**Probabilistic Modelling**

- Probabilistic choice is made at probabilistic junctions.
- Each outgoing transition must have a probability value (inside $p()$) between 0.0 and 1.0.
- Probability values of all outgoing transitions from a probabilistic junction sum to 1.0.

**Probabilistic Property Language**

- Based on the PRISM’s property language (PCTL*) for DTMC and MDP.
- Allow to specify properties using variables, expressions, states, events, functions, operations, etc.
- from RoboChart models.
- Properties are specified in a particular constant configuration, function definitions, or uncertain environment.

**Formally Verified Animation for RoboChart**

- Operational semantics of RoboChart given in interaction trees (mechanised in Isabelle/HOL).
- Generated Haskell code for animation (on terminal now).
- Able to animate a state machine, an operation, a controller, or a whole model.

**Probabilistic Model Checking**

- RoboChart’s probabilistic semantics given in MDP and automated generation of semantics for PRISM in RoboTool.
- Formalised translation from RoboChart to PRISM.
- Run multiple instances of PRISM: one for each property.
- Easily extended to other probabilistic model checkers like Storm and MODEST.

**Statistic Model Checking**

- Approximate results.
- Analyse properties on a large number of (Monte Carlo) simulations.
- Able to analyse big models.
- Illustrations and debugging problems.
- Design space exploration (DSE).
- Generate test cases that satisfy or falsify properties.

**Theorem Proving**

- Denotational semantics of probabilistic programs in UTP.
- Both epistemic and aleatoric uncertainty.
- Mechanised in Isabelle/UTP.

- Able to reason about large models with an infinite state space.

- Bayesian belief model

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**Localisation:** robot’s belief in its current position changed after 3 sensor readings and two movements: very likely (nearly 90%) it is in front of a wall now.