Zeroconf (SPIN 2009/STTT)

AVACS S3
Phase 2

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Zeroconf allows the installation and operation of a network in the most simple way. When a new host joins the network, it randomly selects an address among the $K = 65024$ possible ones. With m hosts in the network, the collision probability is $q = \frac{m}{K}$. The host asks other hosts whether they are using this address. If a collision occurs, the host tries to detect this by waiting for an answer. The probability that the host gets no answer in case of collision is p, in which case he repeats the question. If after n tries the host got no answer, the host erroneously consider the chosen address as valid. A sketch of the model is depicted in Figure 1. We implemented this model in *PARAM* 2.0α [1] and examined the expected number of tries till either the IP address is selected correctly or

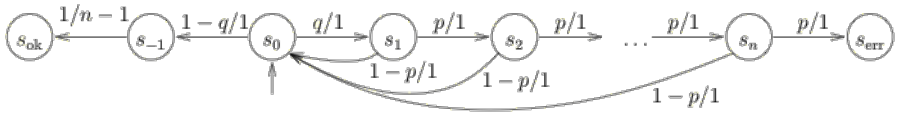

Figure 1: Model of the underlying network

erroneously, so that the set of target states is $B = \{ok, err\}$. For $n = 140$, the plot of this function is given in Figure 2. The expected number of tests till termination increases with both the collision probability as well as the probability that a collision is not detected. Bisimulation optimisation was not of any use since the quotient equals the original model. For $n = 140$, the analysis took 64 seconds and 50 MB of memory.

References

[1] Ernst Hahn, Holger Hermanns, and Lijun Zhang. Probabilistic Reachability for Parametric Markov Models. *STTT*, pages 1–17, 2010.

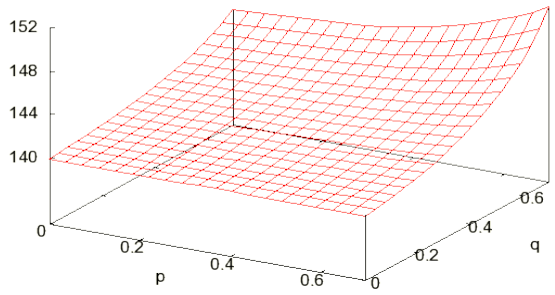

Figure 2: Coherence between collision probability, probability that a collision is not detected and number of steps