

## Comp-304 : Productivity Lecture 2

Alexandre Denault  
Original notes by Hans Vangheluwe  
Computer Science  
McGill University  
Fall 2006

# Announcements

- Class canceled next Wednesday
  - Next class will be held on Friday
- I've decided on the assignment scheme
  - Unit Testing, 5% - 1 week - Solo
  - OO, 5% - 1 week - Solo
  - UML, 10% - 2 weeks - Solo
  - Statecharts, 10% - 2 weeks – Must Pair Programming
  - Command Pattern, 5% - 1 week – Pair Programming Optional
  - Observer Pattern, 15% - 2 weeks – Pair Programming Optional

# Comparing Processes

- Unclear specification
- Changes during the project
- Management Overhead
- Time-to-market
- Customer Confidence
- Required Resources / Staff
- Concurrency of Resources

# How to measure the size of an App?

## ■ Lines of Code?

- ◆ Language
- ◆ Comments
- ◆ Refactoring
- ◆ How much is delivered

## ■ FFP metric

- ◆ File (number of records in system)
- ◆ Flows (interface between product and env: screen, report)
- ◆ Process (logical manipulation of data)
- ◆  $\text{Size} = F_i + F_l + P_r$
- ◆  $\text{Cost} = d \times \text{Size}$ , where  $d$  is the productivity

# What is Productivity?

- Economics: Amount of unit of output created per unit of input.
- Software: Amount of software (code/features) produced per unit of input.
  - ◆ What is the input for software
    - Time
    - People

# Which group was more productive?

- Group A, which is composed of 8 programmers, finished the software in 12 months.
- Group B, which is composed of 6 programmers, finished the software in 14 months.

# What affects productivity

■ ...

# What affects productivity

- Number of people on the project
- Experience of staff
  - ◆ Similar challenges
  - ◆ Amount of Re-use
- Quality of specification
- Infrastructure

# The process influences productivity

*“Adding manpower to a late software project makes it later”*

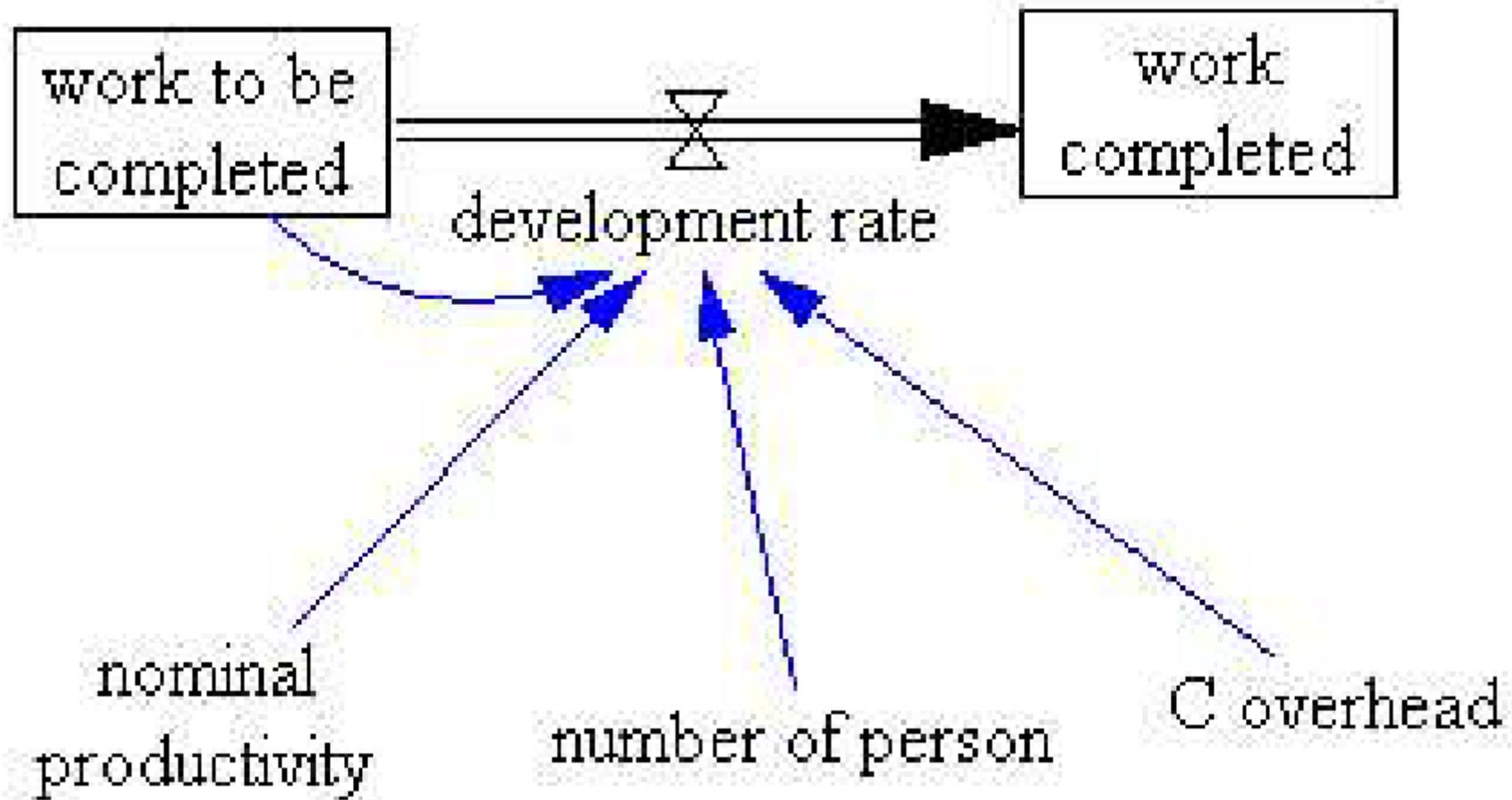
Fred Brooks. The Mythical Man-Month.  
<http://www.ercb.com/feature/feature.0001.html>

# The process influences productivity

*“The bearing of a child takes nine months, no matter how many women are assigned.”*

Fred Brooks. The Mythical Man-Month.  
<http://www.ercb.com/feature/feature.0001.html>

# Why Brooks' Law ? Team Size

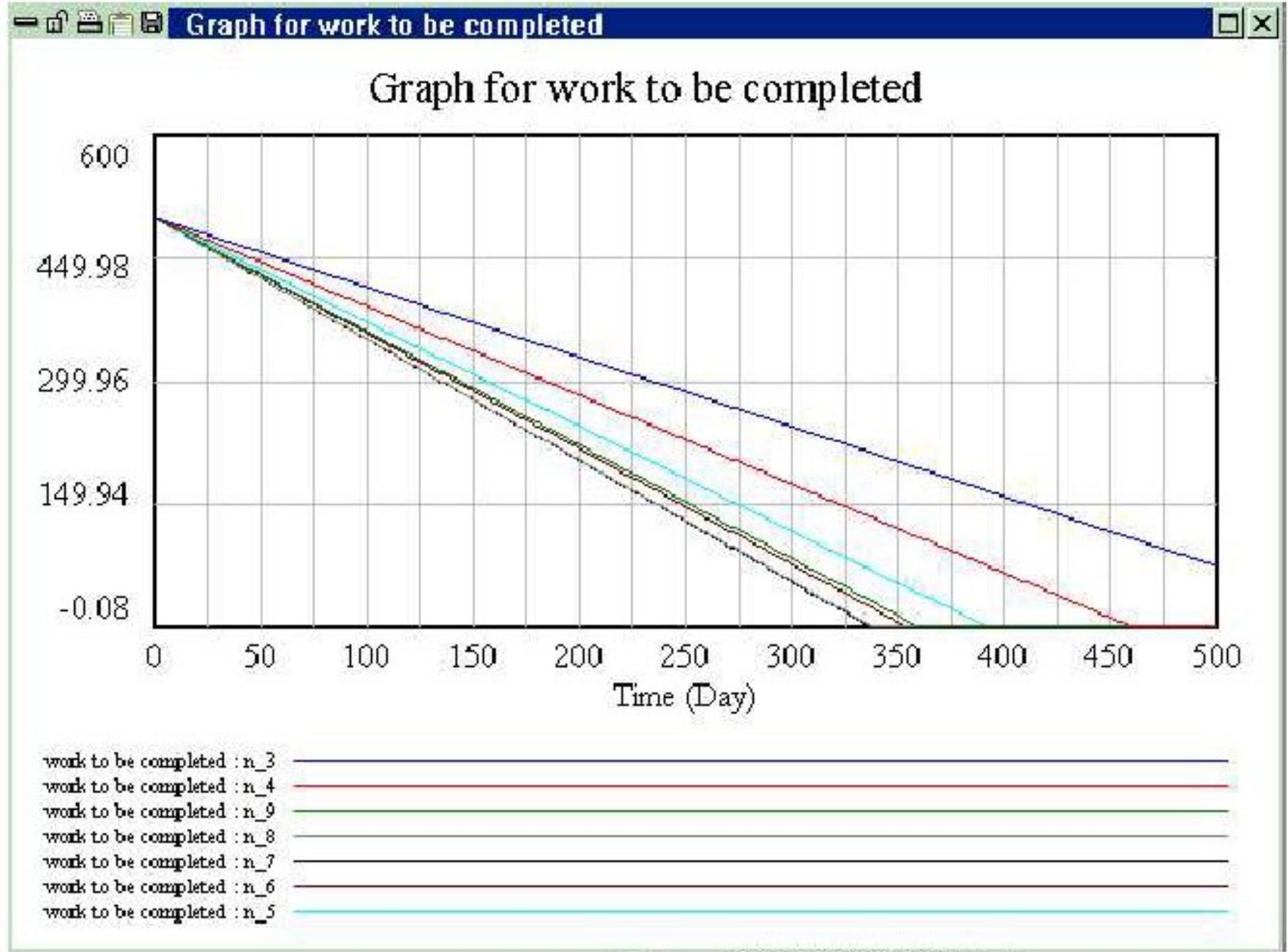


- Model in Forrester System Dynamics using Vensim PLE ([www.vensim.com](http://www.vensim.com))

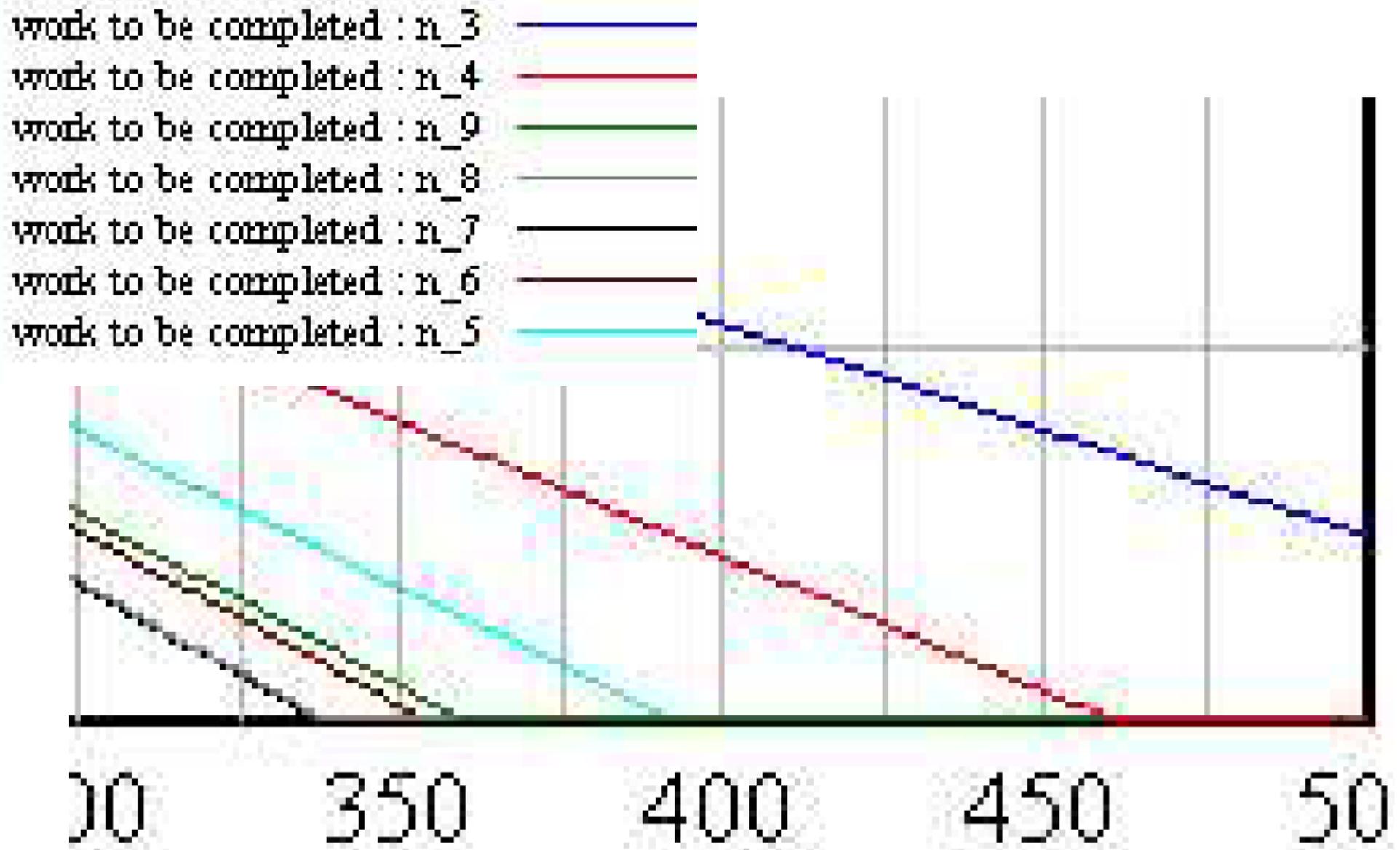
development rate =

$$\text{nominal\_productivity} * (1 - \text{C\_overhead} * (\text{N} * (\text{N} - 1))) * \text{N}$$

# Team size of N 3...9



# Zoom in



# Let's do the Math

development rate =

$$\text{nominal\_productivity} * (1 - C\_overhead * (N * (N - 1))) * N$$

- So the slope is determined by  $(1 - C\_overhead * (N * (N - 1))) * N$ 
  - ♦ If  $C\_overhead$  is 0.006, then

$$N = 1 : \text{Slope} = 1$$

$$N = 2 : \text{Slope} = 1.98$$

$$N = 3 : \text{Slope} = 2.89$$

$$N = 4 : \text{Slope} = 3.71$$

$$N = 5 : \text{Slope} = 4.4$$

$$N = 6 : \text{Slope} = 4.92$$

$$N = 7 : \text{Slope} = 5.24$$

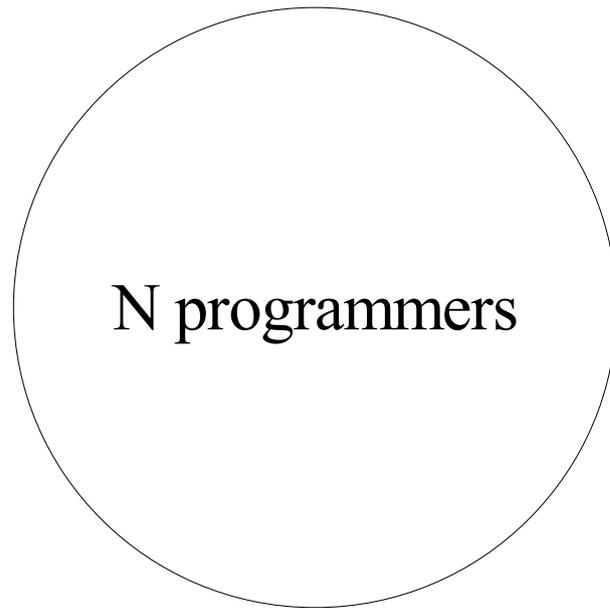
$$N = 8 : \text{Slope} = 5.31$$

$$N = 9 : \text{Slope} = 5.11$$

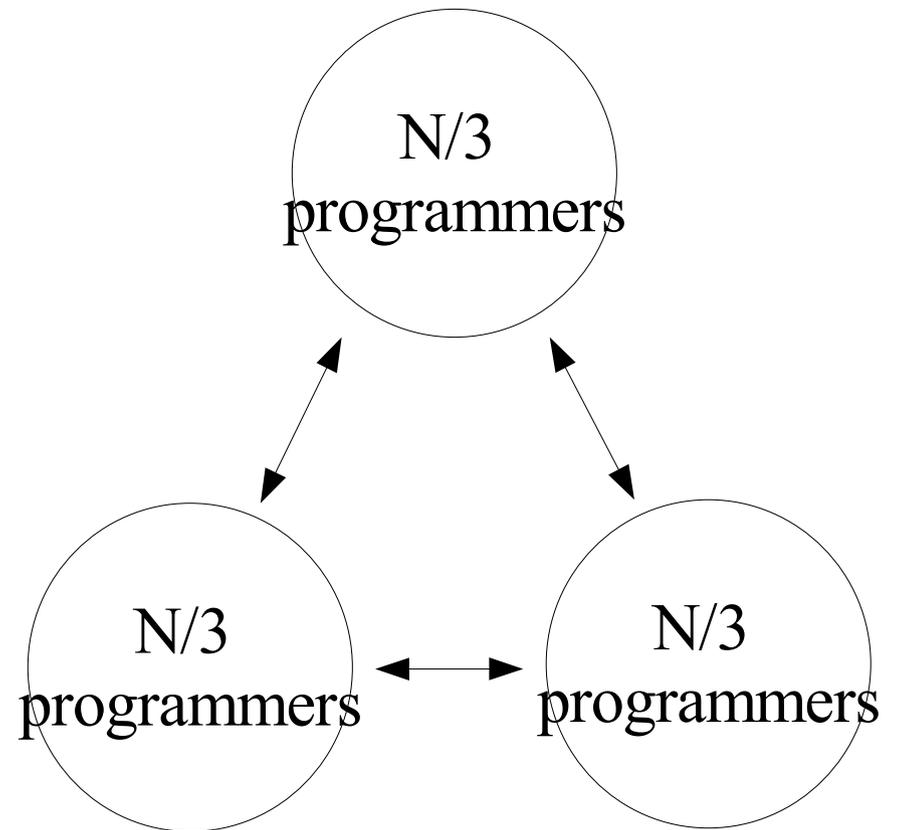
# Team Size

- The productivity of teams decreases as their number increases.
- Which software development process addresses this problem?

# Solution?



$N*N$  Interactions



$(N*N)/3 + 3$  Interactions

# Number of Interactions

N	1 <sup>st</sup> Sol	2 <sup>nd</sup> Sol
3	9	6
9	81	30
18	324	111
30	900	303