Principles & Practices of Software Development

Daniel Spoonhower
Carnegie Mellon University
Pittsburgh, PA

Daniel Huttenlocher
Cornell University
Ithaca, NY

Intelligent Markets, Inc.
San Francisco, CA
New York, NY

In This Talk

- Purpose
  - Relate some of our experience
  - Introduce way of talking about software development
    - Language for dialogue
- Audience
- ***Not*** in this talk
  - Breadth of experiences
  - Scientific study

Outline

- Background
- Experience: Requirements & Estimation
- Terminology: Principles, Problems and Practices
  - Some examples & comparisons
  - Things to look out for (e.g. competing Principles)
- Relating Principles to experience

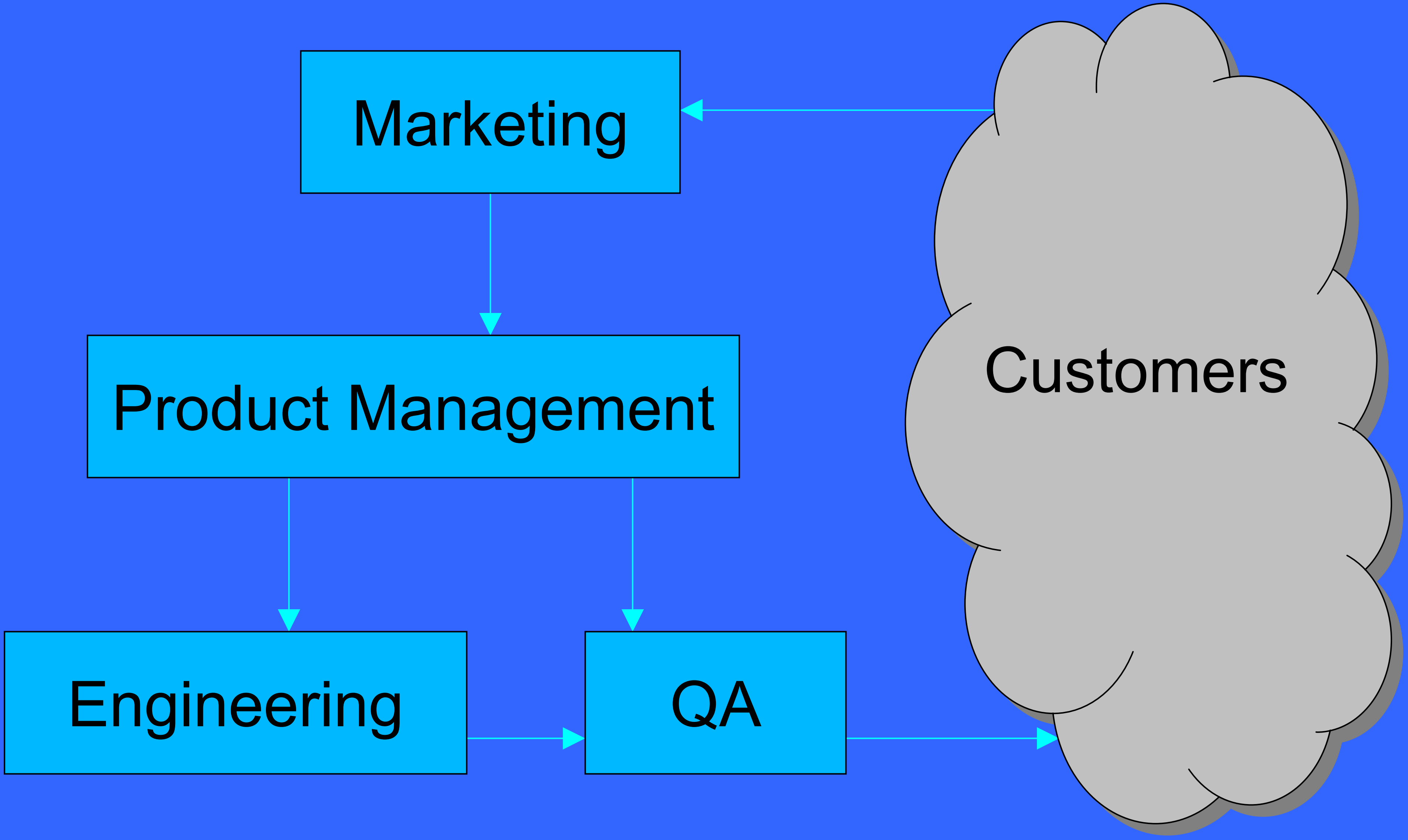
Background

- Our task – system for trading convertible bonds
- Our (prior) experience
- Our team – best people we'd ever worked with
- Our challenge:
  - High reliability
  - Complex (user) requirements
  - Technically challenging
  - Demanding schedule

Background

- Your experiences?
  - Written software (or just programs)?
- Your teams?
  - Size, project duration?
- Your challenges?

Simplified Organization



Requirements & Estimation

Requirements & Estimation

- First implementation
  - Started with partial outsourced version
  - Screen shots used as requirements
- No product management
  - Responsibilities shared by marketing & engineering
- Internal customer
  - Frequent delivery, rapid feedback

First Solution(!) Results

- Sparse documentation
  - Both requirements and implementation
  - Verbally conveyed = many changes
  - Written by developers
- Success!
  - Very flexible, agile process
  - System launched in 8 months
  - Many lessons learned

Product Management

- Second solution
  - Now enterprise software not service
  - External customers
  - Demanded clearer definition of product
- Feature by feature description
  - Hierarchical, outline format
- Specification change process
  - Manage document updates
  - Understand effects of changes

Second Solution

- Problems:
  - Lacked coherence
  - Serving many different parts of the company
    - Marketing, product design, engineering
  - Didn’t convey understanding
  - Delivered on-time but with poor set of features

More Documentation

- Third solution (attempted, not fully implemented):
  - Several levels of documentation, one for each use, e.g.
    - MRD (Marketing)
    - HLD & DLD (Product Management and QA)
    - TD (Engineering and QA)
- Conventional big company approach

Third(!) Solution Results

- Problems:
  - Lots of effort, difficult to manage
    - Many dependencies, gated tasks
  - Skew between different documents
  - Focus on **documents** more than on **development**

Interleaved Stages

- Our final solution: incremental!
  - Alternate requirements with estimates
  - Start with quick, rough ideas; work towards details
  - Drive to ship date – cut features to do so

Interleaved Stages

- Requirements
  - Business need, short descriptions, detailed functional and UI specs
  - Reprioritize as estimates established
- Several levels of specs and estimates
  - Day-week-month, “factor of 2 guess”, then +/- 25% with *small* tasks
  - More specific estimates derived from more detailed specs

Ongoing Challenges

- “Delta” specifications – note changes to product
  - Need both complete and difference spec
- Product team gaining understanding of implementation
  - Can find more workable solutions
  - More difficult to think independently
- Meet the needs of testing
  - Function point combinations
  - Workflow sequences

Lessons Learned

- Communication is important
  - Business needs → engineering
  - Estimates & implementation → PM
- Conflicting forces:
  - Include the best features
  - Ensure maintainability
  - **Ship on time**
- Make sure the **process** focuses resources on getting **product** done

Terminology

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- Predictive
- Broadly applicable
- Relates to experience
- Expands understanding

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Something that can get in the way of rapidly developing high quality software that meets customer needs, while having fun doing it.

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- Observable
- Describes a state of being
- To be identified, minimized, avoided, solved

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- Most importantly: an **action**
- Still abstract (as opposed to implementation)
- Focus of many methodologies

Our Goals

Principles

Problems

Practices

- Explicitly enumerate
- Study interactions
- Compare results

BUT…

…keep them separate!

Principles, Problems and Practices

Principles, Problems and Practices

- Seen some Problems and Practices related to requirements and estimation
- Consider some underlying Principles
  - Sometimes competing
- Relate to the experiences in specification and estimation

Domain Expertise

Principle: Understanding the domain is critical to understanding, explaining, and interpreting user requirements.

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- Key to many of our initial practices
- Important for communication
  - Understand language; interpret spec
  - Critical for QA
  - Understand user needs (and feedback)

Changing Requirements

Principle: Requirements change, both because the understanding of the needs of users change and because the needs themselves change.

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- When is a specification finished? Never!
  - But need to ship the product
- All requirements change
  - More changes for new products

Specification Cost

Principle: There is a high cost to writing and maintaining detailed specification documents that are accurate and effectively convey understanding.

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- What form of specification is most useful? E.g.
  - None, note cards, templates
  - Functional, UI, relationship, sequence

Little or No Specification?

- Advocated by eXtreme Programming
- Successful practice for our first implementation
- For large and/or new projects, cost of maintenance can be astronomical
  - E.g. “big company” approach

Why do we need a specification?

Unreliable Memory

Principle: Personal memory is a poor substitute for a written document.

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- Verbal communication can easily be misconstrued
- Memories fade over time
- People make expensive storage devices

Adequate Specificity

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- Applies differently to different projects
  - Depends on complexity of user needs
  - E.g. compression software

Detailed Specification?

- Specification is important for establishing obligations
  - What will be implemented
  - What will be tested
  - What will be delivered
- Specification evolves with product
  - As opposed to Waterfall, where spec drives remainder of process

Competing Principles

Changing Requirements

Unreliable Memory

Specification Cost

Adequate Specification

How do we achieve a balance?

Clear Statement

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- Accessible to company & customers
- Guidelines:
  - Use informal communication to establish understanding
  - Use documentation to preserve it

Incremental & Iterative

- Incremental specification avoids risks inherent in this set of Principles
- Other iterative practices can be found in:
  - Technical design
  - Scheduling releases
- Negotiation between competing forces
  - Taking "small steps" reduces the chance that one force will "defeat" the others

Driving Force: Ship Date

- For new companies
  - Establish reputation and credibility
- Balancing force
  - Counteracts “feature creep”
  - Millions of ways ***not*** to ship!
- Healthy part of project lifecycle
  - Allow for personnel & process transitions
- It is an **external** and **concrete** goal!

Real Use

Principle: Understanding the needs of users and validating that those needs have been met is best done with a real implementation of the software and real users.

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- "Line in the sand"
- Ultimate validation
  - Not just for the spec, but for the product

… & Incremental Processes

- Real Use – push the product all the way through the process
  - At regular intervals
  - To validate feature set (incremental specification)
  - To check implementation (incremental delivery)
  - To get feedback on the process itself (projects change – no single process is “correct”)

Summary

- Use Principles to understand working constraints
  - Abstract away from Problems/Practices
- Be aware of competing Principles
- Use incremental and iterative processes to alleviate risk caused by conflicts
  - Take small steps and re-evaluate