

## **Image Interpretation as Configuration**

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## **Image interpretation as a configuration problem**

**What is a configuration problem?**

**Construct an aggregate (a configuration) given**

- **generic descriptions of parts**
- **compatibility constraints between parts**
- **a concrete task description**

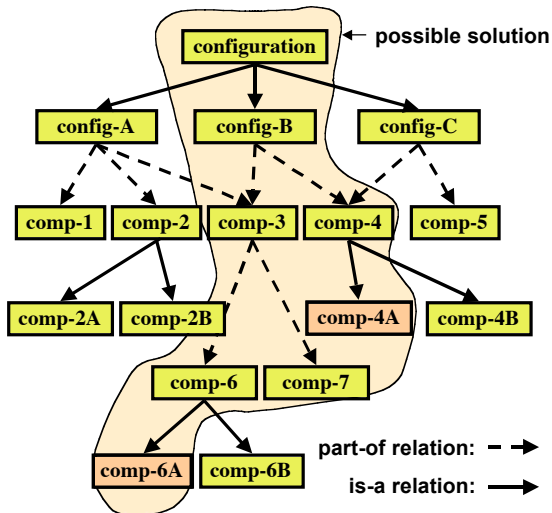
**Image interpretation may be viewed as constructing a "scene aggregate" which**

- **meets generic constraints and**
- **incorporates parts prescribed by the concrete task**

**Methods and tools of configuration technology may be exploited**

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## Illustration of configuration



- boxes (frames) specify aggregate and component properties
- has-part relations bind components to aggregates
- is-a relations describe variants of entities
- constraints between entities (not shown) restrict choices and parameter combinations

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## A Real Configuration Task



Placement of cabin equipment (seats, kitchens, toilets, etc.) in view of

- customer wishes
- technical constraints
- legal constraints
- optimality criteria

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## Example of Concept Definition in KONWERK

Concept "galley" describes service station in Airbus A340

```
def-concept
:name galley
:super-concept {cabin-interior-component rectangle}
:parameters
  ref-nr [integer 2531000 2533999]
  door {1 2 4}
  trolleys {0 2 3 4 5 6 7 8 9 10}
  half-size-trolleys {0 1 2 3 4 5}
  meals [integer 28 140]
  type {longitudinal transversal}
  height {full half} (default 'full)
:relations
  part-of [passenger-class]
```

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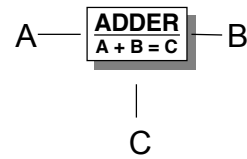
## Representation Language of KONWERK

- Language constructs can be mapped to logical constructs of a description logic by using:
  - Conjunction
  - Negation and disjunction with atomic concepts
  - Value restrictions
  - Qualifying number restrictions
  - Inverse roles
  - Sets
  - Concrete domains over R

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## Constraint-based configuration

- **Constraints represent relations between parameters or concepts**
- **Constraints are multi-directional**
- **Generating a constraint network (system of equations)**
- Consistency **check for value settings**
- **Restricting value ranges by propagation**
- **Computing all solutions by using constraint-satisfaction technologies**
- Incrementally increasing **constraint net**



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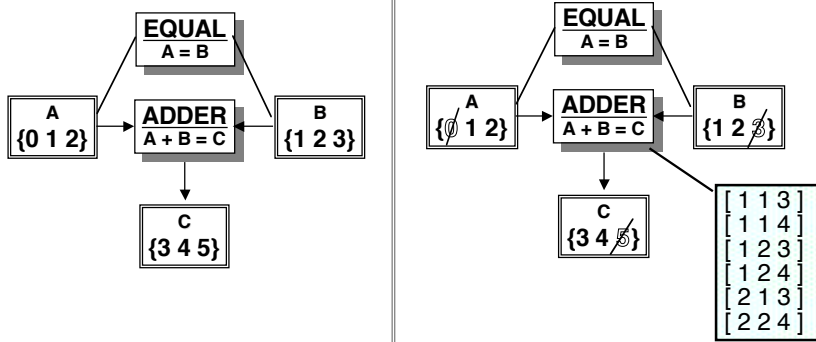
## Constraints in KONWERK

- ◆ **Constraint relations**
  - Predefined or definable
  - extensional or intensional description of the relation
- ◆ **Conceptual constraints**
  - Descriptive selection of concept parameters
- ◆ **Constraint net**
  - Internal, automatic management

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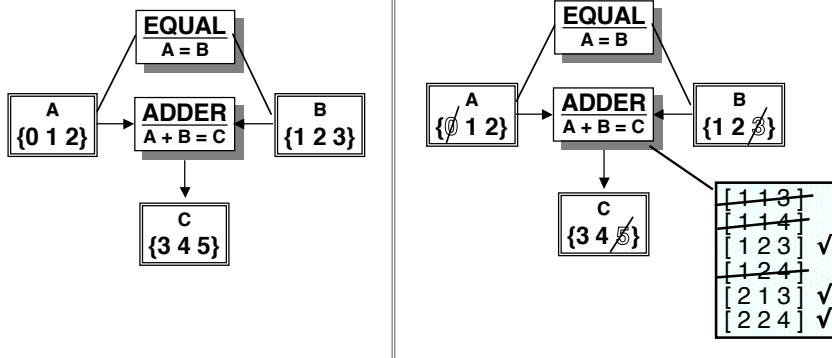
## Constraint Propagation (1)

Constraint propagation ensures local consistency



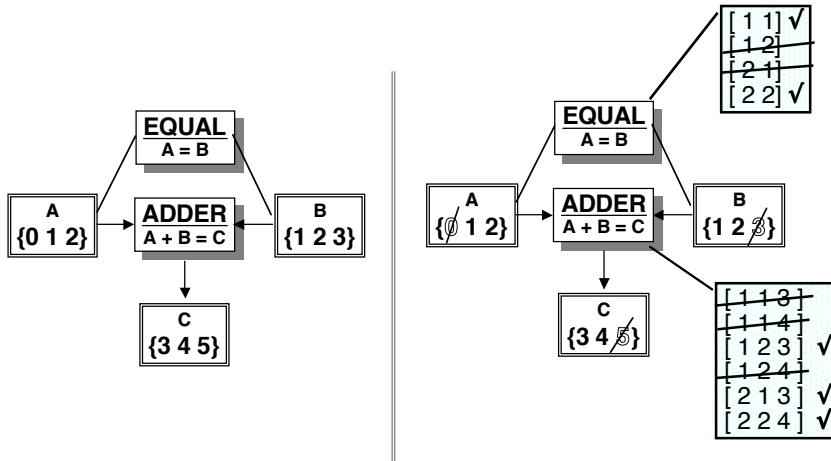
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## Constraint Propagation (2)



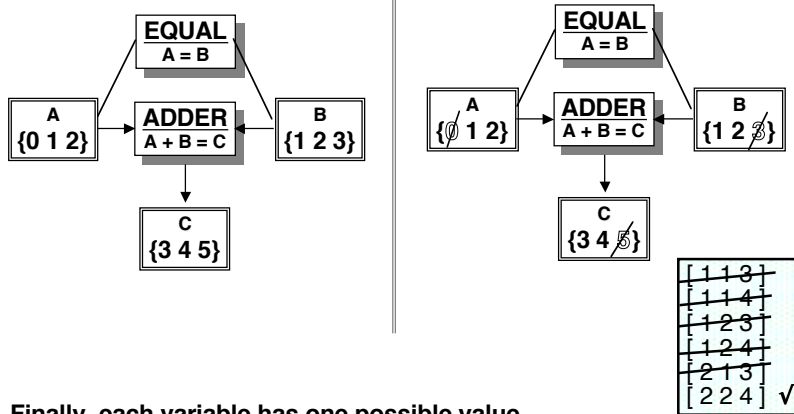
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## Constraint Propagation (3)



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## Constraint Propagation (4)



Finally, each variable has one possible value.








[No constraint processing](#)

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## Temporal Constraints

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## Interval Relations in Allen's Algebra

	<b>BEFORE (I1, I2)</b>	<b>&lt; &gt;</b>
	<b>MEETS (I1, I2)</b>	<b>m mi</b>
	<b>OVERLAPS (I1, I2)</b>	<b>o oi</b>
	<b>FINISHES (I1, I2)</b>	<b>f fi</b>
	<b>STARTS (I1, I2)</b>	<b>s si</b>
	<b>DURING (I1, I2)</b>	<b>d di</b>
	<b>EQUAL (I1, I2)</b>	<b>=</b>

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## Convex Time-point Algebra

Qualitative relations between time points which can be described by the inequality

$$T1 + c12 \leq T2$$

(T1, T2: time points; c12: constant)

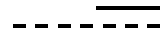
"Convex relation":

All intervals satisfying a convex relation can be generated by continuous displacements of the begin and end points of an interval

In Allen's Algebra:

convex relation e.g.

d v m



non-convex relation e.g.

b v bi

