Inconsistent-Tolerant DL-Lite Reasoning: An Argumentative Approach

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BRAZIL

DL-Lite$_{\mathcal{A}}$

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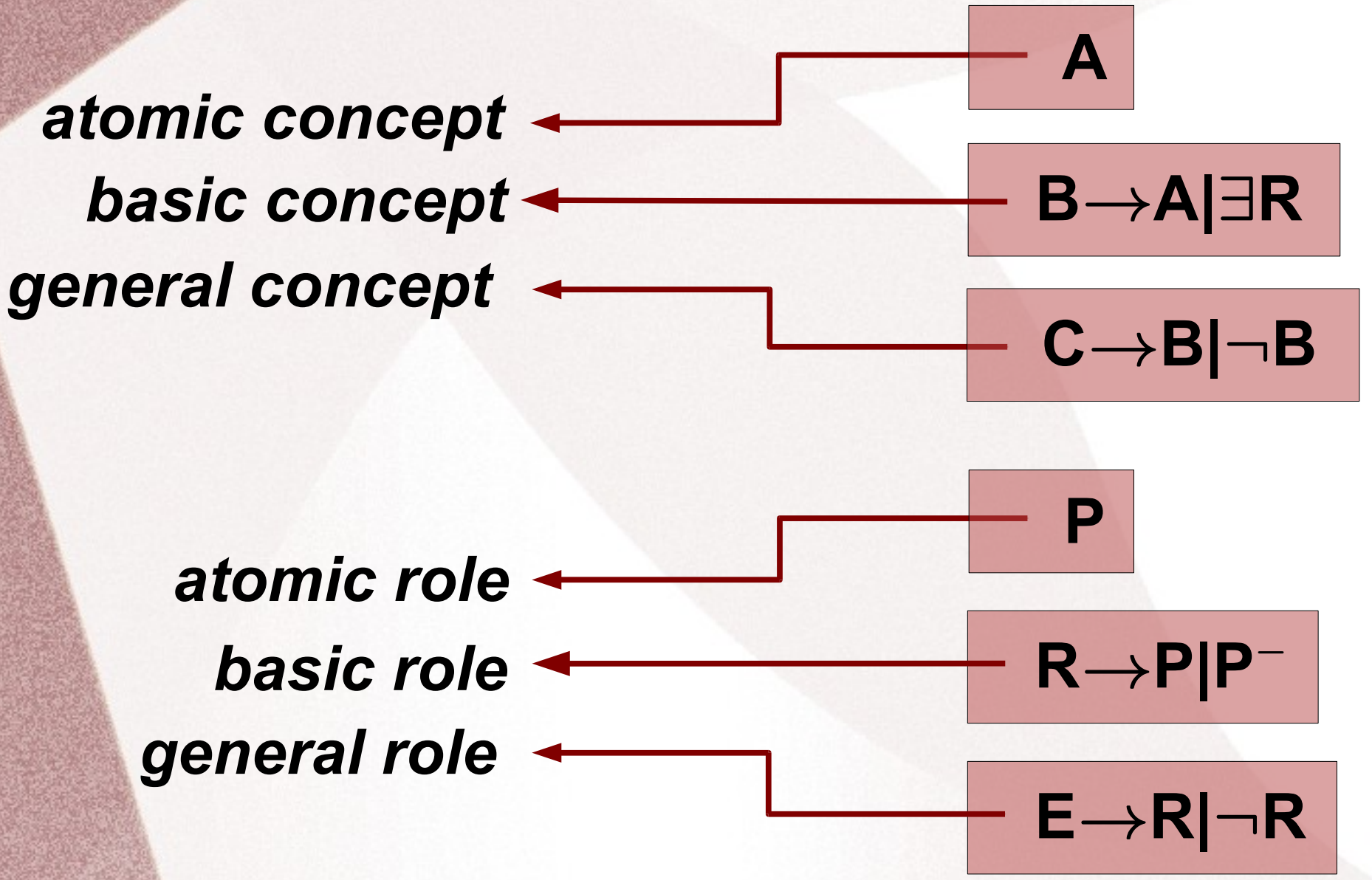
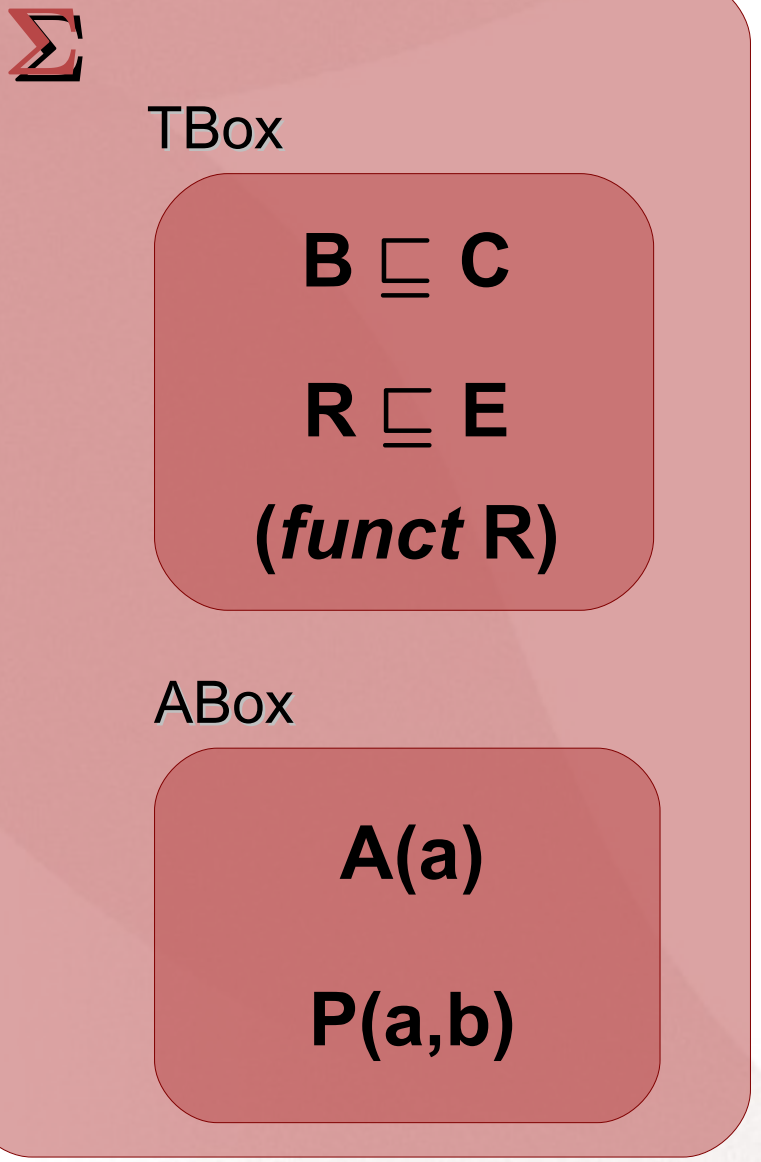
Grammar



Knowledge Base

DL-Lite $_{\mathcal{A}}$



DL-Lite Grammar:

$B \rightarrow A \mid \exists R \qquad C \rightarrow B \mid \neg B$

$R \rightarrow P \mid P^{-} \qquad E \rightarrow R \mid \neg R$

DL-Lite$_{\mathcal{A}}$

Reasoning Sevices

Subsumption

$\Sigma \models C_1 \sqsubseteq C_2$

$\Sigma \models E_1 \sqsubseteq E_2$

Functionality

$\Sigma \models (\mathit{funct}\ R)$

$\Sigma \models \neg(\mathit{funct}\ R)$

Query Answering

$\Sigma \models q(\tilde{y})$

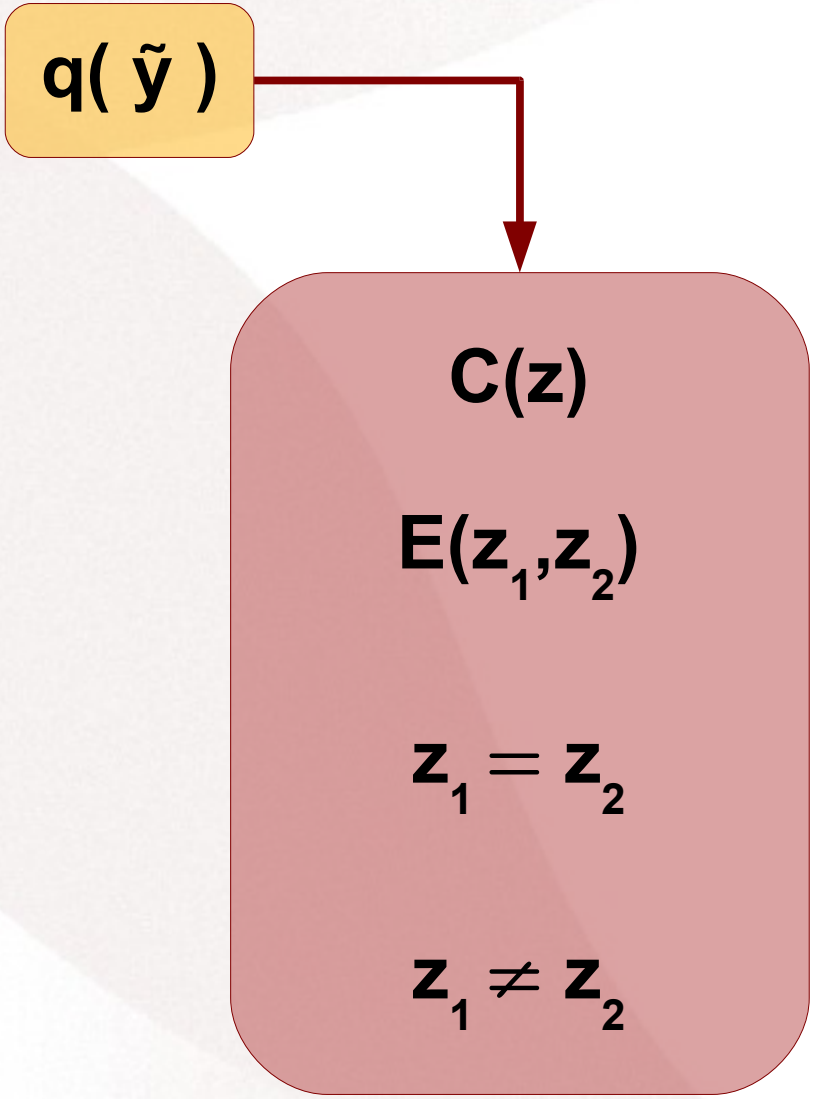
DL-Lite Grammar:

$B \rightarrow A \mid \exists R \qquad C \rightarrow B \mid \neg B$

$R \rightarrow P \mid P^- \qquad E \rightarrow R \mid \neg R$

Conjunctive Queries

DL-Lite$_{\mathcal{A}}$



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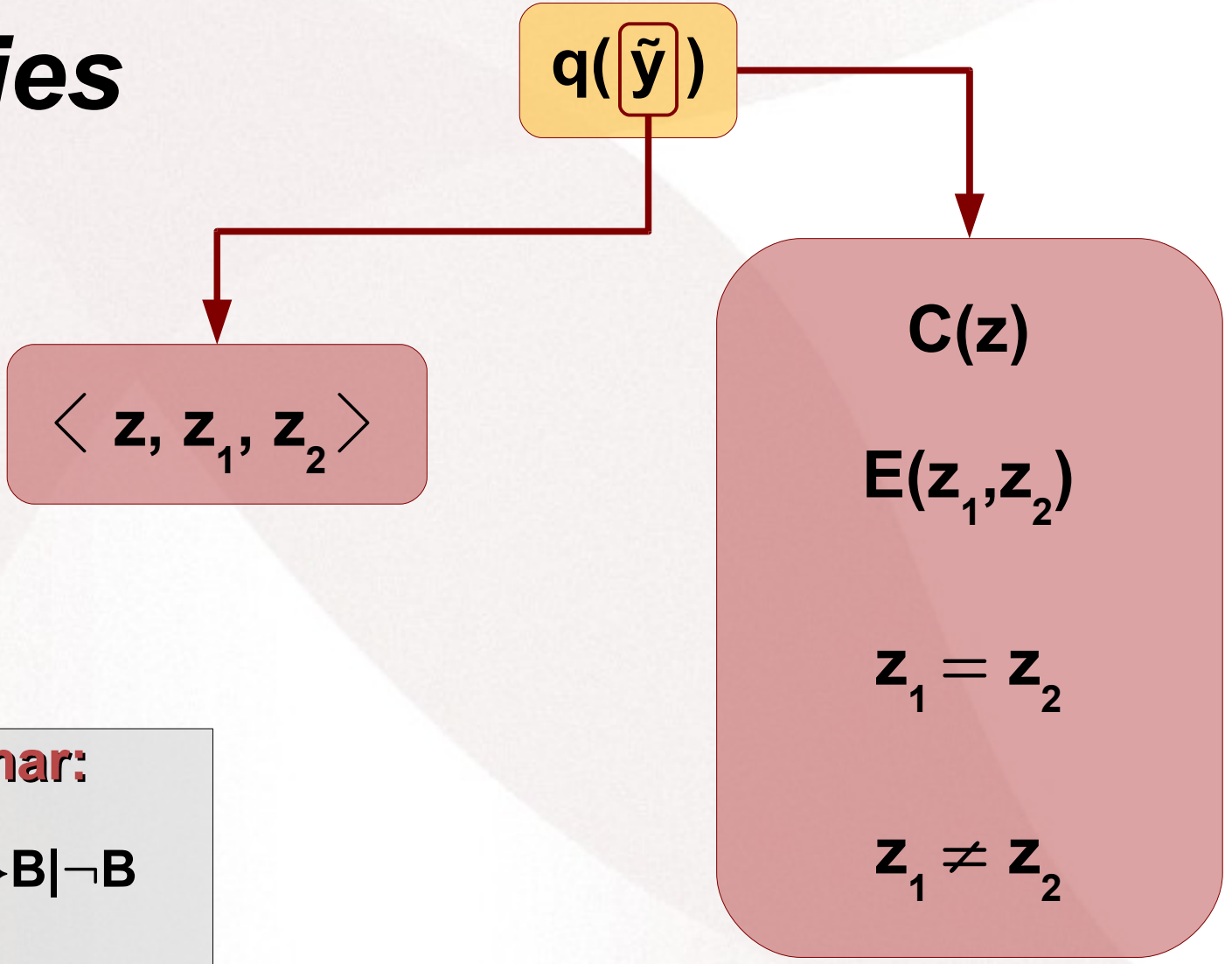

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Conjunctive Queries

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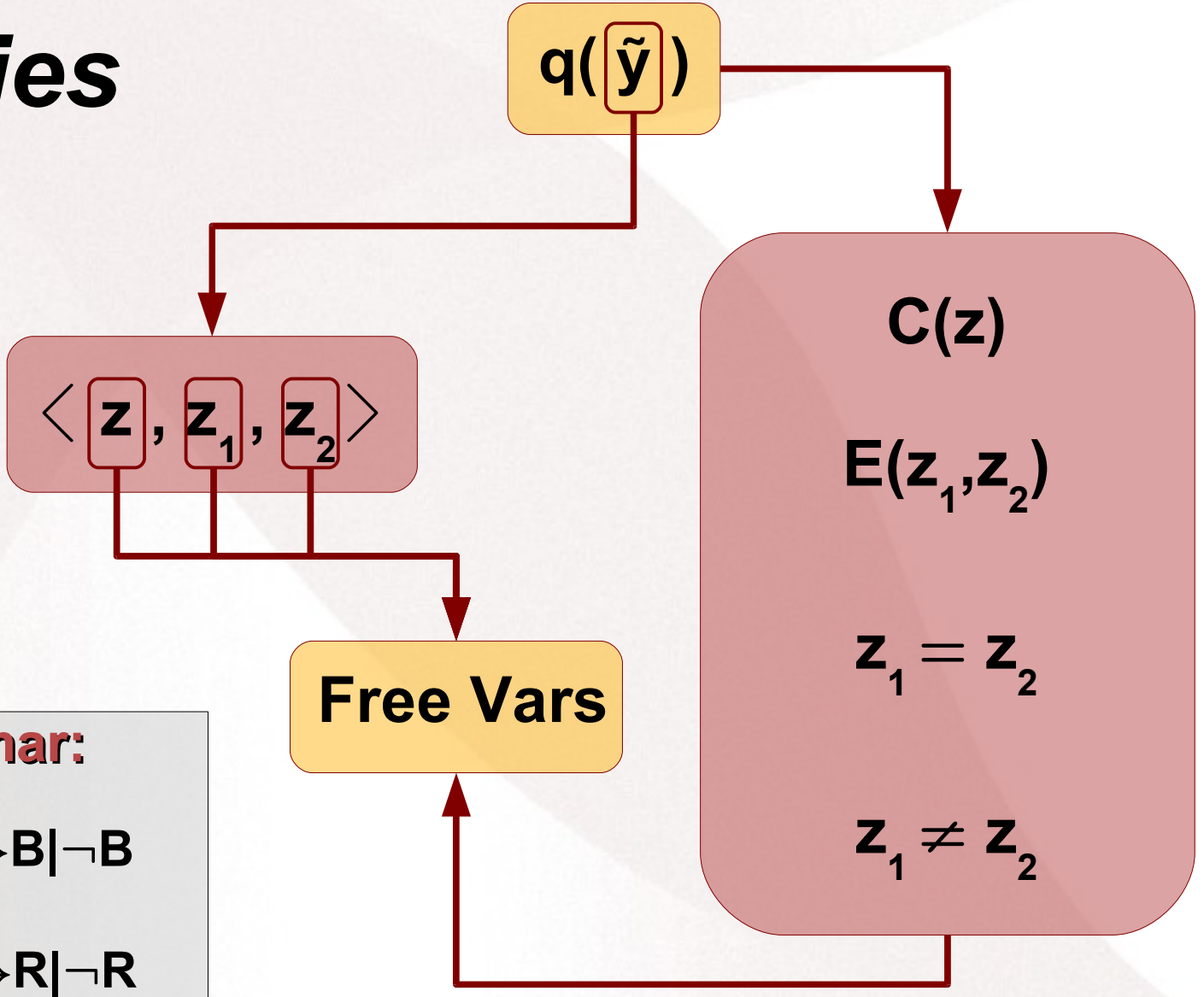

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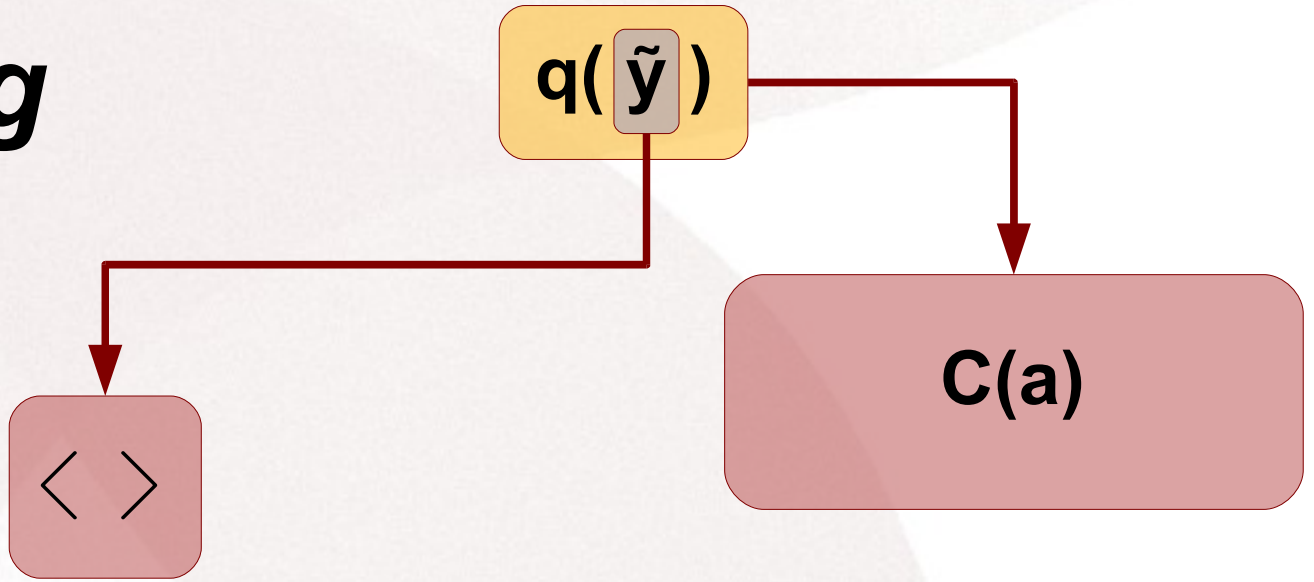
DL-Lite $_{\mathcal{A}}$

Instance Checking



DL-Lite Grammar:

$B \rightarrow A \mid \exists R \qquad C \rightarrow B \mid \neg B$

$R \rightarrow P \mid P^{-} \qquad E \rightarrow R \mid \neg R$

DL-Lite Argumentation: Foundations

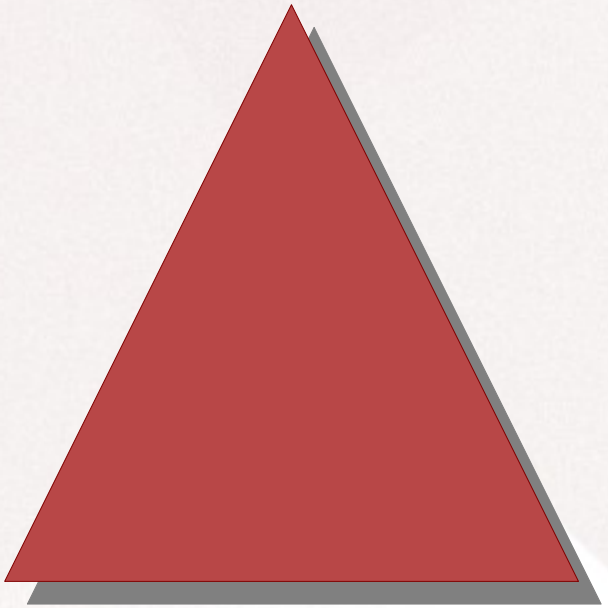
Argumentation

Intuition:

Basis by which people protect their beliefs or self-interests in rational dialogue, in common parlance, and during the process of arguing.

Argumentation

Arguments

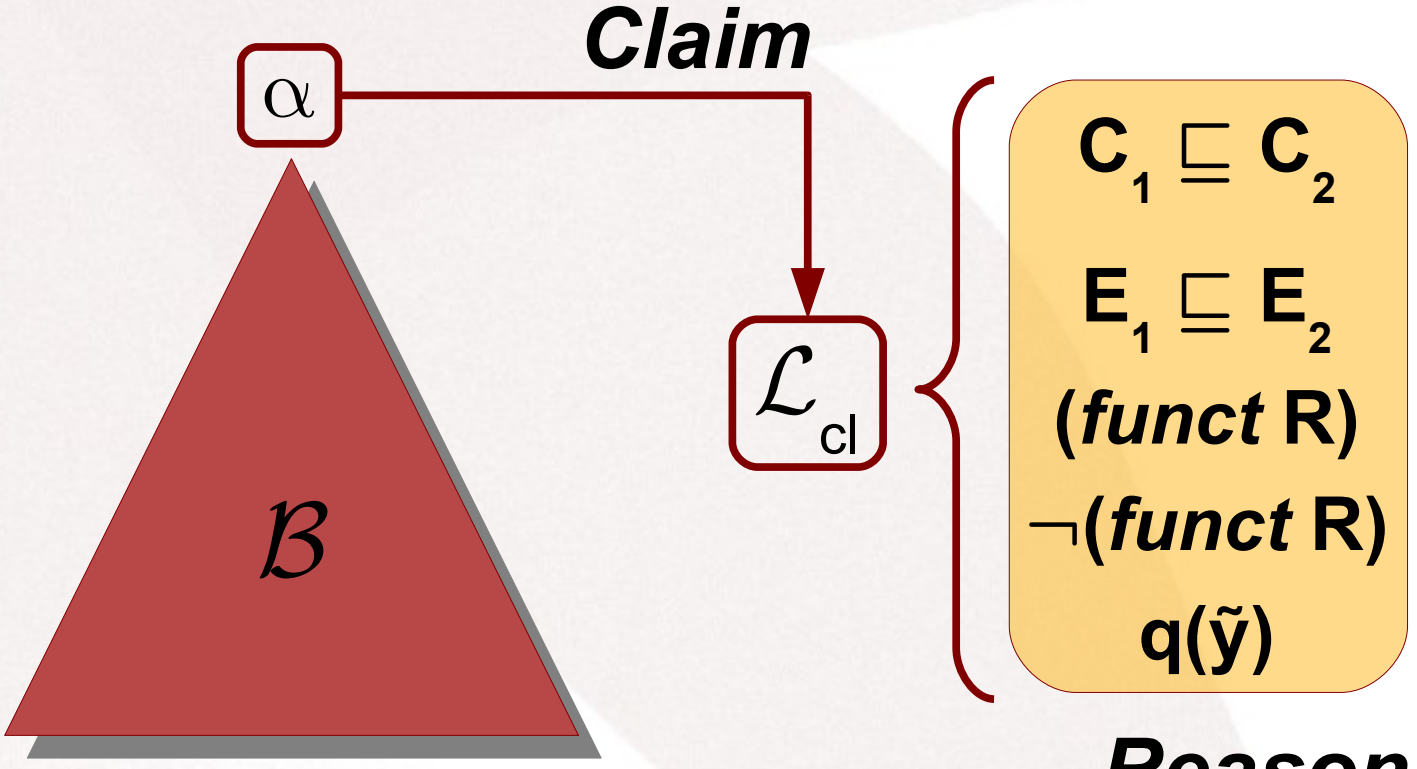


Intuition:

Set of interrelated pieces of knowledge supporting a claim.

DL-Lite Argumentation

Arguments

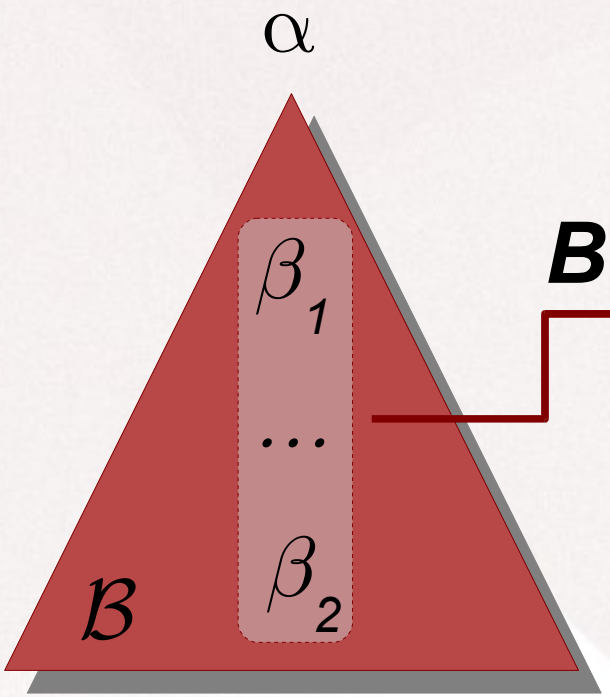


Reasoning Services

Argument $\mathcal{B}$ for α.

Argumentation

Arguments



Body

(1) $\Delta \subseteq \Sigma$

(2) $\Delta \vdash \alpha$

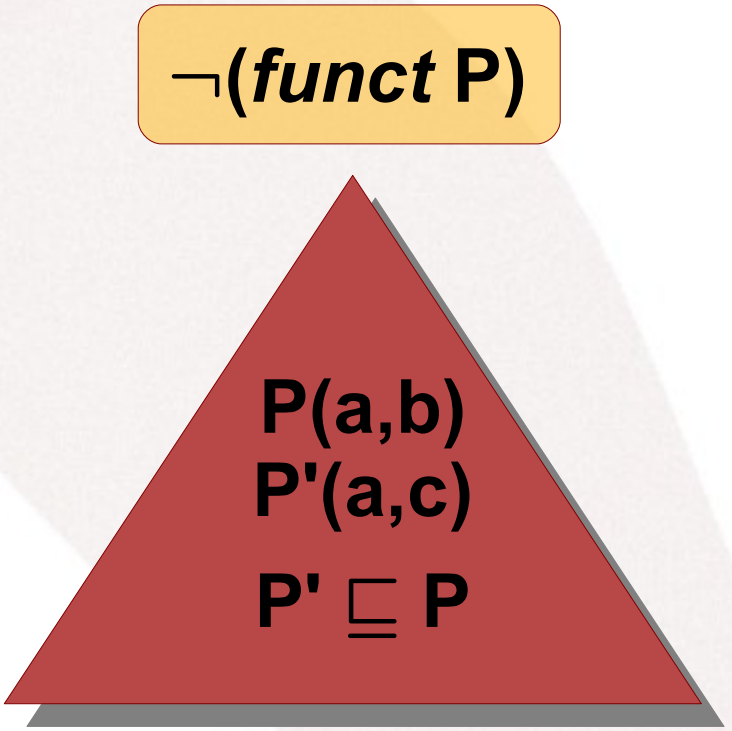
(3) $\Delta \nvdash \bot$

(4) $\nexists X \subset \Delta : X \vdash \alpha$

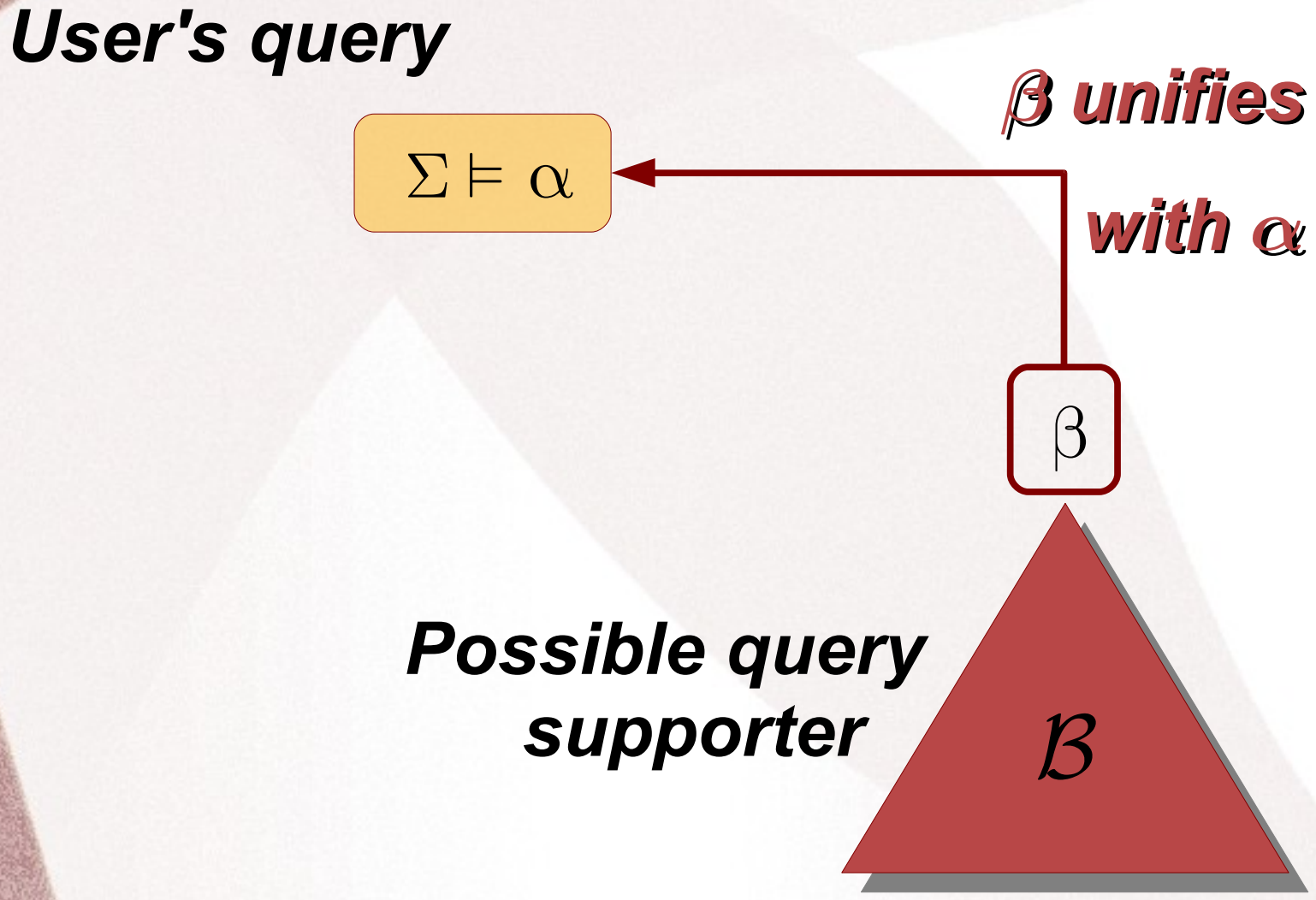
Argument $\mathcal{B}$ for α.

Arguments

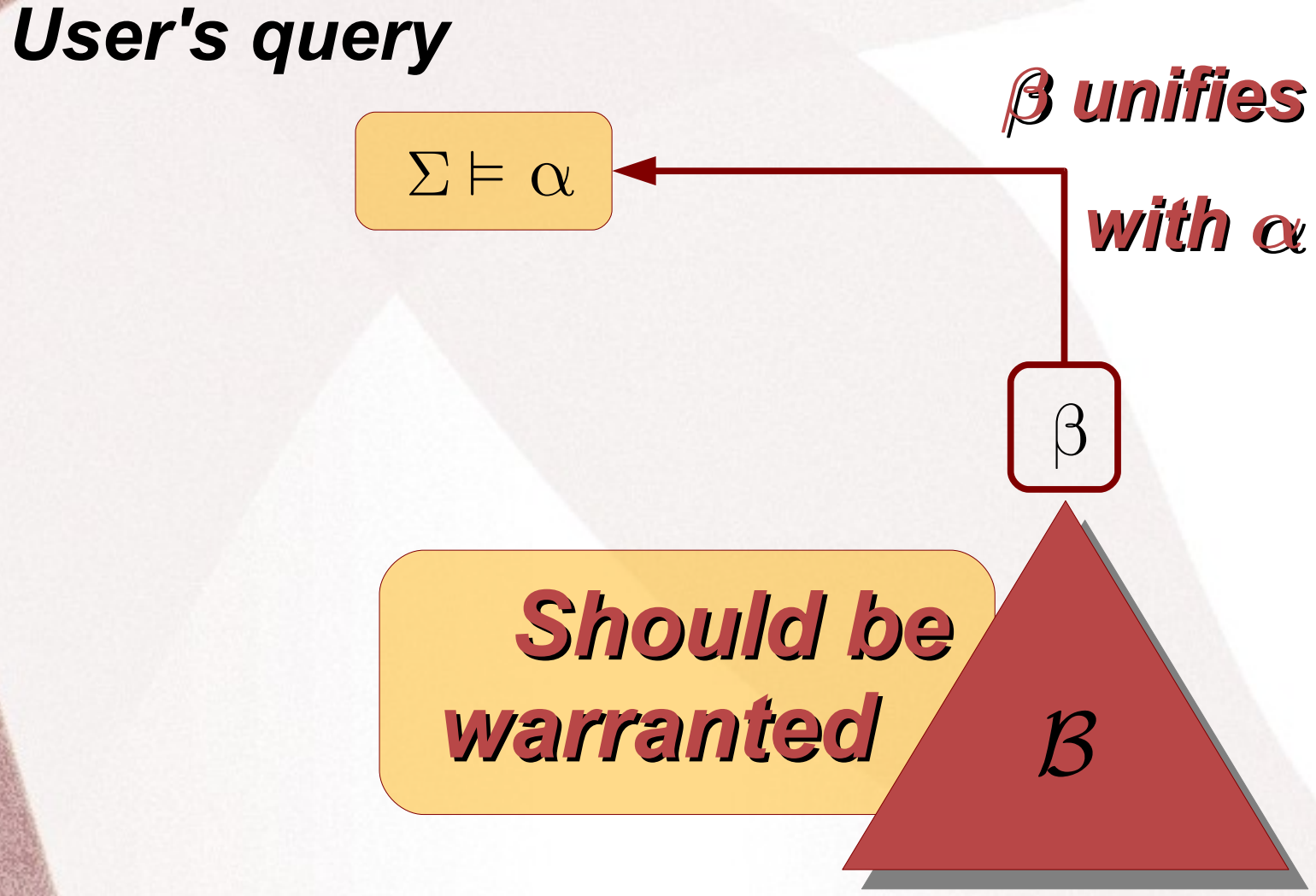
Examples



Arguments supporting the user's query

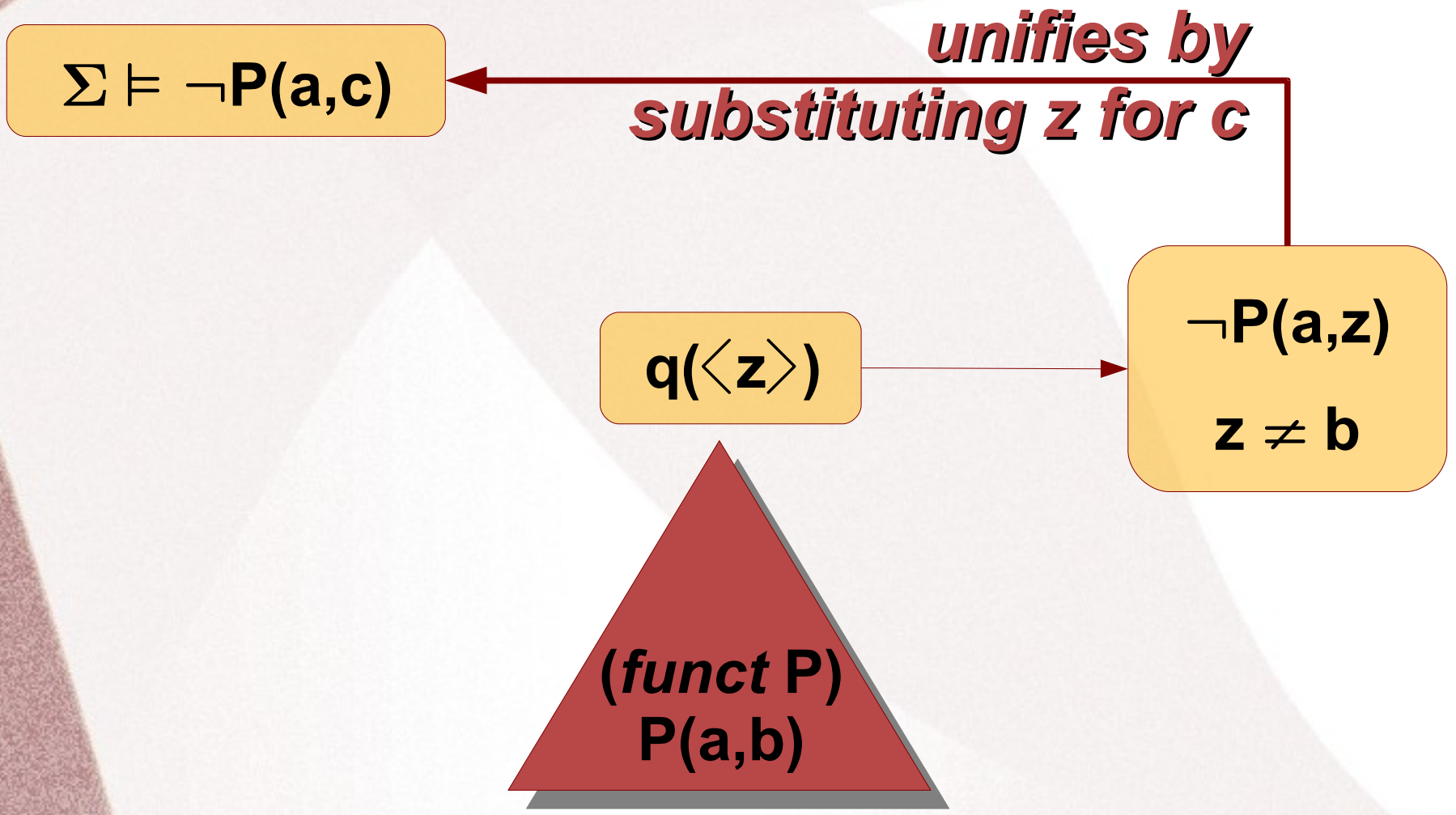


Arguments supporting the user's query



Arguments supporting the user's query

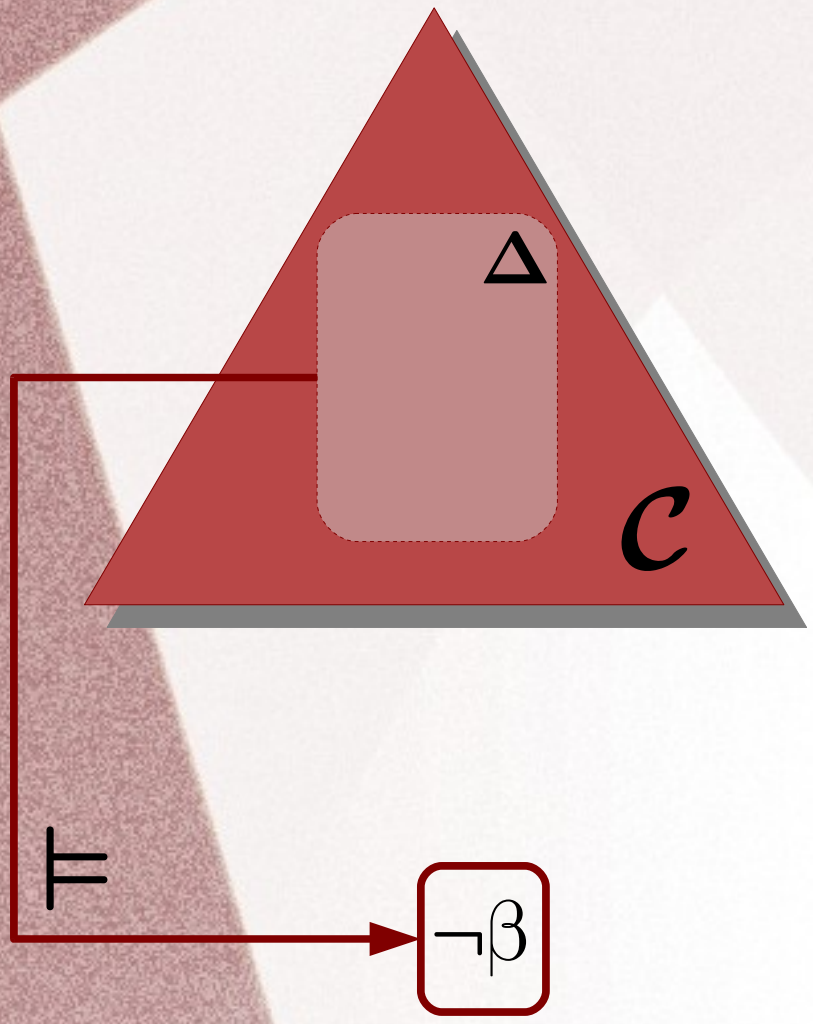
Examples

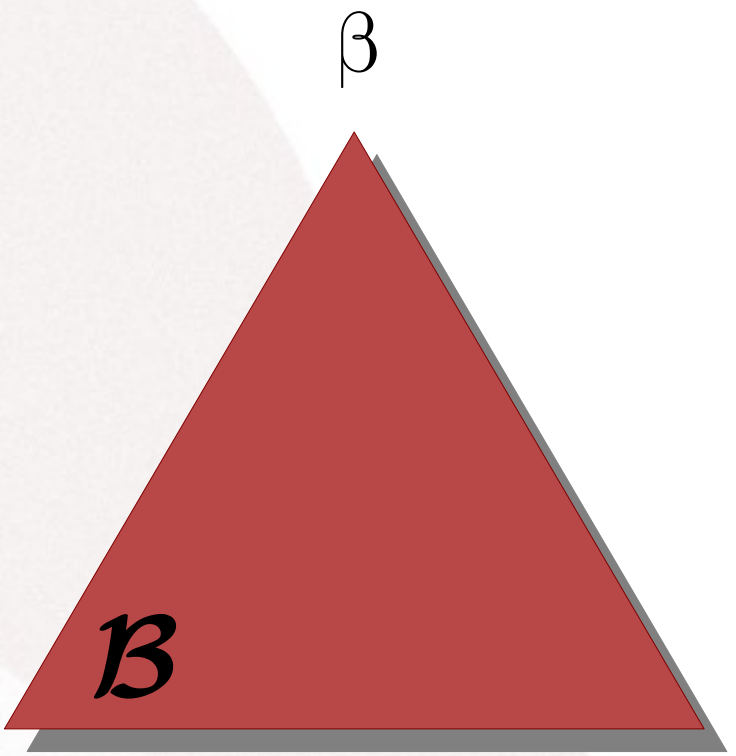


DL-Lite Argumentation: Conflict and Attack

Conflict

$\mathcal{B}$ counterargs $\mathcal{C}$





Conflict

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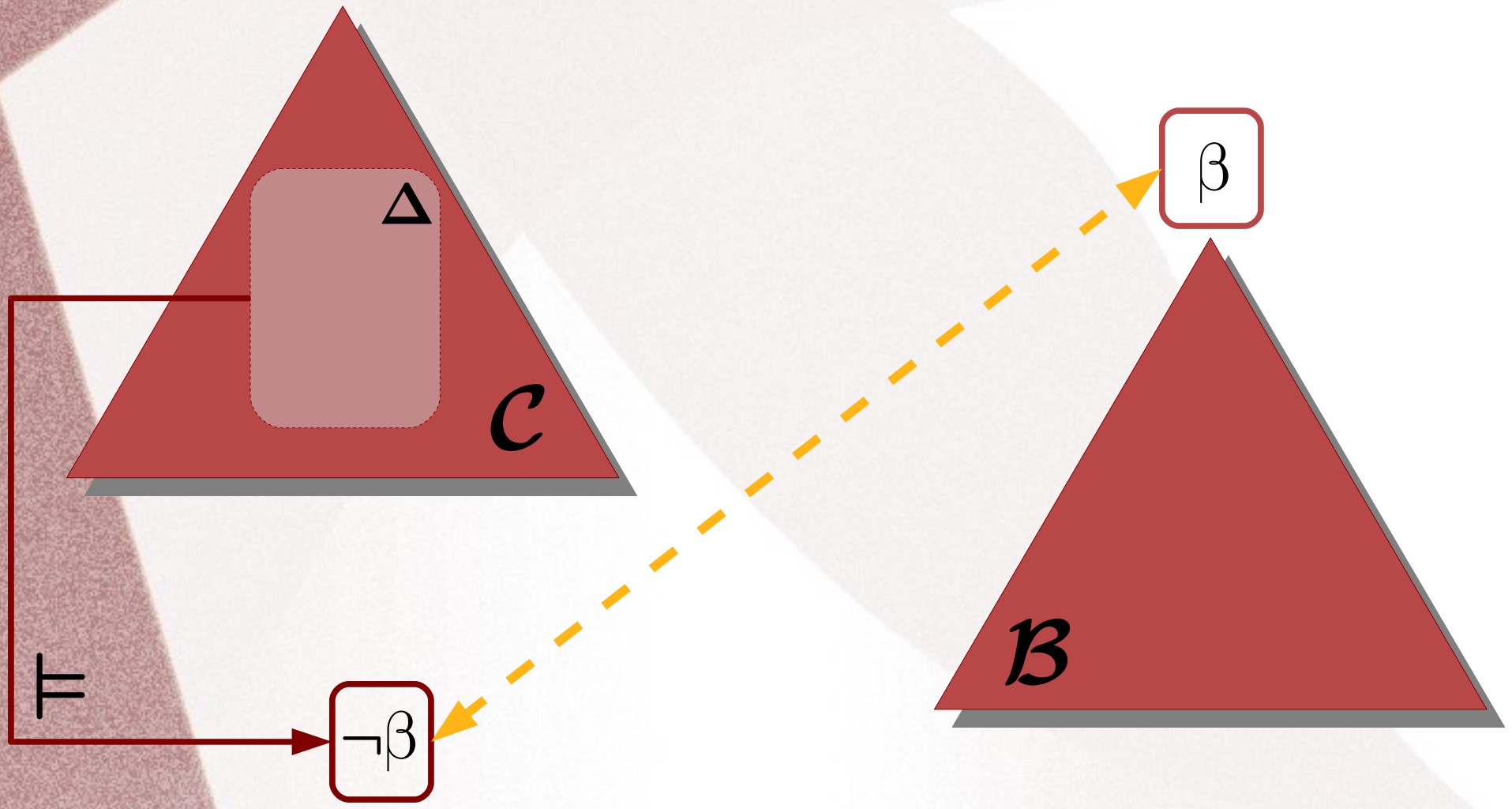

Conflict

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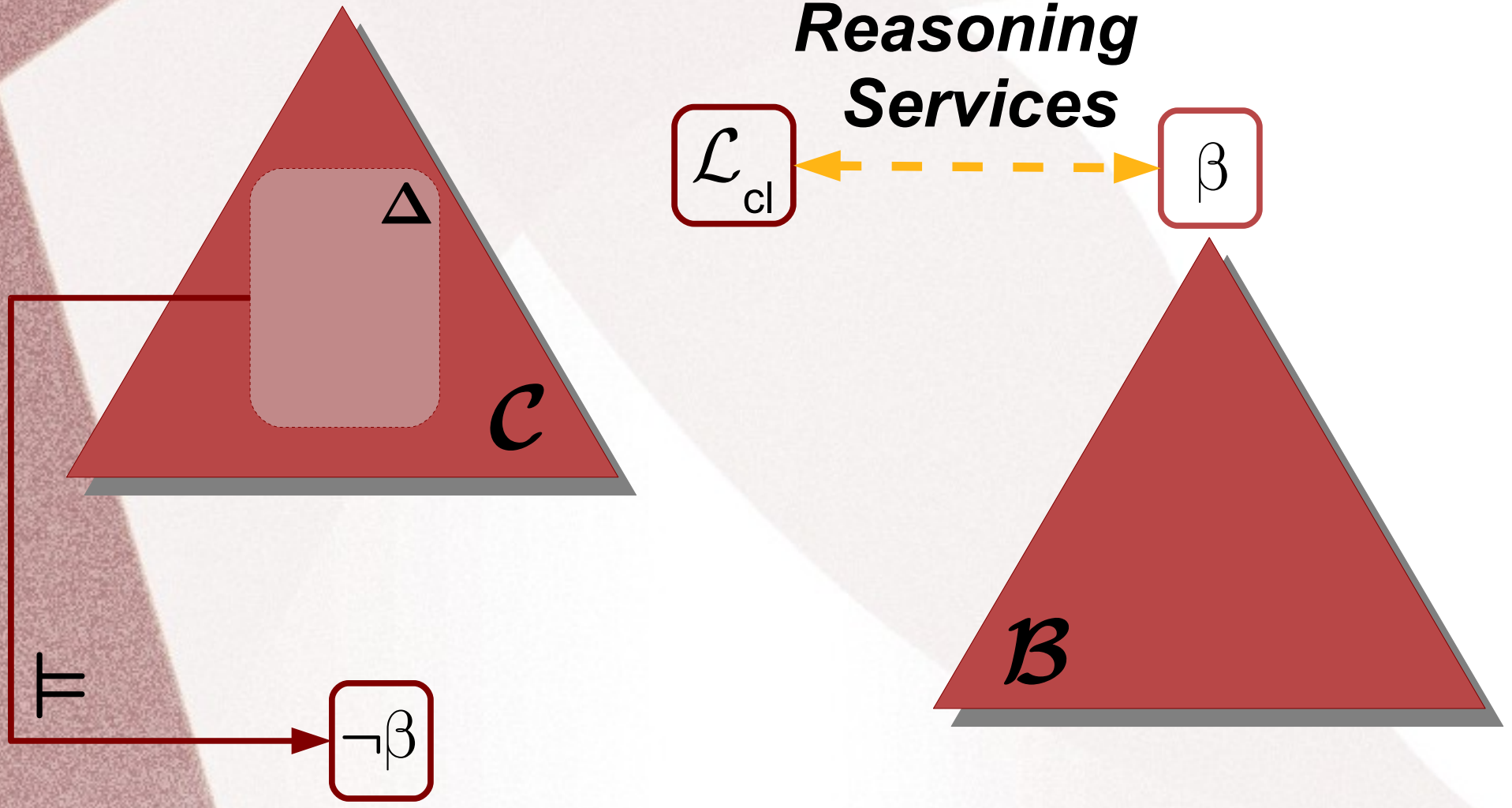

Conflict

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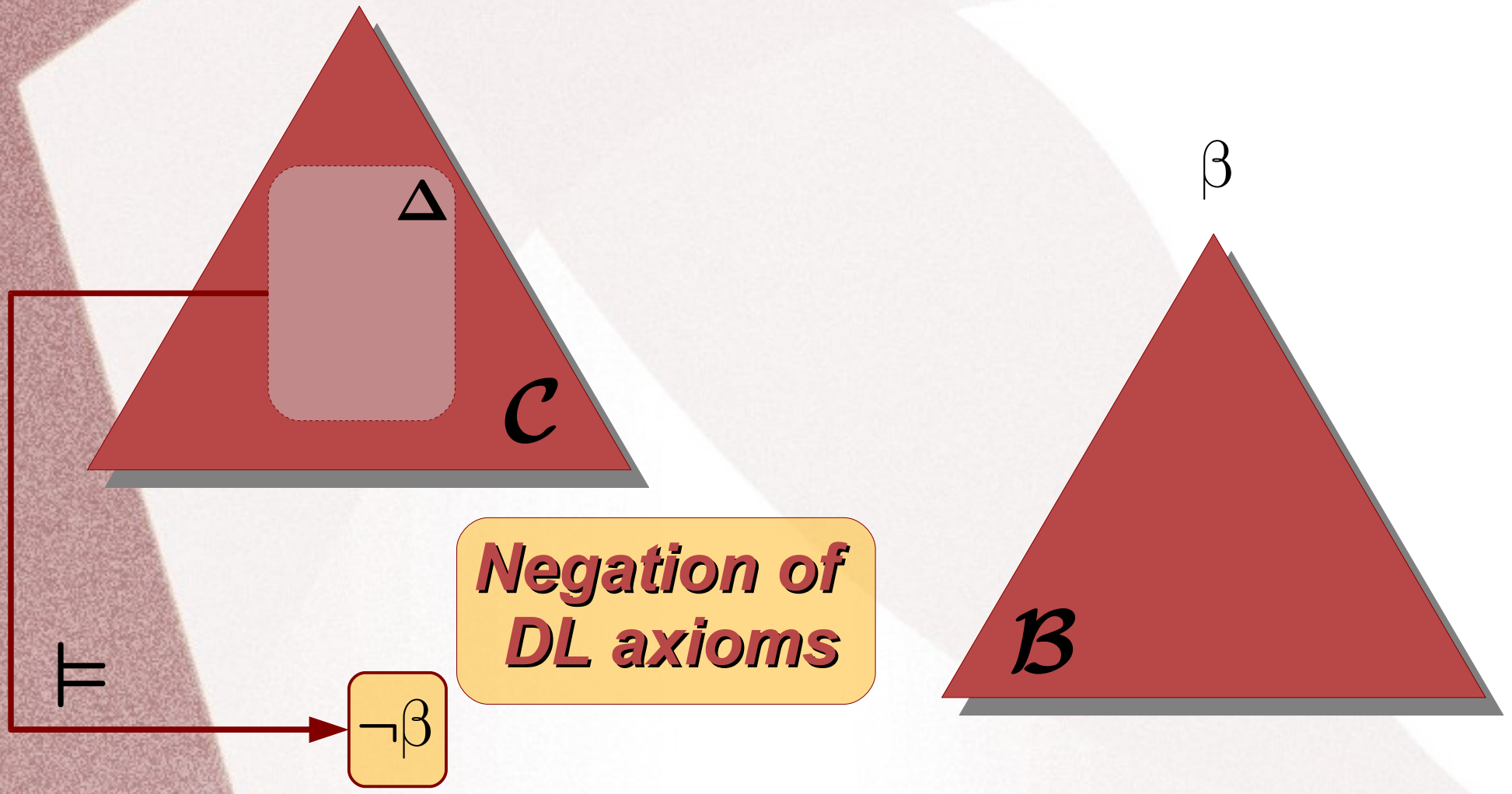
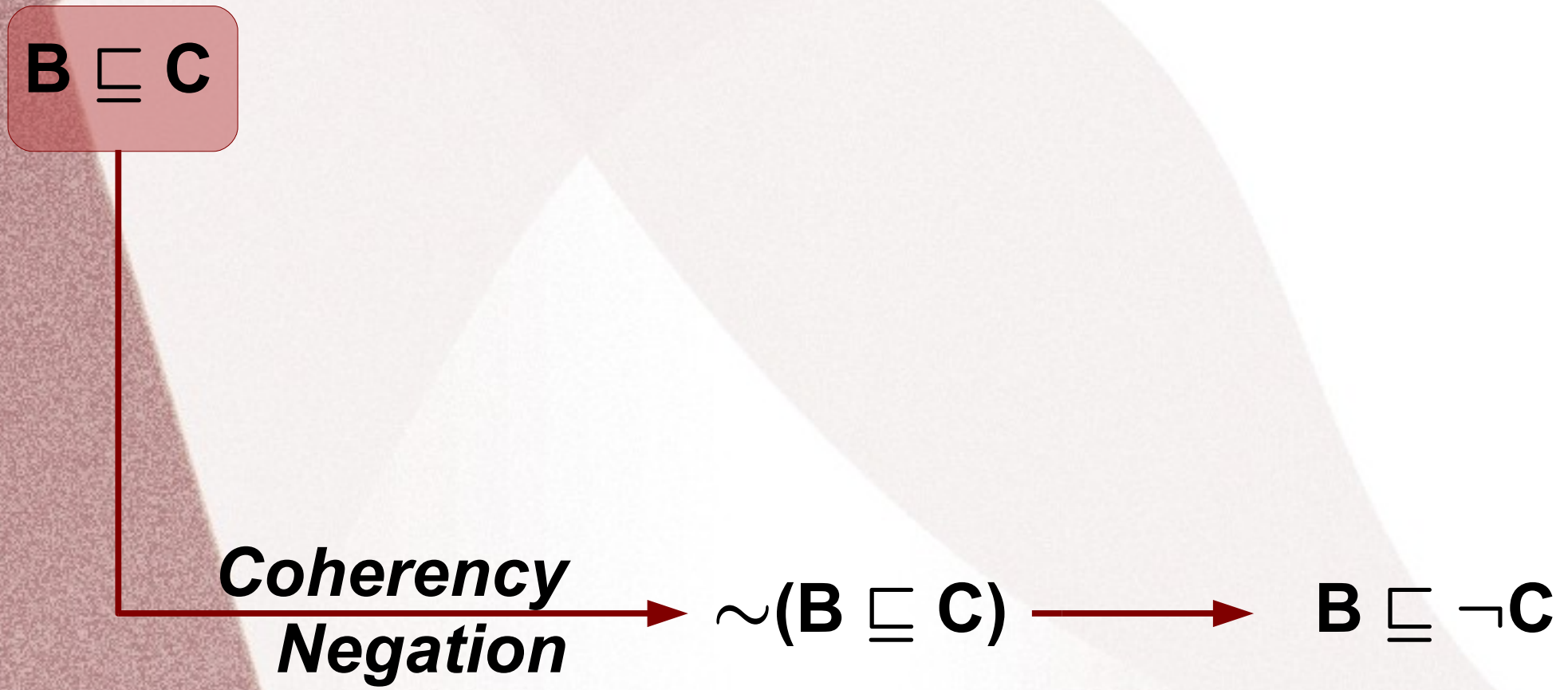


Conflict

Negation of DL Axioms

In AAAI 2006 (G.Flouris et al.)



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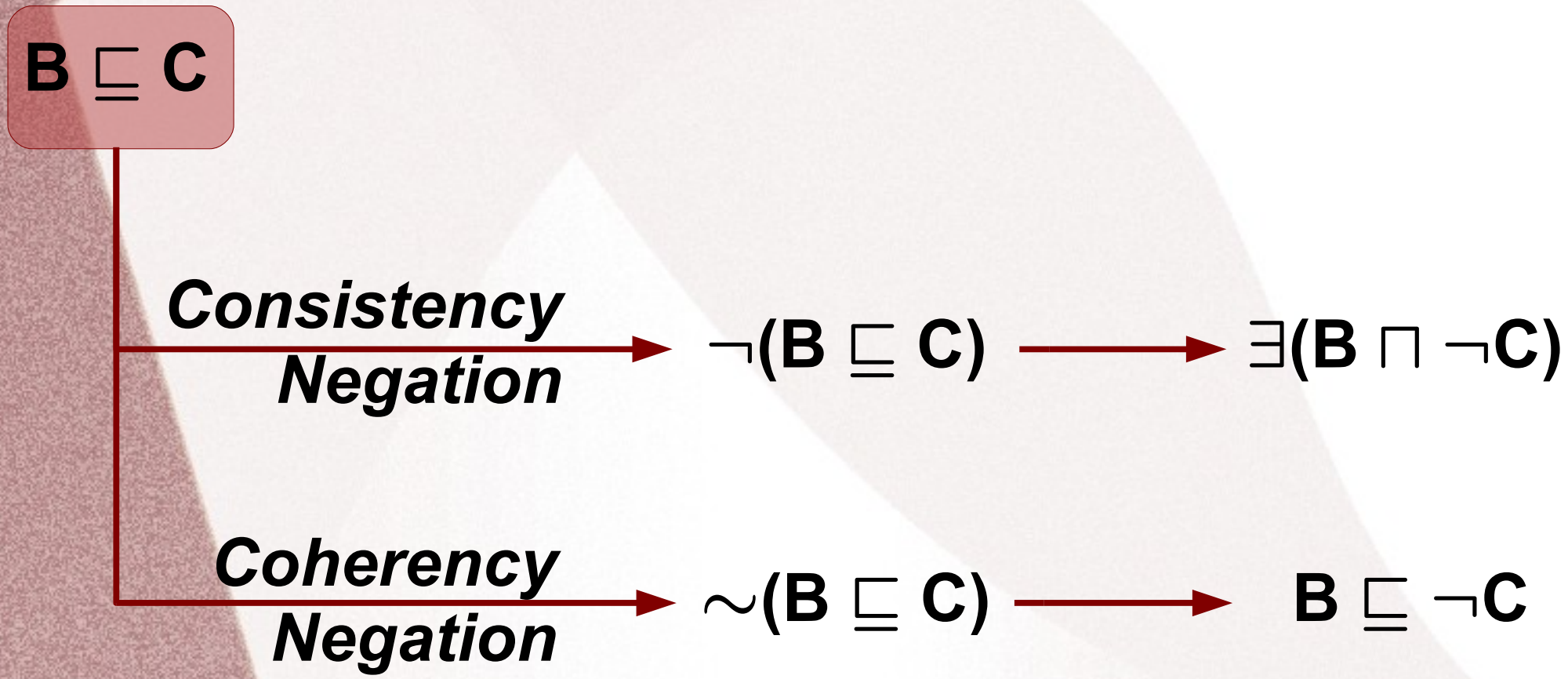

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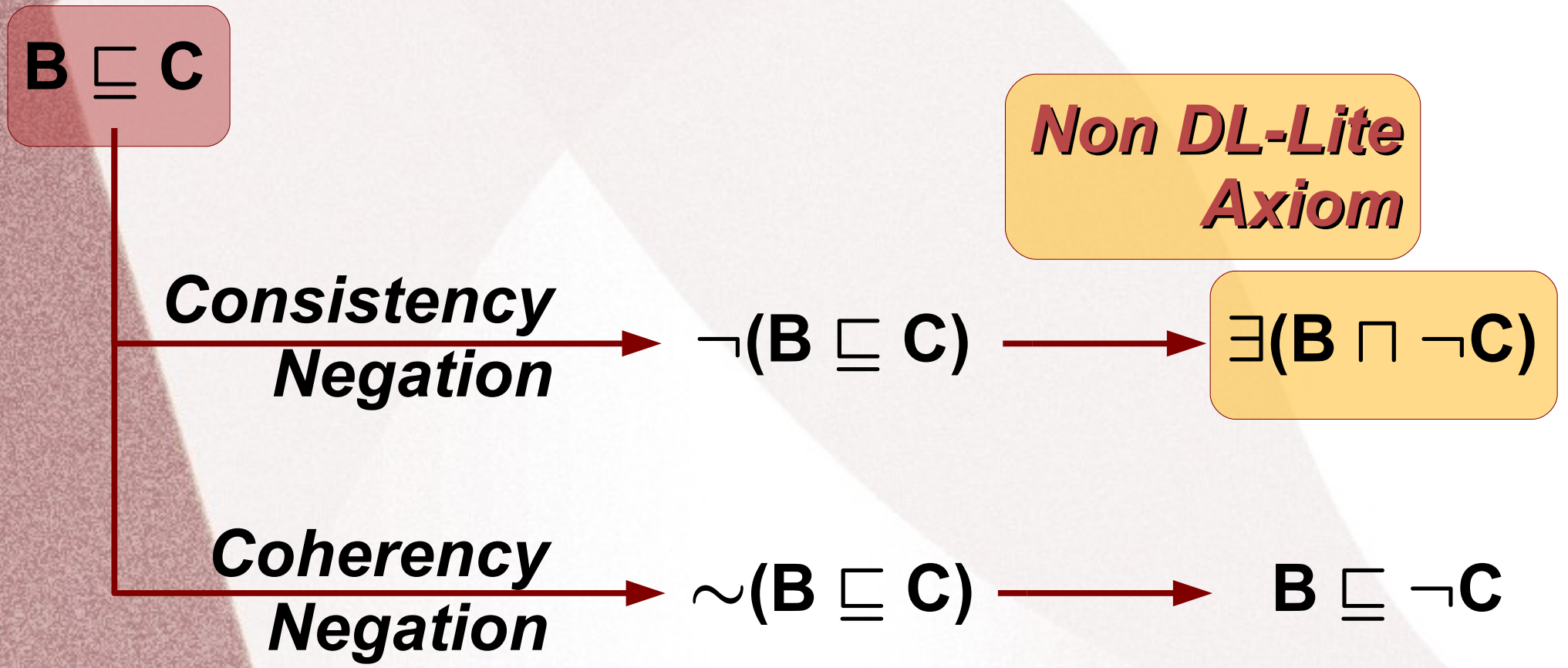
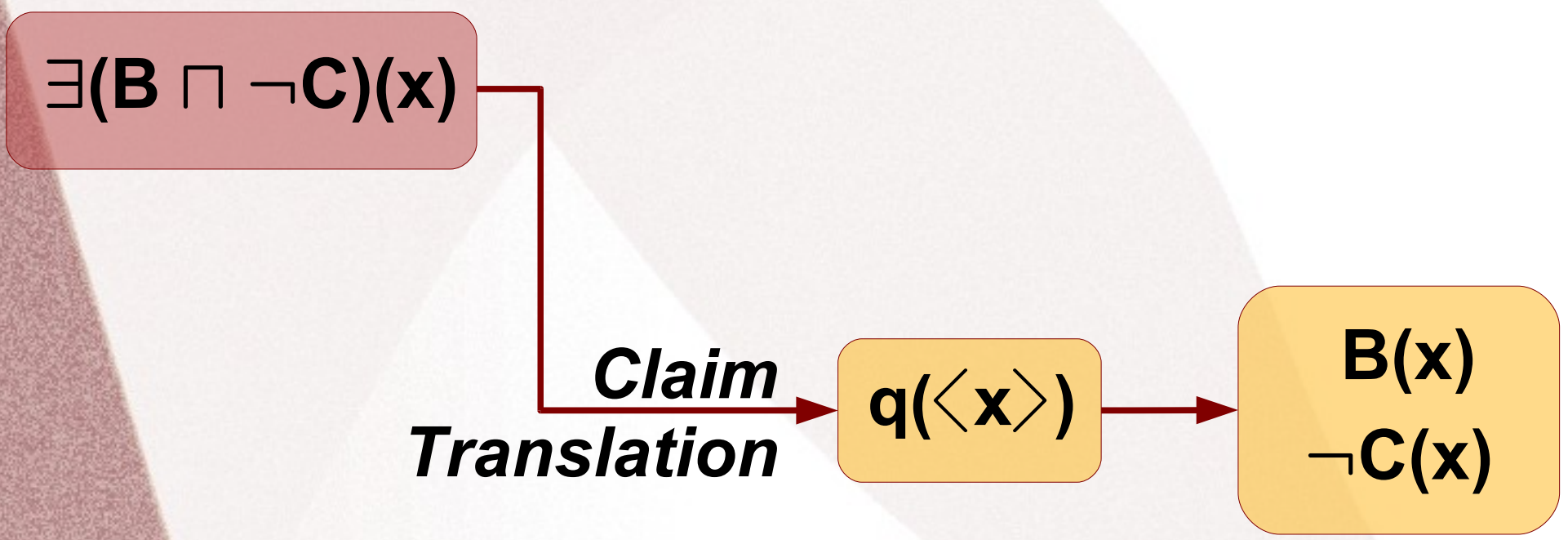


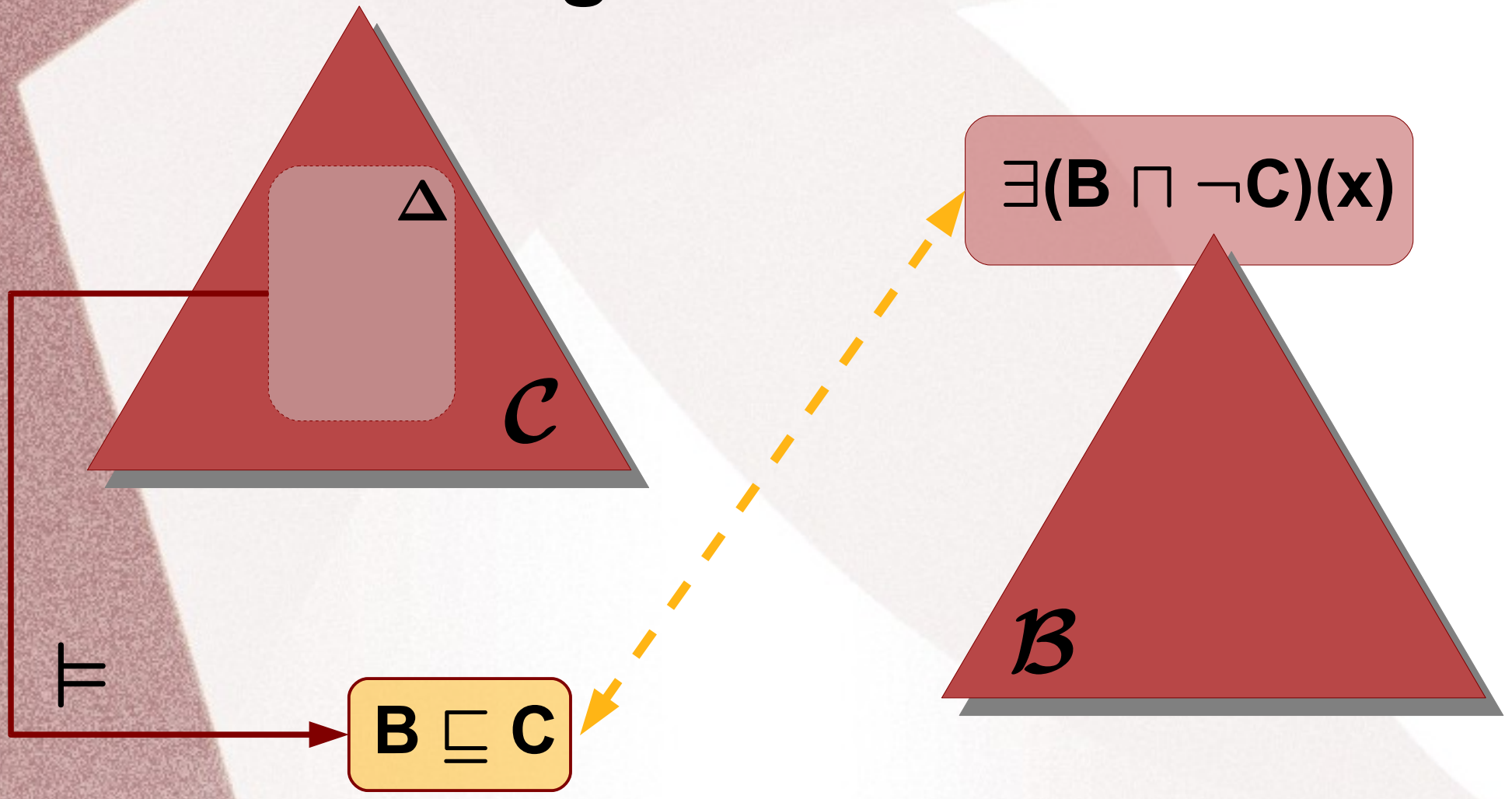
Consistency Negation

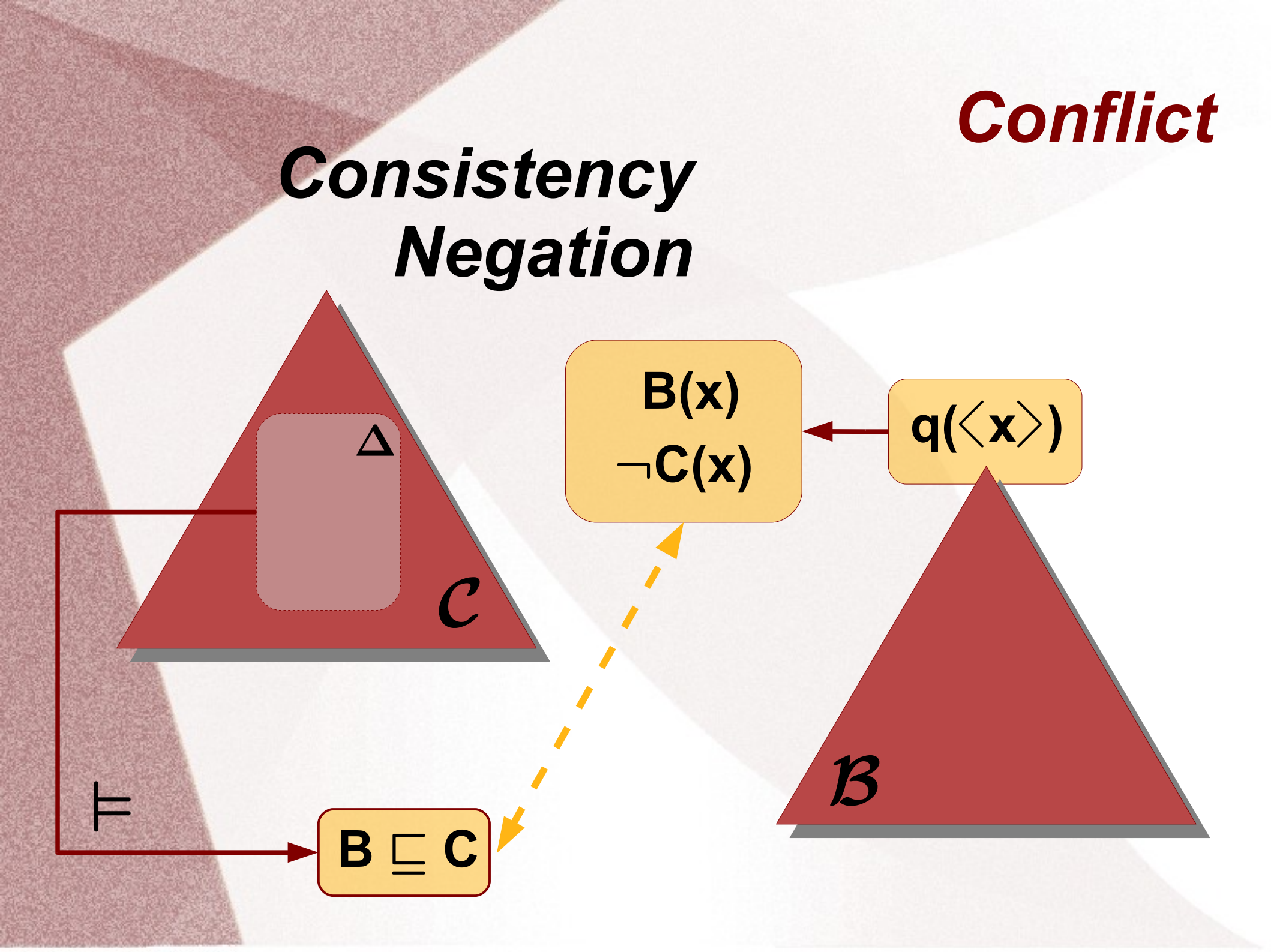
Conflict



Conflict

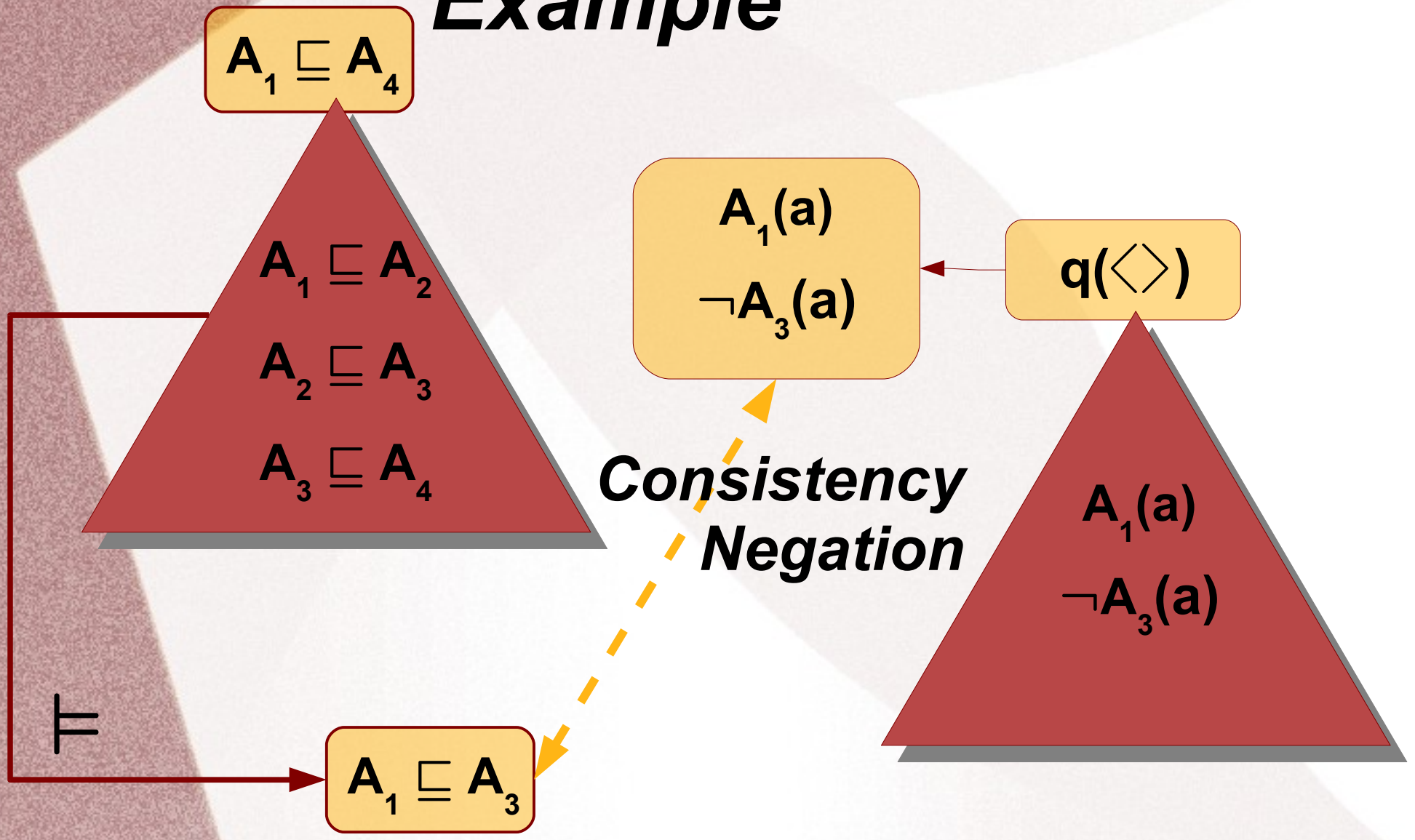
Consistency
Negation




Conflict
Consistency
Negation
B(x)
¬C(x)
q(〈x〉)
Δ
C
⊨
B ⊑ C
B

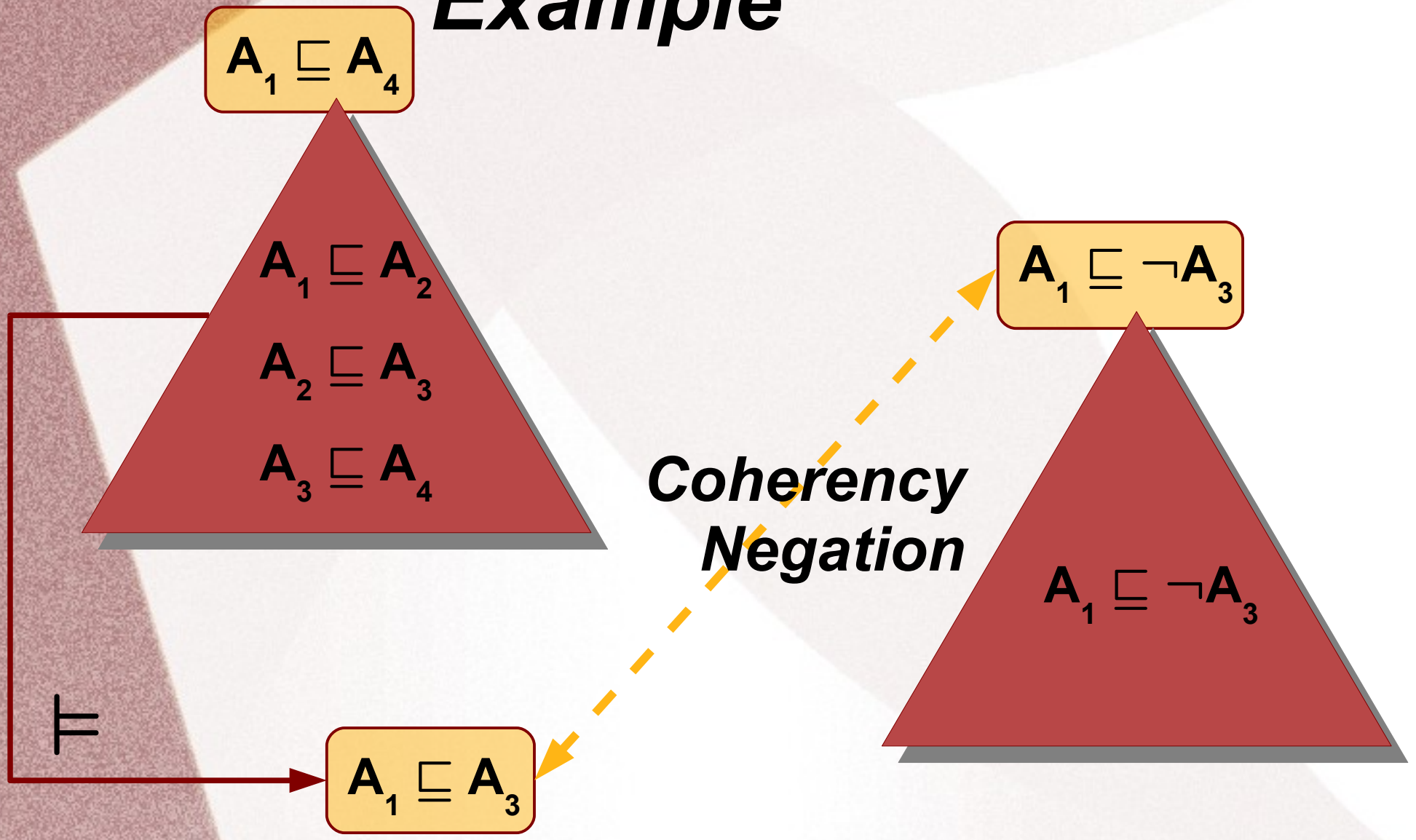
Conflict

Example



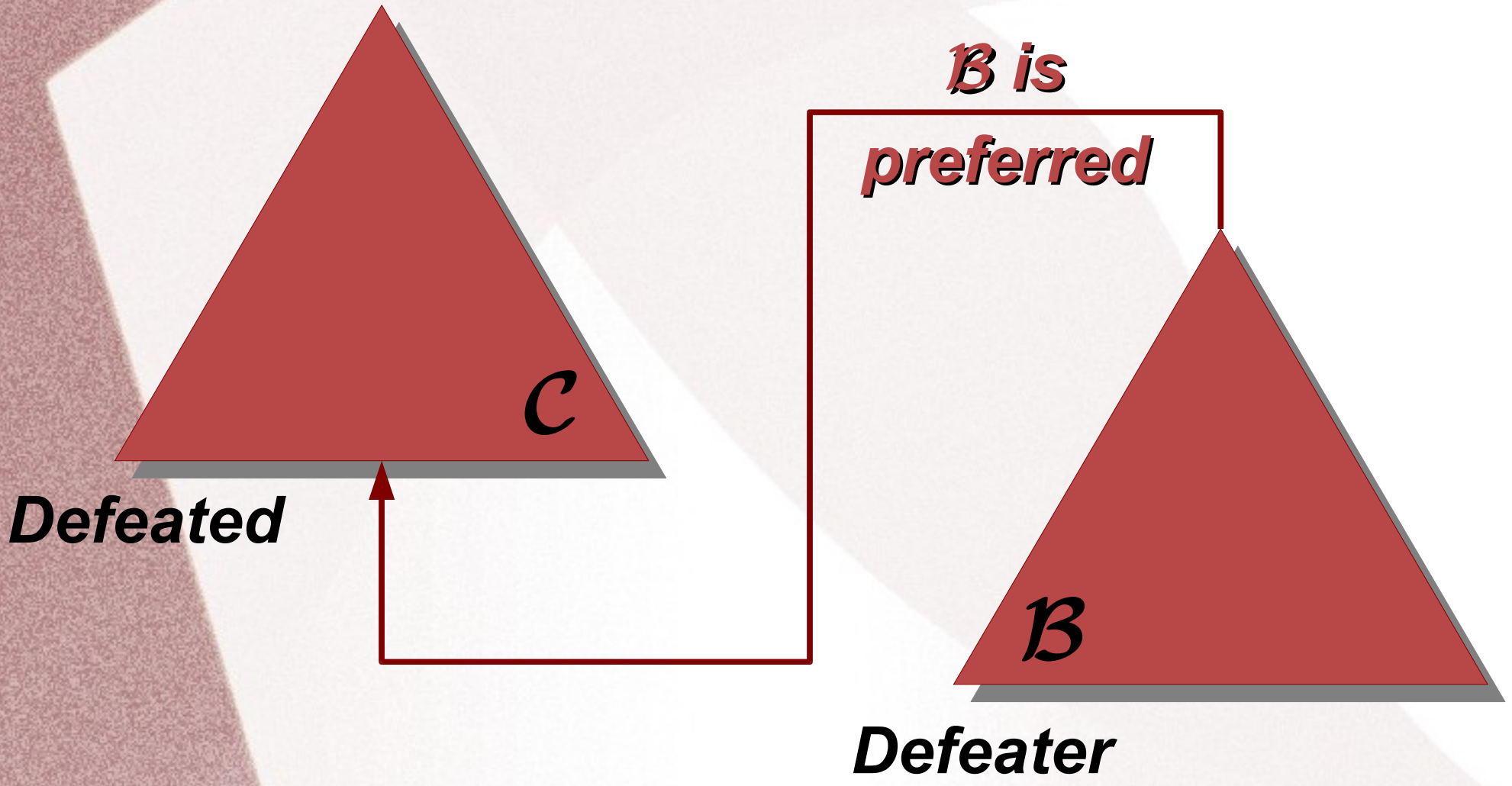
Conflict

Example



Attack

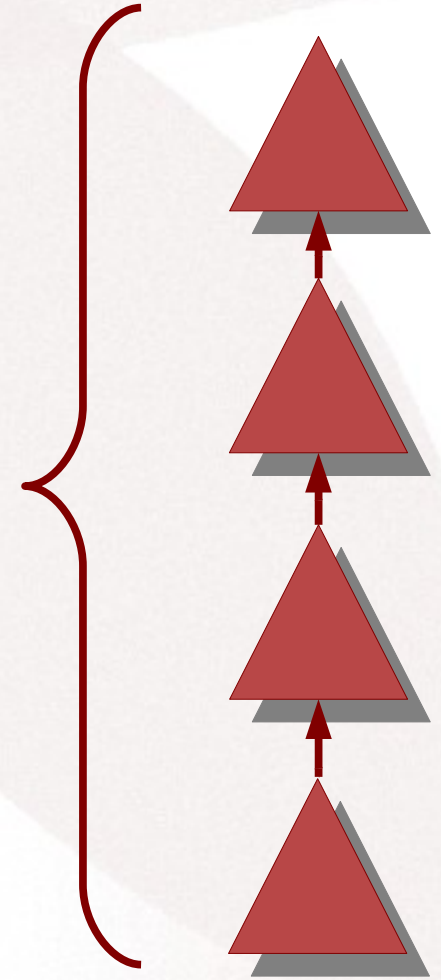
$\mathcal{B}$ counterargs $\mathcal{C}$



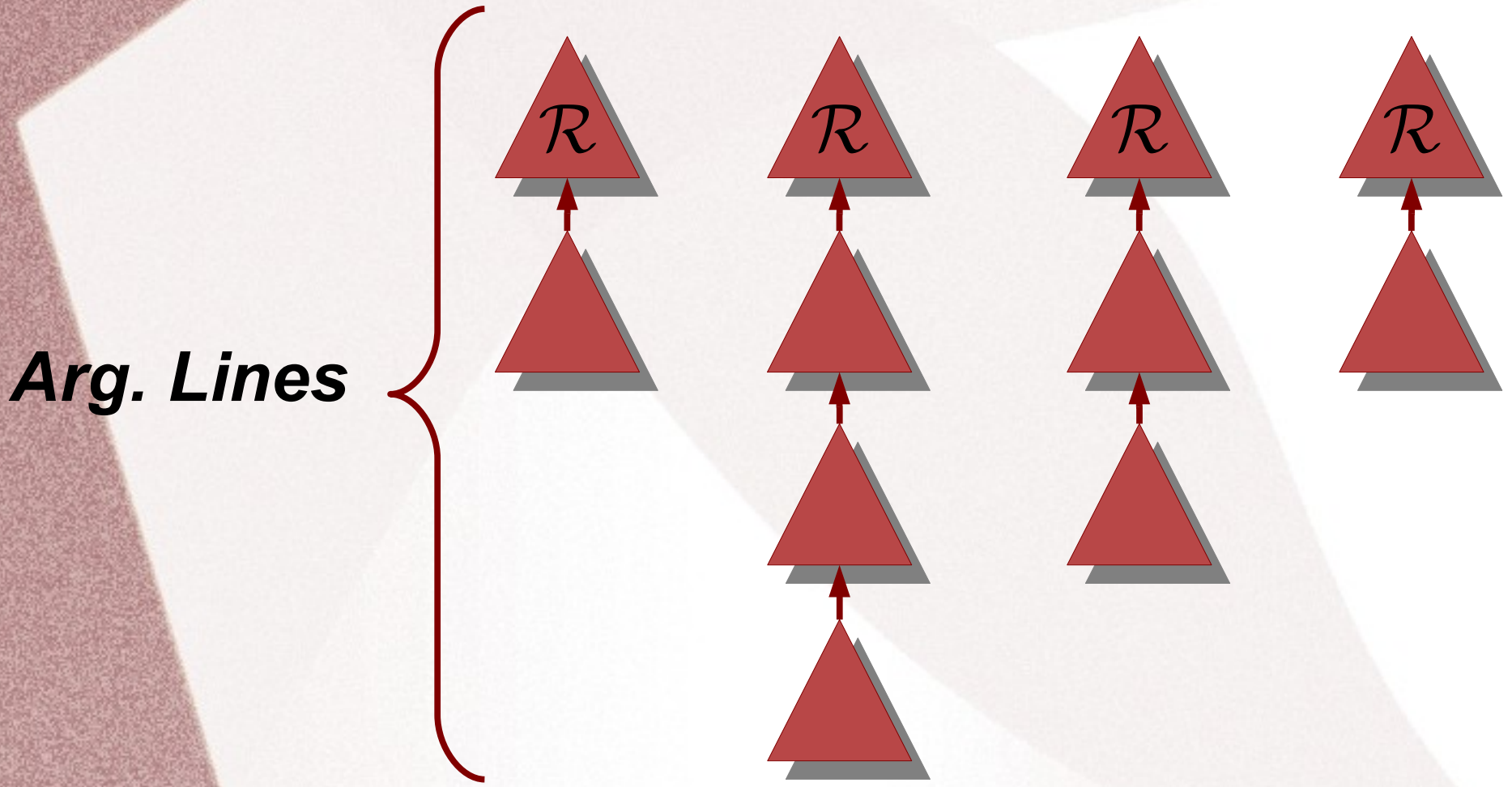
Dialectical Argumentation

Argumentation Lines

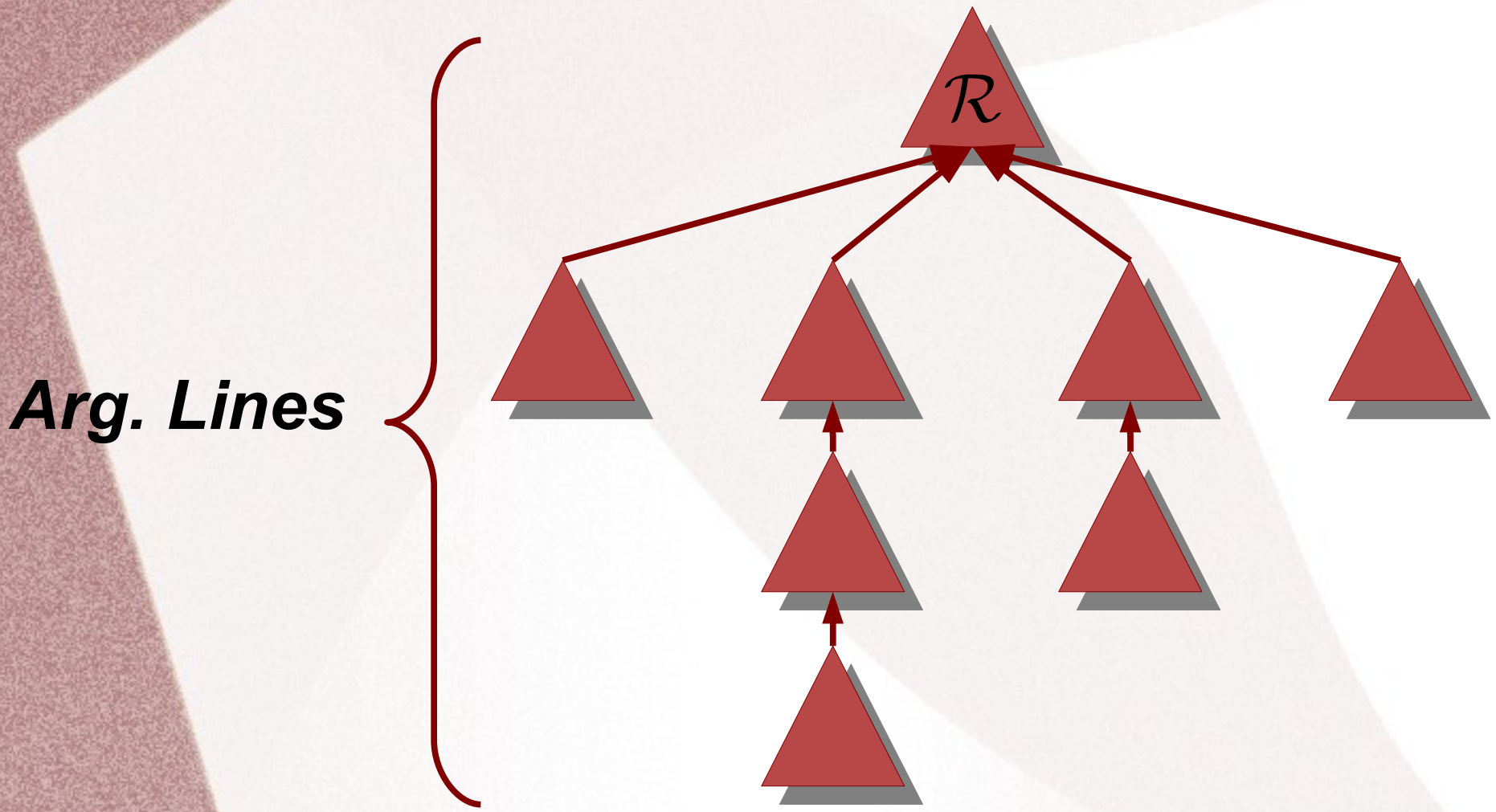
Arguments



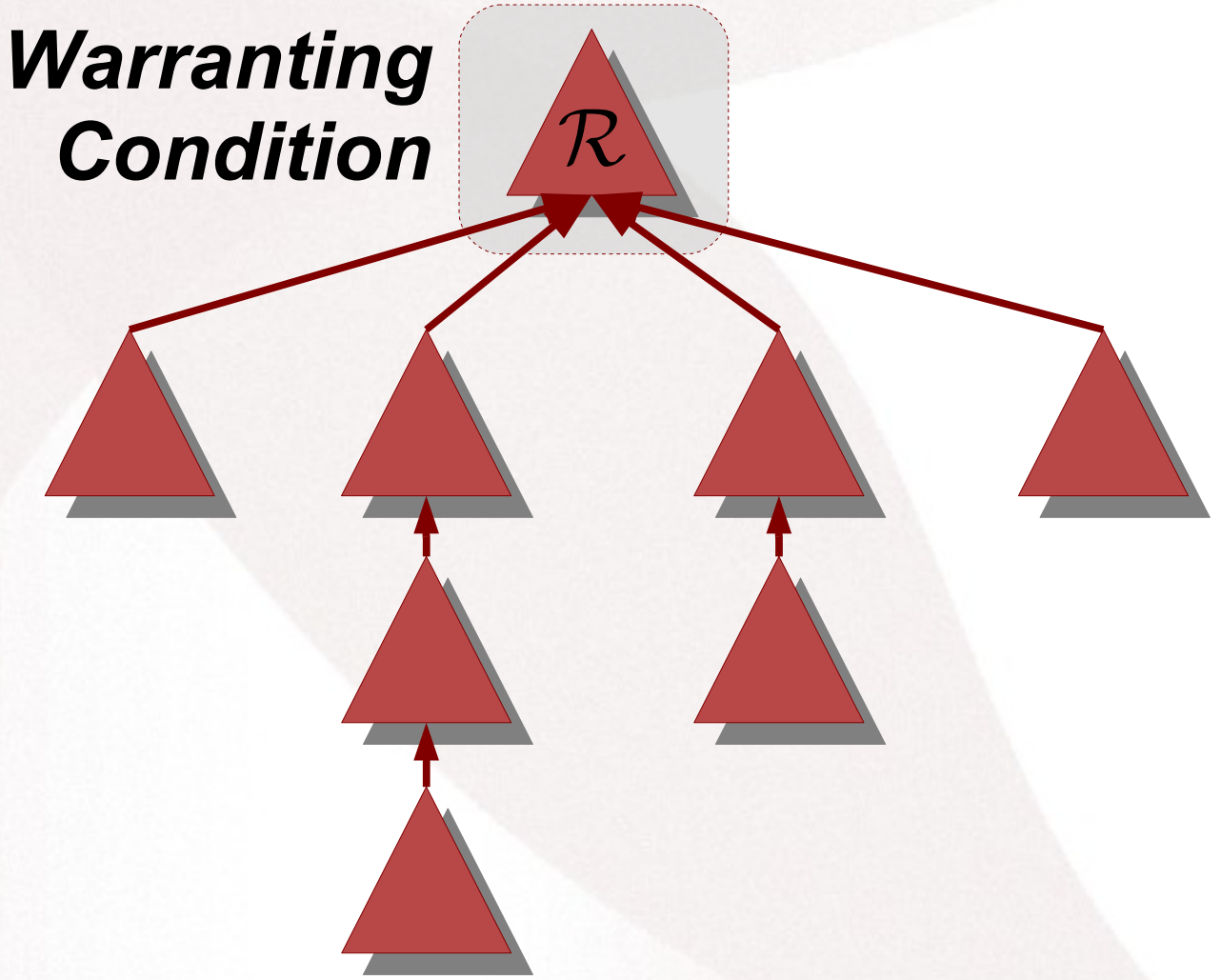
Bundle Set



Dialectical Tree

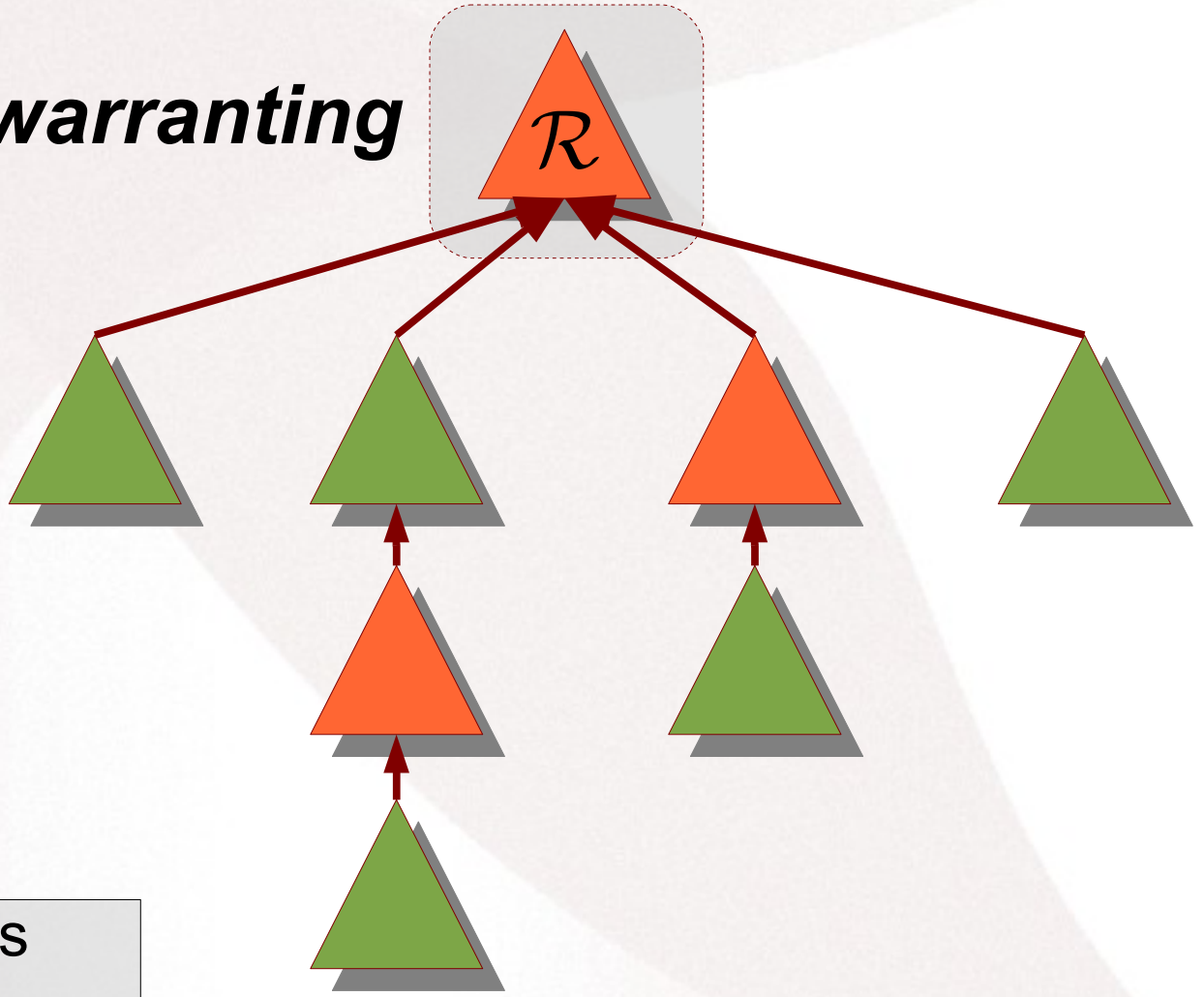


Dialectical Tree



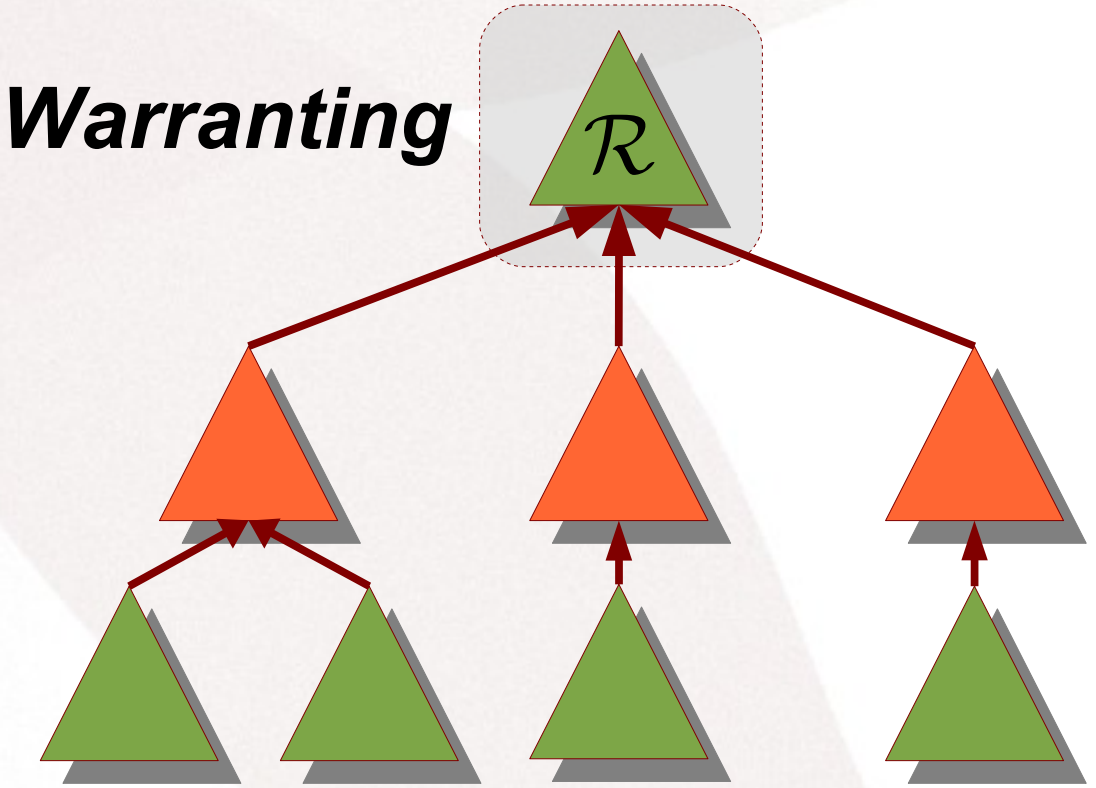
Marking Criterion

Non-warranting



Undefeated: leaves and nodes whose defeaters are defeated.

Marking Criterion



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Inconsistent-tolerant DL-Lite Reasoning

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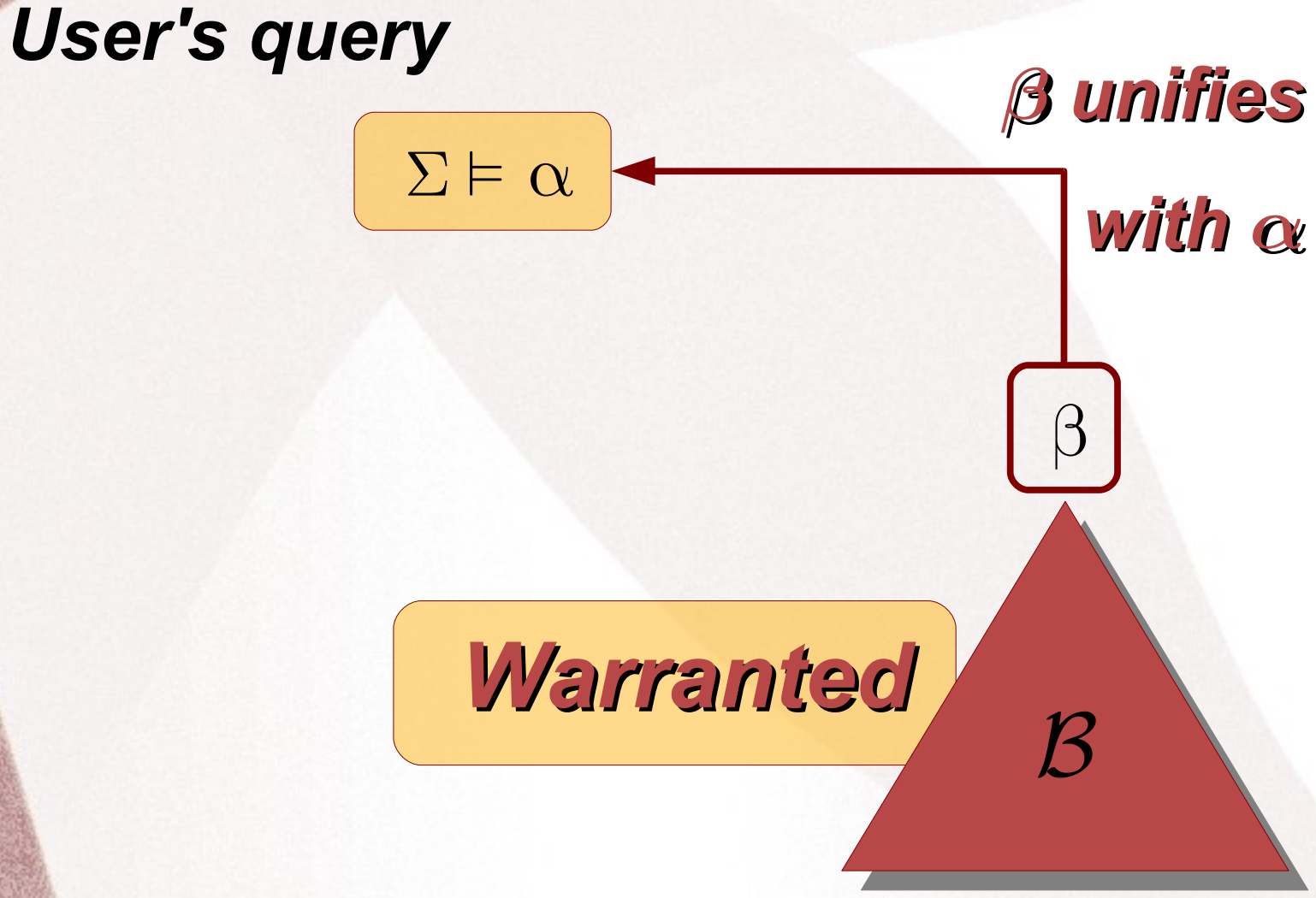


Inconsistent-tolerant DL-Lite Reasoning

$\Sigma \models \alpha$ iff there exists a warranted supporter $\mathcal{B}$.

Example

User's query

$\Sigma \models B(a)$

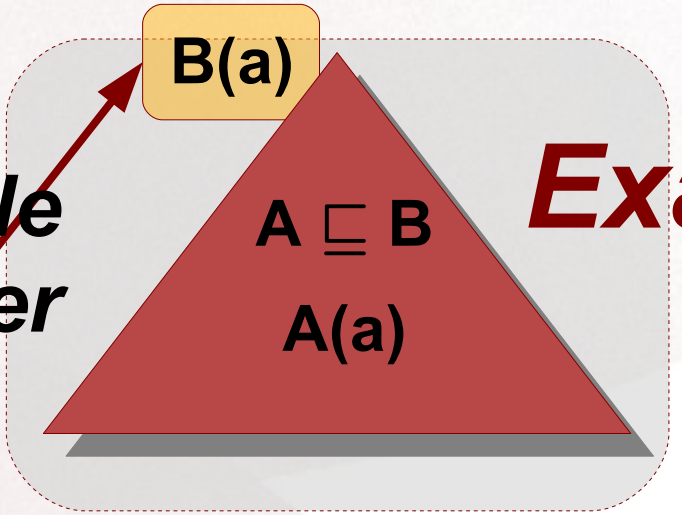
Σ

$A \sqsubseteq B$, $A \sqsubseteq C$,

$C \sqsubseteq \neg B$, $D \sqsubseteq A$,

$A(a)$, $C(b)$, $D(b)$

Example



Possible supporter

User's query

$\Sigma \models B(a)$

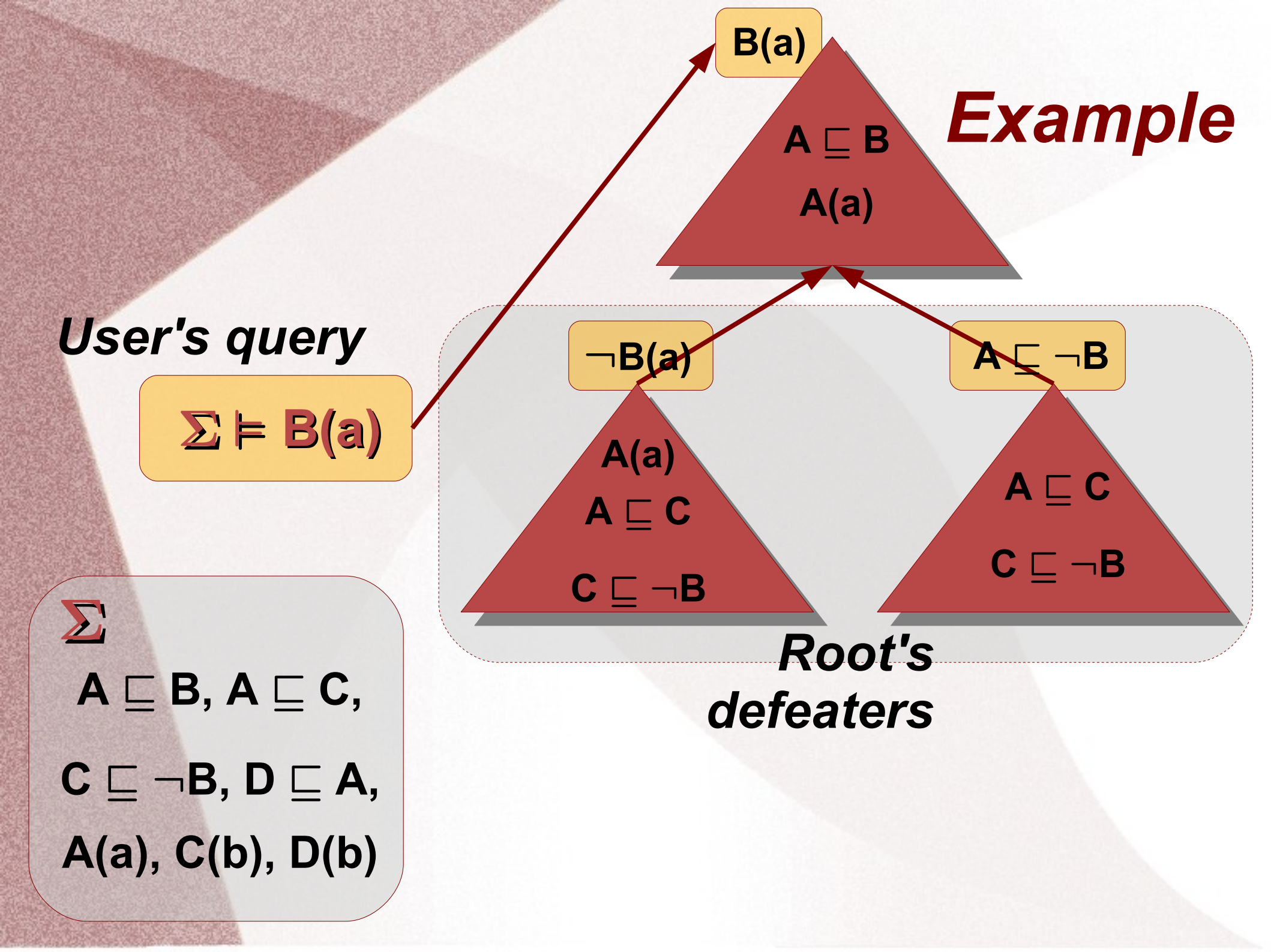
Σ

$A \sqsubseteq B,\ A \sqsubseteq C,$

$C \sqsubseteq \neg B,\ D \sqsubseteq A,$

$A(a),\ C(b),\ D(b)$

Example


B(a)
A ⊑ B
A(a)
User's query
Σ ⊨ B(a)
¬B(a)
A ⊑ ¬B
A(a)
A ⊑ C
C ⊑ ¬B
A ⊑ C
C ⊑ ¬B
Root's defeaters
Σ
A ⊑ B, A ⊑ C,
C ⊑ ¬B, D ⊑ A,
A(a), C(b), D(b)

Example

User's query

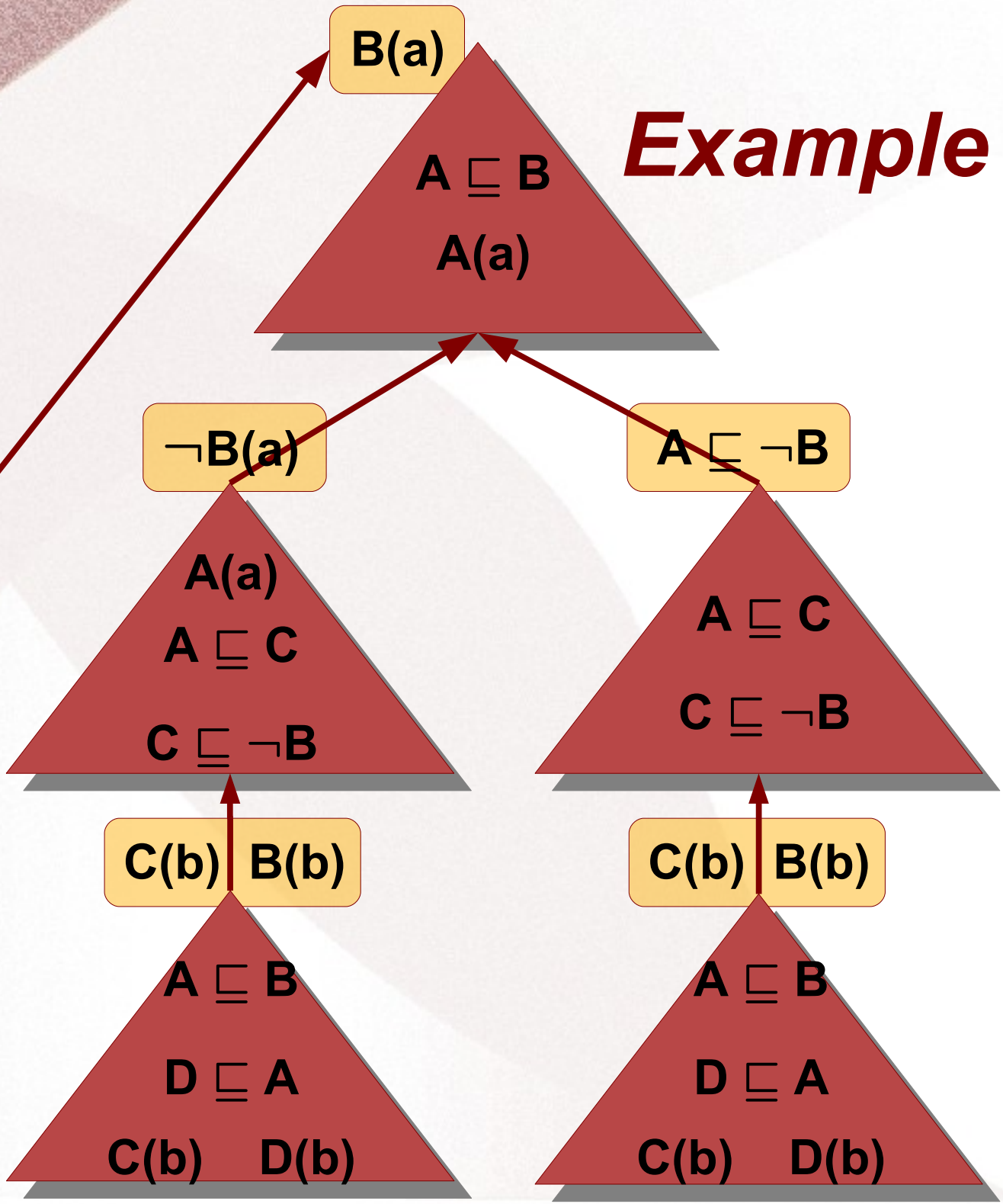
$\Sigma \models B(a)$

Σ

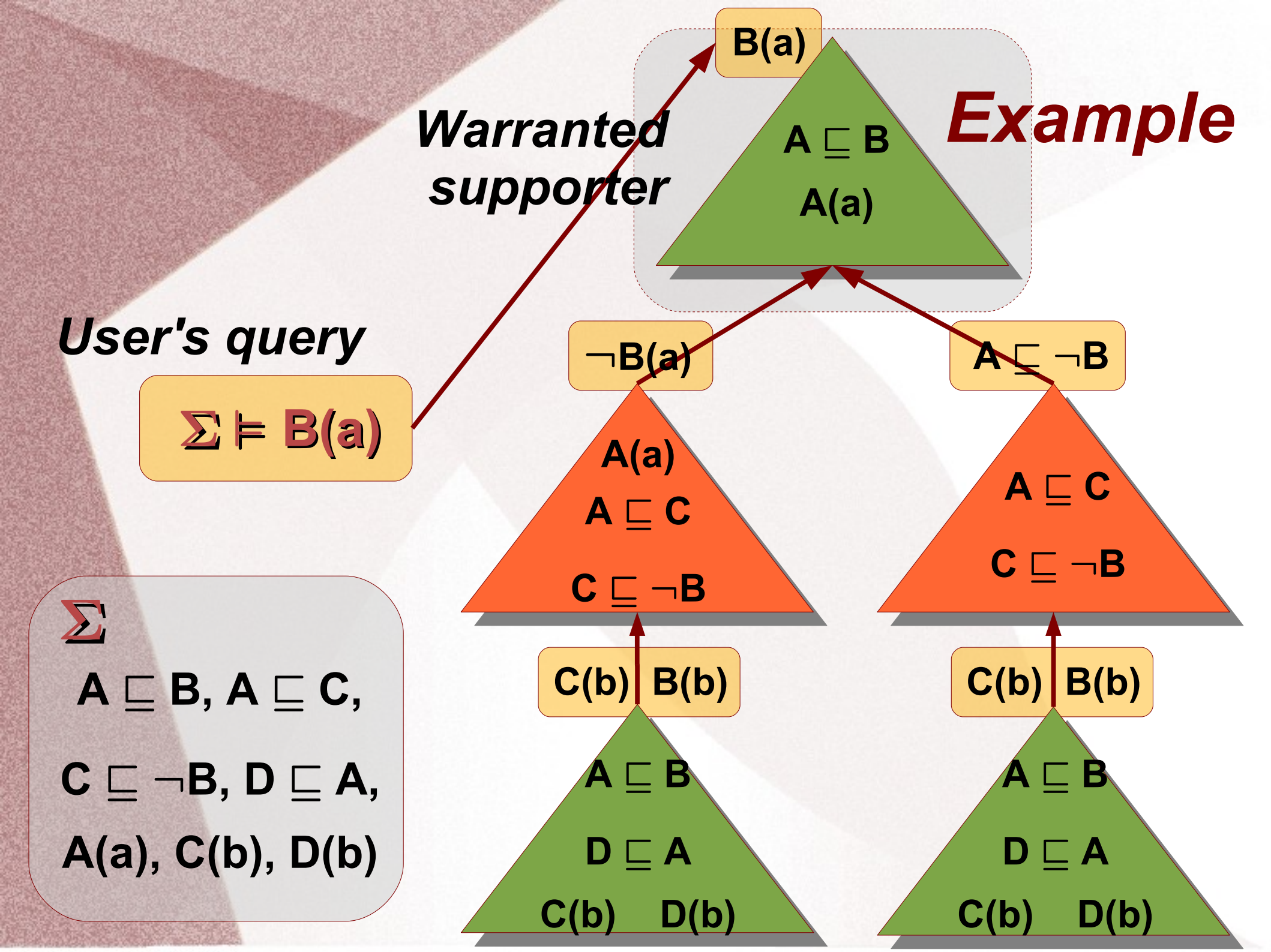
$A \sqsubseteq B,\ A \sqsubseteq C,$

$C \sqsubseteq \neg B,\ D \sqsubseteq A,$

$A(a),\ C(b),\ D(b)$



Example


Warranted supporter
User's query
$\Sigma \models B(a)$
Σ
$A \sqsubseteq B, A \sqsubseteq C,$
$C \sqsubseteq \neg B, D \sqsubseteq A,$
$A(a), C(b), D(b)$
B(a)
A ⊑ B
A(a)
¬B(a)
A ⊑ ¬B
A(a)
A ⊑ C
C ⊑ ¬B
A ⊑ C
C ⊑ ¬B
C(b) B(b)
C(b) B(b)
A ⊑ B
D ⊑ A
C(b) D(b)
A ⊑ B
D ⊑ A
C(b) D(b)

Final Remarks

Ongoing Work

- More expressive DLs may be handled with the argumentative approach.

- Ontology change may be tackled through dynamics of arguments.

  - Argument Theory Change

    In AAAI 2008
    (Moguillansky et al.)

Thank you.