A Reference Architecture for a National e-Learning Infrastructure

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Introduction

• This research is about developing e-learning architecture based on NREN
• Currently, around 120 NRENs operate worldwide and provide high-speed communication between educational and research organizations,
• The existing and evolving NRENs offer a good opportunity in academic organizations for e-learning implementation
Research problem

• Researchers did not focused sufficiently on the e-learning architectures for a national level
• Currently researchers mostly focused on application layer and data repository, network layer needs more research.
• E-learning architectures using public networks and public cloud computing are vulnerable to different attacks
• Public cloud computing also has limitations of modifiability, interoperability, security and performance
• Traditional e-learning system also has problems pertaining to scalability, interoperability, maintainability and security.
Motivation

- Existing NRENs are a good infrastructure for e-learning but are not using sufficiently as e-learning infrastructure.
- It provides a high-speed national/ international connection between educational organizations.
- Specially AfgREN are using mostly public services.
- NREN is extendable to an educational private cloud computing that can provide PaaS, IaaS, and SaaS.
- By considering our expected result, NRENs provide a worldwide collaboration between educational organizations.
Objective

- To provide a national reference architecture
- To solve the problem of Interoperability, integrity and security of e-learning systems based on NREN.
- To systematically design a reference architecture for NREN e-learning deployment with the model driven engineering method.
- To collect, recognize and prioritize the requirements of NREN e-learning architecture.
- To evaluate the proposed architecture based on the quality attributes
- to recognize and prioritize the quality attributes
Research Method

Environment

- AfgREN
- Academic staff and students
- Organizations System
- Technical System

Problems & opportunities

Design Science Research

- Building Design Artifact & Process
- Design Cycle
- Evaluation

Rigor Cycle

Knowledge Base

- Foundation Scientific Theories & Methods
- Experience & Expertise
- Meta-artifacts (Design products & Design process)

RQ1: How to analyze existing e-learning system in the context of nationwide e-learning architecture?

RQ2: How to deduce the reference architecture for NREN e-learning?

RQ3: How to validate proposed reference architecture in consideration of quality attributes?
Research Design

Diagram:

- Conceptual knowledge
- Formal knowledge
- Domain knowledge
- Context details
- Reference architecture
- Tentative standard architecture
- Concrete architecture
- Styles & patterns
Research Design
Research Design
Research Design
Research Design
RESULT (scenario 1)


Schmidt, D.C., 2006. Model-driven engineering
RESULT( scenario 2)

RESULT (scenario 3)

Evaluation (ATAM/ Requirements bazaar)

PHASE I
Scenarios and requirements gathering

PHASE II
Architectural views and Scenario realization

PHASE III
Attribute model building and analyses

PHASE IV
Trade-offs

1. Collect Scenarios
2. Collect Requirements/Constraints/Environment
3. Describe Architectural Views
4. Realise Scenarios
5. Attribute-Specific Analyses (best individual theoretical models)
6. Identify Sensitivities
7. Identify Trade-offs

Action plan
Evaluation (ATAM/ Requirements bazaar)
Conclusion

- The goal of this research is to design the e-learning based on NREN architecture.
- Current e-learning systems including traditional and cloud based has problem of interoperability, data integrity, security, collaboration and high performance.
- We found that concept of eSRA can be adapted to e-learning system, we designed standard architecture and concrete architecture, while it is still a reference architecture based on NREN.
- NREN provide a good infrastructure for e-learning in the national level.
- We presented four papers that each of them are a scenario of this research.
Future Work

- Developing an e-learning platform based on the proposed e-learning architecture
- Developing a collaboration platform for data exchange between NRENs based on proposed architecture,
- Technology infrastructure architecture,
- Information architecture,
- Application architecture,
- Business architecture.
Any question

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