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ENGR 110 / 112 – Design I

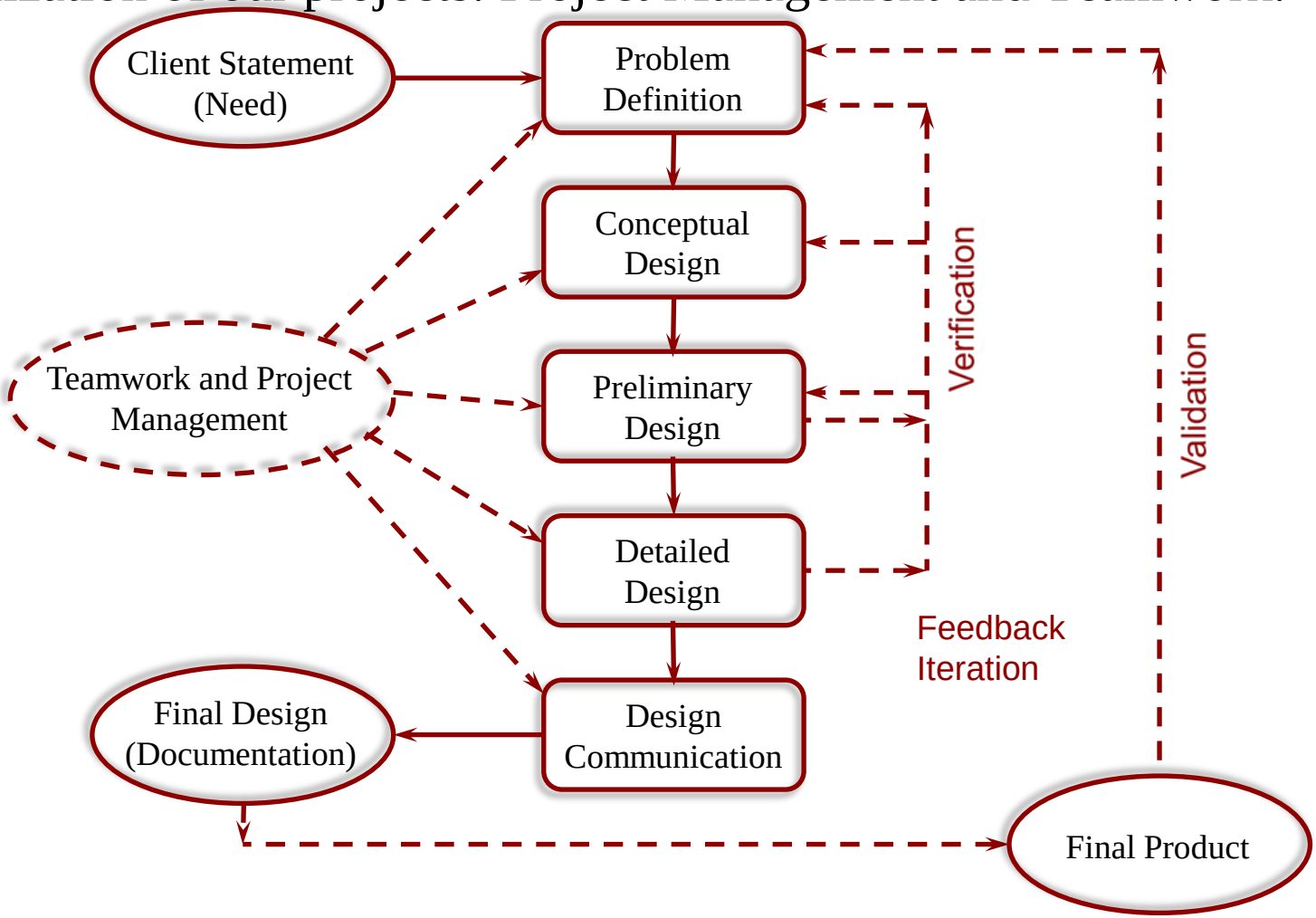
Design Process

Final Design Stages and Project Management

Instructor: Dr. Flavio Firmani

Engineering Design

In engineering design, there are two aspects that critically affect the realization of our projects: Project Management and Teamwork.



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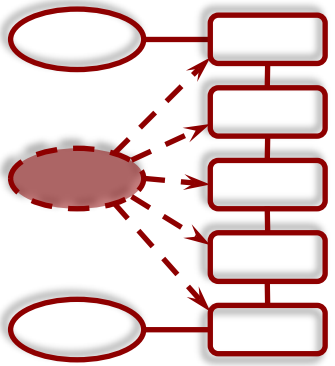
Teamwork



Team Definition

A team is a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable."

Katzenbach and Smith, The Wisdom of Teams, Harper Collins, New York, 1994.

Team members with diverse backgrounds will bring diverse solutions to the table, which leads to a more informed decision-making process and improved results.

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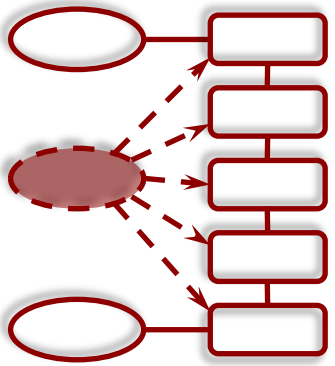

Teamwork in Engineering

Engineering design is a branch of engineering that relies on creativity and innovation. This is achieved during the conceptual phase of the design process.

It is imperative to explore different ideas and be critical of pre-conceived ideas.

Having multiple opinions allows a team to enlarge the design space and move away from established ideas. For this reason, teams generally outperform individuals.

However, working in teams is challenging, as every member has different working styles and different personalities.

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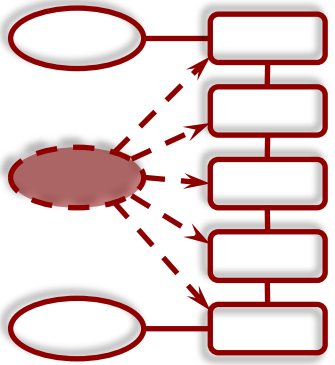

In your university career, you will be working in teams often. This experience will continue when you begin your professional career as engineers.

As engineering expands into other disciplines, you will find yourself working with people from other disciplines.

Therefore, it is important that you recognize how teams are built, how to interact within the team, and how to resolve conflict whenever happens.

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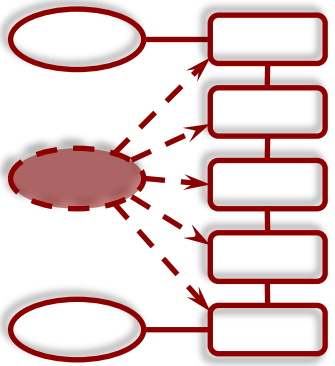

Advantages of Teamwork

Working in teams has some important advantages,

- Increases knowledge, information, and expertise
- Increases diversification of ideas
- Increases productivity
- Develops motivation
- Increases understanding and acceptance
- Increases commitment

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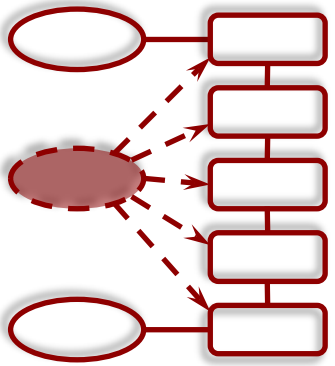
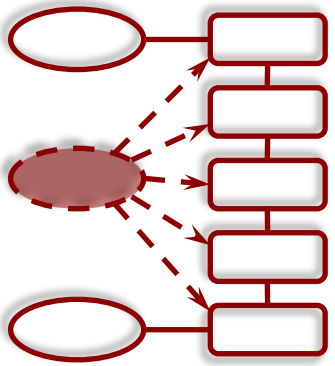


Disadvantages of Teamwork

Working in teams has natural challenges,

- Communication problems
- Time requirements
- Individual or minority group domination
- Non-cooperative attitude
- Social pressure to conform
- Intergroup conflicts
- Lack of equal commitment
- Lack of trust

Teamwork



Expectations of a Team Member

For the team to work properly, each member should

- Contribute to discussions and express her/his ideas
- Be respectful.
- Listen and ask helpful questions.
- Take responsibility for the success of the team
- Deliver on commitments.
- Give and receive useful feedback

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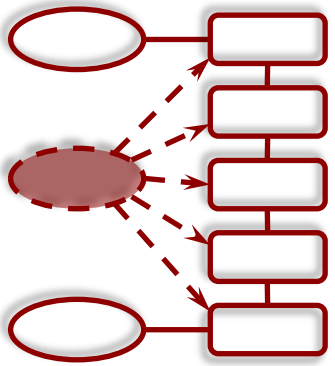
Teamwork



Expectations of a Team Leader

Each team should have a leader, who facilitates the communication among the members.

A team leader in an engineering design project must be a *Facilitative Leader*, who

- Creates an open environment for all the members.
- Communicates with all the members
- Welcomes creativity and considers all ideas.
- Maintains focus on the group vision.
- Ensures that the norms agreed by the team are followed
- Resolves conflict

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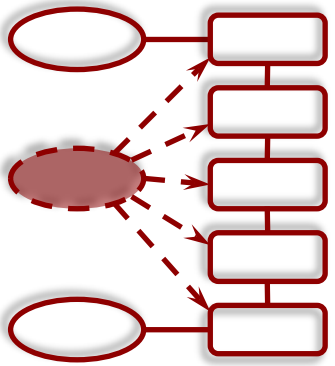

As opposed to an *Autocratic Leader*, who

- Directs and controls everybody
- Disregards questions and ideas
- Becomes the sole decision maker of the team

or, a *Passive Leader*, who

- Provides too much freedom
- Avoids resolving conflict
- Fails to communicate and guide the project
- Fails to implement the norms (rules) agreed by the team

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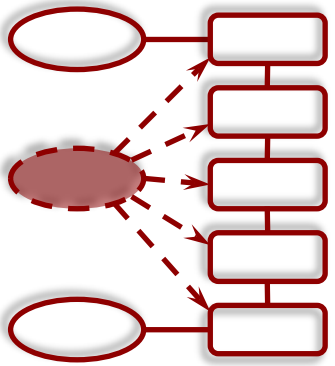

Tasks of a Team Leader

A team leader should

- Organize and chair team meetings.
- Organize meetings with client / supervisor
- Submit the work
- Monitor team progress
- Help coordinate the individual tasks
- Help resolve conflicts

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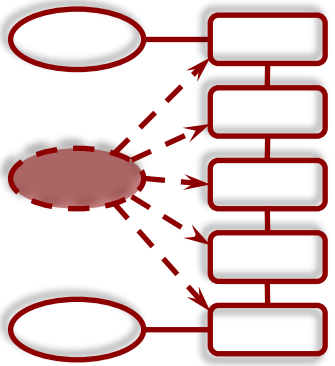

Positive Roles

Positive roles of the team members

Initiator-Coordinator	Suggests new ideas of new ways of looking at the problem
Elaborator	Builds on ideas and provides examples
Coordinator	Brings ideas, information, and suggestions together
Evaluator-Critic	Evaluates ideas and provides constructive criticism
Recorder	Records ideas, examples, suggestions, and critiques

https://pressbooks.bccampus.ca/technicalwriting/chapter/understandingteamdynamics/

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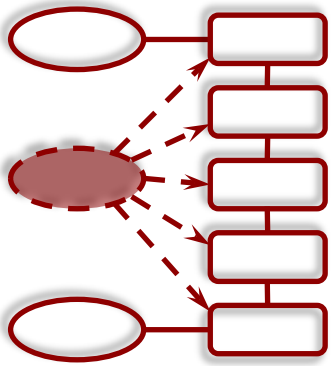

Negative Roles

Negative roles of the team members

Dominator	Dominates discussion, not allowing others to take their turn
Recognition Seeker	Relates discussion to their accomplishments; seeks attention
Special-Interest Pleader	Relates discussion to special interest or personal agenda
Blocker	Blocks attempts at consensus consistently
Joker or Clown	Seeks attention through humor and distracts group members

Note that sometimes a good laugh brings the team together or a person who takes control of the project at crunch time. Both are time specific.

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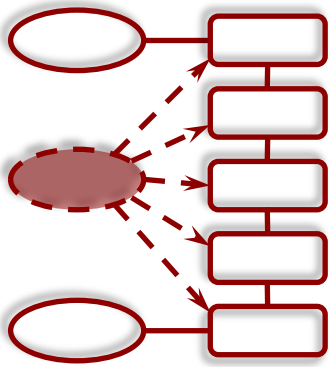
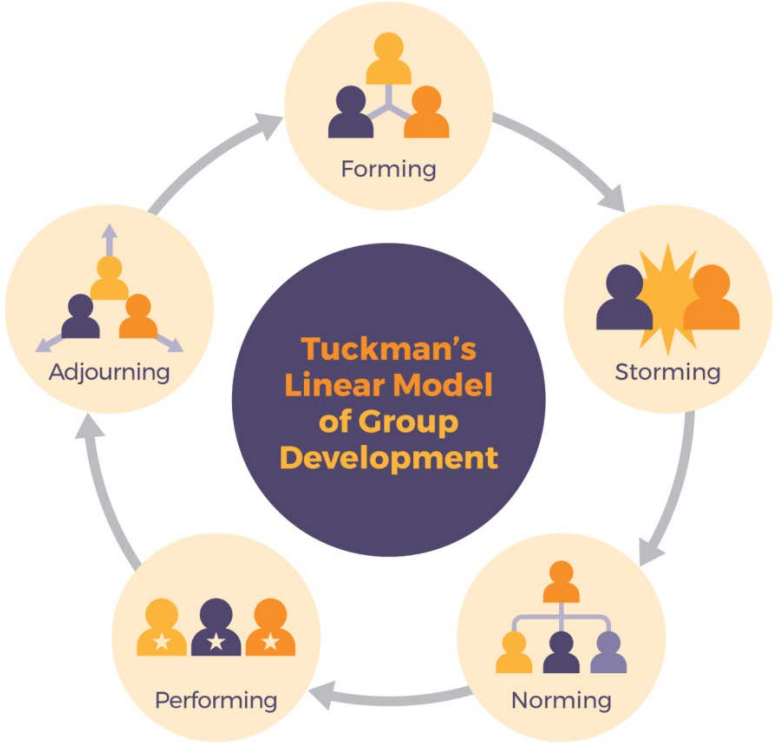


Stages of Team Development

Tuckman proposed a model that encompasses the stages of a team life's cycle.



The cycle begins with Forming and ends with Adjourning. However, the dynamics of this model depend on each team. In some cases, it is not linear.

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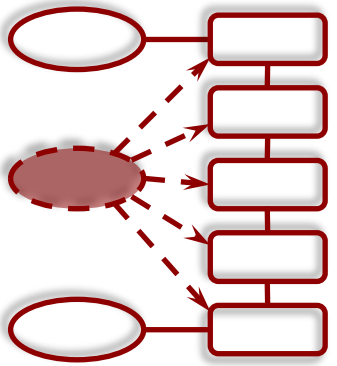

Forming – The formation of a group of people who came together to accomplish a shared purpose.

Storming – There is intense conflict about the direction of the project. Team members decide for themselves who will lead the team, as well as the roles of the other team members.

Norming – The team agrees on methods for working together based on a set of acceptable rules (norms). The team roles are clarified and accepted, as well as the direction of the project.

Performing – At this point all the members are focused on the tasks of the project, conducting themselves in accordance with the established norms, and generating useful ideas.

Adjourning – This is the culmination of the project when the team is dissolved.

Video - Fellowship of the Ring

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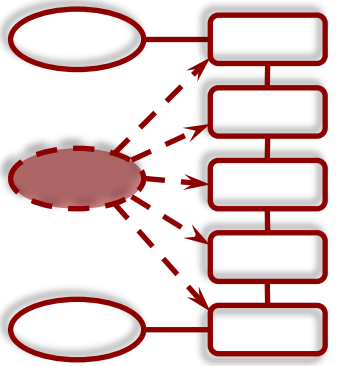

Strategies for Team Management

The success of a project relies on team dynamics.

Team leader: Elect a team leader who will act as the hub for communication and tasks.

Clear goal: Ensure that the goal is clearly understood and agreed upon by all the members on the team.

Team rules: Establish the rules in which the team will operate. These are expectations around time, meetings, attendance, communication, decision-making, contribution, and mechanisms to warn (fire) a team member.

Assign responsibilities: Establish a Linear Responsibility Chart.

S. Last, *Technical Writing Essentials: Introduction to Professional Communications in the Technical Fields*, Online access: BCampus.ca, University of Victoria, 2019

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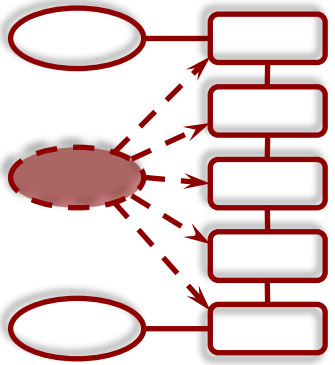

Set agendas for meetings: Ensure that team meeting time is useful and achieves its purpose, plan an agenda for each meeting to help keep everyone on task. Have someone take minutes to record decisions that are made.

Schedule tasks: Establish a schedule with dependencies early on in your project, for example develop a Gantt Chart.

Team Communications: if a problem arises with someone on the team, the team leader should speak privately to the person and clearly indicate what needs to change and why. The focus should be on the behaviour, not on the person's character. Issues should be dealt with quickly rather than left to deteriorate further.

S. Last, *Technical Writing Essentials: Introduction to Professional Communications in the Technical Fields*, Online access: BCampus.ca, University of Victoria, 2019

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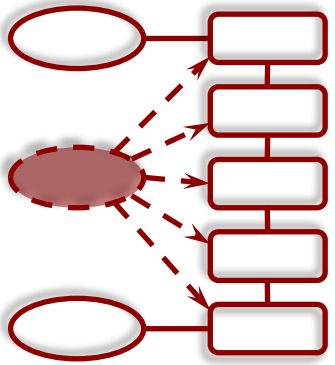

Conflict Resolution

Avoidance – Ignoring the conflict and hoping it will go away. Avoidance could work for non-critical decisions.

Smoothing – Allowing the desires of another member to prevail. Smoothing works if one member does not have a strong opinion.

Forcing – Imposing a solution to another member. Forcing works with clear power relationships (boss/subordinate).

Compromise – Attempting to meet the other member halfway. It may be "compromising" the value of an idea.

Constructive Engagement – Determining the underlying desires of all the members and then seeking ways to realize them.

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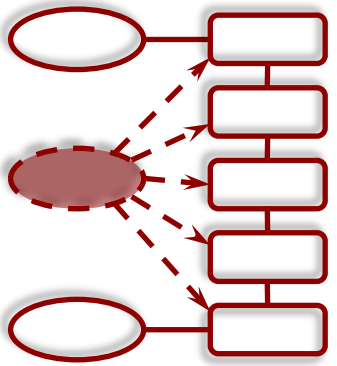

Managing People

Ideally, all the members in a team contribute to the work equally; however, it is common to find different types of personalities that can disrupt the dynamics of the team.

There are four personalities that are traditionally present in engineering design projects. These personalities can be present as individuals or as a small group within the team.

Hitchhikers (Most common)

Hijackers

Isolationists

Enablers

S. McCahan, P. Anderson, M. Kortschot, P. E. Weiss, and K. A. Woodhouse, *Designing Engineers: An Introductory Text*, Hoboken, NJ: Wiley, 2015.

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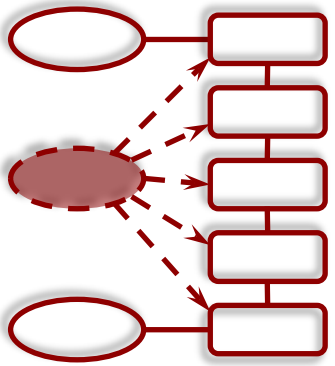

Hitchhikers

Hitchhikers are people who contribute significantly less to a project than everyone else.

They usually have an excuse (‘*I am too busy*’, ‘*I have an exam*’, ‘*I have to work*’, ‘*I forgot*’, etc.) or they often miss meetings, go silent (do not respond to emails). However, they expect to get credit for the work done by the rest of the team.

If the student’s behavior is caused by health reasons or work outside school time, encourage the student to seek help. Shifting work to the teammates is not acceptable.

- Establish warnings and early deadlines as part of the team rules.
- If the improper behavior continues contact your instructor.

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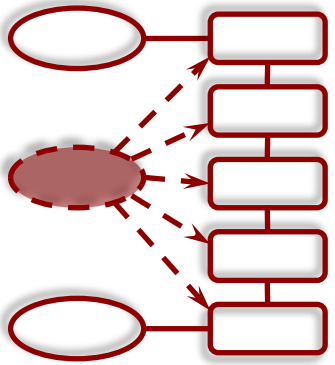


Hijackers

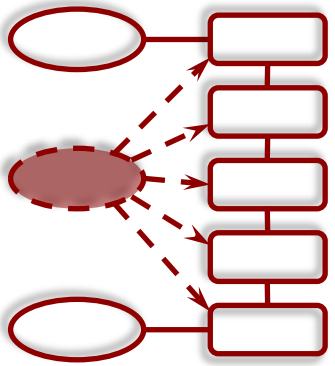
A hijacker is someone who likes to take control of the project. Their moto is, "*if you want something done right, do it yourself*".

A hijacker mistrusts other people's abilities. Often, the hijacker redoes the work done by someone else, this affects the morale of the team.

A hijacker becomes overwhelmed with work as no one else in the team is in a position to help, as they were left out of the decisions and tasks, and they do not know what to do (lack or ownership).

- Avoid having a hijacker as the leader of the team.

Teamwork



Isolationists

Isolationists work and usually complete their part, but do not want to interact with the rest of the team. Their moto is "*tell me what to do and I'll do it* ".

Their work is generally acceptable but it does not fit with the rest of the project due to the lack of communication.

Isolationists tend to break the cohesion of the team, forming subgroups. The team spends too much energy trying to draw this person in. They do not want to listen other teammates.

- Engage the isolationists to be an active member of the team, for example being the chair of the meetings.
- As a team, avoid spending too much time/energy accommodating their behaviour.

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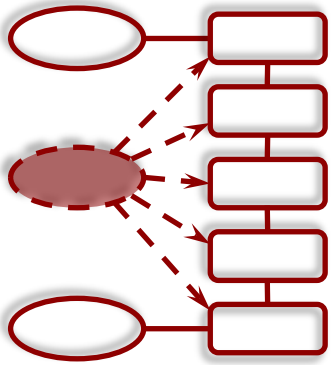

Enablers

Enablers help everyone out and can end up getting too much work, because they do not say “no”. They simply want everyone else to be happy/

As a result, they become overwhelmed, and consequently they are unable to deliver all the work they promised. Therefore, the team does not meet their goals.

- The team must assign the tasks evenly and do not overload the enablers.
- While it may be tempting to take advantage of the enablers, in the end the team can suffer when the load is too much for them to complete.