

# Discovering Hierarchical Consolidated Models from Process Families

Nour Assy

**AIS meeting**

# What are Process Families?

- Collections of related process variants

Different versions of the same process

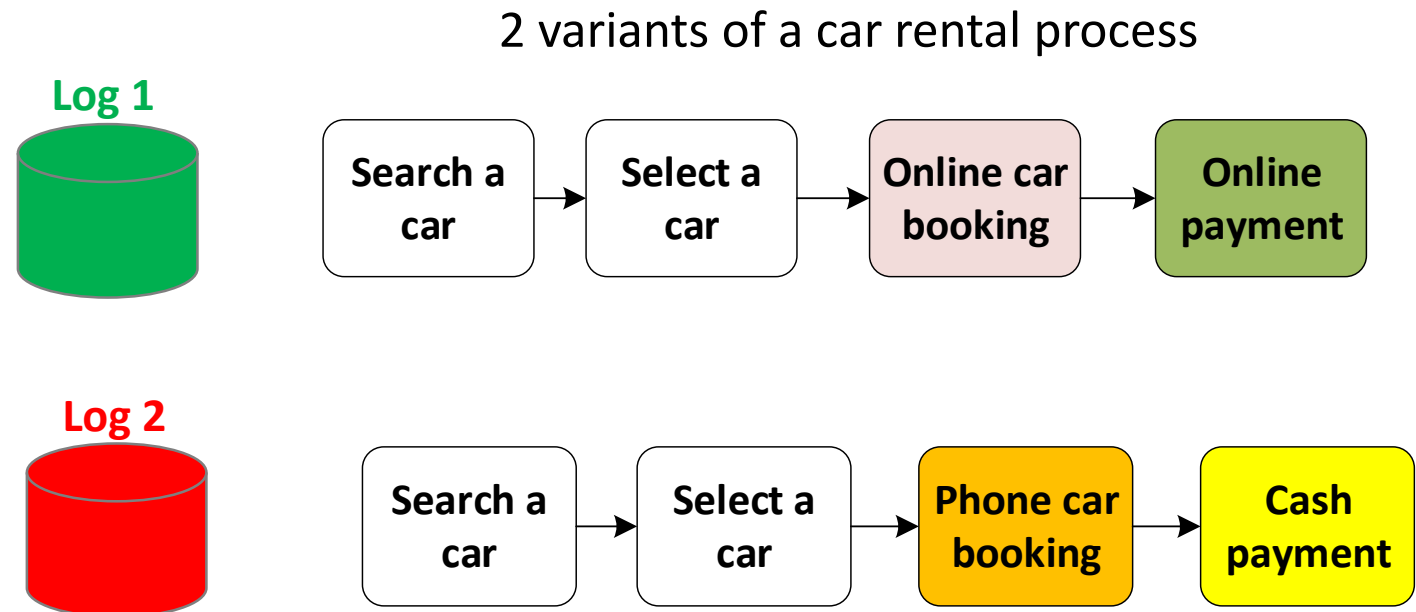


Process with varying features (e.g. for different customers' types)



# Problem of Process Families

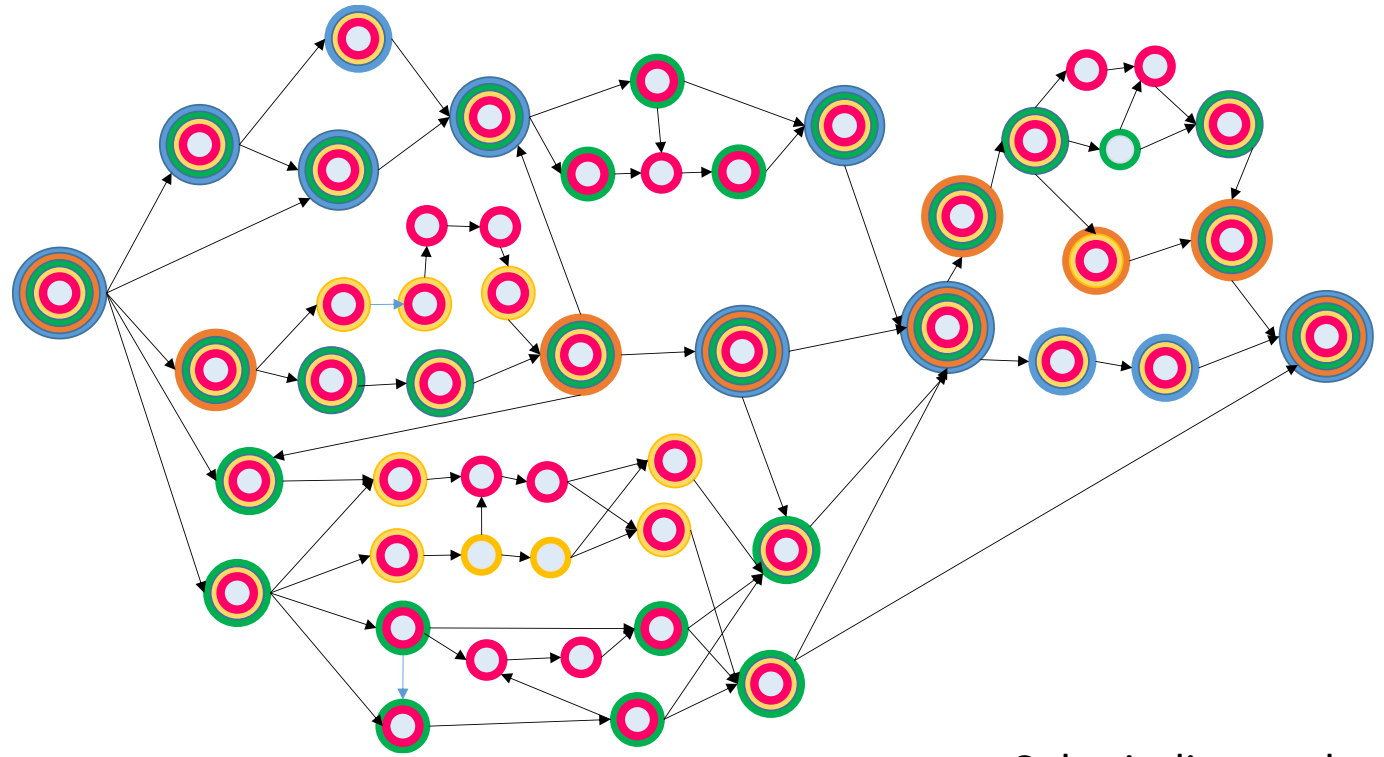
- Variants are executed similarly, but also with some differences
- Discovering and maintaining each variant separately is costly and creates redundancy



# Need for consolidated models

- One generic process model
- shows the commonalities and differences among variants
- Allows to efficiently analyze and track changes between variants in a unified way

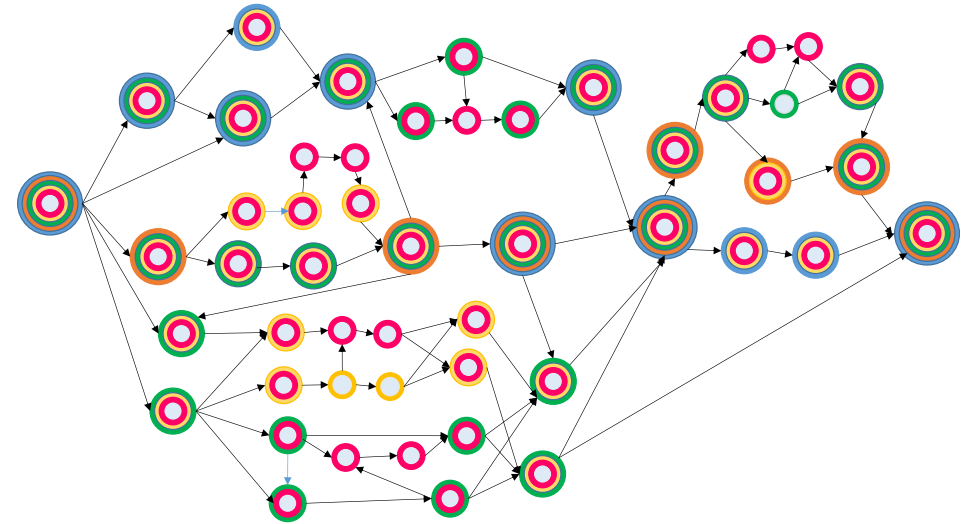
# Discovering consolidated models (State-of-the-art, without technical details)



Color indicates the variant to which the activity belongs

# The Challenge

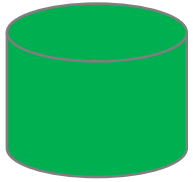
- number of variants increases → more common to observe partly shared behavior between a subset of the variants
- Result:
  - Large and complex consolidated models
  - Difficult to obtain comparative insights



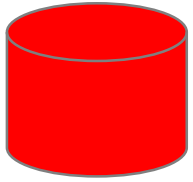
# Proposed approach

- Discovering a hierarchical consolidated model
- Hierarchy with two features:
  - Different levels of abstraction
  - Commonalities and differences between fragments instead of elements

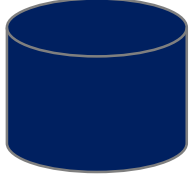
**L1**



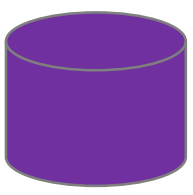
**L2**



**L3**

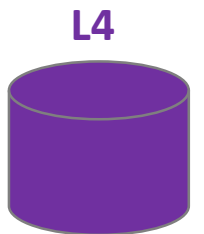
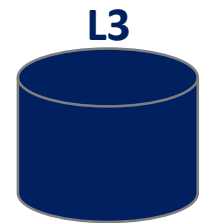
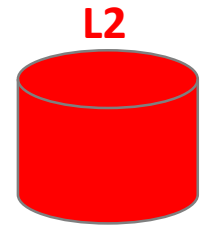
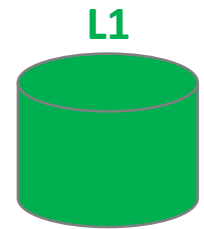


**L4**

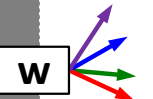
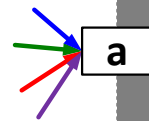




# Most abstract level

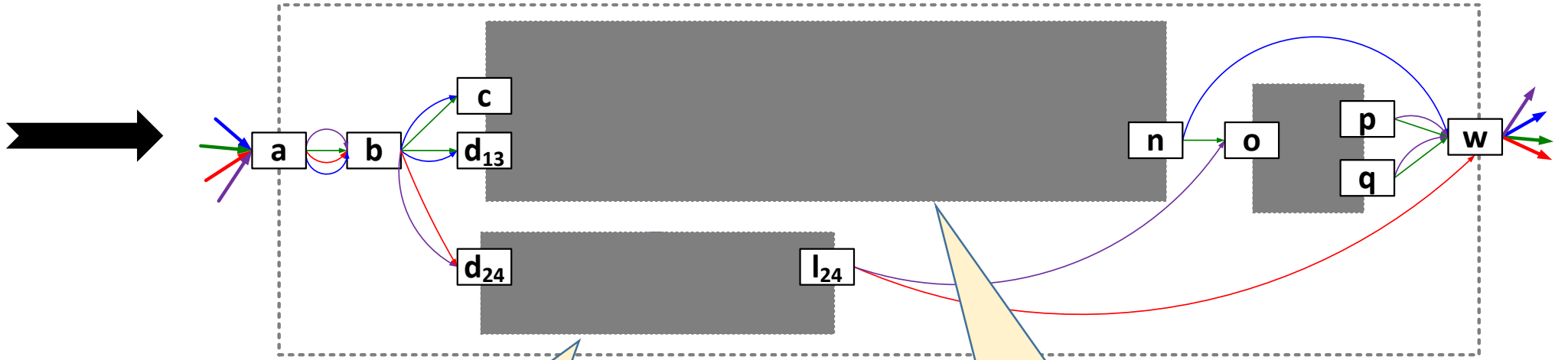
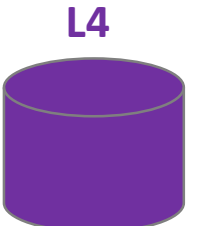
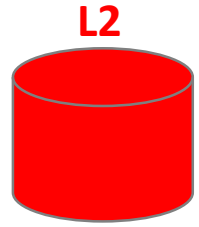
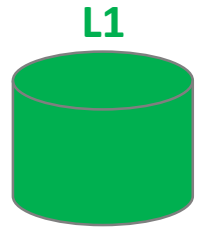


Edges are colored in the consolidated model instead of nodes



**All variants enter through "a" and exit through "w"**

Going one level down  
→ Unfold the internal behavior

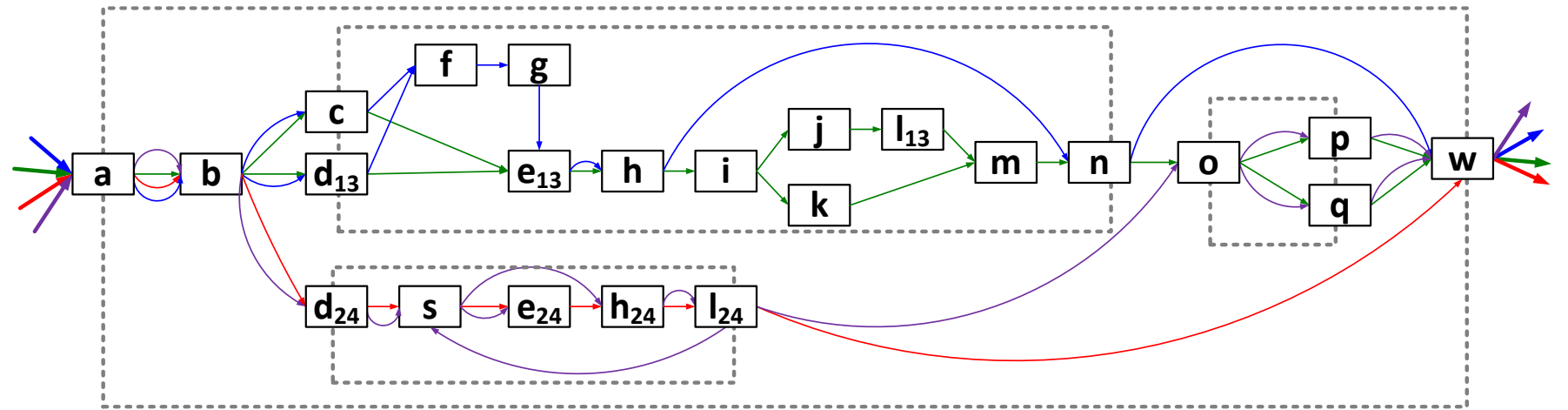
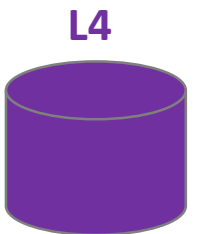
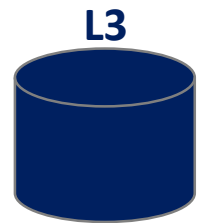
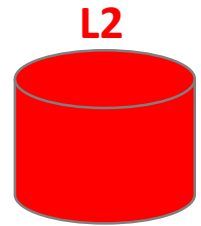
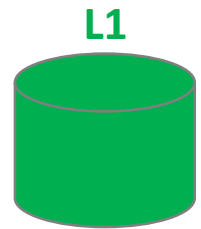


**P2** and **P4** enter through "d<sub>24</sub>", exit through "l<sub>24</sub>"

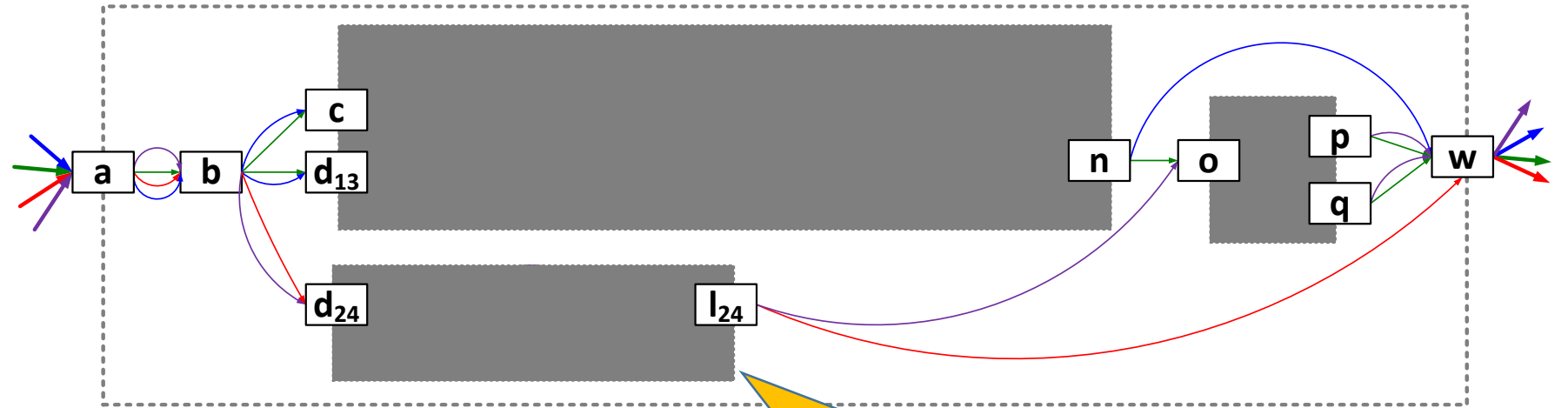
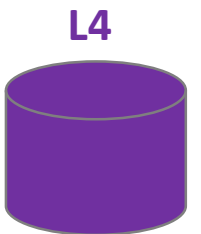
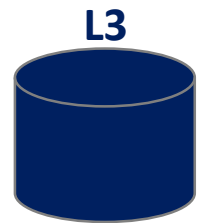
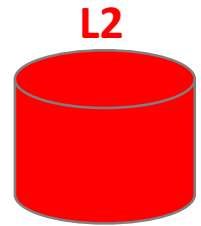
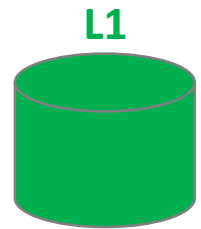
**P1** and **P3** enter through "c" and "d<sub>13</sub>", exit through "n"

One more level down

→ The entire consolidated model



Going back to one upper level:  
What do these gray boxes stand for?



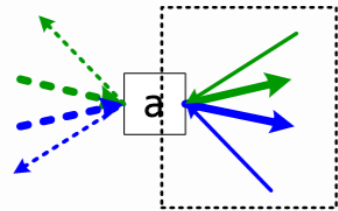
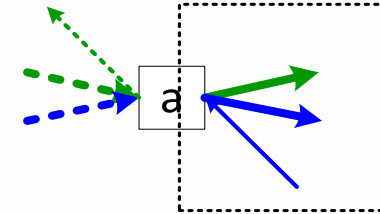
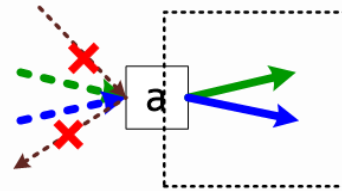
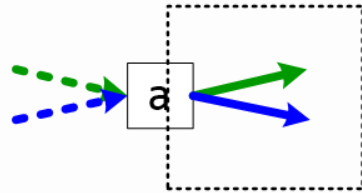
**SHARED-Entry SHARED-Exit  
SHESHE**

# SHared-Entry SHared Exit (SHESHE)

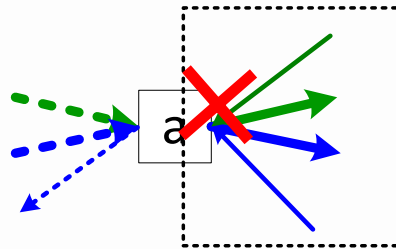
- Inspired from the well-known concept Single-Entry Single-Exit (SESE)
- independent block with well-defined interfaces
- Entered and exited via shared paths
- Internal behavior: encloses a local variability between its variants

# SHESHE Definition (more details in the paper)

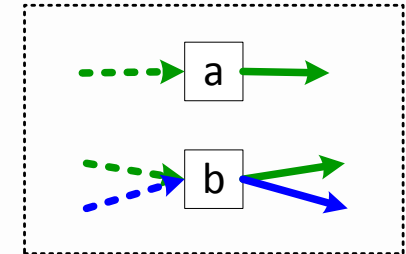
**Shared Entry**



**Shared Entry and Exit**



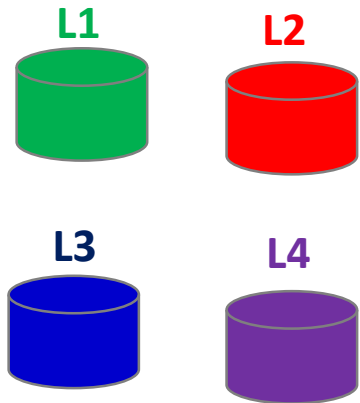
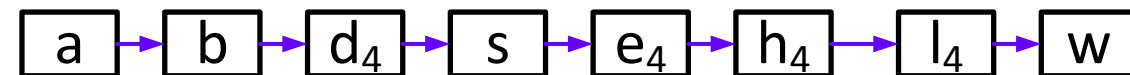
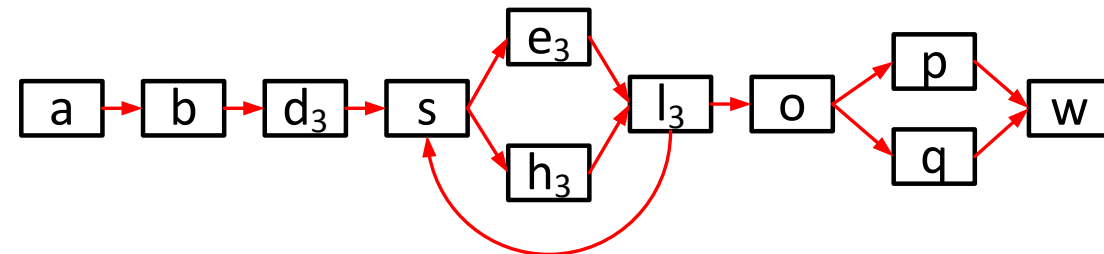
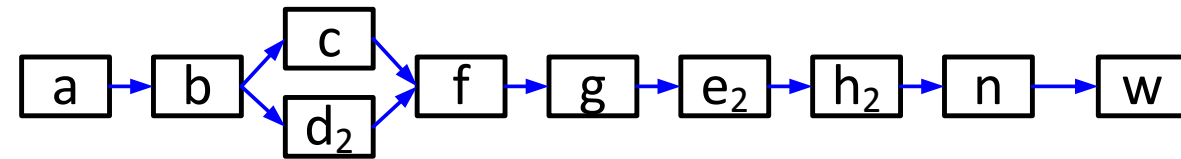
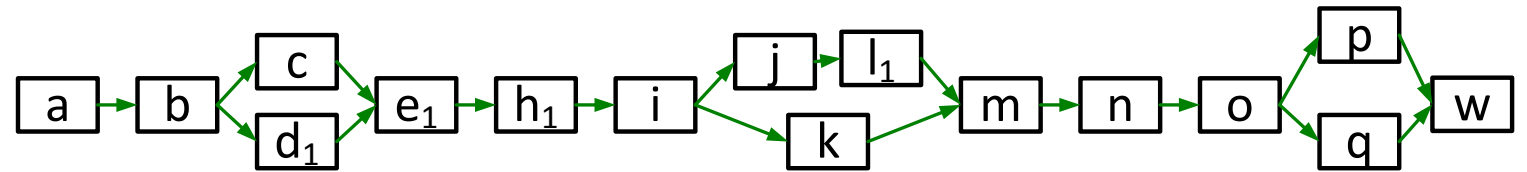
**Blue is entry and exit  
Green only entry (not allowed)**



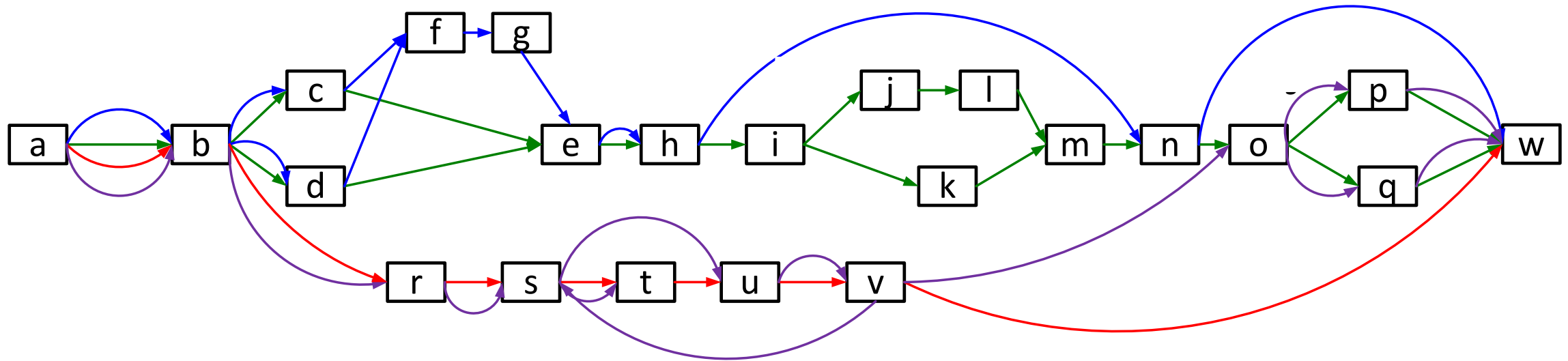
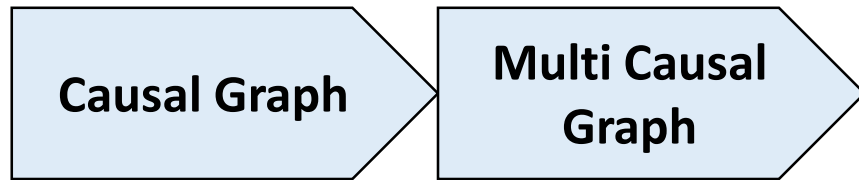
**Local**

# Deriving hierarchy of SHESHEs

Causal Graph

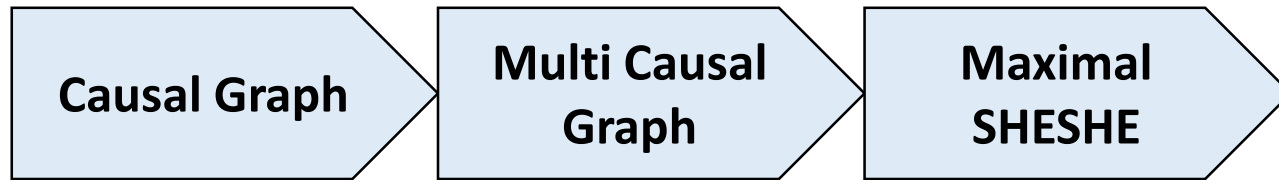


# Deriving hierarchy of SHESHEs

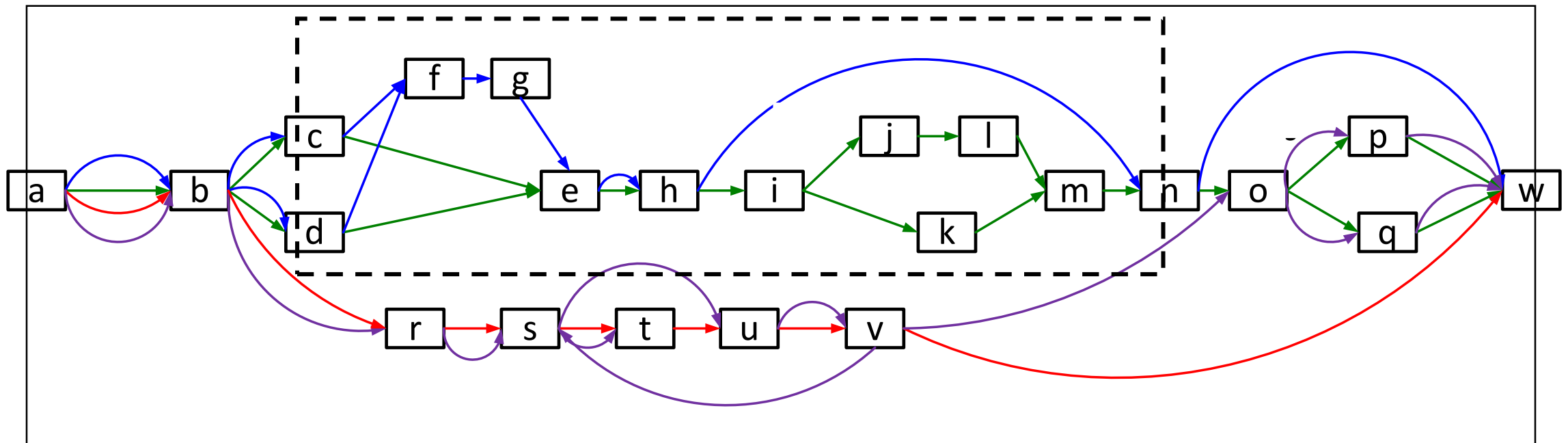




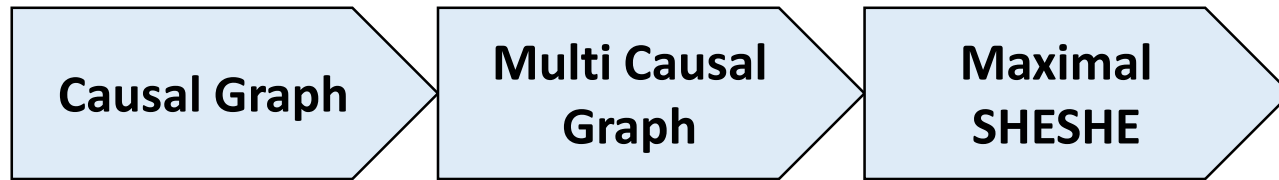
# Deriving hierarchy of SHESHEs



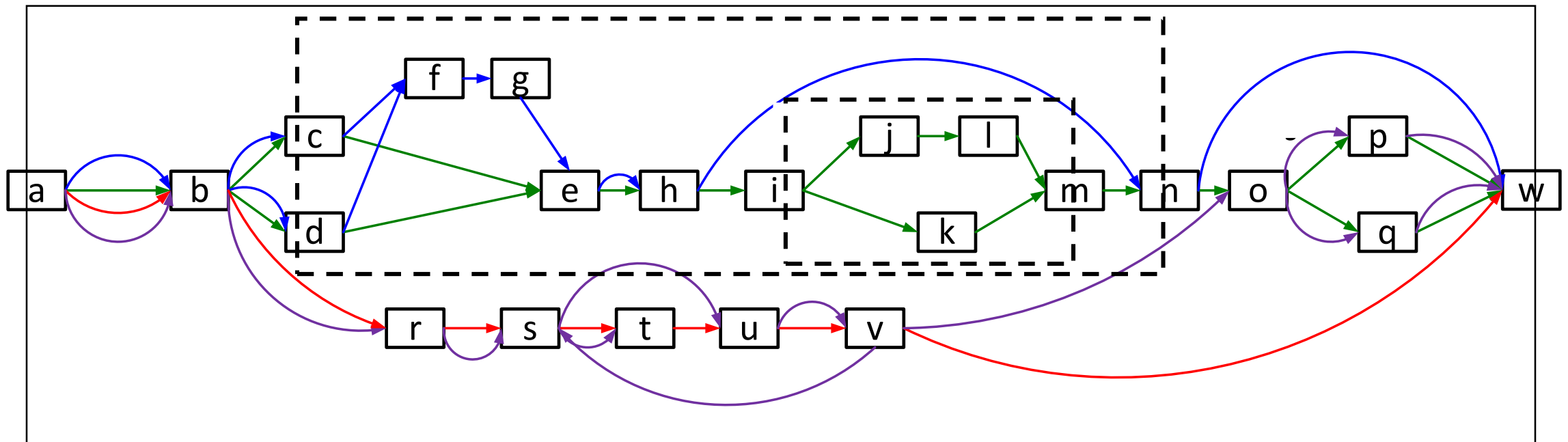
**Largest weakly connected**  
fragment shared between  
a subset of variants



# Deriving hierarchy of SHESHEs

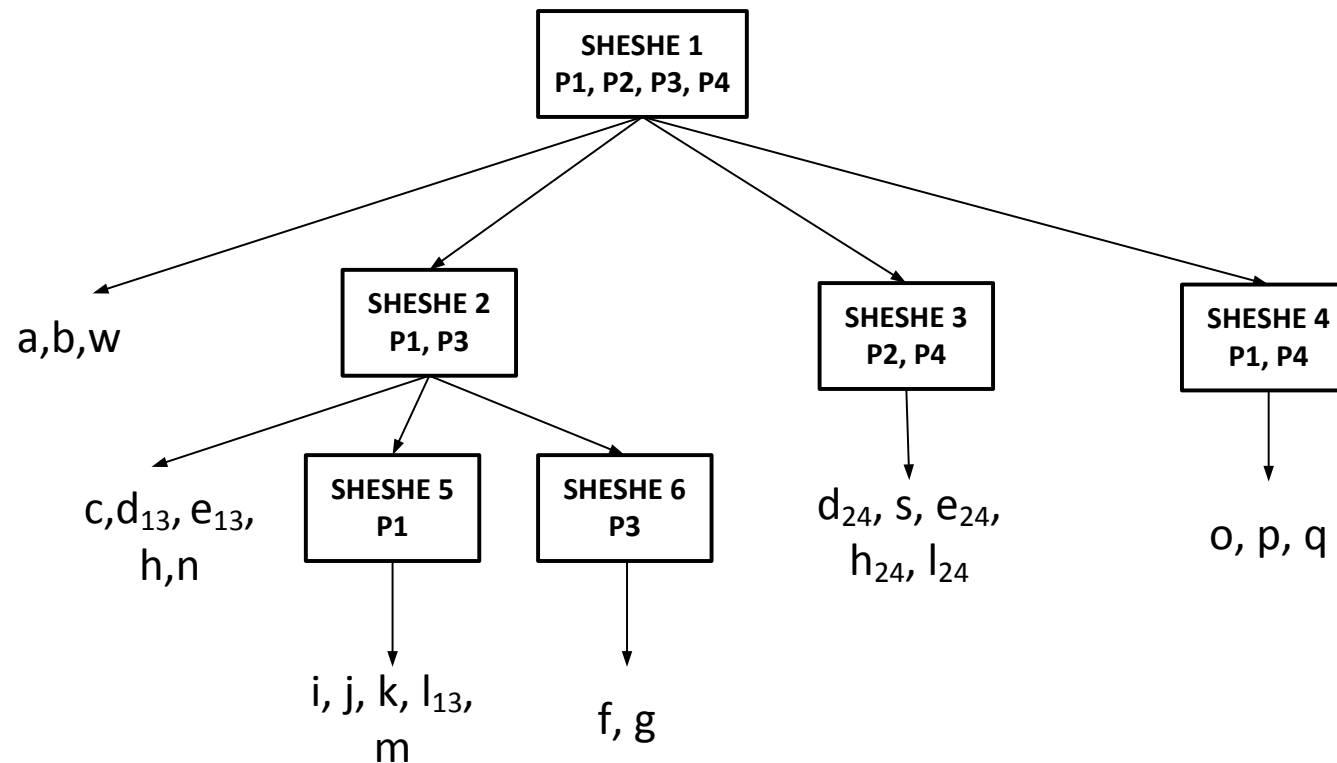
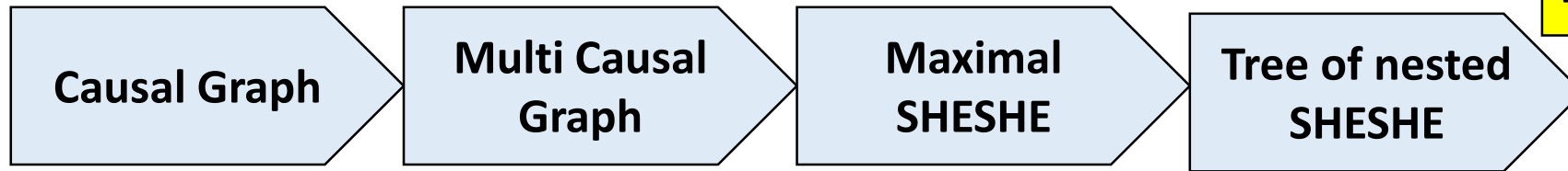


**Largest weakly connected**  
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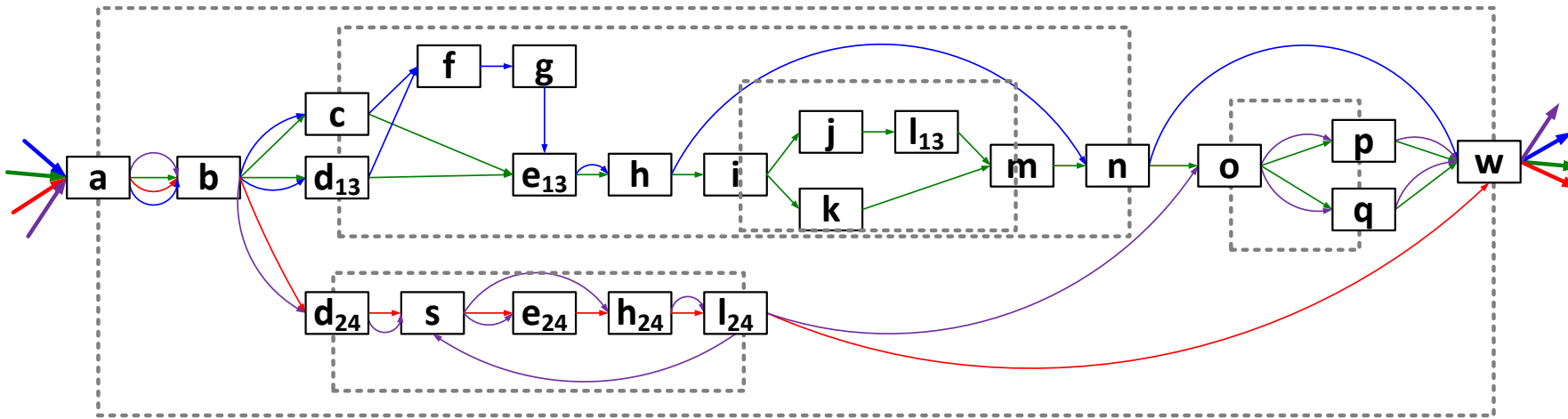
# Deriving hierarchy of SHESHEs

Unique  
Non overlapping SHESHE

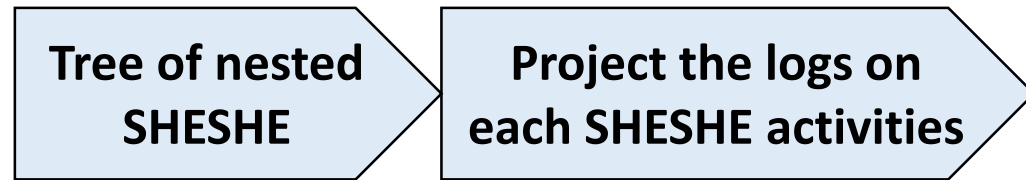


# Discovering the hierarchical consolidated model

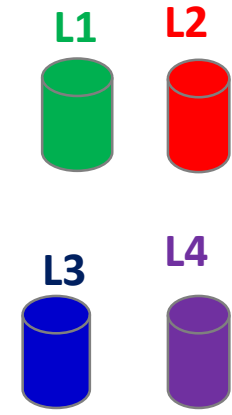
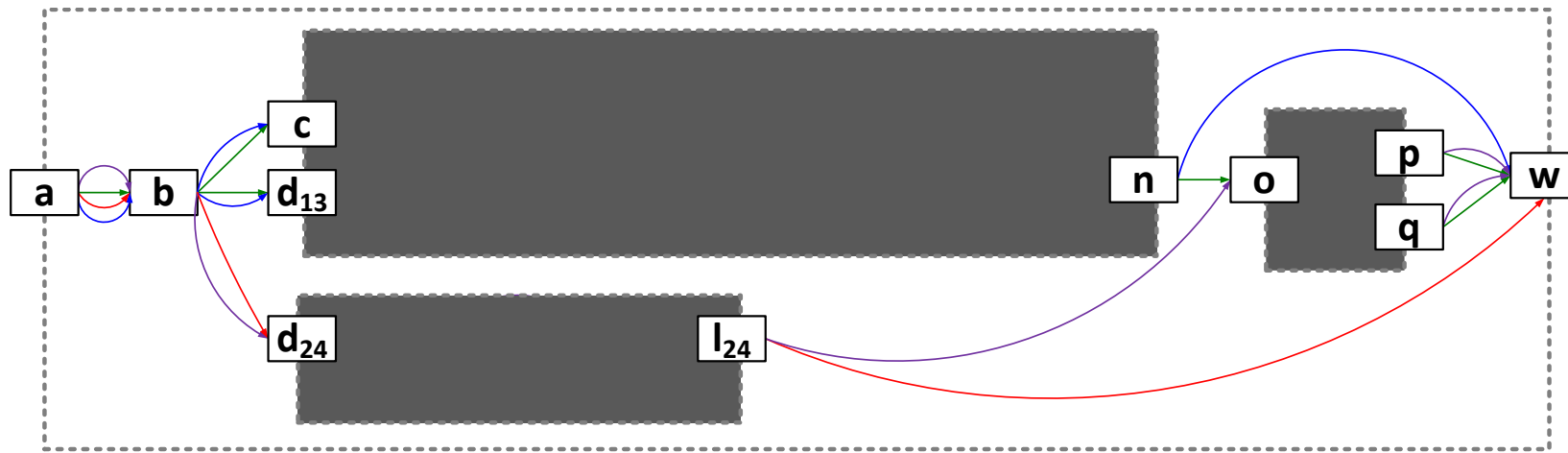
Tree of nested SHESHE



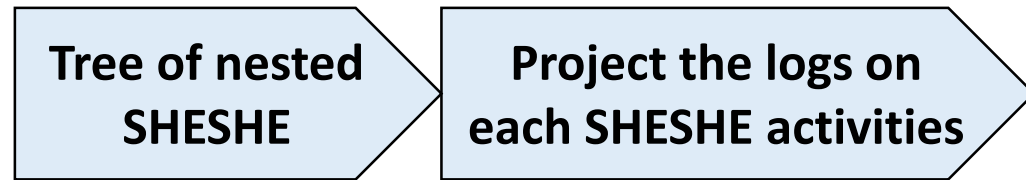
# Discovering the hierarchical consolidated model



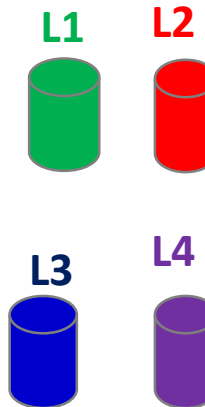
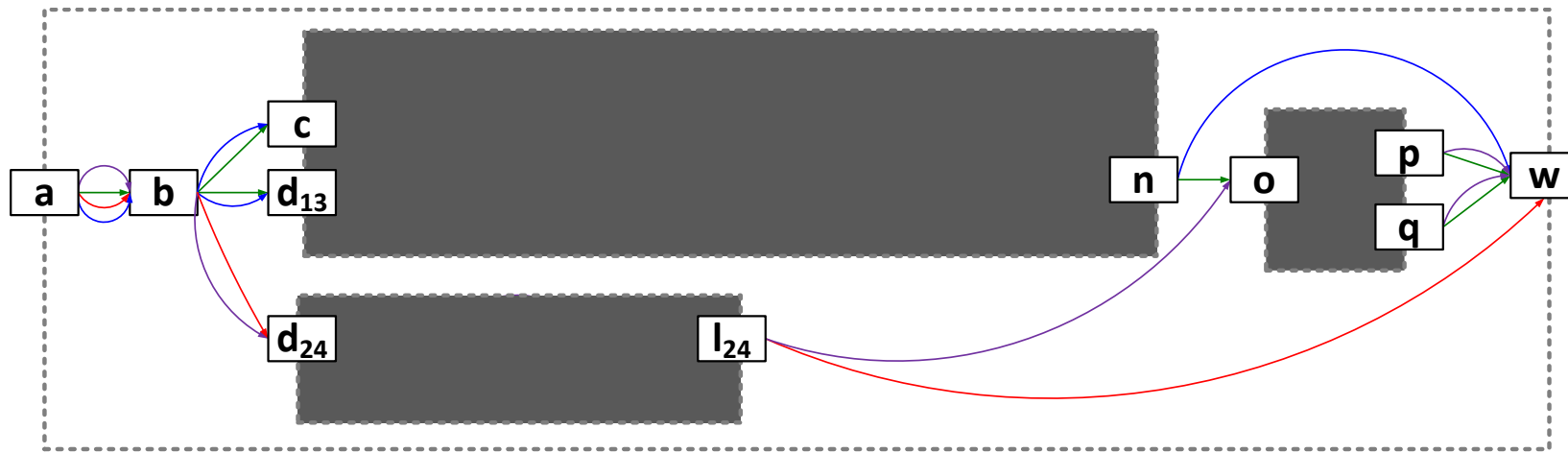
Project the traces on "a", "b", "c", "d<sub>13</sub>", "n", ...



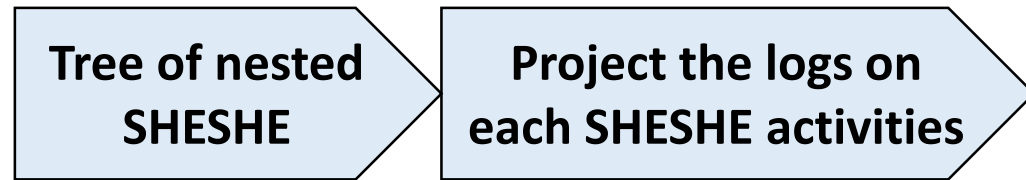
# Discovering the hierarchical consolidated model



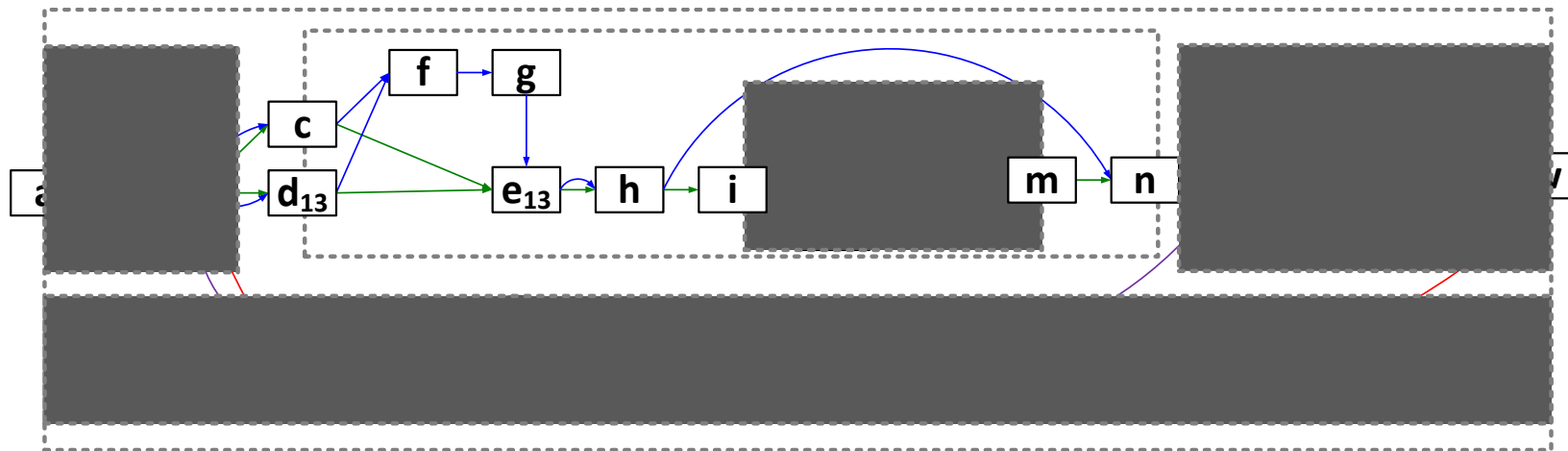
Discover a fragment



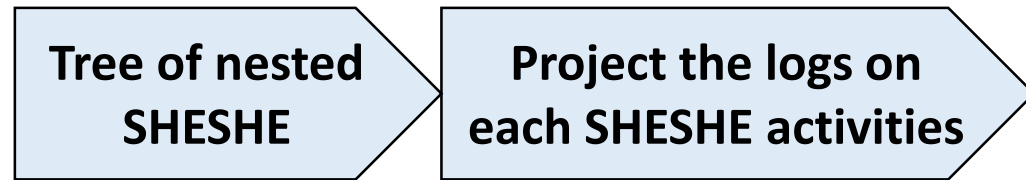
# Discovering the hierarchical consolidated model



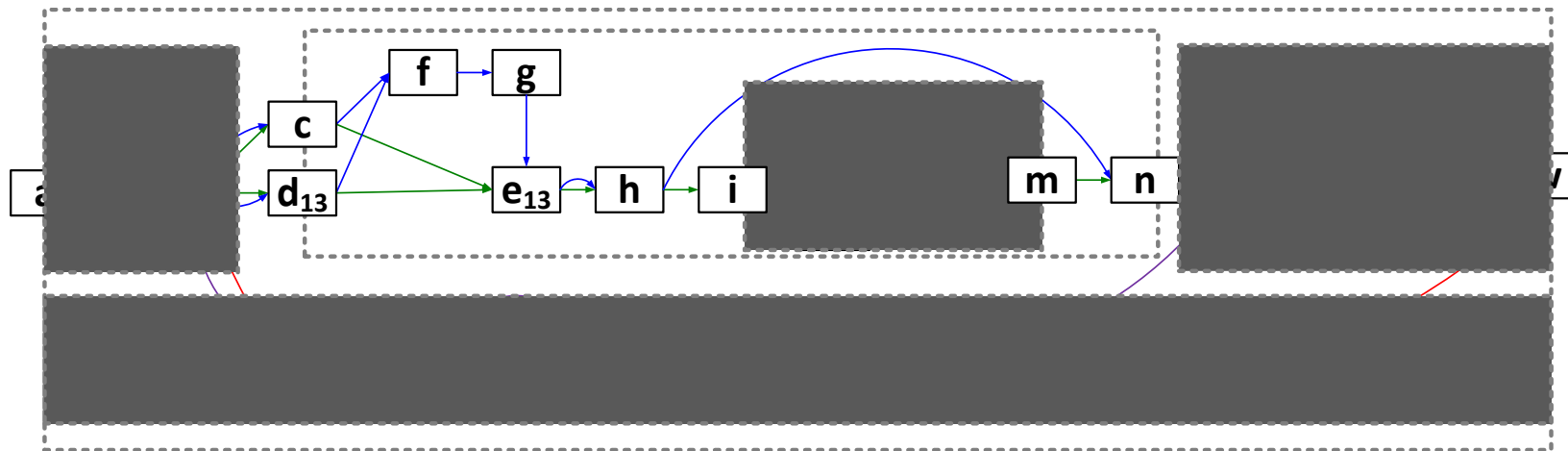
Project the traces on "c", "d<sub>13</sub>", "n", "f" ...



# Discovering the hierarchical consolidated model

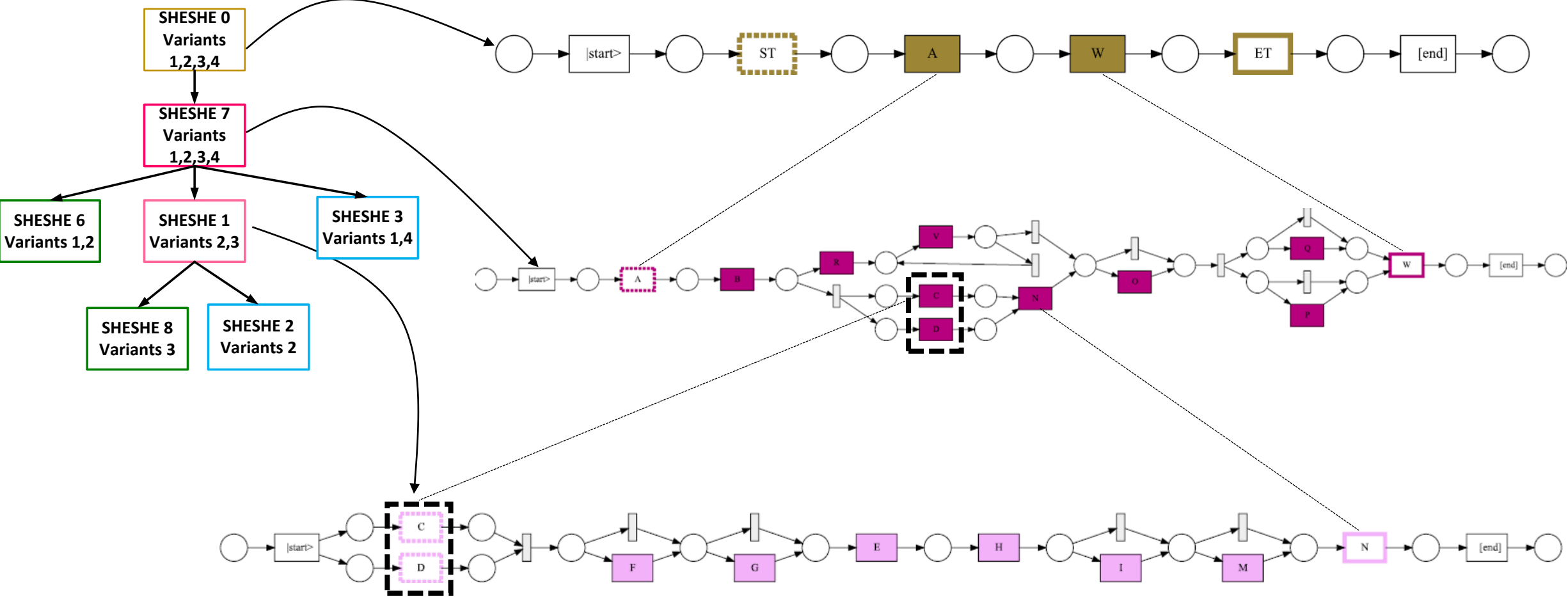


Discover a fragment



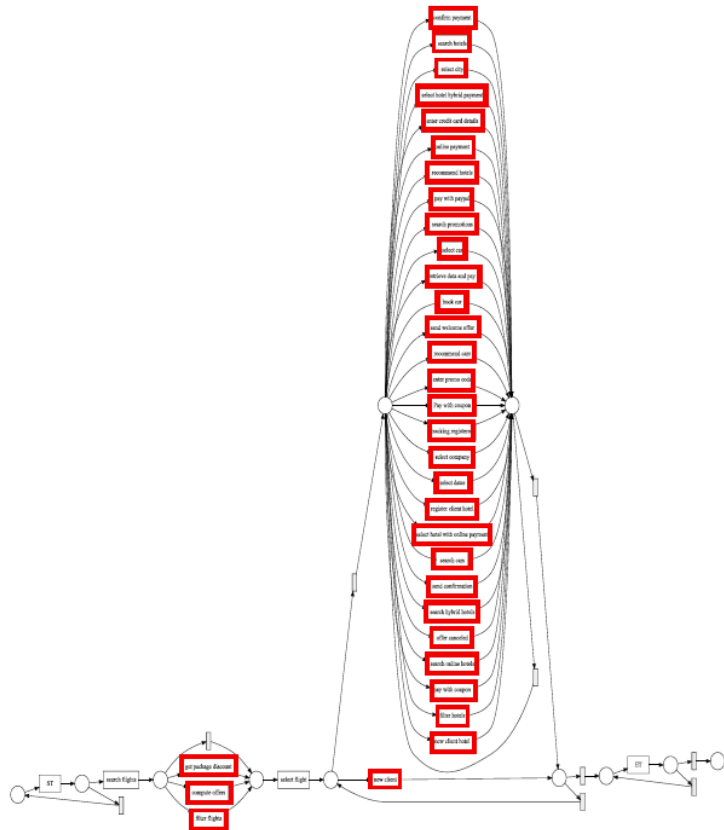


# Example with 4 variants



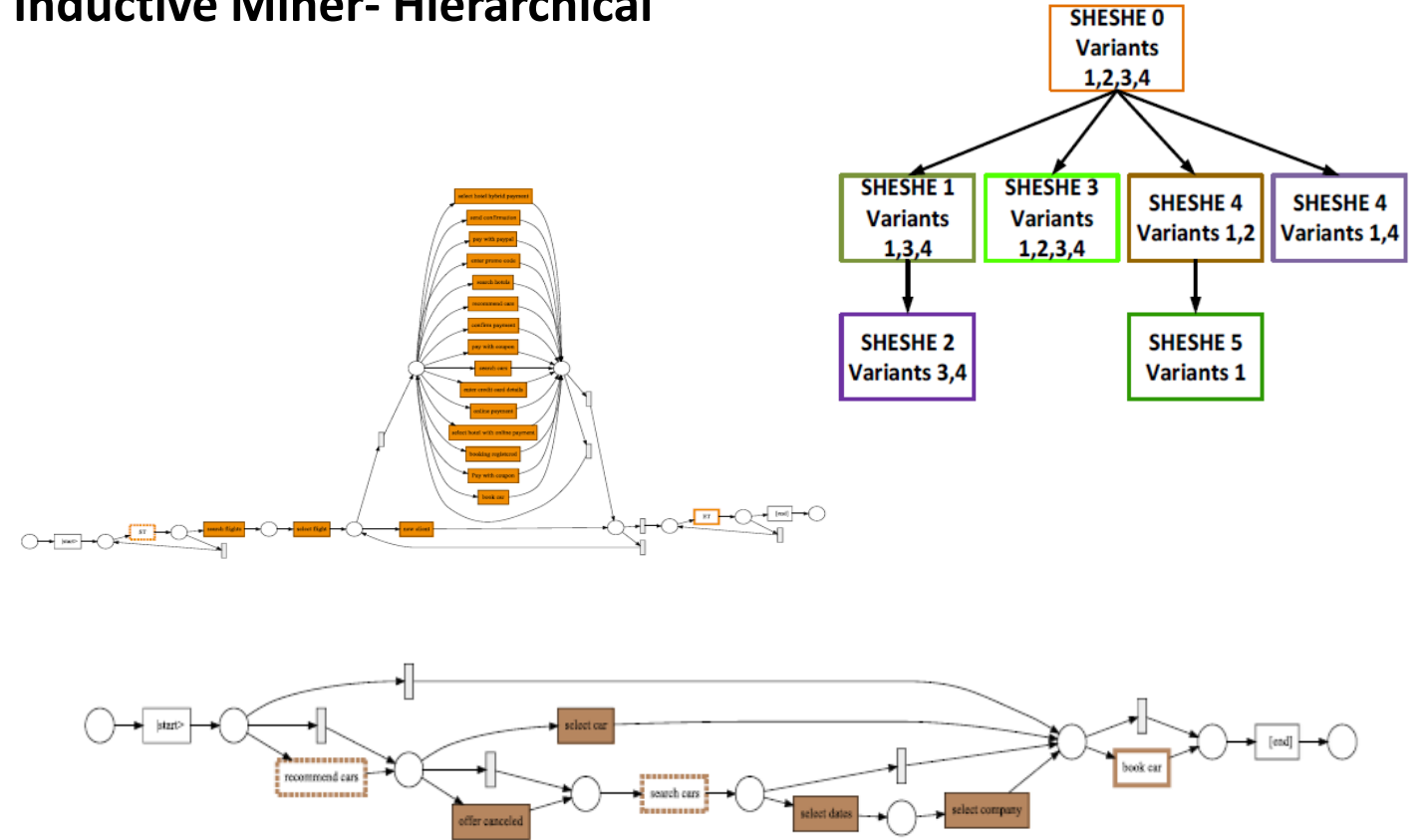
# Flat vs Hierarchical Discovery (Preliminary)

## Inductive Miner- flat



24/3/2017

## Inductive Miner- Hierarchical



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