters

Digital Professional 350

- Crippled F-11
- F-11 had 22-bit addressing
- motherboard missing 4 lines
- oops!!!
 - later Professional 380 was J-11-based
 - missing four address lines reappeared
 - bus was specified as 22-bit ab initio

Boeing 777

- engine oil caps detachable
- field mechanics complained
- result: captive caps



Think city in a microcosm

- utilities
- waste
- flow of raw/finished goods
- the future is unknowable
 - but preserve flexibility
 - insurance during project
 - amortizes NRE by reuse

Inevitable changes

- processors
- memories
- I/O bandwidth

Planning difference

- plan for tactical flexibility
- hubris to regard requirements as guarantees for future
- beware cost-plus mindset
- beware "customer capitalism"

Summary

- long term vision is not costly
- foresight is priceless
- profitability is increased
- NRE is reduced by amortization

Questions?

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Session Notes & Materials:

<http://www.rlgsc.com/ieee/longisland/2009/implementation-long-term.html>