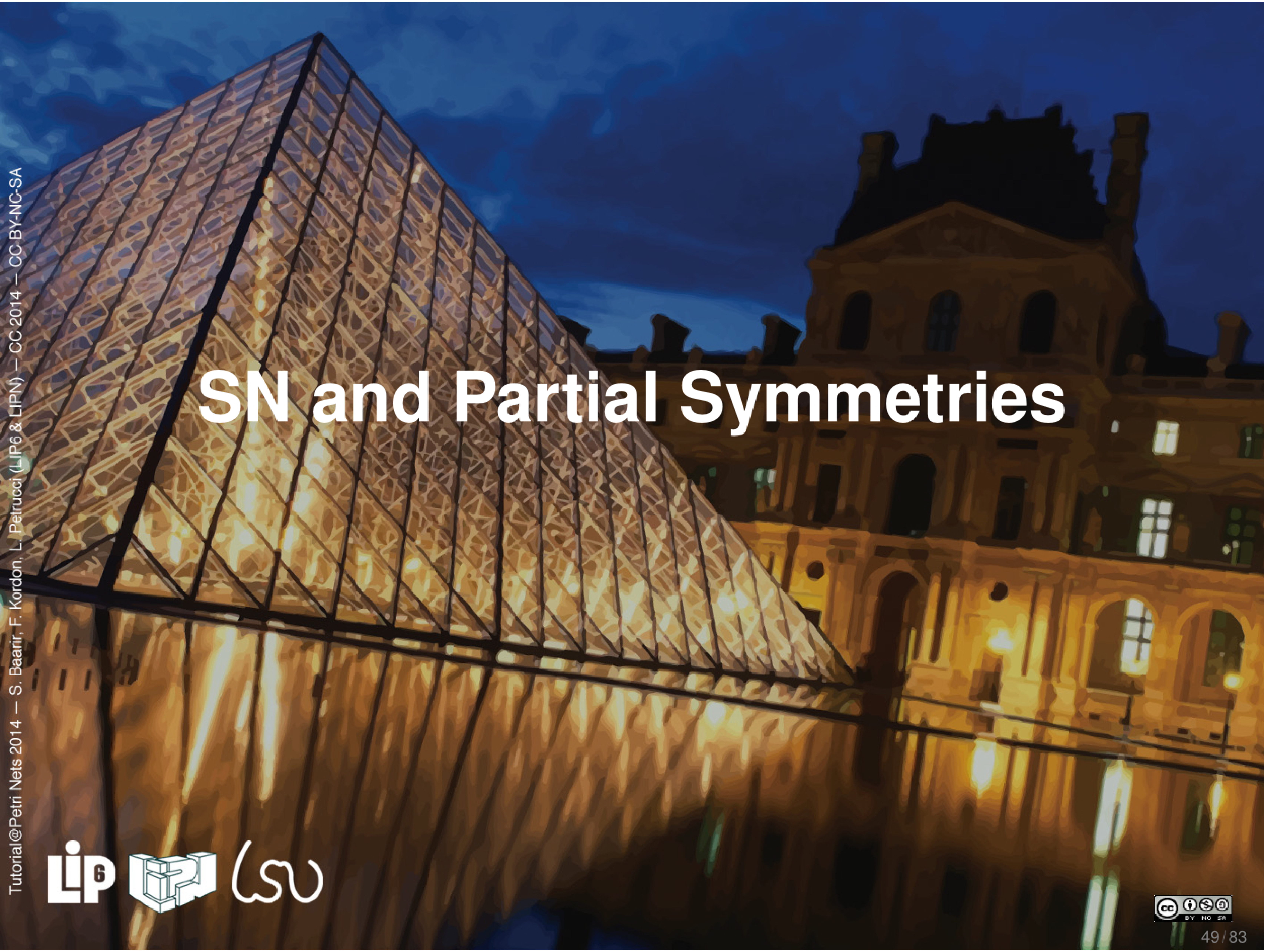
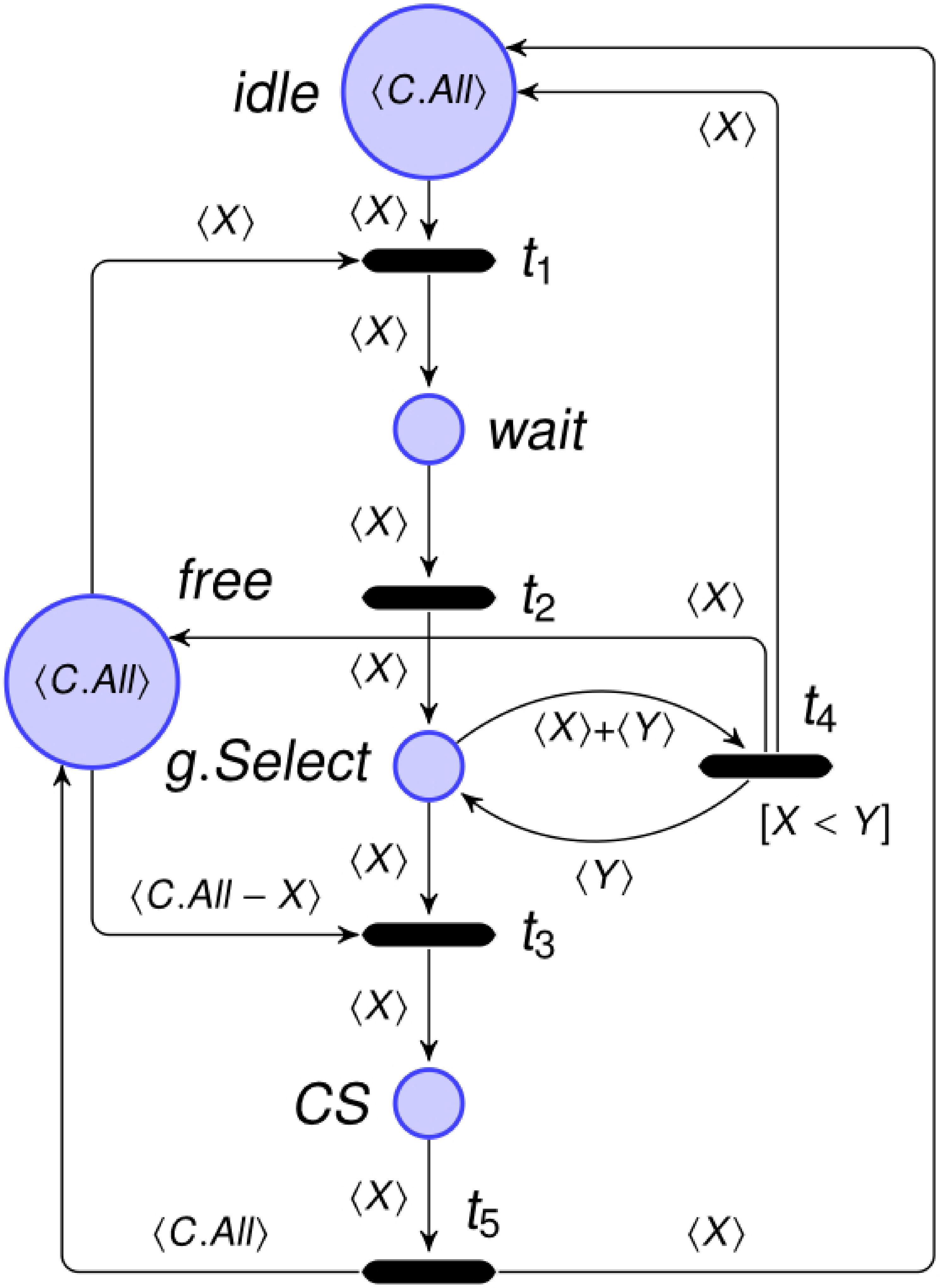


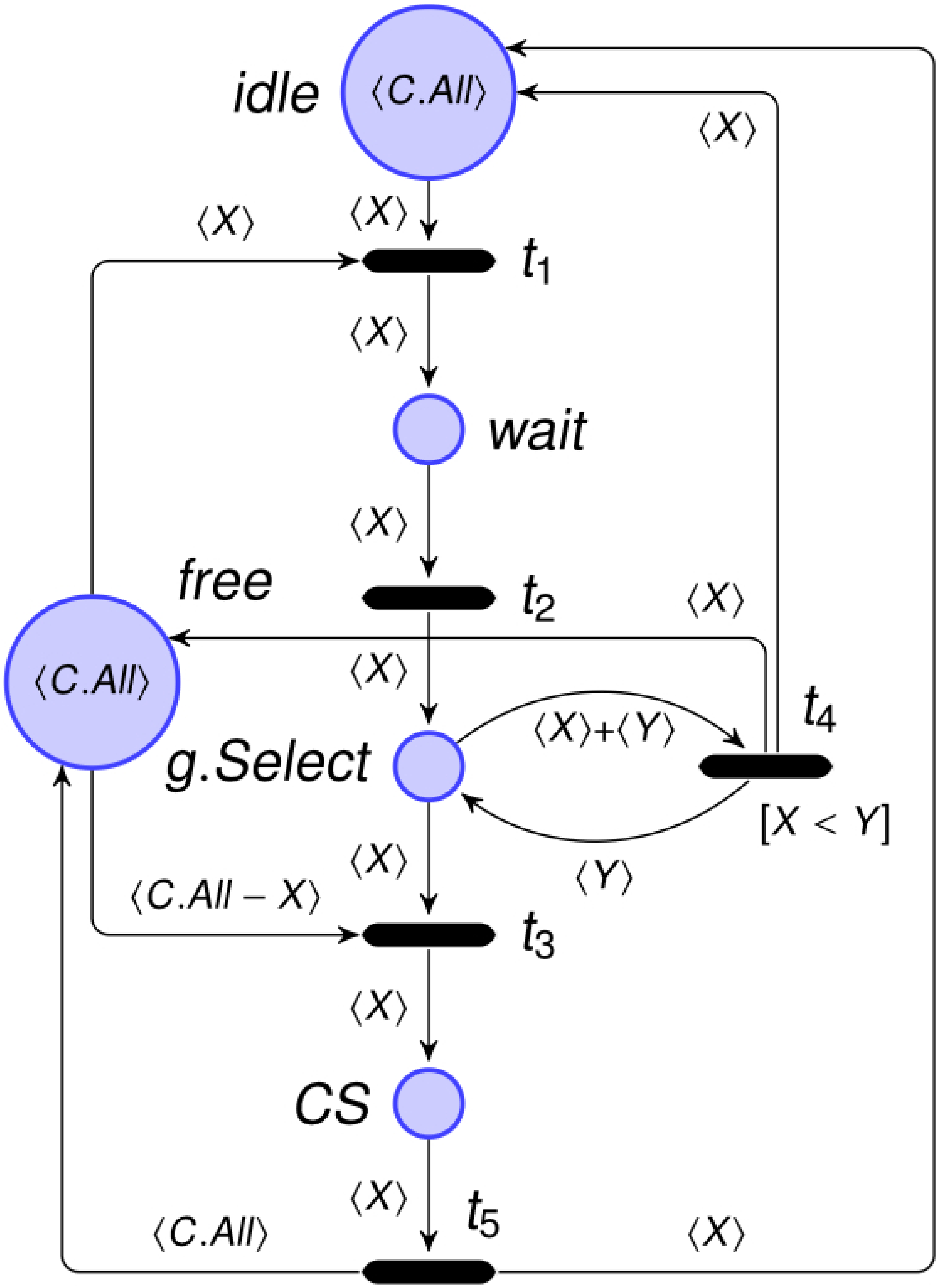
SN and Partial Symmetries

- Static subclasses are needed to model complex algorithms in a compact way.
- A symbolic marking must refer, in its definition, to the these static subclasses, otherwise the underlying represented markings will be spurious!
- The efficiency of the constructed SRG (the reduction factor) depends on these static subclasses:
  - When each class of the net contains only one static subclass, the reduction is maximal.
  - When the classes of the net are partitioned into static subclasses with only one element, there is no reduction.

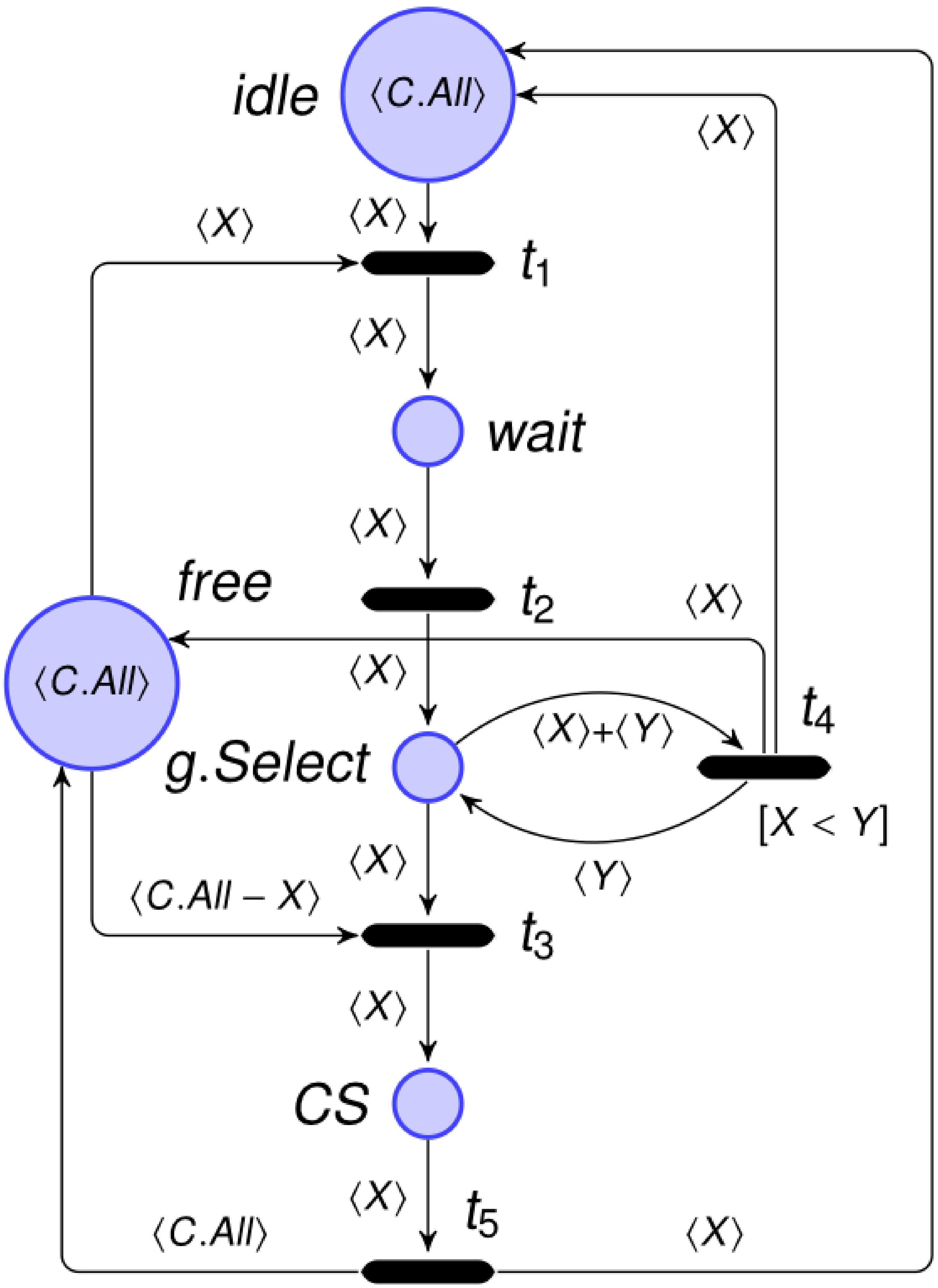
How to deal with this last case.



- All places have $C = \{p_1, p_2, p_3\}$ as colour domain.
- Because of the guard $[X < Y]$ on transition t_4, C has to be partitioned into 3 static subclasses: $C = D_1 \cup D_2 \cup D_3$, where $D_i = \{p_i\}$, for $i \in \{1, 2, 3\}$.
- The guard $[X < Y]$ is written: $\bigvee_{i<j} (X \in D_i \wedge Y \in D_j)$

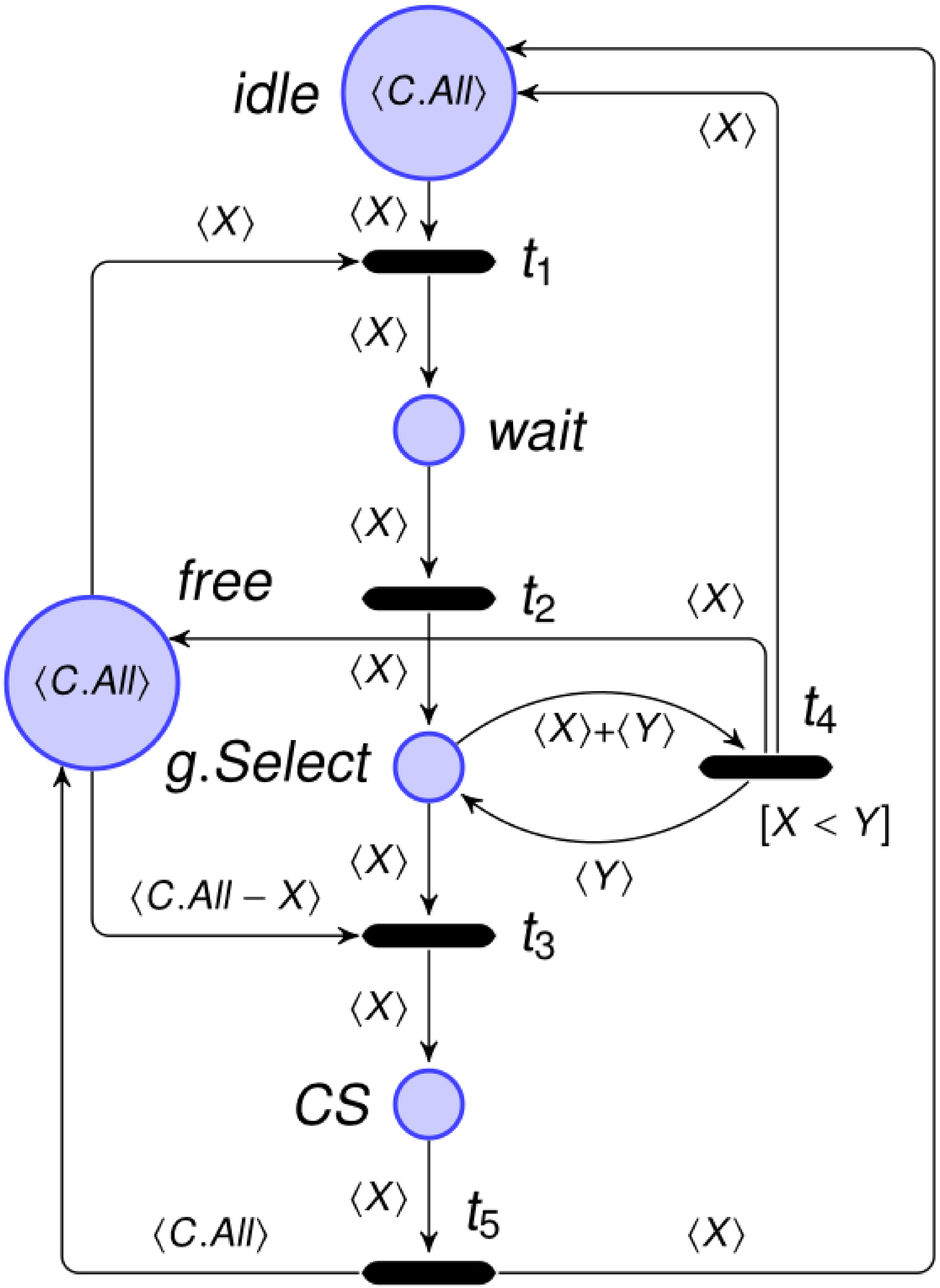


- Since all defined static subclasses are singletons, and
- the symmetries of a SN are defined according to these subclasses (i.e. only objects of the same subclass are symmetrical),
- then, the constructed SRG of this SN has the same size as the RG, i.e. no reduction is possible!
- Is it possible to deal with this problem?



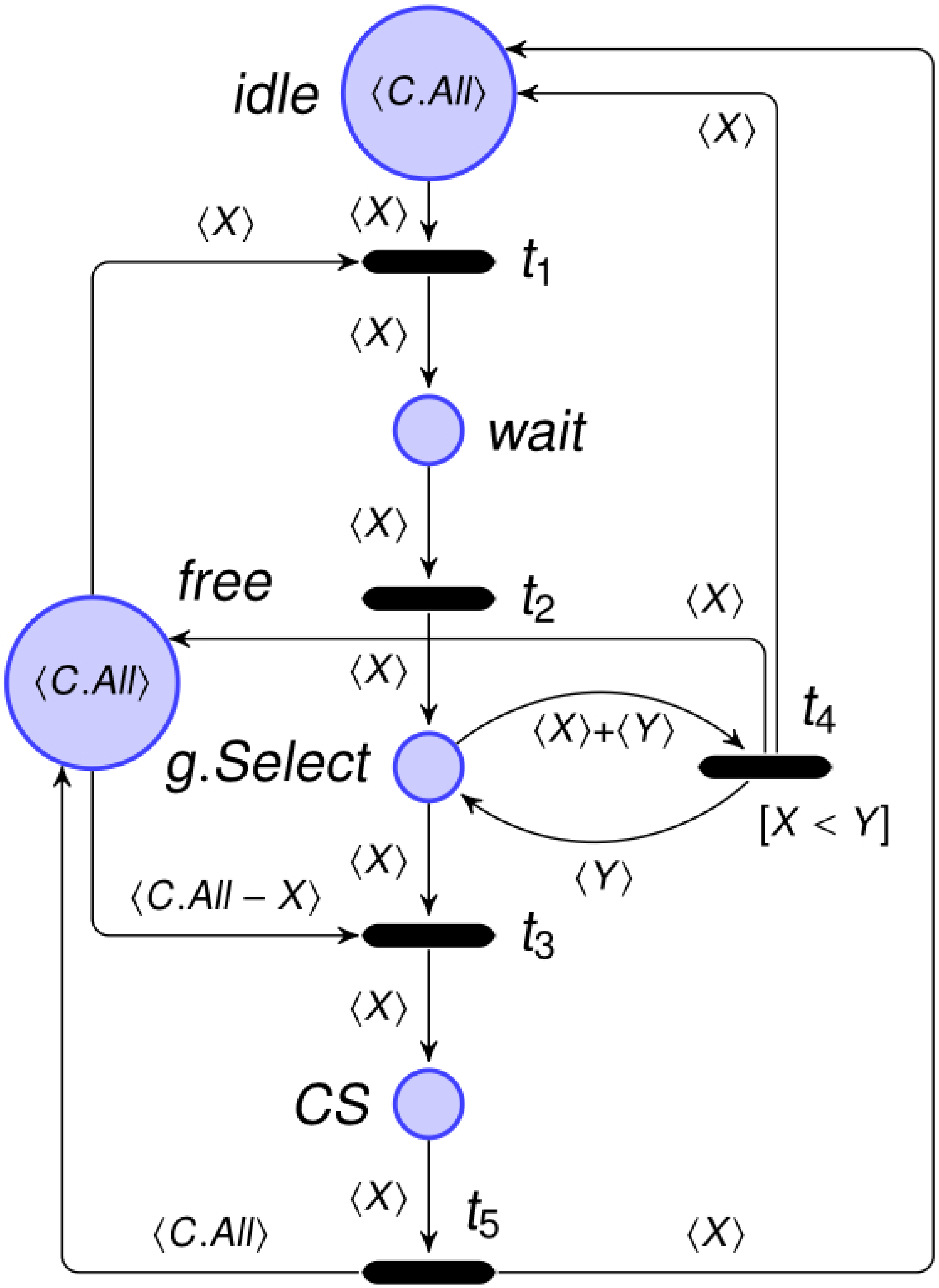
- The problem (**asymmetry**) comes from a single transition (t_4) and is propagated on whole net!
- The guard of enabling and the firing of t_4 distinguishes the objects $\Rightarrow$ objects are asymmetrical.
- The enabling and the firing of transitions t_1, t_2, t_3 and t_5 do not need information about the identity of the objects $\Rightarrow$ objects are symmetrical.

SN and partial symmetries: idea



- **Forget** the asymmetries (static subclasses) while not needed to test the enabling of a transition.
- **Reintroduce** the static subclasses while testing the enabling of asymmetrical transitions (transitions that refer to static subclasses).
- This way, the propagation of asymmetries will be contained in small parts.

SN and partial symmetries: Extended Symbolic Marking



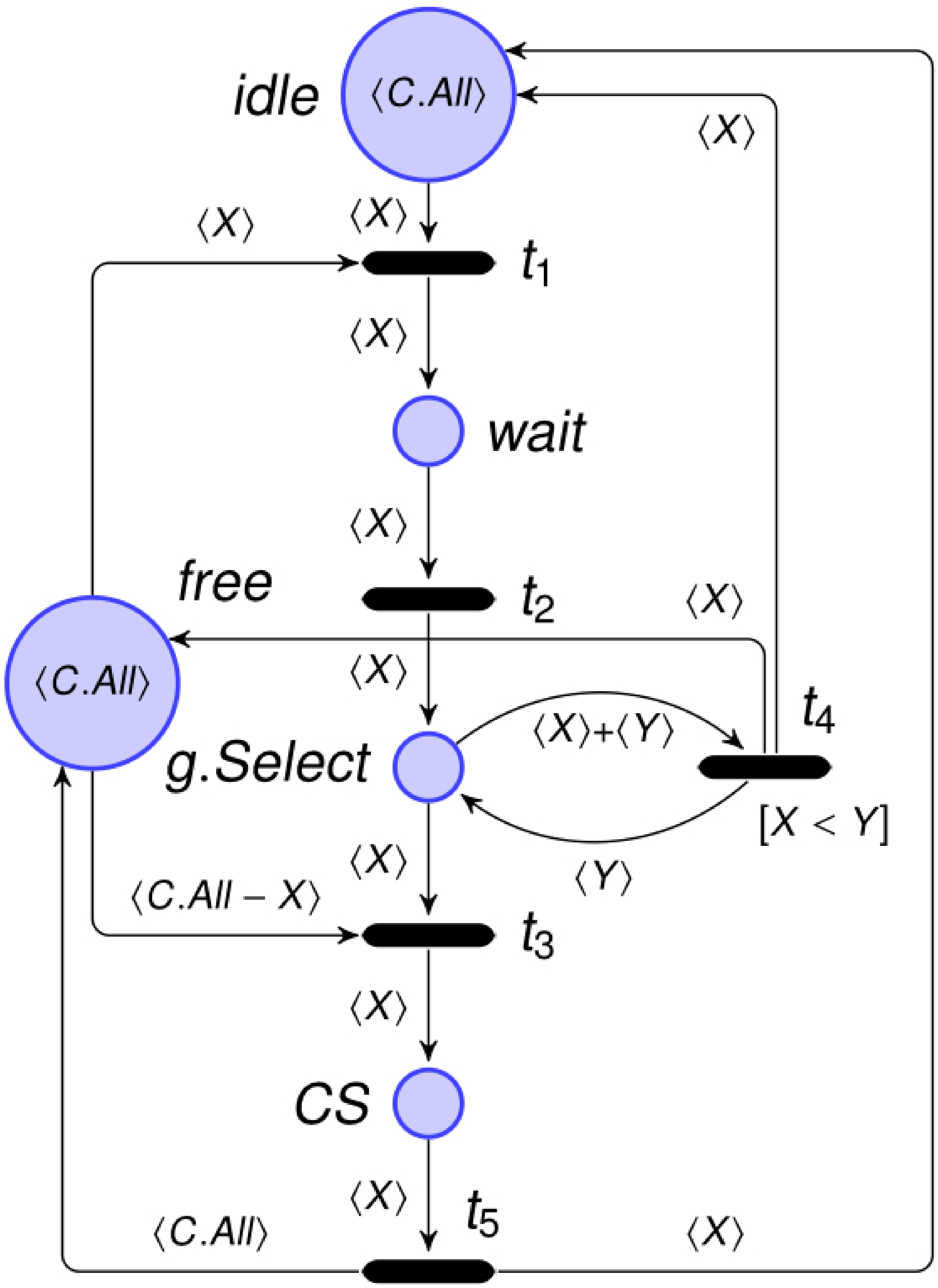
(Idle, wait, g.Select, CS, free)

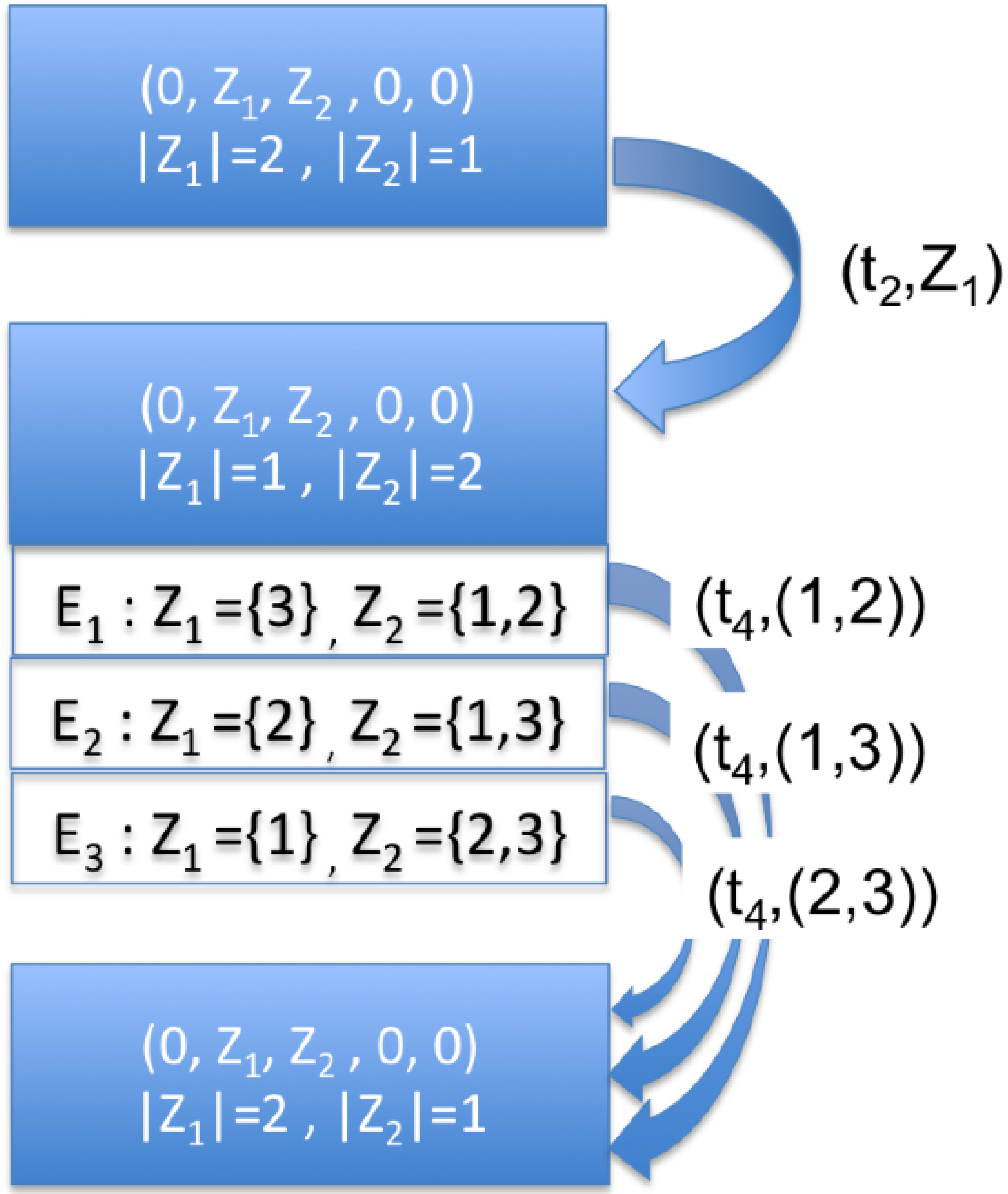
$(Z_1, 0, Z_2, 0, Z_3)$ $\lvert Z_1\rvert=1$, $\lvert Z_2\rvert=2$
$E_1 : Z_1=\{3\}, Z_2=\{1,2\}$
$E_2 : Z_1=\{2\}, Z_2=\{1,3\}$
$E_3 : Z_1=\{1\}, Z_2=\{2,3\}$

Symmetrical Representation (SR)

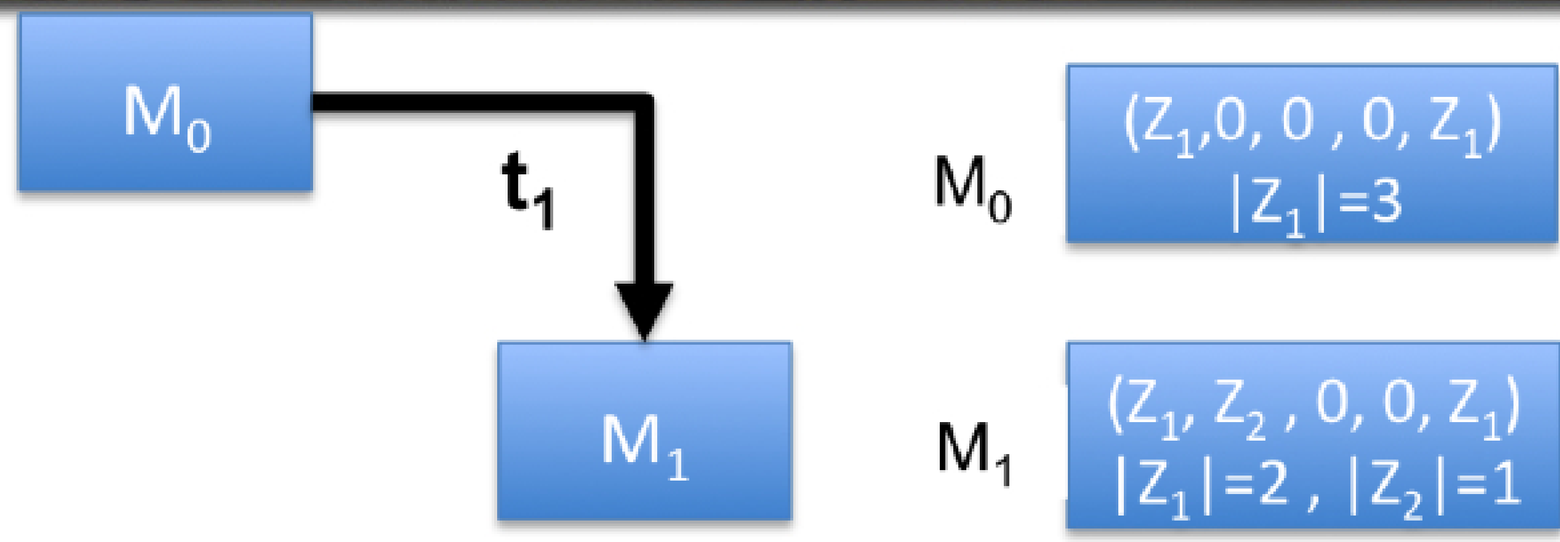
Eventuality (E)

SN and partial symmetries: esm firings

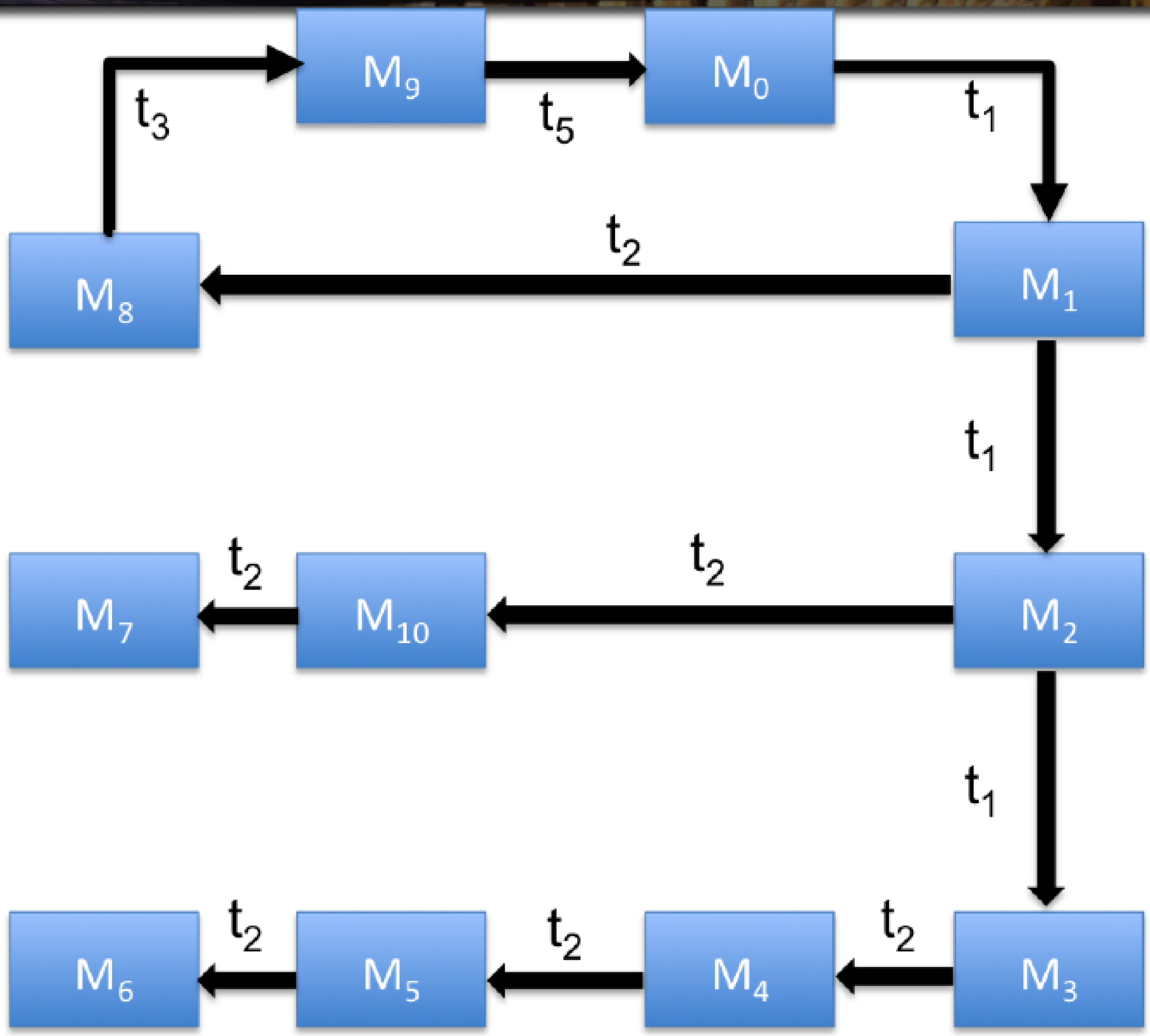




SN and partial symmetries: Extended SRG (1/3)

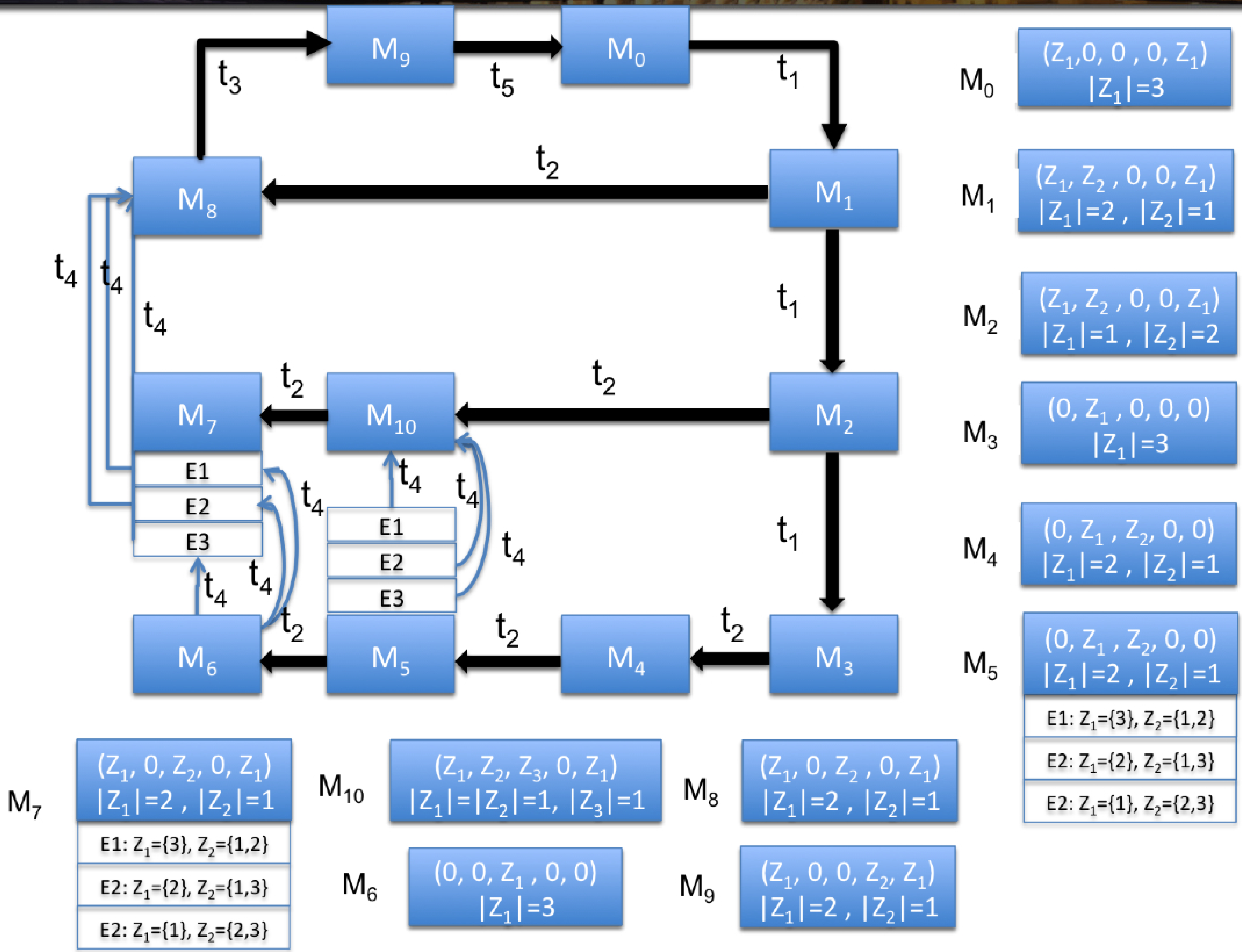


SN and partial symmetries: Extended SRG (2/3)



- M_0: $(Z_1, 0, 0, 0, Z_1)$, $|Z_1|=3$
- M_1: $(Z_1, Z_2, 0, 0, Z_1)$, $|Z_1|=2$, $|Z_2|=1$
- M_2: $(Z_1, Z_2, 0, 0, Z_1)$, $|Z_1|=1$, $|Z_2|=2$
- M_3: $(0, Z_1, 0, 0, 0)$, $|Z_1|=3$
- M_4: $(0, Z_1, Z_2, 0, 0)$, $|Z_1|=2$, $|Z_2|=1$
- M_5: $(0, Z_1, Z_2, 0, 0)$, $|Z_1|=2$, $|Z_2|=1$
- M_7: $(Z_1, 0, Z_2, 0, Z_1)$, $|Z_1|=2$, $|Z_2|=1$
- M_{10}: $(Z_1, Z_2, Z_3, 0, Z_1)$, $|Z_1|=|Z_2|=1$, $|Z_3|=1$
- M_8: $(Z_1, 0, Z_2, 0, Z_1)$, $|Z_1|=2$, $|Z_2|=1$
- M_6: $(0, 0, Z_1, 0, 0)$, $|Z_1|=3$
- M_9: $(Z_1, 0, 0, Z_2, Z_1)$, $|Z_1|=2$, $|Z_2|=1$

SN and partial symmetries: Extended SRG (3/3)



Conclusion

- The ESRG approach tackles the limitation of the SRG by alternating the two symmetrical and asymmetrical levels.
- When the system few asymmetrical transitions,
  - almost all the ESRG is constructed using SRs, and
  - few eventualities are developed.
  - Hence, the ESRG presents a high reduction degree with respect to the SRG.
- However, when the system is highly asymmetric,
  - a big amount of eventualities is developed.
  - Hence, the ESRG will have almost the same size then the SRG (RG), i.e., almost no reduction is obtained
- This can be handled thanks to local symmetries (not detailed here)

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Next, how to better parameterize models
How to reduce interleaving