Institute of
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COMP41530 - Web Services in Cloud Computing

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Lecture 11

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Overview

- Review
- Cloud Computing Overview
- SoA and Cloud Computing
- Security and Cloud Computing

Overview

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What is Management of IT Systems?

- To manage effectively, we need to know:
  - What's happening now
  - How is that changing over time
- This allows us to:
  - Resolve problems
  - Improve Service
    - Automatic or manual intervention to fix problems or improve performance

Management of Legacy Systems

- Architecturally Simpler Systems
- Highly staffed / high skill levels
- Generally limited change in infrastructure
- More centralised
- Fewer components
- Generally easier to manage (less flexible)
- Single “view of the world” available
- Generally easier to investigate / resolve problems

Managing Distributed Systems

- Distributed Computing Systems
- Loose Coupling
- Heterogeneous Computing Systems
  - Implies different Development and Infrastructural teams
- Requires a different approach to Management

Distributed Management Systems

- Software systems that allow us to:
- Monitor
  - Capture and record stats. and events over time
- Track
  - Watch single "units of work" flow through the system
- Control
  - Change and manage the system while live

The Traditional Technical Overview

- Traditional Systems Management focused on infrastructure:
  - Networks
  - Processor Load
  - Disk Space
  - Events Logs
  - System Performance

The Business Systems Overview

- Now we need to focus on delivery of business functions to end users
- We need a composite view across many systems – the “Business” view
- We may also add "business performance" metrics.
- A combined "Management Dashboard" view
  - ...rather than a traditional IT Systems View

Management of SOA Environments

- Even more complicated than the Distributed Systems management problem
- Resources of System may be entirely outside our control
- No single console any more!
- No single system overview
- Huge number of points of possible failure
- No single "expert" who can trace problem
  - System is too complex and distributed

Enterprise Management Frameworks

- Software Systems
- Designed to manage complex IT Systems
- One or more "Management Servers"
- Trying to centralise and unify:
  - Reporting
  - Logging/recording/analysis
  - Alerting

EMS Data Collection and Reporting

- External and Agent based monitoring are commonly used together
- Data from two sources are merged to give a single view of the resource
- Data from multiple resources combined together to give:
  - “Infrastructural” view, e.g. all LAN components
  - “Business System” view, e.g. every resource required by the Call Centre

Standard Frameworks

- **S**imple **N**etwork **M**anagement **P**rotocol
- **C**ommon **I**nformation **M**odel

Typical Metrics for a WebService (1/2)

- Number of requests received
  - ...number of successes
  - ...number of failures
- Performance
  - Avg processing time
  - Max processing time
  - Min processing time
- …and compound views of these

WebService Service Degradation

- We also care about the relationships between these metrics
- What happens to the system under load?
  - Nothing?
  - Gradual slow down?
  - Sudden tipping point?
  - Crash?

Management of WebServices

- So, we need to monitor all of:
  - User Experience
  - Infrastructure Monitoring
  - Resource Provisioning
  - Transaction Monitoring
  - SLA Monitoring:
- From these we need to:
  - Record (and allow analysis)
  - Alert (on exception)
  - Fix (manual or automatic?)

Active Management of WebServices

- We need to be able to:
  - Bring them up or down
  - Balance the load between multiple providers
  - Launch, Deprecate, Upgrade versions of a service
- ...all non-disruptively
- Middleware can help:
  - Virtual addressing
  - Load Balancing
  - Failover
  - Best monitoring point?

Key points (1/2)

- Management is about:
  - Monitoring
  - Tracking
  - Controlling
- You can do SOA without Management
  - …but you'll miss a lot of the value.
- You can do WebServices without Management
  - …but it gets very complicated very fast!

Key points (2/2)

- Don't build your own Management framework/infrastructure
  - Buy in one of the many systems already available
  - …or at least stick to one of the standards.
- Consider the overall Management strategy at the "Plan" phase of SOA
  - Easy to build in from the start
  - Hard to retro-fit later

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What is Cloud Computing?

- No real consensus yet
- Sometimes just a marketing buzzword
- Often overlaps with virtualisation.
  - ...often confused with virtualisation!

Main Agreed Features

- Delivery of computing resources from a shared pool
- Virtualised Resources
- Some or all of: Networks, servers, storage, middleware and applications
- Rapid provisioning
- Easily managed

It's been around a long time!

- Shared computing resources are nothing new
  - Look at legacy systems
    - Mainframes in particular
    - "Open Systems" world is only now catching up
  - Hosted websites
  - Hosted email servers
- ...nothing new here!

Typical Characteristics of Cloud Computing

- On demand provision
- Network based access
- Geographically independent
- Quick to scale up and down
- Metered use of resources
  - ...often "Pay as you go" model

Basic Delivery Models: IaaS

- Infrastructure as a Service
- Virtualised:
  - Servers
  - Storage
  - Networking
  - …and other resources
- Build your own systems on top of these

Basic Delivery Models: PaaS

- Platform as a Service
- Providing the "middle tier“ of software:
  - Operating Systems
  - Databases
  - Runtime environments
  - Middleware
  - Utility Services
    - Mail Servers, Mail Filtering, Backups etc.
- Build your environment on top of these
- Available with more-or-less management provided by vendor

Basic Delivery Models: SaaS

- Software as a Service
- "End User" Applications
  - Mail Clients
  - Virtual Desktops
  - “Office” Applications
  - Accounting, Payroll, CRM applications
- Put your data into their systems.
- Available with more-or-less management from vendor

Cloud Deployment Models

- Public Cloud
  - Best scaling, availability etc.
- Private Cloud
  - This can be very close to plain virtualisation
- Hybrid Cloud
  - Bit of both

Specific problems in the Hybrid Cloud

- All the complexity of internal systems
- Plus complexity of running own "cloud"
- Plus all the concerns of using Public cloud

Types of Virtualisation: Network

- Building Virtual Private Networks
- Many independent networks running over shared links
- Loads up links as high as possible
  - Can be more cost effective
- Take care of privacy/security etc once at a network level
- Applications can then assume links are secure

Types of Virtualisation: Server

- Partitioning physical servers
- Multiple "guest" servers running on one physical server
- Guest may not be aware that it is virtual!
- Run fewer servers, but run them harder
- Better Return on Investment
  - "Sweating the asset"
- Excellent manageability

Types of Virtualisation: Server Clustering

- A single virtual service
- Running on multiple physical servers simultaneously
- Resilience and Failover
- Must provide load balancing
- Must build applications to deal with failure of one or more cluster members
  - ...can be much harder than to deal with a single system crash

Types of Virtualisation: Storage

- Large pools of storage
- Shared out to multiple systems
- Storage Area Networks (SANs) are required
- Requires very high bandwidth links.
  - Network latency may become important
- Can be very resilient storage
  - ...but have added additional LAN/WAN risks

Types of Virtualisation: Application Virtualisation

- The application is running across many virtualised resources
- Can be presented to the user as running "on" their device
  - ...but is actually running elsewhere
  - Thin Client devices
  - Virtualised desktops
- Portability and resilience

System Virtualisation and Management

- Management becomes even more important in a Cloud Based environment
  - More possible points of failure
  - Even harder to trace and resolve problems
  - More providers and vendors involved
  - Less control!
- Must "build in" cloud support when designing systems

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What the Cloud offers for SOA

- SOA Services are generally available for use by third parties
  - Internal or external customers
  - Often, volume of use can't be predicted in advance
  - Website crashes under load
- Cloud Computing offers a solution
  - Rapid deployment/scaling
- Cloud Computing and SOA can be complementary

SoA must be designed for the Cloud

- The Architecture must be designed with the Cloud in mind.
- Assume:
  - Clustering
  - ...and occasional cluster member failure!
  - Platform independence
  - Location independence

SLAs and the Cloud

- An SLA has been provided to service consumers
- Service cannot be delivered without Cloud resources
- Now dependent on SLA of Cloud provider
- If using Public/Hybrid cloud, essential parts of service provision are beyond your control
  - Public cloud providers SLAs' are generally bulletproof

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Cloud Security: Risks

- Most security risks are increased in a cloud environment
- Broad Risk Categories:
  - Data Isolation Failure
  - Data Protection Failure
  - Lack of Governance
  - Compliance Problems
  - Additional externally exposed interfaces and APIs
  - Loss of control of resources
  - Malicious Individuals

Cloud Security: IaaS Countermeasures

- Minimise functionality of VM
- Harden image before deployment
- Secure inter-resource communication
- Use application keys and federated identities
- Periodically destroy/recreate resources

Cloud Security: PaaS Countermeasures

- "Data at rest" should be encrypted
- Harden application
- Reduce attackable surface of application
- Assume all communications are insecure

Cloud Security: SaaS Countermeasures

- Audit in advance of use
- Where possible, encrypt or reduce data before placing in the cloud
- Use vendors with a good reputation
- Ummm…

API Standard Initiatives

- Significant risks of becoming bound to a single cloud vendor
  - APIs, VM Image formats etc. are not generally standardised between vendors
  - "Open Stack" initiative is heading that way...

Potential Benefits of Cloud Computing

- Cost Reduction/Avoidance/Delay
  - Accounting structures may negate some of that for established companies
- Spend time building business functions, not Servers/Networks etc.
- Dynamic scaling to load
- Fast provisioning of systems to meet new needs

Potential Risks of Cloud Computing

- Cloud service outages
- Communication service outages
- Vendor lock-in
- Lack of compatibility of existing applications
  - "Just do it" approach to moving to cloud – it's not always that simple.
- IT policy concerns
- Security, Legal and Compliance risk
- Pay-as-you-go and bandwidth costs can be unpredictable

SoA can address some of these risks

- Both SoA and Cloud focus on service availability, continuity etc
- Good SoA will ensure platform independence
  - Focus on interfaces of services, not internals
- Modular services and design fit well into Cloud environment
  - Put relevant and suitable parts of the system into the cloud
- Cloud is one of the tools you can use as part of your SoA

Key points

- SoA and Cloud Computing are compatible and complementary
- Management and Governance are key to both
- Architecture, Design and Applications need to be written with the Cloud in mind
- There are more risks in Cloud computing than in conventional computing
  - Particularly if using Public Cloud resources

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