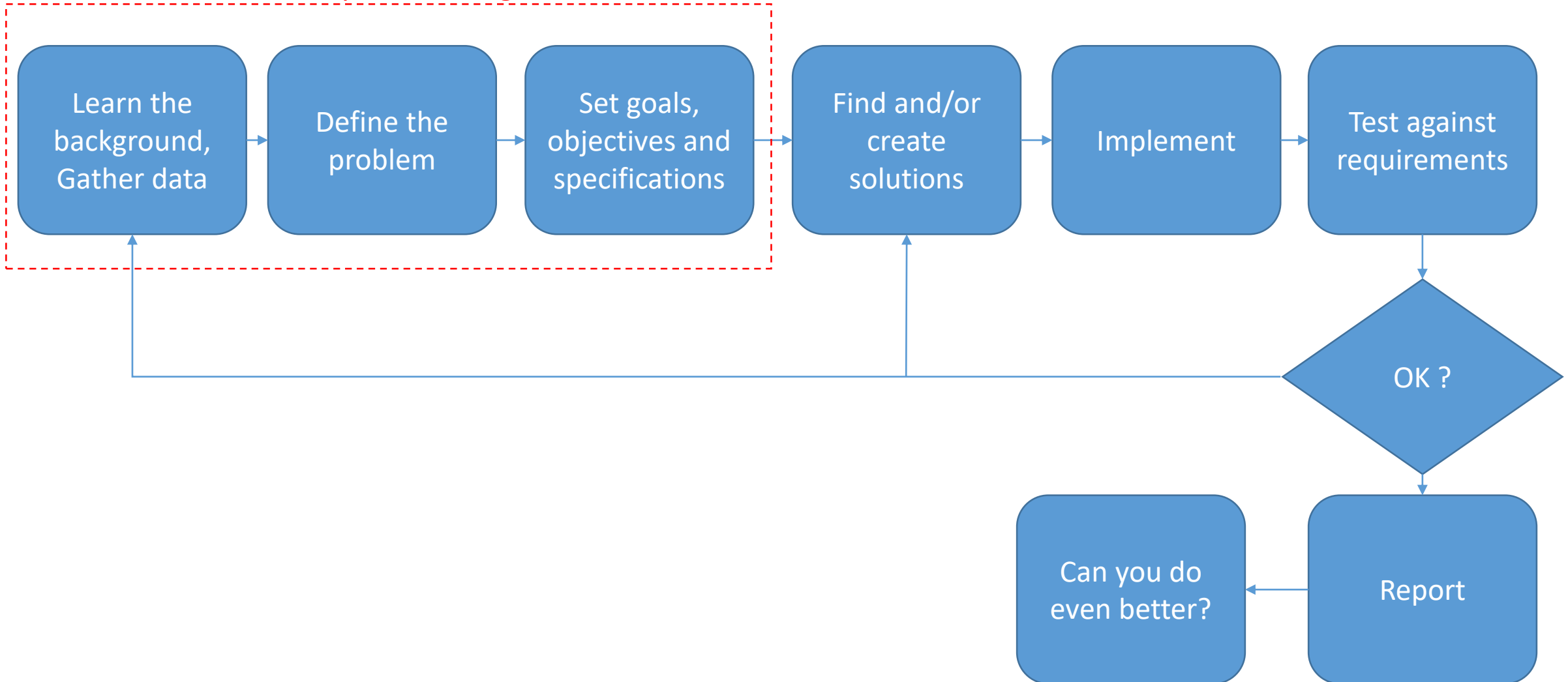# Final Year Projects - Lecture 2

- Problem solving cycle
- Writing a proposal:
  - Why & how to write one
  - Background research
  - Generating ideas
  - Planning - setting objectives
- Purpose statement

Problem solving cycle

This is what you are doing now

| Learn the background, Gather data | → | Define the problem | → | Set goals, objectives and specifications | → | Find and/or create solutions | → | Implement | → | Test against requirements |

OK ?

Can you do even better? ← Report

Why compile a proposal?

Projects fail because the team:

Starts late, or moves slowly.
- Pro tip: Everything takes longer than you think.
- Don't fear failure!

Spend too much time trying to implement ideas that won't work
- Confused or wrong idea about what you should try to achieve
- Initial ideas not good enough
- Try to do too much and miss what really needs to be done; making it too complicated
- Find out problems too late

Make the wrong decisions
- How do you find out if it's wrong, while there is still time to try something else?

Make key decisions too late
- Too little time to implement the decision
- Too little time to obtain parts or make items
- What if your suppliers are late?

Pick people with the wrong skills for particular tasks

Waste time in internal conflict

Lose the trust of essential people

Technical reasons (insurmountable obstacle, beaten to market)
- HOWEVER you can often bypass an obstacle or recover from a competitor's actions

Projects turn out mediocre when:
- not ambitious enough; not enough stretch
- not enough quality time put into it

Most of these can be avoided with proper forward thinking (planning):

- Defining the essential problem clearly
- Breaking it down into pieces you can manage
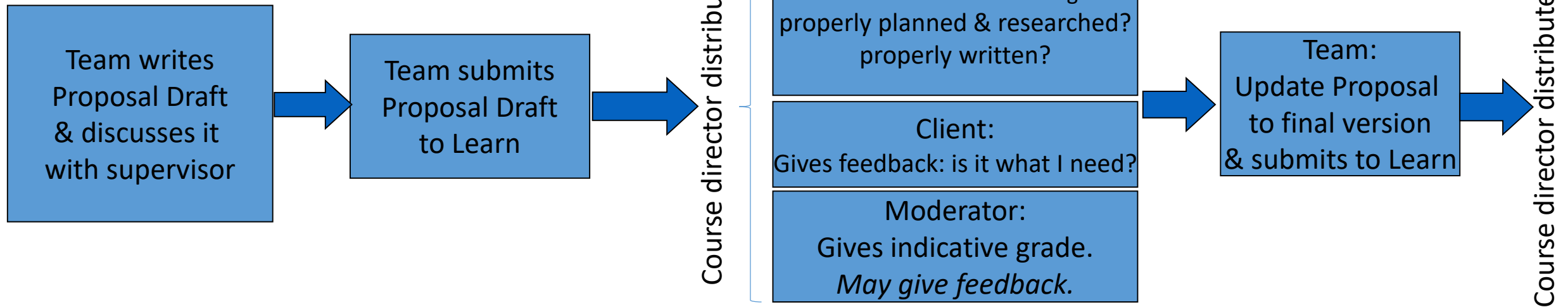- Building & testing ideas early & crudely: *Fail fast*

The proposal is a key step in good planning.

The rest can be avoided with good teamwork and individual responsibility.

Writing the project proposal

- Executive summary (< 1 page)
- Introduction (Background to problems, background research and literature review)
- Purpose Statement (1 paragraph)
- Scope and deliverables
- Requirements and Specifications
- Work streams
- Risks
- Resources
- Financial/Budget
- Project plan (Gantt chart)
- Any other material you see necessary

Graded draft due 22nd March; final version 31st March
More information, template and advice on Learn

Team writes Proposal Draft & discusses it with supervisor

→

Team submits Proposal Draft to Learn

→

Course director distributes to:

Supervisor:
Gives feedback and indicative grade: properly planned & researched? properly written?

Client:
Gives feedback: is it what I need?

Moderator:
Gives indicative grade.
May give feedback.

→

Team:
Update Proposal to final version & submits to Learn

→

Course director distributes to clients

Background research: finding information: don't reinvent the wheel

Ask
- Client: ask good questions
- Staff
- Vendors
- People you know (beware of confidentiality)

Read
- Wikipedia - technologies, products: 5 min expert
- You Tube – shows How
- Google:
  - Client's company: products, size, markets
  - Competitors
  - Technologies used
- UC Library:
  - Books
  - Interloans
  - Subject Librarian Dave Lane
- Patent offices- start with the US (is what you want to do already protected?) http://www.uspto.gov/

We live in an information age: the problem is not finding information but finding *relevant* information (filtering). You may have to cycle through this a few times as your ideas come clearer.

- What is the state of the art?
- What has been tried?
- Who else is looking into this?
- What is the context? – needs, problems, competitors, costs, regulations
- What models or tests can I do?
- What data is already available?

# Generate ideas: Brainstorming

Principles:
Suspension of critical judgement allows creativity
Out of many ideas, one will be good: one is all you need

- Everyone puts ideas forward with minimal explanation
- Recorded *without comment or criticism* by others
  - Whiteboard, Post-It notes on the wall
- Be brief. Use as few words as possible to convey meaning.
- Go for quantity
- Withhold criticism
- Welcome wild ideas
- Combine and improve ideas
- Set a time limit (5 mins?)

- Evaluate: but keep a record of every idea
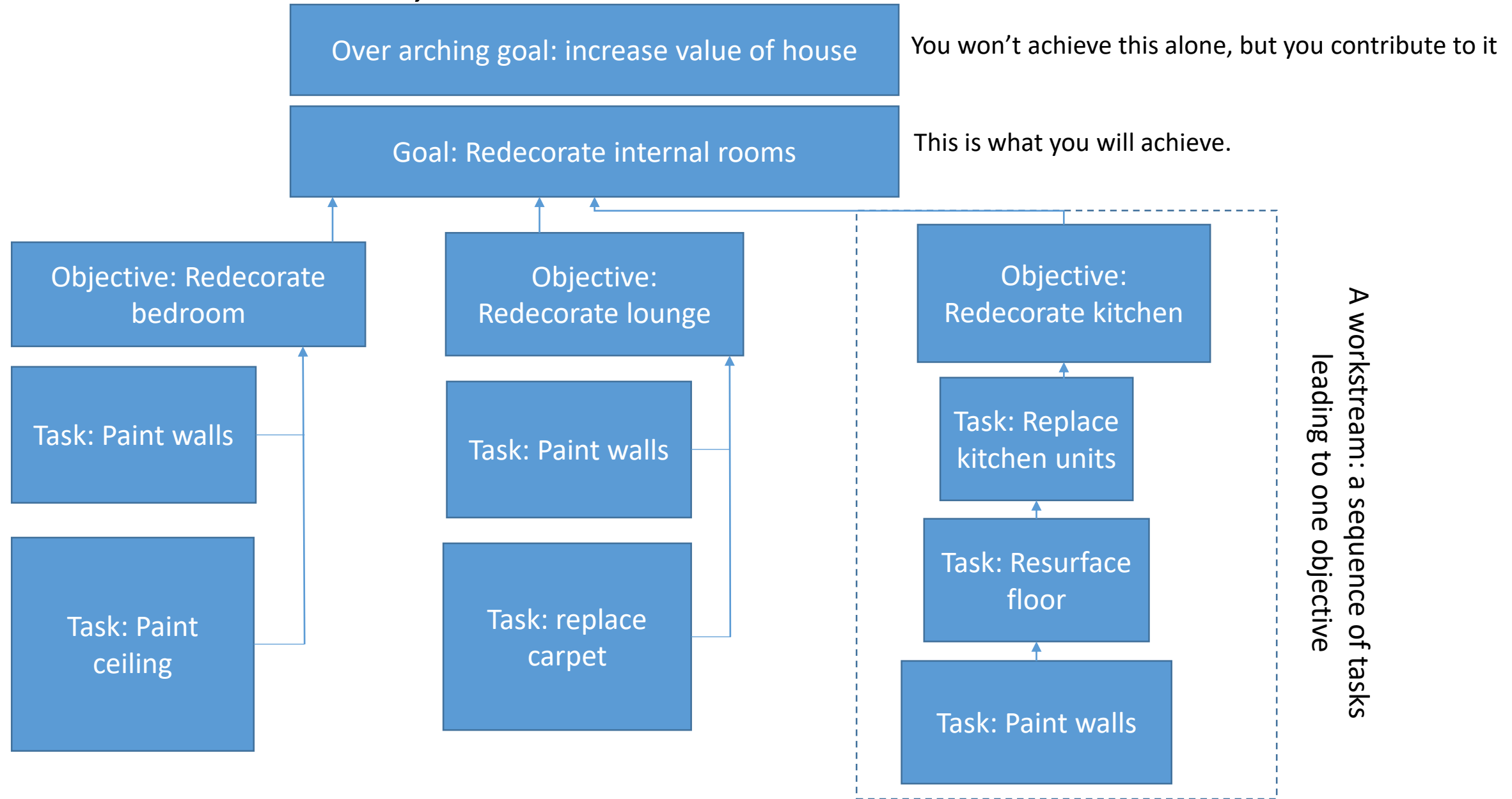- Discuss and do background research
- Repeat

Gantt chart*: contains all tasks, start and end dates, relationships with other tasks, and milestones*
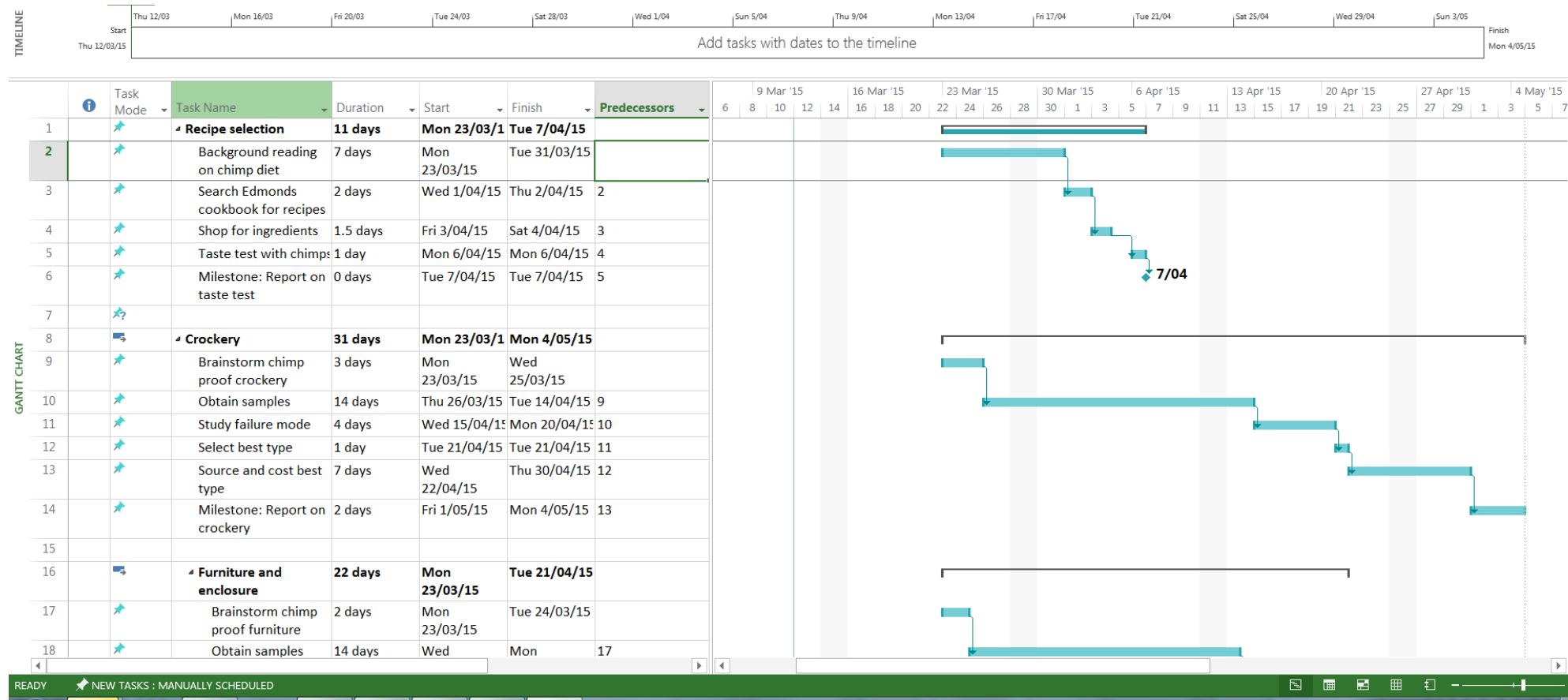
You can't start making the Gantt chart straight away: you need to work out the structure of the project first: Goal, Objectives, Tasks

One goal, several objectives and many tasks:
organized in a hierarchy- "Work Breakdown Structure"

Over arching goal: increase value of house

You won't achieve this alone, but you contribute to it

Goal: Redecorate internal rooms

This is what you will achieve.

Objective: Redecorate bedroom

Task: Paint walls

Task: Paint ceiling

Objective: Redecorate lounge

Task: Paint walls

Task: replace carpet

Objective: Redecorate kitchen

Task: Replace kitchen units

Task: Resurface floor

Task: Paint walls

A workstream: a sequence of tasks leading to one objective

Purpose statement: summarises objectives

First: Develop a clear sense of PURPOSE

- What will your team accomplish?
- What will be the benefit? To whom?
- What will exist in October that does not exist now?
  - Why?
  - How?
- How will you know when you have achieved that purpose?

Procedure:

- Listen to the Client. The more ears the better.
- With your Supervisor and Technician, discuss what the Client's NEED is, and what you can offer that will add VALUE. Not everything the Client wants can necessarily be provided.
- The team discuss the different ideas, and accept some STRETCH taking you out of your comfort zone.
- Express this as a PURPOSE statement

Purpose Statements

- Also called "Mission" or "Vision" (but these are often wider in scope)

- Answers these questions with technical accuracy:

  - What are we going to do? "The team will…

  - Why or for whom? "…the purpose of the project is…"

  - Give quantitative aims if you can "it will cost less than $1000 to manufacture"

  - What does success look like?

- Uses positive language "we will…."
  - Is clear and concise
  - Specific about <u>what</u> you will achieve, without limiting you as to <u>how</u>

- Task: By 5pm next Tuesday, upload your team's purpose statement (a brief concise paragraph) to Learn
  - One upload per team
  - These will be shared with the rest of the class

Examples from previous projects

"The Centre Pivot Team will conduct research and provide a solution to the problem of irrigators toppling over in high winds."

"The purpose of the project is to analyse plant data from the Ngatamariki Power Station to gain insight on the process of mineral scaling and its effects on heat exchanger effectiveness, plant efficiency and power output. Detailed plant models will be created to analyse the plant data and quantify the effects of mineral scaling. A maintenance schedule defining the cleaning process and frequency will be recommended based on the results of the data analysis and will take into account the economic factors of a plant shutdown."

Examples from previous projects

"Our aim is to continue developing the prototype XXXX robot, bringing it to a functional status for field trials."

'The purpose of this project is to design and build a prototype for a device to recover the lees from the bottom of a wine tank, without requiring human access into the tank.'

"The purpose of the project is to represent both the University of Canterbury and New Zealand at the Shell Eco-Marathon competition in March 2017 and to create publicity opportunities for UC and Shell NZ. This will be achieved by the design and manufacture of an energy efficient electric vehicle. The solution must be a realistic car that people would want to drive and also must demonstrate good design."

Examples from previous projects

The purpose of this project is to design and build an auto-sampler suitable for integration with existing Company XXXX devices. This is done as an alternative to current auto-samplers on the market, which are typically costly and expensive to transport. Additionally, through the production of such a system the cheaper alternative will become attractive to a larger market. Currently, Company XXXX devices need to be manually fed. Through the use of this system, less labour will be required for this simple task. At the end of the project a working prototype will be developed, tested and validated.

"The team will provide a vortex generator solution to improve the annual energy production of the XXXX turbine. This will be achieved through prototype testing in the University wind tunnel and Computational Fluid Dynamics modelling. The team will deliver guidelines for the optimal shape of the vortex generators and their optimal layout on the wind turbine blade."

The objective is to design a means to increase the value of an (animal product) in a continuous production environment. The solution must be taken to the prototype stage and be capable of producing a repeatable output while accepting input size variability between carcasses. The solution needs to be economically viable to effectively replace current means that achieve the same output. Manufacturing of the solution must fit within the production capability of XXX Sponsor's current facilities and will not require new production methods or equipment.

Next steps:

- **Make/continue contact with your client and supervisor**

- **Start work on proposal**
  - **Background research**
    - See Learn for tips on literature searches
  - **Generate ideas**
  - **Start planning,** see Learn for more videos and templates for:
    - Planning a project
    - Writing the proposal
    - Risk assessment
    - Making a Gantt chart
  - **Purpose statement**
    - Brief concise paragraph
    - Due 5pm next Tuesday
    - One upload per team