# Recommendation Strategy for Cloud Computing Environments

Federal University of Pernambuco

Center of Informatics

Erica Sousa – etgs@cin.ufpe.br

Paulo Maciel – prmm@cin.ufpe.br

Centro de Informática U·F·P·E

MoDCS Group

# Agenda

- Introduction
- Main Aims
- System Architecture
  - Portal Editor
  - Model Generator
- Scenario
- Results
- Conclusions

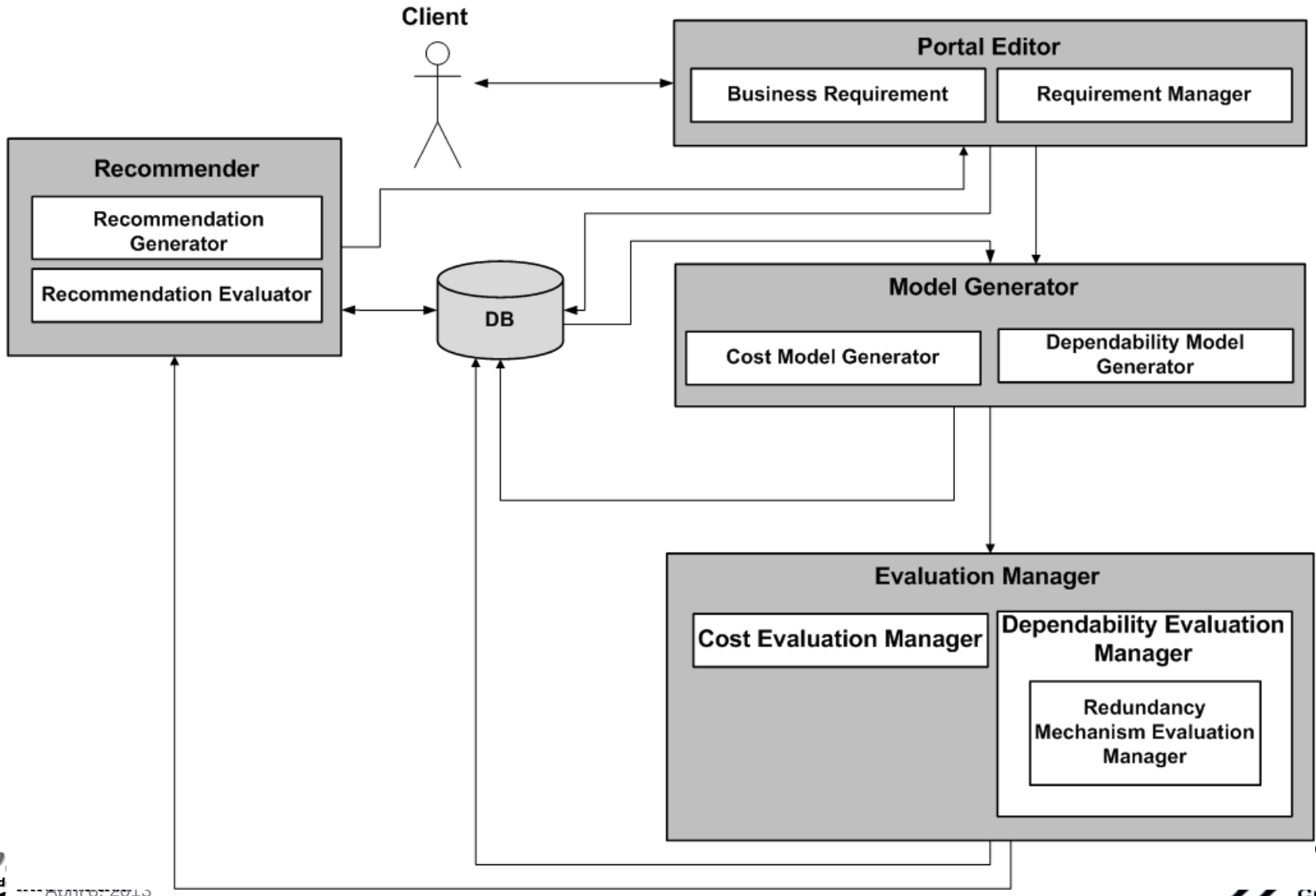
# Introduction

- The dependability of the cloud computing is very critical but hard to analyze due to its characteristics [3]:
  - massive-scale service sharing
  - wide-area network
  - heterogeneous software/hardware components.
- The threat to the dependability infrastructure may seriously affect the QoS for the business in Cloud computing [1].
- Achieving required level of dependability is one of the most challenging issues in implementing the cloud environments [1].

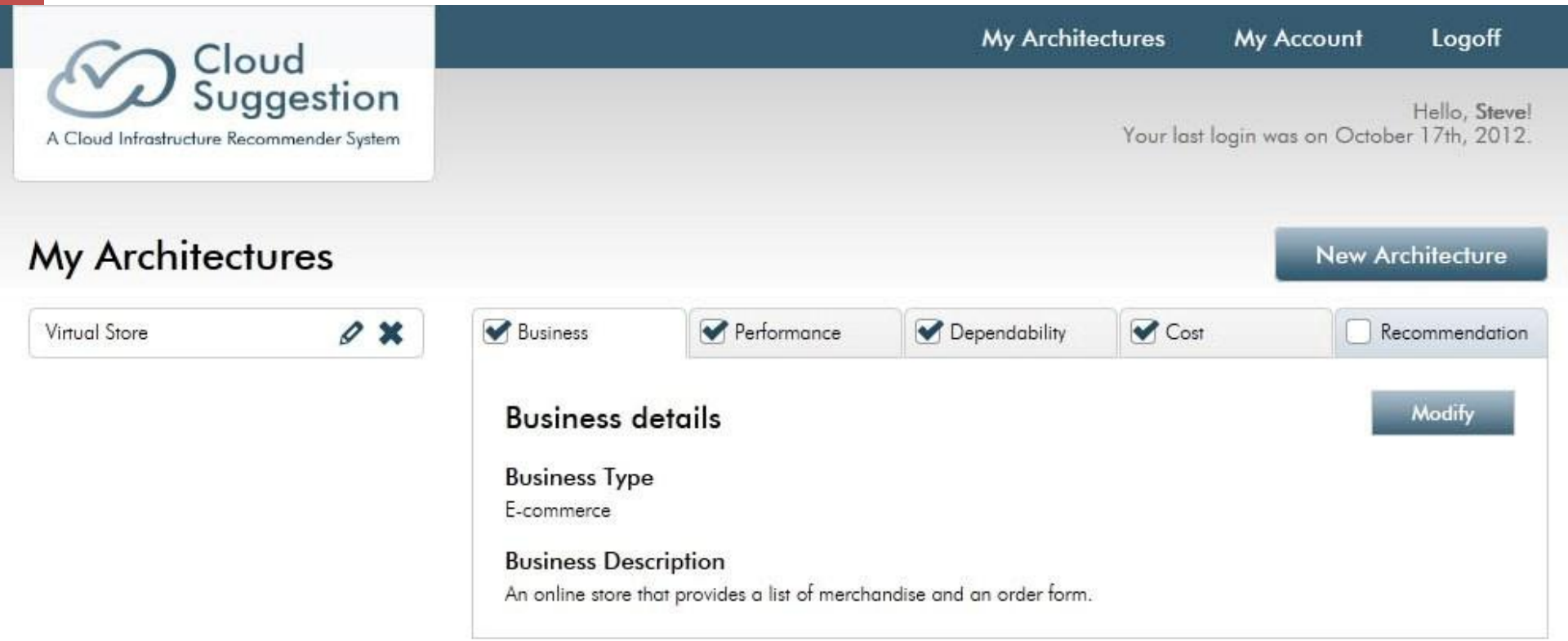
# Main Aims

- This work proposes a recommendation strategy for cloud computing environments.
- Recommendation strategy adopts a hybrid recommendation technique for suggesting cloud infrastructures.
- Recommendation strategy adopts stochastic models, such as stochastic Petri nets (SPN) and Reliability Block Diagrams (RBD).

# System Architecture

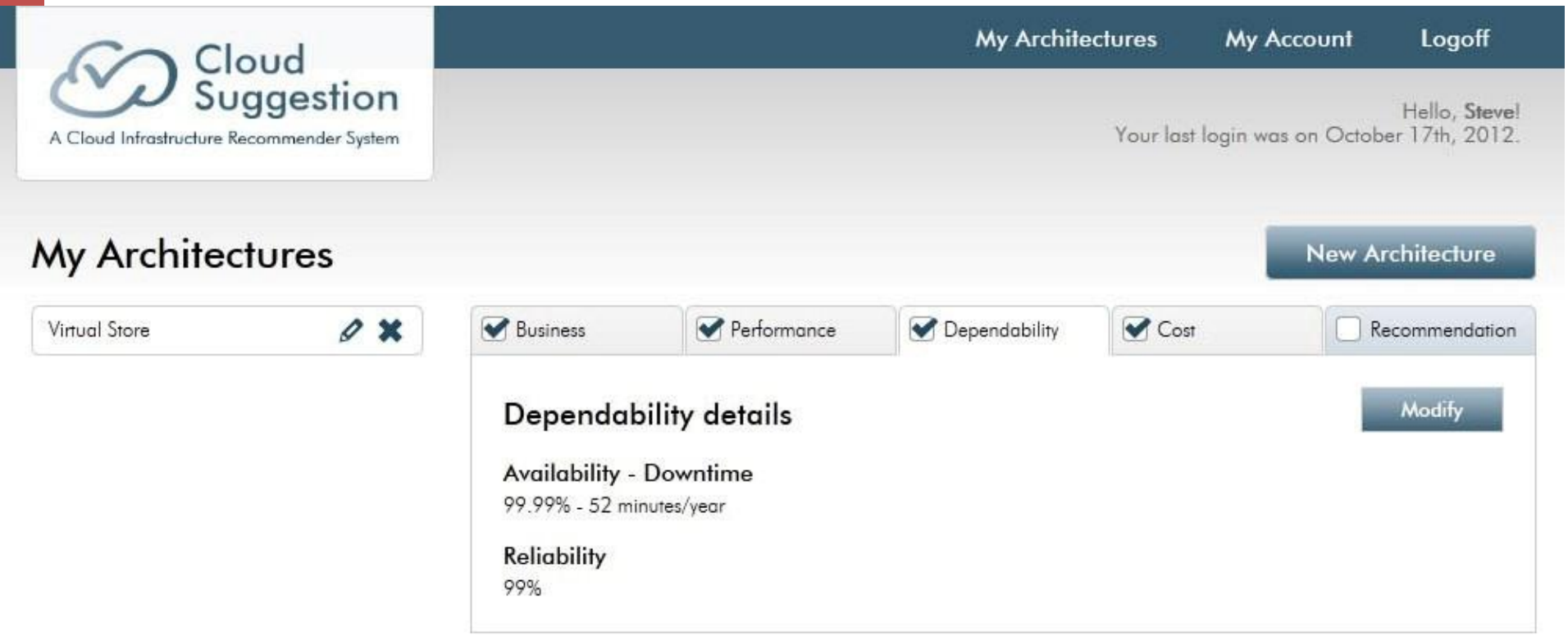


# System Architecture - Portal Editor



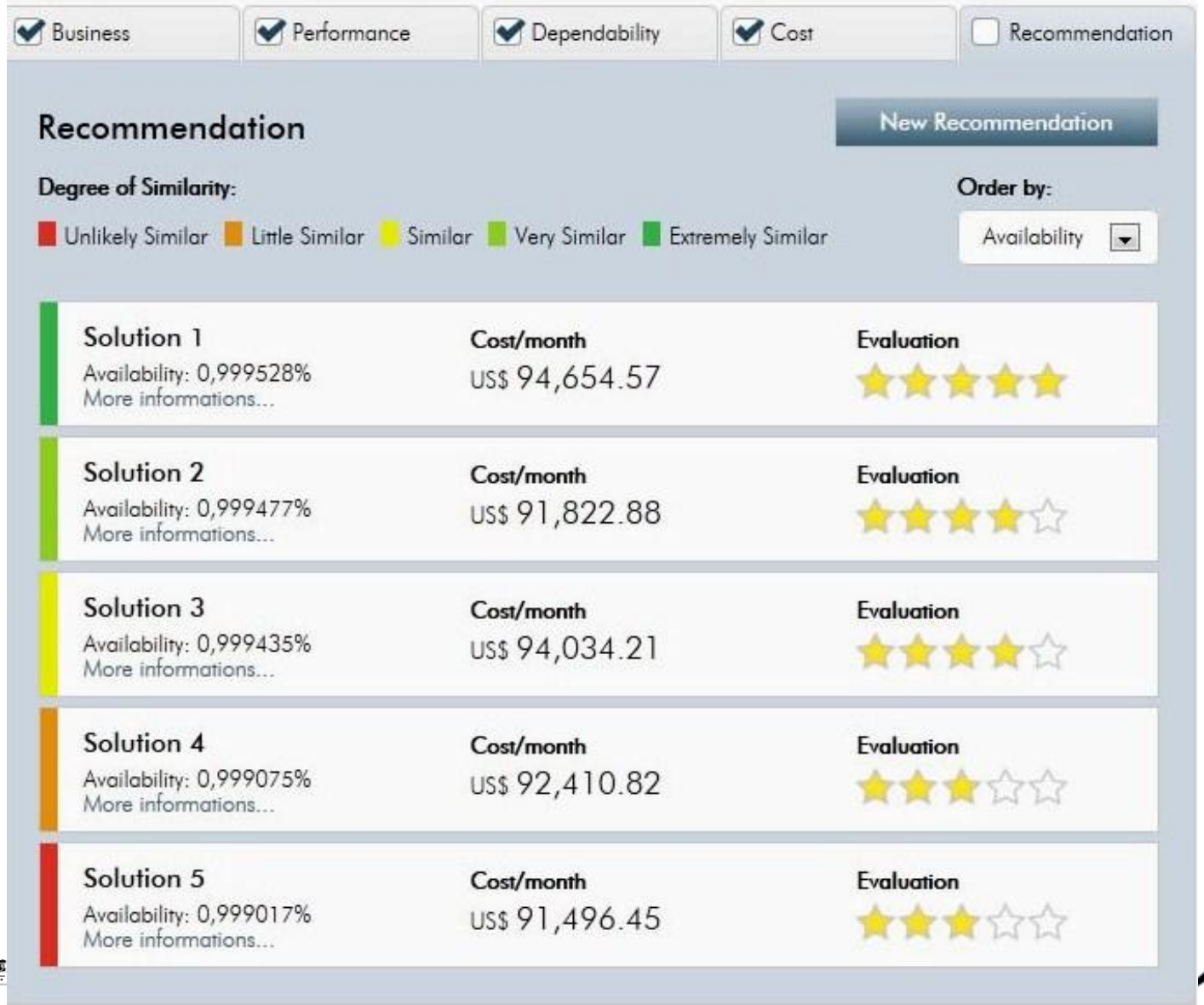

Business Editor

# System Architecture - Portal Editor



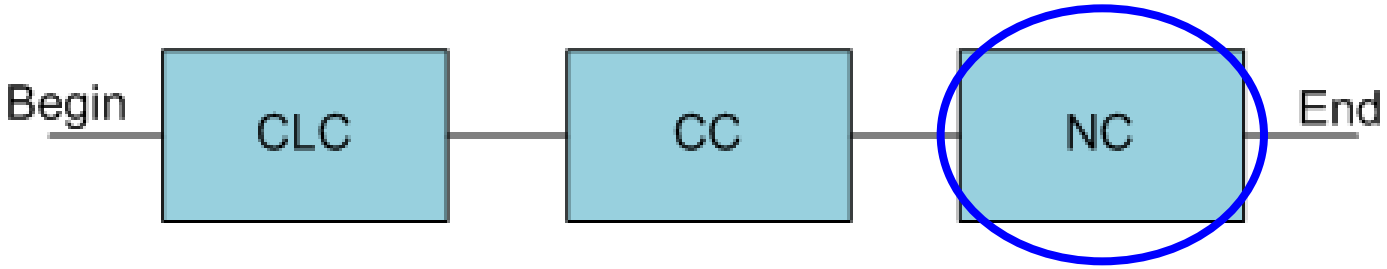

Dependability Editor

# System Architecture - Portal Editor



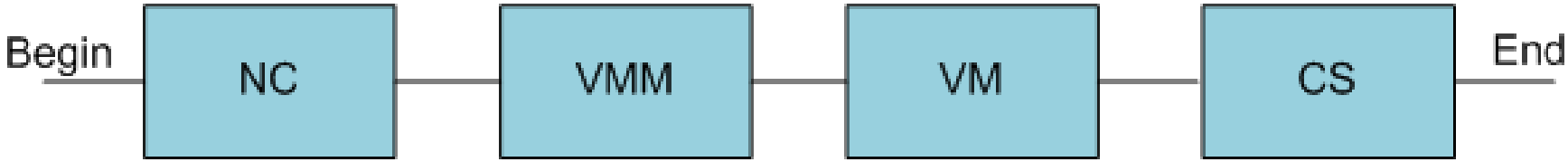
# System Architecture - Model Generator

- Dependability Model




Eucalyptus model

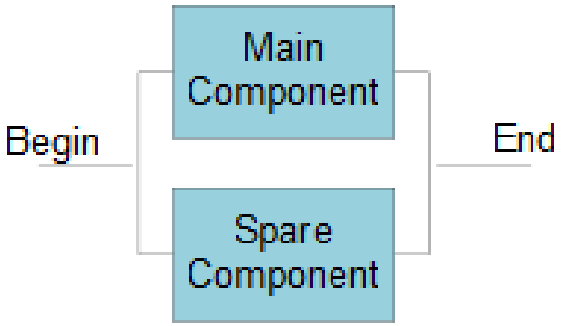
High-Level Model



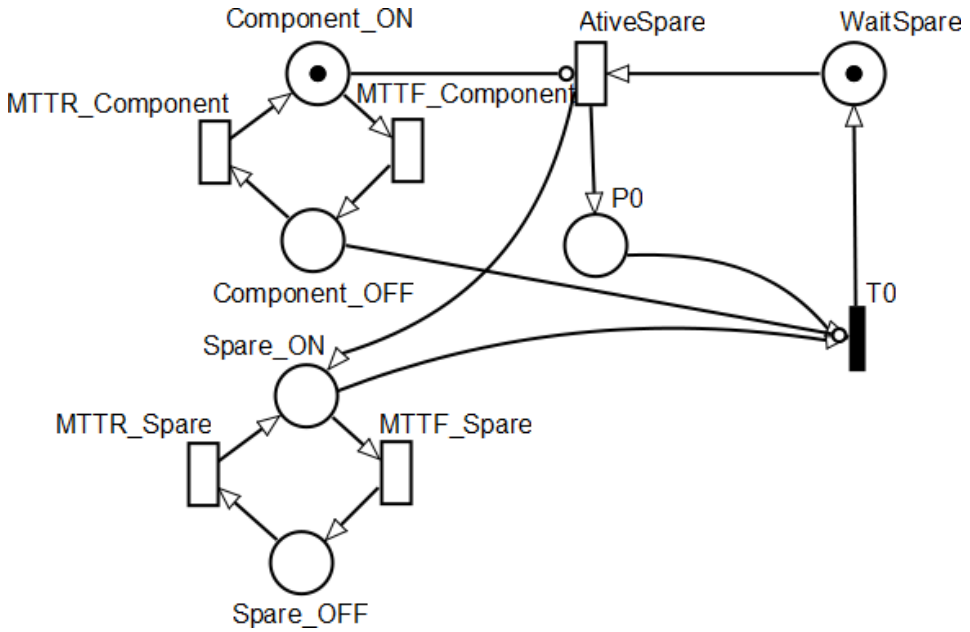

Low-Level Model

# System Architecture - Model Generator

- Dependability Model




Hot Standby Model




Cold Standby Model

# System Architecture - Model Generator

- Redundant Cost Model

$$\sum_{i=1}^{RCN} RCN_i \times RC_i$$

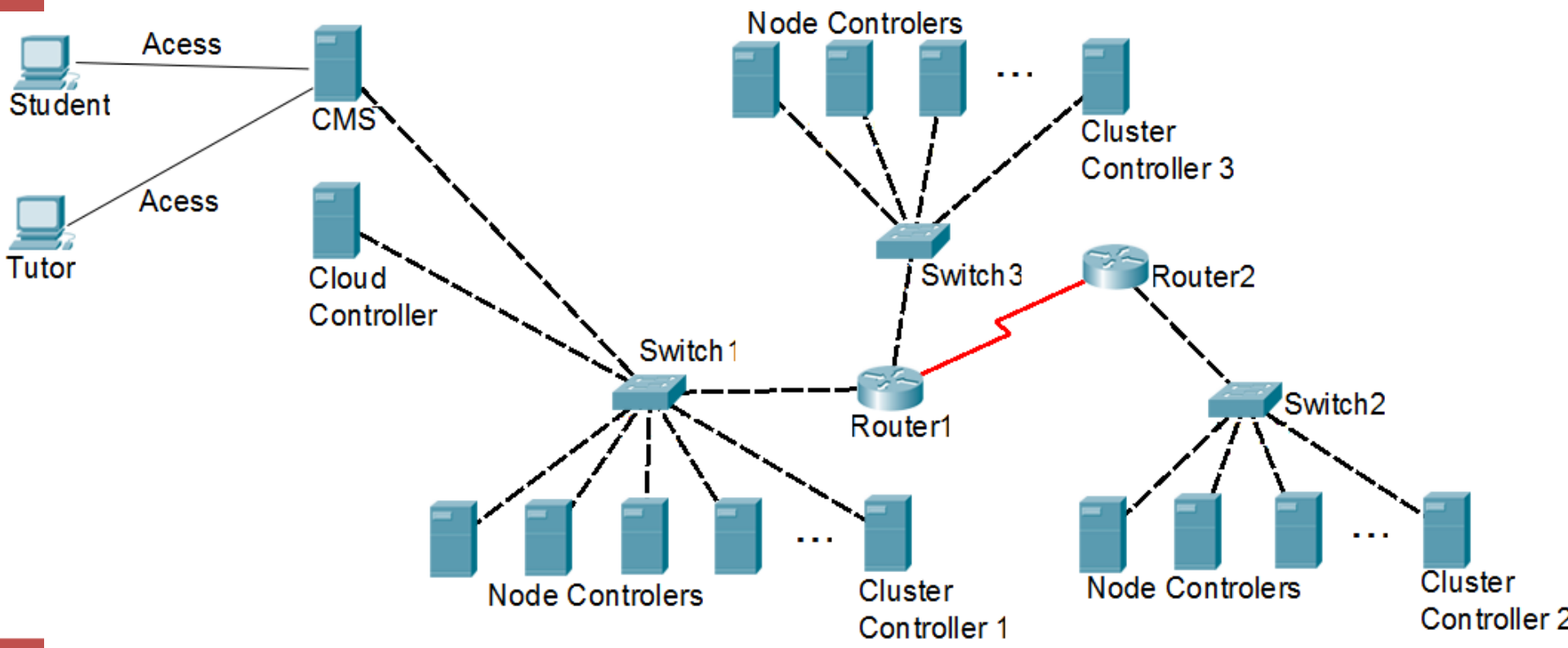
- RCN: number of distinct component types
- $RCN_i$: amount of a specific item (e.g.: hot and cold standby module)
- $RC_i$: unit cost.

# Scenario

- Private cloud for e-Learning services [2]
  - This private cloud consists of three computer pools, that are located at different locations.
  - The pools are used by students and staff for teaching, research and development purposes during the day.
  - The pools are managed by a Cloud Management System (CMS).
  - The pools have 30 computers with Ubuntu OS and KVM, Debian OS and Xen.
  - A web front-end was developed, where students can login and create, suspend, or delete VMs using a wizard, according to their project demands.

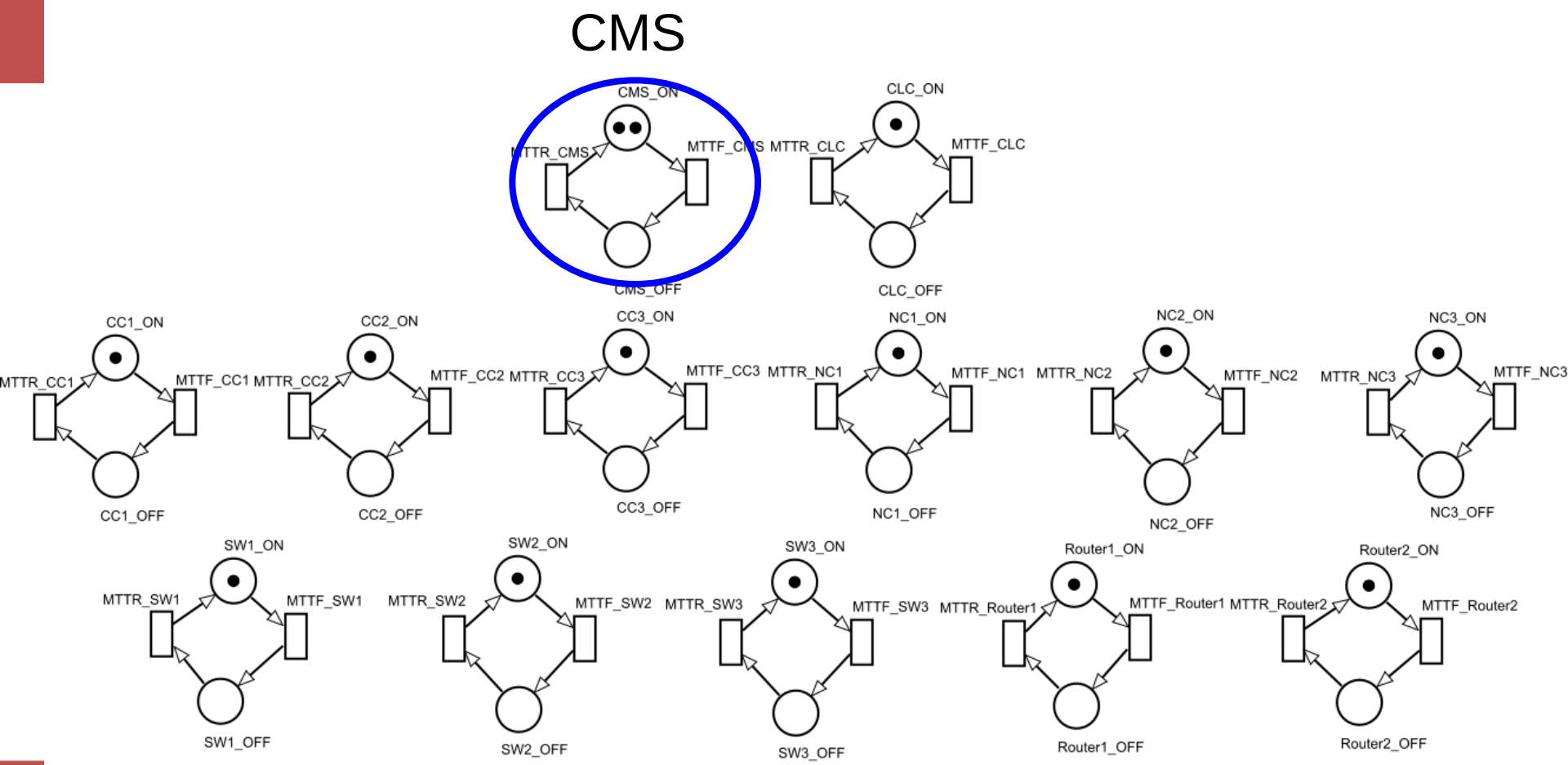
# Scenario

- Private cloud for e-Learning services




Private Cloud Architecture (inspired on [2])

# Scenario




Eucalyptus Model

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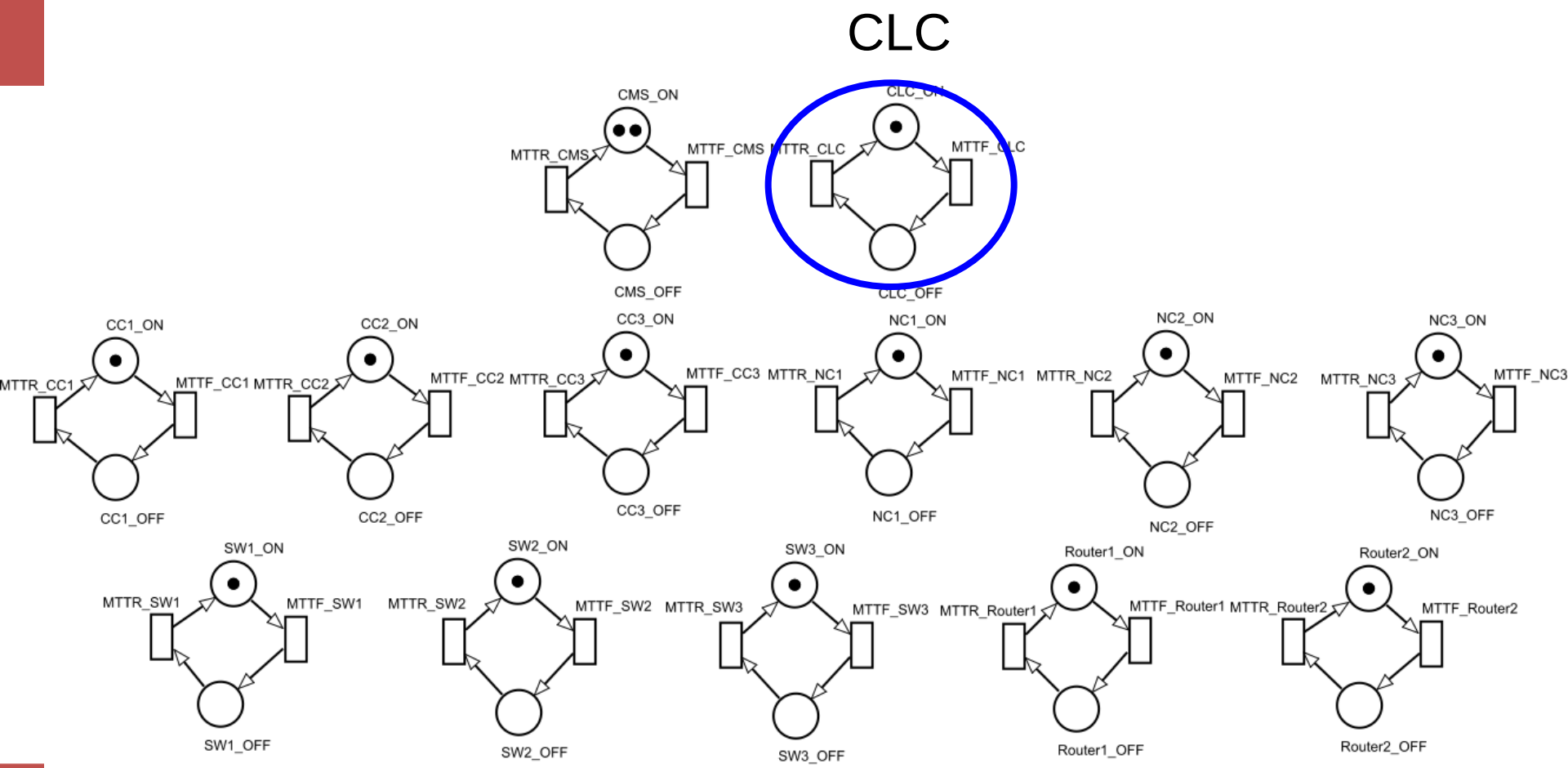


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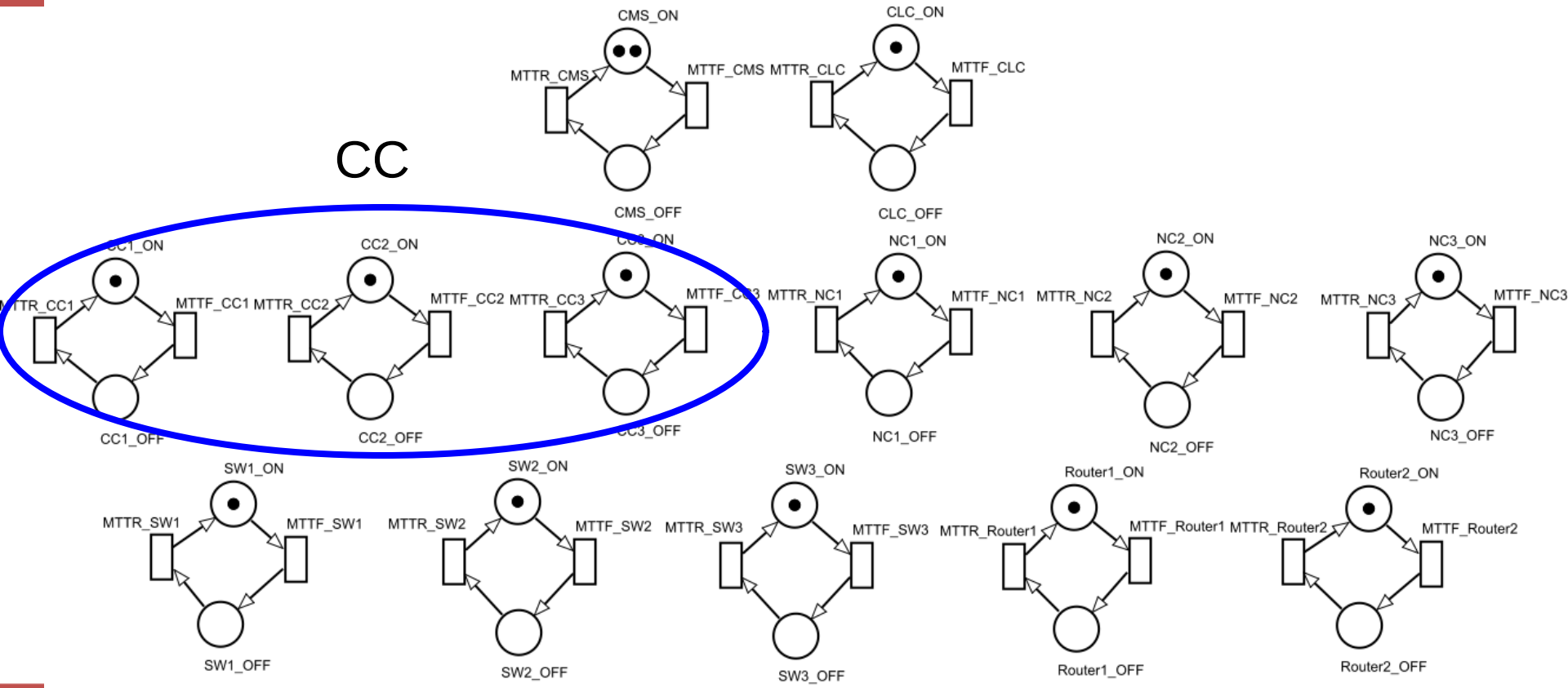


Eucalyptus Model

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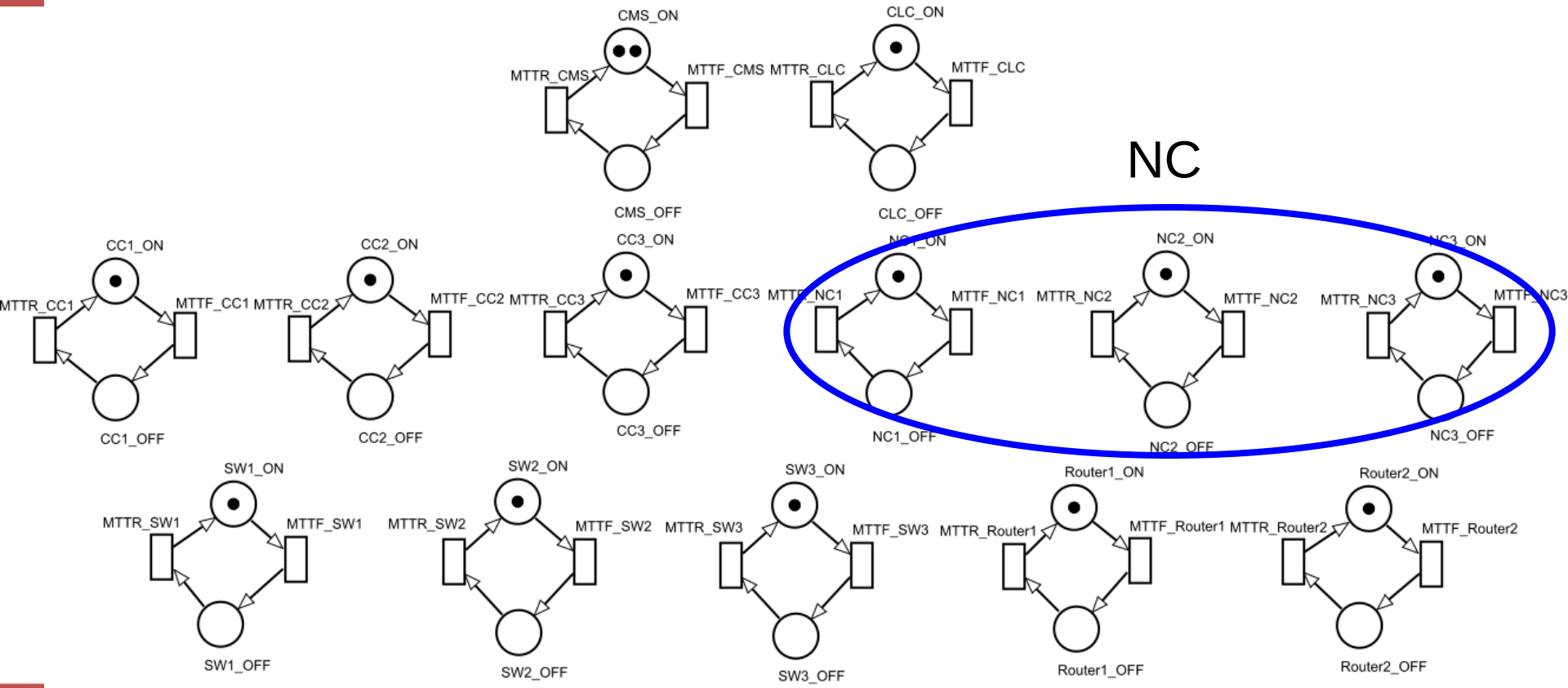


Eucalyptus Model

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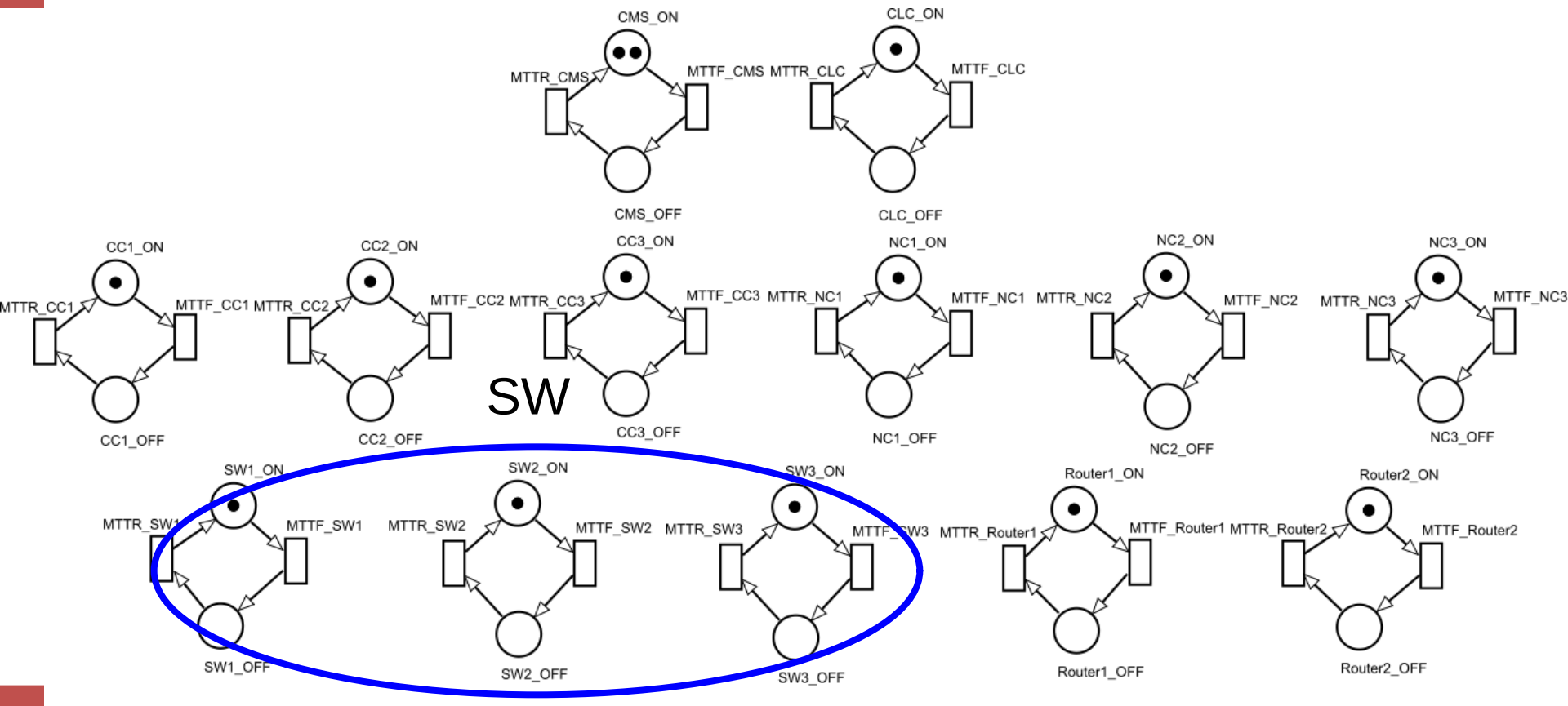


Eucalyptus Model

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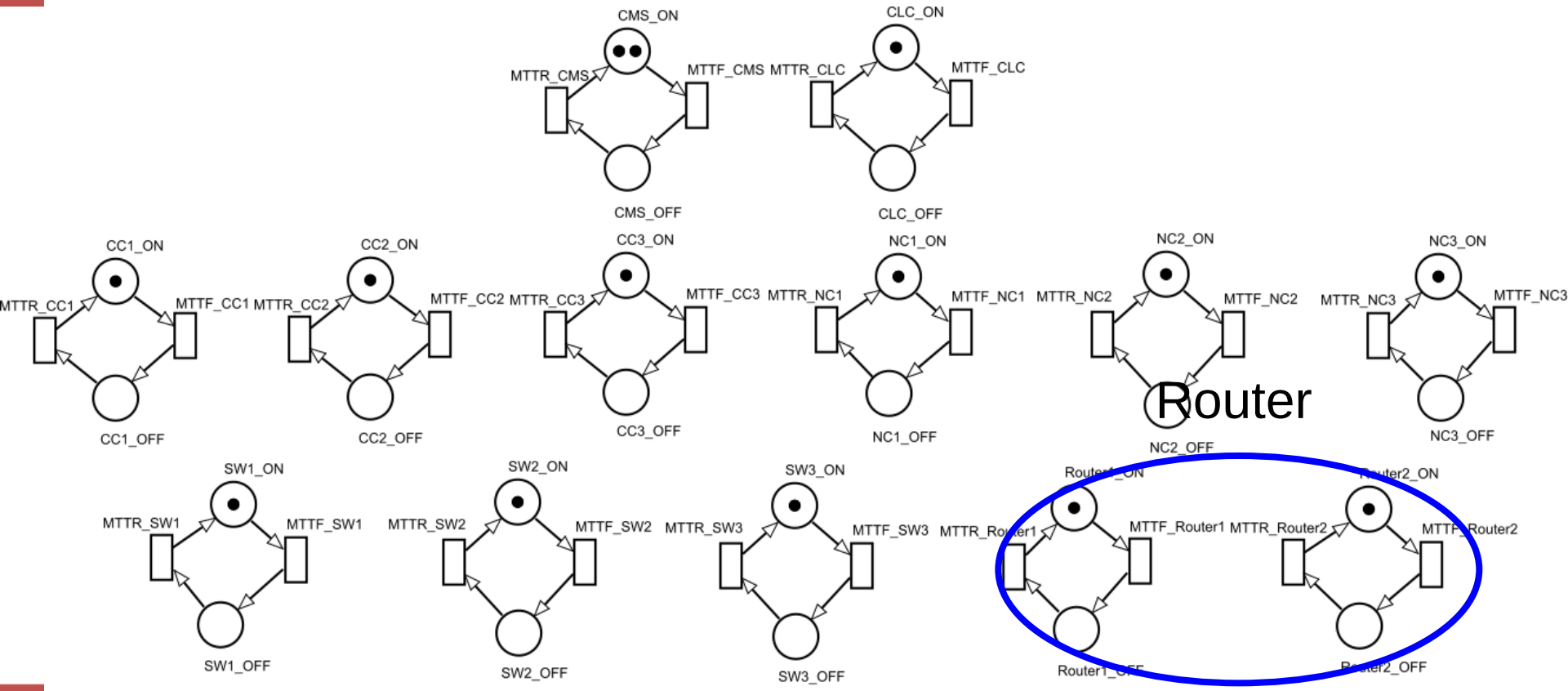


Eucalyptus Model

# Scenario

- Parameters

| Component | MTTF (hour) | MTTR (hour) |
|---|---|---|
| CC | 17,520.00 | 8 |
| CLC | 17,520.00 | 8 |
| CMS | 17,520.00 | 8 |
| CS | 26,280.00 | 8 |
| NC | 4,320.00 | 8 |
| VM | 2,880.00 | 8 |
| VMM | 2,880.00 | 8 |
| Switch | 30,660.00 | 8 |
| Router | 26,280.00 | 8 |

(inspired on [1])

# Scenario

- Private cloud for e-Learning services [2]
  - E-learning system must be robust enough to serve the diverse needs of thousands of learners, administrators, content builders and instructors simultaneously.
  - One of major concerns in e-learning is to have the working system, and prevent outages or slowdowns since it has a great impact on learners.

# Scenario

- Results

| Scenario | Component Redundant | Redundancy Mechanism | Availability | Cost (U$) |
|---|---|---|---|---|
| 1 | - | - | 0.9063 | 0.00 |
| 2 | CC1,CC2,CC3 | Cold Standby | 0.9970 | 3,200.00 |
| 3 | CLC | Cold Standby | 0.9960 | 3,200.00 |
| 4 | CMS | Cold Standby | 0.9960 | 9,600.00 |
| 5 | CC1,CC2,CC3 | Hot Standby | 0.9987 | 12,000.00 |
| 6 | CLC | Hot Standby | 0.9968 | 4,000.00 |
| 7 | CMS | Hot Standby | 0.9968 | 4,000.00 |

# Conclusions

- This work presented recommendation strategy for cloud infrastructures, which provides higher availability and reliability at lower cost.
- This work focused on the presentation of a recommendation strategy architecture as well as the conceived models for estimating dependability and costs metrics.