Software Development CYCLE in Astronomy

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ESO
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What is software engineering?

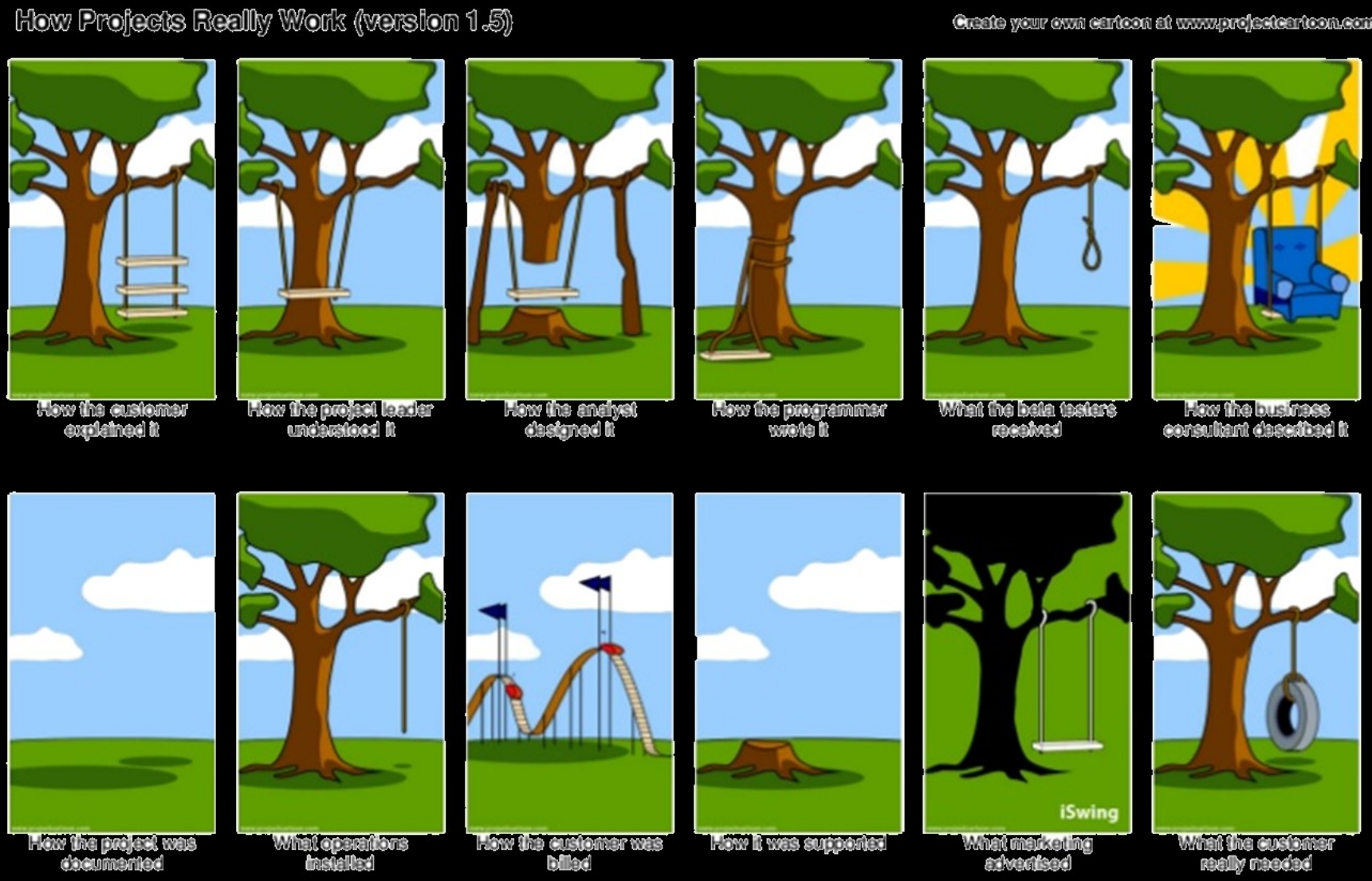
- *Convert ideas to software*
- *Deliver on time*
- Keep it running..(reliably, efficiently)

Its about…

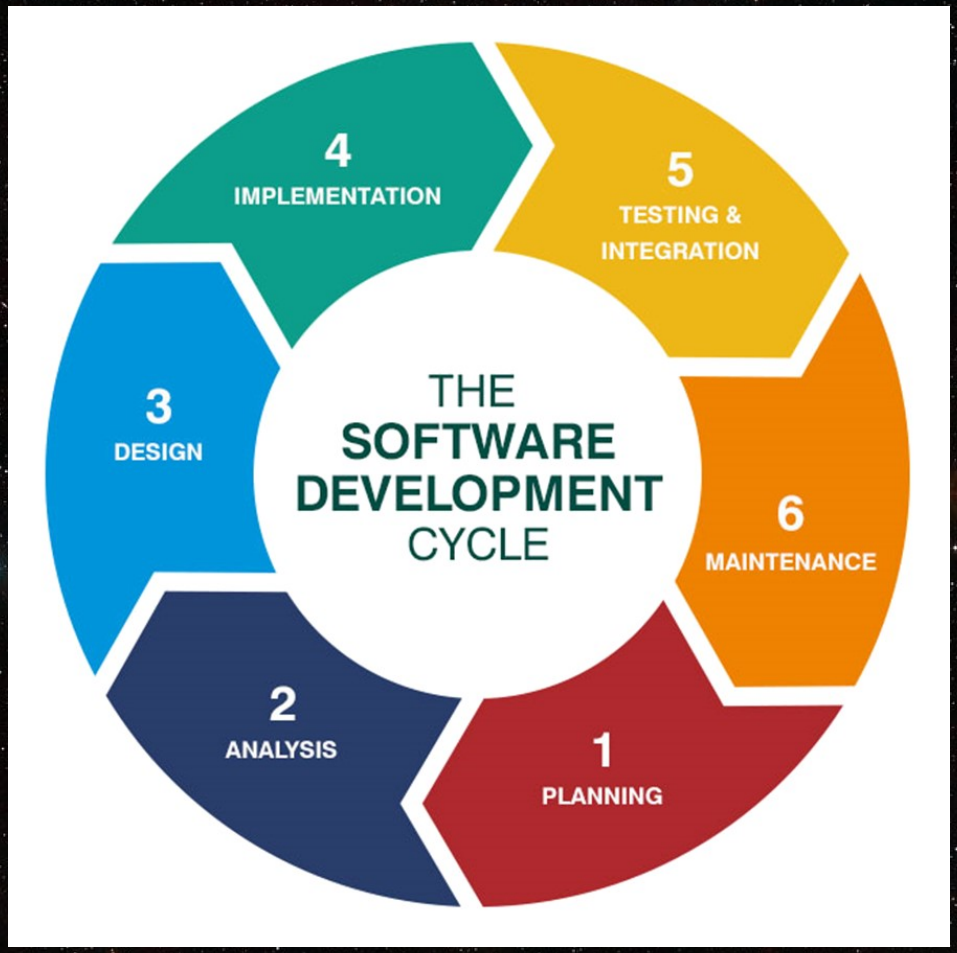
$$m_i \frac{d\mathbf{r}_i}{dt} = \sum_{\substack{i=1 \\ i \neq j}}^{N} \frac{G m_i m_j (\mathbf{r}_i - \mathbf{r}_j)}{\|\mathbf{r}_i - \mathbf{r}_j\|^3}$$

101010

Project pitfalls…



SDLC

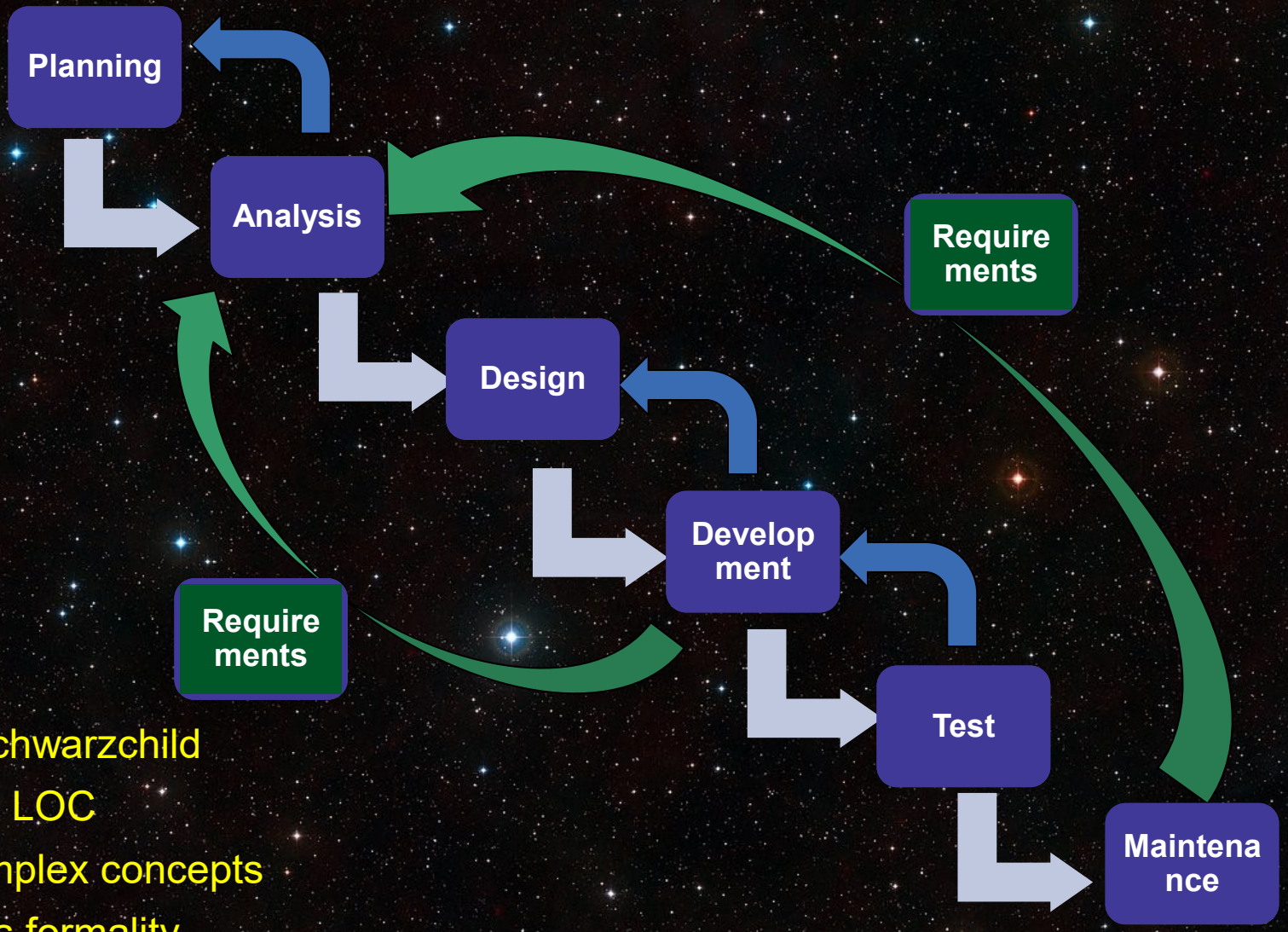

4
IMPLEMENTATION
5
TESTING &
INTEGRATION
3
DESIGN
THE
SOFTWARE
DEVELOPMENT
CYCLE
6
MAINTENANCE
2
ANALYSIS
1
PLANNING

Process for Small project

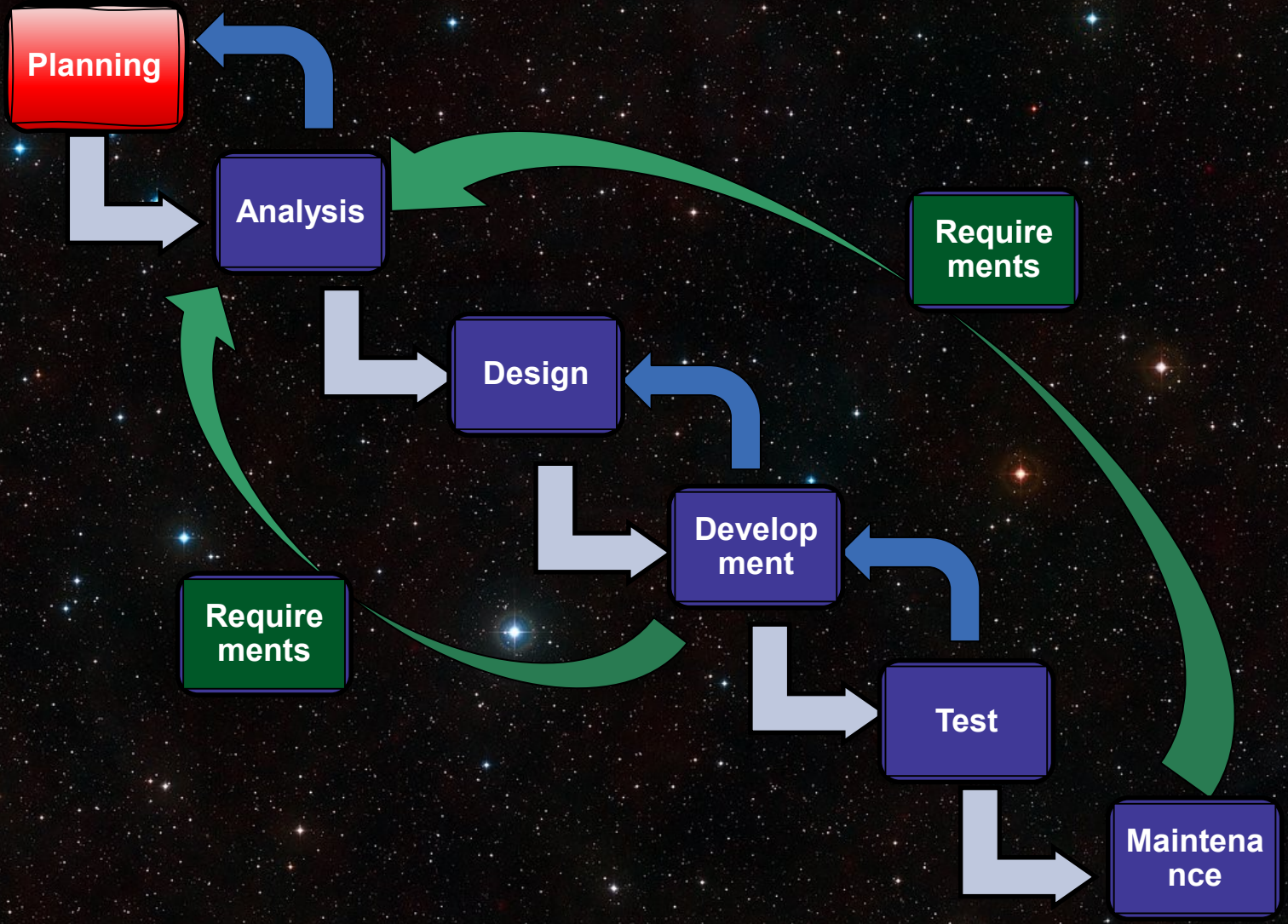
Big Bang Model

- This model is ideal for **small projects like academic projects** or practical projects. One or two developers can work together on this model.
- In this model, developers do not follow any specific process. Development begins with the necessary funds and efforts in the form of inputs.
- And the result may or may not be as per the customer's requirement, because in this model, even the **customer requirements are not defined**.
- https://www.javatpoint.com/software-engineering-big-bang-model

Prototyping



- triaxalSchwarzchild
  - 10K LOC
  - Complex concepts
  - Less formality


Planning
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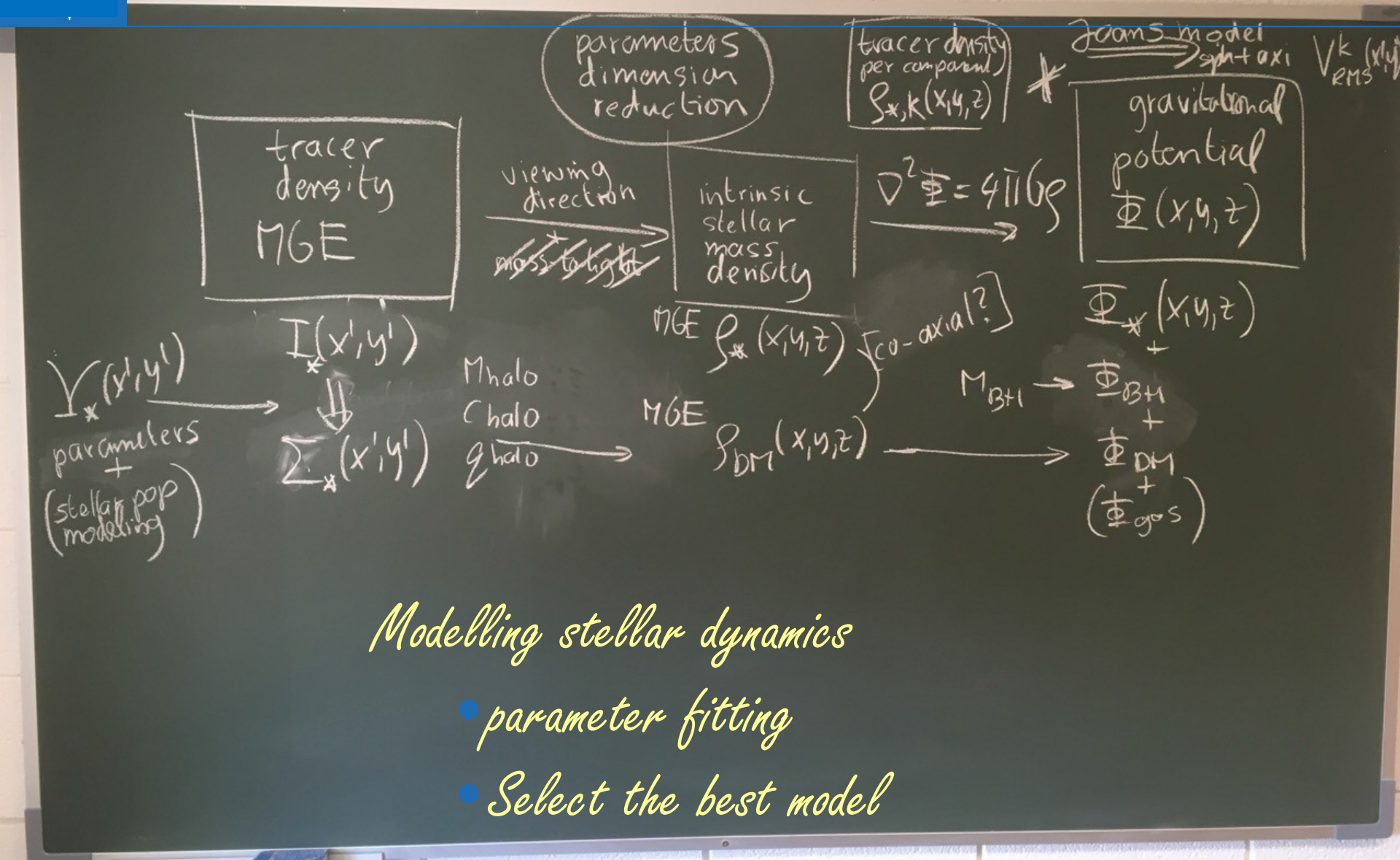
Require ments
Design
Develop ment
Require ments
Test
Maintena nce

What?

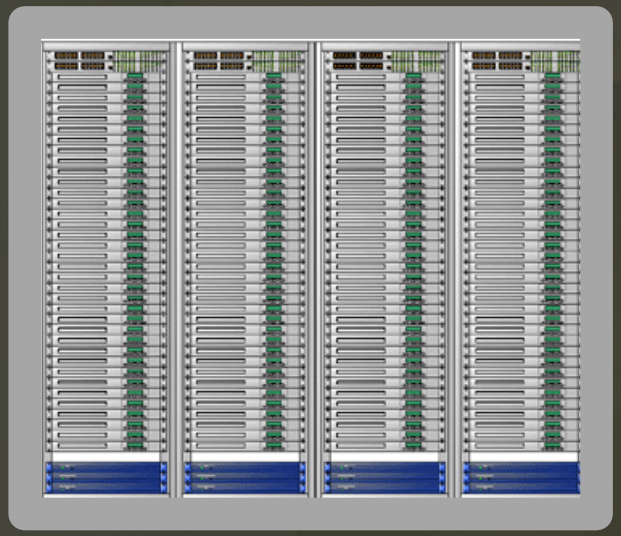


Modelling stellar dynamics

- parameter fitting
- Select the best model

How?

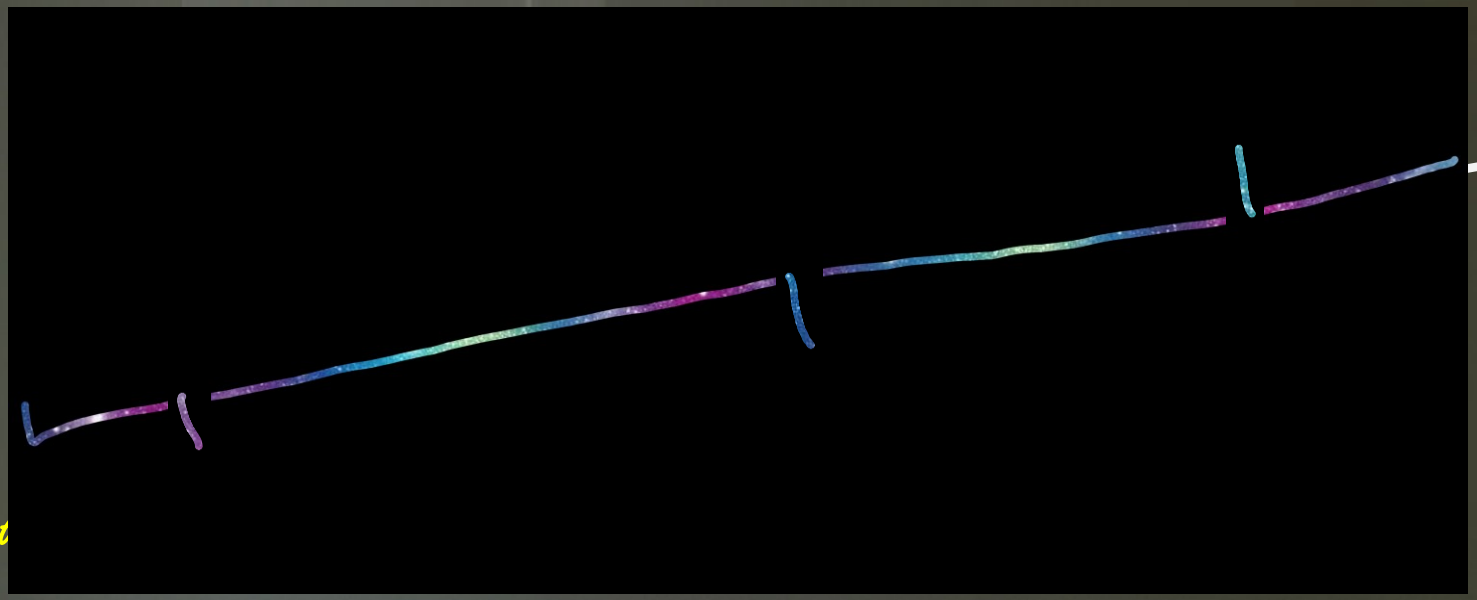
make better use of
underlying parallel hardware

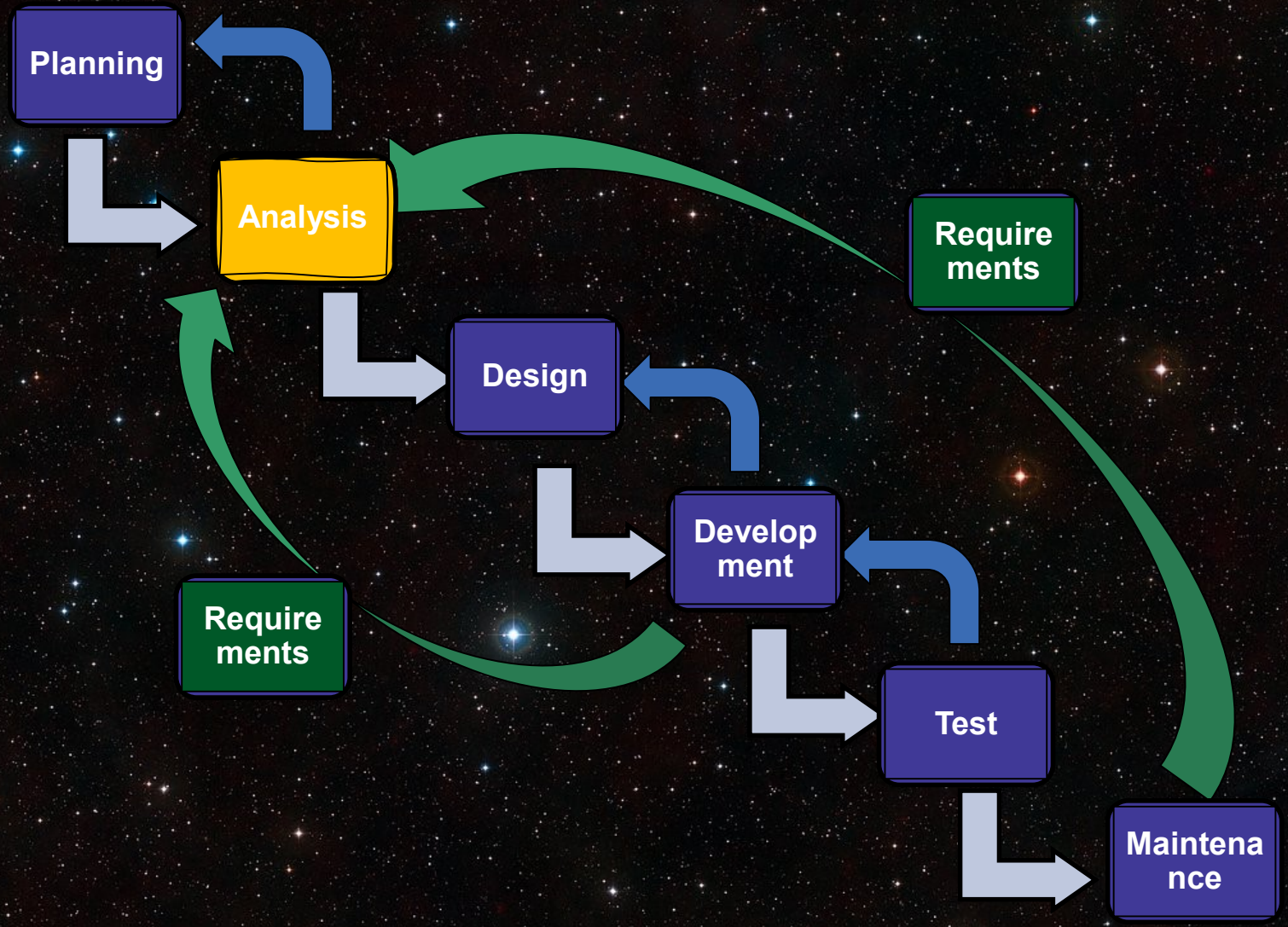


Cluster of computer

Parallel computing is perfect
for modeling, simulating

When?

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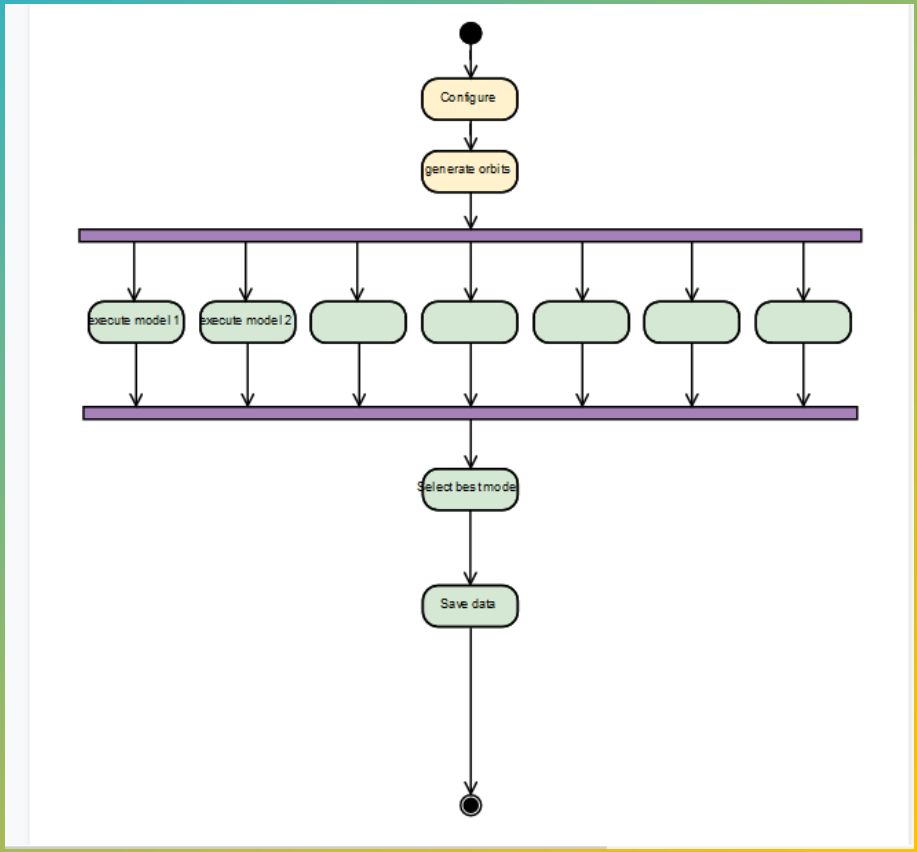
Analysis

- Feasibility study
  - Details
  - Prototyping/Testing
  - Discuss GUI
- Check availability reusability of existing software
- Cost, Time

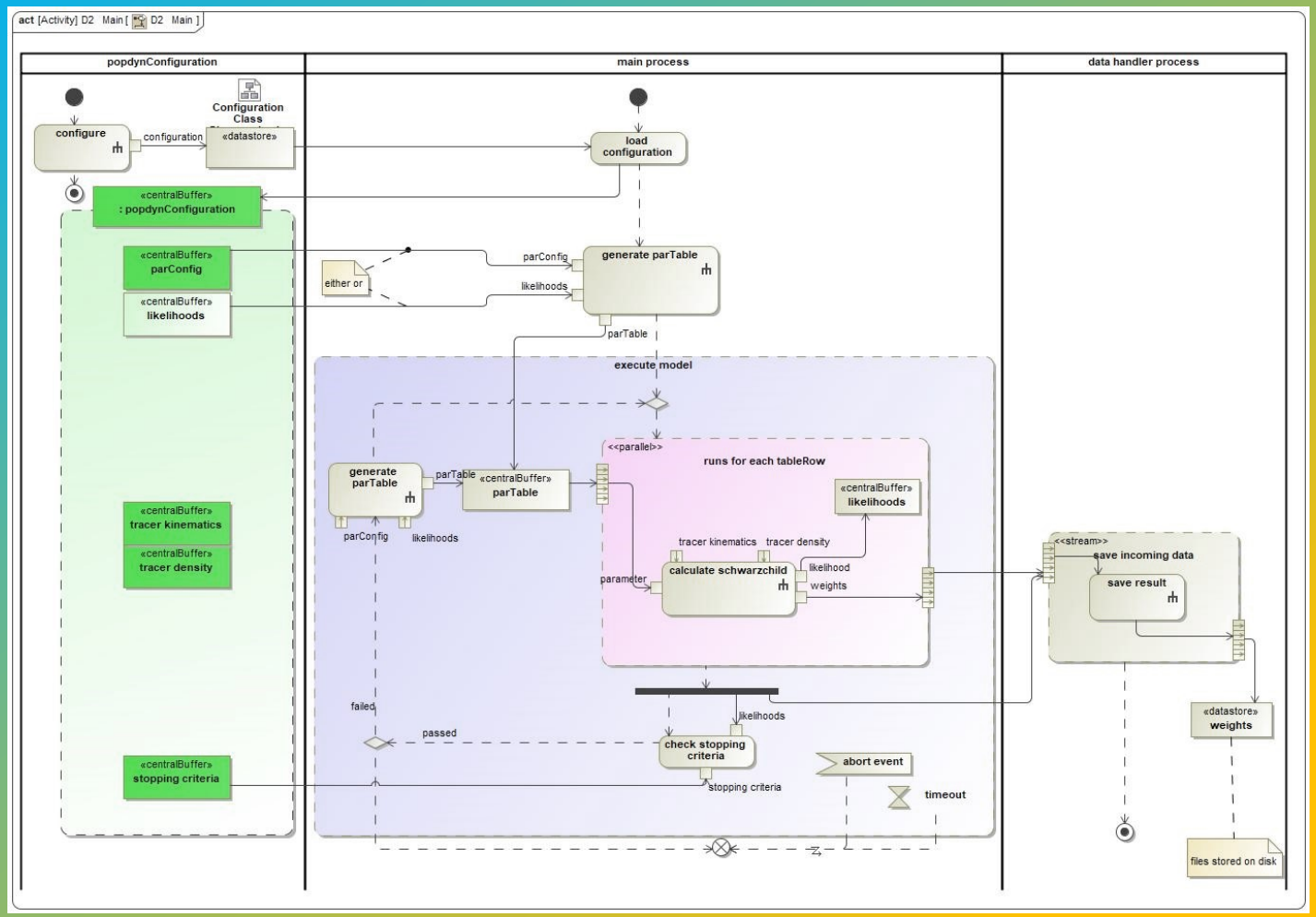
Analysis

- Document your idea in a way that is meaningful for software people (UML, Activity diagram)

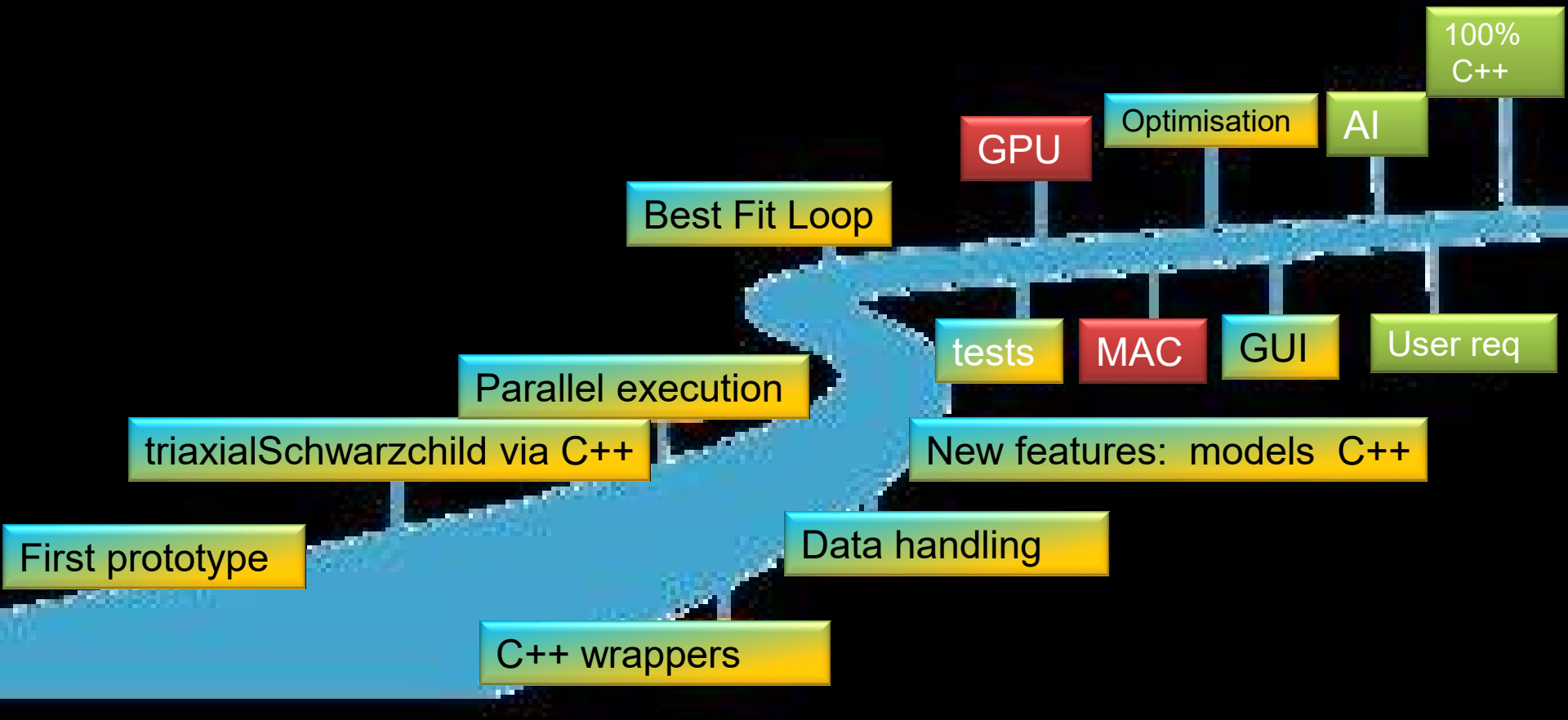


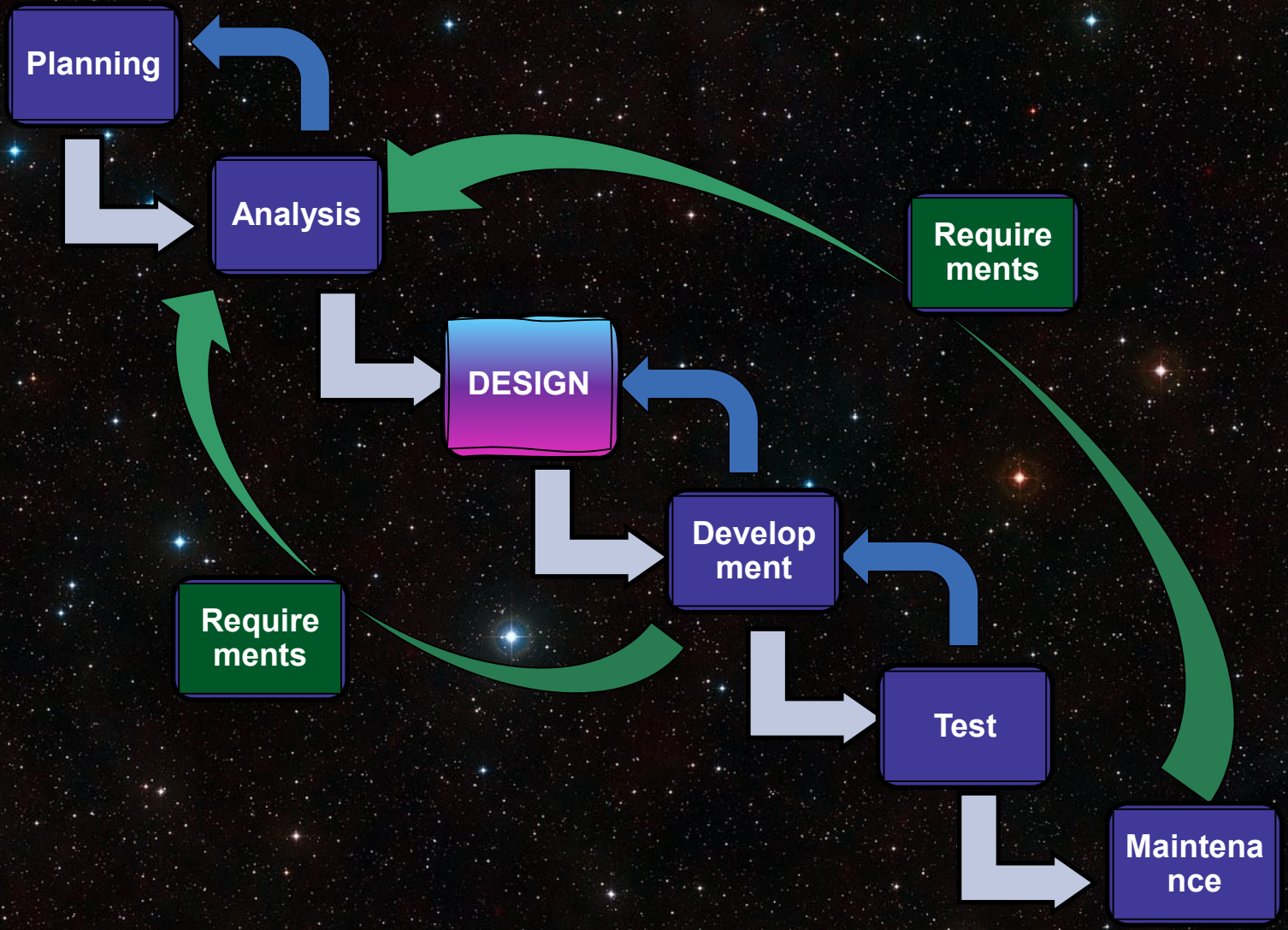
Analysis

- Concept via UML activity diagrams



Milestones


100% C++
Optimisation
AI
GPU
Best Fit Loop
tests
MAC
GUI
User req
Parallel execution
triaxialSchwarzchild via C++
New features: models C++
First prototype
Data handling
C++ wrappers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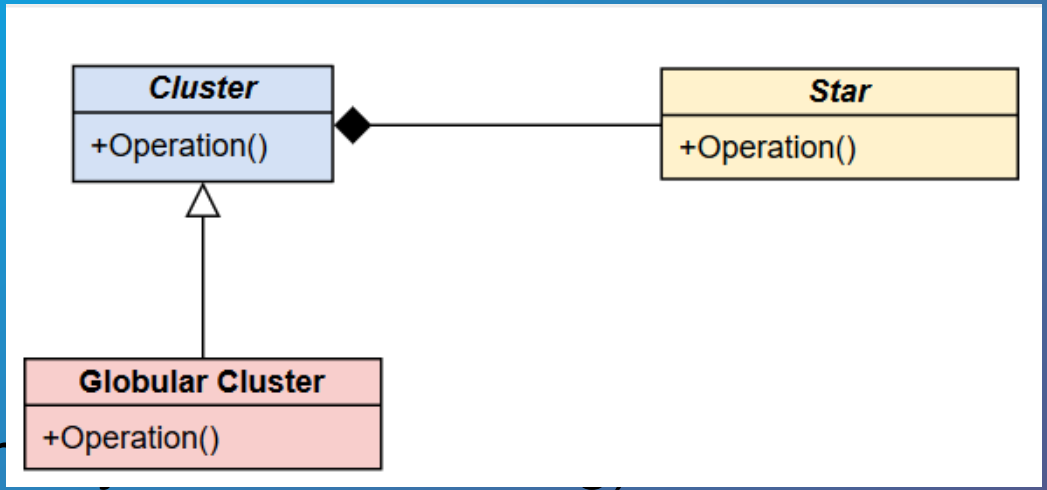
Design

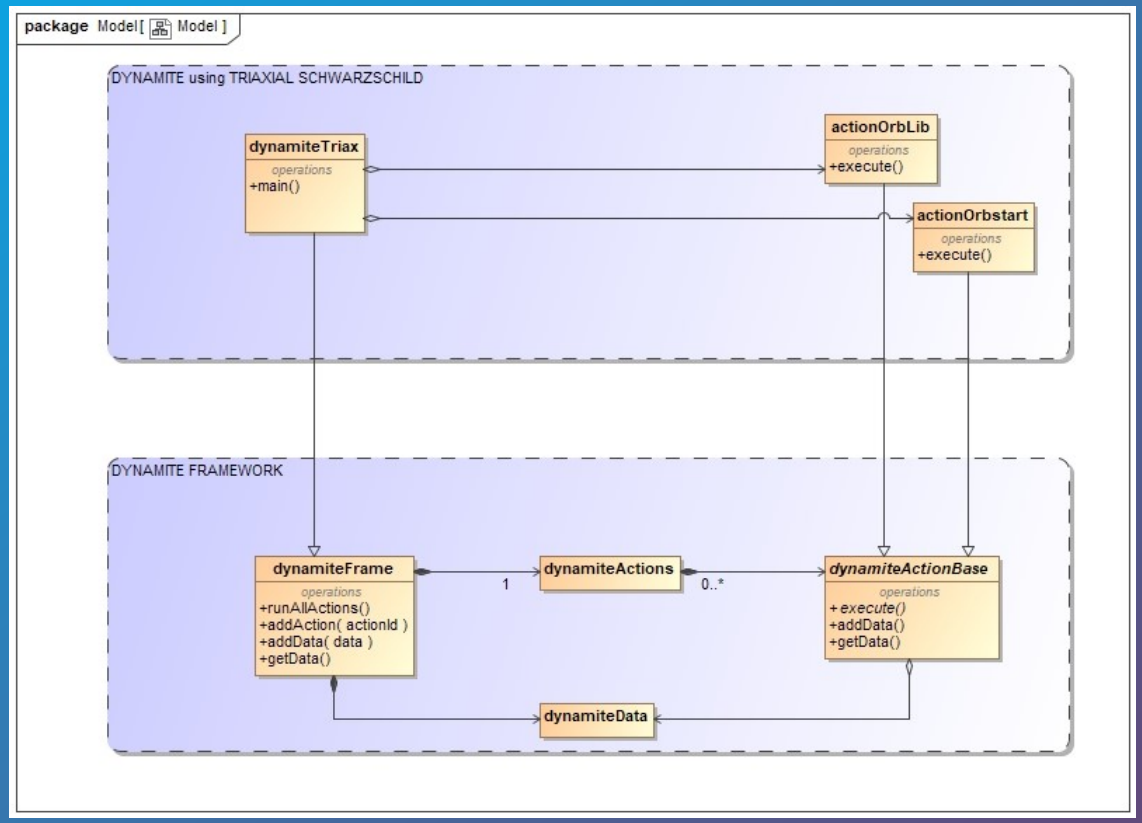
- Architecture
  - Packages
    - classes
  - Connections

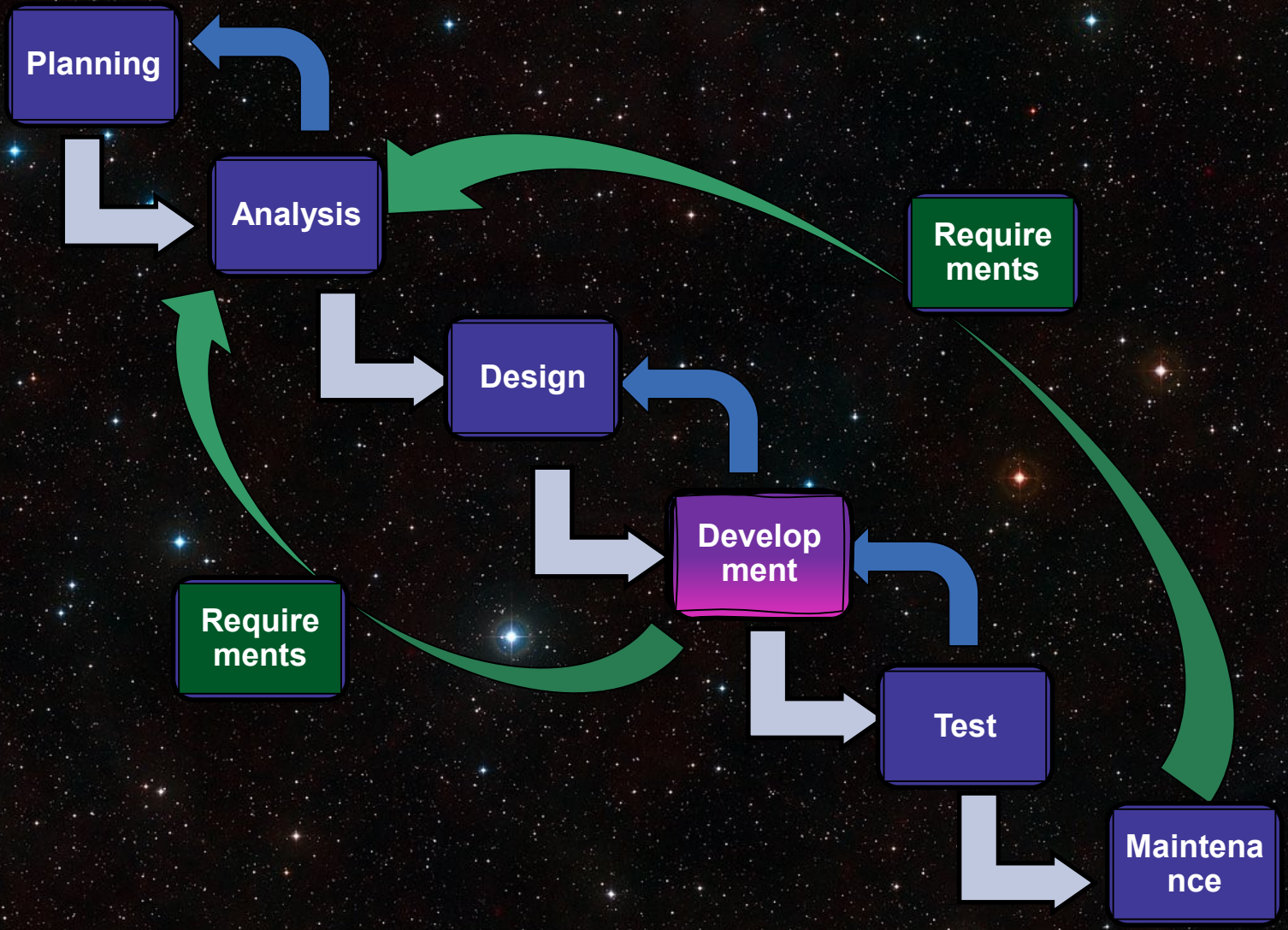


- Data handling (mer
- Flexibility/ Configuration etc.
- Logging and debugging
- User interface

Software Design

- Design patterns
- Design decisions (e.g. process or thread)

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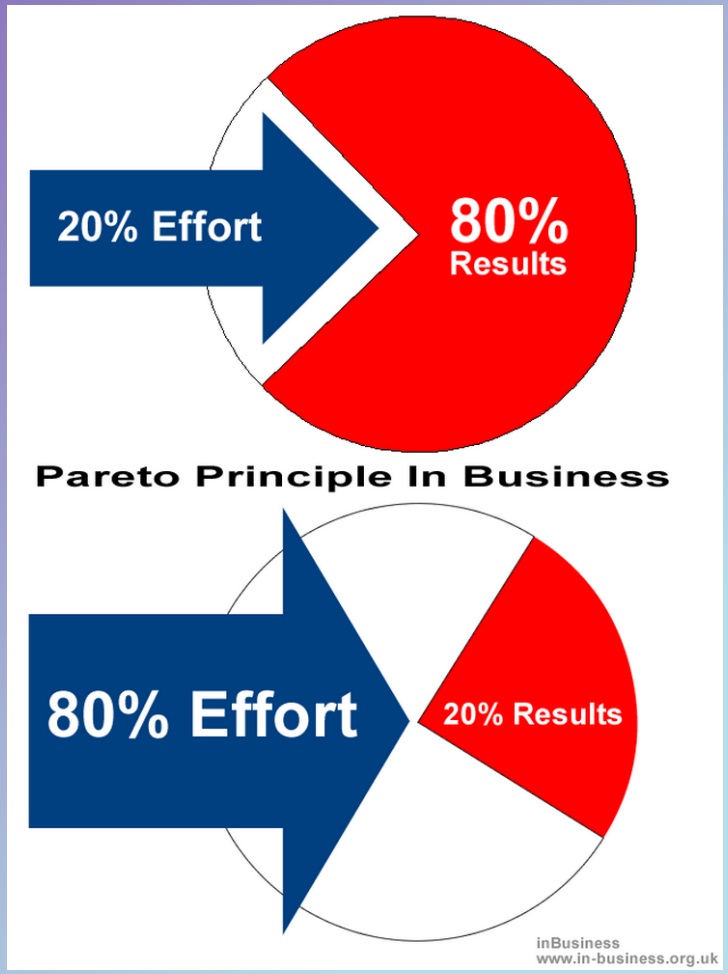
Preparation

- Free stuff
  - Platform : Linux by Linus Torvalds
  - GIT version control
  - Language : C++ by Bjarne Stroustroup
  - IDE
  - Download support Libraries
  - Installation method (Makefile,Maven,Gradel,Waf..)
  - Problem reporting system (Jira, Bugzilla)
  - Setup Database

Development…

- **80 % of the time the software runs in 20% of the code (Pareto rule)**
  - Stability is given by the rest!!
    - Error handling, Special cases,
    - preparation, logging,
    - startup/shutdown actions
- Unit test
- Documentation



Software development practices

DRY

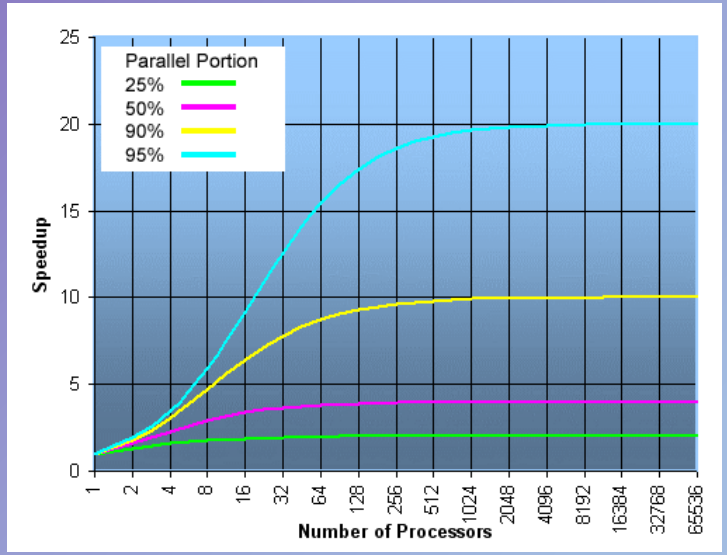
KISS

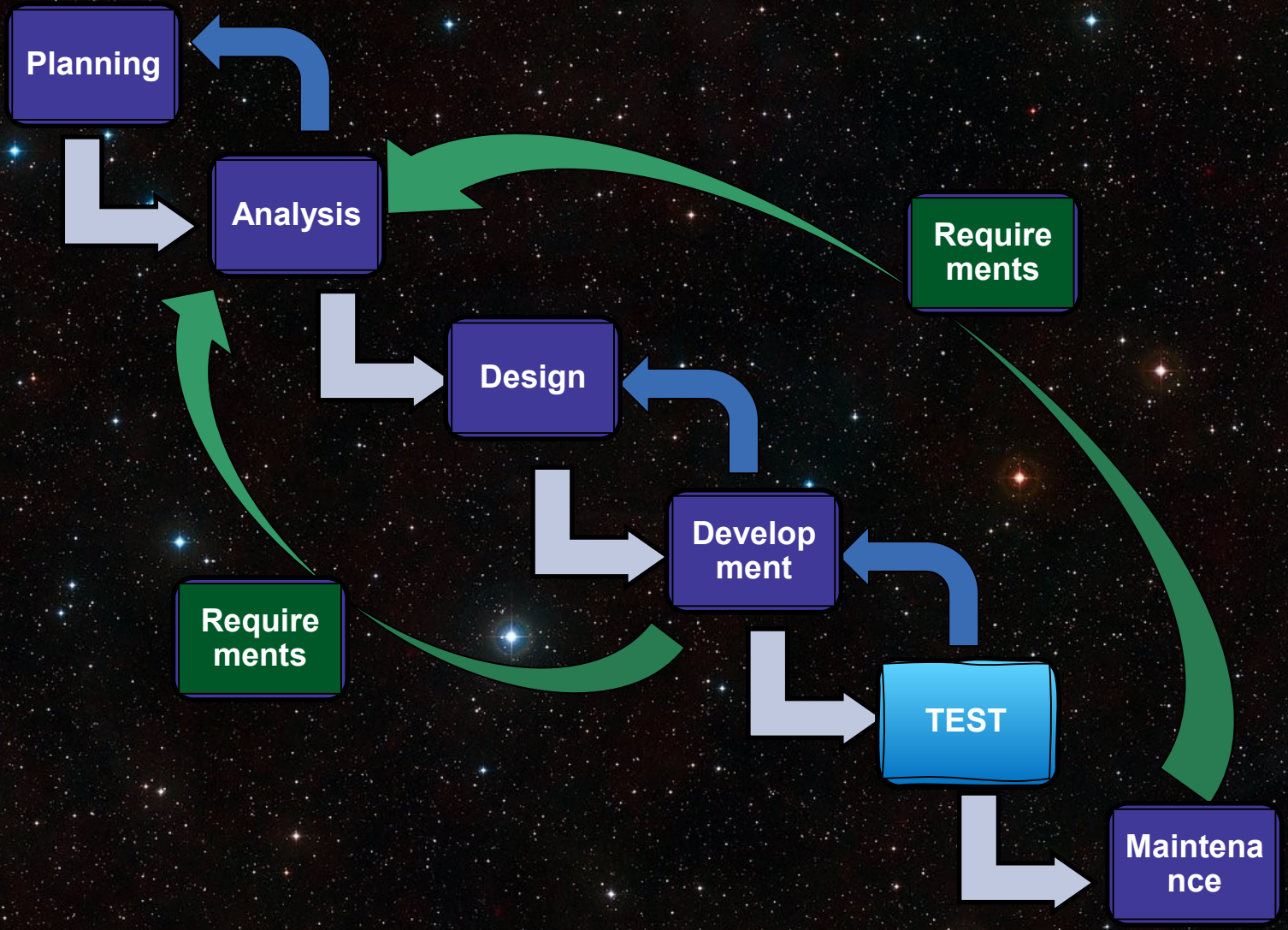
robust

modular

Software Challenges

- Interface Fortran/C++
- Parallelization
  - Race conditions
- Memory handling
- Flexibility via design pattern
- Stability
- Optimization for speed

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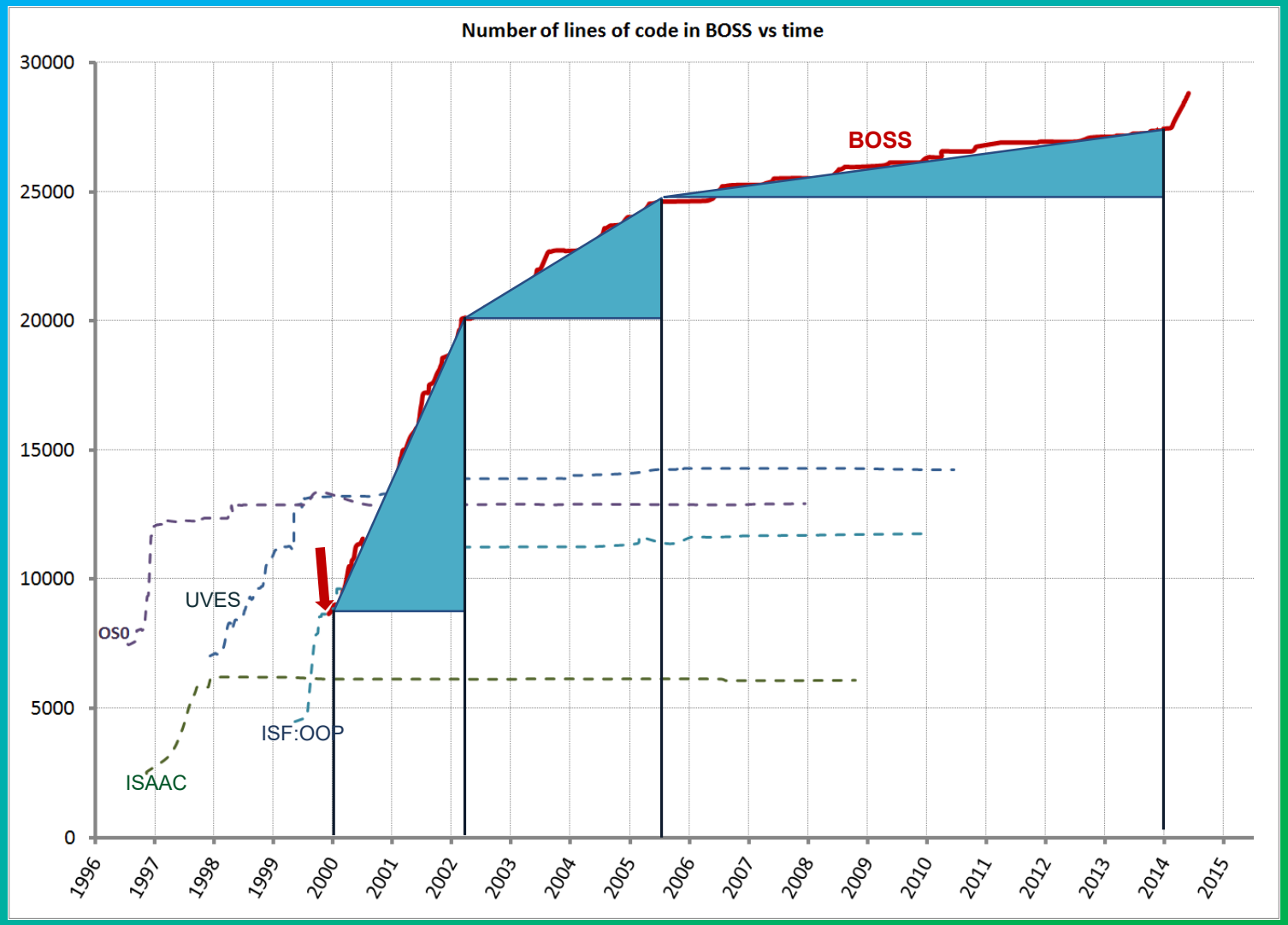
Test and integration

- Test: phaseA (developer) → phaseB (professional testers) → phaseC (requester)
- Integration: Test platform ➔ User platform

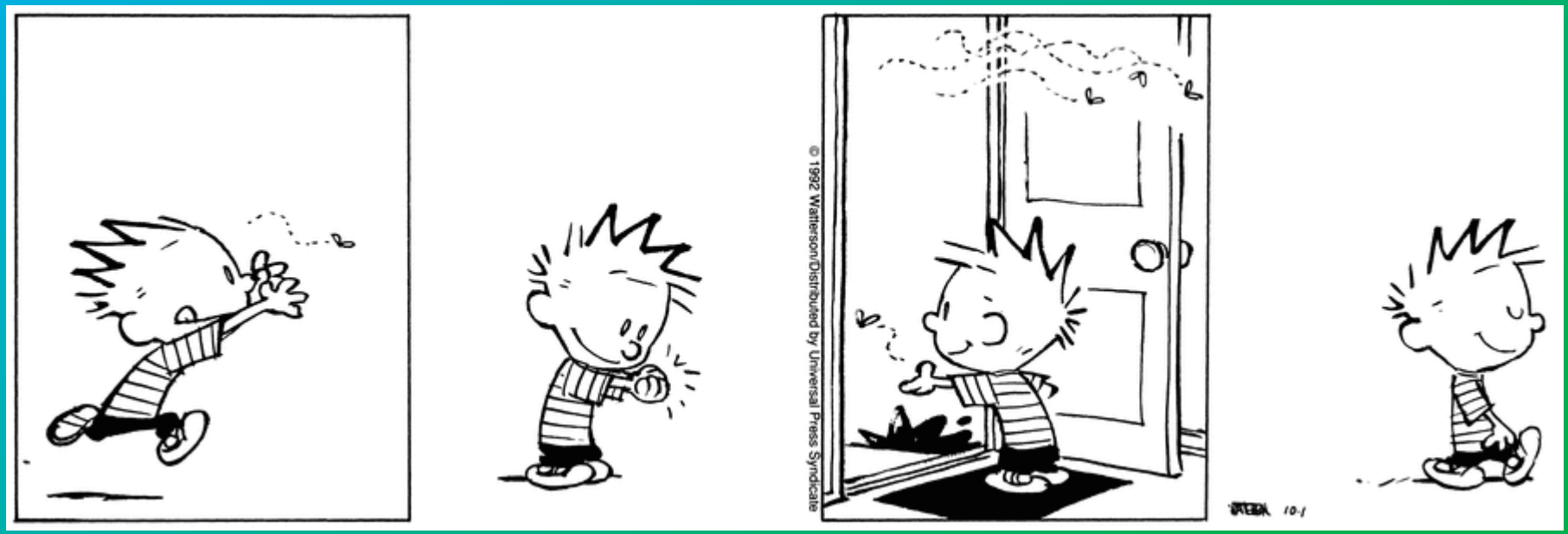
MAINTENANCE

Evolution


Number of lines of code in BOSS vs time
30000
25000
20000
15000
10000
5000
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
BOSS
UVES
OS0
ISF:OOP
ISAAC

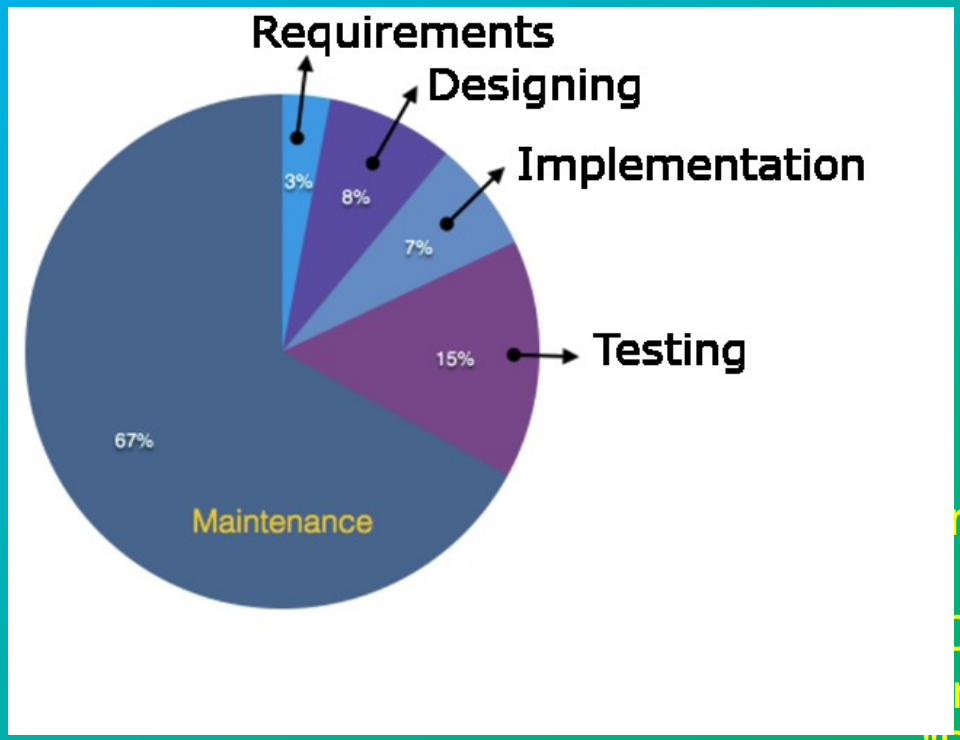
Maintenance

- **repeatedly updating software for various reasons**
  - improvement: Involve changes in functionality
  - Adaptative: Changes in the environment are adapted to the requirements
  - Corrective: Activities for error correction
  - Preventive: Improvements to avoid future problems



MAINTENANCE COST

- 50% and 70% of all total costs



man's Laws

- Continuing Change“
- ncreasing Complexity“
- "Declining Quality"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