

# Prioritizing Fixes

- Depends on severity and breadth of discovery
- Hierarchy
  - Severe functional problem with no work-around
    - As soon as possible
  - Severe functional problem with work-around
    - 1 – 2 weeks
  - Non-severe functional problem with work-around
    - 3 – 4 weeks
  - Minor problems
    - Next release

# Applying Fixes

- Regular
  - Maintenance releases every 6 – 12 months
  - Clients are supposed to apply each release promptly
    - Seldom happens
  - But releases are sequential
    - Need a fix and no maintenance applied for 18 months, need to apply all previous
- Emergency
  - Fix urgent problems immediately
    - Typically done only by those experiencing problem
  - May or may not be in regular release
    - Clients may need to back out emergency fix before applying regular

# Discontinuing a Product

- Stop development of new features
- Fix only high severity problems
- Announce replacement product
- Encourage clients to move to replacement
- Notify old clients of termination date
- Recommend other vendors who will support the old product
- Terminate the product

# Lehman's Laws of Software Evolution

- Continuing change
  - Or it becomes less useful
- Increasing complexity
  - Unless something is done to reduce complexity
- SEs doing maintenance may not have as thorough understanding of overall design and implementation as original developers

# Maintenance

- Final phase of software development
- Accounts for > 80% of cost and effort of software project
- => reducing SW cost requires reducing maintenance cost
- Maintenance requests are either
  - Repairs
  - Enhancements

# Types of Maintenance

- Repair
  - **Corrective**: fix errors in requirements, design or implementation (20%)
  - **Adaptive**: accommodating new platforms (25%)
- Enhancement
  - **Perfective**: adding new features (50%)
  - **Preventative**: improving SW quality for next round of maintenance (5%)

# Types of Maintenance (cont.)

- Corrective maintenance
  - What people think of when “maintenance” is mentioned
- Adaptive maintenance
  - New operating systems
    - Or significant new releases of old OS
  - New databases
  - New platforms
    - Support mobile access

# Types of Maintenance (cont.)

- Perfective maintenance is high cost, but SW organization can't account for all future enhancements initially
  - Use evolutionary SW process model
  - Perform preventive maintenance
- Preventive maintenance (Refactoring)
  - Fixing bugs induces bugs
  - Preventative maintenance aims to minimize that
    - Re-architect or re-implement problem components
    - Can use defect metrics to identify candidates
  - “applying today's methodologies to yesterday's systems to support tomorrow's requirements”

# Maintenance Issues

- Management challenges
- Process challenges
- Technical issues

# Management Challenges

- Senior management focused on revenue from new products or cost savings
  - Resources for maintenance limited
  - Systems for internal customers don't generate revenue
- Trend is toward smaller and more frequent maintenance releases
  - More management overhead

# Process Challenges

- Collecting, tracking, prioritizing, and implementing requires coordinated process
  - Selecting requests to complete
  - Coordinating resources
    - Developers, testers, writers, etc.
  - Deciding when to update related artifacts
    - SRS
    - Design
    - User support documentation
    - Test suites and plans

# Technical Challenges

- Build on current design or redesign?
  - Use current: don't disturb working design but may make overall design unacceptable.
  - Redesign: get better design but not as tested
- Testing
  - Changes often require new or modified test plans
  - Regression testing required (costly)

# Maintenance Process

- Maintenance requests are batched and evaluated by Change Control Board
- Impact analysis
  - Maintenance engineer estimates time to implement and impact on system
  - User documentation determines if updates needed
  - QA determines testing needs and ripple effects
  - Customer support determines possible workarounds and impact on customers

# Maintenance Process (cont.)

- Cost analysis

Activity	Estimate
Identify problem and determine what must change	2 - 5
Design changes	1 - 4
Implement changes	1 - 4
Change documents (SRS, SDD, STP)	1 - 4
Compile and merge into baseline	2 - 6
Test functionality of changes	2 - 4
Regression testing	2 - 4
Release new baseline and document results	1
Total	14 - 35

# Maintenance Process (cont.)

- Release
  - Regular release or emergency patch?

Advantages of Patch	Disadvantages of Patch
May be a complete fix to problem	May duplicate work (patch and final fix)
Fast, keeps customer satisfied	Patches sometimes never replaced
Allows continued operation and testing without defect present	Complicates final fix, since patch needs to be removed
Avoids masking other defects	Complicates documentation process
Allows test of fix	Patch insertion may compromise code base

# Other Maintenance Terms

- Legacy system
  - Old system developed when environments and needs were different, but still critical
    - Cost of fixing a system grows exponentially with age
      - Talent and tools to fix become scarce and expensive
- Reverse engineering
  - Extracting design from code
- Re-engineering
  - Reverse engineering followed by forward engineering

# Software Engineering

COEN 174

Ron Danielson

Project Management

Chapter 13

# Objectives

- Understand the four phases of project management
- Learn some simple estimation techniques
- Contrast advantages and disadvantages of different team management styles

# Goals of SPM

- Results of the project will satisfy the client's need
- All project attributes will be met
- Teams are operating effectively with high morale
- Required tools and resources are available and effectively used
- POMA
  - Planning
  - Organization
  - Monitoring
  - Adjusting

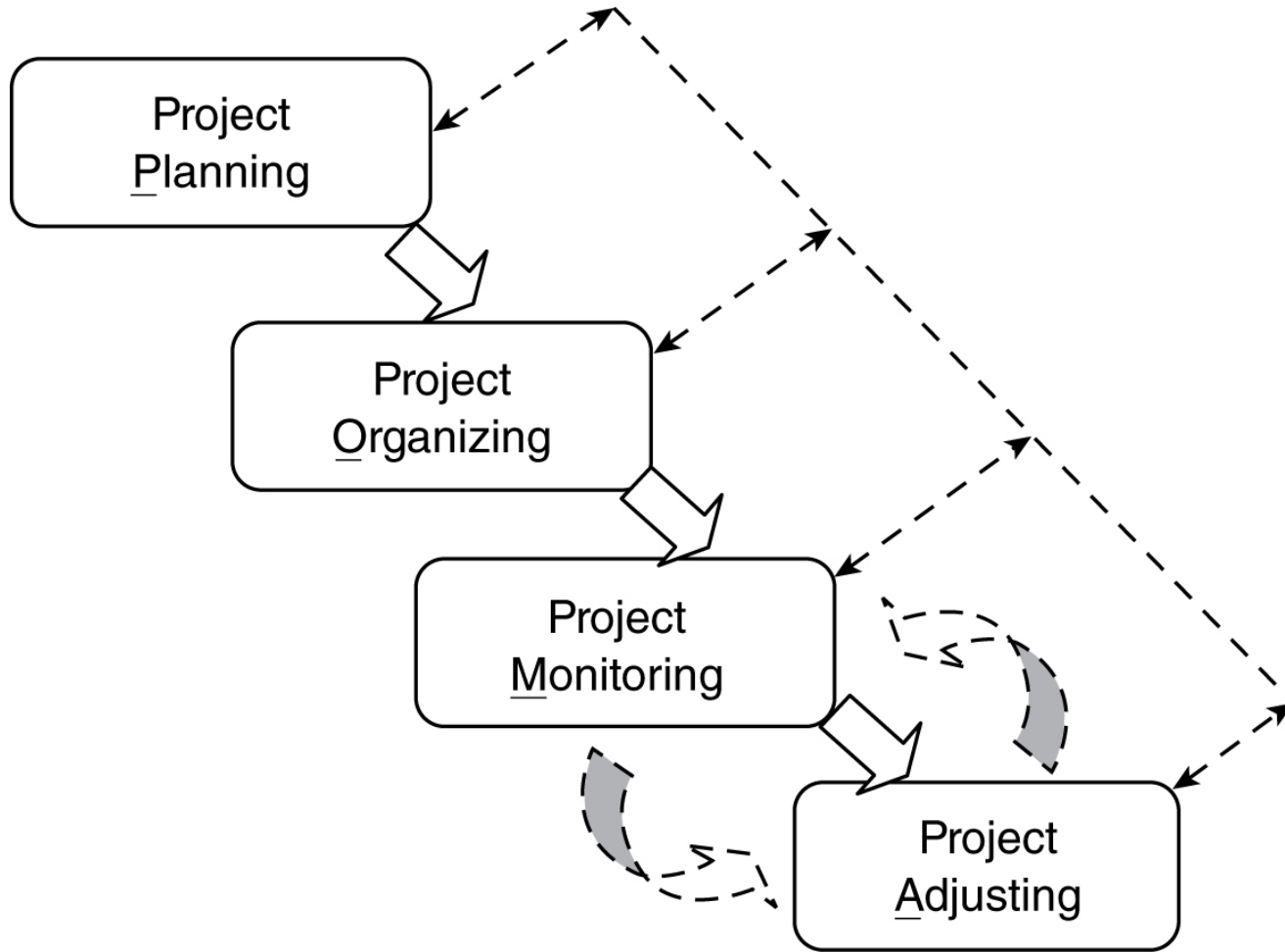
# Goals of SPM – Another View

- Organization
- PM tools
- Risk management
- Estimation
- Scheduling
- Documentation and monitoring

# Goals of SPM

- POMA
  - Planning
  - Organization
  - Monitoring
  - Adjusting

# POMA



# Planning

- Understand the requirements
- Estimate
  - Work effort
  - Schedule
  - Needed resources
- Define and measure goals
- Allocate resources
  - People
  - Process
  - Tools and facilities
- Identify and analyze risks

# Planning (cont.)

- Project plan includes
  - Description of requirements and deliverables
  - Estimations
  - Work effort
  - Needed resources
  - Schedule
  - Goals
  - Assumptions and risks

# Schedule Example

[illegible]

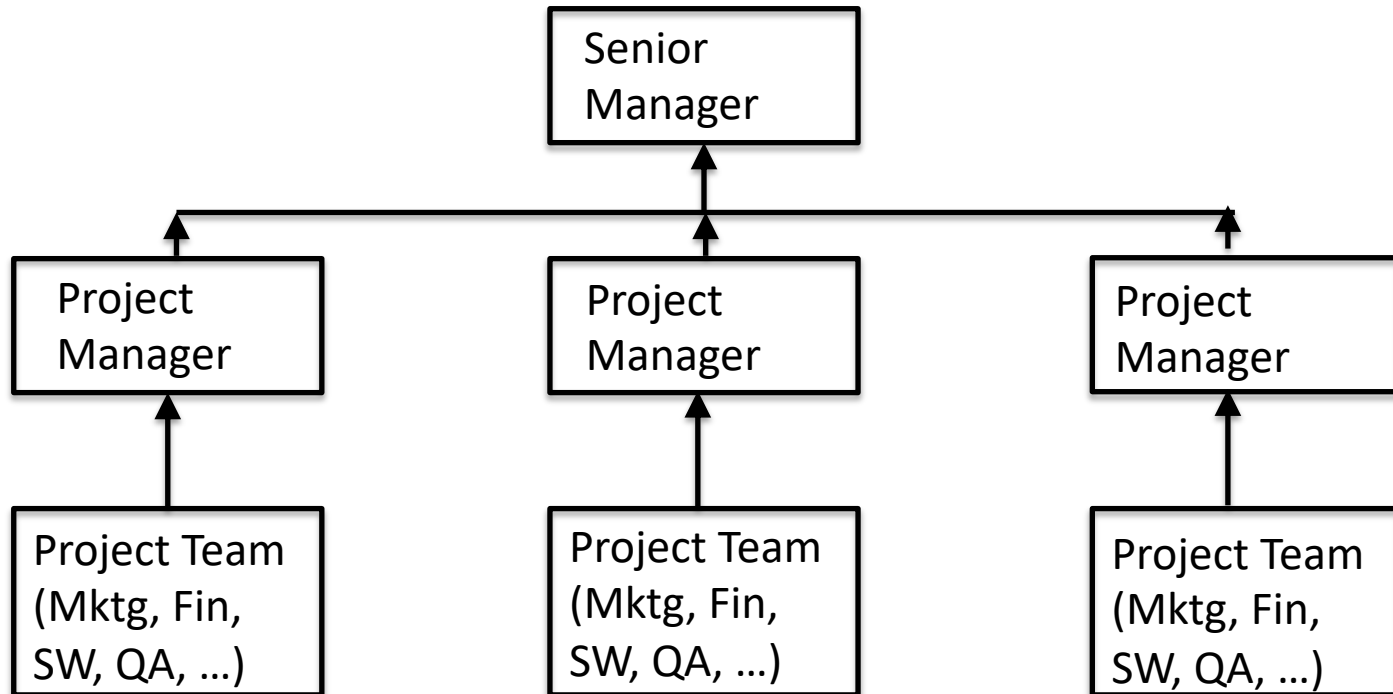
# Organizing

- Design organization structure
- Start hiring staff and acquiring other resources
- Educate and train staff
- Establish tracking mechanisms
  - Risk tracking and mitigation
  - Project goals
    - Schedules
      - Critical path
    - Cost
    - Quality

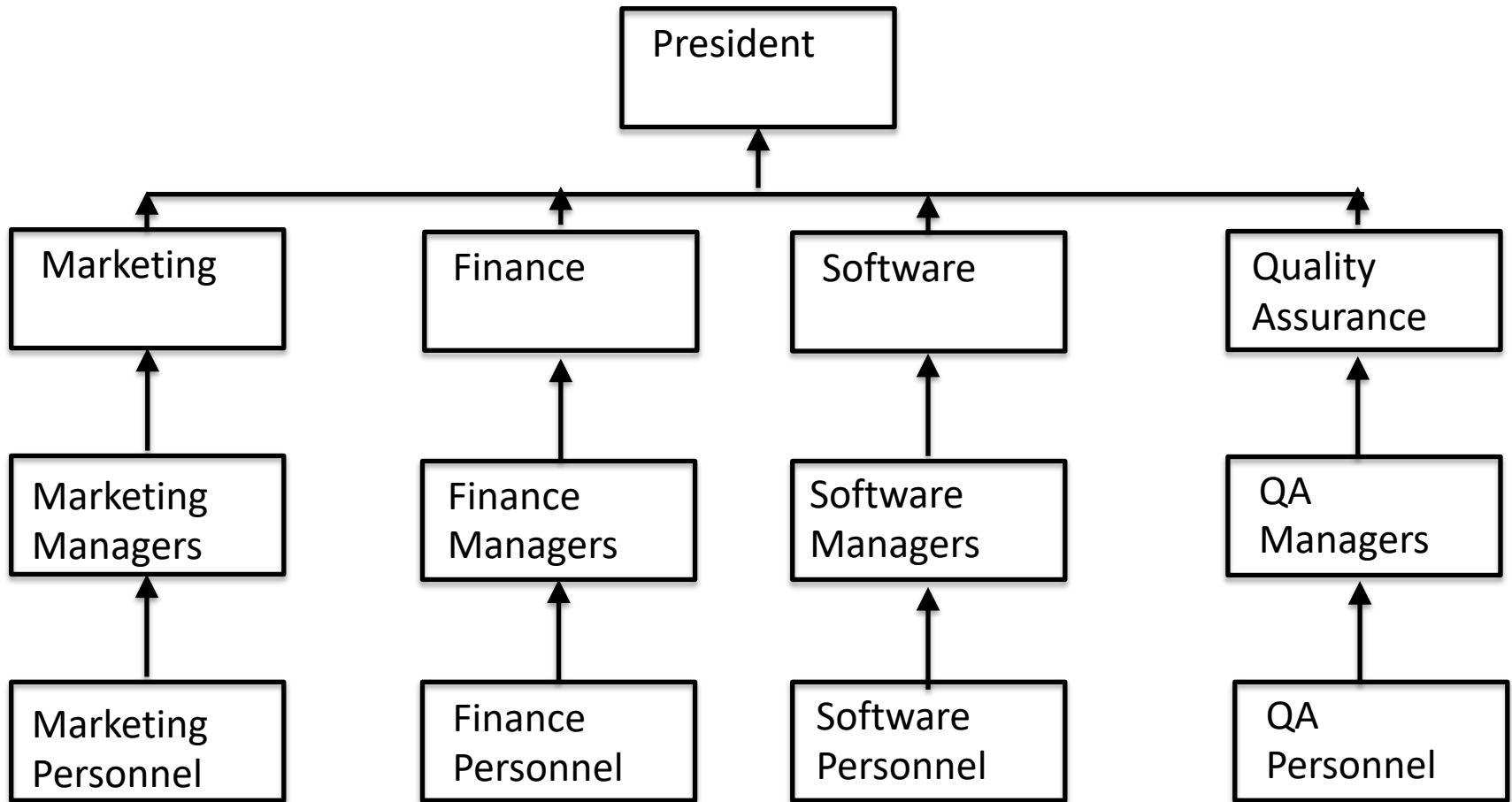
# Common Organization Structures

- Project-oriented
- Function-oriented
- Matrix

# Project-oriented Organization



# Function-oriented Organization



# Matrix Organization

		Project			
		Telepathic Registration	Grade Prediction	Restart Football	Swig Replacement
Functional Unit	Project Management Department	Irene Smith, FT	Edna SV Millay, HT	Vince Lombardi, FT	Edna SV Millay, HT
	Marketing Dept. (Wild Guess, Mgr.)	Dale Achabal, FT	Shelby McIntyre, FT	Al Bruno, FT	Mike Munson
	Software Dept. (Code God, Mgr.)	Darren Atkinson, FT ...	Darren Atkinson, FT	Nam Ling, FT ...	Silvia Figueira, FT ...

# Comparing Organization Structures

- Project-oriented
  - **Advantage:** staff loyalty primarily to project
    - Pure focus, greater schedule predictability
  - **Disadvantage:**
    - Individual contributors may be isolated from peers
    - Limited professional stimulation between projects
    - Potentially reduced reuse
- Function-oriented
  - **Advantage:** clear and responsible decision-making
  - **Disadvantage:**
    - Managers may get distracted
    - Fair resource allocation across projects

# Comparing Organization Structures (cont.)

- Matrix
  - **Advantage:**
    - Project managers focus on their project(s)
    - Functional managers focus on disciplinary content of their area
  - **Disadvantage:** staff have two masters