

Towards a new framework for recursive interactions in abstract bipolar argumentation

Claudette Cayrol¹

Andrea Cohen²

Marie-Christine Lagasquie-Schiex¹

¹ Institut de Recherche en Informatique de Toulouse
Université de Toulouse
FRANCE



² Institute for Computer Science and Engineering
CONICET - Universidad Nacional del Sur
ARGENTINA



Introduction

- We address the issue: How can an **interaction impact another** one by **attacking** or **supporting** it?
- We identify different **features of interactions** involved in a recursion:
 - **Validity**
 - **Groundness**
 - **Activity**
- We present a new method for **flattening** the **Attack-Support Argumentation Framework (ASAF)** using **meta-arguments**.

Outline

- A new method for encoding an ASAF into a MAS
 - Unlabelled (basic) interactions
 - Labelled (recursive) interactions
- Meaning of meta-arguments in extensions of MAS
- Comparison with ASAF approach of [CGGS15]

Encoding Interactions of the ASAF

Unlabelled + Labelled

Encoding interactions of the ASAF

- We use **labels** to **reason about interactions** and determine the **impact** an interaction has on another one.
- A Labelled ASAF is a tuple $\langle A, R_{\text{att}}, R_{\text{sup}}, \mathcal{V}, \mathcal{L} \rangle$ where:
 - A is a set of arguments
 - $R_{\text{att}} \subseteq A \times (A \cup R_{\text{att}} \cup R_{\text{sup}})$ is an attack relation
 - $R_{\text{sup}} \subseteq A \times (A \cup R_{\text{att}} \cup R_{\text{sup}})$ is a necessary support relation
 - $R_{\text{att}} \cap R_{\text{sup}} = \emptyset$
 - \mathcal{V} is a set of labels (greek letters)
 - \mathcal{L} is a bijection from $R \subseteq (R_{\text{att}} \cup R_{\text{sup}})$ to \mathcal{V}

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- We distinguish between:
 - **Unlabelled interactions**: basic interactions, not involved in a recursion.
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Encoding Unlabelled Interactions

- **Basic interactions** are not related to any other interaction. They can be considered as **always valid** and do not require labels (*i.e.*, they are the **unlabelled interactions**).
- Step 1 - Unlabelled interactions in LASAF remain the same in BAS:
 - An attack $a \longrightarrow b$ in LASAF remains $a \longrightarrow b$ in BAS.
 - A support $a \Longrightarrow b$ in LASAF remains $a \Longrightarrow b$ in BAS.
- Step 2 - Unlabelled interactions in BAS are directly encoded in MAS using the flattening of [CLS15]:
 - An attack $a \longrightarrow b$ in BAS remains $a \longrightarrow b$ in MAS.
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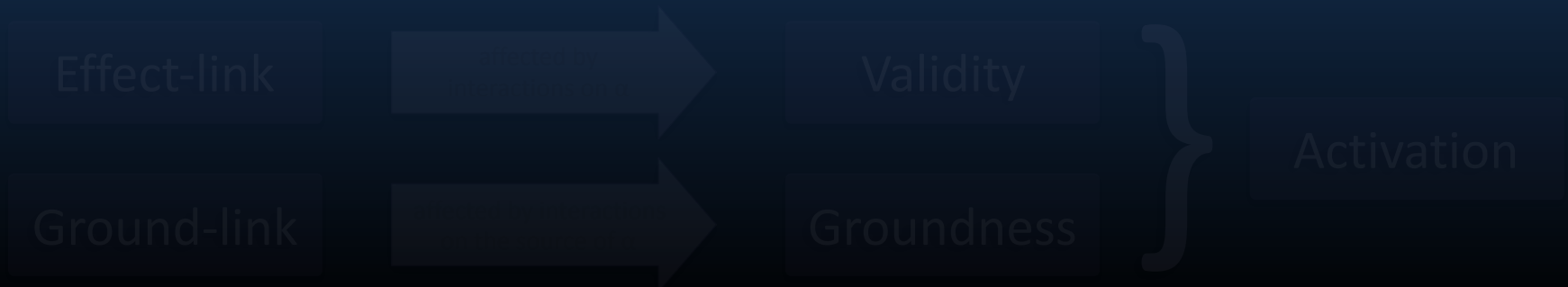
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“The acceptance of a is necessary to get the acceptance of b ” because “ a is the only attacker of a particular attacker of b ”

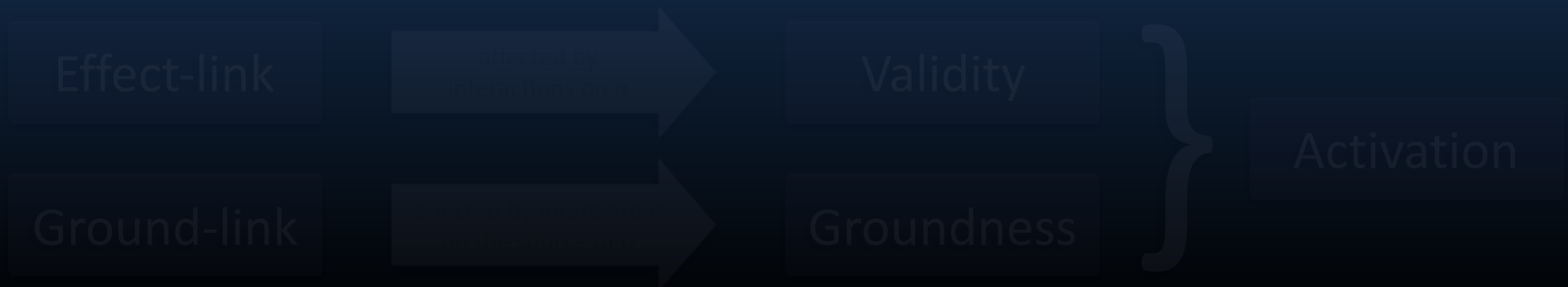
Encoding Labelled Interactions

- An **interaction** that is **attacked/supported** (respectively, that **attacks/supports** another interaction) must be **labelled** and its **label** is used as a **meta-argument**.
- A labelled interaction $\alpha = (a, b)$ encompasses two links:
 - Effect-link: relates α to b , representing the role of α (attack or support).
 - Ground-link: relates a to α , representing the grounding of α .
- This suggests two kinds of “validity” for labelled interactions:



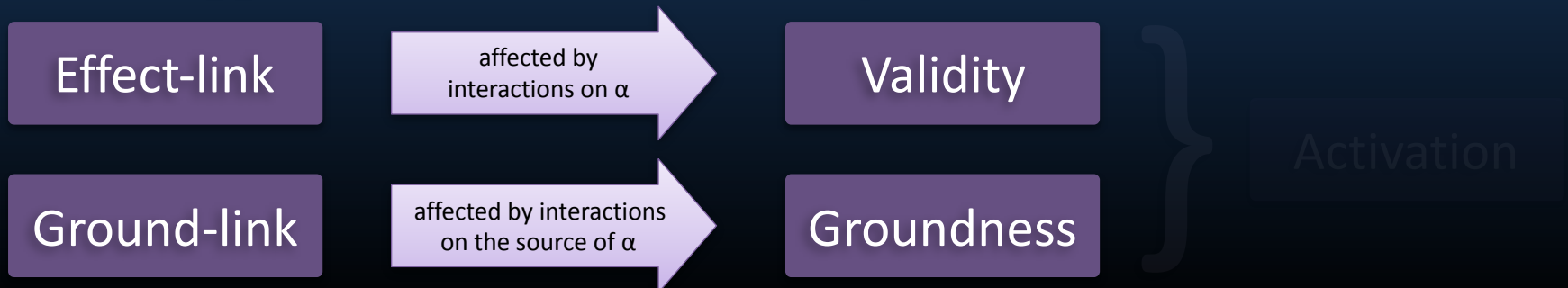
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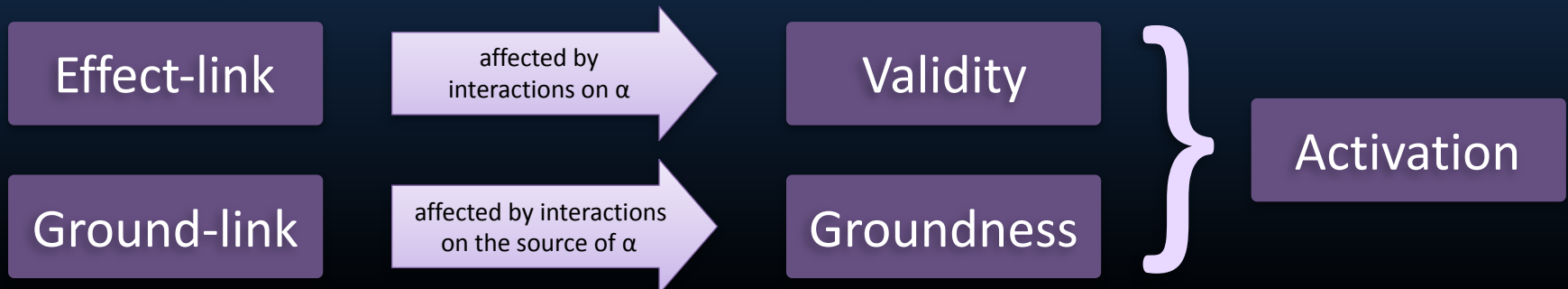
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Encoding Labelled Interactions

- **Step 1** - To encode a **labelled interaction** $\alpha = (a,b)$ in LASAF we need to encode the **effect-link** and the **ground-link** in the **associated BAS**:

- The effect-link is represented in BAS by:

$$\alpha \longrightarrow b \text{ (}\alpha \text{ is an attack)}$$

$$\alpha \Longrightarrow b \text{ (}\alpha \text{ is a support)}$$

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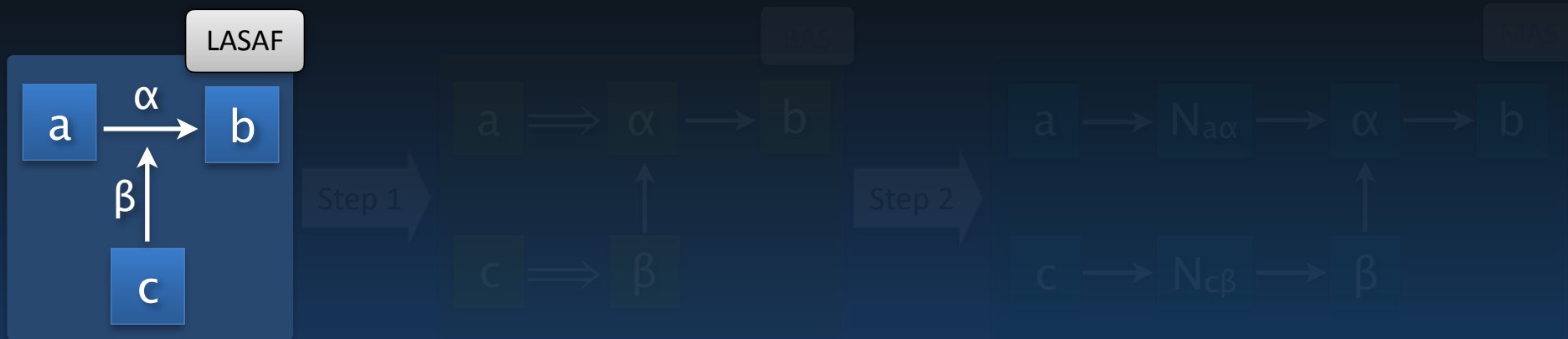
- **Step 2.1 - Attacks and supports** in BAS are **encoded in MAS** using the flattening of [CLS15].
- Step 2.2 - Additional attacks are included in MAS to capture the impact an interaction has on the validity of another one.
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Encoding Labelled Interactions - Attack to Attack

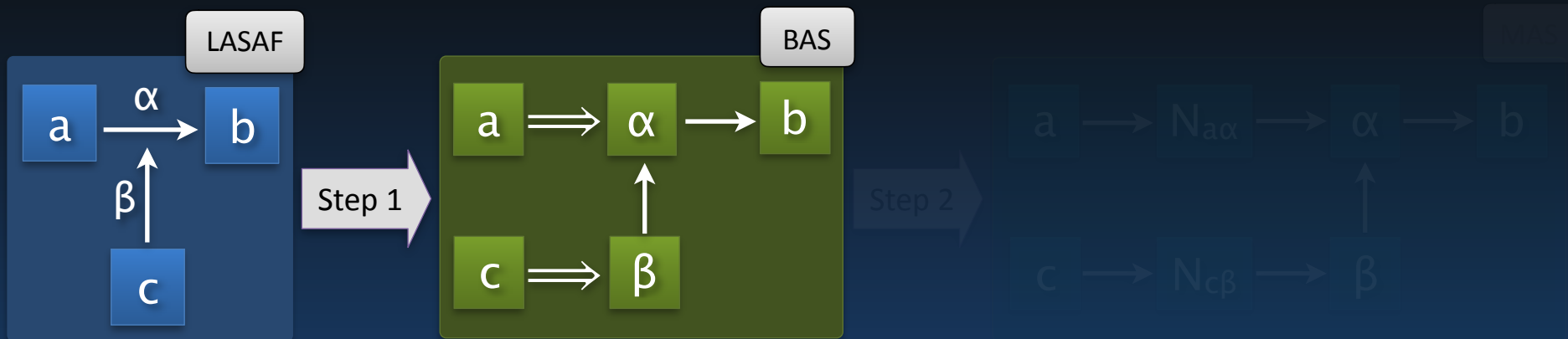
- Let $\alpha = (a, b)$ and $\beta = (c, \alpha)$ be two attacks in LASAF:



If β is active (grounded and valid)
then α is not valid nor active

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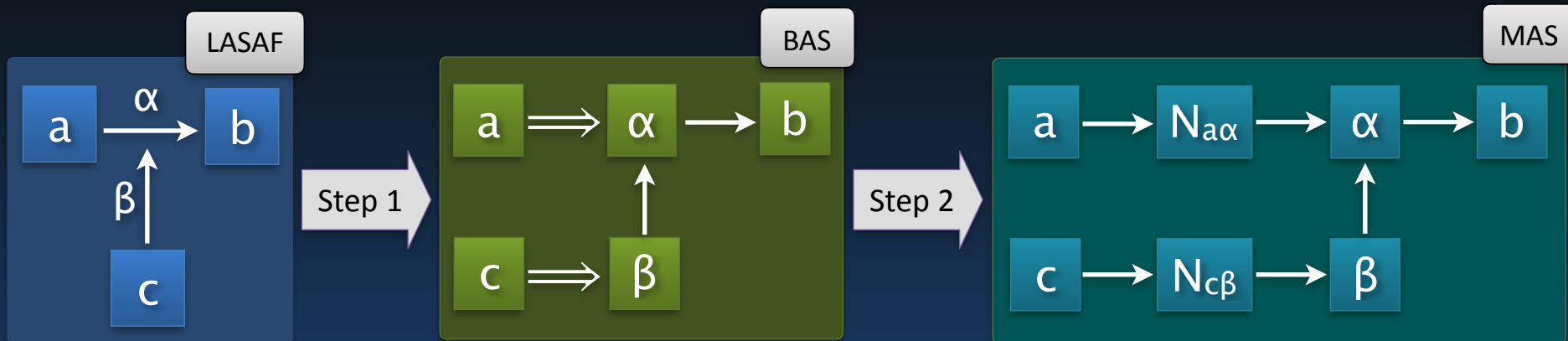
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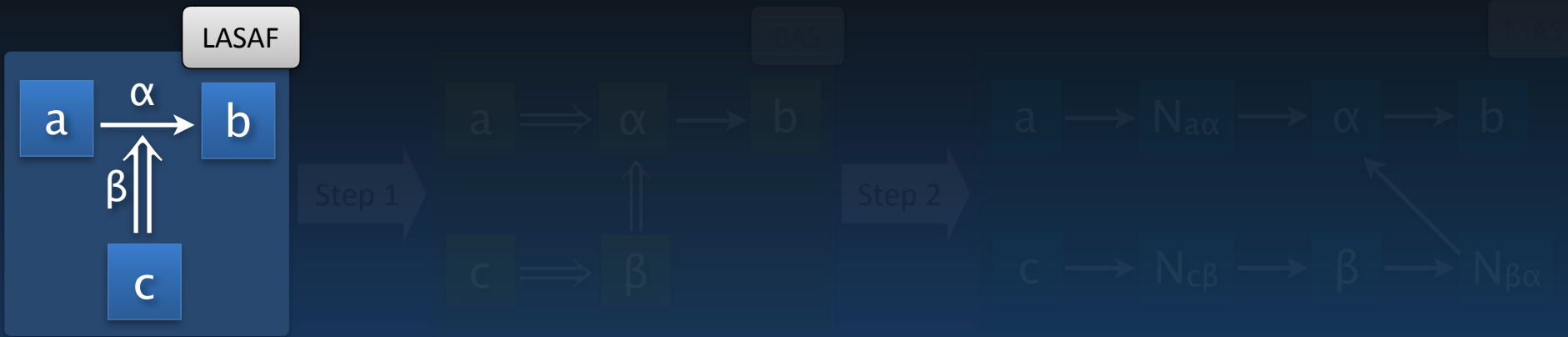
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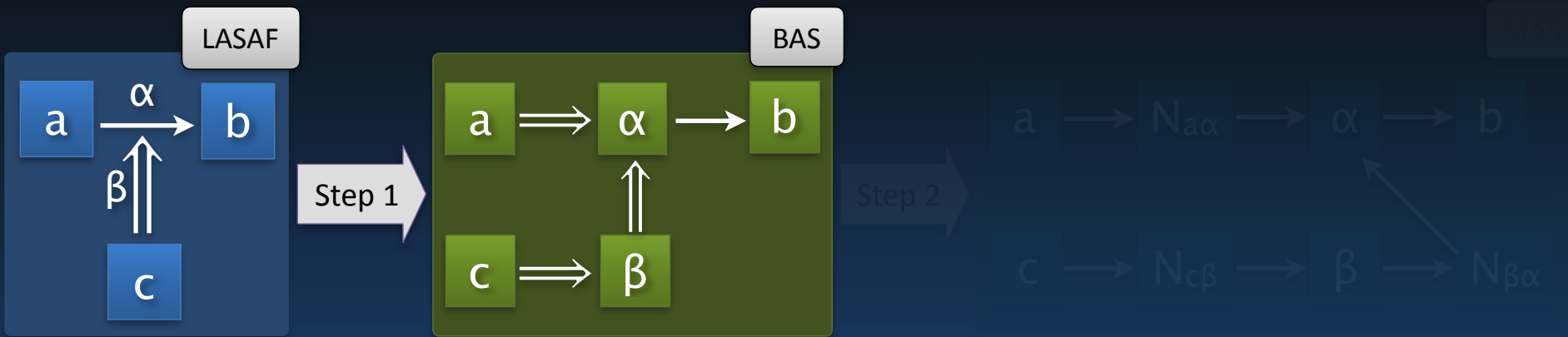
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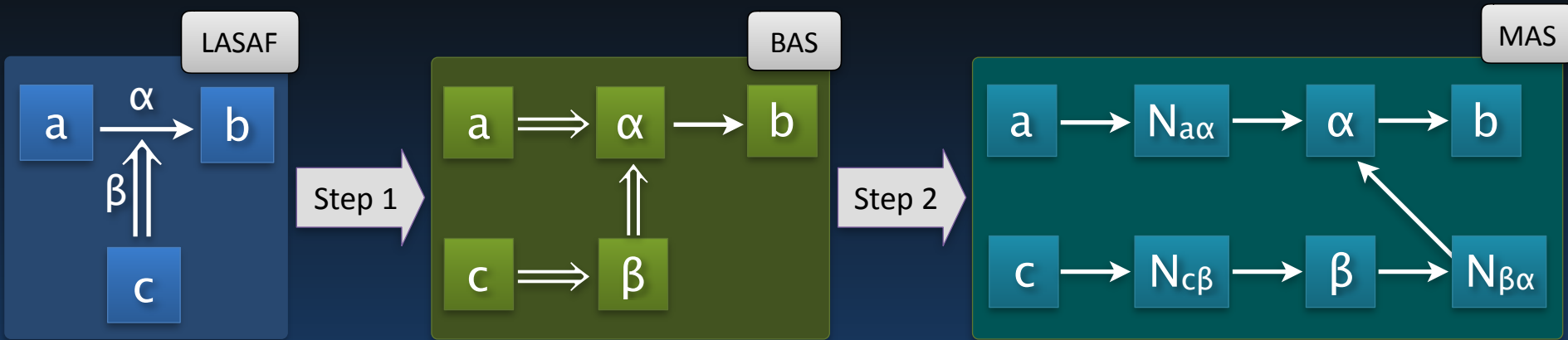
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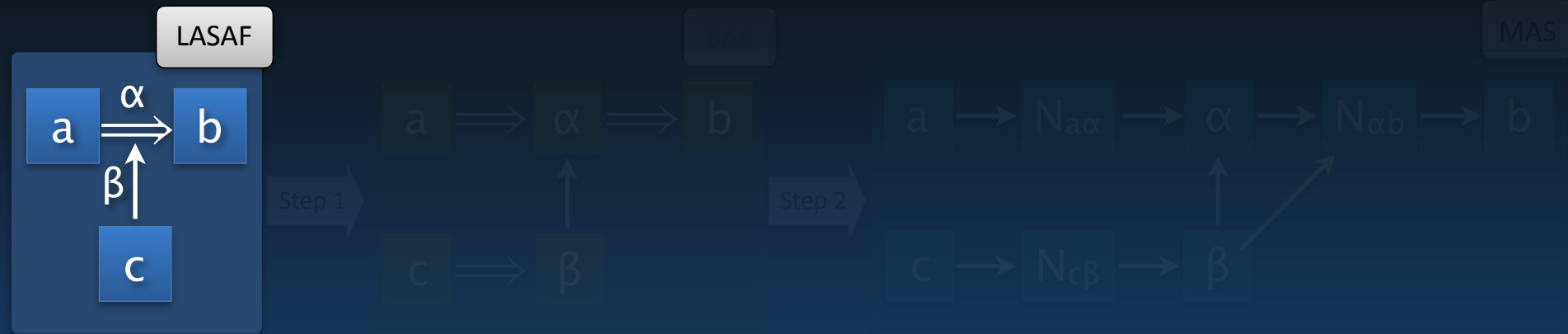
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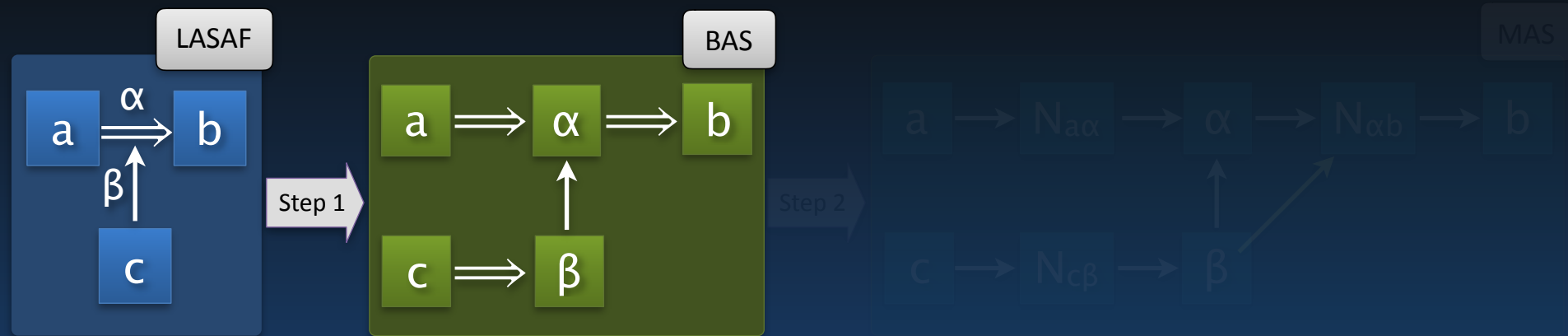
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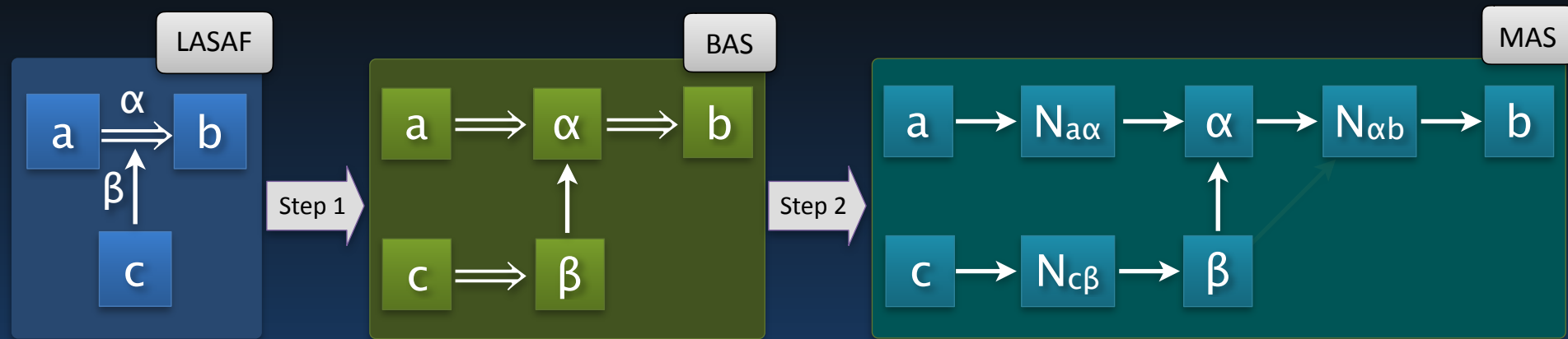
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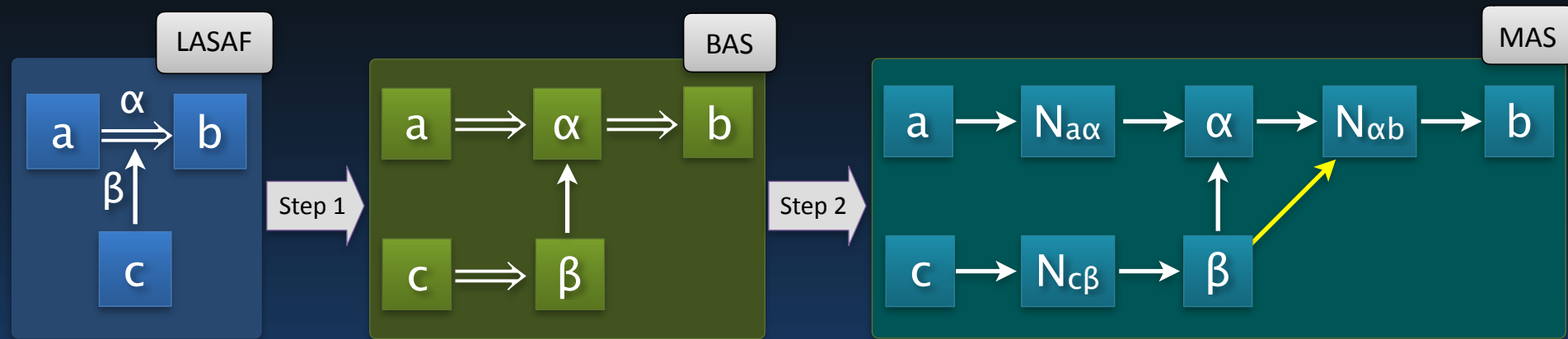
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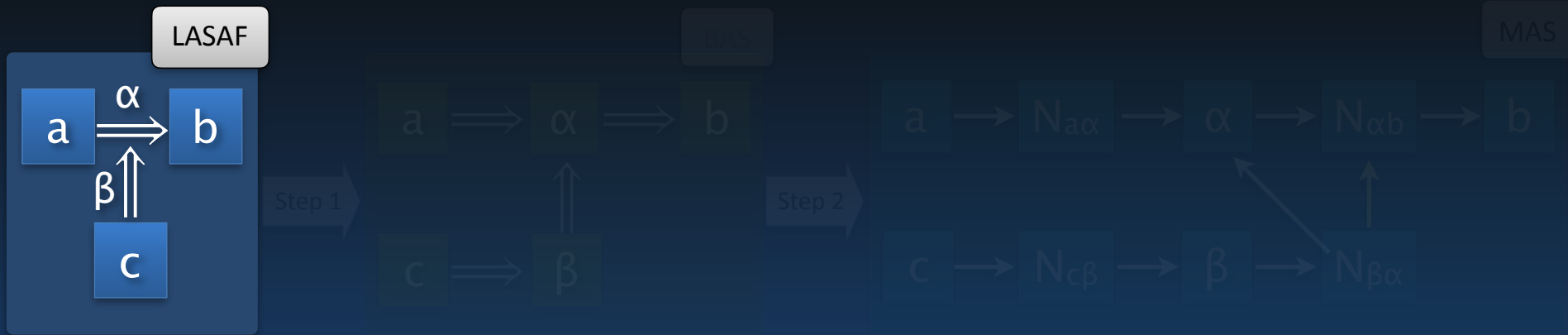
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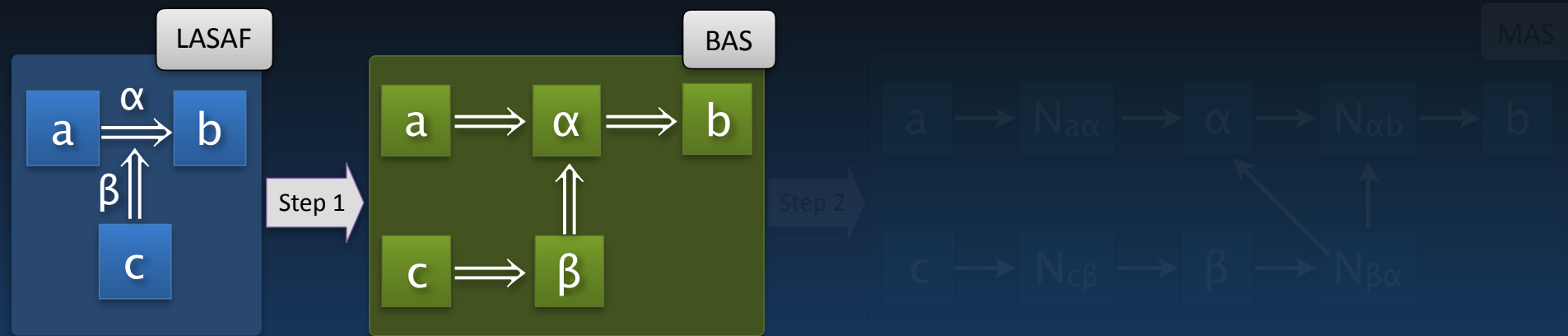
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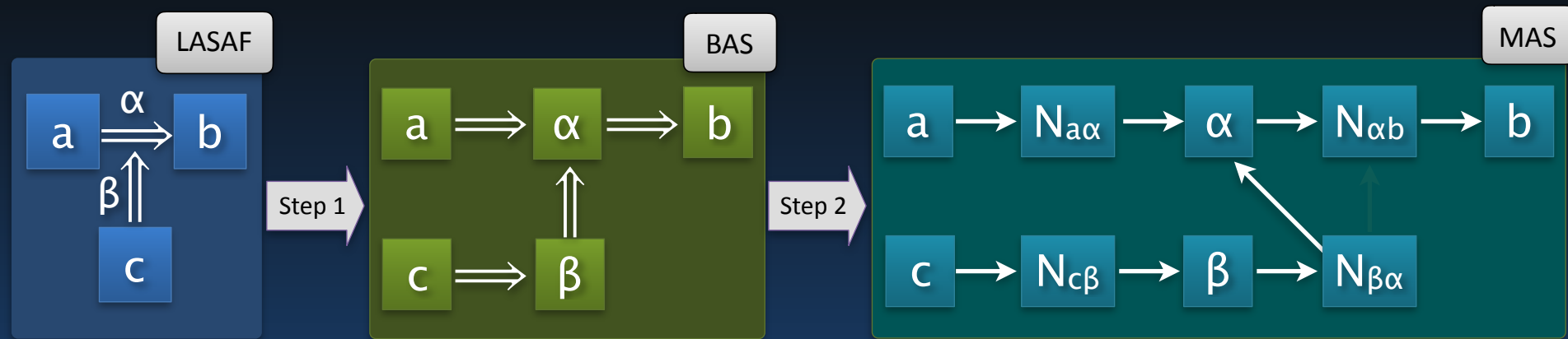
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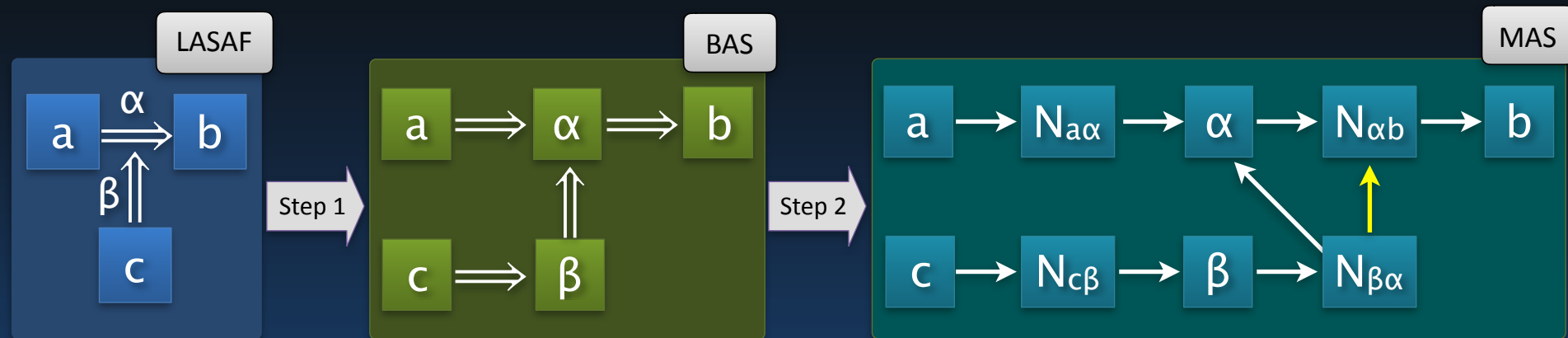
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*Comparing the MAS with
the ASAF translation of [CGGS15]*

Similarities - MAS and ASAF approaches

- Both approaches follow a **2-Step process** in the **translation** of an ASAF.
- The first step of the transformation in both approaches produces a BAS.
- Both approaches encode attacks in the same way, by introducing meta-arguments associated with the attack.

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Differences - MAS and ASAF approaches

- Encoding supports:

- MAS approach → All supports (in the ASAF or in the associated BAS) are translated by introducing meta-arguments.
- ASAF approach → Supports in the ASAF are translated by introducing meta-arguments. Supports in the associated BAS are modeled through extended attacks.

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- Meaning ascribed to the presence of interactions (labels) in the extensions:
 - MAS approach \longrightarrow If an attack or a support α belongs to an extension, then it means that the interaction α is active.
 - ASAF approach \longrightarrow If an attack α belongs to an extension, then it means that the attack α is active.
If a support β belongs to an extension, then it means that the support β is valid.

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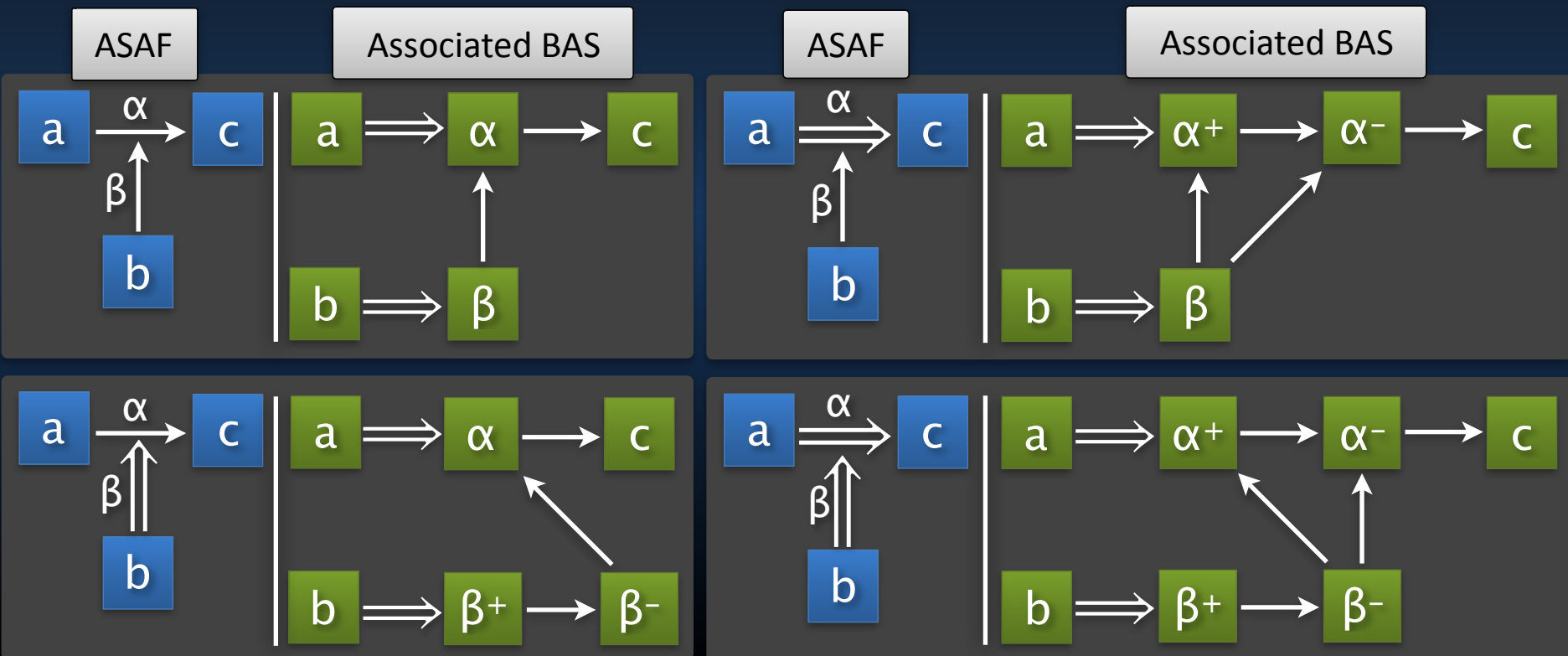
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Thank You!

Questions?

ASAF - Translation

- In [CGGS15] a **translation** from an **ASAF** into a Dung's **AS** following a **two-step process**.
- Step 1** transforms the **ASAF** into a **BAS** with necessary support:



ASAF - Translation

- **Step 2** transforms the associated **BAS** with necessary support into a **Dung's AS** through the **addition of extended attacks**.
- Let $BAS = \langle A, R_{att}, R_{sup} \rangle$ be the BAS associated with ASAF. The pair $AS' = \langle A', R' \rangle$, where $A' = A$ and $R' = R_{att} \cup \{(a, b) \mid \text{there is a sequence } a_1 R_{att} a_2 R_{sup} \dots R_{sup} a_n, n \geq 3, \text{ with } a_1 = a, a_n = b\}$ is the **AS associated with BAS and ASAF**.
- Example:

