SUBTYPES IN ERM, PART 2

HAN_UNIVERSITY
OF APPLIED SCIENCES

DERIVING A PDM FROM A CDM WITH SUBTYPES

- Flexibility with subtypes:
  Settings in PowerDesigner
- Standard choice 1:
  Every subtype separate table
- Standard choice 2:
  One table for supertype and all subtypes
- Other choices
- Rules and recommendations

Flexibility with subtypes

Many different table structures possible with subtype network

Subtypes in a CDM offer many possibilities for generating a PDM

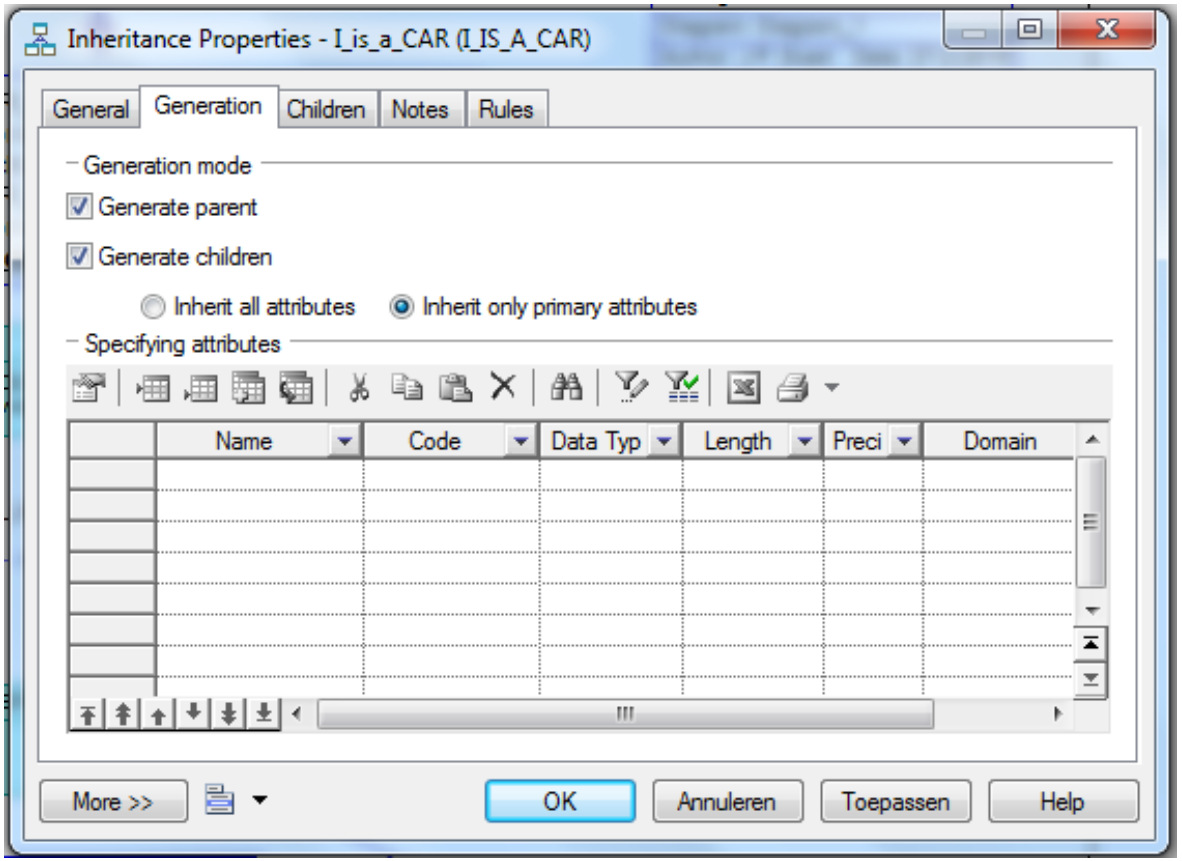
For each subtype, the choice can be:

- Seperate table for this subtype
- No separate table: subtype attributes are absorbed into the table for its supertype

There can be a complex network
with several levels of subtypes:
many different table structures possible

FLEXIBILITY WITH SUBTYPES

In PowerDesigner, the settings in the Inheritance Properties window control how a PDM is derived



The options in this window will be explained in the following examples

FLEXIBILTY WITH SUBTYPES

Options in the PowerDesigner Inheritance Properties window

Purpose of the options in the previous slide:

- **Generate parent**: make a parent table for the supertype of this Inh. Link
- **Generate children**: make child tables for the subtypes of this Inh. Link
  (fine-tuning: use tab Children)
- **Inherit only primary attributes**:
  in child tables: **only** copy <pk> of parent table into child tables as <pk, fk> (default choice)
- **Inherit all attributes**:
  in child tables: copy all attributes of parent table into child tables (only possible under strict conditions)
- **Specifying attributes**:
  must be filled in for every declarative subtype
  if no seperate table for the subtype is desired

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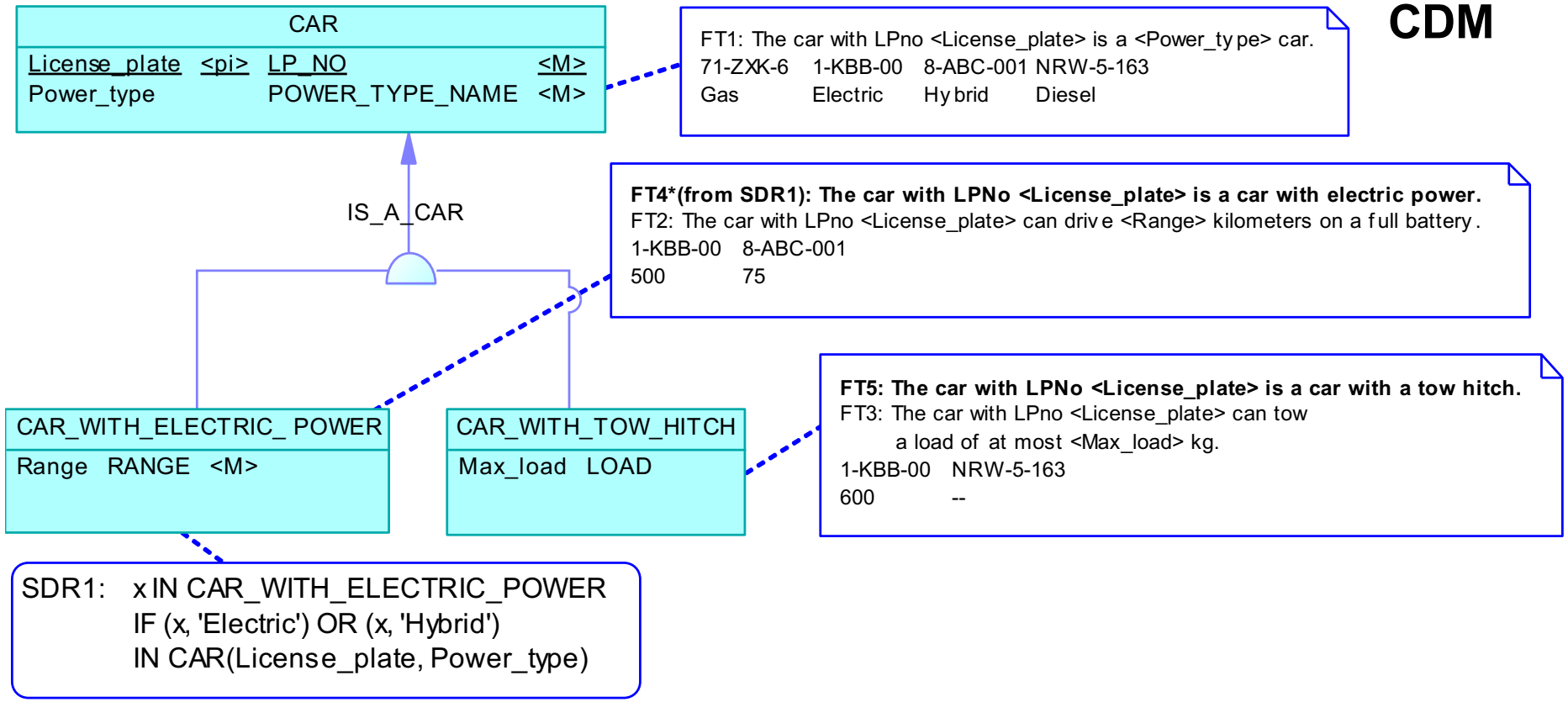
SEPARATE TABLE FOR EACH SUBTYPE

BR1 Range is only to be recorded for all electric and hybrid cars. Modeled by derivable subtype.
BR2 Max_load is only to be recorded for cars with a tow hitch. Modeled by declarative subtype.



CDM

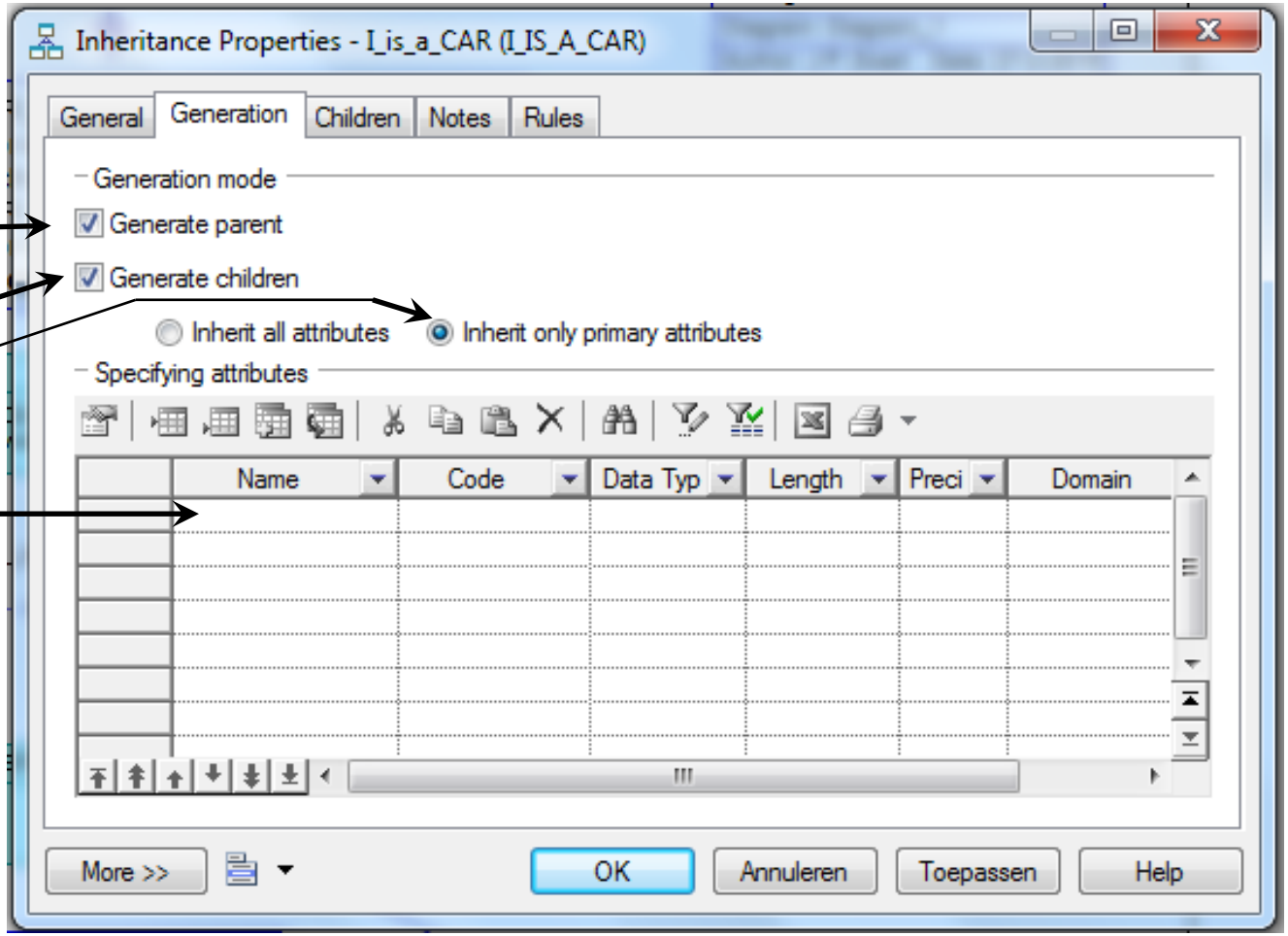
SEPARATE TABLE FOR EACH SUBTYPE

Table for supertype

Tables for subtypes

Copy only <pi>

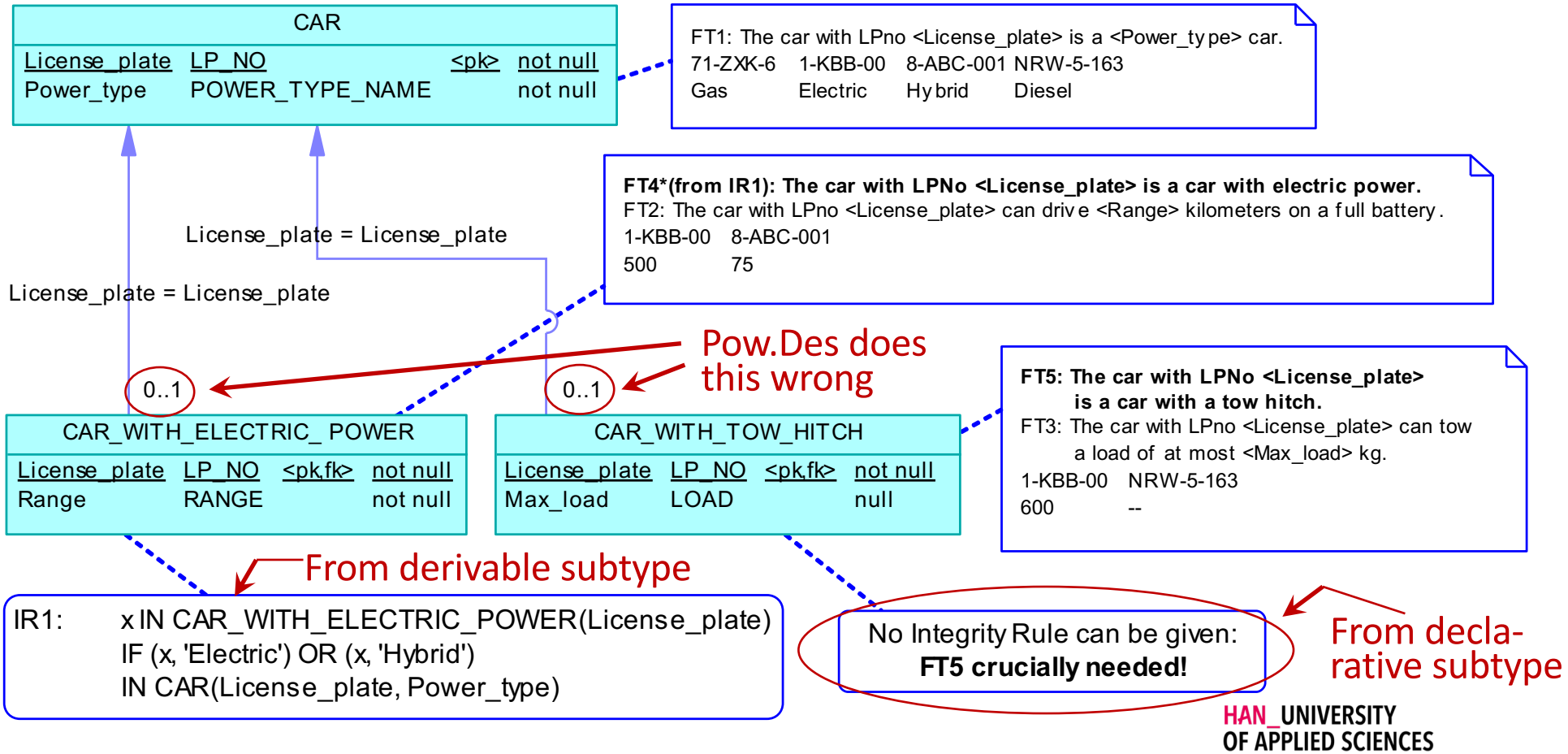
No spec. Att. needed



SEPARATE TABLE FOR EACH SUBTYPE

PDM:

BR1 Range is only to be recorded for all electric and hybrid cars. Implemented by IR1.
BR2 Max_load is only to be recorded for cars with a tow hitch. Implemented by FT5.



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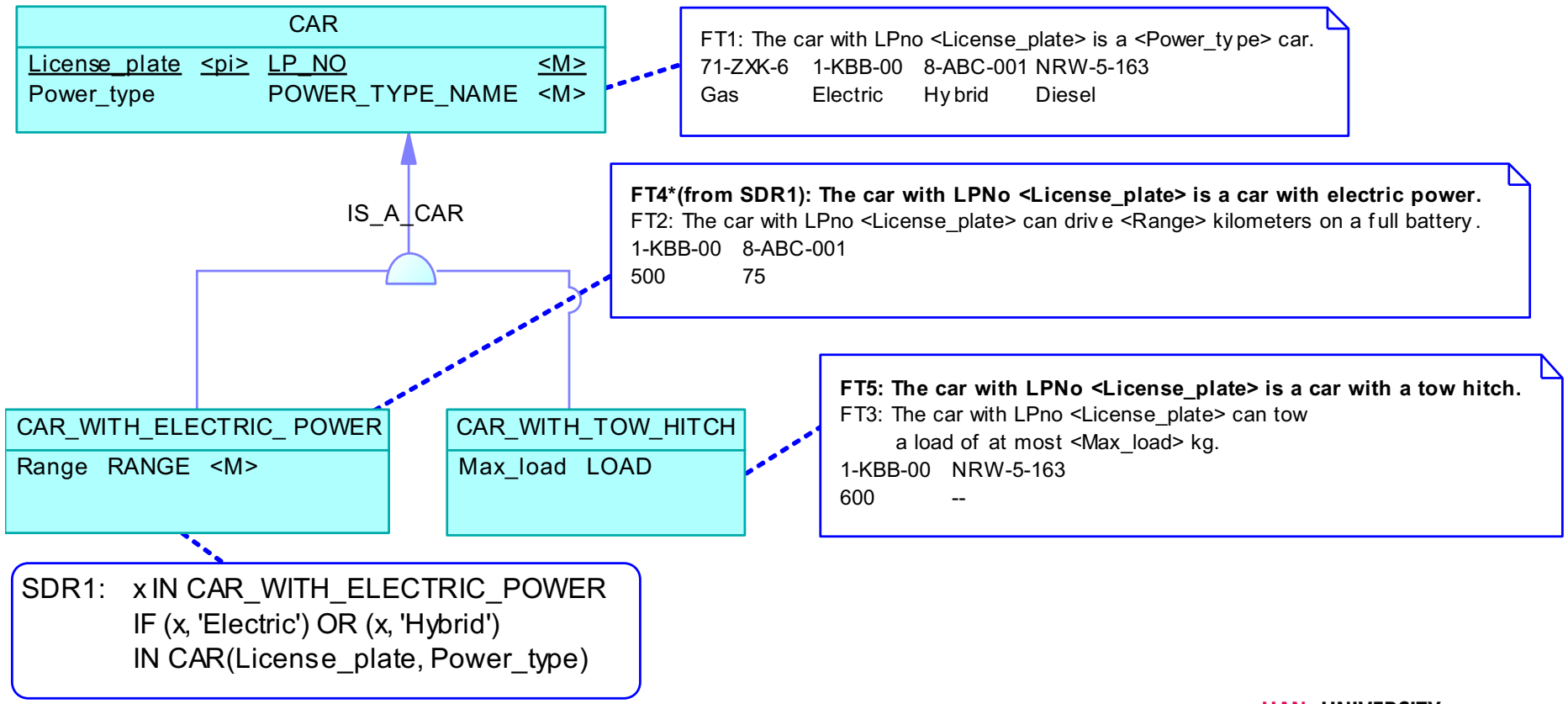
ONE TABLE FOR SUPERTYPE AND ALL SUBTYPES

CDM:

BR1 Range is only to be recorded for all electric and hybrid cars. Modeled by derivable subtype.
BR2 Max_load is only to be recorded for cars with a tow hitch. Modeled by declarative subtype.



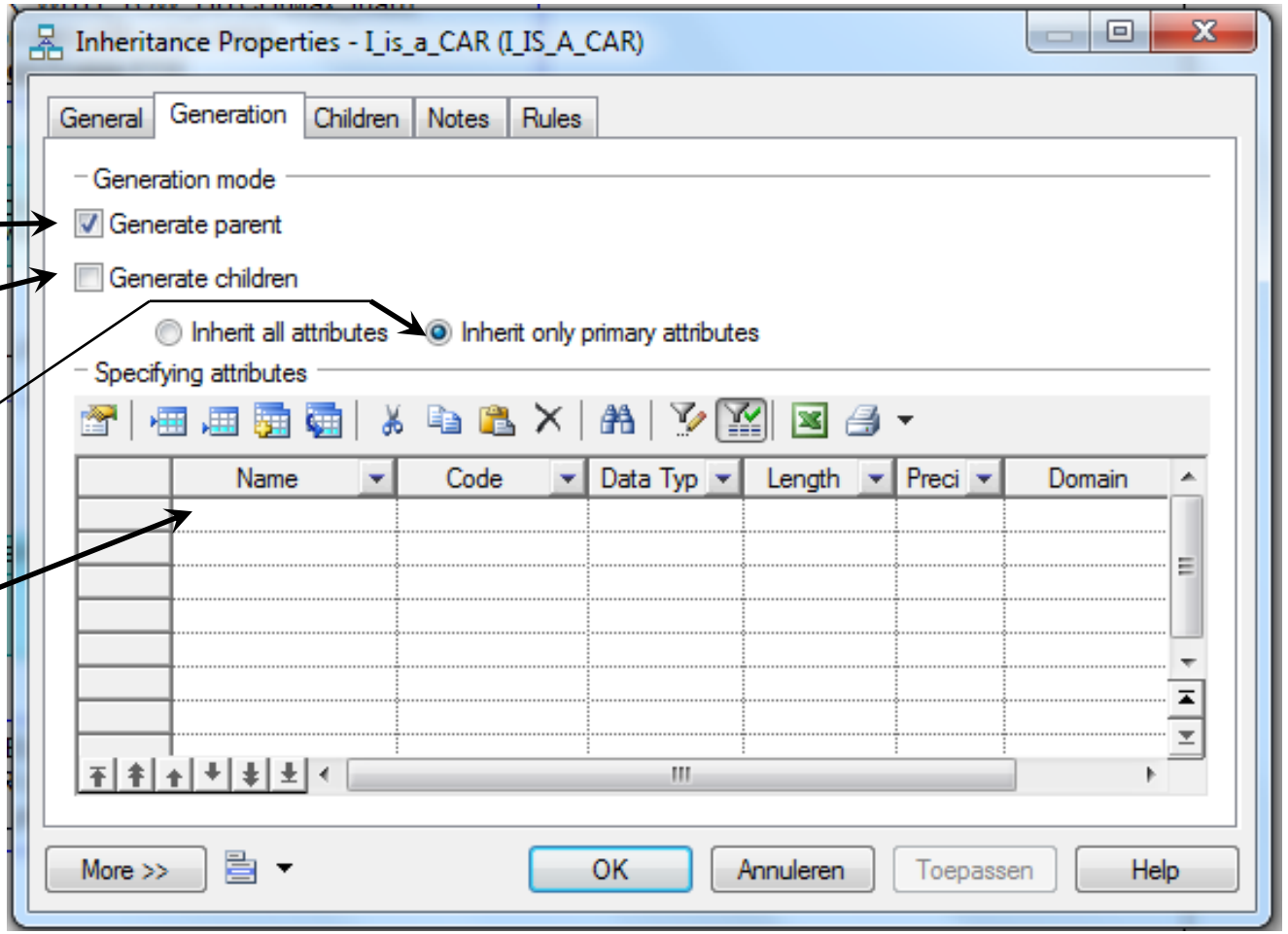
ONE TABLE FOR SUPERTYPE AND ALL SUBTYPES

Table for supertype

No tables for subtypes (subtype Atts absorbed by supertype)

Irrelevant: no children

Spec. Att. needed! What happens if this is ´forgotten´?



ONE TABLE FOR SUPERTYPE AND ALL SUBTYPES

PDM **wrong**:

BR1	Range is only to be recorded for all electric and hybrid cars. Implemented by IR1.
BR2	Max_load is only to be recorded for cars with a tow hitch. **Not possible to implement, info (FT5) is missing.**

CAR			
License_plate	LP_NO	<pk>	not null
Power_type	POWER_TYPE_NAME		not null
Range	RANGE		null
Max_load	LOAD		null

FT1: The car with LPno <License_plate> is a <Power_type> car.
FT2: The car with LPno <License_plate> can drive <Range> kilometers on a full battery.
FT3: The car with LPno <License_plate> can tow a load of at most <Max_load> kg.
FT4*(from IR1): The car with LPNo <License_plate> is a car with electric power.

71-ZXK-6	1-KBB-00	8-ABC-001	NRW-5-163
Gas	Electric	Hybrid	Diesel
--	500	75	--
--	600	--	--

From derivable subtype

IR1: For each tuple in table CAR:
CAR(Range) must have value IF AND ONLY IF
in the same tuple CAR(Power_type)
has the value 'Electric' OR 'Hybrid'

Missing information:
FT5: The car with LPNo <License_plate>
is a car with a tow hitch.

FT5 cannot be assigned to License_plate: all cars would have a tow hitch.

If a declarative subtype is absorbed by its supertype,
then its subtype defining fact type must be replaced by a ‘specifying attribute’,
otherwise information is lost.

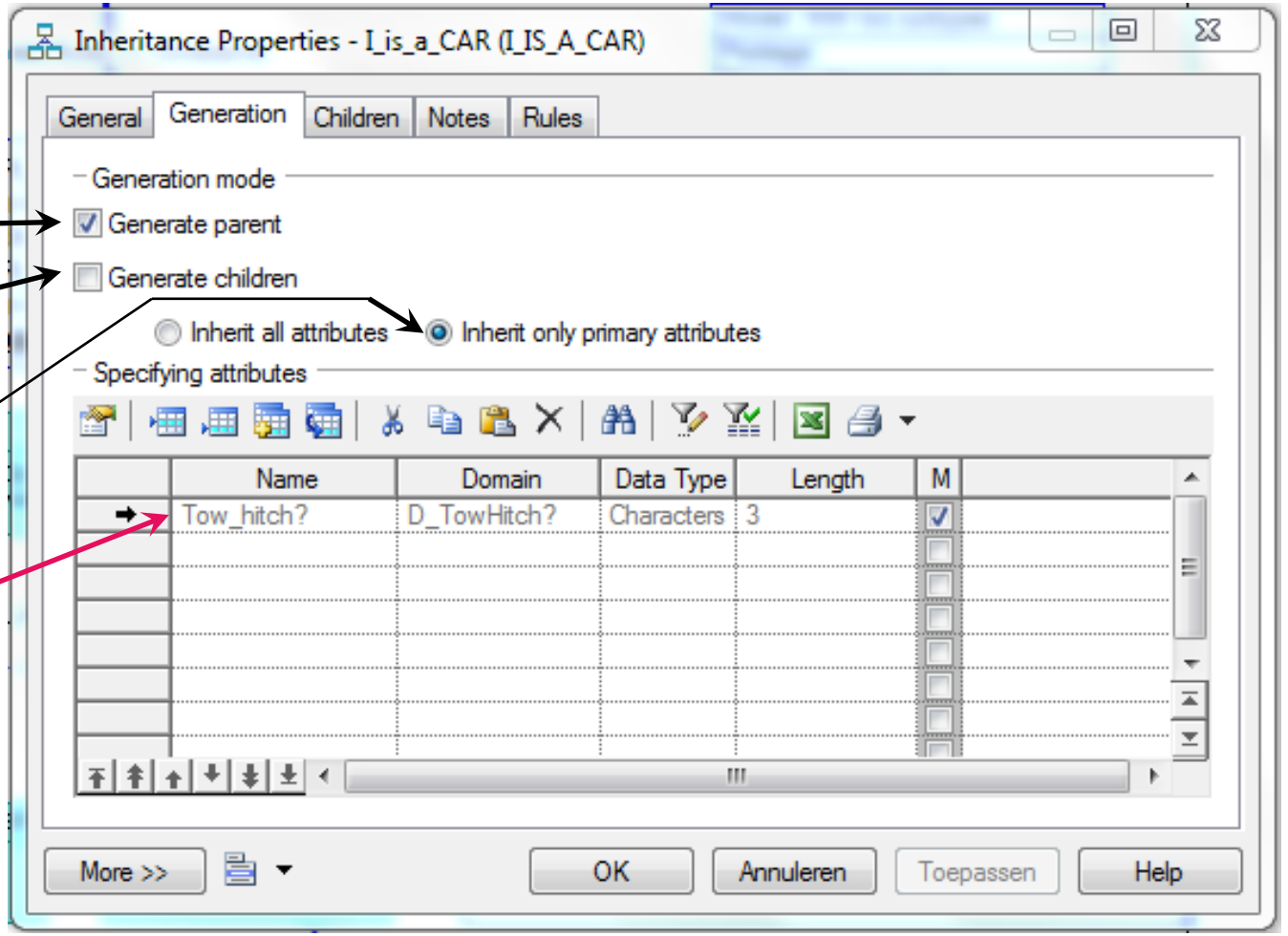
ONE TABLE FOR SUPERTYPE AND ALL SUBTYPES

Table for supertype

No tables for subtypes (subtype Atts absorbed by supertype)

Irrelevant: no children

Spec. Att. needed!



ONE TABLE FOR SUPERTYPE AND ALL SUBTYPES

BR1	Range is only to be recorded for all electric and hybrid cars. Implemented by IR1.
BR2	Max_load is only to be recorded for cars with a tow hitch. Implemented by IR2.

PDM correct:

CAR			
License_plate	LP_NO	<pk>	not null
Power_type	POWER_TYPE_NAME		not null
Range	RANGE		null
Tow_hitch?	TOW_HITCH		not null
Max_load	LOAD		null

FT1: The car with LPno <License_plate> is a <Power_type> car.
FT2: The car with LPno <License_plate> can drive <Range> kilometers on a full battery.
FT3: The car with LPno <License_plate> can tow a load of at most <Max_load> kg.
FT4*(from IR1): The car with LPNo <License_plate> is a car with electric power.
FT5*(from IR2): The car with LPNo <License_plate> is a car with a tow hitch.
FT6: Does the car with LPno <License_plate> have a tow hitch? <Tow_hitch?>

71-ZXK-6	1-KBB-00	8-ABC-001	NRW-5-163
Gas	Electric	Hybrid	Diesel
--	500	75	--
N	Y	N	Y
--	600	--	--

From Specifying Att

IR1: For each tuple in table CAR:
CAR(Range) must have value IF AND ONLY IF
in the same tuple CAR(Power_type)
has the value 'Electric' OR 'Hybrid'

IR2: For each tuple in table CAR:
CAR(Max_load) can only have a value IF
in the same tuple CAR(Tow_hitch?)
has the value 'Yes'.

If both subtypes were derivable to start with,
then no specifying attribute would be needed.
The original CDM would then already have contained Att 'Tow_hitch?'

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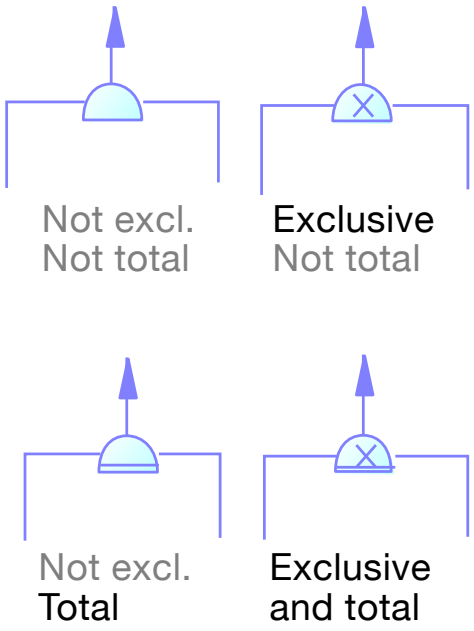
OTHER CHOICES

Other choices might also be possible under certain conditions



An Inheritance Link can have two other properties:

1. **Exclusive**
   A supertype entity can be in at most one subtype
   E.g.: EMPLOYEE, subtypes JUNIOR, EXECUTIVE
2. **Total**
   Every supertype entity is in at least one subtype
   E.g.: PERSON, subtypes PARENT, CHILD

PowerDesigner can show these for each Inh. Link.

Depending on these properties,
several other options for generating a PDM might exist
(see the Reader DM-RDS, section 6.5)

In general: explore the possibilities of generating a relational schema from a CDM with subtypes.

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RULES AND RECOMMENDATIONS

Rules for using subtypes

Rule 1:

- Modeling a subtype always implies adding a subtype defining fact type.
- Every subtype must have such a fact type.

Rule 2:

- If possible, specify a Subtype Derivation Rule.
- A Subtype Derivation Rule can only refer to:
  - fact types from the supertype,
  - not to fact types from the subtype itself.

Recom - mendations for using subtypes

Recommendations:

- Use derivable subtypes as much as possible.
- Add extra attributes to change declarative subtypes into derivable ones if needed.
- Beware of information loss if declarative subtypes are used (enter Spec. Atts when deriving a PDM).