# Development Methodologies

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# TEAMS

# Overview

**Team organization**

**Democratic team approach**

**Classical chief programmer team approach**

**Beyond chief programmer and democratic teams**

**Synchronize-and-stabilize teams**

**Extreme programming teams**

# Programming Team Organization

**A product must be completed within 3 months, but 1 person-year of programming is still needed**

**Solution**

- If one programmer can code the product in 1 year, four programmers can do it in 3 months

**Nonsense**

- Four programmers will probably take nearly a year
- The quality of the product is usually lower

# Task Sharing

If one farm hand can pick a strawberry field in 10 days, ten farm hands can pick same strawberry field in 1 day

One woman can produce a baby in 9 months, but nine women cannot possibly produce that baby in 1 month

Unlike baby production, it is possible to share coding tasks between members of team

BUT: Unlike strawberry picking, team members must interact in meaningful and effective way

# Programming Team Organization (contd)

**Example:**

- Freda and Joe code two modules, mA and mB, say.

**What can go wrong?**

- Both Freda and Joe may code mA, and ignore mB
- Freda may code mA, Joe may code mB. When mA calls mB it passes 4 parameters; but mB requires 5 parameters
- Or, the order of parameters in mA and mB may be different
- Or, the order may be same, but the data types may be slightly different

**This has nothing whatsoever to do with technical competency**

- Team organization is a managerial issue

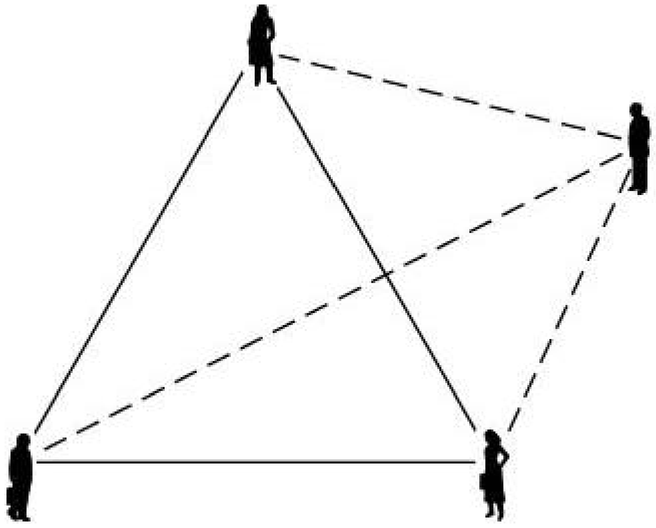
# Communications Problems

## Example

- There are three channels of communication between 3 programmers working on project. The deadline is rapidly approaching but the code is not nearly complete

## “Obvious” solution:

- Add a fourth programmer to the team



# Communications Problems (contd)

## But other three have to explain in detail

- What has been accomplished
- What is still incomplete

## Brooks's Law

- Adding additional programming personnel to a team when product is late has the effect of making the product even later

# Team Organization

## Teams are used throughout software production

- Especially during implementation
- Here, the discussion is presented within the context of programming teams

## Two extreme approaches to team organization

- Democratic teams (Weinberg, 1971)
- Chief programmer teams (Brooks, 1971; Baker, 1972)

# Democratic Team Approach

**Basic underlying concept—egoless programming**

**Programmers can be highly attached to their code**

- They even name their modules after themselves
- They see their modules as extension of themselves

**If a programmer sees a module as an extension of his/her ego, he/she is not going to try to find all the errors in “his”/“her” code**

- If there is an error, it is termed a bug 🕷
- The fault could have been prevented if code had been better guarded against the “bug”
- “Shoo-Bug” aerosol spray

# Democratic Team Approach (contd)

## Proposed Solution

## Egoless programming

- Restructure the social environment
- Restructure programmers' values
- Encourage team members to find faults in code
- A fault must be considered a normal and accepted event
- The team as whole will develop an ethos, group identity
- Modules will “belong” to the team as whole
- A group of up to 10 egoless programmers constitutes a democratic team

# Strengths of Democratic Team Approach

**Democratic teams are enormously productive**

**They work best when the problem is difficult**

**They function well in a research environment**

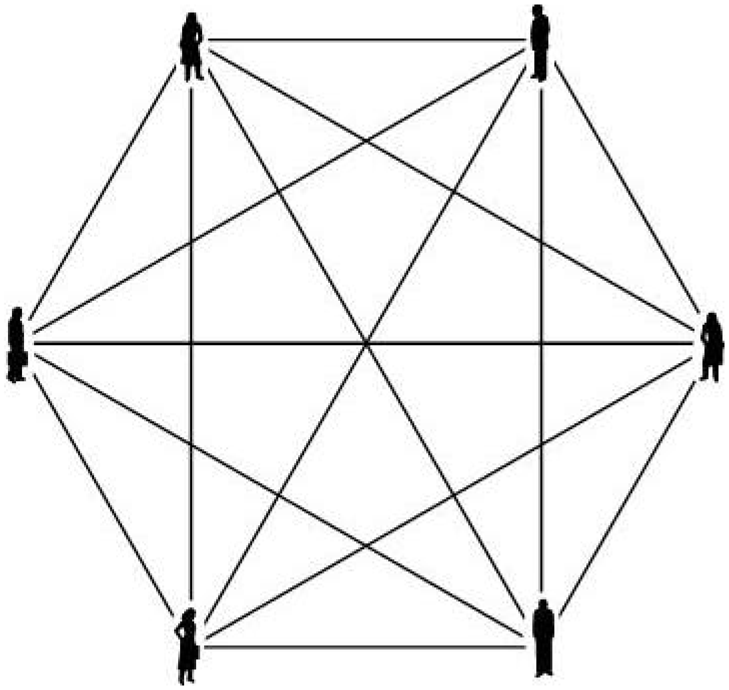
**Problem:**

- Democratic teams have to spring up spontaneously

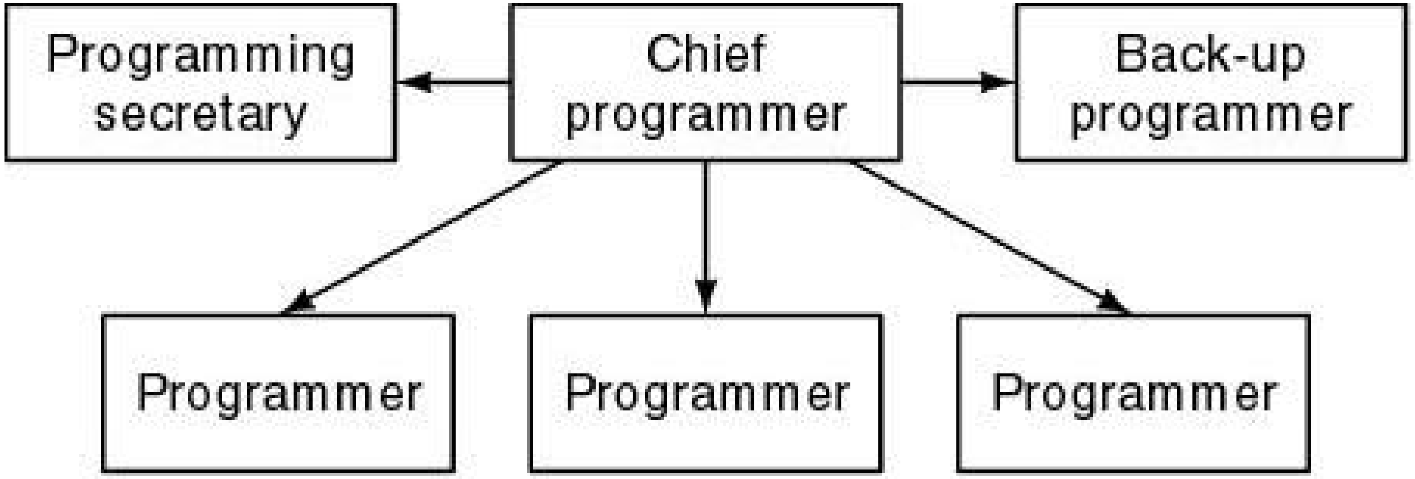
# Chief programmer teams

## Consider a 6-person team

- Fifteen 2-person communication channels
- The total number of 2-, 3-, 4-, 5-, and 6-person groups is 57
- The team cannot do 6 person-months of work in 1 month



# Chief programmer teams (contd)



**Six programmers, but now only 5 lines of communication**

# Classical Chief programmer teams

## Basic idea behind the concept

- Analogy: chief surgeon directing operation, assisted by
  - Other surgeons
  - Anesthesiologists
  - Nurses
  - Other experts, such as cardiologists, nephrologists

## Two key aspects

- Specialization
- Hierarchy

# Classical Chief programmer teams (contd)

## Chief programmer

- Successful manager *and* highly skilled programmer
- Does the architectural design
- Allocates coding among the team members
- Writes the critical (or complex) sections of code
- Handles all the interfacing issues
- Reviews the work of the other team members
- Is personally responsible for every line of code

# Classical Chief programmer teams (contd)

## Back-up programmer

- Necessary only because the chief programmer is human
- The back-up programmer must be in every way as competent as the chief programmer
- Must know as much about the project as the chief programmer
- Does black-box test case planning and other tasks that are independent of the design process

# Classical Chief programmer teams (contd)

## Programming secretary

- A highly skilled, well paid, central member of the chief programmer team
- Responsible for maintaining the program production library (documentation of project), including:
  - Source code listings
  - JCL
  - Test data
- Programmers hand their source code to the secretary who is responsible for
  - Conversion to machine-readable form,
  - Compilation, linking, loading, execution, and running test cases (1971, remember!)

# Classical Chief programmer teams (contd)

## Programmers

- Do nothing but program
- All other aspects are handled by the programming secretary

# *The New York Times* Project

## Chief programmer team concept

- first used in 1971
- by IBM
- to automate the clippings data bank (“morgue“) of *The New York Times*

## Chief programmer—F. Terry Baker

# *The New York Times* Project (contd)

83,000 source lines of code (LOC) were written in 22 calendar months, representing 11 person-years

After the first year, only the file maintenance system had been written (12,000 LOC)

Most code was written in the last 6 months

21 faults were detected in the first 5 weeks of acceptance testing

25 further faults were detected in the first year of operation

# *The New York Times* Project (contd)

Principal programmers averaged one detected fault and 10,000 LOC per person-year

The file maintenance system, delivered 1 week after coding was completed, operated 20 months before a single failure occurred

Almost half the subprograms (usually 200 to 400 lines of PL/I) were correct at first compilation

# Why Was the NYT project Such a Success?

## Prestige project for IBM

- First real trial for PL/I (developed by IBM)
- IBM, with superb software experts, used its best people

## Very strong technical backup

- PL/I compiler writers helped the programmers
- JCL experts assisted with the job control language

**But, after this fantastic success, no comparable claims for chief programmer team concept have been made**

# Why Was the NYT project Such a Success?

## F. Terry Baker

- Superprogrammer
- Superb manager and leader
- His skills, enthusiasm, and personality “carried” the project

## Strengths of CPT Approach

- It works
- Numerous successful projects have used variants of CPT

# Impracticality of Classical CPT

**Chief programmer must be a highly skilled programmer and a successful manager**

- Shortage of highly skilled programmers
- Shortage of successful managers
- Programmers and managers “are not made that way”

**Back-up programmer must be as good as the chief programmer**

- But he/she must take a back seat (and a lower salary) waiting for something to happen to the chief programmer
- Top programmers, top managers will not do that

**Programming secretary does only paperwork all day**

- Software professionals hate paperwork

**Classical CPT is impractical**

# Beyond CP and Democratic Teams

**We need ways to organize teams that**

- Make use of the strengths of democratic teams and chief programmer teams, and
- Can handle teams of 20 (or 120) programmers

**Democratic teams**

- Positive attitude to finding faults

**Use CPT in conjunction with code walkthroughs or inspections**

# Beyond CP and Democratic Teams (contd)

## Potential Pitfall

**Chief programmer is personally responsible for every line of code.**

- He/she must therefore be present at reviews

**Chief programmer is also team manager**

- He/she must therefore *not* be present at reviews!

# Beyond CP and Democratic Teams (contd)

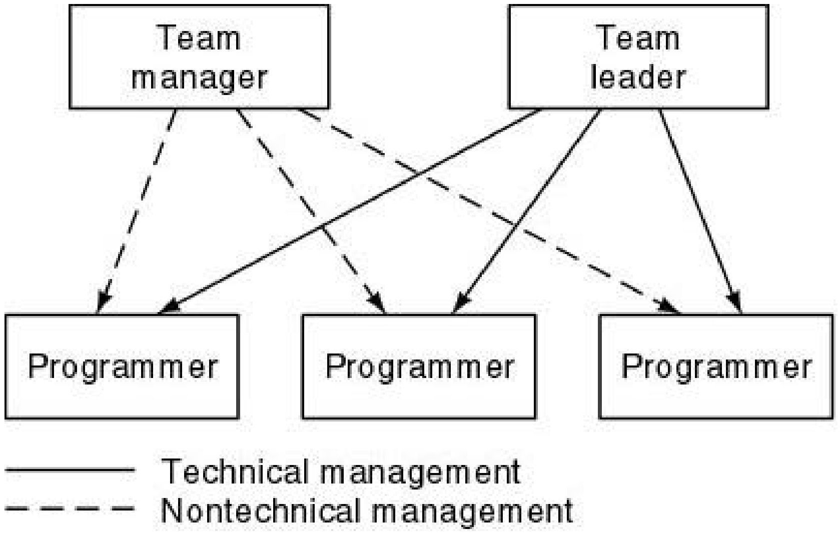
## Solution

- Reduce the managerial role of the chief programmer

**It is easier to find a team leader than a chief  programmer**

**Each employee is responsible to exactly one manager—lines of responsibility are clearly delineated**

**Team leader is responsible for only technical management**



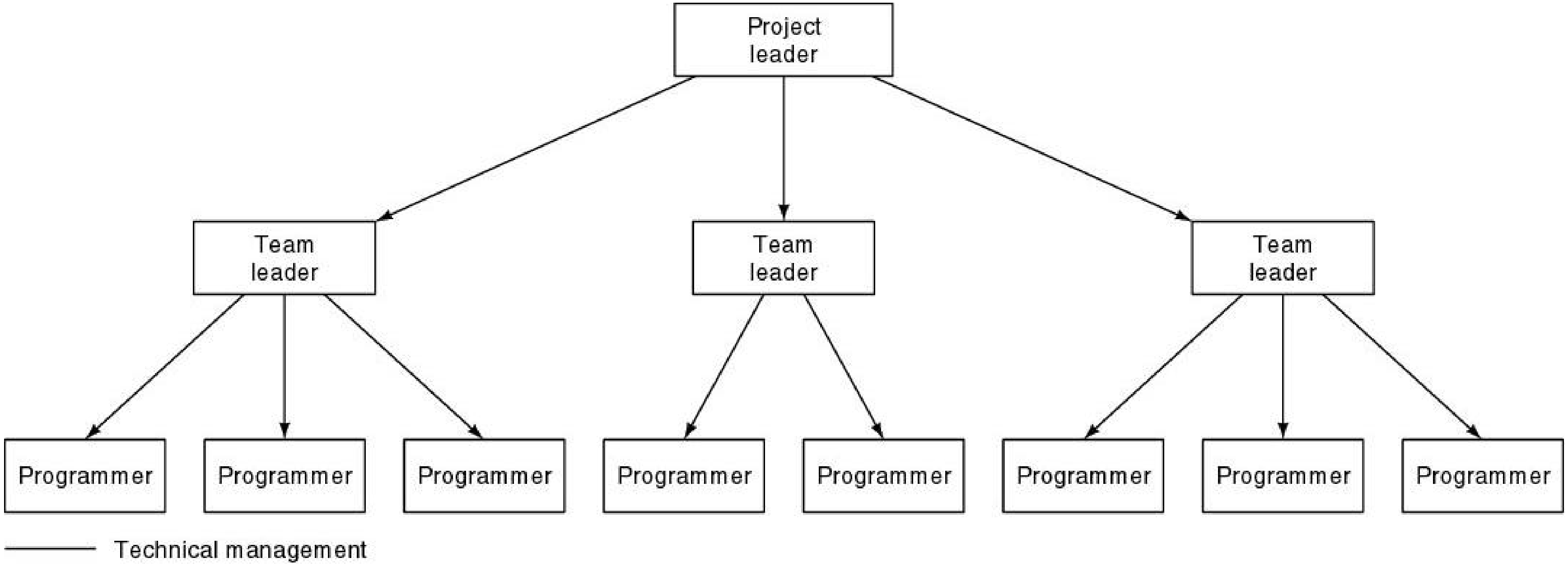
# Beyond CP and Democratic Teams (contd)

Budgetary and legal issues, and performance appraisal are not handled by the team leader

Team leader participates in reviews—the team manager is not permitted to do so

Team manager participates at regular team meetings to appraise the technical skills of the team members

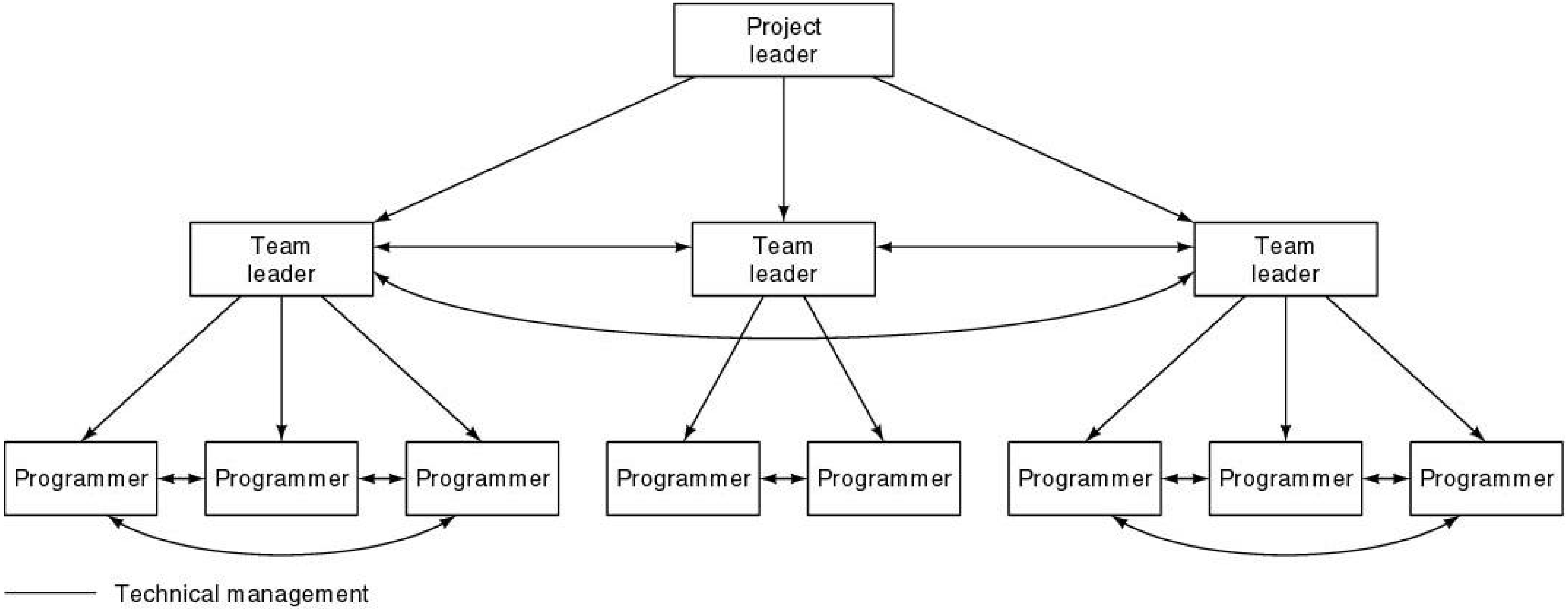
# Larger Projects



**Nontechnical side is similar**

**For even larger products, add additional layers**

# Beyond CP and Democratic Teams (contd)



Decentralize the decision-making process where appropriate

Useful where the democratic team is good

# Synchronize-and-Stabilize Teams

**Used by Microsoft**

**Products consist of 3 or 4 sequential builds**

**Small parallel teams**

- 3 to 8 developers
- 3 to 8 testers (work one-to-one with developers)
- Team is given the overall task specification
- They may design the task as they wish

**Why this does not degenerate into hacker-induced chaos**

- Daily synchronization step
- Individual components always work together

# Synchronize-and-Stabilize Teams (contd)

## Rules

- Must adhere to the time to enter the code into the database for that day's synchronization

## Analogy

- Letting children do what they like all day…
- … but with a 9 P.M. bedtime

## Will this work in all companies?

- Perhaps if the software professionals are as good as at Microsoft
- Again, more research is needed

# Extreme Programming Teams

## Feature of XP

- All code is written by two programmers sharing a computer
- “Pair programming”
  - Test cases drawn up by one member of team
  - Knowledge not all lost if one programmer leaves
  - Inexperienced programmers can learn
  - Centralized computers promote egoless programming

# Final Remarks

**There is no one solution to the problem of team organization**

**The “correct” way depends on**

- The product
- The outlook of the leaders of the organization
- Previous experience with various team structures

**Very little research has been done on software team organization**

- Instead, team organization has been based on research on group dynamics in general

**Without *relevant* experimental results, it is hard to determine optimal team organization for a specific product**

# Link

**I would like everyone in class to take the Jung/Myers-Briggs typology test.**

**Althought www.keirsey.com is charging $14.95 to give you complete results there is a site that gives results for free:**

**http://www.humanmetrics.com/cgi-win/JTypes2.asp**