Risk Thinking for Cloud-Based Application Services

Eric Bauer
September 14, 2016
The Cloud Operator’s Risk Management Challenge

Organizations invest in cloud in pursuit of two benefits:

1. **Deliver new services and value faster**
   - grow top line

2. **Improve operational efficiency**
   - boost bottom line

…and those organizations seek to avoid **unacceptable downside consequences**, especially

- Impaired service reliability
- Impaired service latency
- Impaired service availability

**Risk Management** is “coordinated activities to direct and control an organization with regard to risk” meaning **activity to reduce the uncertainties of achieving desired upside benefits without unacceptable downside consequences**
Primary Cloud Operator Roles

**Cloud Service Customers (CSCs)** operate application services hosted on public or private clouds.

**Cloud Service Providers (CSPs)** own and operate the physical infrastructure equipment, etc, that serve the virtual resources, automated lifecycle management and functional components to CSCs.

Considering risks facing the cloud service customer organization
Expected Cloud Service Customer Benefits of Cloud Deployment

- **Deliver new services and value faster** to grow the top line, especially via:
  1. Enhanced Service Value Chains…rapidly leverage off-the-shelf service components
  2. Agile/DevOps and Accelerated Application Service Lifecycle

- **Improve operational efficiency** to grow the bottom line, especially via:
  1. Aggressive automation and self service
  2. DevOps and application lifecycle changes
  3. Perfect capacity management
  4. Transparency and continuous improvement
  5. Aggressive cost management
Cloud User Service Quality Risk Fishbone Diagram

**VNF Product Risks**
- Faulty VNF Configuration Specifications
- Defective VNF Lifecycle Management Scripts
- Residual Product Defect

**Virtualized Application Latency Risks**
- TAIL Application Latency
- TYPICAL Application Latency

**Virtual Machine Risks**
- VM Dead on Arrival
- VM Failure
- VM Stall
- VM Scheduling Latency
- VM Clock Error
- VM Placement Policy Violation

**Virtual Network Risks**
- Packet Loss
- Packet Delay
- Packet Jitter
- Network Delivered Throughput
- Network Outage
- VN Diversity Compliance Violation

**Virtual Storage Risks**
- Storage access latency
- Storage access reliability
- Volume capacity
- Volume outage
- Volume throughput

**Service Integration Risks**
- Wrong Element Used
- Integration Defect
- Element Operational Conditions Violated
- Faulty Service Delivery Architecture
- Faulty Service Control Architecture
- Faulty Service Workflow

**Visibility Risks**
- Obstructed Vision
- Poor Resolution
- Stale Vision
- Mirage

**Accountability Risks**
- Incomplete Accountability
- Conflicting Accountability
- Ambiguous Demarcation
- Ambiguous Service Level Objective
- Inadequate/Ambiguous Data

**Service Policy Risks**
- Insufficient Spare Capacity (Target)
- Faulty Resource Placement Policy
- Faulty Scaling Decision Criteria
- Inaccurate Demand Forecast
- Organization and Incentive Design
- (Human) Process Risks
- Human Error

**Lifecycle Management (Execution) Risks**
- VNF Lifecycle Management
- Network Service Lifecycle Mgmt
- Forwarding Graph Service Lifecycle Mgmt
- Virtual Link Service Lifecycle Mgmt

**Cloud Service Provider Catastrophe Risks**
- (Semi?) Permanent loss of cloud service
- (Semi?) Permanent loss of CSC data

**Unknown-Unknown Risks**
- Fundamental Disruption
- Emerging Technology
- Technical Debt
- Flawed Standards
- Faulty IaaS CapEx Reduction
- Faulty CSP OpEx Reduction

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Risk Identification and Analysis Techniques

Primary Risk Identification Techniques

- Influence Diagrams
- Cause and Effect Analysis
- Failure Mode Effect Analysis
- Structured Interviewing and Brainstorming
- Structured what-if technique (SWIFT)
- Fault Tree Analysis

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Risk Control Analysis Techniques

Primary Risk Control Analysis Techniques

- Layers of Protection Analysis
- Critical Control Point Analysis
- Event Tree Analysis
- Bow Tie Analysis
Risk Evaluation Techniques

Primary Risk Evaluation Techniques

- Failure Mode Effects and Criticality Analysis
- Dose-Response (Toxicity) Assessment
- Consequence/Probability matrix
- FN Curves
- Risk indices
- Decision tree
- Cost/benefit analysis

![Risk Evaluation Techniques Diagram](image)
Reconsidering Quality and Risk

**Canonical Risk Map**

**Hypothetical Dose-Response Chart**

*Super* acceptable service quality may be an opportunity to reduce resource allocation to increase operational efficiency and save money.
Quality and Risk-Based Thinking

- ISO 9001:2015 “Quality Management Systems - Requirements” Clause 0.3.3 – “To conform to the requirements of this International Standard, an organization needs to plan and implement actions to address risks and opportunities. Addressing both risks and opportunities establishes a basis for increasing the effectiveness of the quality management system, achieving improved results and preventing negative effects.”

Methodically identifying, analyzing, treating and monitoring uncertainties for desired benefits and undesirable consequences is a best practice for service, risk and quality management.