Achieve agreement among all stakeholders about the requirements
• has to deal with conflicts about requirements
Requirements Lifecycle

Source: Adapted from Pohl, CAISE 1993
Conflict

• Defining Conflict
  – In **Social psychology**, focus is on interdependence and perception:
    • “the interaction of interdependent people who perceive opposition of goals, aims, and values, and who see the other party as potentially interfering with the realization of these goals” [Putnam & Poole, 1987]
  – In **RE**, focus typically is on **logical inconsistency**:
    • E.g. conflict is a divergence between goals - there is a feasible boundary condition that makes the goals inconsistent [van Lamsweerde et al. 1998]

Note:
• conflict may occur between individuals, groups, organizations, or different roles played by one person
Conflicts

• **Conflict (in RE)**
  – Exists if the needs and wishes of different stakeholders (or groups of stakeholders) regarding the system contradicts each other,
  – Exists if some needs and wishes cannot be taken into account

• **Risks of unresolved conflicts**
  – Compromise acceptance of the system by stakeholders
  – If conflict disregarded or suppressed, some stakeholders may not support development of the system
  – May result in failure of the project

• **Involve relevant stakeholders**
Requirements negotiation

• The goal of negotiation
  – Identify conflicts
  – Analyse the causes of each conflict
  – Resolve the conflicts by means of appropriate strategies
  – Document the conflict resolution and the rationale

• Resolve conflicts at the goal level
  – Goals document rationale of the solution-oriented requirements
  – Fundamental contradictions can be resolved before the stakeholders go into technical details (of the goals realisation)
Requirements negotiation

• The goal of negotiation
  – Identify conflicts
  – Analyse the causes of each conflict
  – Resolve the conflicts by means of appropriate strategies
  – Document the conflict resolution and the rationale

• Resolve conflicts at the goal level
  – Goals document rationale of the solution-oriented requirements
  – Fundamental contradictions can be resolved before the stakeholders go into technical details (of the goals realisation)
Requirements negotiation

• The goal of negotiation
  – Identify conflicts
  – Analyse the causes of each conflict
  – Resolve the conflicts by means of appropriate strategies
  – Document the conflict resolution and the rationale

• Resolve conflicts at the goal level
  – Goals document rationale of the solution-oriented requirements
  – Fundamental contradictions can be resolved before the stakeholders go into technical details (of the goals realisation)

  • Conflict dependency
    – G1: It shall be possible to localise the car via GPS
    – G2: The country-specific privacy laws shall be observed

  G1 and G2 are conflicting…
Requirements negotiation

• **The goal of negotiation**
  – Identify conflicts
  – Analyse the causes of each conflict
  – Resolve the conflicts by means of appropriate strategies
  – Document the conflict resolution and the rationale

• **Resolve conflicts at the goal level**
  – Goals document rationale of the solution-oriented requirements
  – Fundamental contradictions can be resolved before the stakeholders go into technical details (of the goals realisation)
  – **Goals support decision making**
    • Choose realisation that satisfies most of the defined goals
Softgoals as selection criteria

- Maintain passenger comfort
  - Serve more passengers
  - Minimize operation costs
  - Minimize development costs
  - Reduce staffing

- Minimize costs
  - Maintain safe distance
  - Improve safety

- Clearer signalling
  - Automate collision avoidance
  - Automate braking
  - Increase train speed

- More frequent trains
  - Add new tracks
  - Maintain passenger comfort

- Hire more operators
  - Buy new rolling stock
Causes of Conflicts

- **Deutsch (1973):**
  - Control over resources
  - Preferences and nuisances
    - tastes or activities of one party impinge upon another
  - Values
    - a claim that a value or set of values should dominate
  - Beliefs dispute over facts, information, reality, *etc.*
  - Nature of the relationship between the parties

- **Robbins (1989):**
  - Communicational
    - insufficient exchange of information, noise, selective perception
  - Structural
    - goal compatibility, jurisdictional clarity, leadership style
  - Personal factors
    - individual value systems, personality characteristics
Resolving Stakeholder Conflict

• **Observations:**
  – deviant behaviour & conflict are normal in small group decision making
  – more aggression and less co-operation when communication is restricted
    • a decrease in communication tends to intensify a conflict
      – the contact hypothesis
  – heterogeneous teams experience more conflict
  – homogeneous groups are more likely to make high risk decisions
    • groupthink
  – effect of personality is overshadowed by situational and perceptual factors
Conflicts in different RE activities

- **During the elicitation workshop**
  - Two stakeholders state requirements that contradict each other and hence cannot be realised together

- **When documenting requirements**
  - The stakeholders detect a conflict between two requirements that originate from different interviews

- **Requirements management**
  - Conflict occurs during requirements prioritisation – different stakeholders have different opinions regarding the requirements priority

- **Requirements validation**
  - Conflicts occurs while stakeholders check the specified requirements for correctness
  - One stakeholder considers a requirement correct – another objects
Conflict types

- Data conflict
- Interest conflicts
- Value conflicts
Data conflict

• **Data conflict exists**
  – if stakeholders are wrongly or incompletely informed about the requirement
  – If stakeholders interpret the meaning of the requirements differently

• **Example:**
  
  R4: The DVD player shall be able to handle re-writable CDs (CD-RW) and DVDs (DVD-RW).

A stakeholder disagrees with the requirement. In his opinion it does not make sense for a DVS player in the car to be able to write data onto CDs or DVDs.
Interest conflict

• **Interest conflict exists**
  – if stakeholders’ interests or goals contradict each other

• **Example:**

  A stakeholder wants the car entertainment system to be equipped with MP3 functionality, and optional hard disk, and a USB interface in order to attract technology-oriented customers.

  Another stakeholder wants the system to be equipped merely with standard CD player functionality and a radio. His goal is to reduce the cost in order to attract price-conscious customers.
Value conflict

- **Value conflict exists**
  - if different stakeholders evaluate a requirement differently
  - Each stakeholder considers the importance of requirement differently

- **Example:**
  A stakeholder demands that the DVD player of the car entertainment system shall support the OGG format in addition to MP3 format.

  Another stakeholder objects to this requirement since he thinks that supporting the OGG format is unimportant.
Heuristic of Conflict Analysis

• **Checking for conflict analysis**
  – Let stakeholders explain the conflicting requirements
  – Does one of the explanations deviate from the actual requirements?
  – **If so, a data conflict exist**

• **Asking for the stakeholders’ interests**
  – Ask the stakeholders for their goals with regard to the conflicting requirements
  – Check the resulting goals for contradictions
  – **If there is a contradiction, an interest of conflicts exists**

• **Clarify the stakeholders’ evaluation background**
  – Ask the stakeholder why he/she evaluates the conflicting requirements in the way he/she does
  – Check the evaluation backgrounds of the different stakeholders for differences that may cause the detected conflicts.
  – **If there is such a difference, a value conflict exists**
Resolving Conflicts

• The approach used to settle a conflict
  – Methods include negotiation, competition, arbitration, coercion, and education
  – Not all conflicts need a resolution method: not all conflicts need to be resolved

  » Negotiation
  » Creative solution
  » Decision

• Example
  – A car safety shall be equipped with radar technology in order to be able to monitor the traffic ahead of the car. There is a conflict among two groups of stakeholders regarding the distance up to which the radar sensor shall monitor the traffic in front of the car. One group demands 1000 m, the other one demands 500 m.
Resolving Conflicts:

Negotiation

- **Agree on the solution by means of negotiation**
  - Exchange argument
  - Agree upon solution

- **Example**
  - The stakeholders resolve the conflict using the negotiation strategy by agreeing on a detection range of 750 m.

- **Negotiation**
  - ...is collaborative exploration:
    - participants attempt to find a settlement that satisfies all parties as much as possible
  - also known as:
    - integrative behaviour
    - constructive negotiation
  - distinct from:
    - distributive/competitive negotiation
Resolving Conflicts:

Negotiation

• Agree on the solution by means of negotiation
  – Exchange argument
  – Agree upon solution

• Example
  – The stakeholders resolve the conflict using the negotiation strategy by agreeing on a detection range of 750 m.

Negotiation
  – …is collaborative exploration:
    • participants attempt to find a settlement that satisfies all parties as much as possible
      – also known as:
        • integrative behaviour
        • constructive negotiation
  – distinct from:
    • distributive/competitive negotiation

Diagram:

- Stakeholder A
- Stakeholder B
- Range for a conflict resolution

Identify
Analyse
Resolve
Document
Resolving Conflicts:

Creative solution

• Original viewpoints are **discarded**
• A **new, creative solution** is developed to harmonise the viewpoints

• Example
  – The stakeholders resolve the conflict by proposing a novel solution. By equipping the car with laser sensor instead of a radar sensor the detection range in increased to 1000 m without causing additional cost.
Resolving Conflicts: Creative solution

- Original viewpoints are **discarded**
- A **new, creative solution** is developed to harmonise the viewpoints

Example – The stakeholders resolve the conflict by proposing a novel solution. By equipping the car with laser sensor instead of a radar sensor the detection range is increased to 1000 m without causing additional cost.
Resolving Conflicts: Decision

• Higher **authority** makes a decision
  – in favour of one conflicting party

• Example
  – The client is involved as a higher authority. The client decides that the detection range shall be 500 m.

• Voting

---

**Third Party Resolution**

– participants appeal to outside source
  • the rule-book, a figure of authority, or the toss of a coin.
  • can occur with the breakdown of either negotiation or competition as resolution methods.

– **types of third party resolution**
  • **judicial**: cases presented by each participant are taken into account
  • **extra-judicial**: a decision is determined by factors other than the cases presented (e.g. relative status of participants)
  • **arbitrary**: e.g. toss of a coin
Resolving Conflicts:

Decision

- Higher authority makes a decision – in favor of one conflicting party
  - Example - the client is involved as a higher authority. The client decides that the detection range shall be 500 m.

- Voting

- Third Party Resolution
  - Participants appeal to outside source
    - the rule-book, a figure of authority, or the toss of a coin.
    - Can occur with the breakdown of negotiation or competition as resolution methods.
  - Types of third party resolution
    - Judicial: cases presented by each participant are taken into account
    - Extra-judicial: a decision is determined by factors other than the cases presented (e.g. relative status of participants)
    - Arbitrary: e.g. toss of a coin
### Evaluation of the Conflict Resolution Strategies

<table>
<thead>
<tr>
<th></th>
<th>Negotiation</th>
<th>Creative solution</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data conflict</td>
<td>Suitable</td>
<td>Not suitable</td>
<td>Not suitable</td>
</tr>
<tr>
<td>Interest conflict</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
</tr>
<tr>
<td>Value conflict</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
</tr>
</tbody>
</table>

- **Data conflicts**
  - Parties provide additional, relevant information

**Why Creative solution and Decision are not suitable?**
Evaluation of the Conflict Resolution Strategies

<table>
<thead>
<tr>
<th>Conflict Type</th>
<th>Negotiation</th>
<th>Creative solution</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data conflict</td>
<td>Suitable</td>
<td>Not suitable</td>
<td>Not suitable</td>
</tr>
<tr>
<td>Interest conflict</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
</tr>
<tr>
<td>Value conflict</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
</tr>
</tbody>
</table>

- **Creative solution:**
  - Conflict because of misinformation
  - Creative solution will be based on incomplete information

- **Decision making:**
  - Could be made in favor of the wrong viewpoint due to missing information

Why **Creative solution** and **Decision** are not suitable?

---

28
Evaluation of the Conflict Resolution Strategies

<table>
<thead>
<tr>
<th></th>
<th>Negotiation</th>
<th>Creative solution</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data conflict</td>
<td>Suitable</td>
<td>Not suitable</td>
<td>Not suitable</td>
</tr>
<tr>
<td>Interest conflict</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
</tr>
<tr>
<td>Value conflict</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
</tr>
</tbody>
</table>

• **Interest conflicts**
  – Identifying common interests
  – **Negotiation** based on common interests
  – **Decision** for irresolvable parts of the problem

Why **Creative solution** only conditionally suitable?
Evaluation of the Conflict Resolution Strategies

<table>
<thead>
<tr>
<th></th>
<th>Negotiation</th>
<th>Creative solution</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data conflict</td>
<td>Suitable</td>
<td>Not suitable</td>
<td>Not suitable</td>
</tr>
<tr>
<td>Interest conflict</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
</tr>
<tr>
<td>Value conflict</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
</tr>
</tbody>
</table>

- **Interest conflicts**
  - Identifying common interests
  - Negotiation based on common interests
  - Decision for irresolvable parts of the problem

- **Main problem is conflicting goals / interests**
  - Goals/interests should be harmonized before making a creative solution

Why **Creative solution** only conditionally suitable?
## Evaluation of the Conflict Resolution Strategies

<table>
<thead>
<tr>
<th></th>
<th>Negotiation</th>
<th>Creative solution</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data conflict</td>
<td>Suitable</td>
<td>Not suitable</td>
<td>Not suitable</td>
</tr>
<tr>
<td>Interest conflict</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
</tr>
<tr>
<td>Value conflict</td>
<td>Conditionally suitable</td>
<td>Suitable</td>
<td>Conditionally suitable</td>
</tr>
</tbody>
</table>

### Value conflicts
- Act sensitively – not to offend stakeholders’ personal values
- Creative solution!
  - If it is of significant importance
  - If there are sufficient resources for implementing the solution

Why **Negotiation** and **Decision** only conditionally suitable?
## Evaluation of the Conflict Resolution Strategies

<table>
<thead>
<tr>
<th></th>
<th>Negotiation</th>
<th>Creative solution</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data conflict</strong></td>
<td>Suitable</td>
<td>Not suitable</td>
<td>Not suitable</td>
</tr>
<tr>
<td><strong>Interest conflict</strong></td>
<td>Suitable</td>
<td>Conditionally</td>
<td>Suitable</td>
</tr>
<tr>
<td><strong>Value conflict</strong></td>
<td>Conditionally</td>
<td>Suitable</td>
<td>Conditionally</td>
</tr>
</tbody>
</table>

### Why Negotiation and Decision only conditionally suitable?

- **Negotiation**
  - Values are deeply rooted in stakeholders’ personality – they can’t be easily changed

- **Decision making**
  - If the values of the conflicting parties are irreconcilable
  - If it is of significant importance
  - If there are sufficient resources for implementing the solution
Documenting Conflict Resolution

• Document resolutions
  – To make them traceable
  – The achieve solution may be forgotten and conflict may reoccur in other/related requirements

• Document central arguments
  – Conflict resolution
  – Arguments of the conflicting parties
  – Pros and cons of each viewpoint
Message to Take Home

• Requirements Negotiation
  – Conflict identification and resolution
  – Causes of conflicts
  – Types of conflicts
  – Resolution