On the Three-way Interaction
Optimizing Feature Based Systems Verification

Laura Semini

joint work with Alessandro Fantechi

ISTI–CNR, Pisa, Italy
Università’ di Pisa, Italy
Università’ di Firenze, Italy

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The feature interaction problem has been recognized as a general problem of software engineering.

"A feature interaction occurs when the behavior of one feature is affected by the presence of another".
Optimising feature interaction detection

One of the sensitive issues is the capability to make pairwise verification with respect to verify all possible combination, so to achieve a quadratic, in the number of features, cost instead of an exponential cost of a complete verification.
The Example

AC   Air change
     If it is not freezing, at 10:00 a.m. open the windows.

EAC  End of air change
     At 10:30 a.m. close the windows.

CW   Close window with rain
     Close the windows when the rain sensor is triggered.

DP   Danger prevention
     Open the main door and open the windows when smoke is sensed.

IA   Intruder alarm
     Raise an intruder alarm when the main door is open and the alarm is ON.

RIA  Reaction to intruder alarm
     If an intruder alarm has been raises, then close all doors and windows.
The Model for the Features

Syntax: \[ F = \langle C, [A] \rangle \]

Semantics: \[ s \models C \Rightarrow s \xrightarrow{A} s' \]

Parallel composition: interleaving \[ F_1 \parallel \ldots \parallel F_n \]

\[ AC = \langle \sim \text{freezing} \land 10:00 \text{ a.m., [open the windows]} \rangle \]
\[ IA = \langle \text{main door open} \land \text{alarm on, [raise an intruder alarm]} \rangle \]
\[ RIA = \langle \text{intruder alarm, [close the main door, close windows]} \rangle \]
In our setting,
any 3-way interaction
is due
to the interaction between 2 of the considered features.
Limitations

True 3-way interactions can exist when:

- Features are tags that drive conditional compilation in a java-like program.
- Features have to compete for the usage of shared (physical) resources: non-functional interactions.