

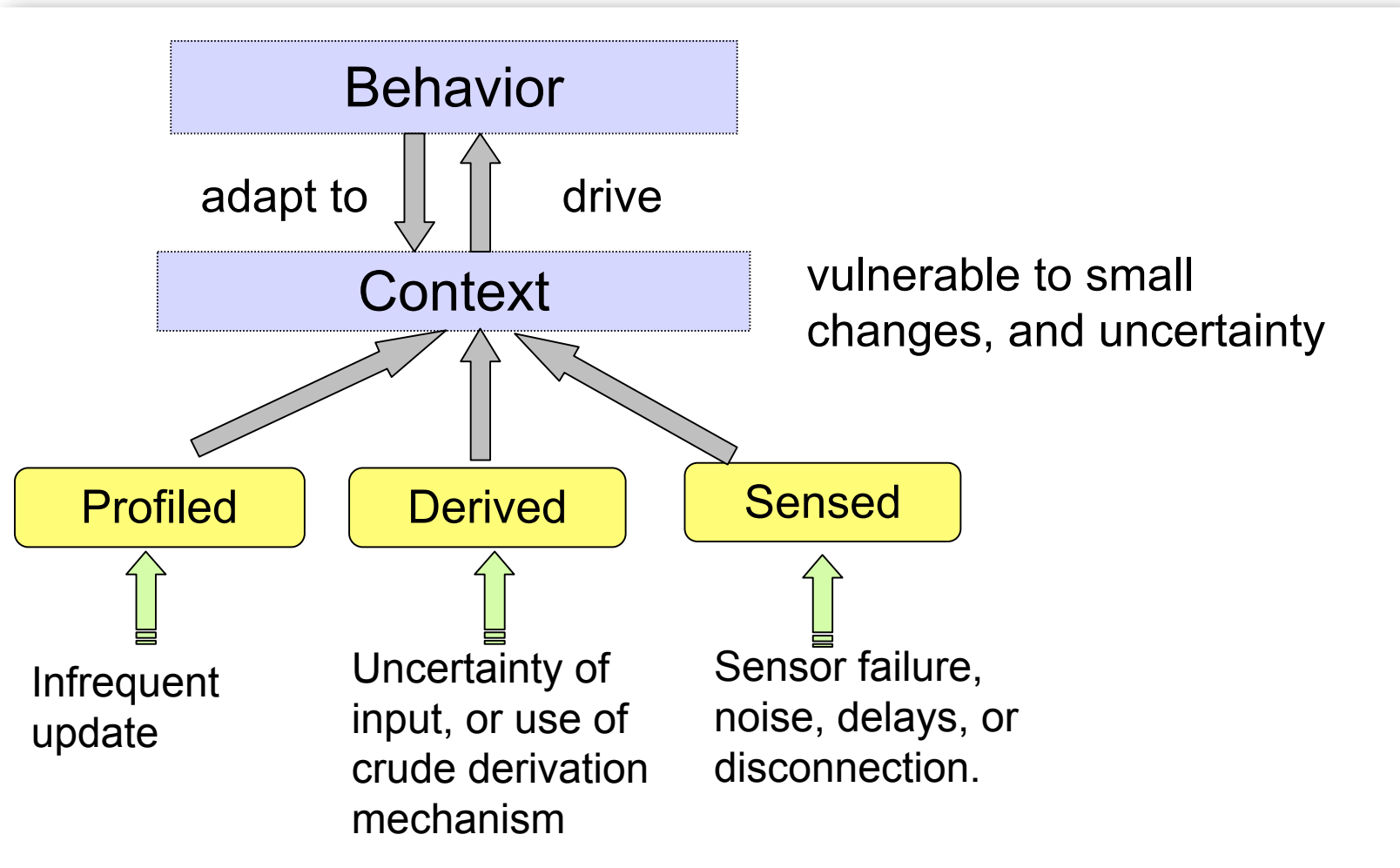


Juan Ye, Lorcan Coyle,
Simon Dobson, and Paddy Nixon

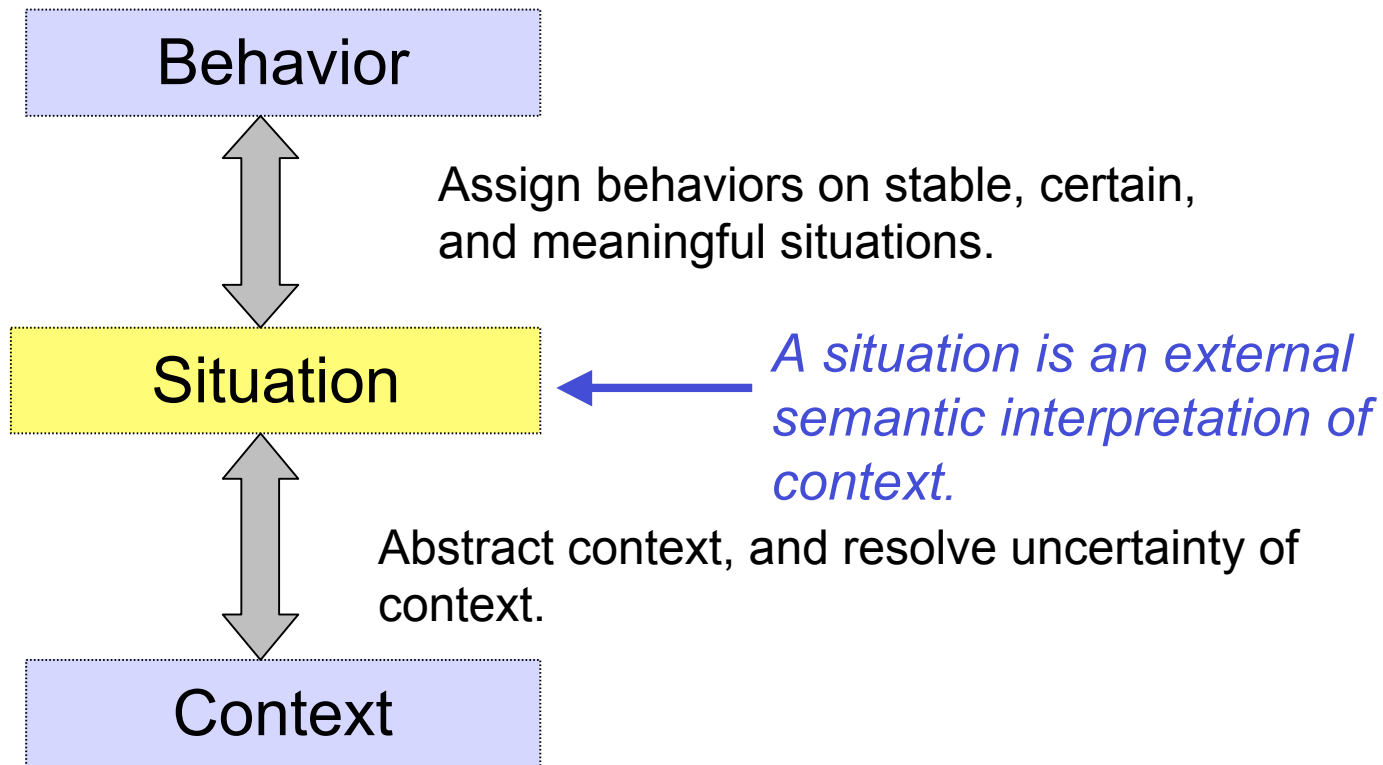
Systems Research Group
School of Computer Science and Informatics
UCD Dublin Belfield, Dublin 4, Ireland
<http://www.ucd.ie/csi>

Using Situation Lattices to Model and Reason about Context

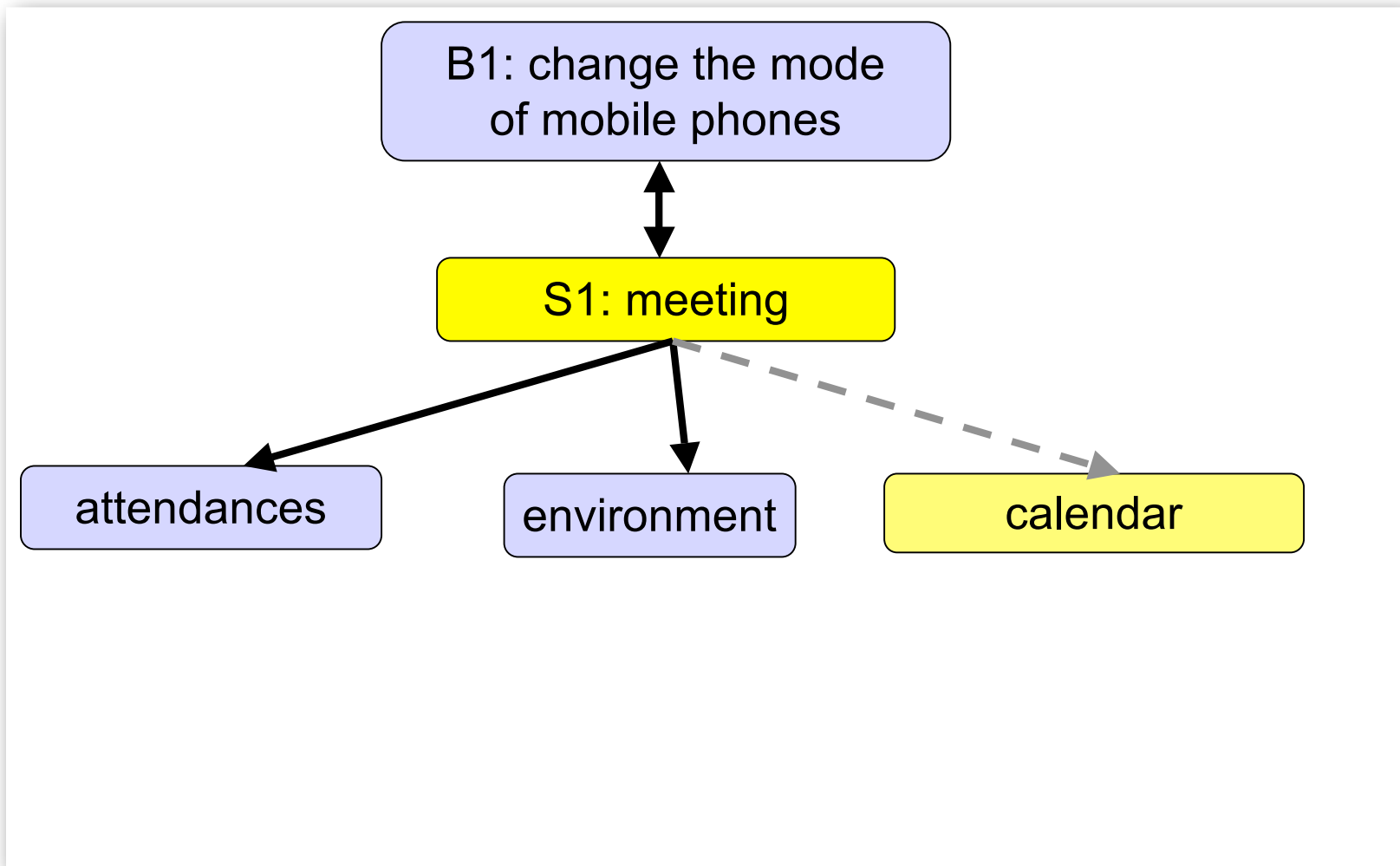
Context-aware Systems



Situation-aware Systems

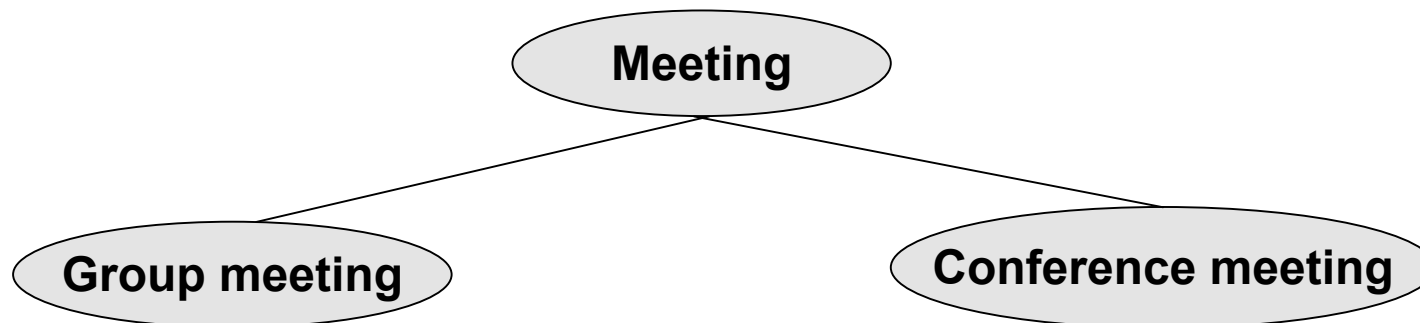


Meeting Scenario



Characteristics of Situation

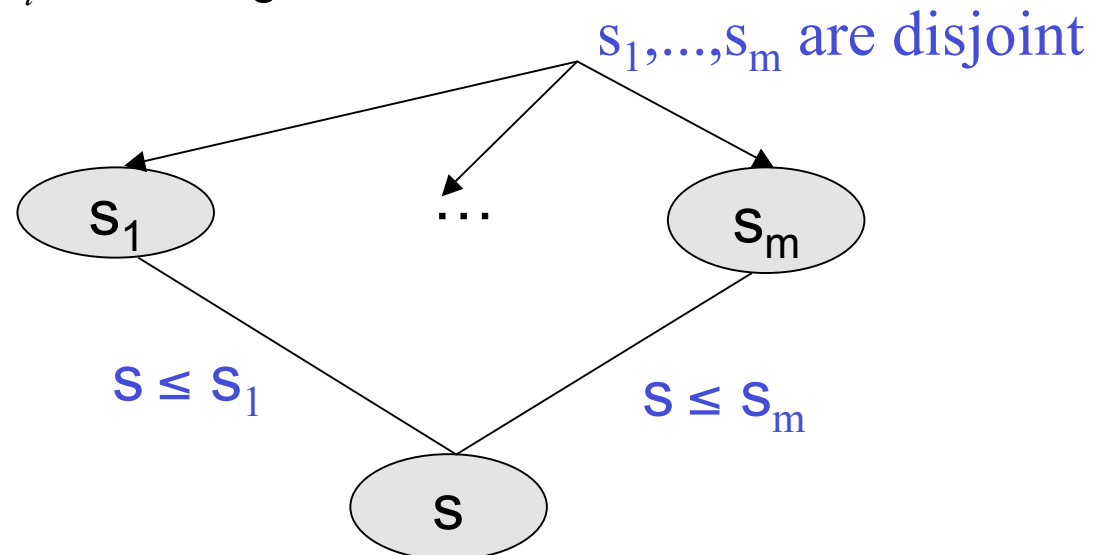
- A situation can be:
 - *Interpretation of a single piece of context;*
 - *or a composition of contexts or other situations.*
- Generalisation:
 - *More general situation* → *more basic behaviors;*
 - *More specific situation* → *more customised behaviors.*



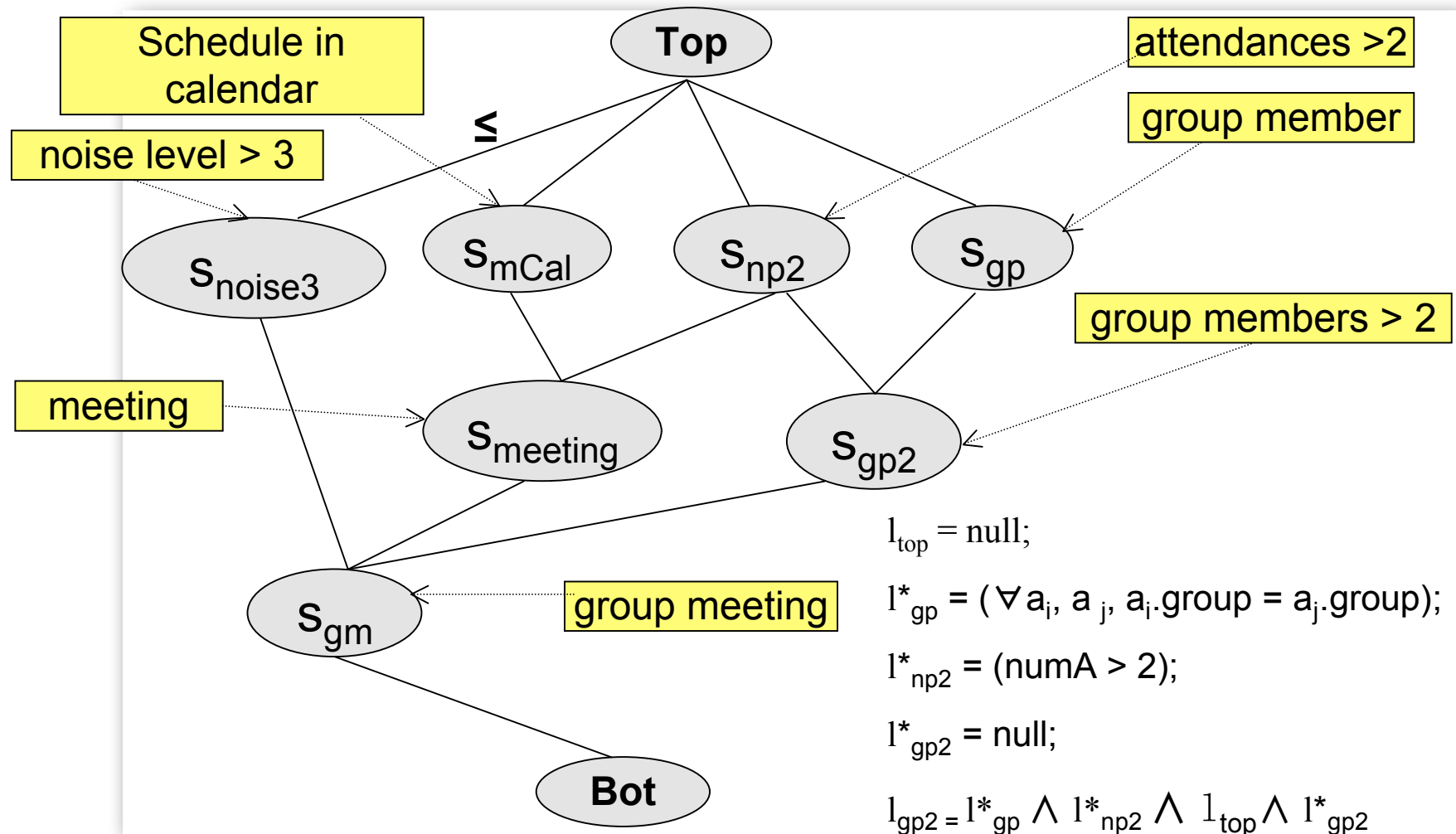
Situation Lattice

A **situation lattice**, $L = (S, \leq)$,

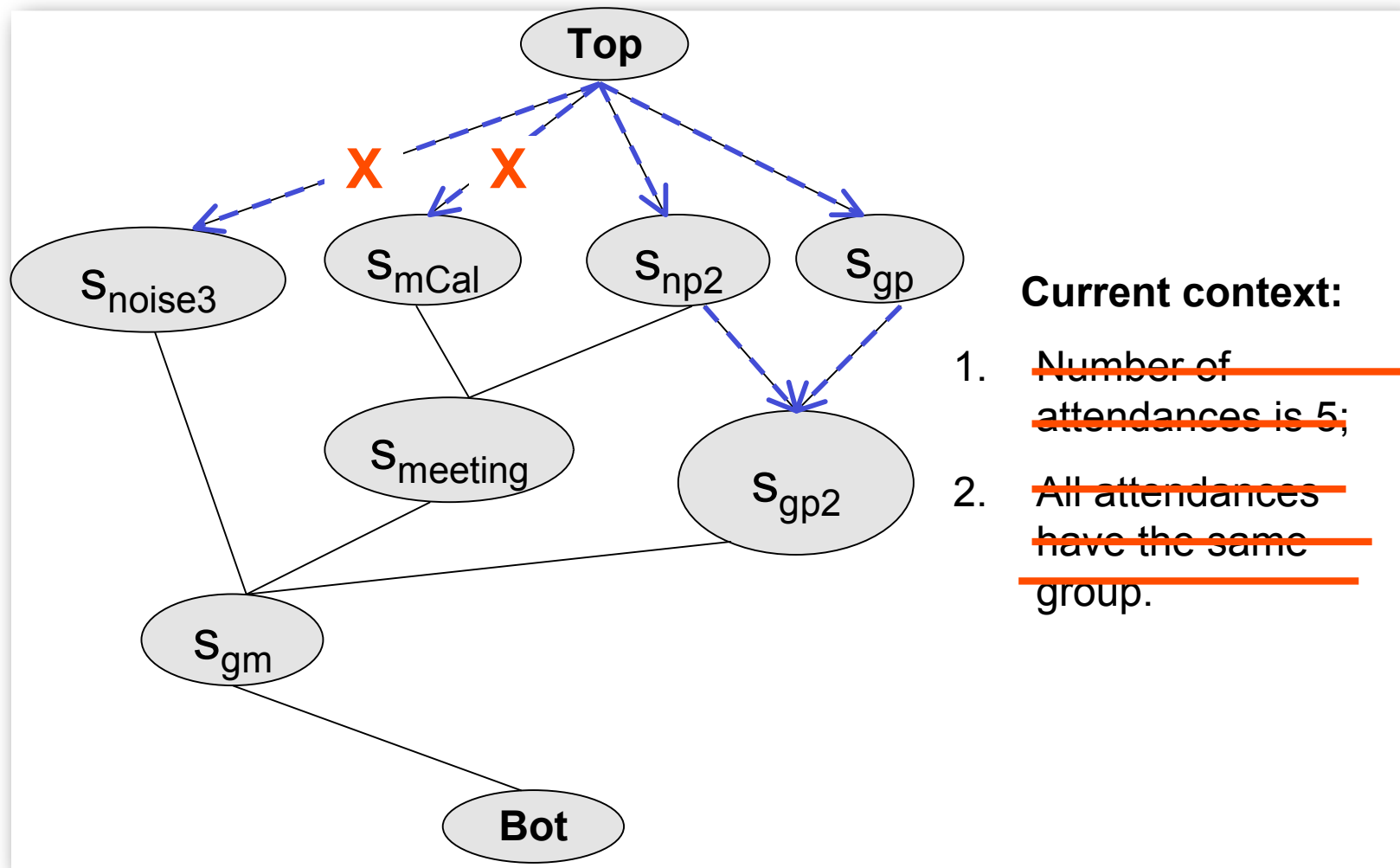
- S : a set of situations;
- \leq : generalisation;
 - $s \leq s_i$: s_i is more general than s .



Building a Situation Lattice

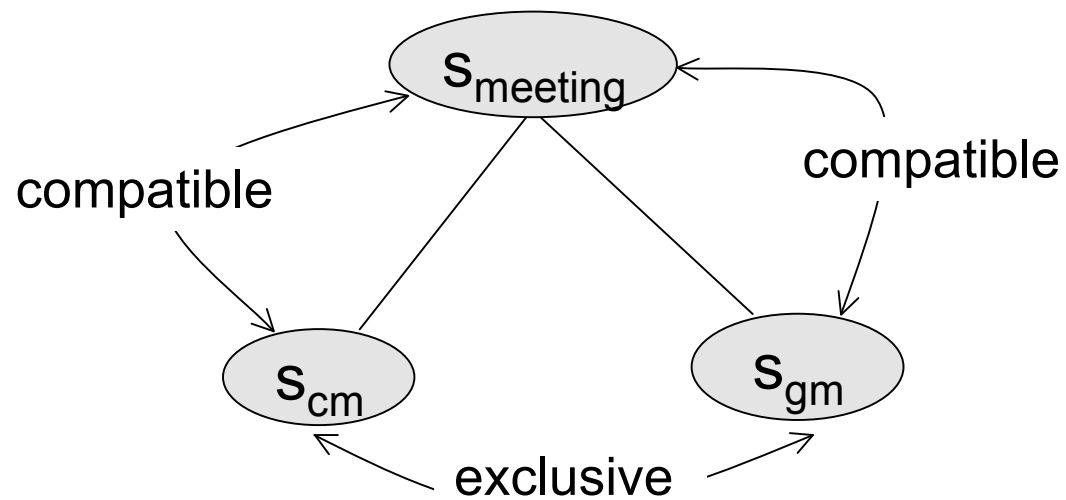


Identify situations



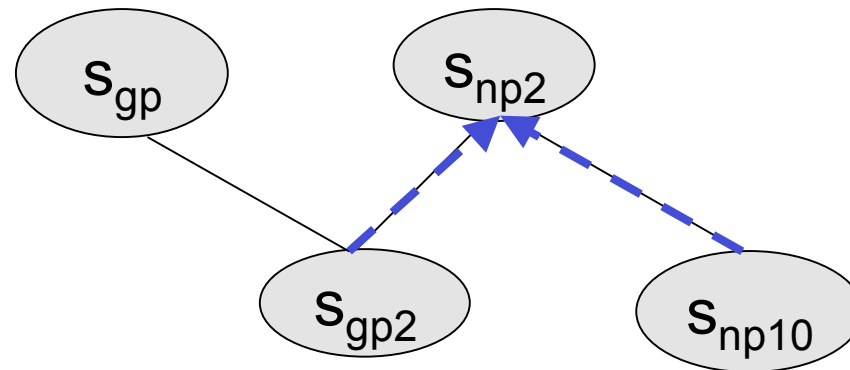
Maintain consistency and Integrity

- Consistency:
- Integrity:



Dealing With Uncertainty

Coarse-grained approach



- **Incomplete context:**

a specific situation → more general one.

- **Conflicting context:**

multiple disjoint situations → the most specific of their common general situation.

Dealing with Uncertainty

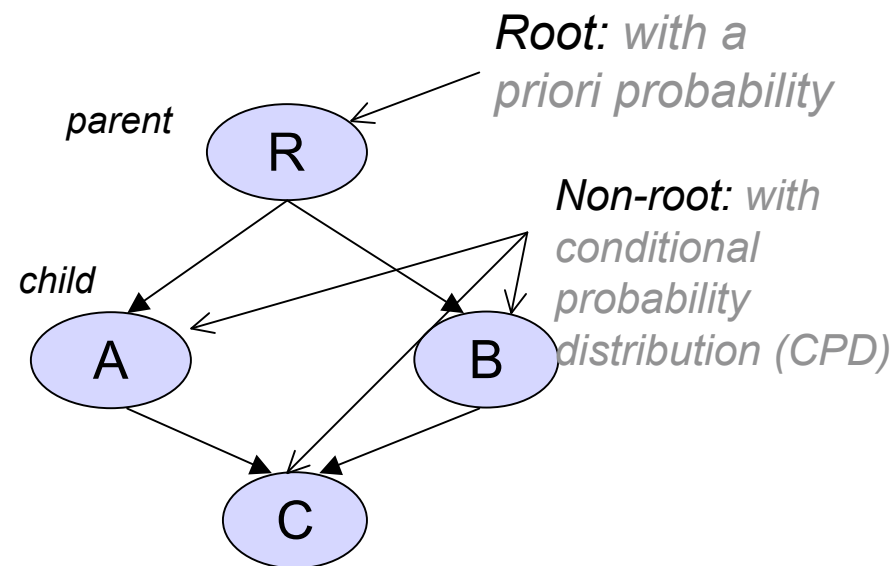
Fine-grained approach

- Uncertainty is quantified as probabilities.
- Assess probabilities in Bayesian Networks.

Bayesian Network:

A directed acyclic graph:

- node => variable;
- arc => causal relation



Dealing with Uncertainty

Convert a situation lattice to a Bayesian Network:

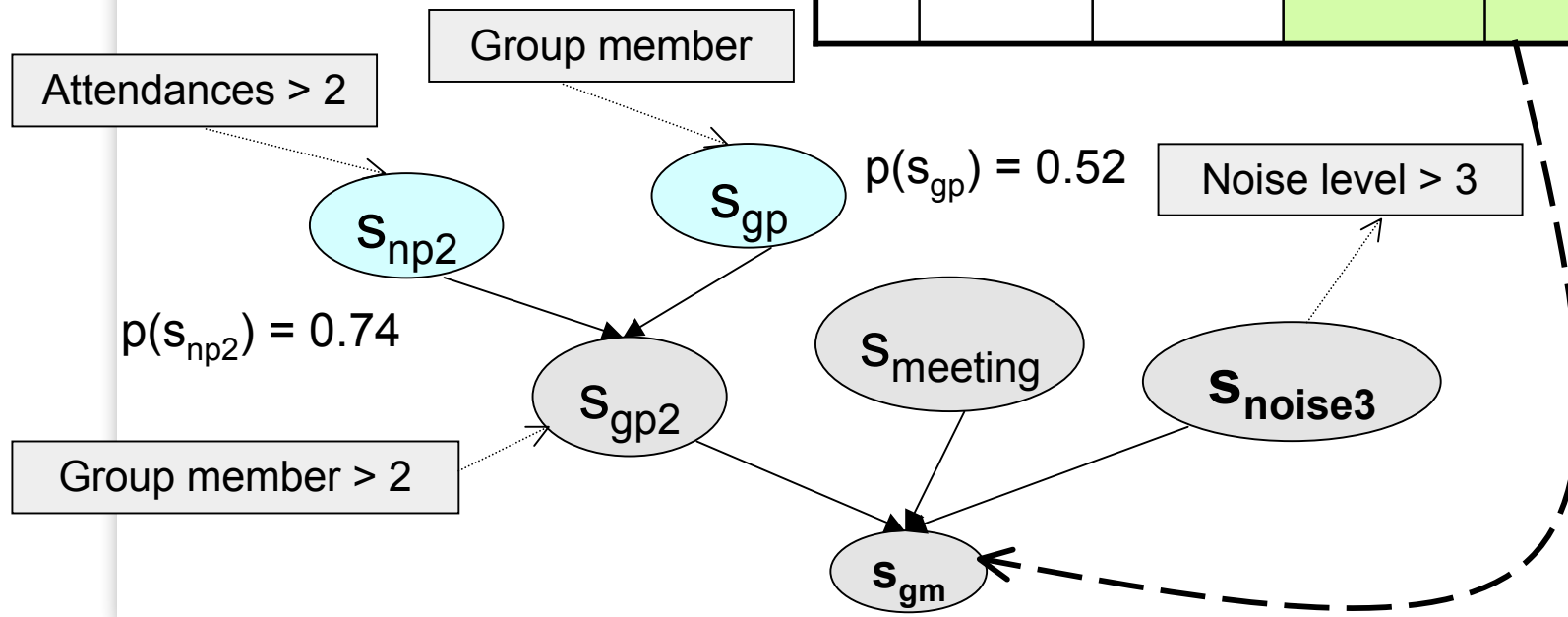
- A situation \Rightarrow a node;
- \leq generalisation \Rightarrow an arc;
- All the basic situations \Rightarrow root.

Dealing with Uncertainty

Assess probabilities:

- Prior probability;
- Conditional probability.

S_{gp2}	$S_{meeting}$	S_{noise3}	S_{gm} (=true)	S_{gm} (=false)
true	true	high	0.99	0.01
true	true	low	0.87	0.23
...



Conclusion and Future Work

- *Conclusion:*
 - A novel structure to define and organise situations;
 - to improve the *efficiency* of identifying situations;
 - to resolve *uncertainty*.
- **Future work:**
 - Implementation: small => large lattice;
 - Scalability and efficiency;
 - Optimisation of the BN performance.

Thanks!

Q & A

Juan Ye

School of Computer Science and Informatics

UCD, Ireland

juan.ye@ucd.ie