

Virtual Environments: Easy Modeling of Interdependent Virtual Appliances in the Cloud

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The Problem

- Realizing groups of interdependent virtual machines (VMs) in the cloud is a common task in today's Internet.
 - This require a good understanding of:
 - Software installation for each piece of the stack
 - Network details such as IP addresses, ports, etc.
 - They are typically deployed in a cloud layer called Infrastructure as a Service (IaaS).
 - Each IaaS provider has different APIs!

The Problem (Cont)

- Research has pointed the need for better tools for composition in the cloud [1].
 - Clearly, an easier to understand model can help non-experts in cloud computing to develop solutions in this domain.

Motivation

- We envision that different IaaS APIs and providers will continue to proliferate.
- Non-expert users such as Web developers and CS students should not be bothered by the configuration details!
- We have identified specific concepts which could use better abstractions.

Proposed Solution

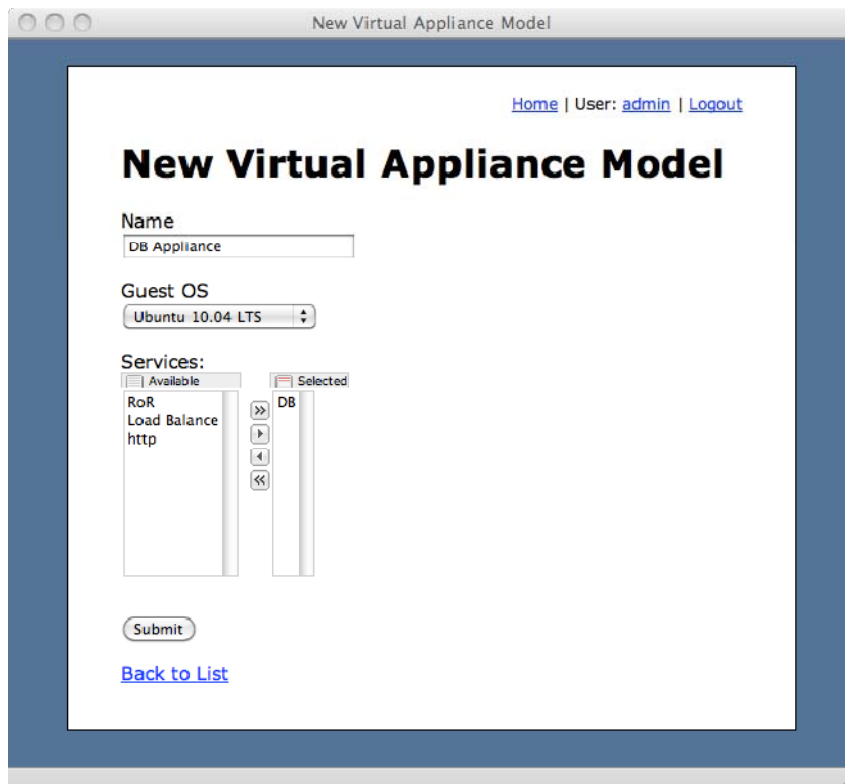
- We propose a modeling approach that is abstract enough to allow these interdependent VMs systems to be seen as “appliances providing specific services”.
 - An appliance is a VM with well defined services [2].
- This abstraction allows solutions to be:
 - **easily designed**
 - **fast to deploy**
 - **unaffected by IaaS vendor lock-in**

Proposed Solution (Cont)

- We call these models *Virtual Environments*.
 - A *Virtual Environment* is a model of a group of interdependent virtual appliances that specifies certain constraints on the exposed services of each appliance.
- We have developed a prototype visual designer for easy composition of these environments.

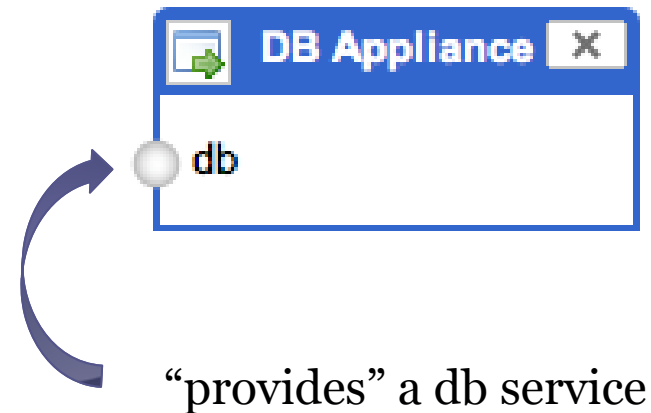
The Flexible Tool: Defining VAs

Defining an Appliance:



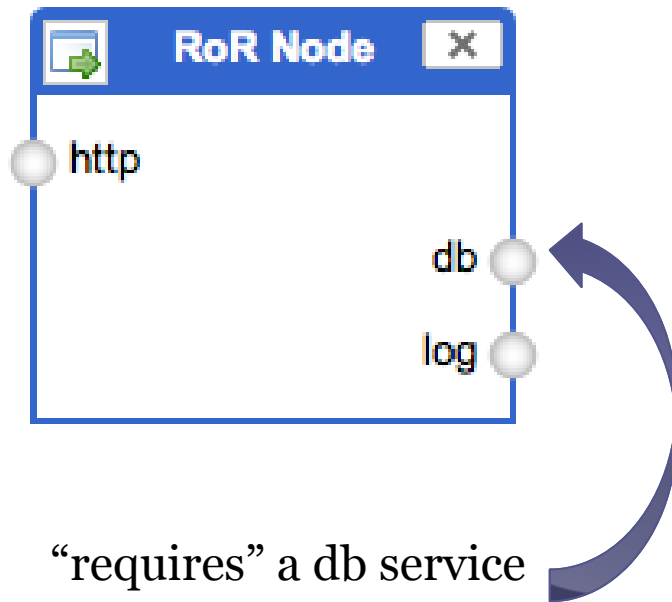
The screenshot shows a web browser window titled "New Virtual Appliance Model". At the top right, there are links for "Home", "User: admin", and "Logout". The main heading is "New Virtual Appliance Model". Below this, there are several form fields: "Name" with the value "DB Appliance", "Guest OS" with a dropdown menu set to "Ubuntu 10.04 LTS", and "Services:". The "Services:" section has two columns: "Available" and "Selected". In the "Available" column, there are three items: "RoR", "Load Balance", and "http". In the "Selected" column, there is one item: "DB". At the bottom of the form, there is a "Submit" button and a "Back to List" link.

Once defined, it looks like this:



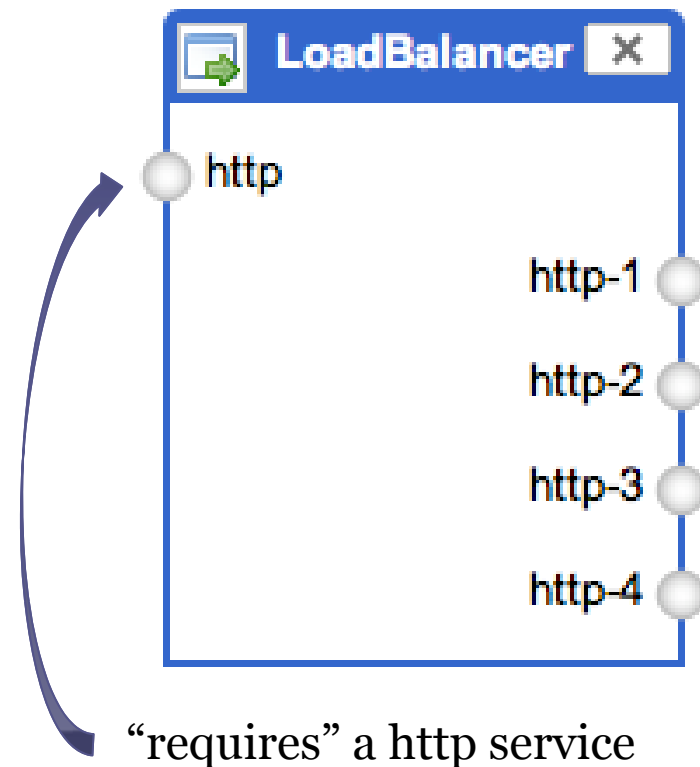
The Flexible Tool: More VA examples

Example of an Ruby on Rails Appliance



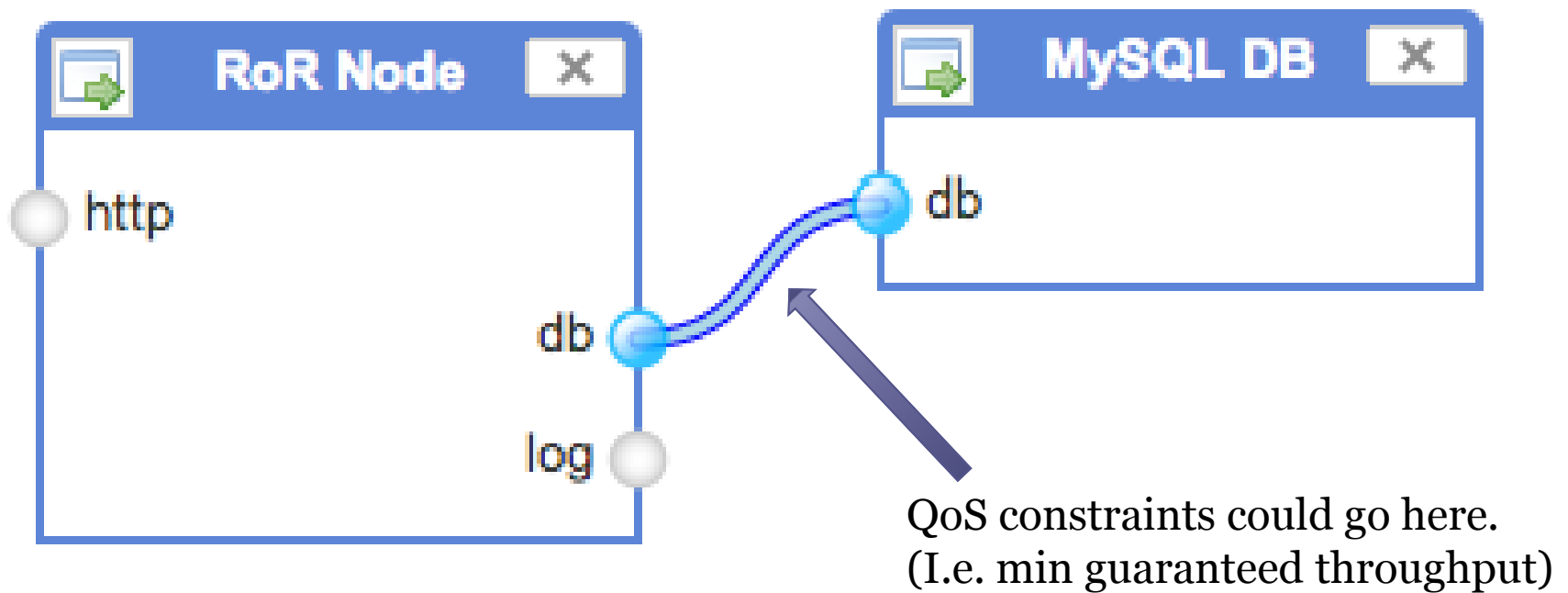
“requires” a db service

Example of a Load Balancer Appliance

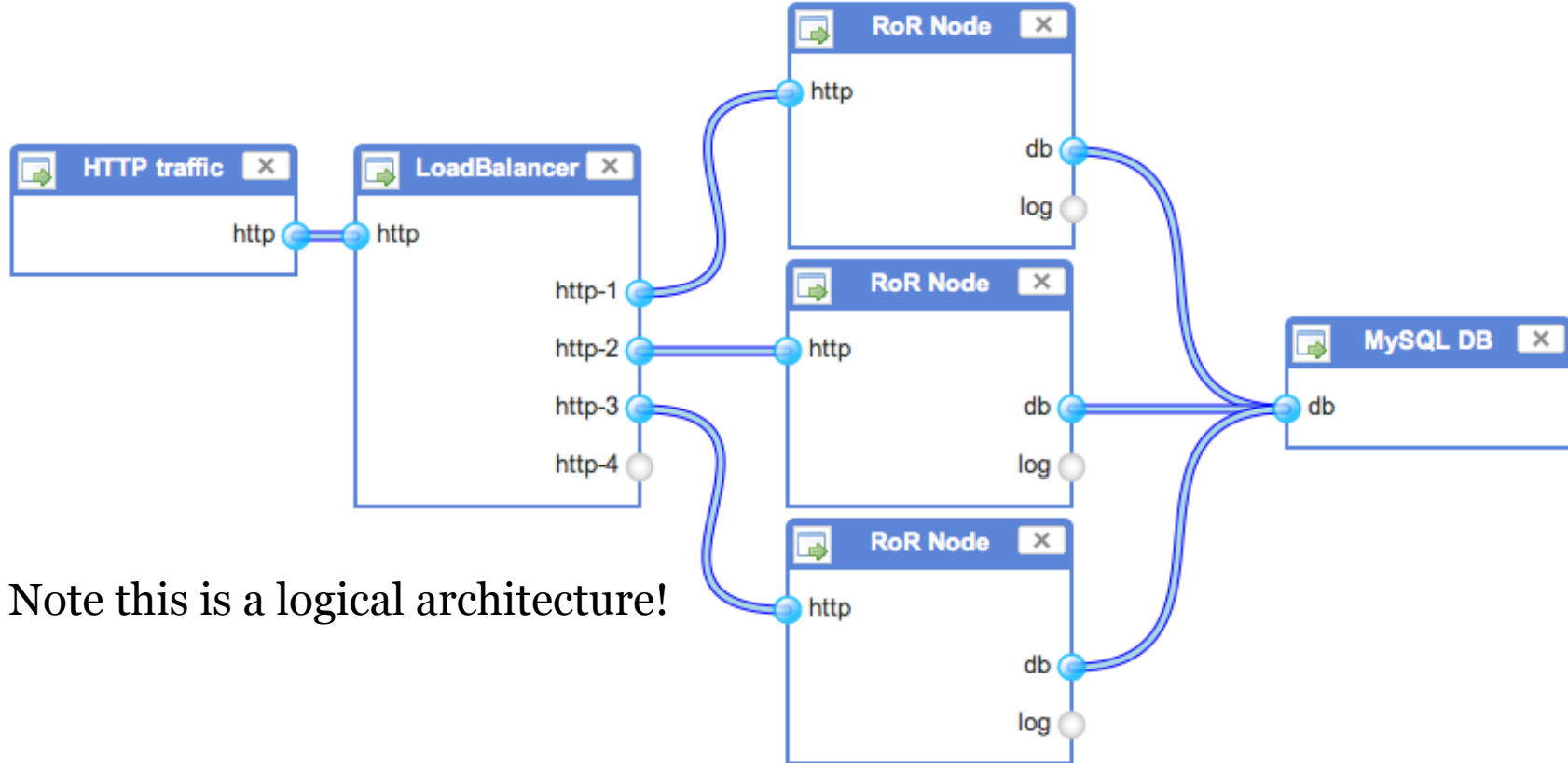


“requires” a http service

The Flexible Tool: endpoint connection example

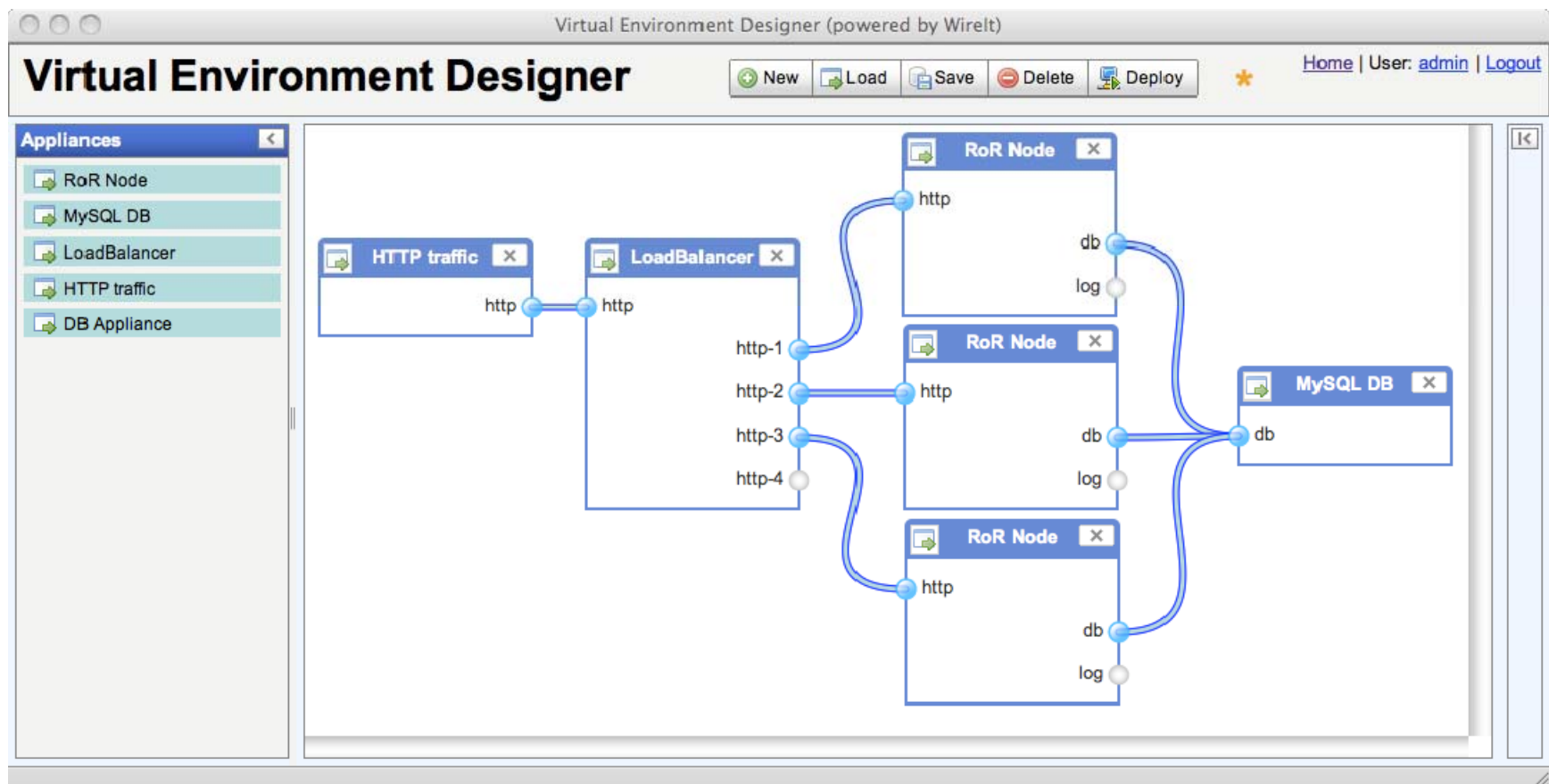


The Flexible Tool: A fully defined VE

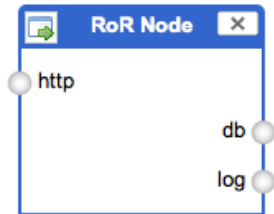


Note this is a logical architecture!

The Flexible Tool: Visual Environment



Transforming the model



```
<Appliance rev="1">  
  <name>RoR Node</name>  
  <guestOS ver="10.04">Ubuntu</guestOS>  
  <dependencies>  
    <dep ver="2.2.16">Apache HTTPD</dep>  
    <dep ver="2.3.8">Ruby on Rails</dep>  
    <dep ver="1.2.3">...etc...</dep>  
  </dependencies>  
</Appliance>
```



QoS-Aware IaaS Cloud
(work being done in our lab)

Most Relevant Related Work

- IaaS providers, such as Amazon Web Services [3] or GoGrid [4], provide raw virtualized computing power.
 - All the configuration needs to be done by the user.
 - We leverage this work by building another layer of abstraction on top of it.
- Platform as a Service (PaaS) providers, such as Google AppEngine [5], abstract away the underpinnings of a fully working web application.
 - Catch: Vendor lock-in.
 - Our approach will provide a fully working IaaS environment, but no app logic.

Most Relevant Related Work

- Commercial applications implementing a similar modeling approach are available [6, 7].
 - They only work on their proprietary cloud platforms.
- IBM has worked on a similar project [8].
 - Their implementation assumes that users are experts.
 - While they target enterprise customers, we target non-expert cloud users.

Concluding Remarks and Future Work

- In this paper, we presented the basics of our modeling ideas focusing on what matters to a non-expert end user.
 - A detailed view of the underpinnings is future work.
- We envision fast deployment of working systems through an automatic configuration process.
- For future work
 - Short term: fully working virtual environments.
 - Long term: providing various IaaS deployment choices.

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Questions?

Thanks so much for your time!