

University

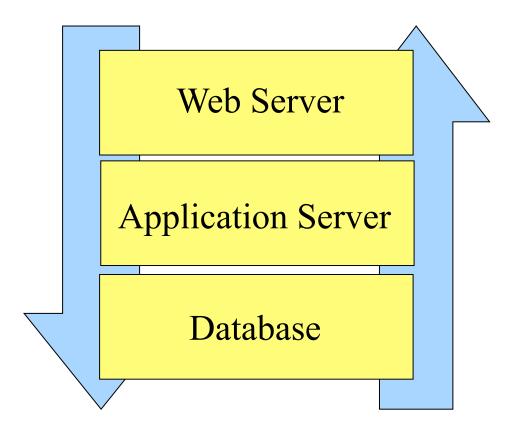
of Victoria

Overcast: Eclipsing High Profile Open Source Initiatives ...seeding the clouds?

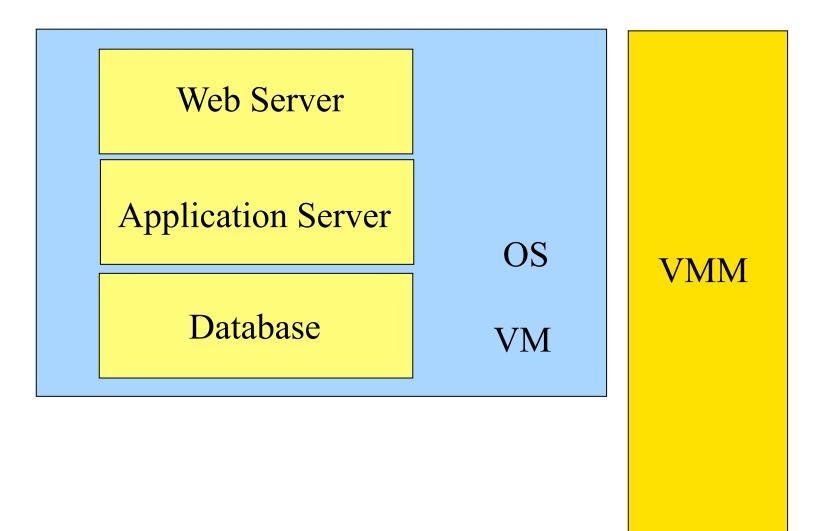
Chris Matthews, Stephen Neville, **Yvonne Coady**, Jeff McAffer and Ian Bull

Classic

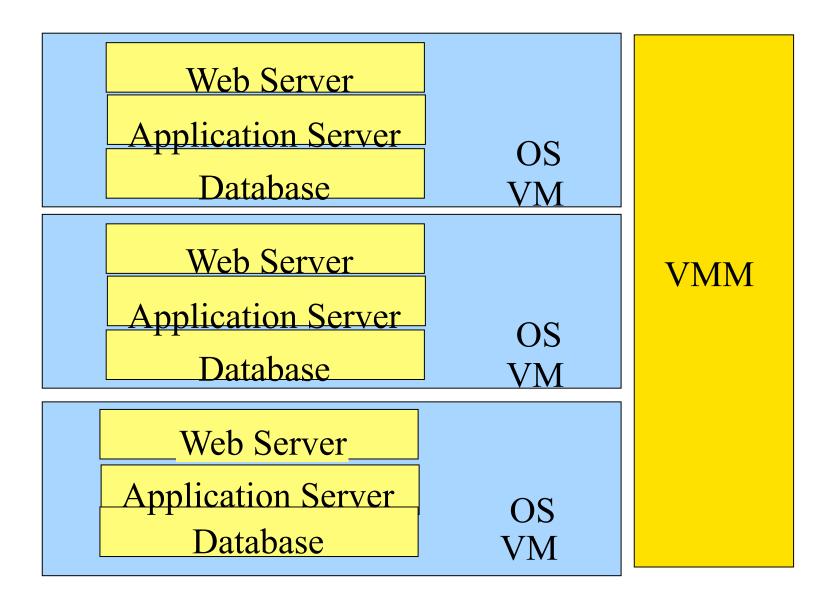
a simple web services stack...





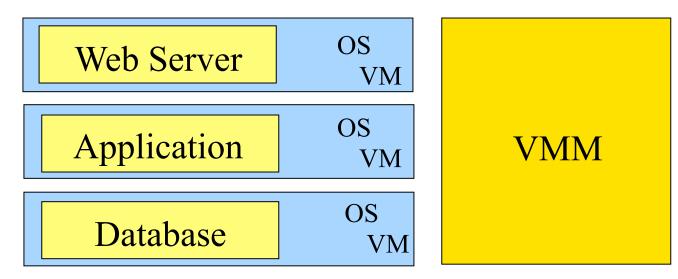






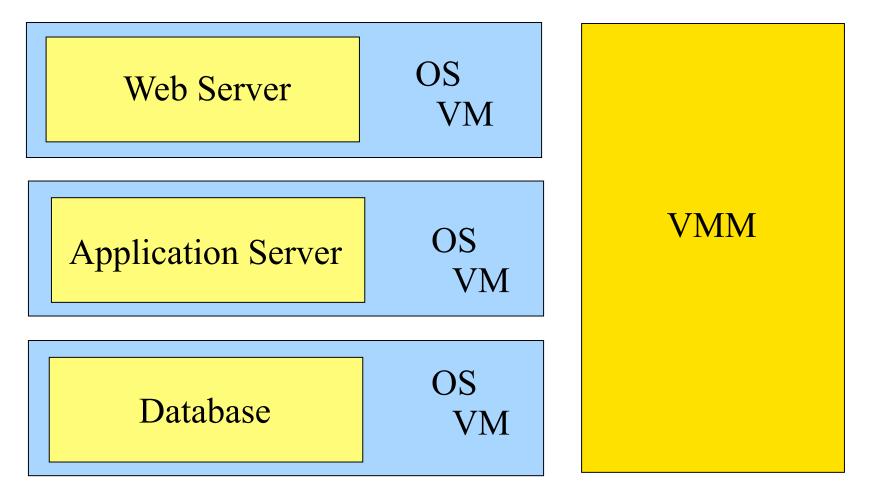
How Virtualization helps

- Functionality and Utilization
 - heterogeneity, hardware
- Security and Privacy
 - assertions, "black box"
- Reliability and Robustness
 - isolation, snap shoting
- Decomposition
 - migration, conceptual model



Decomposition

... More of a good thing? Further decompose into domains?



Road Map

- Today's virtual appliances and the cloud
 - Easybake appliances!
- Proposed approach
 - why is Chris trapped in a basement in BC?
- Tools that might help
 - CloudClipse = OSGi + P2 + Virtualization
 - Overcast
- How we can build better software for the cloud?
 - Software engineering challenge



Virtual Appliances

- Services prebuilt into VM images
- Building monolithic VM images is easy

Convenient interfaces for constructing!



- Amazon's AMI
- rBuilder from rPath
- OpenQRM

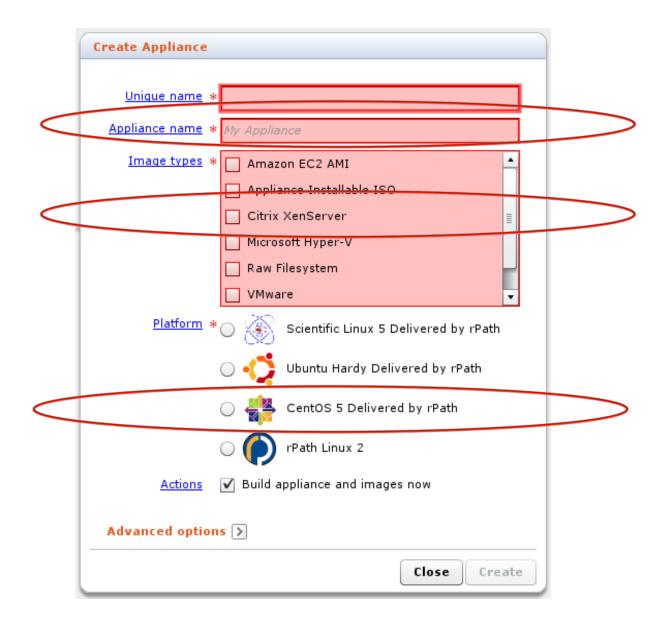
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rPath Management Console

Resources	Appliances Brief Detailed
Appliances Ready-to-deploy applications	Amiga 100 Software Platform
Platforms Foundations for appliances Repositories Packages for a variety of uses	Another Custom Linux Just having a play to check this thing out at this stage
	Operation Apache Appliance A small Linux build designed only to support httpd. The image contains the minimal group-core from rPath Linux and an Apache web server (httpd) that s
	It also include openssh client and server, vim and slocate for convenience. Selection Asterisk 2 Billing Live CD
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Create an Appliance from your Application

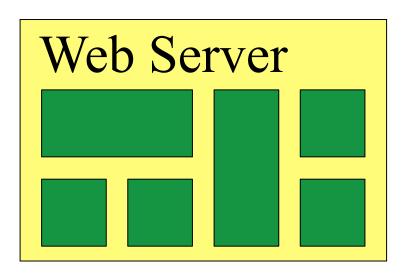


"Plugins" in OpenQRM

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J Iscsi-Storage Junux-VServer J Local-server J Local-Storage J Local-Storage J Local-Storage	4	dhqpd	network	The dhcpd-plugin automatically manages your ip-address assignment and network-boot environemnt for the rapid- deployment features of openQRM.	۲	0		
🖻 💭 Nagios2	0			The high availability olugin	~	1.00		
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e 📁 Higa e 💭 VMware-server e 💭 Xen				directly from the Isosi-Target.				

Proposed Approach

What if we tried to further decompose the system?



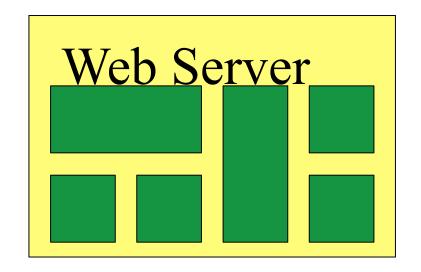
- Virtual Co-processors
 - firewall
 - encryption
 - random number generator
 - TPMs
- Services
 - logging
 - time stamp
 - inspection monitor

Principles for decomposition...

C⁴: The Cs system decompositon

Componentization Composition Communication Control

To enable fine-grained components in a system.



Componentization

Disaggregate the elements of the system into components

- Modern day modularity?
- What will change in the system?

These components benefit from the properties of virtualization

 Must trade off with the intrinsic costs How big are they? How are they packaged?

Composition

- Ideally we want dynamic programmatic composition of domains
- We need mechanisms for

referencing other components exploring component's metadata and interfaces creating, updating, distributing them destroying them customization

...BUT who does the composition? ...AND how is the composition done?

Communication

Communication should be as easy as IPC or a function call

 The system needs to provide some plumbing between domains naming and registration interfaces to describe services and communication defined communication semantics security services

Need secure, reliable, cross domain communication that is easy to use

what are the communication semantics?

Control

- The system should be able to define policies and enforce them with mechanisms
 - controlling life-cycle
 - monitoring resource usage

what mechanisms are needed to correctly control a component?where are these mechanisms controlled from?where are the policies of a component defined?

So Why is Chris Locked in a Basement?

- As the decomposition becomes more fine-grained the attendant costs of the decomposition increase in two ways
 - Scalability
 - Sustainability
- High burden of composition
 - on the system resources...
 - on the programmer...

Leveraging Existing Technology: OSGi

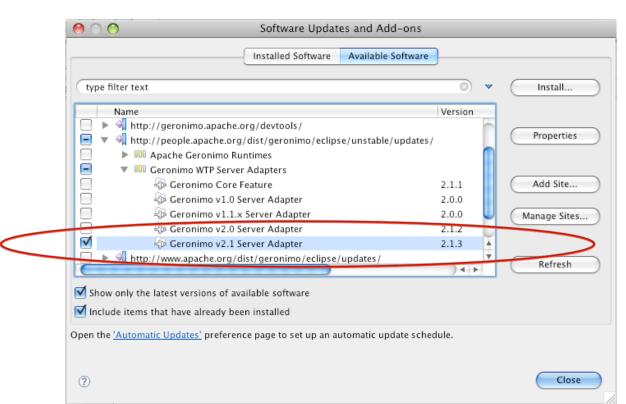
- Popular Java component model
- Provides services, naming, versioning and lifecycle management
- Dynamic service model maps to distributed systems (R-OSGi)
- Eclipse Foundation provides reference implementation named Equinox
- Equinox powers the Eclipse IDE



OSGI Framework

P2: a provisioning platform

- A provisioning system for OSGi applications
- In some ways similar to a package management system
- Used in the Eclipse IDE update mechanism



CloudClipse

- Google Summer of Code
 - Eclipse plugin
- Combines the power of P2 and OSGi with virtualization
- Extends the P2 engine with the tools to build VM images

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CloudClipse

- CloudClipse extends the P2 installer to:
 - Mount images
 - Install RPMs
 - Copy new files in
 - Run commands in the image with chroot
 - Compact images

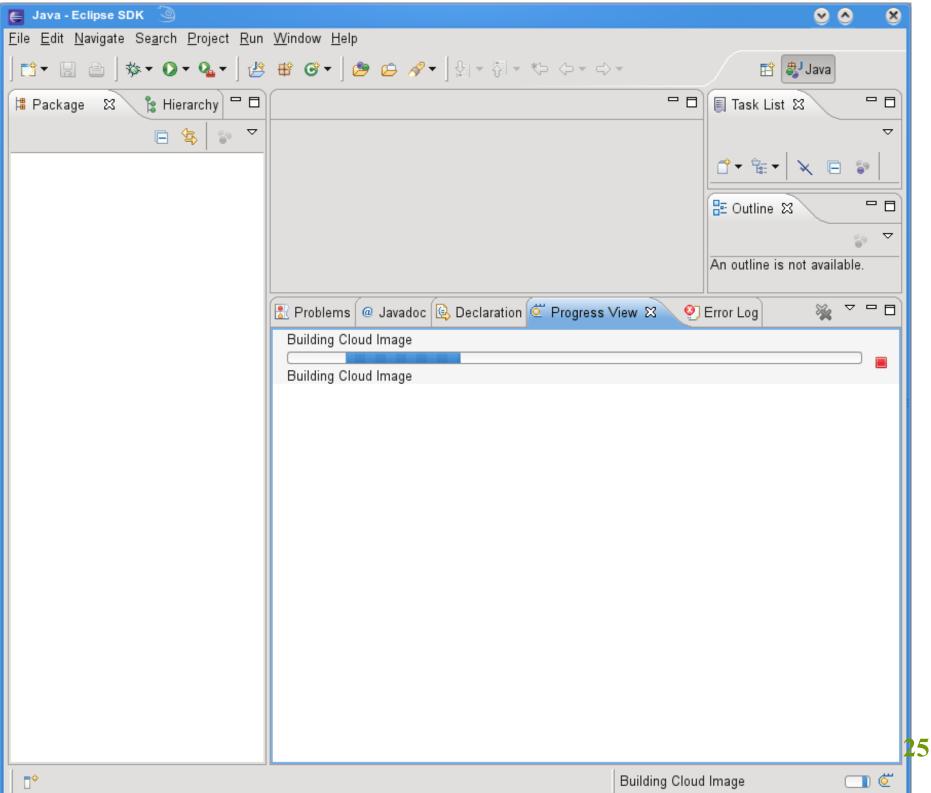
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CloudClipse

Basic Operation:

- P2 finds and downloads a base image (to save time)
- Image is mounted
- RPMs are installed
- Config files are setup
- Passwords are set, ssh keys are installed
- Your application is installed

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Overcast: The Vision!

- Boot strapping!
- Create an image with P2 within it
- Dynamically construct the rest of the software

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YES WE CAN Leverage Current Component Systems... we think!

- OSGi provides an interesting component model for MacroComponents and more generally Cloud Service Compositions
- R-OSGi shows dynamic services could work as distributed services
- Preexisting tool support for OSGi

 Still lacking Communication and Control systems



This could allow us to build and deploy better software for the cloud!

Summary and Conclusions

- Want to tap into the software engineering benefits of components
 - strongly isolated
 - redundancy is easily inserted into the system
 - hot standbys are cheaper
- Overall a more robust secure and scalable software system of heterogeneous components
- Breaks the dependence on large software stacks
- Match conceptual models!

- Challenges:
 - Adoption
 - Privacy
 - Overheads

Chris: one day he'll have a REAL Parrot!





Questions

www.christophermatthews.ca