Performance Evaluation of UML Software Architectures with Multiclass Queueing Network Models

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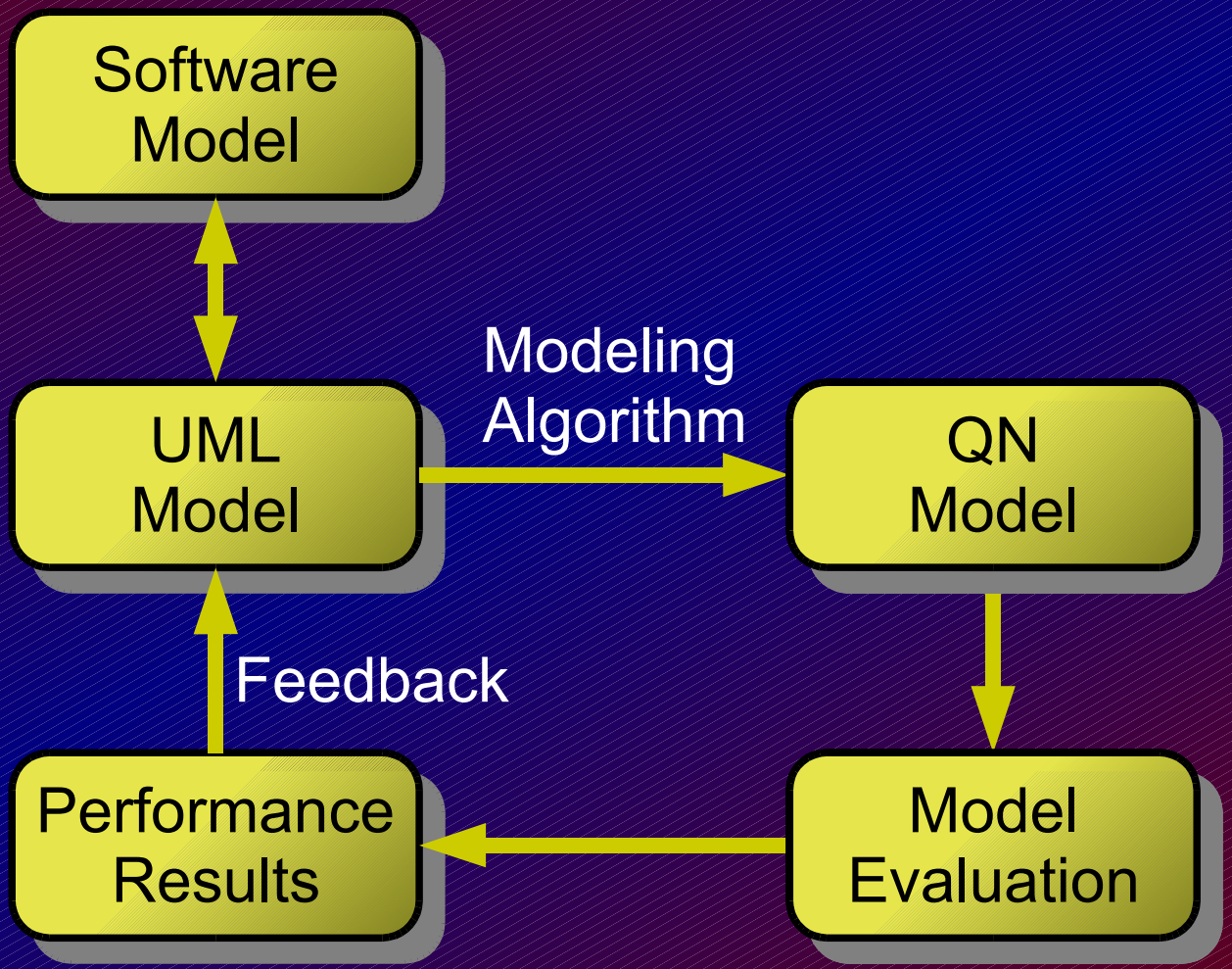
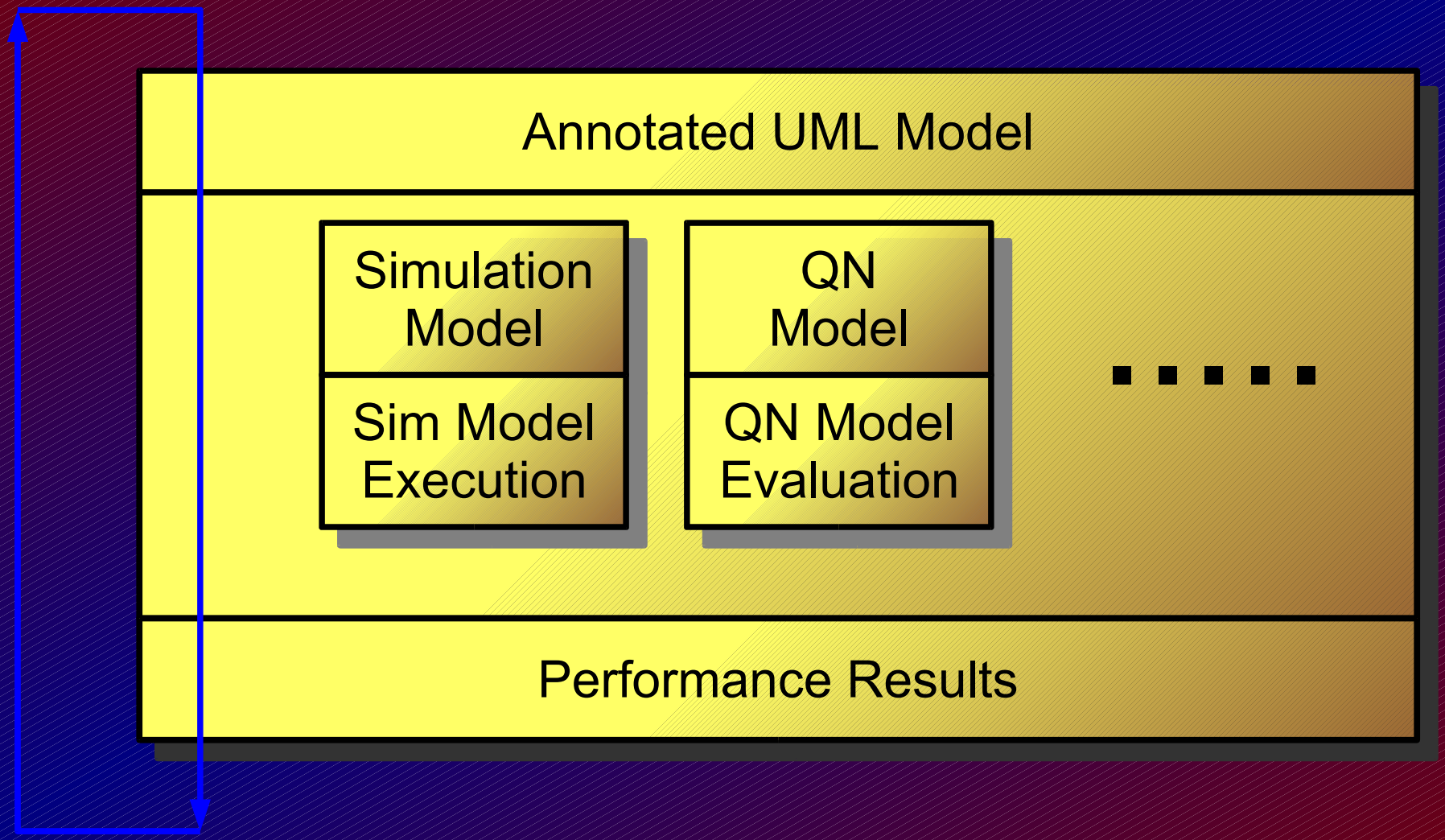
Software Performance Modeling



Performance Modeling Framework



Performance Modeling with multiclass QN

- Starting point
  - Use Case diagrams (workloads)
  - Deployment diagrams (hardware model)
  - Activity diagrams (system execution model)
- Target notation
  - Mixed Multiclass QN model
  - Use Case diagrams ⇨ Workloads
  - Deployment diagrams ⇨ Service centers
  - Activity diagrams ⇨ Topology

Why?

- Performance model generation can be done efficiently
  - O(*#transitions* + *#action states*)
- Performance model can be solved efficiently
  - If some constraints are satisfied
- The approach uses standard UML SPT profile annotations
  - Can be integrated with existing software performance modeling frameworks based on the profile

Translating UC diagrams

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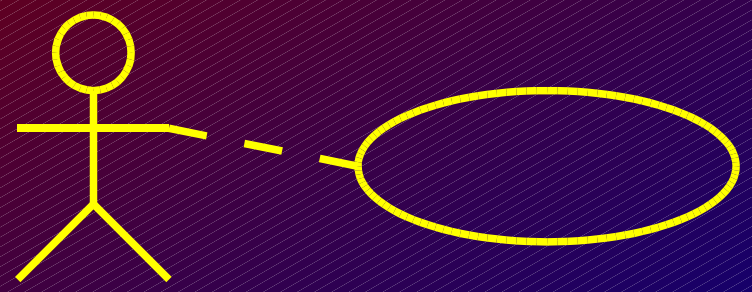
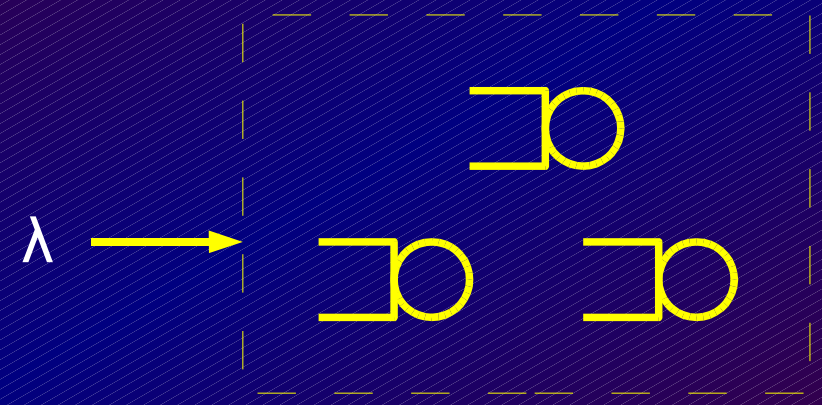


PAoccurrence = λ



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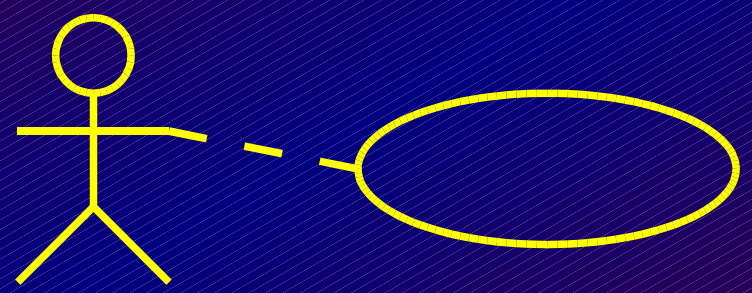
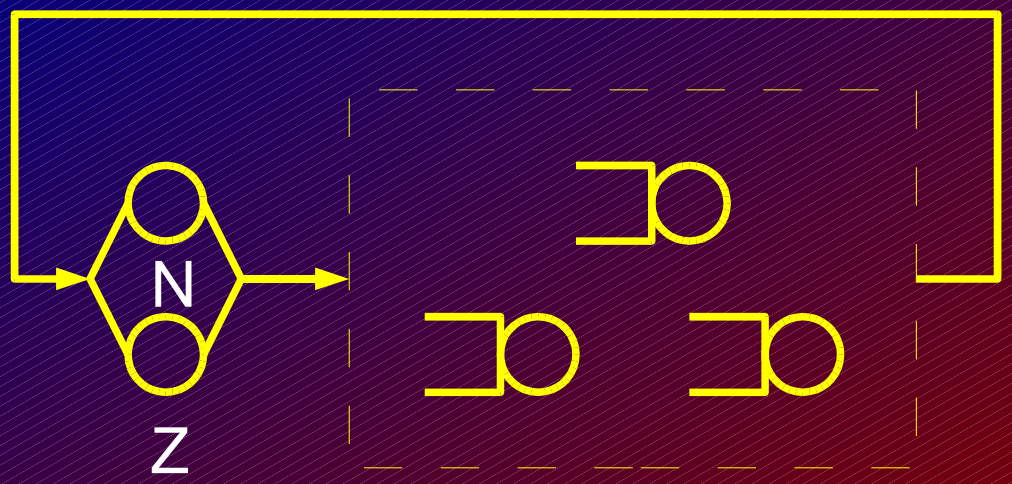
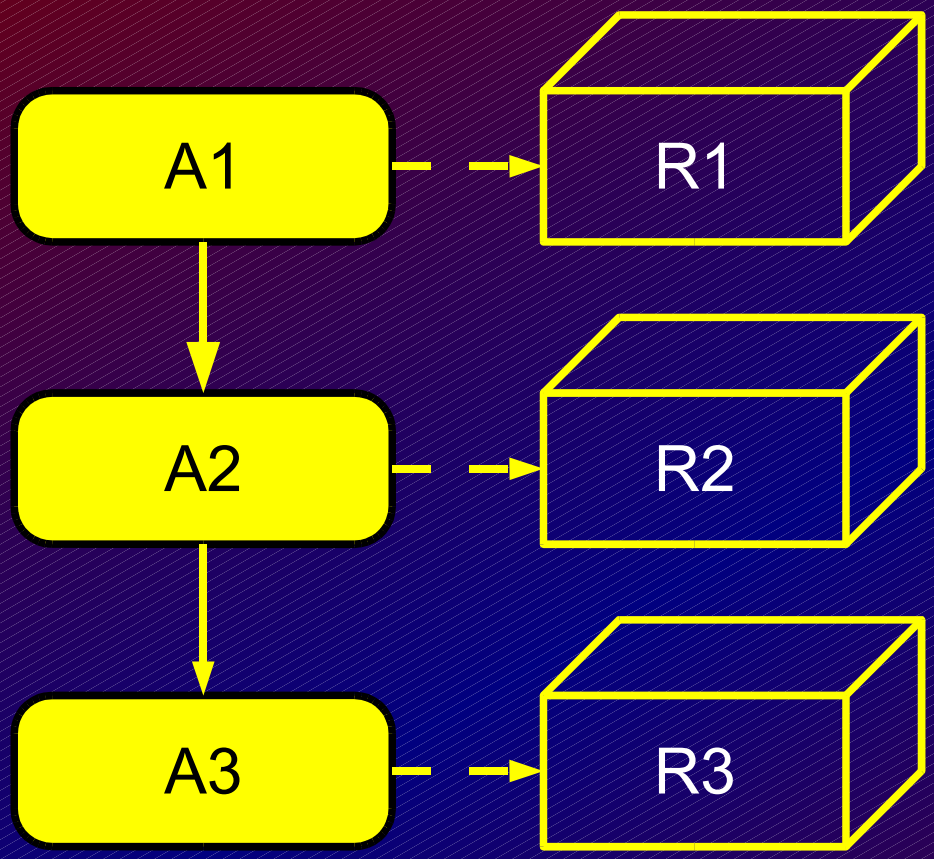
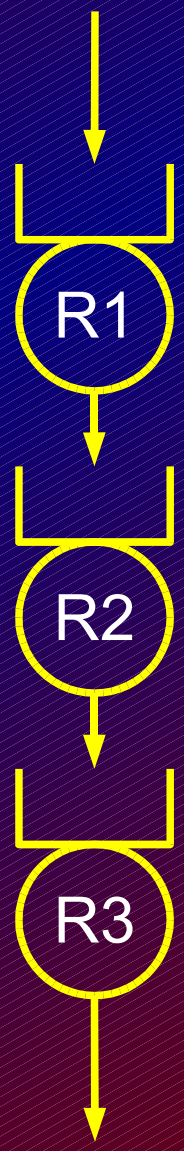


PApopulation = N
PAextDelay = Z

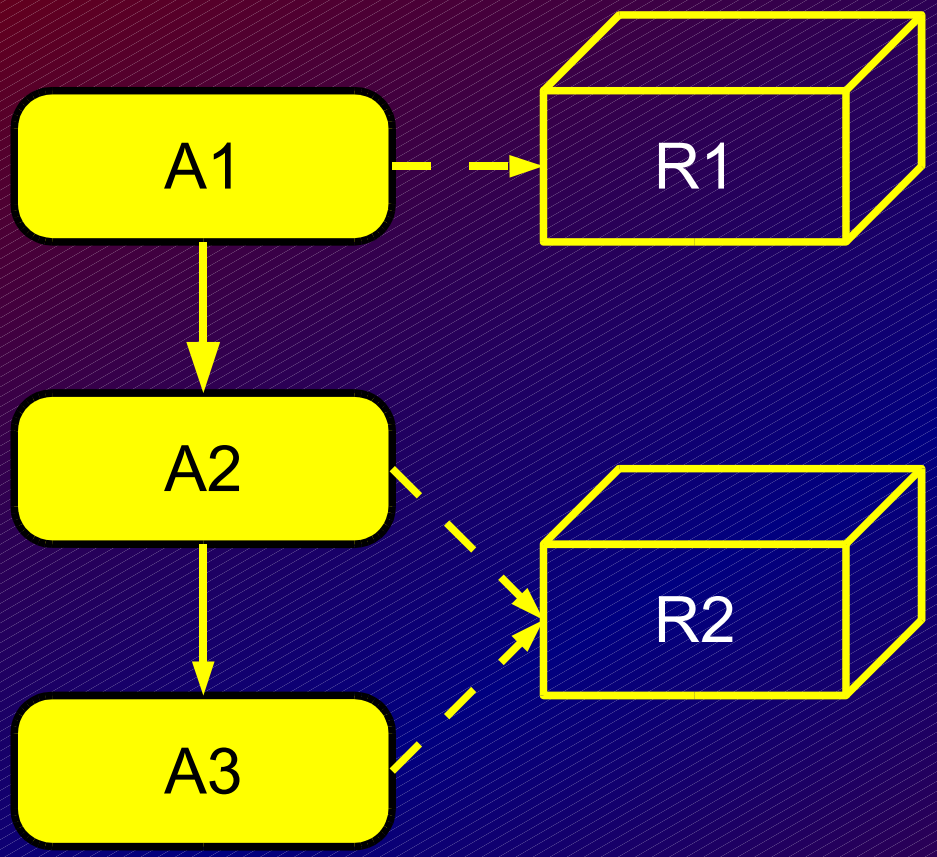


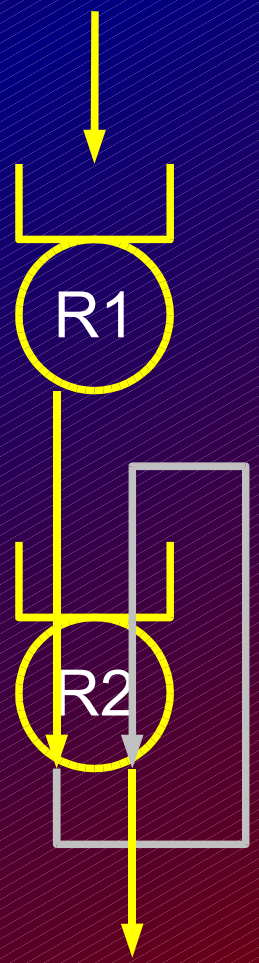
Translating Activity diagrams the easy case





Translating Activity diagrams the difficult case

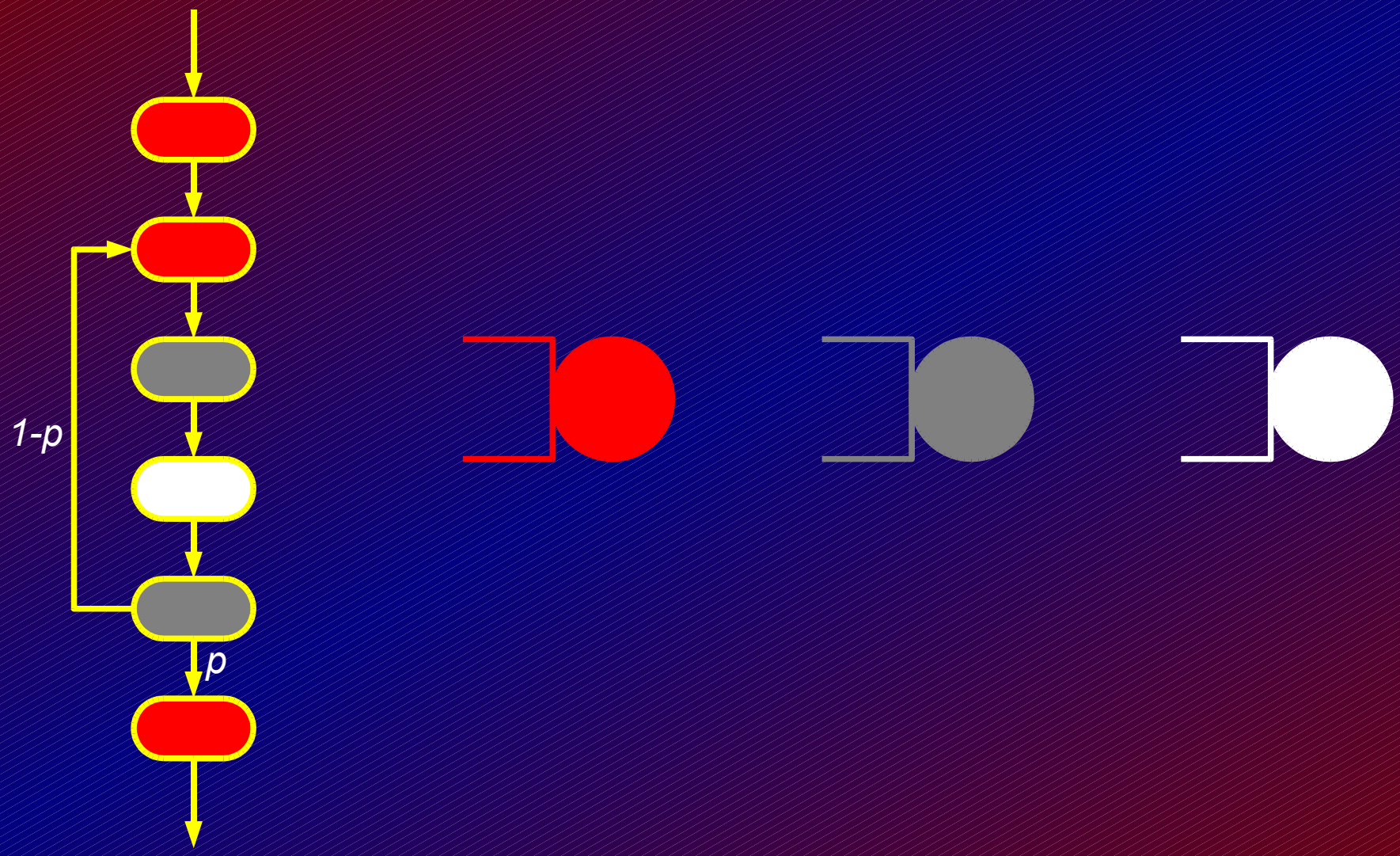




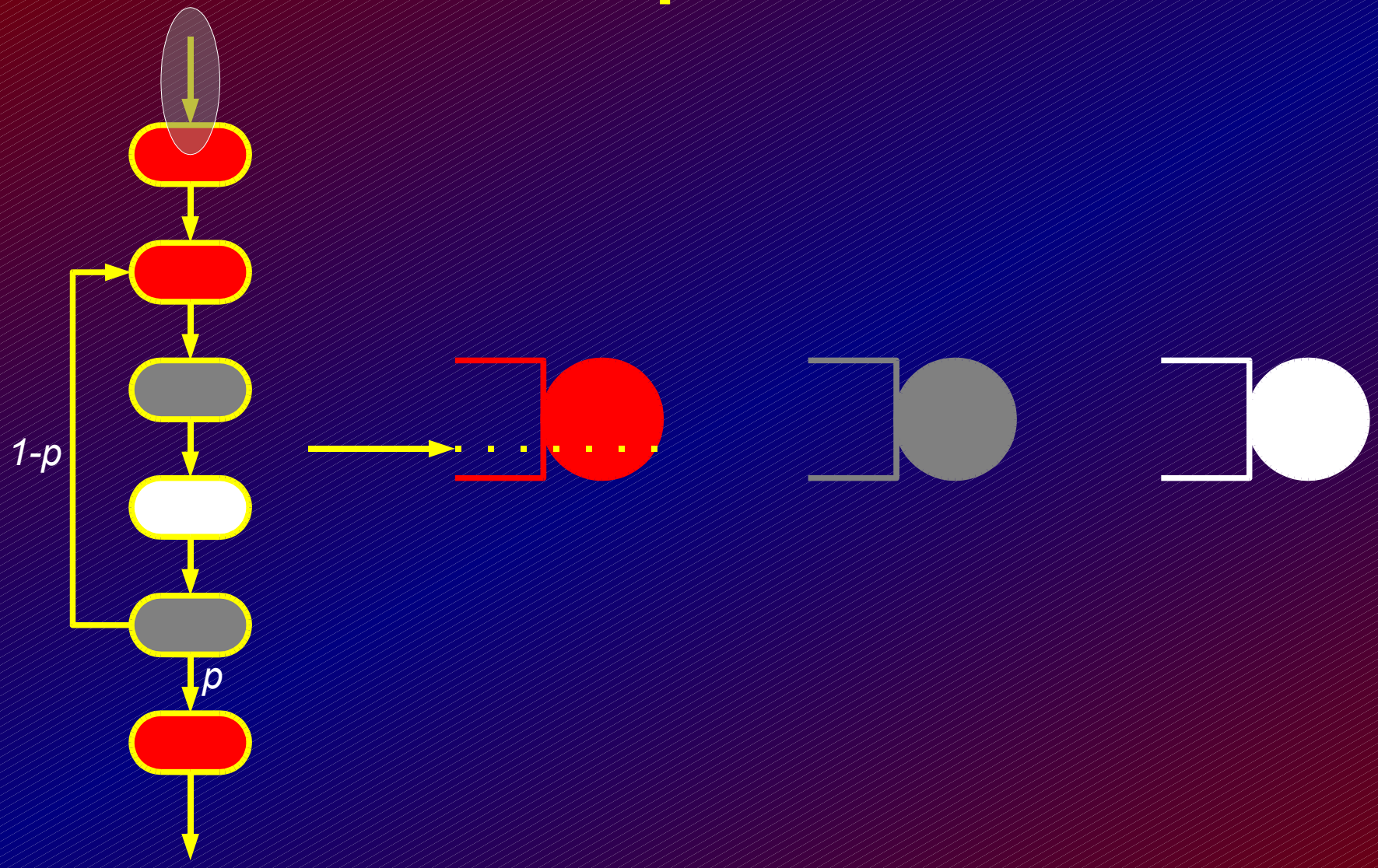
Outline of the transformation algorithm

- Translate one Activity diagram at a time
  - Each Activity diagram corresponds to a single chain
- Resources correspond to service centers
- Translate an Activity diagram as follows
  - All actions requesting service from the same resource receive a unique label in the range [1..k]
  - If there is a transition with probability *p* from an action with label *r* requesting service from resource *i* to an action with label *s* requesting service from resource *j*
    - Set $P[i,r,j,s] = p$

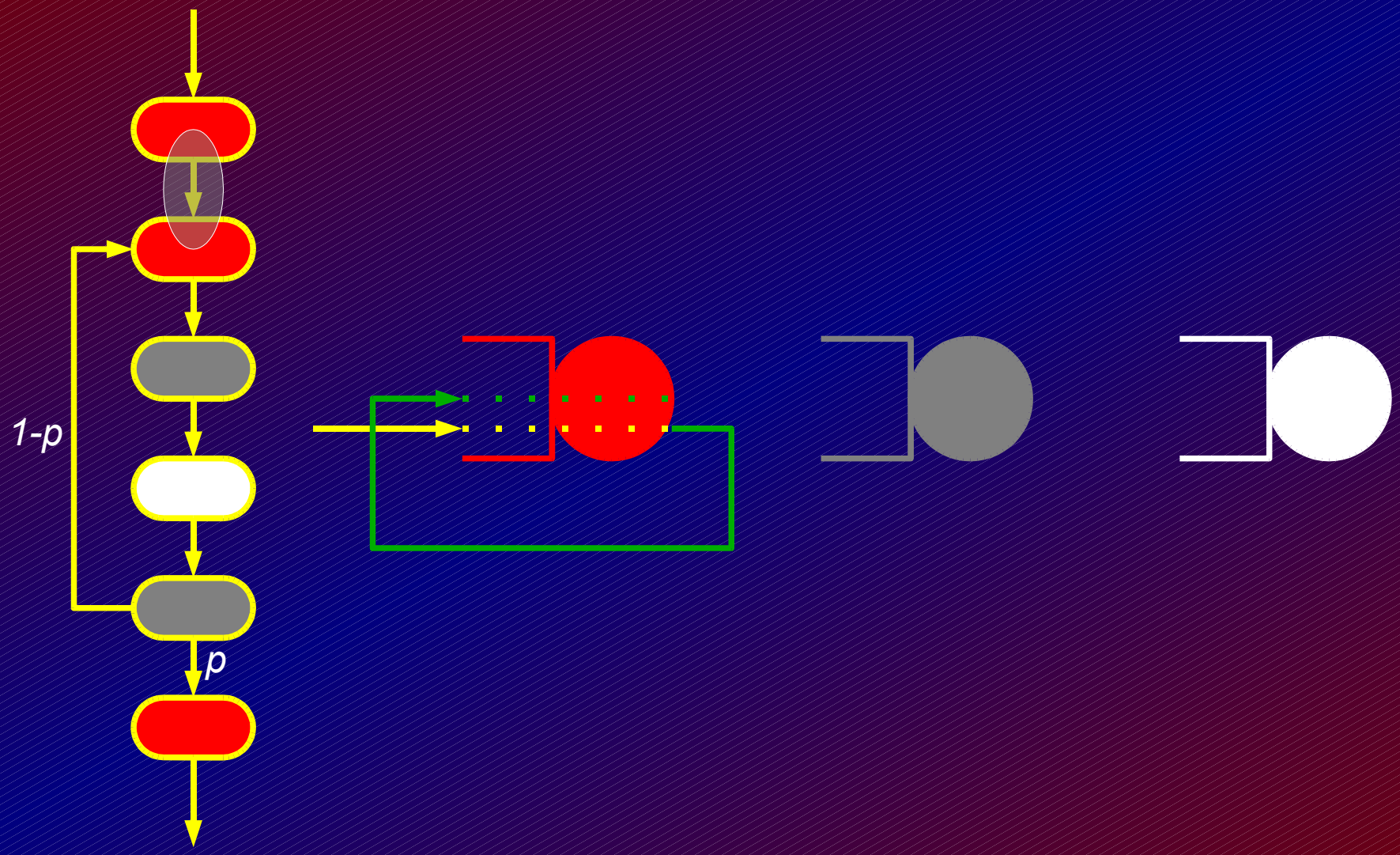
Example / 1



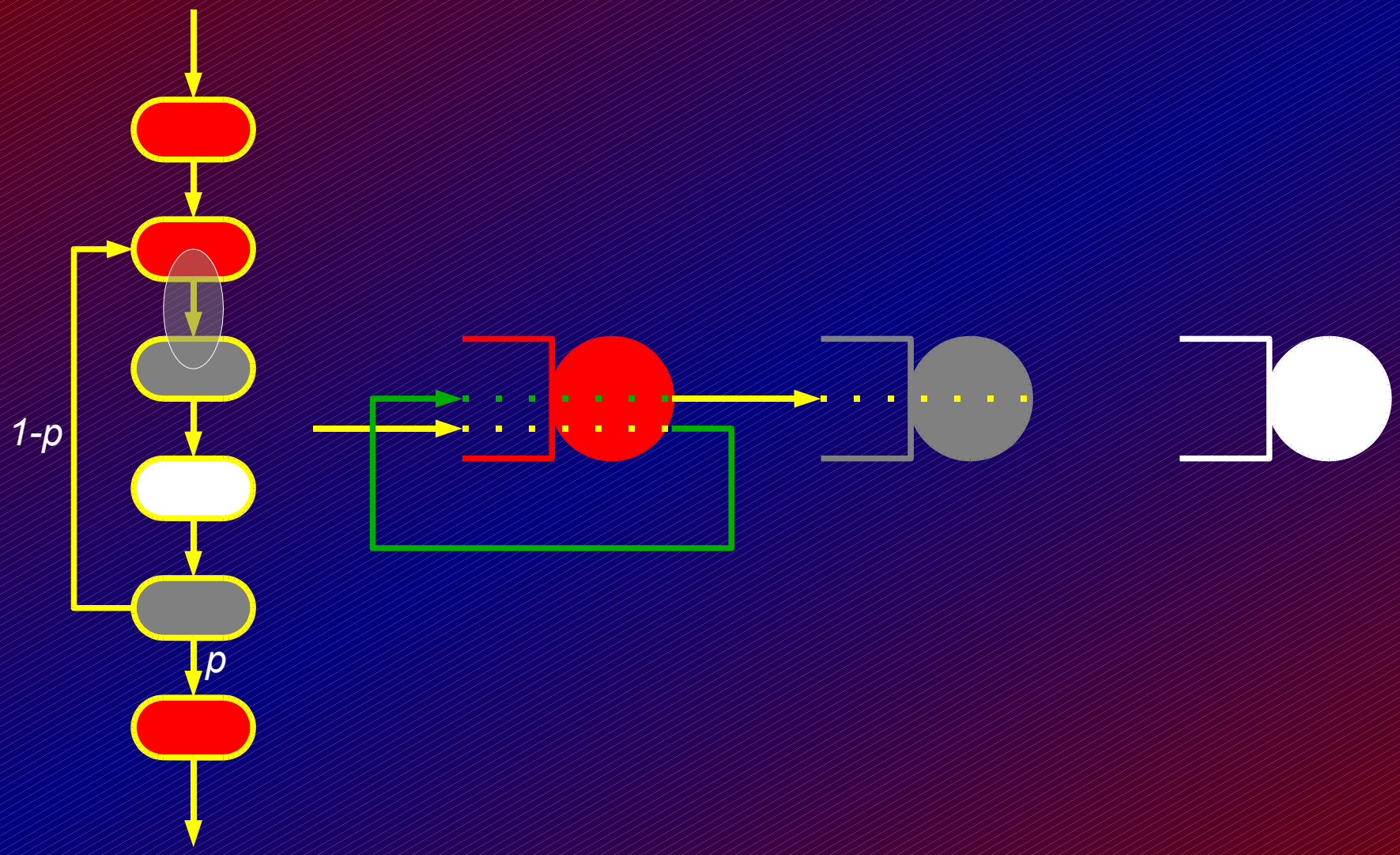
Example / 2



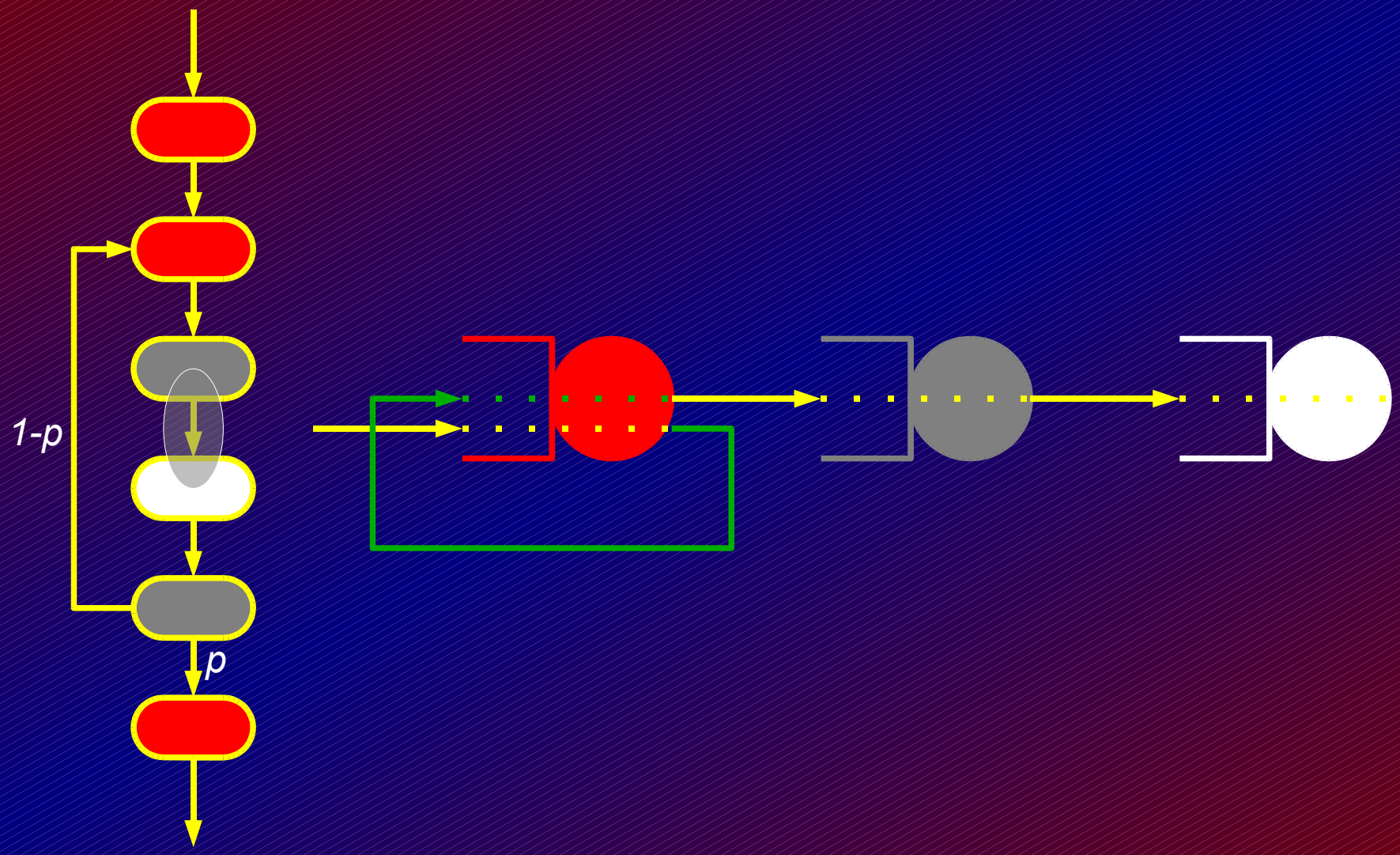
Example / 3



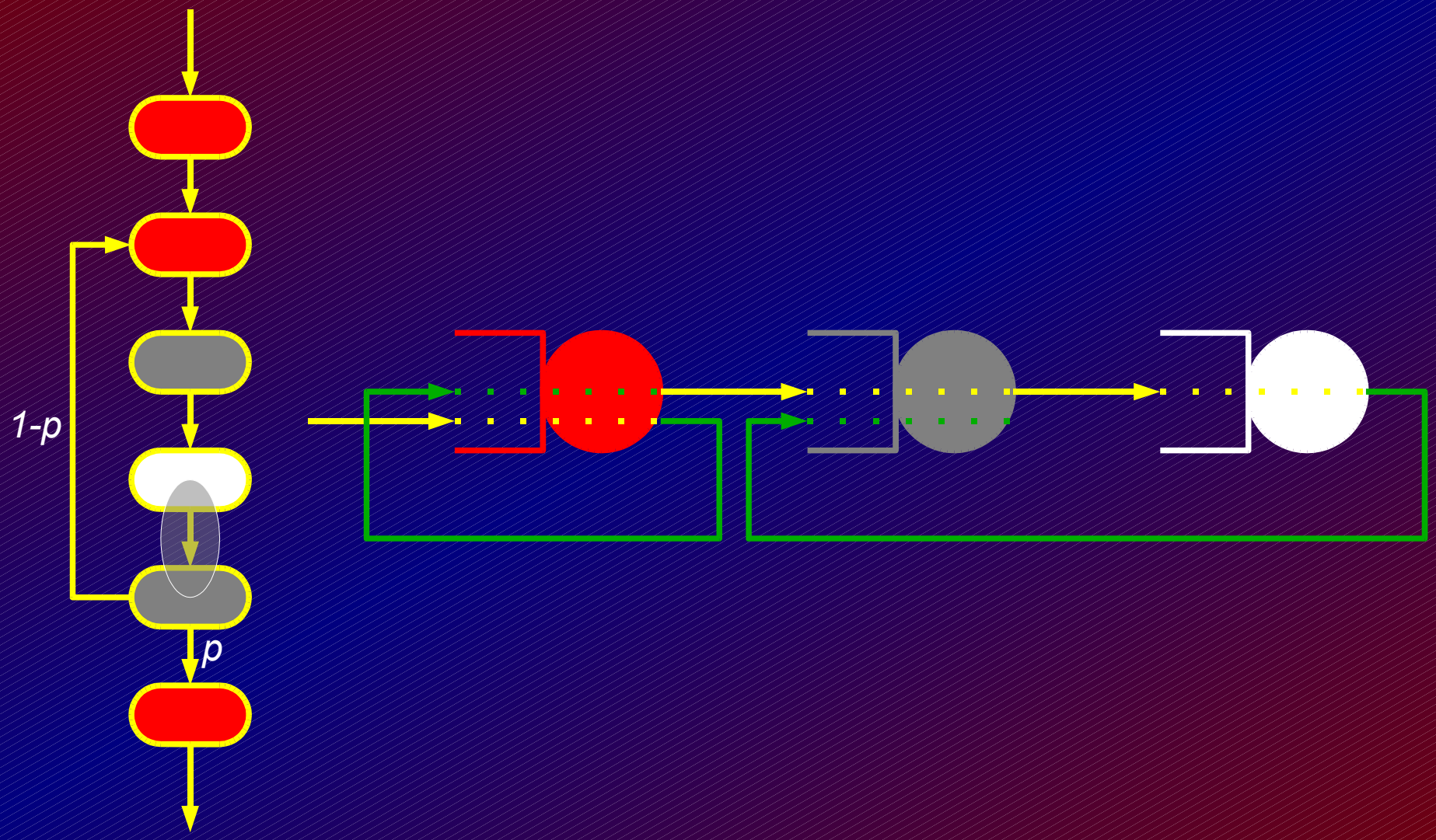
Example / 4



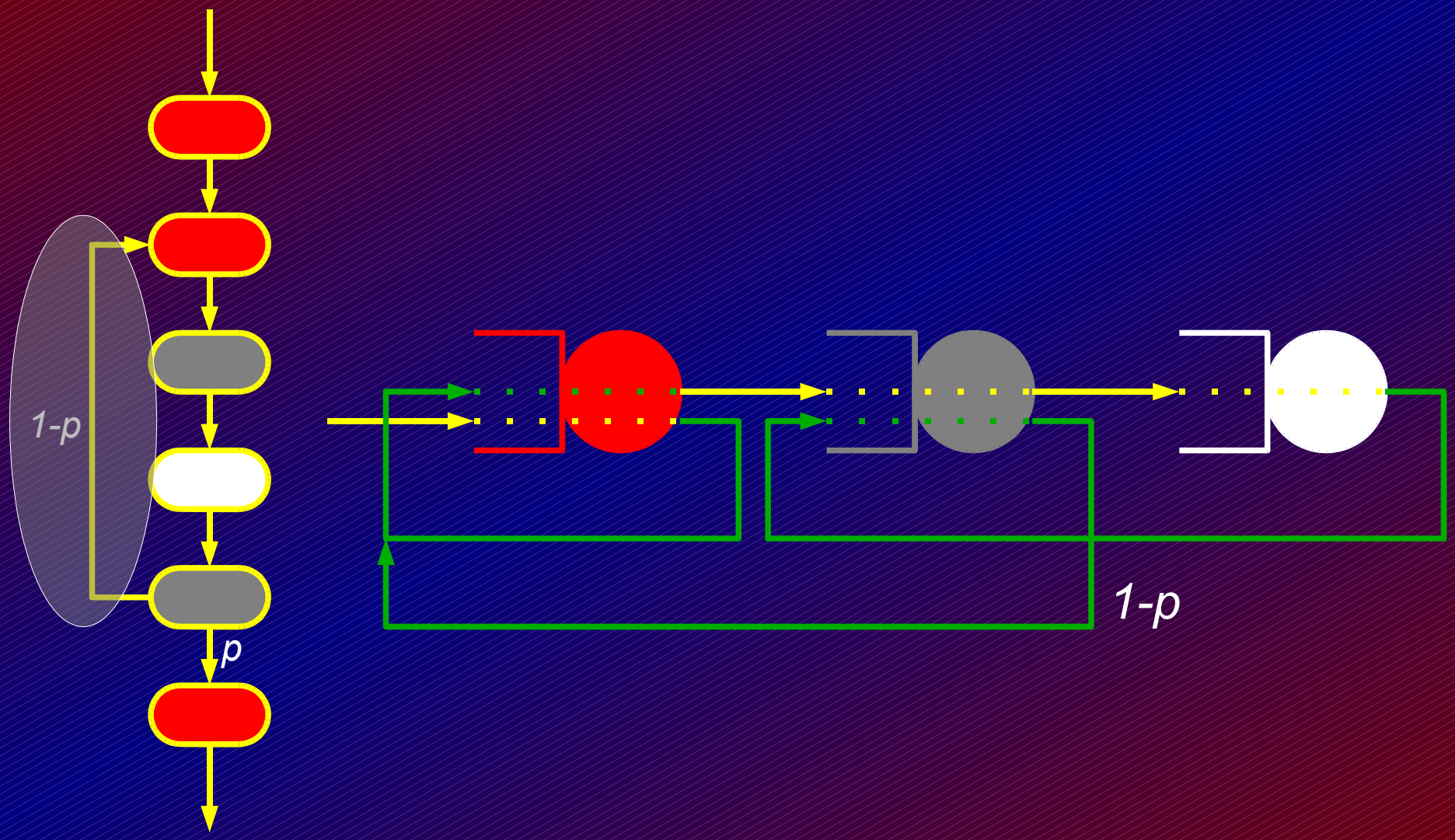
Example / 4



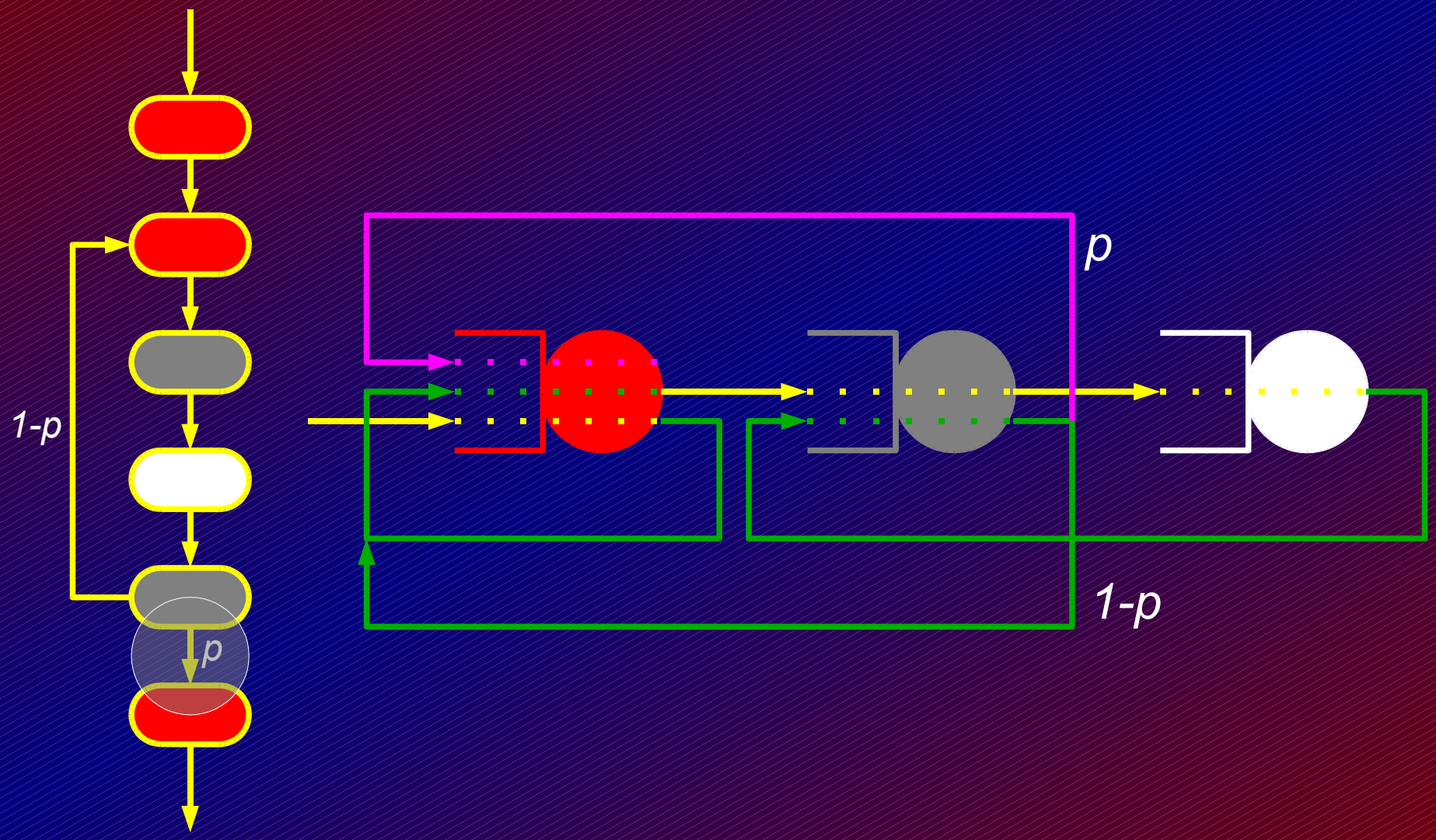
Example / 5



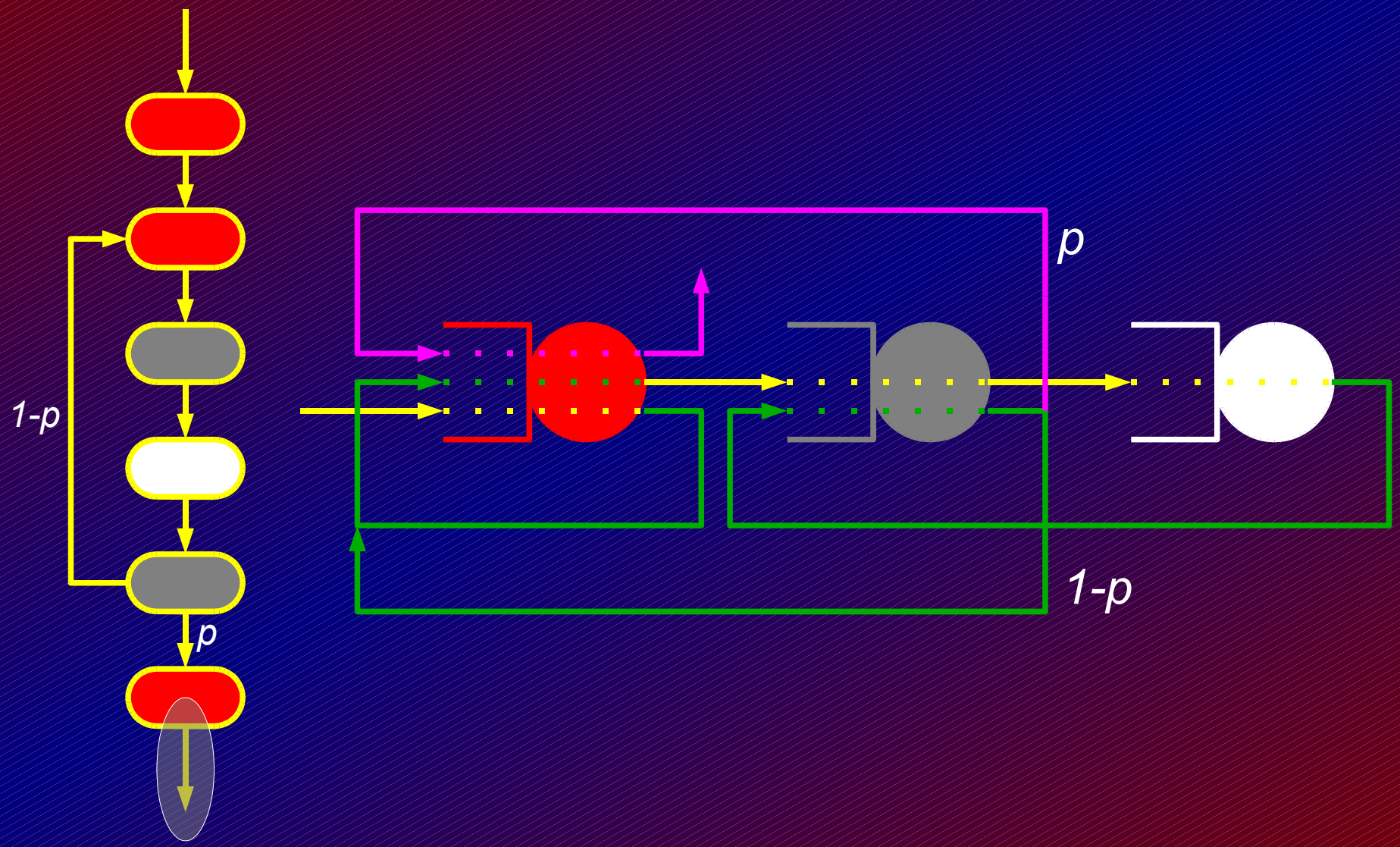
Example / 6



Example / 7



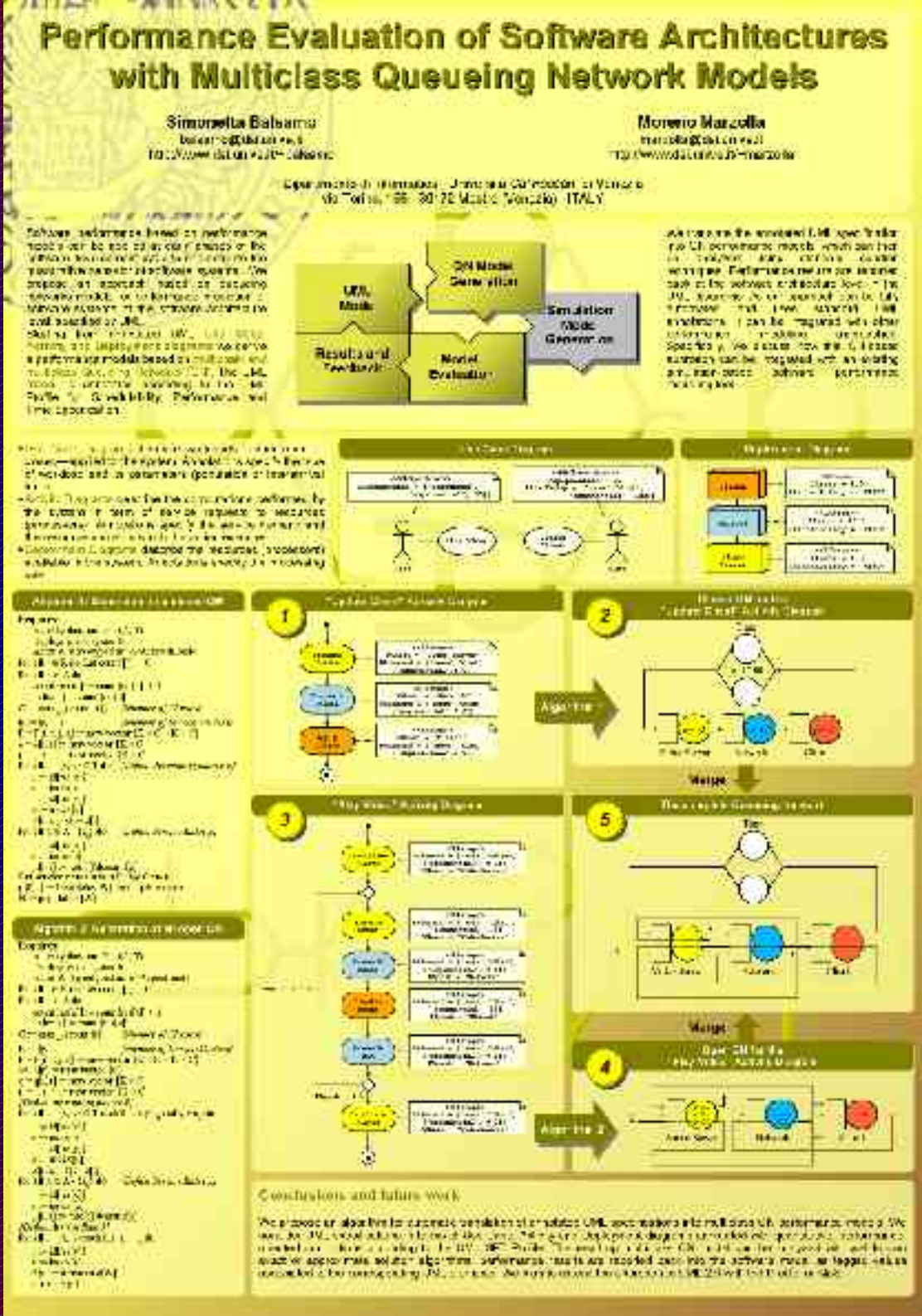
Example / 8



Conclusions and Future Works

- We proposed an algorithm for translating annotated UML specifications in multiclass, multichain QN performance models
- Future works include
  - Integration of the approach in a general framework
    - Partly done, nearly incorporated in our tool UML-Ψ
  - Extend the approach to UML2.0 composite structure diagrams (and the new QoS profile?)

Thank you!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UML Model
QN Model Generation
Simulation Model Generation
Model Evaluation
Results and Feedback
Algorithm 1
Algorithm 2
Merge
Conclusions and future work