# Specifying Overlaps of Heterogeneous Models for Global Consistency Checking

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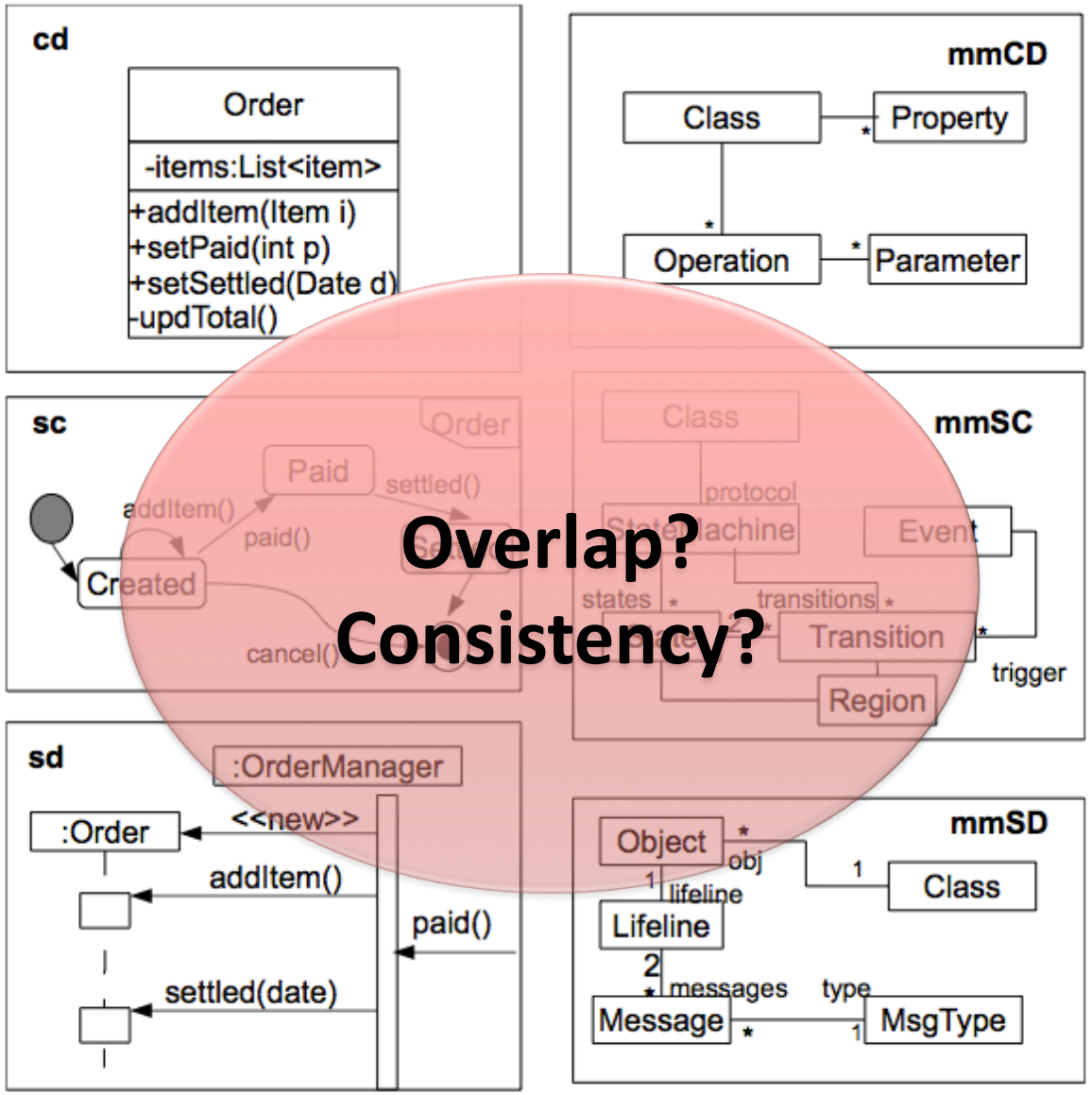
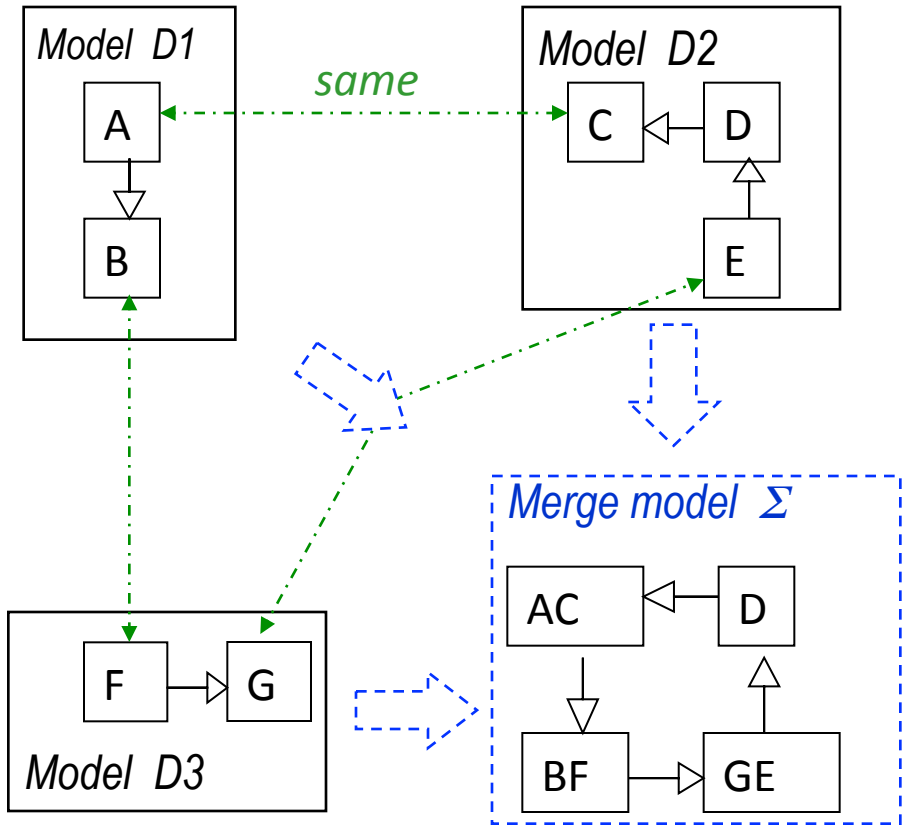
# Motivation

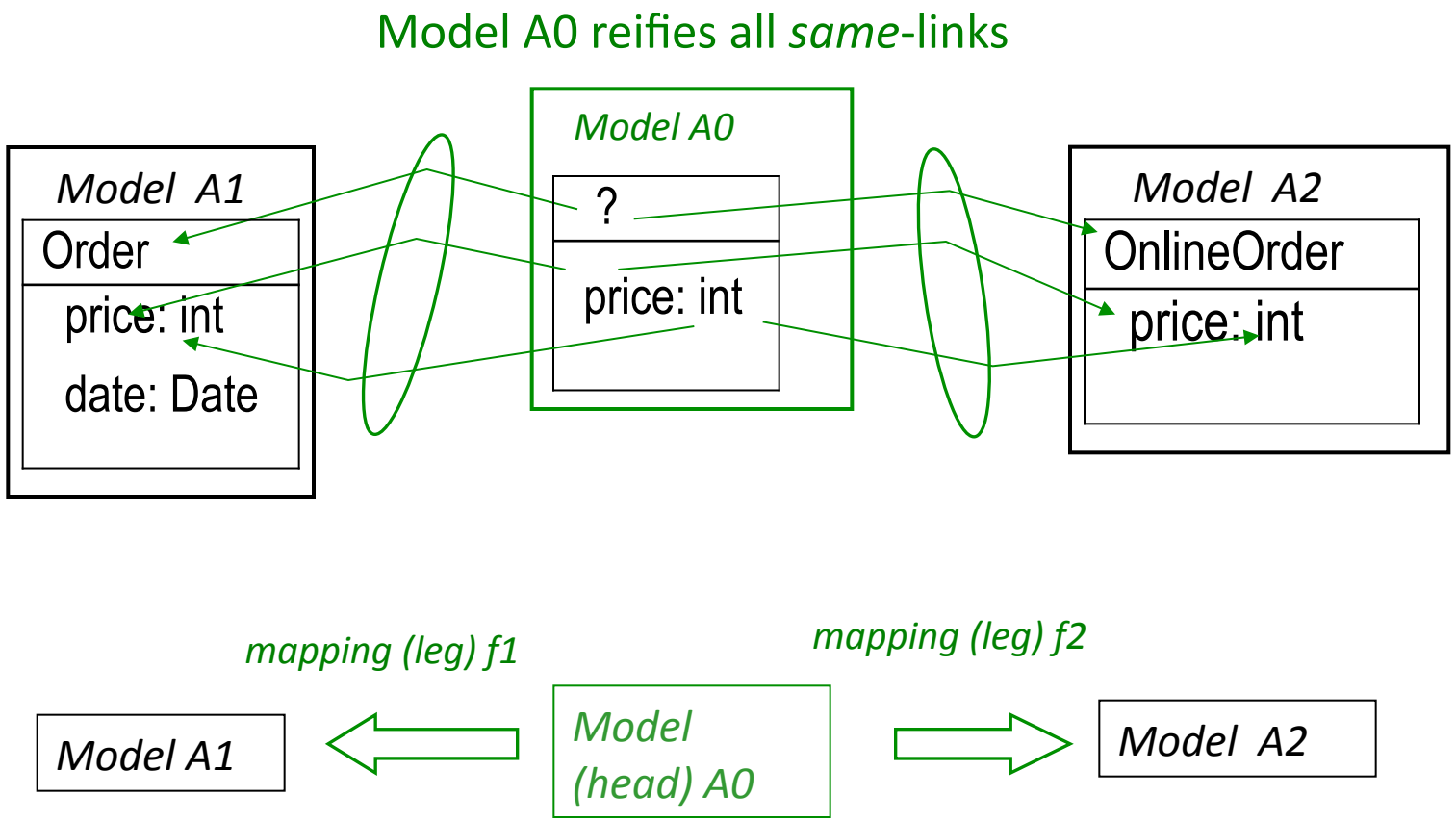

cd
Order
-items:List<item>
+addItem(Item i)
+setPaid(int p)
+setSettled(Date d)
-updTotal()
mmCD
Class
Property
Operation
Parameter
sc
Order
Paid
settled()
addItem()
paid()
Created
cancel()
mmSC
Class
protocol
StateMachine
Event
states
transitions
Transition
Region
trigger
sd
:OrderManager
:Order
<<new>>
addItem()
paid()
settled(date)
mmSD
Object
obj
lifeline
Class
Lifeline
messages
type
Message
MsgType
Overlap?
Consistency?

# Homogenous Overlap and Consistency Checking by Merging

[Sabetzadeh, Easterbrook 2006]


Model D1
A
B
same
Model D2
C
D
E
Merge model Σ
AC
D
BF
GE
F
G
Model D3

# Model Correspondence via Span




Triple (A0,f1,f2) is called a **span** from A1 to A2

# Heterogeneous Overlap and Consistency Check

**Can we do consistency check by merge?**

**What is the correspondence?**

# Heterogeneous Case

Class diagram

**cd**

Sequence diagram

**sd**

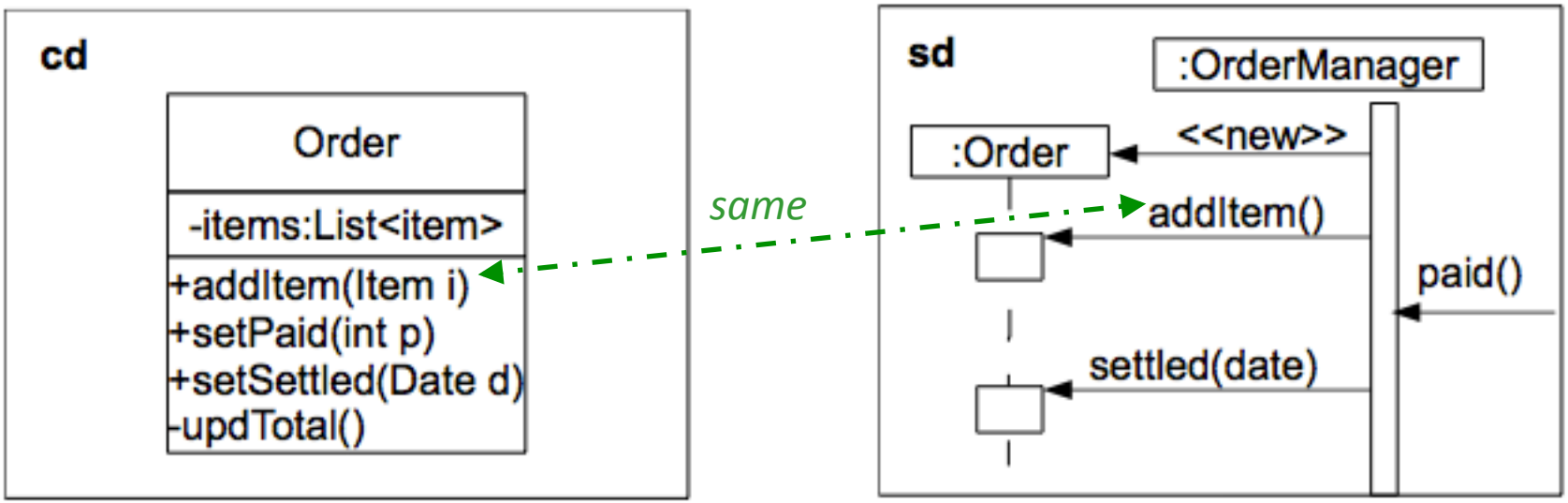
Statechart

**sc**

?

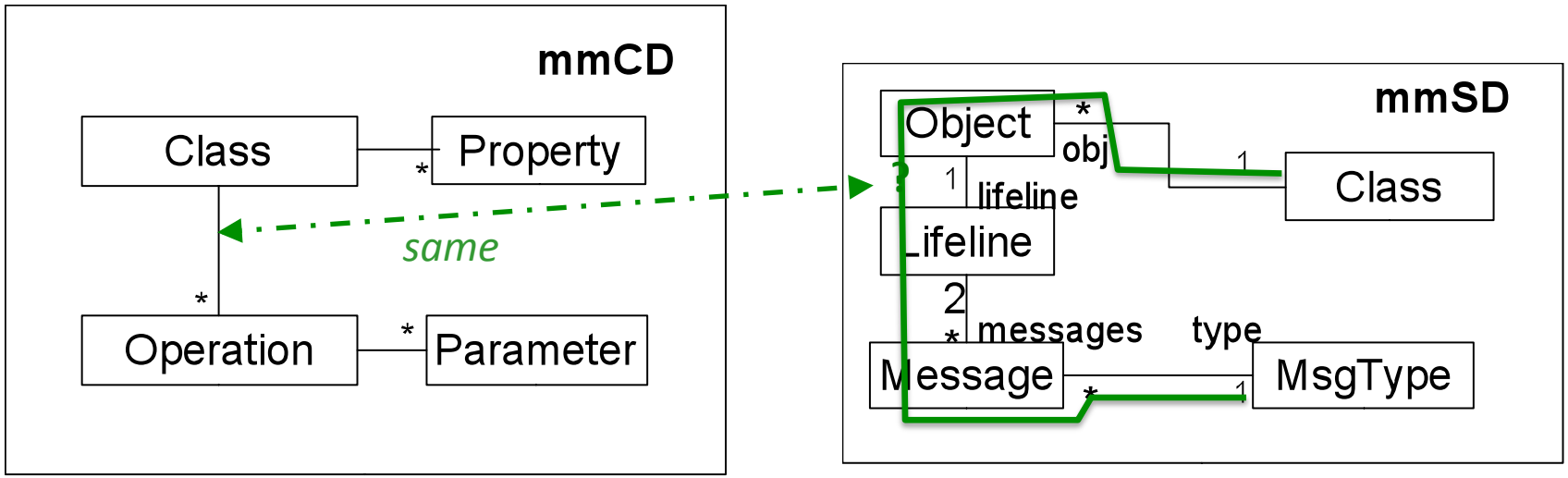
# Four problems

# Problems 1: Type Safety



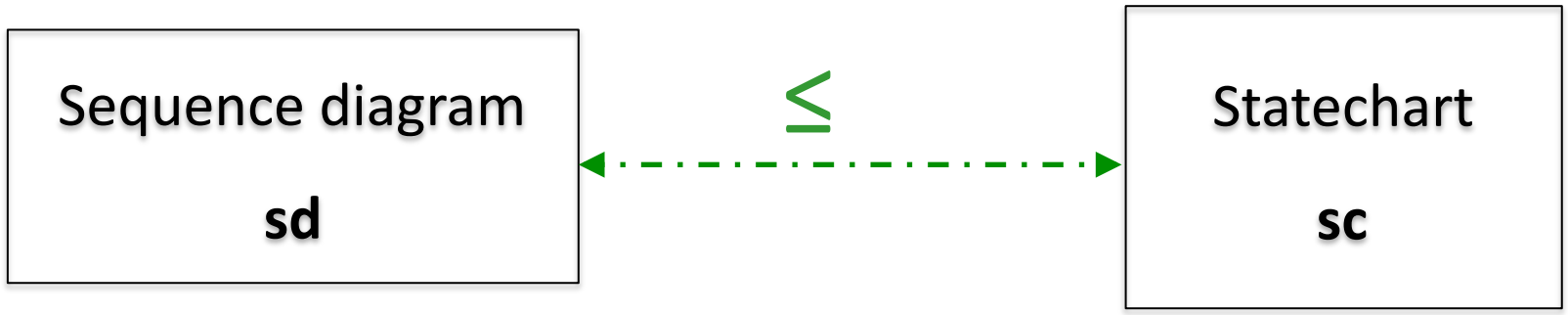

Incompatible types: Operation vs. MessageType !

# Problem 2: Indirect correspondence



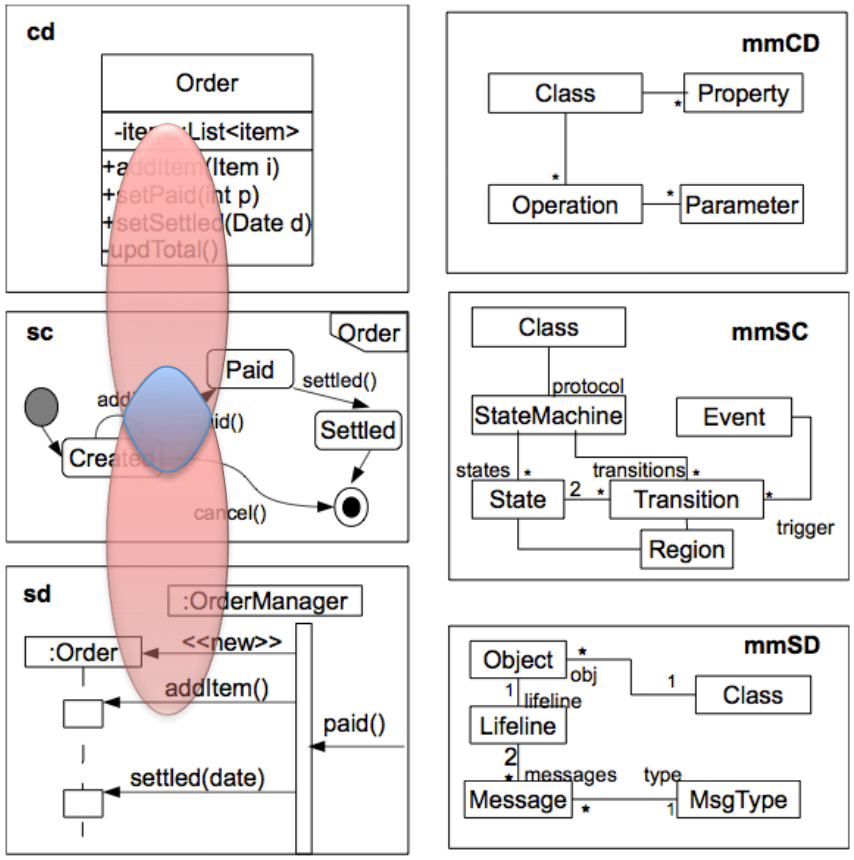

No explicit target in mmSD (and sd)!

# Problem 3: Inter-Model Constraints



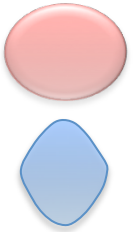

The inter-model constraint is neither in mmSD nor mmSC!

# Problem 4: N-ary Metamodel Relations



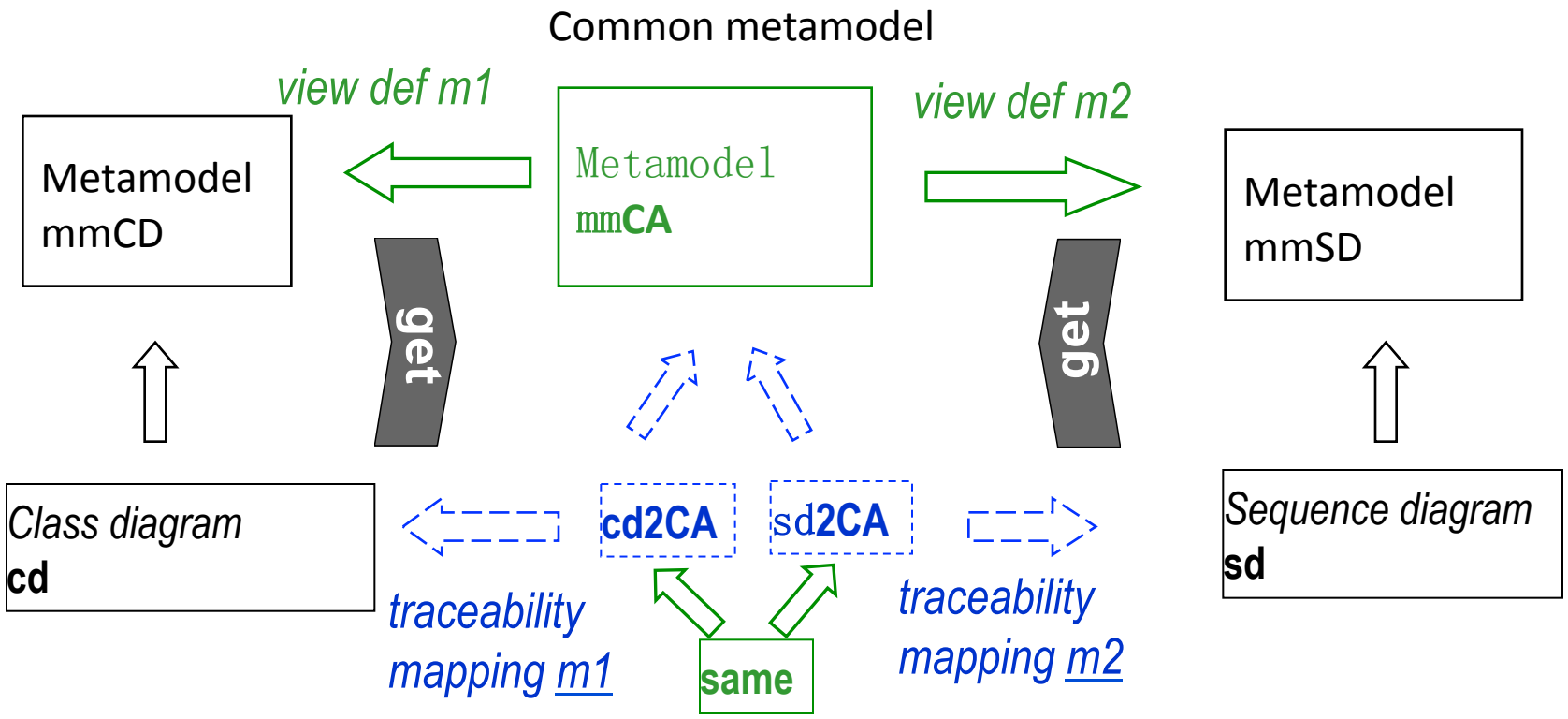

Pairwise, ternary, … overlaps!

Overlaps between overlaps!



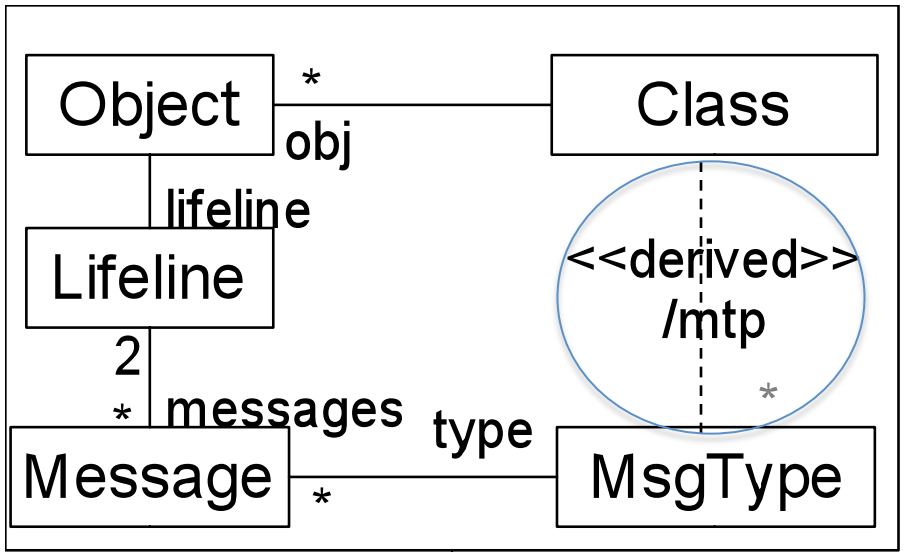
# Solutions

# Problem 1: Type Correspondence



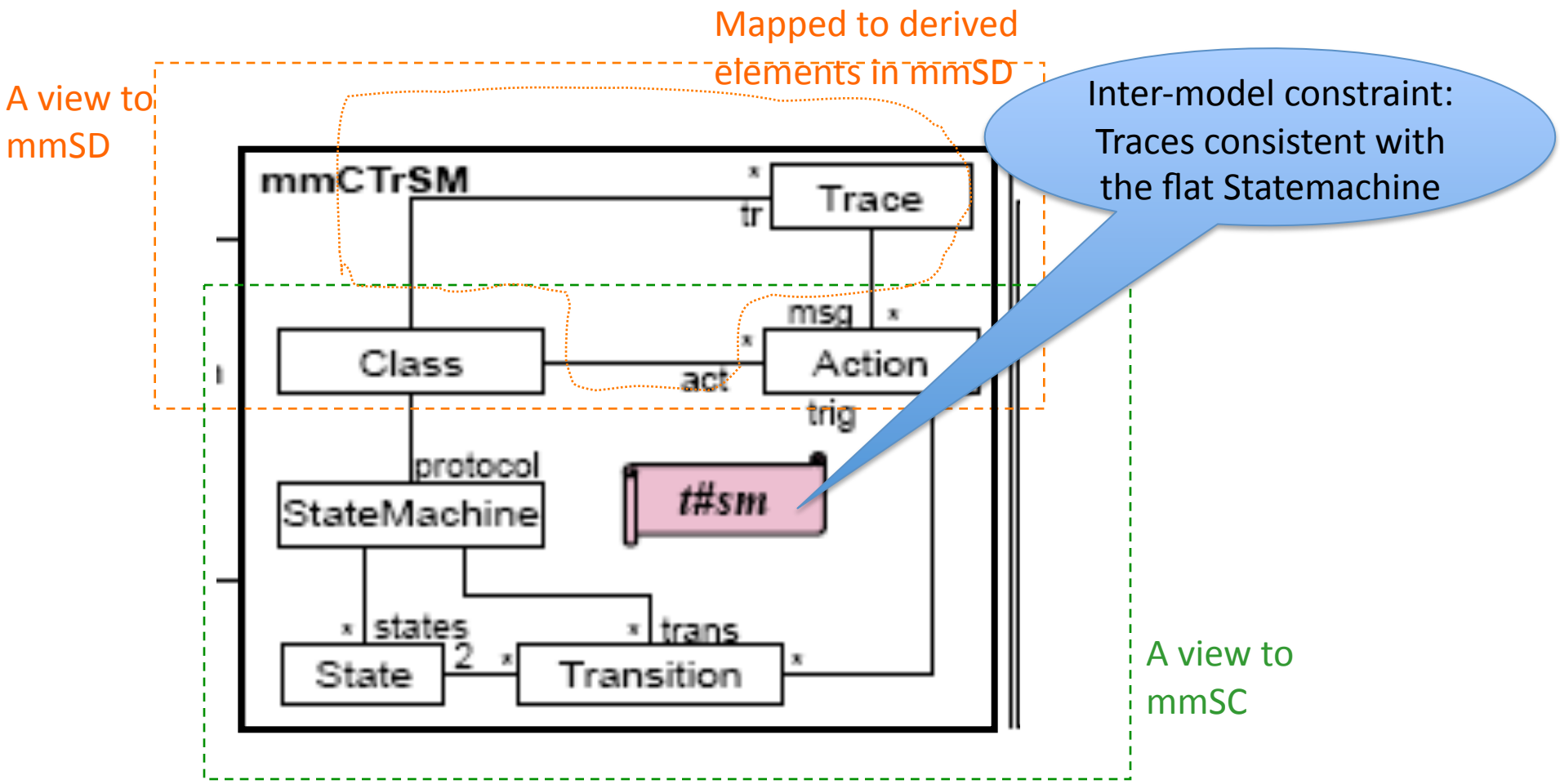

*Operation '**get**' models view execution mechanism*

# Problem 2: Indirect Overlap

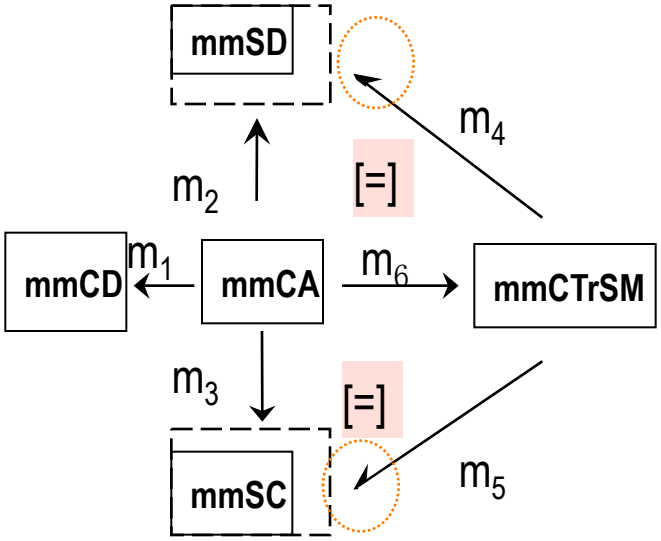



**mmSD+**

# Problem 3: Inter-Model Constraints



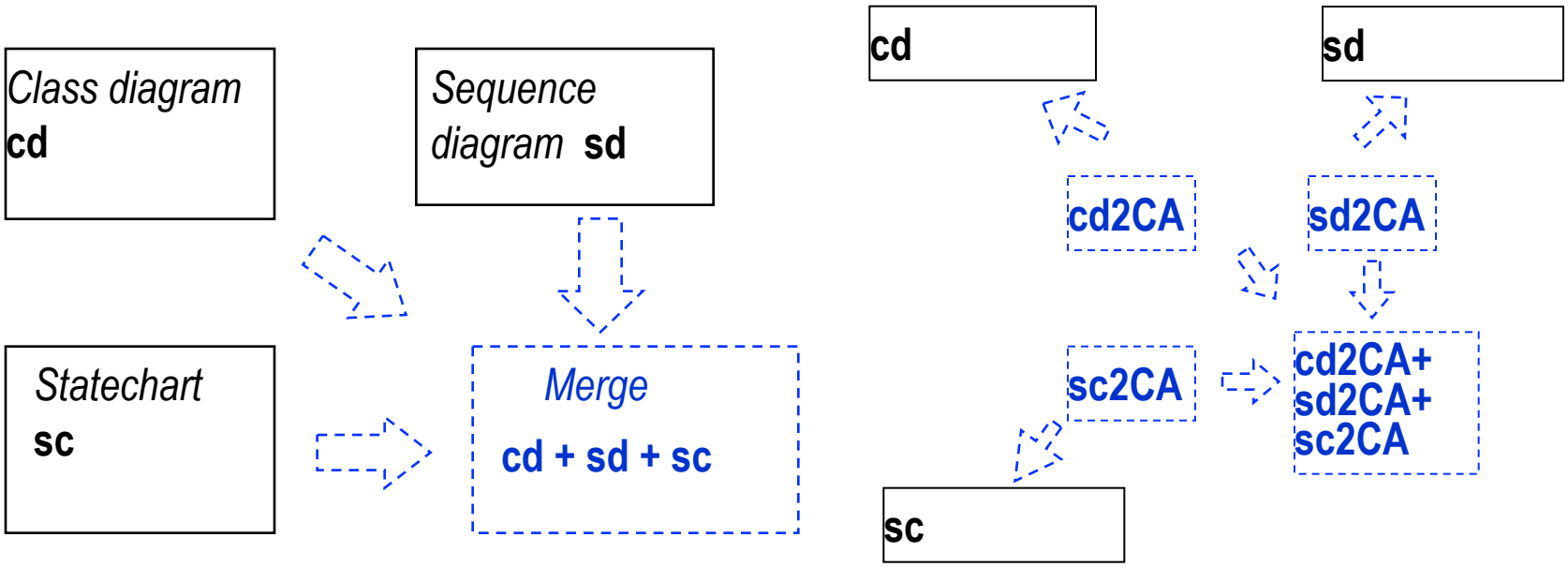
# Problem 4: N-ary Metamodel Interrelations



# Summary

- Heterogeneous consistency check is reduced to the homogeneous one but metamodel merging is minimal
  - only to manage inter-metamodel constraints, working as locally as possible
- Despite heterogeneity, matching is type safe
- Applicability to a wide class of metamodeling techniques (based on graph-like structures)
- Formal foundations based on the well-established *institution theory*

# Local vs. total consistency checking: Discussion




Two approaches:

(a) Total direct merge: cd, sd, sc are considered instances of the same global metamodel M.
M can be derived from the metamodel mappings.

(b) Local merge: we first specify an overlap metamodel CA = a common view to CD, SD, SC. Then project the three models to the overlap and apply Consistency Checking by Merge.

# Future work

- Theoretical validation
  - complete the formal semantics outlined in the paper
  - prove that (a) local and (b) global (via total merging of all metamodels) CC are equivalent
  - develop a taxonomy of heterogeneous multimodels and verify its usability
- Experimental validation of the approach