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COMMODITY SOFTWARE SOLUTIONS

The software development process

A personal view

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Founder and non-executive director, Brady plc

References

- “Debugging the Development Process”
  - Steve Maguire, Microsoft Press
  - Real disaster stories
  - Inspirational and rational solutions
  - Recommended template, unashamedly plagiarised here
- Big Blues: The Unmaking of IBM
  - Paul Carroll, Three Rivers Press
  - Journalist on how IBM couldn’t write software (and Microsoft worked out how to – sort of – at critical time of s/w change)
- “Showstopper!”
  - G Pascal Zachary, Macmillan
  - Fly on the wall for the first release of Windows NT
- Google Chrome development cartoon
  - http://www.google.com/googlebooks/chrome/index.html

Agenda

- The three most important things
  1. Bugs
  2. Bugs
  3. Bugs
- Why is software development hard?
- Managing the code
- Development team ground-rules
- Making the management decision to ship

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Why is software development hard?

History

- According to “Big Blues: the Unmaking of IBM”:-
  - In the late 1980’s, IBM lost $70 billion of stock value
  - and gave an entire market away to a small company
  - Mainly because it couldn’t write software effectively.
- But IBM “did it right”. It followed all the standard rules taught in computer science courses at the time:
  - Get the design right before you write the code
  - Write complete documentation
  - Get it right first time
  - Use formal methods, design walk-throughs etc. to satisfy yourself that the code is bug-free, before release
  - Regard other methods (eg Microsoft’s) as “hacking”
- So what went wrong?

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Size is important

- 0.1-1kb — Typical punch-card program
  The IBM development method was probably developed for this type of program
- 2kb-10kb — Typical software module/class
  Typical computer science project(?)
- 16kb — Operating system of Sinclair Spectrum
- 200kb — Our first software product – 1986
- 18 Mb — Human Genome – active code
  (30k genes * protein size 800)
  Number varies from year to year
- 200Mb — Our current software product
- 750Mb — Human genome - including rubbish code
  (3×10^9 base-pairs)
- 4Gb — Windows Vista and associated products
- 218Gb — Storage on my laptop

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Software development process

How size affects the basic assumptions

	Punch-card program	2kb of code	Large program
Complete the design in advance	Almost essential	Difficult	Too complex - not possible
Complete the documentation in advance	Highly desirable	Difficult	Too complex - not possible
Prove it is bug-free	Very difficult mathematical challenge	Too complex - not possible	Too complex - not possible
“Right first time”	A worthy goal	Too complex - not possible	Too complex - not possible

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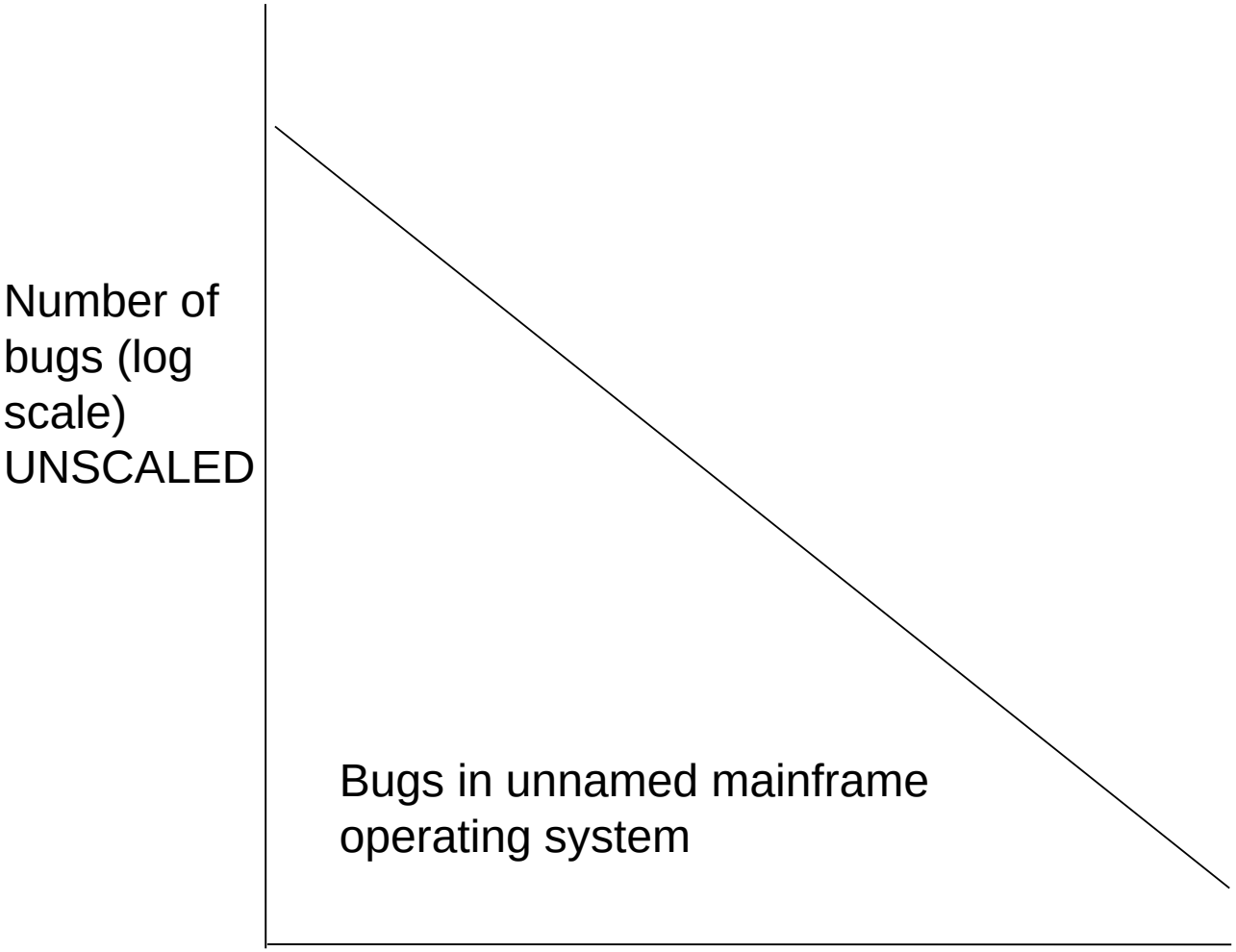
IBM: Seminal measurements 1984



Adams E. N., *Optimising preventive maintenance of software products*, IBM Journal of Research & Development, Vol. 28, issue 1 pp 2–14 (1984)

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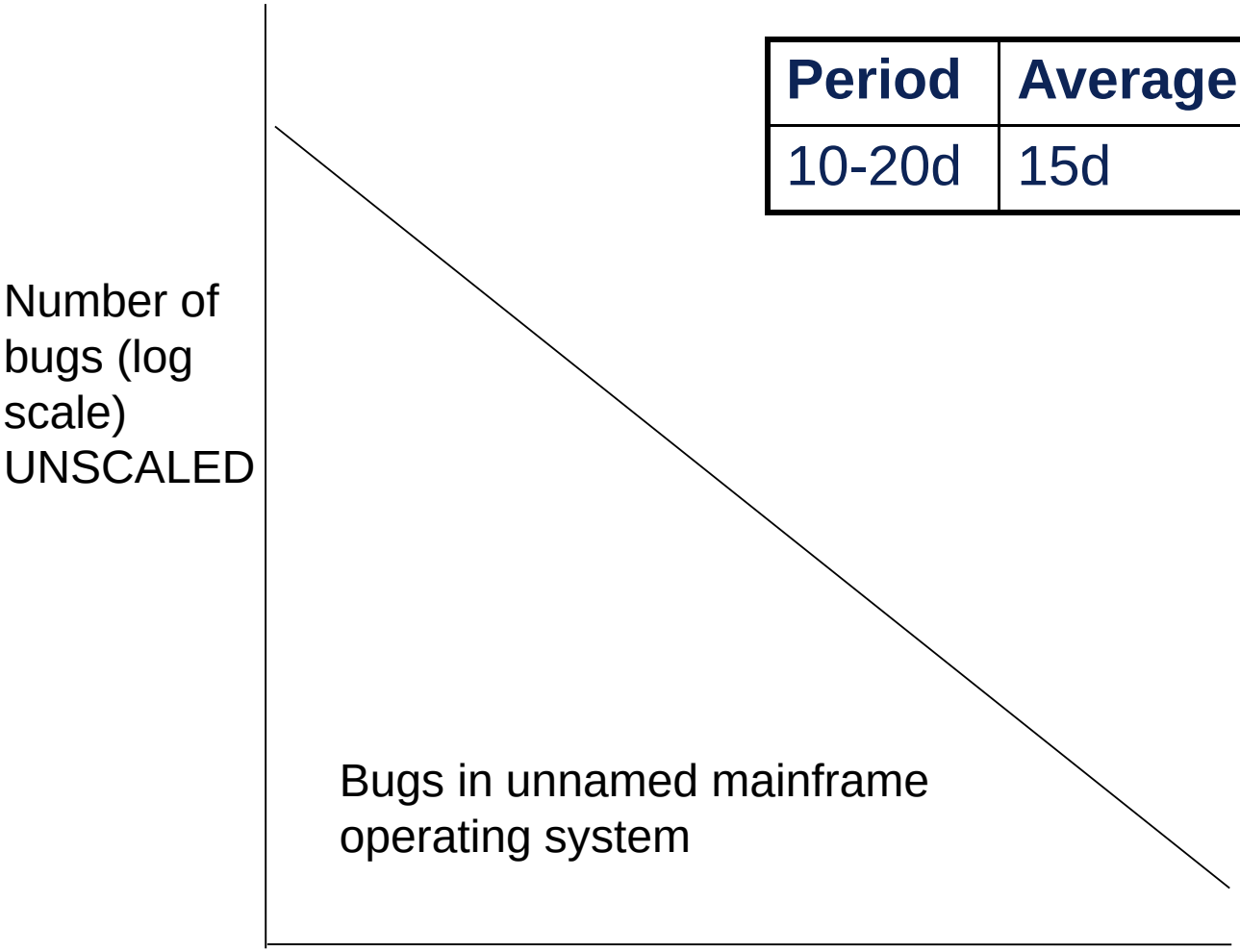
IBM: Seminal measurements 1984

Period	Average	bugs	MTTF
10-20d	15d	1	15d



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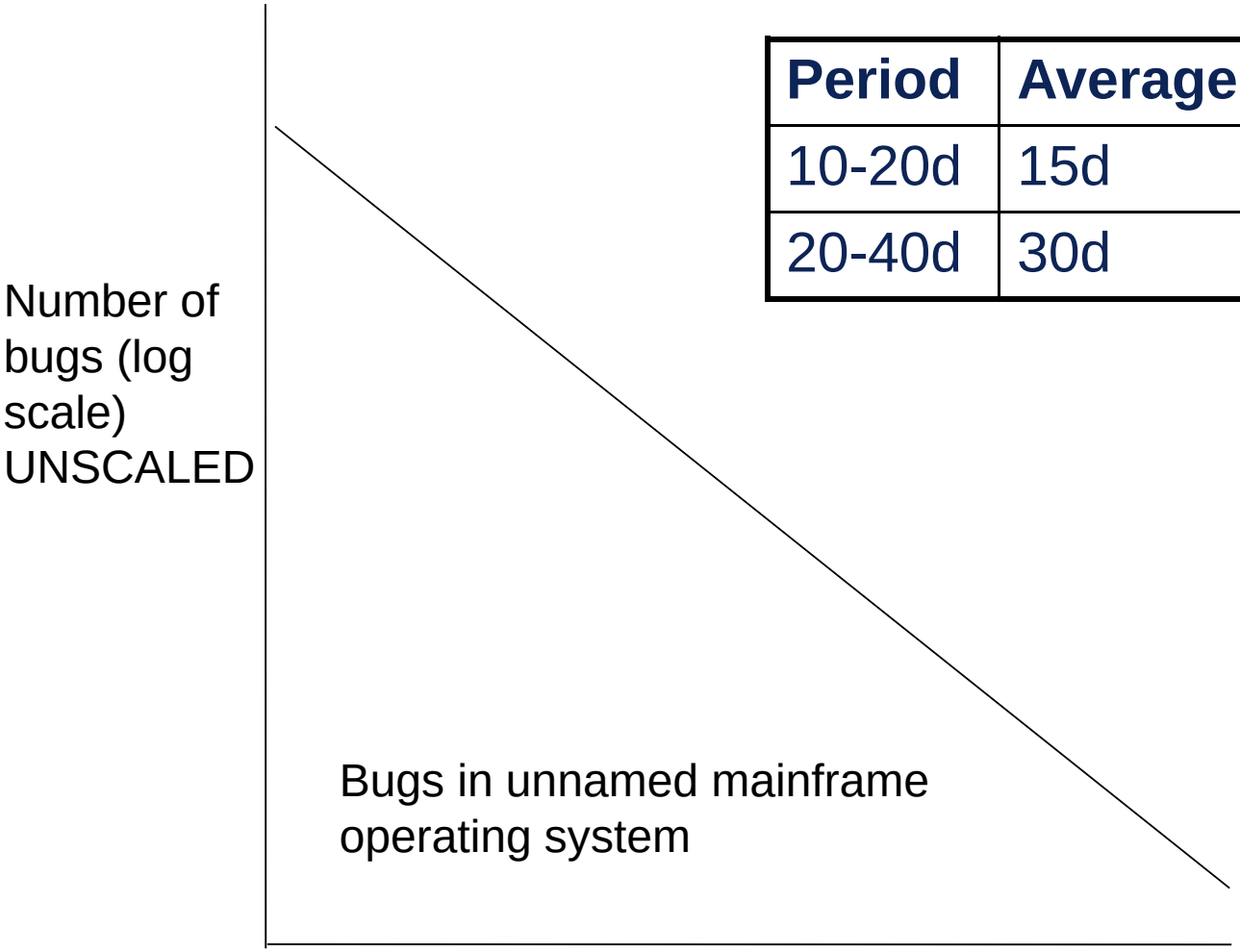

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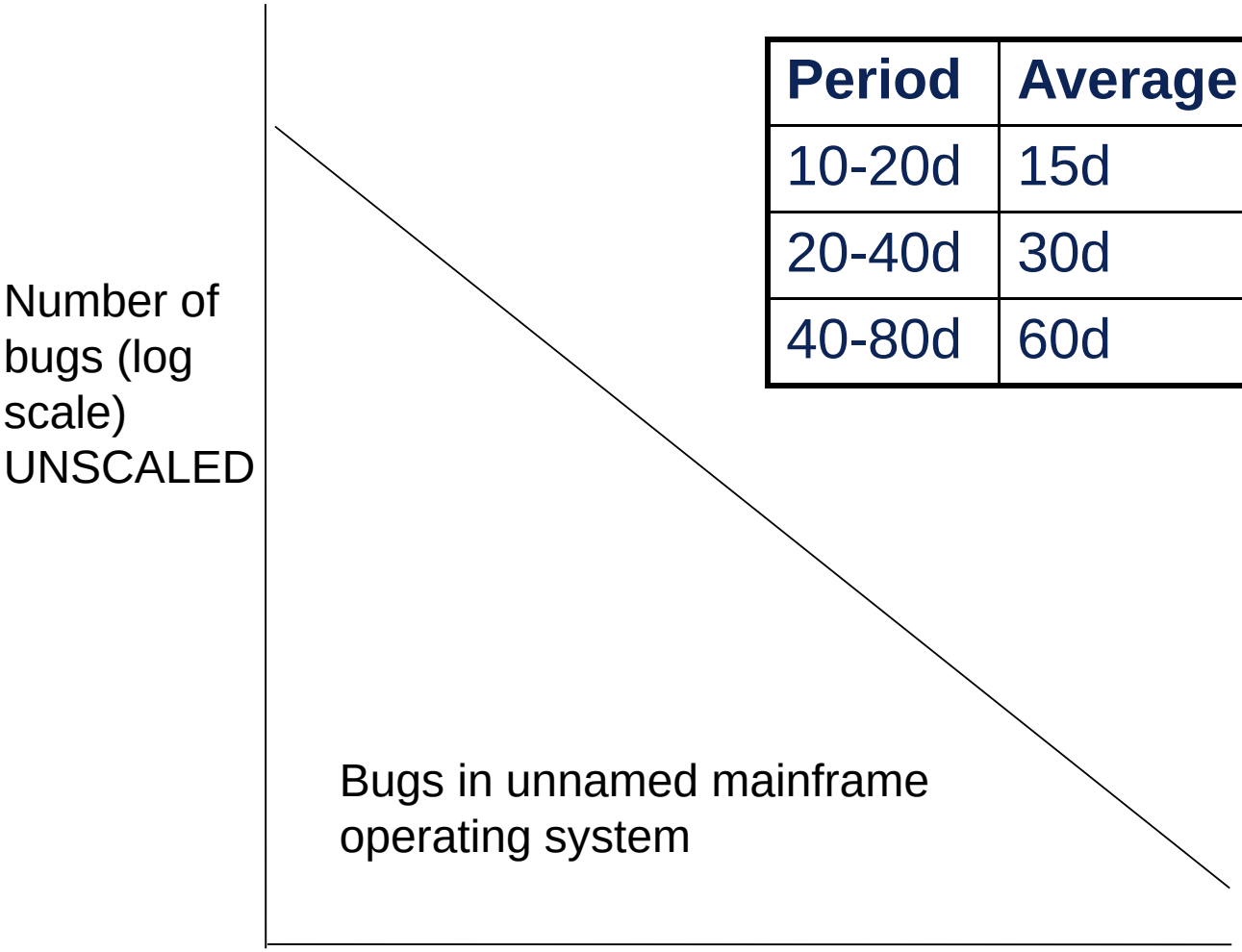

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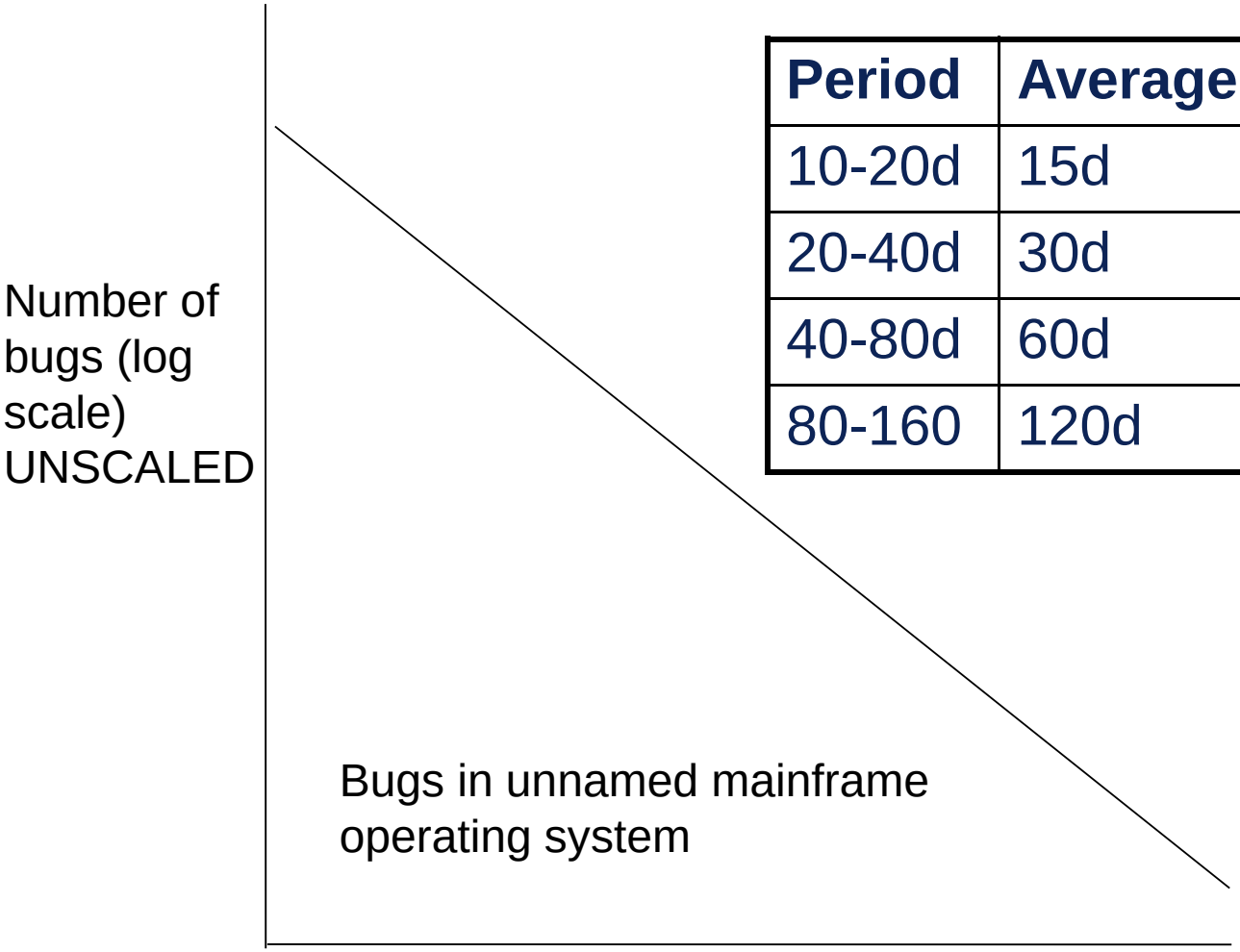
IBM: Seminal measurements 1984

Period	Average	bugs	MTTF
10-20d	15d	1	15d
20-40d	30d	2	15d
40-80d	60d	4	15d
80-160	120d	8	15d



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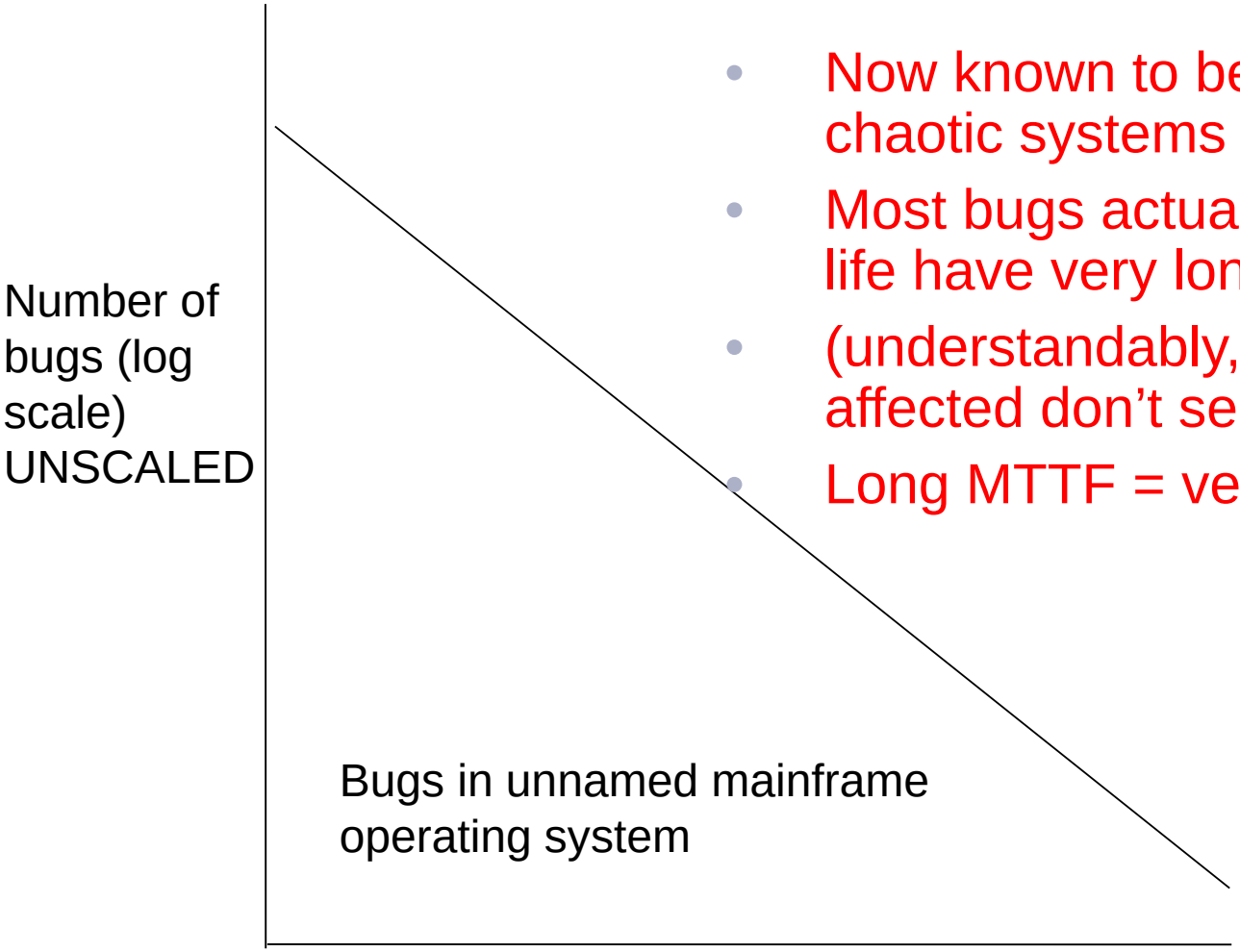
IBM: Seminal measurements 1984



- Now known to be a key signature of chaotic systems
- Most bugs actually triggered in real life have very long MTTF
- (understandably, customers who are affected don't see it that way)
- Long MTTF = very hard to find

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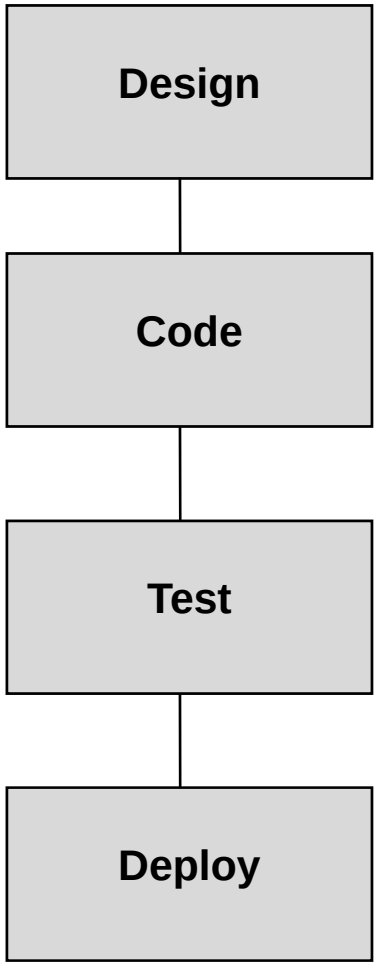
Managing the code

Waterfall Model



- Mainstay of development process
- Good for small modules or sub-units, particularly if you can have simple and well-specified interface.
- Be careful
  - Different people for each stage = lost information = failure
  - Microsoft at one stage: “We don’t have programmers, we have developers”

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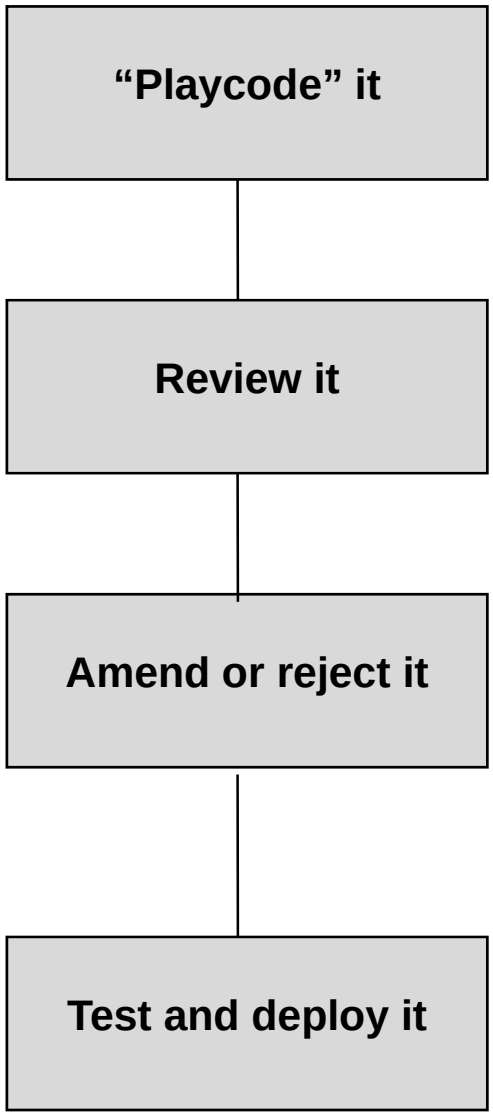
Prototyping model



- Good where there are significant project risks or unknowns
  - e.g. external software, new techniques or methods, or can't decide between alternatives
- Not very predictable
  - a big problem in contracted developments

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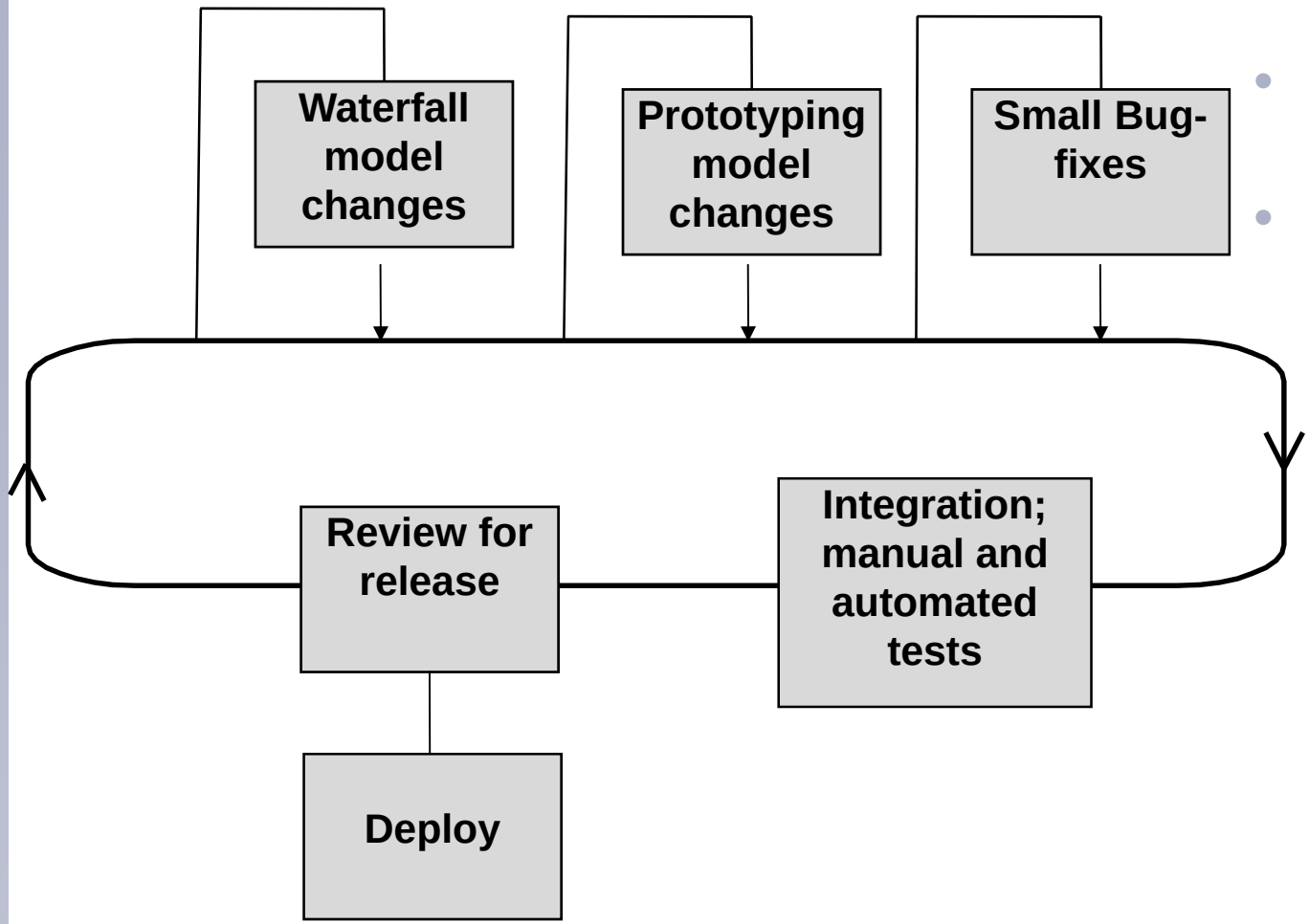
Evolutionary model



- Version control system
- Everyone does this in practice
- Manages complex interactions between developments

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Development team ground-rules

An interactive quiz

Please don’t peek ahead!

Your starter for 10

- You are the manager of a small (2 person) software development/test team
  - David the Developer
  - Terry the Test Engineer
- They come to you with a **problem** and a proposed **solution**.
- Do you approve it?

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Your starter for 10

- **Problem**
  - We need to implement 10 features. We have reviewed the designs, we now need to code and test them.
  - Time is very tight. We will have to pull out all the stops to do it by the contracted deadline of next month
  - David is the best person to do development
  - Terry is the best person to do the testing
- **Proposed solution**
  - David and Terry work closely together to accelerate the development phase
  - David develops the features and makes quick releases to Terry during development
  - Terry provides testing feedback during this phase
  - After this development phase, the software will go into the normal release cycle for testing/bugfix
- **Do you approve?**

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If you approve the plan

- You will send a message to your developers that **bugs don't matter** – you can "throw them over the wall" and someone else will find them for you
- You will accelerate developers who produce sloppy code and slow down developers who produce good code
- The process will be inefficient, eg
  - David will rely on Terry, so won't run 'white box' tests
  - Silly bugs will stop Terry running his automated tests
  - Constant communication will slow the team down
- When you get to the original deadline
  - your project will have all the features, but too many bugs
  - You won't be able to advise the customer of the new ship date, because the automated tests don't work - and they always uncover something new when they do run
  - It will be too late to take corrective action

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If you reject the plan

“Developer has to test his code before release”

- The team will be forced to make the hard project decisions, eg
  - Go back to the design stage for feature number 3; can we implement it more simply?
  - Cut feature number 6 – it’s not strictly in the specification
  - Advise the customer there is a risk. Does he want a delay, or does he want feature number 7 in a later release?
  - Request more resources (a long shot…)
- Your team will work more efficiently
  - Terry will always work on code that is basically stable (so he can develop his regression tests etc.)
  - David will be rewarded for producing quality code, not for producing features that destabilise the product

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If you reject the plan

Your team will be better able to plan the project

- If a feature is in the product then it will “basically work”
- The team (and you) can now monitor progress
- You can get test results and customer feedback early on the features you have implemented
- Management can make the decision to ship with a more predictable freeze-time

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My Damascus moment

- Conventional way to scale development team
  - Tools, methodologies, targets
  - ‘Typing pool’ model
  - Not conducive to commitment, ownership, joy
- Feature teams – eg SCRUM
  - Small teams of 3 -6
  - Everyone fully involved & responsible for all decisions in functional area
  - Post-it notes to advertise work planned, in progress, ready, tested
  - WORKS WITH OUTSOURCING TO RUSSIA

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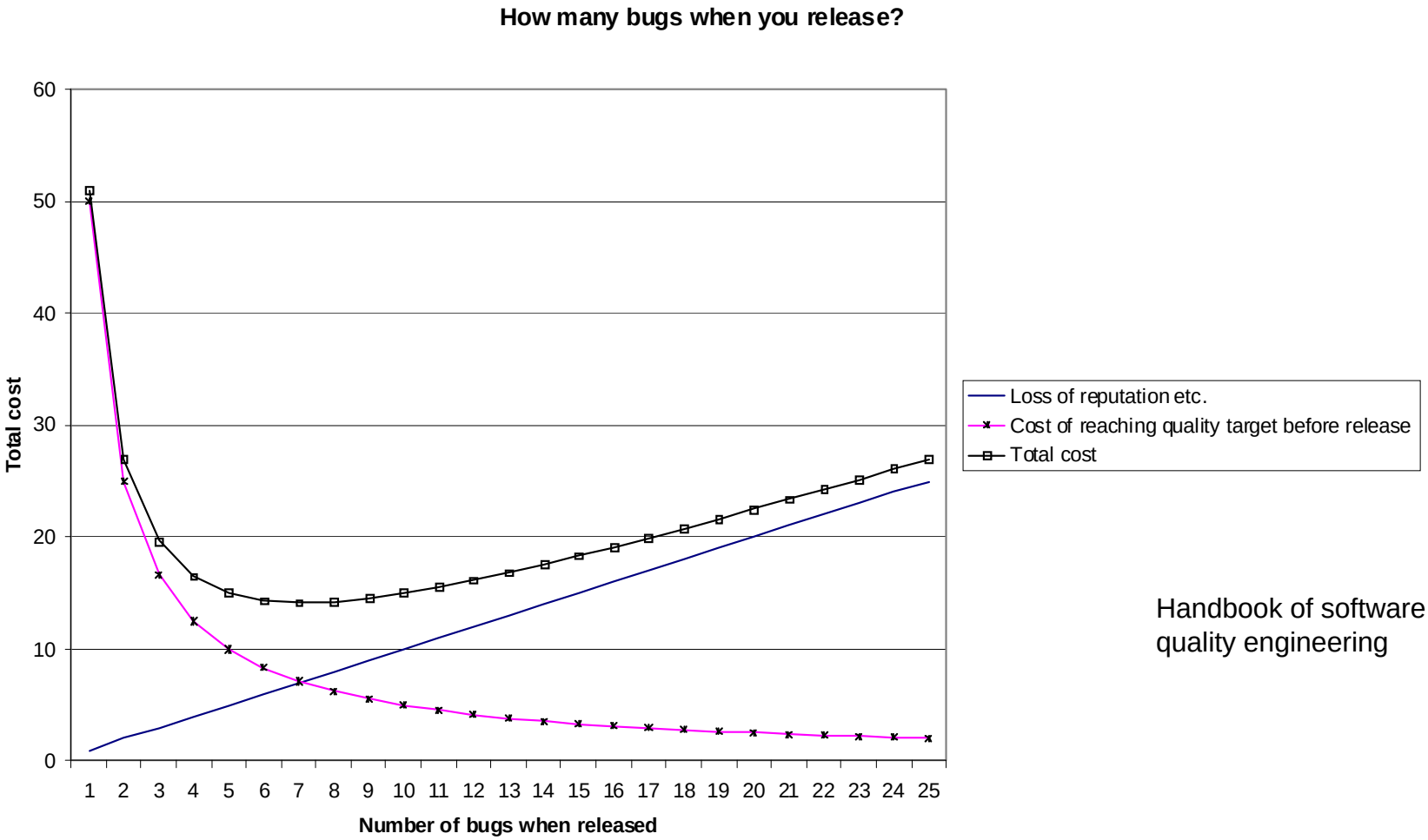
Making the management decision to ship

Recognising the trade-off



Handbook of software quality engineering

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Metrics: NT version 1

- **5.6M lines of code**
  - **1 bug for every 100 lines = 56K bugs to fix**
  - **1 bug for every 10 lines = 560K bugs to fix**
  - **1 bug per line (some academic industry estimates) = 5.6M bugs to fix**
- **Management's major activity: prioritising bugs**
  - **Showstopper (always fixed)**
  - **Priority 1 (fixed except in late stages of release)**
  - **Priority 2 (deferred)**

Date	Release	Serious or showstopper bugs
12 Oct 1992	Beta 1	2,000 known on release
8 Mar 1993	Beta 2	0 known on release 263 found in first 6 days
26 Jul 1993	Final	0 showstoppers known on release

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My personal view

- Avoid the “first release” syndrome altogether if poss
  - Make the first release very small
  - Make regular upgrades (SP or beta versions)
  - Typically monthly or quarterly releases
  - Each release contains only small changes
- Essential to limit risks OF EACH RELEASE
  - Invest in automated regression tests
  - The risk of each change is the primary focus
  - Manage higher risk changes by breaking them up
    - eg Have the ability to switch the risky part on/off
    - eg implement a big change in smaller bits
- Get real customers for each release
  - Forces focus on what the customer really requires
  - Gets real-world feedback that no lab can reproduce
- Problems? Add to automated regression tests

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Summary

- The three most important things
  1. Bugs
  2. Bugs
  3. Bugs
- Why is software development hard?
- Managing the code
- Development team ground-rules
- Making the management decision to ship

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Selling your company

- Typical acquisition size for us
  - 10 years, 15 developers
  - £2M-£12M
- My key question in due diligence (rough and ready indicator): How many lines of code?
  - 500,000 = functionality
  - 3M = duplication nightmare
  - Moral: Reduce code size in the first place
  - Design for code re-use
  - Refuse to code non-general features in the product

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The software development process

Thank you

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