Formal Approaches to Decision-Making under Uncertainty

Lecture 2-1: Modest Tools for DTMCs (II)

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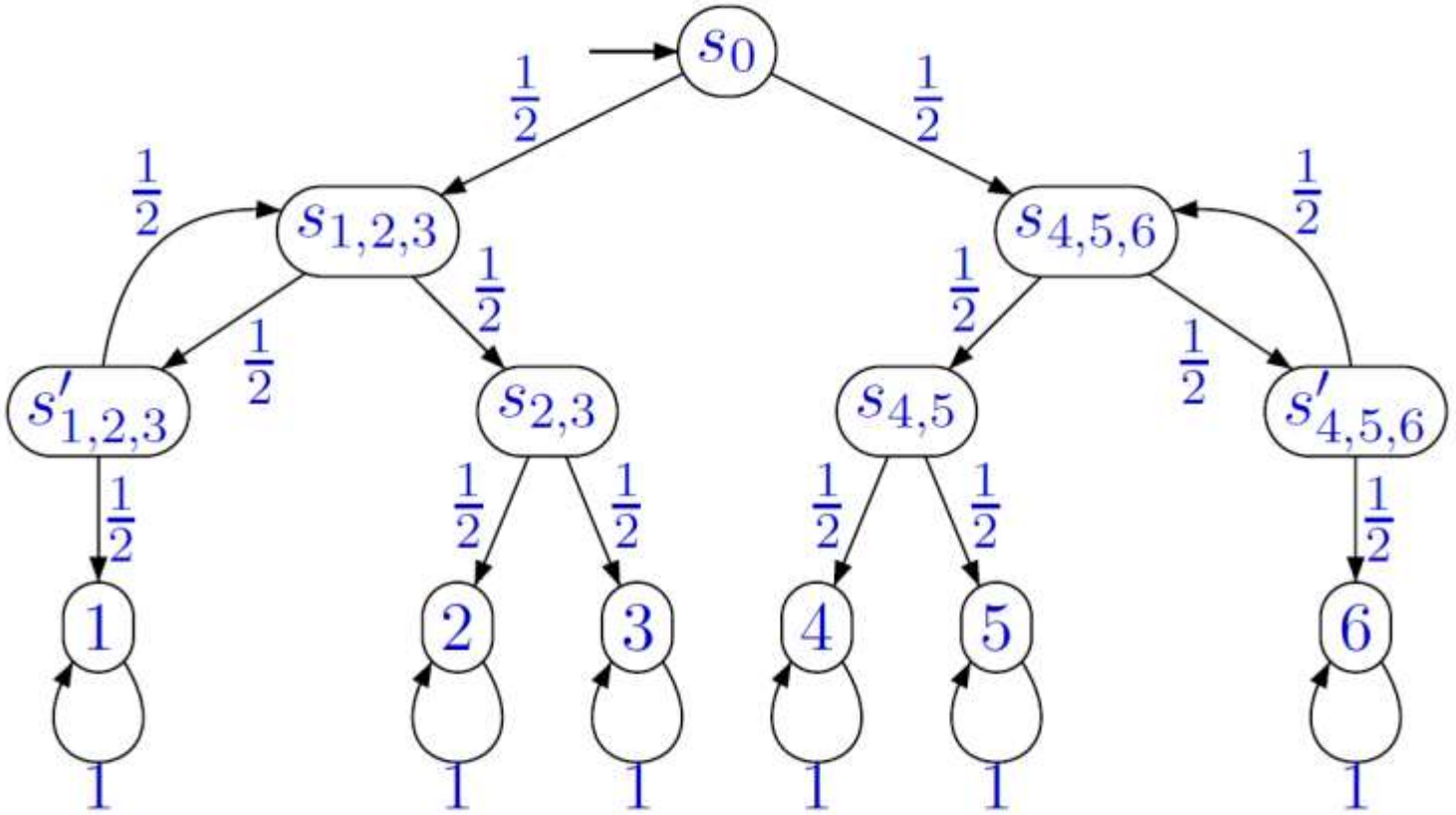
Website

Recall that everything is/will be online at

`https://arnd.hartmanns.name/rio2023/`

Markov Chain Modelling

Have: Coin that we can flip
Want: Play a game that requires 6-sided die
Claim: Can simulate die with coin as follows:



Markov Chain Modelling

Zeroconf protocol:

Automatic configuration of local IPv4 address (169.254.x.x) when DHCP unavailable and no static address configured

Idea:

1. Pick random address
2. Use ARP requests to find out if anybody else already uses the address; if yes, go back to 1

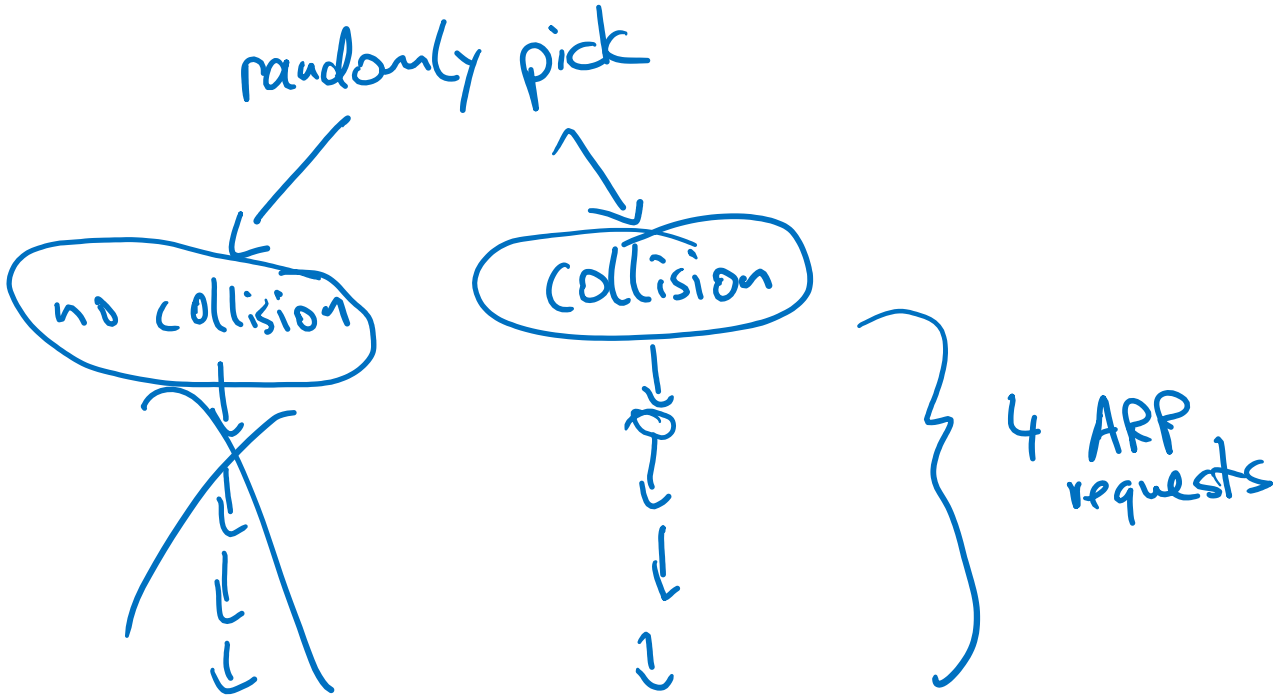
Complications:

Lossy communication channel
(message loss with probability p)

Markov Chain Modelling

Zeroconf protocol model:

Randomly pick one out of $K = 65024$ addresses
Collision probability is $q = \frac{m}{K}$ given m hosts in network
Send 4 ARP requests (each being lost with probability p)



$m = 100$,
$p = 0.001$:

probability of error
$= ?$

Markov Chain Modelling

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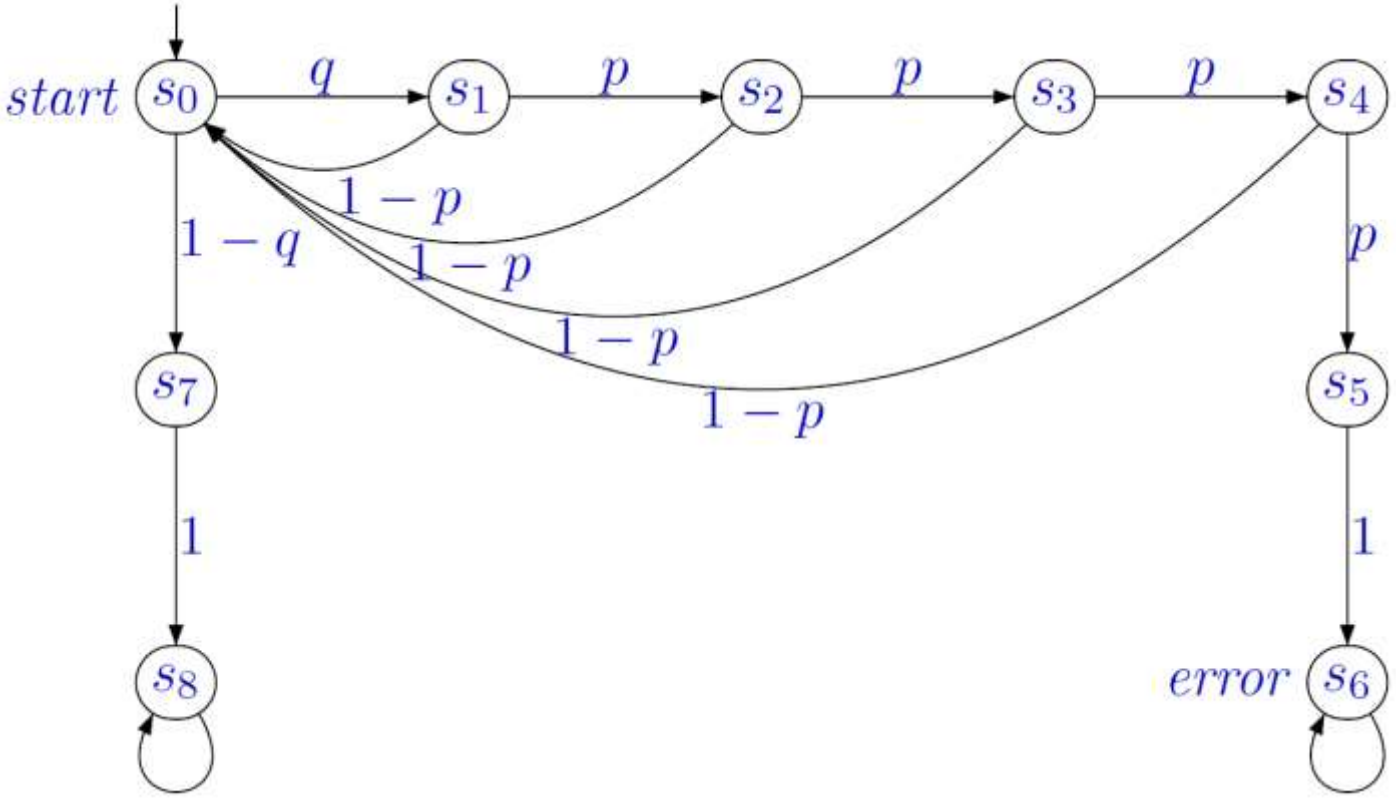

$m = 100$,
$p = 0.001$:

probability of error
$\approx 1.54 \cdot 10^{-15}$