

# Design Implementation for the Long Term

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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



## 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

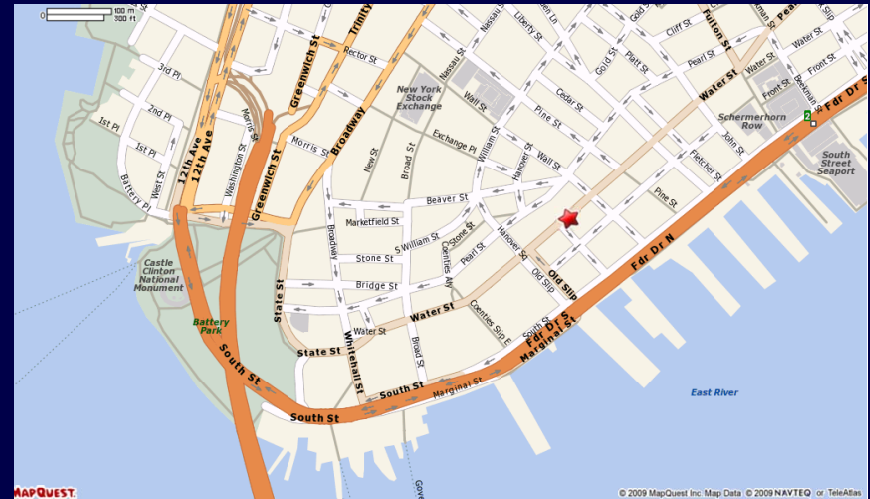


## There trade-offs are not unique

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

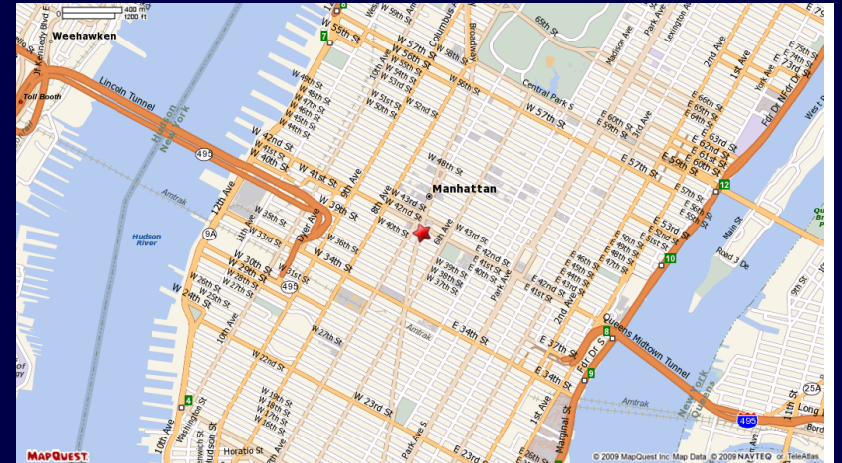
## Medieval cities

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



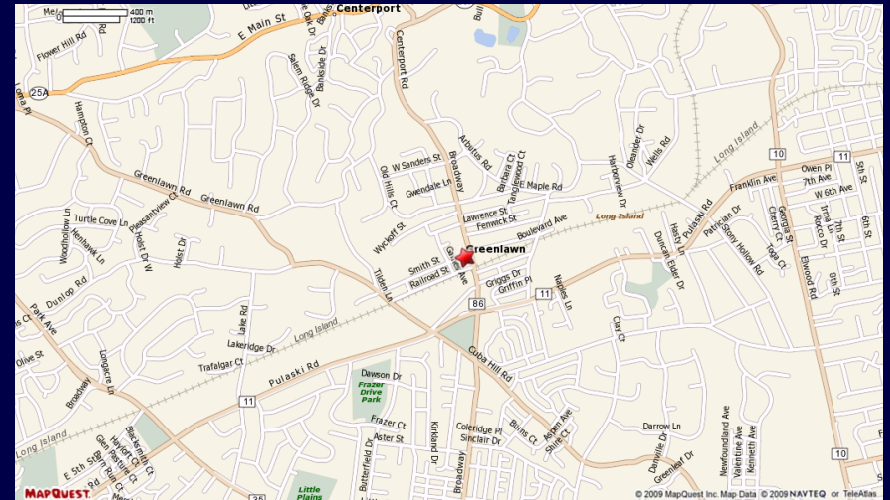
## New York City – the Grid

- 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

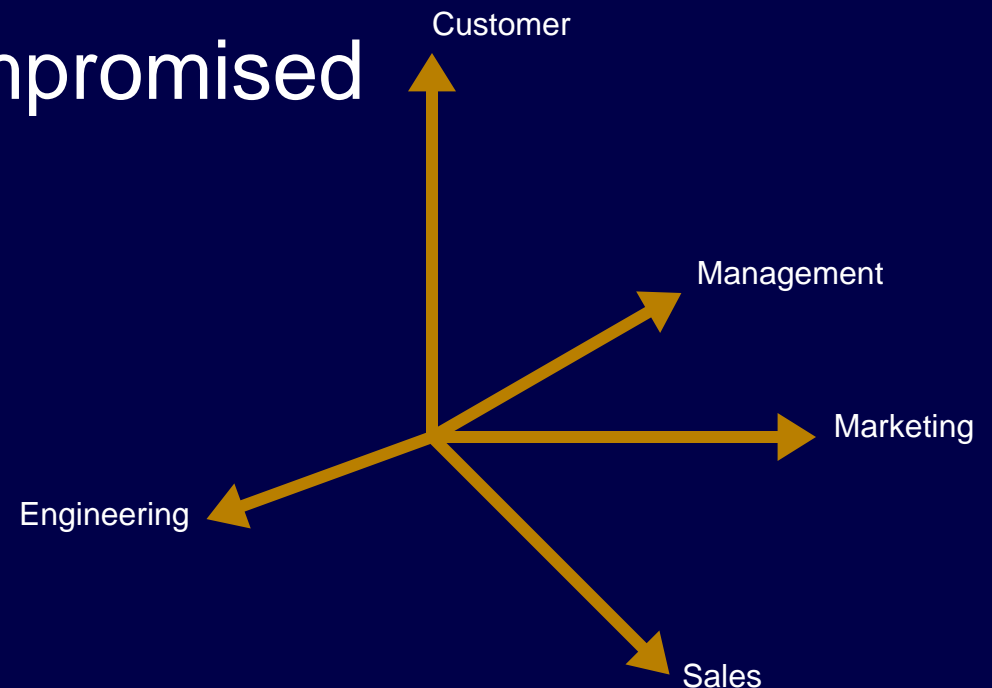
- disruptive expansion is expensive
- low cost of headroom
- insurance against uncertainty

## 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>