Scenario Analysis: Generation of Possible Scenario Interpretations and their Visualization
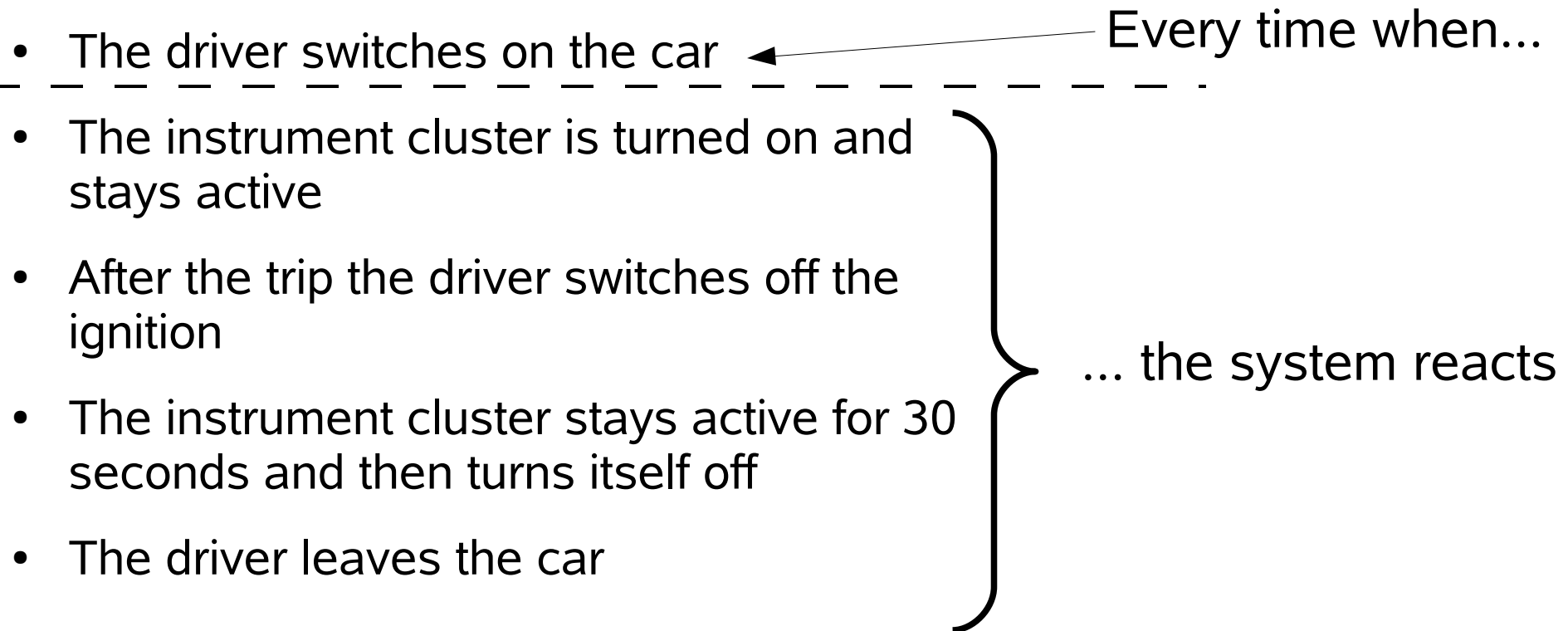
Leonid Kof

kof@in.tum.de

What does a scenario mean?

- The driver switches on the car

- The instrument cluster is turned on and stays active

- After the trip the driver switches off the ignition

- The instrument cluster stays active for 30 seconds and then turns itself off

- The driver leaves the car

What does a scenario mean?

- The driver switches on the car

  Every time when...

- The instrument cluster is turned on and stays active

- After the trip the driver switches off the ignition

  ... the system reacts

- The instrument cluster stays active for 30 seconds and then turns itself off

- The driver leaves the car

What does a scenario mean?

- The driver switches on the car

- The instrument cluster is turned on and stays active

  First independent interaction...

- After the trip the driver switches off the ignition

- The instrument cluster stays active for 30 seconds and then turns itself off

- The driver leaves the car

  ... and second independent interaction

What does a scenario mean?

- The driver switches on the car ← If ...

- The instrument cluster is turned on and stays active ← ... then

} 1st interaction...

- -

- After the trip the driver switches off the ignition ← If ...

- The instrument cluster stays active for 30 seconds and then turns itself off

- The driver leaves the car

... then

} ... 2nd interaction

Overview

- Motivation: ambiguous scenarios

- Specification patterns

- Application of patterns: brute force

- Intelligent application

- Summary
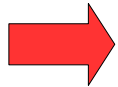
Specification patterns
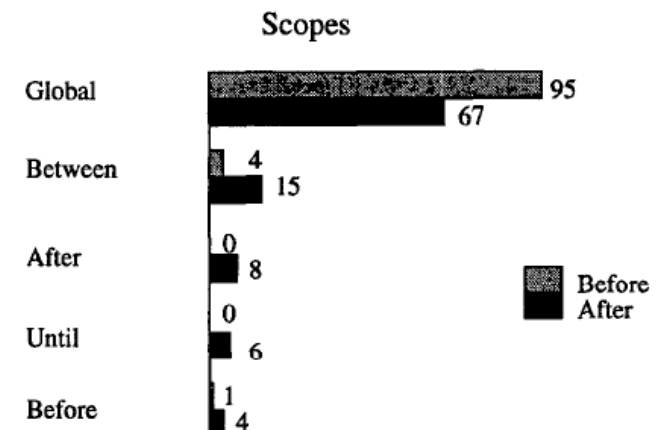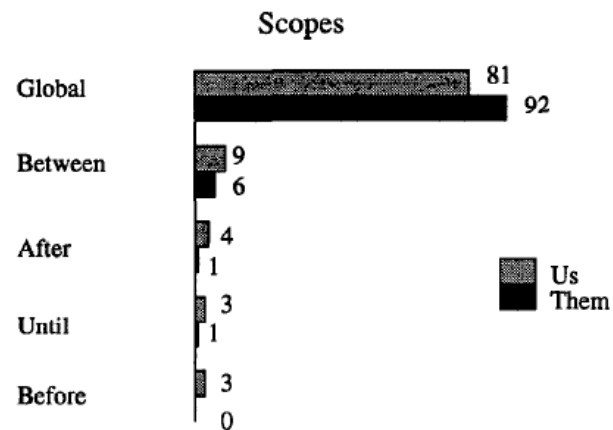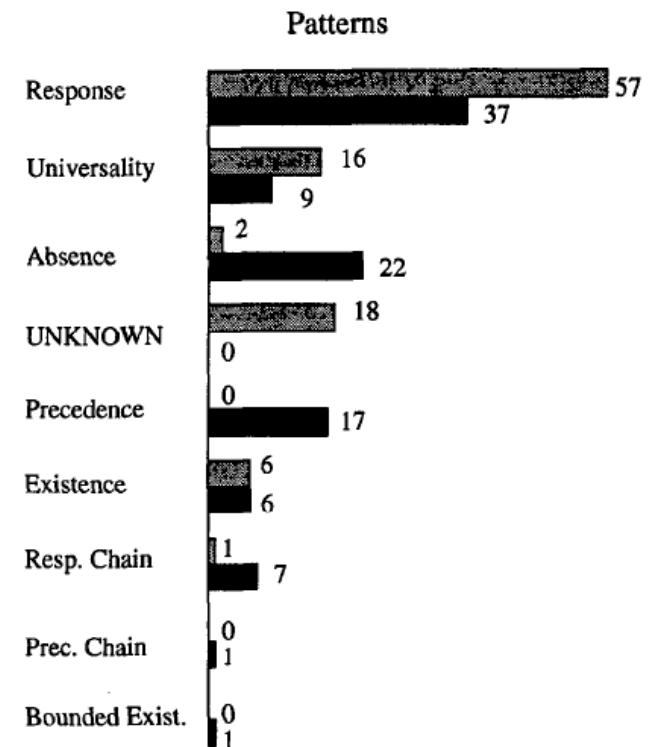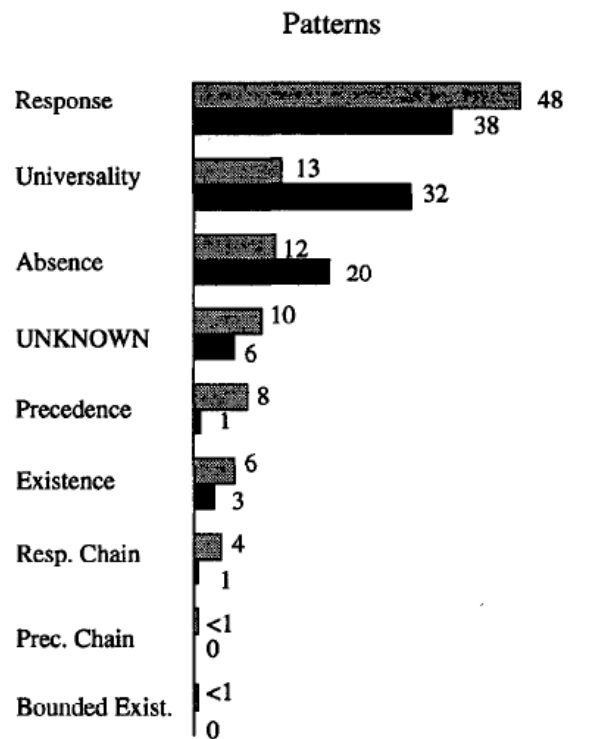
Most frequently used patterns

- (Non-)Occurrence:

  - Prohibited events never happen

  - Invariants

  - Desired event occurs eventually

- Sequence:

  - Precedence: *B* is allowed only after *A*
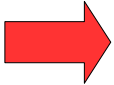
  - Response: If *A*, then *B*

Patterns and their interpretation

Response: If *A*, then *B*

- Is the sequence *(A+)B* allowed?

- Is the sequence *AB+* allowed?

- Events in between: Is the sequence *AxB* allowed?

- Is the sequence *BAB* allowed?

- Is *B* without *A* allowed?

- Does a second *A* require a second *B*?

[R. L. Smith, G. S. Avrunin, L. A. Clarke, and L. J. Osterweil. PROPEL: an approach supporting property elucidation.]
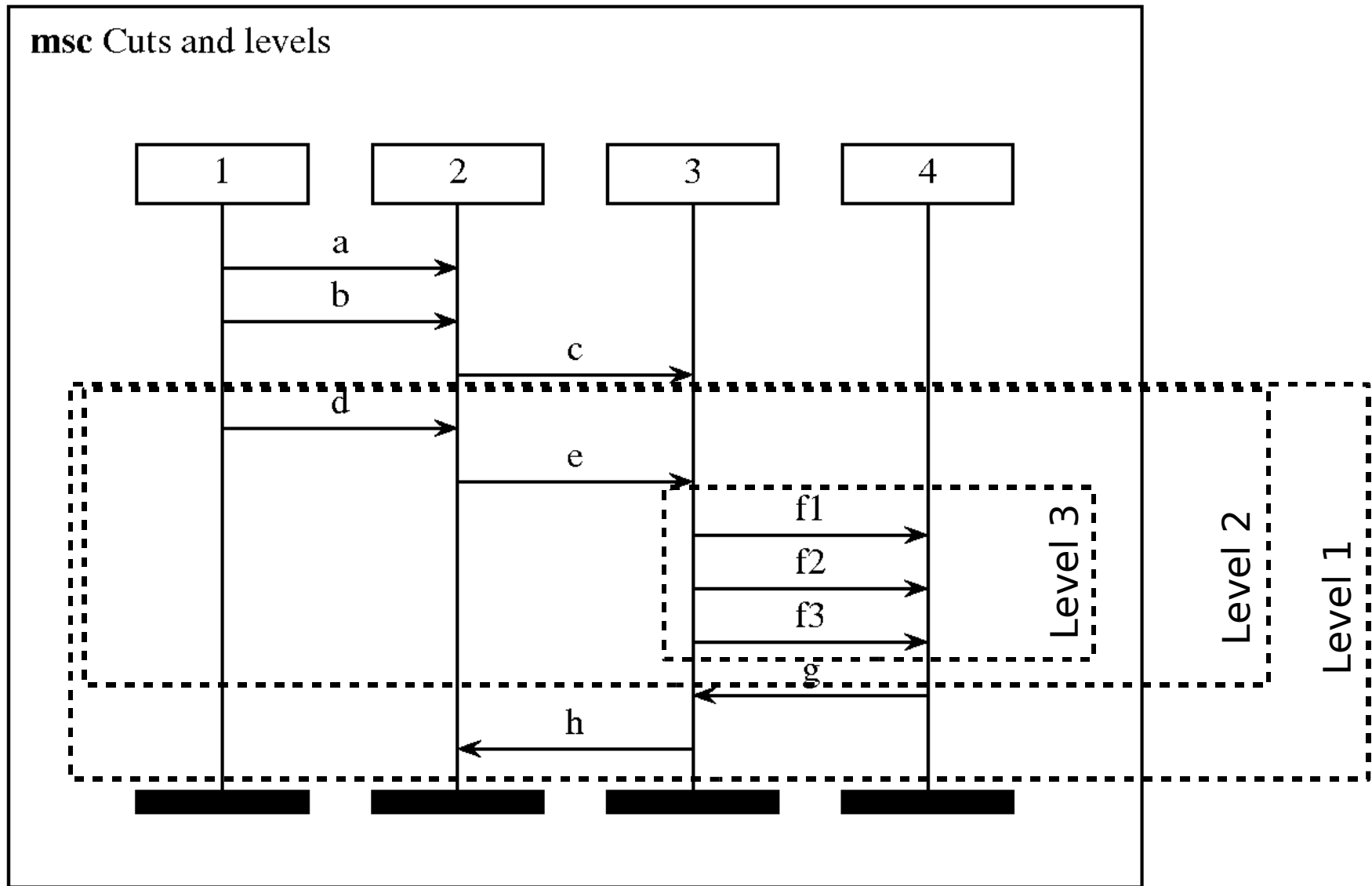
Overview

- Motivation: ambiguous scenarios

- Specification patterns

- Application of patterns: brute force

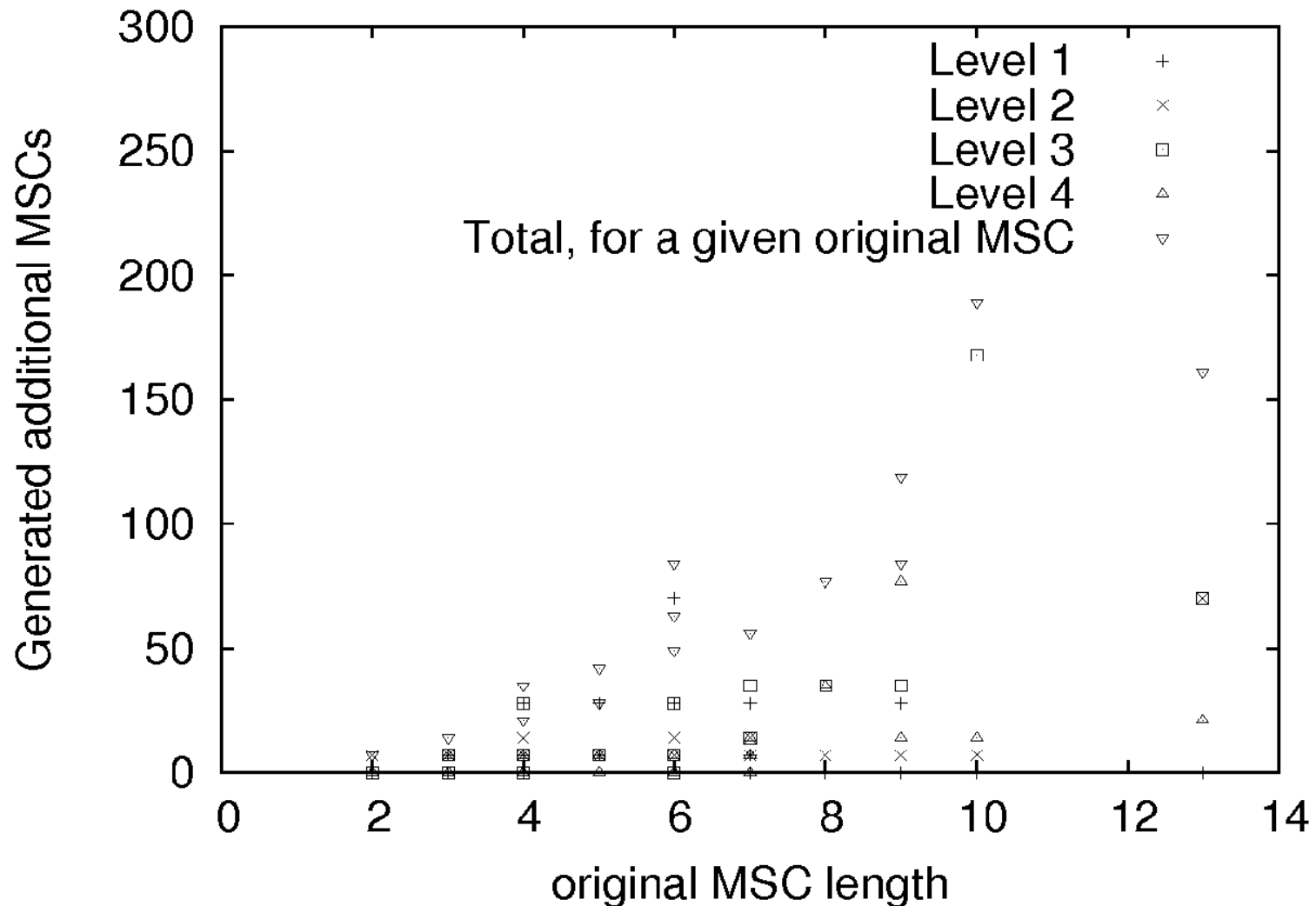- Intelligent application

- Summary

MSC: cutting in pieces
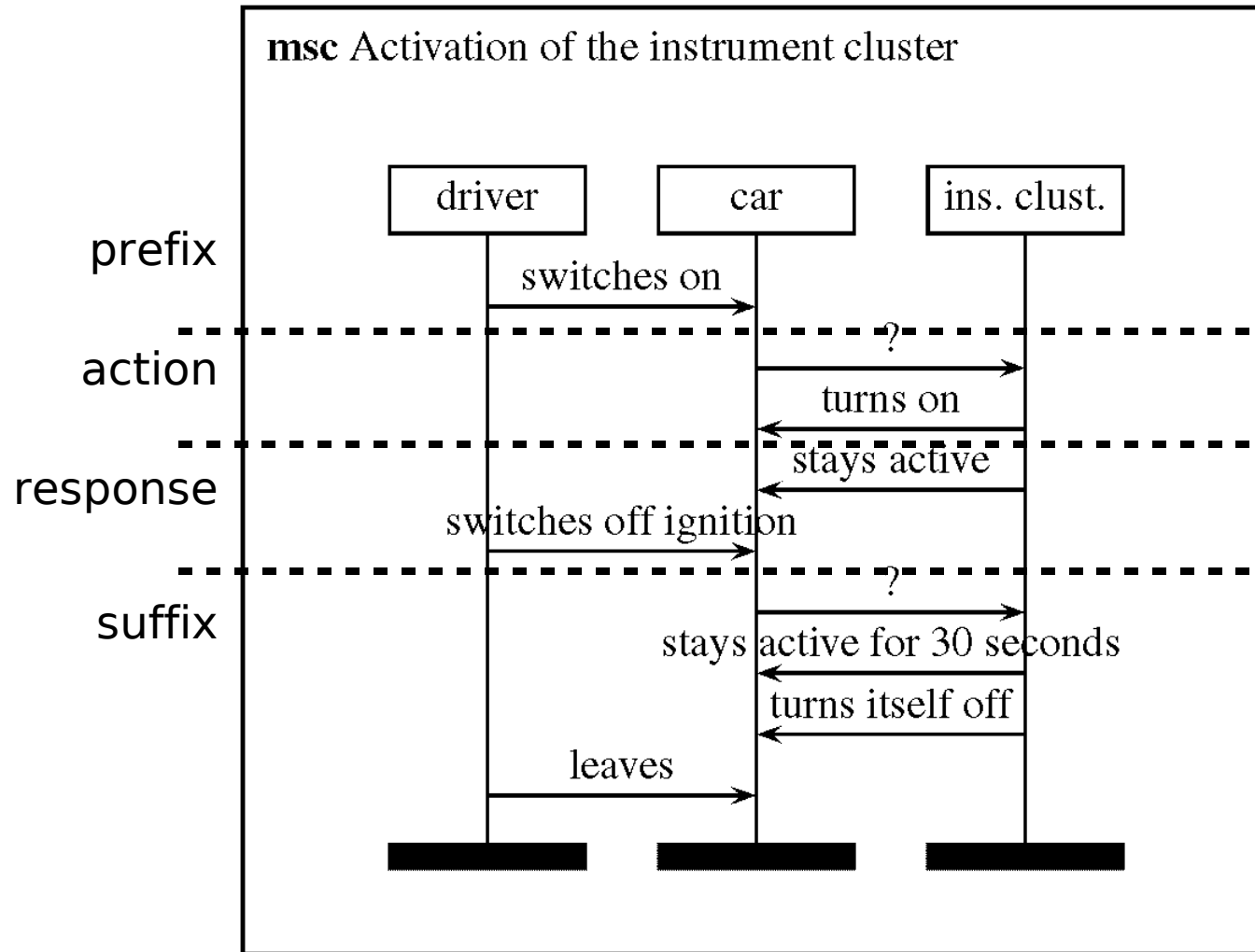
Total: $O(n^3)$ possibilities to cut

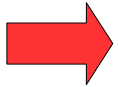# Cutting of structured MSCs

Structured MSCs: statistics

still $O(n^3)$, but smaller n

Overview

- Motivation: ambiguous scenarios

- Specification patterns

- Application of patterns: brute force

➡ • Intelligent application

- Summary

Intelligent application, basics

- **Separately** visualize possible prefix-, suffix- and middle-cuts

- Ask the user which cuts are correct

- Given feedback on cuts, generate and visualize MSCs witth:

  - One action, two responses

  - Two actions with a single response

  - Action, event in between, response

  - Response without action

  - Action without response

  - Reactions on second action

Prefix/Suffix visualization
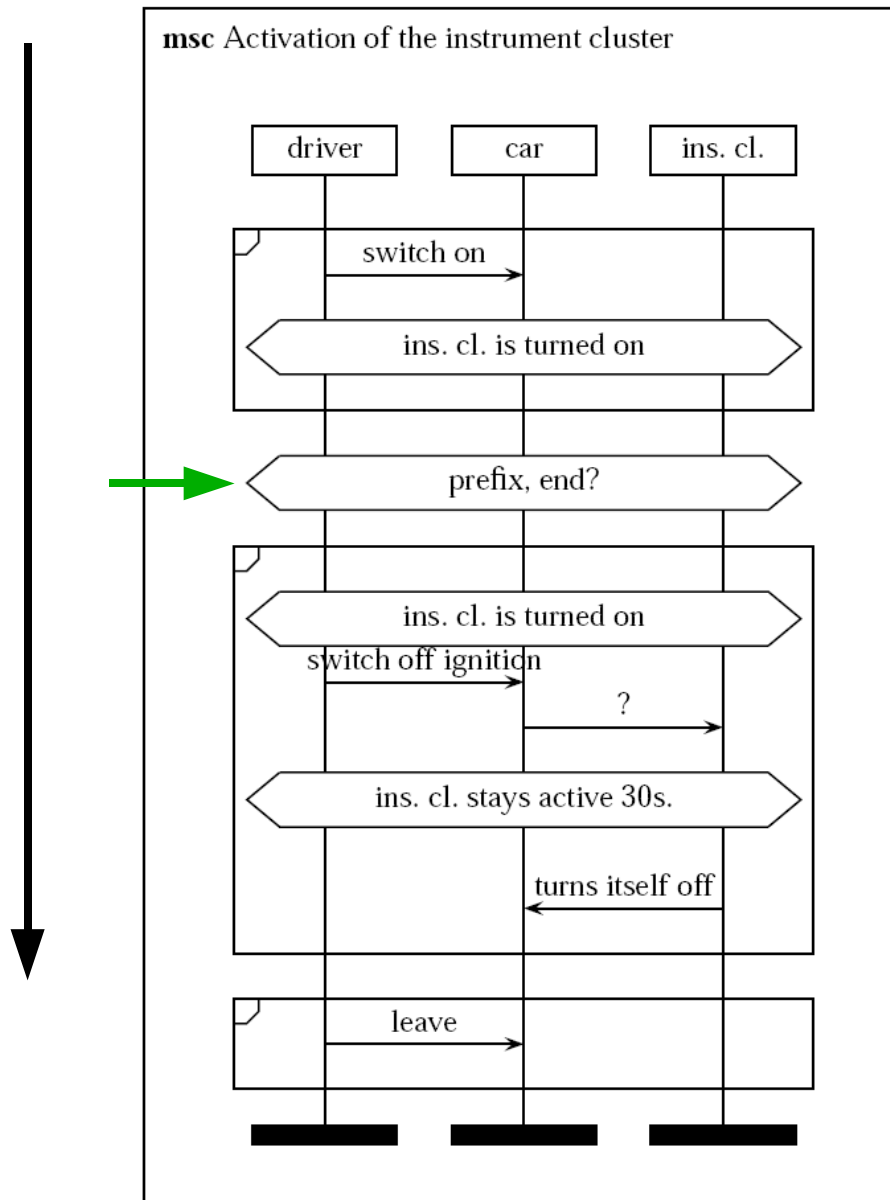
- Cut going down (for prefix) or up (for suffix)

- Yes/no question: „cut correct"?

- Linear complexity *O(n)*

New MSCs: generation + vizualization
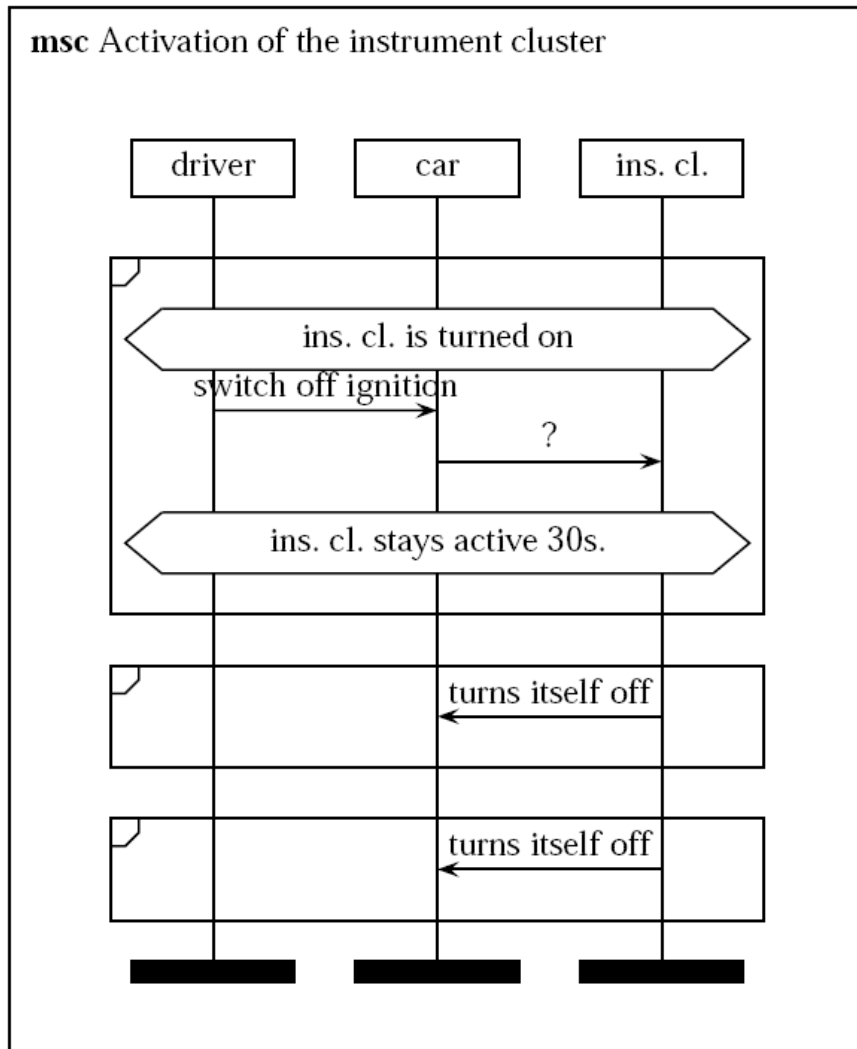


When cuts determined, generate/visualize MSCs with:

- One action, two responses

- Two actions with a single response

- ...

Intelligent application, statistics

	Whole MSCs	Level 1	Level 2	Level 3	Total
"prefix end" questions	43	29	24	9	105
"suffix begin" questions	53	27	28	12	120
"action/response"-cut questions	28	25	26	9	88
additional MSCs as required by PROPEL	196	175	168	63	602
Total	320	256	246	93	**915**

- 41 MSC
- Yes/no questions
- 10 sec. per question => approx. 3 hours

Overview

- Motivation: ambiguous scenarios

- Specification patterns

- Application of patterns: brute force

- Intelligent application
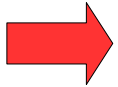
- Summary

Summary

- Cuts ensure that scenarios are subdivided in proper pieces

- Linear complexity

- Generation and visualization of new MSCs:
  allow to interpret scenarios in the intended way