

# High level Petri nets

## Extending classical Petri nets with color, time and hierarchy (informal introduction)

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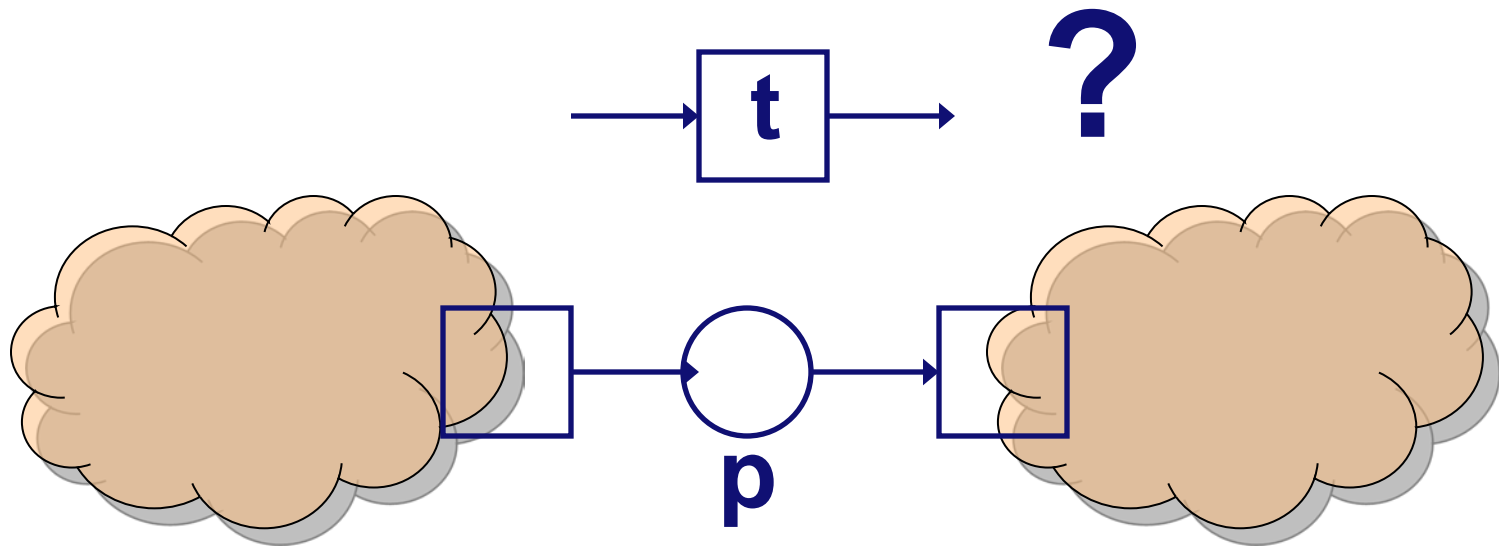
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# Limitations of classical Petri nets

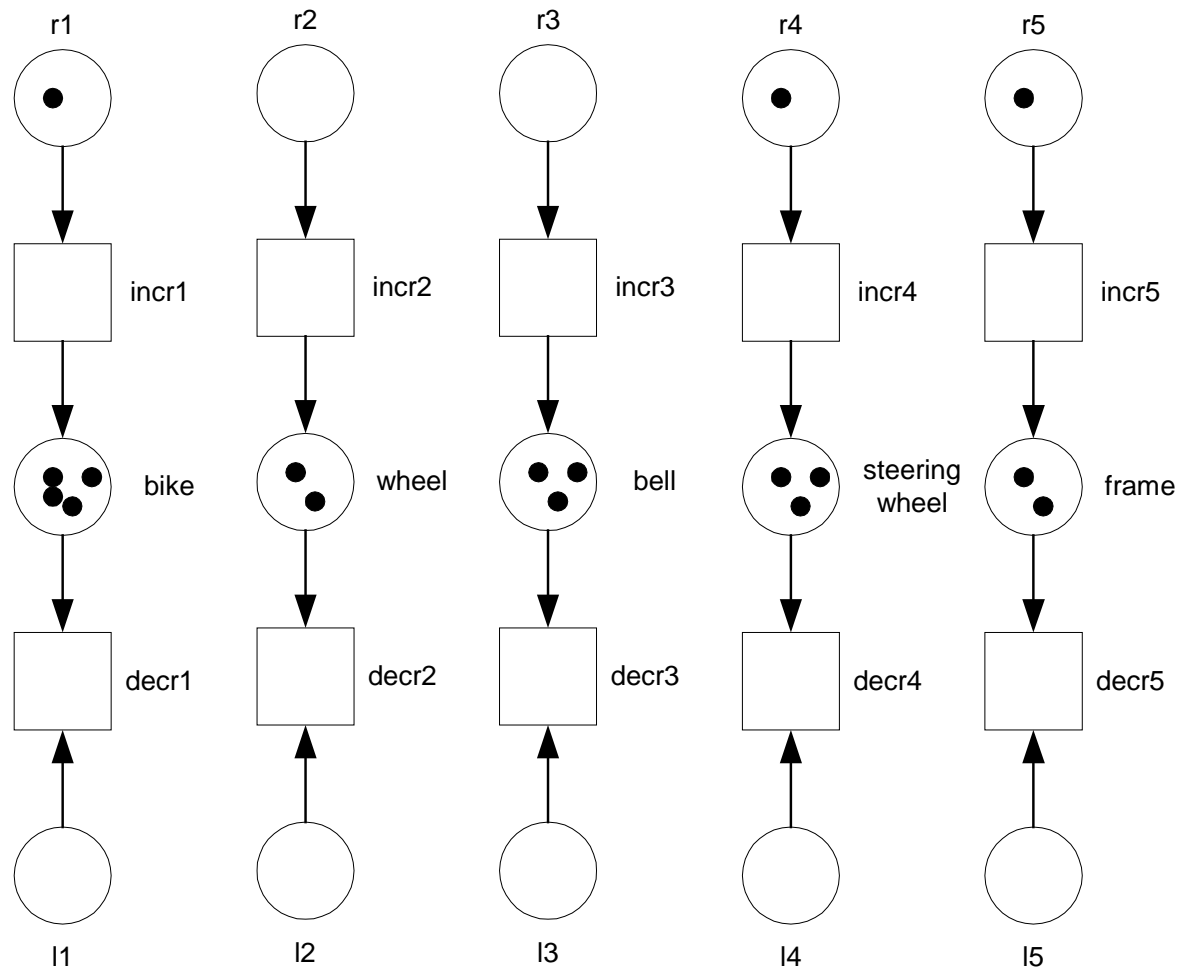
- **Inability to test for zero tokens in a place.**
- **Models tend to become large.**
- **Models cannot reflect temporal aspects**
- **No support for structuring large models, cf. top-down and bottom-up design**

# Inability to test for zero tokens in a place



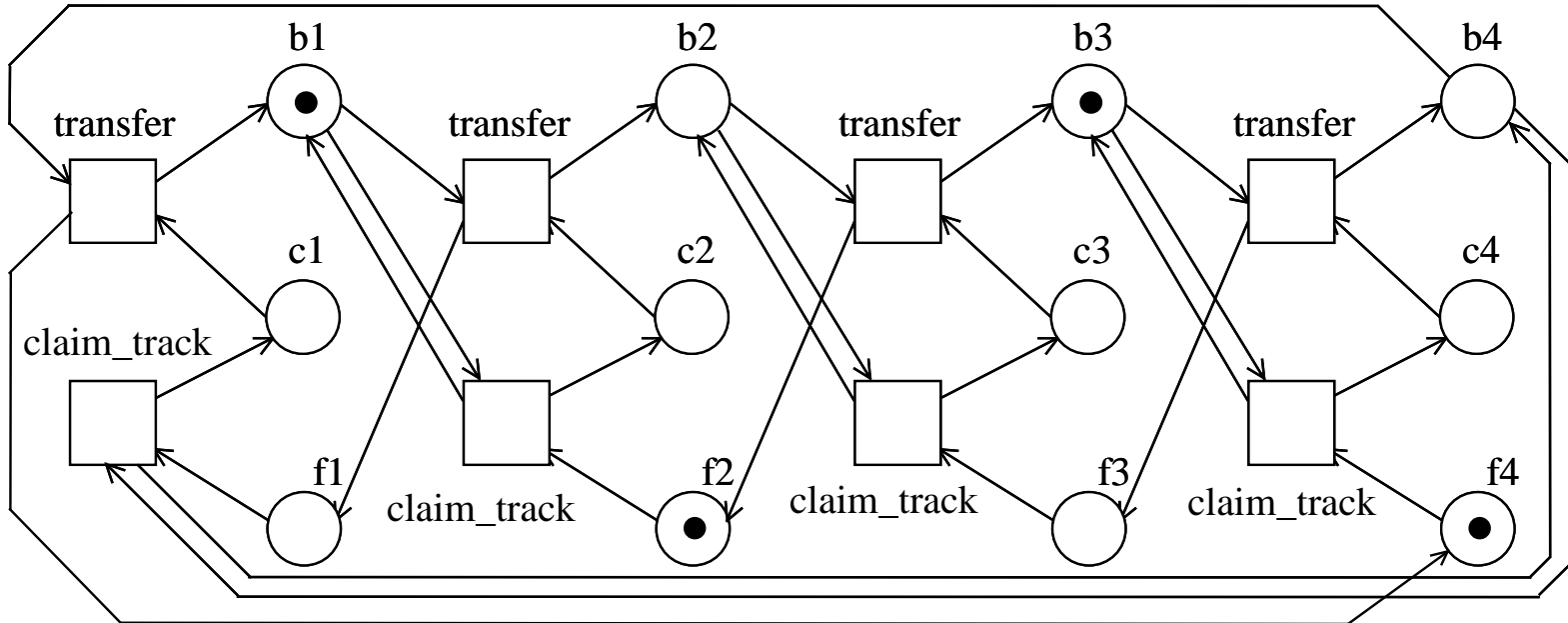
“Tricks” only work if  $p$  is bounded

# Models tend to become (too) large



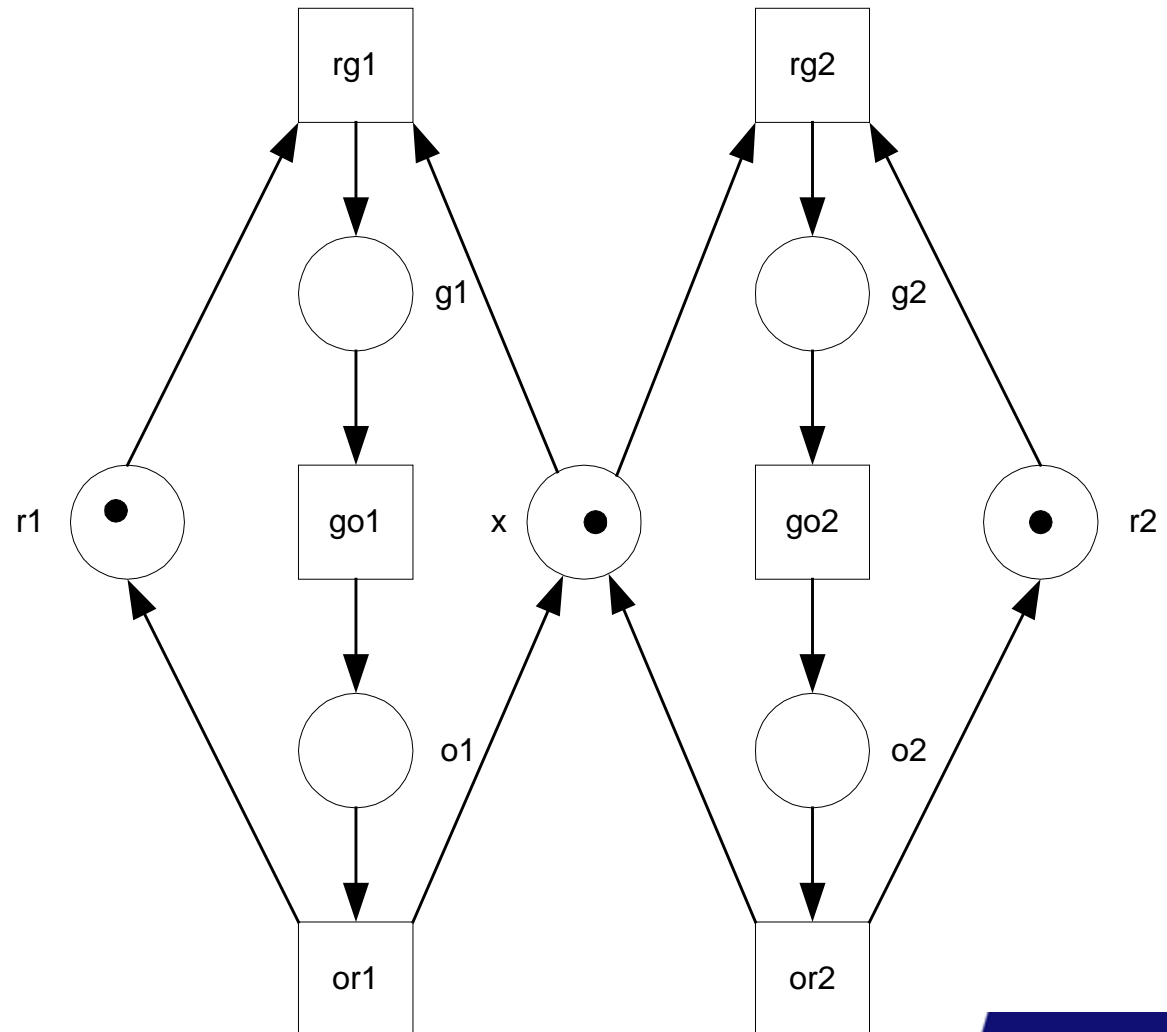
***Size linear in the number of products.***

# Models tend to become (too) large (2)



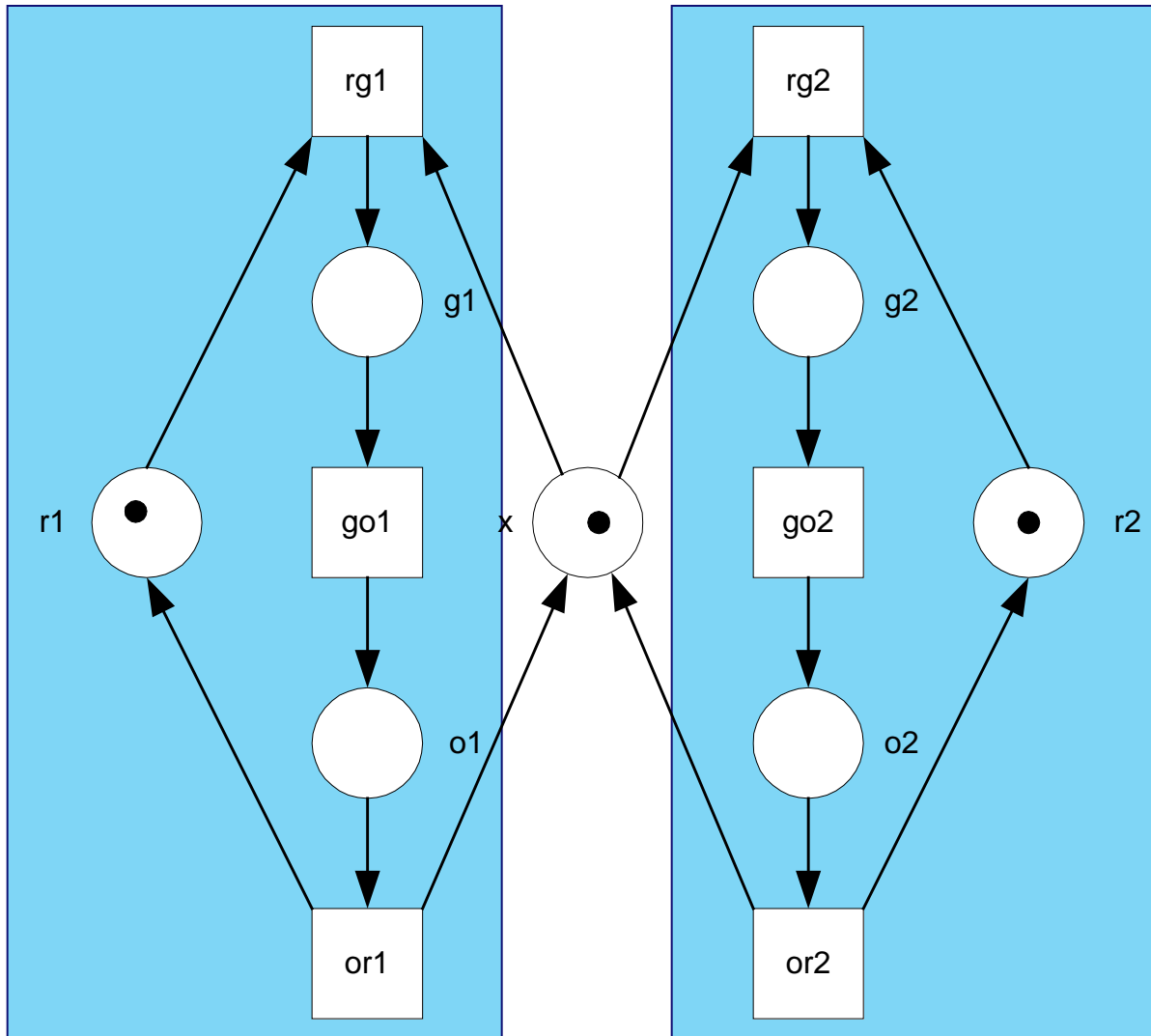
***Size linear in the number of tracks.***

# Models cannot reflect temporal aspects



*Duration of each phase is highly relevant.*

# No support for structuring large models



# High-level Petri nets

- To tackle the problems identified.
- Petri nets extended with:
  - Color (i.e., data)
  - Time
  - Hierarchy
- For the time being we do not choose a concrete language but focus on the main concepts.
- Later we focus on a concrete language: *CPN*.
- These concepts are supported by many variants of CPN including ExSpect, CPN AMI, etc.



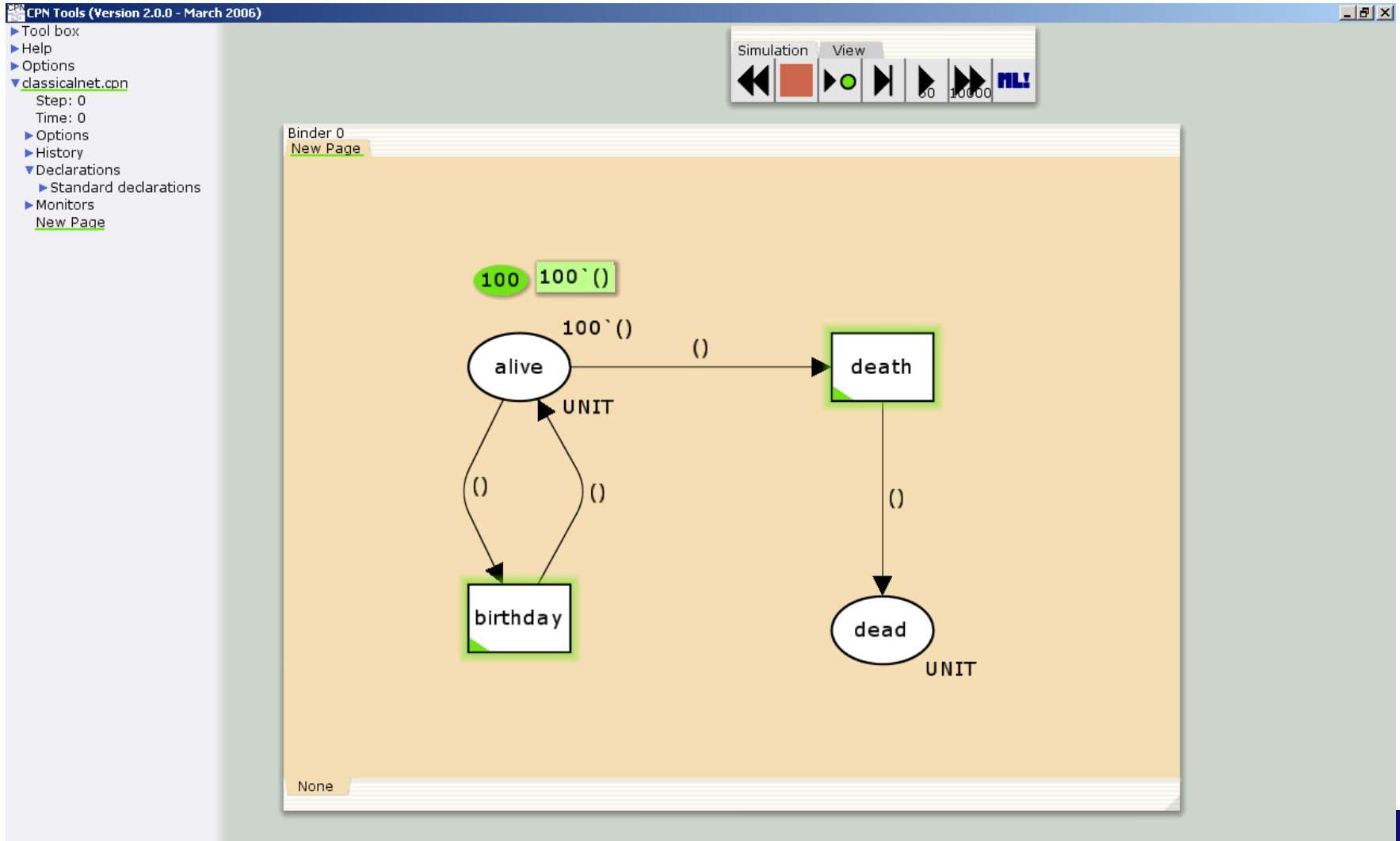
# Example: CPN Tools

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# Classical net



# Extension with color

CPN Tools (Version 2.0.0 - March 2006)

- ▶ Tool box
- ▶ Help
- ▶ Options
- ▼ colorednet.cpn
  - ▶ Step: 0
  - ▶ Time: 0
  - ▶ Options
  - ▶ History
  - ▼ Declarations
    - ▼ Standard declarations
      - ▶ colset UNIT
      - ▶ colset INT
      - ▶ colset BOOL
      - ▶ colset STRING
      - ▼ colset Name = string;
      - ▼ colset Age = int;
      - ▼ colset Person = product Name \* Age;
      - ▼ var n:Name;
      - ▼ var a:Age;
      - ▼ var p:Person;
  - ▶ Monitors
  - ▶ [New Page](#)

Simulation View

Binder 0  
[New Page](#)

The diagram shows a Petri net with the following components:

- Places:** `alive` (circle), `death` (rectangle), `birthday` (rectangle), `dead` (circle).
- Transitions:** `birthday` (rectangle), `death` (rectangle).
- Initial State:** `alive` contains 1 token of color `"John", 0` and 1 token of color `"Mary", 0`. A green box highlights these tokens with the number 2.
- Transitions and Guards:**
  - `birthday` (rectangle) has a guard `[a > 65]` and a label `(n, a)` on the outgoing arrow to `alive`.
  - `death` (rectangle) has a label `(n, a)` on the outgoing arrow to `dead`.
- Labels:** `Person` is labeled near the `alive` and `dead` places.

None

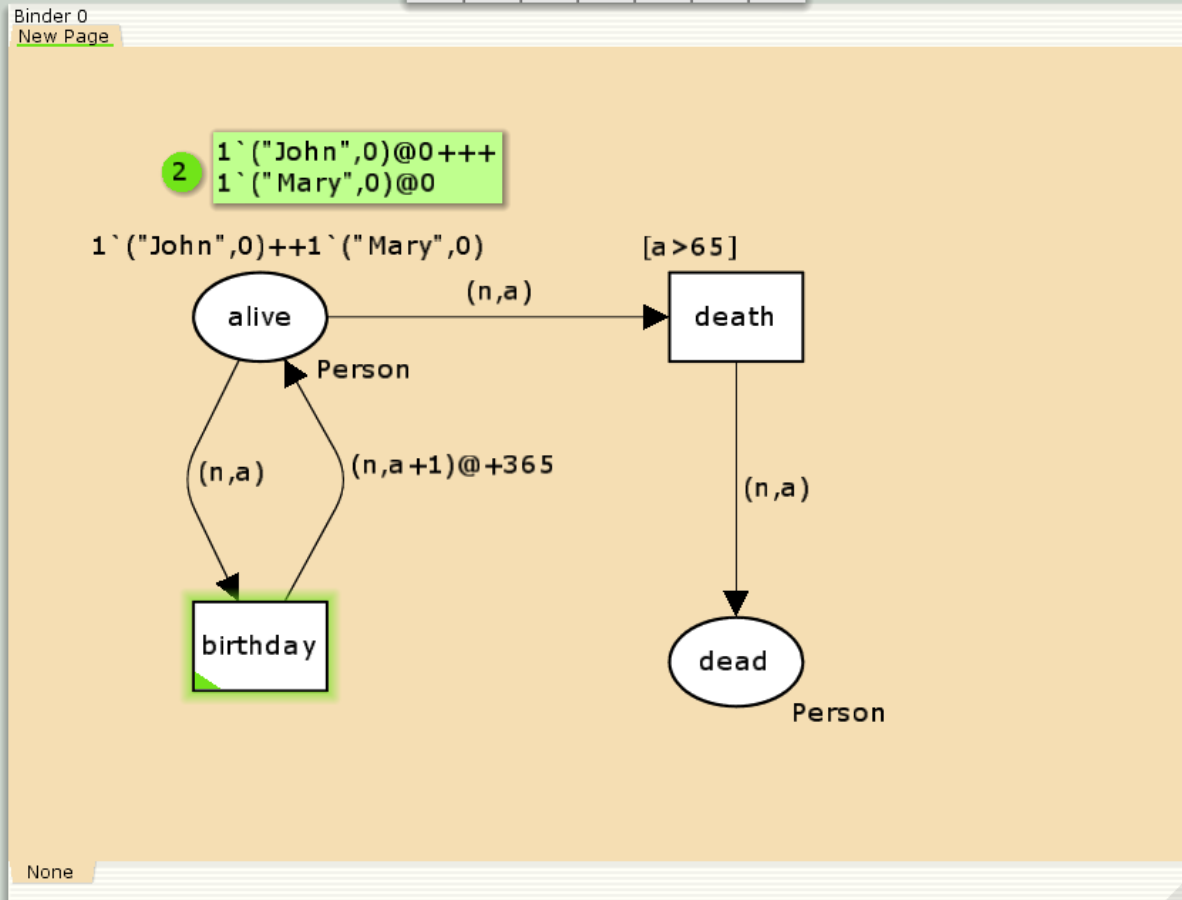
# Extension with time

CPN Tools (Version 2.0.0 - March 2006)

- ▶ Tool box
- ▶ Help
- ▶ Options
- ▼ timednet.cpn
  - Step: 0
  - Time: 0
  - ▶ Options
  - ▶ History
  - ▼ Declarations
    - ▼ Standard declarations
      - ▶ colset UNIT
      - ▶ colset INT
      - ▶ colset BOOL
      - ▶ colset STRING
      - ▶ colset Name
      - ▼ colset Age = int;
      - ▼ colset Person = product Name \* Age timed;
      - ▼ var n:Name;
      - ▼ var a:Age;
      - ▼ var p:Person;
  - ▶ Monitors
  - New Page

Simulation View

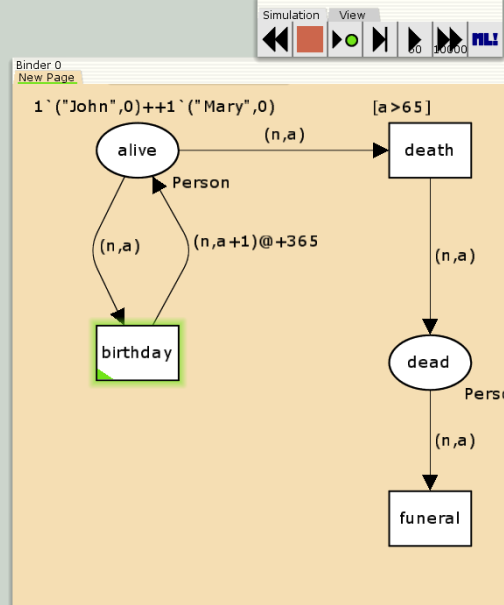
60 10000



# Hierachy

CPN Tools (Version 2.0.0 - March 2006)

- Tool box
- Help
- Options
- extendednet.con
- Step: 0
- Time: 0
- Options
- History
- Declarations
  - Standard declarations
    - colset UNIT
    - colset INT
    - colset BOOL
    - colset STRING
    - colset Name
    - colset Age = int;
    - colset Person = product Name \* Age timed;
    - var n:Name;
    - var a:Age;
    - var p:Person;
- Monitors
- New Page



CPN Tools (Version 2.0.0 - March 2006)

