A Practical Approach to Model-Based Cloud Service Deployment: Using a Smart Interpreter and a Domain Specific Language

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Agenda

- Enterprise Content Management
- Cloud-Service Deployment Automation
- Related Work
- Domain Specific Language Approach
Enterprise Content Management (ECM)

- Manage all life-cycle stages of electronic content in an enterprise
- The functionality of these systems varies widely
- Many different software components comprise an ECM system
- The system topology and component configuration is customized
- The components are integrated with other IT-systems
Enterprise Content Management (ECM)
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Cloud Deployment Automation – Introduction

- **What is Cloud Deployment Automation?**
  - A mechanism for automating the installation and configuration of complex applications on cloud platforms
  - A representation of the components that comprise the application

- **Why do we need this?**
  - Single-tenant applications need to be deployed many times
  - Development and testing benefit from the repeatable and effortless deployment of new instances
  - It enables packaging entire cloud applications
  - Large installations are only manageable when the instances are well known
Cloud Deployment Automation – Challenges

• Challenges and requirements:
  – Control many different Cloud services (VMs, PaaS offerings…)
  – Enable reusability of the deployment model
    • Through easy customization
  – Keep track of instances to aid with DevOps
    • Software updates
    • Migration
    • Monitoring
  – Provide an advantage over manual deployment or scripts
Cloud Deployment Approaches – Overview

- **Commands/Calls**
  - Can't describe whole cloud services
  - High complexity, limited maintainability

- **Scripts**

- **Chef/Puppet**

- **Heat/CloudFormation**

- **TOSCA**

Translate to

Run on
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Related Work (1/3) – Ant Scripts
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• For each component, Ant-tasks were developed that implemented individual install/config logic

• Each component instance then had Ant-tasks to orchestrate the individual steps

• One global Ant-task would orchestrate all the components

• Problems:
  - Giant mess of config parameters needed to be passed down
  - Low reusability of tasks
  - Not transparent
Related Work (2/3) – IBM Workload Deployer (IWD)
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- Model-based declarative deployment
- Components and lifecycle operations need to be defined
- With a graphical tool, the service topology can be defined form a set of components and relationships
- IWD determines an orchestration routine

- Problems:
  - Impossible to express some aspects of custom components
  - Same goes for relationships/lifecycle stages
  - → not powerful enough for complex application scenarios
Related Work (3/3) – (Open)TOSCA

Topology and Orchestration Specification for Cloud Applications
Related Work (3/3) – TOSCA

- OASIS Standard, many implementations exist
- Standard specifies mostly the syntax of the topology definition language (doesn't say much about orchestration).
- Interoperability between TOSCA tools can be compared to interoperability between applications using XML
- Very well suited for describing topologies / service layout
- Most implementations only use this aspect and, like IWD, internally generate the orchestration
Related Work (3/3) – OpenTOSCA

• Open Source implementation of a TOSCA engine
  – Topology modeler
  – Admin-UI
  – Engine:
    • Topology parser / Instance manager
    • Workflow engine (BPEL) for executing orchestration
  → OpenTOSCA does not generate an orchestration process, it must be provided (i.e. imperative orchestration)

• Problems:
  – No tool support for orchestration process development (yet)
  – Variability / interaction of orchestration process with different topologies unclear
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DSL-Approach – Motivation

- Conclusions from related work:
  - Model based systems are well suited for representing complex topologies
  - Models provide an understanding of the topology
  - Domain specific approaches can work very well in their application domain (see IWD and Websphere)
  - Low level capabilities are needed to represent all aspects of custom components
**DSL-Approach – Classification**

- **Pre-defined Heat templates / fragments**
- **Interpreter**
- **Heat**
- **Commands/Calls**
- **Run on**
- **Level of abstraction**

**DSL**
DSL-Approach – Template Catalog

- OpenStack Heat templates provide a good mechanism for defining individual components
- Powerful mechanism for providing scripts and low-level artifacts for deploying components
- We build a catalog of components and topology fragments → re-use of existing Heat infrastructure and tools
**DSL-Approach – Domain Specific Language**

- The DSL provides a syntax and semantic for describing ECM applications
  - Syntax: we use TOSCA → „internal DSL“
  - Semantic: we define TOSCA types for ECM components and relationships

- High level DSL is accessible and understandable

→ re-use of TOSCA topology syntax and modeling tools
DSL-Approach – Interpreter

- The interpreter analyses and checks the service description written in the DSL
- Based on rules and the DSL input, it constructs a Heat template for deploying the desired ECM service
- The rules/templates create a known decision space → we can test and validate all possible output topologies
Thank You!

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