BOINC Virtual Machine Controller Infrastructure

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CERN, Switzerland

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Index

Introduction

What?

Why?

Development (ie, How?)

Going For It

Conclusions

1 Introduction
- What?
- Why?

2 Development (ie, How?)
- Our Proposed Solution
- Getting Technical

3 Going For It

4 Conclusions

Index

Introduction
What?
Why?
Development (ie, How?)
Going For It
Conclusions

1 Introduction
- What?
- Why?

2 Development (ie, How?)
- Our Proposed Solution
- Getting Technical

3 Going For It

4 Conclusions

What?

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction
What?
Why?

Development (ie, How?)

Going For It

Conclusions

... are we looking for

A means to *interact* with the system running inside a VM instance.

With *code*, not a human, as the "user" behind this interaction (namely, the BOINC wrapper).

What?

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction
What?
Why?

Development (ie, How?)

Going For It

Conclusions

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Index

Introduction
What?
Why?
Development (ie, How?)
Going For It
Conclusions

1 Introduction
- What?
- Why?

2 Development (ie, How?)
- Our Proposed Solution
- Getting Technical

3 Going For It

4 Conclusions

Why?

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction
What?
Why?

Development (ie, How?)

Going For It

Conclusions

For one...

The porting or adapting an application isn't always affordable. Or even *possible*.

Why?

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction
What?
Why?

Development (ie, How?)

Going For It

Conclusions

But not only:

Pros

- Ultimate control over the computation environment.
- Isolation.
- Flexible resource allocation.

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BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction
What?
Why?

Development (ie, How?)

Going For It

Conclusions

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Pros

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- Isolation.
- Flexible resource allocation.

Why?

On the other hand:

Cons

- Need for a ”bigger” machine (esp. RAM + HD).
- Performance penalty ($\approx 3\% - 7\%$).

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Index

1 Introduction
- What?
- Why?

2 Development (ie, How?)
- Our Proposed Solution
- Getting Technical

3 Going For It

4 Conclusions

Requirements

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

Cool stuff, I'm all in! What do we need?

To be able to...

- Start / stop the VM.
- Pause / unpause the VM.
- Snapshots (checkpoints).
- VM creation.
- File transfer to/from the VM.
- Arbitrary command execution on the VM.

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BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

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Requirements

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

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BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

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BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

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BOINC Virtual Machine Controller Infrastructure
David García Quintas
Introduction
Development (ie, How?)
Our Proposed Solution
Getting Technical
Going For It
Conclusions

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Index

1 Introduction
- What?
- Why?

2 Development (ie, How?)
- Our Proposed Solution
- Getting Technical

3 Going For It

4 Conclusions

Technologies

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

Three technologies to help us reach our goals:

- Python.
- Twisted Framework.
- STOMP Protocol (`http://stomp.codehaus.org/Protocol`).
- Chirp Protocol (`http://www.cse.nd.edu/~ccl/software/chirp/`).

Technologies

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

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Technologies

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

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Technologies

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

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Technologies

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

What we get from these choices:

- Multiplatform (tested on Windows, Linux and OS X).
- Powerful event-driven network framework.
- Simple yet flexible message passing protocol.

Technologies

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

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Technologies

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

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Wait a minute...

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

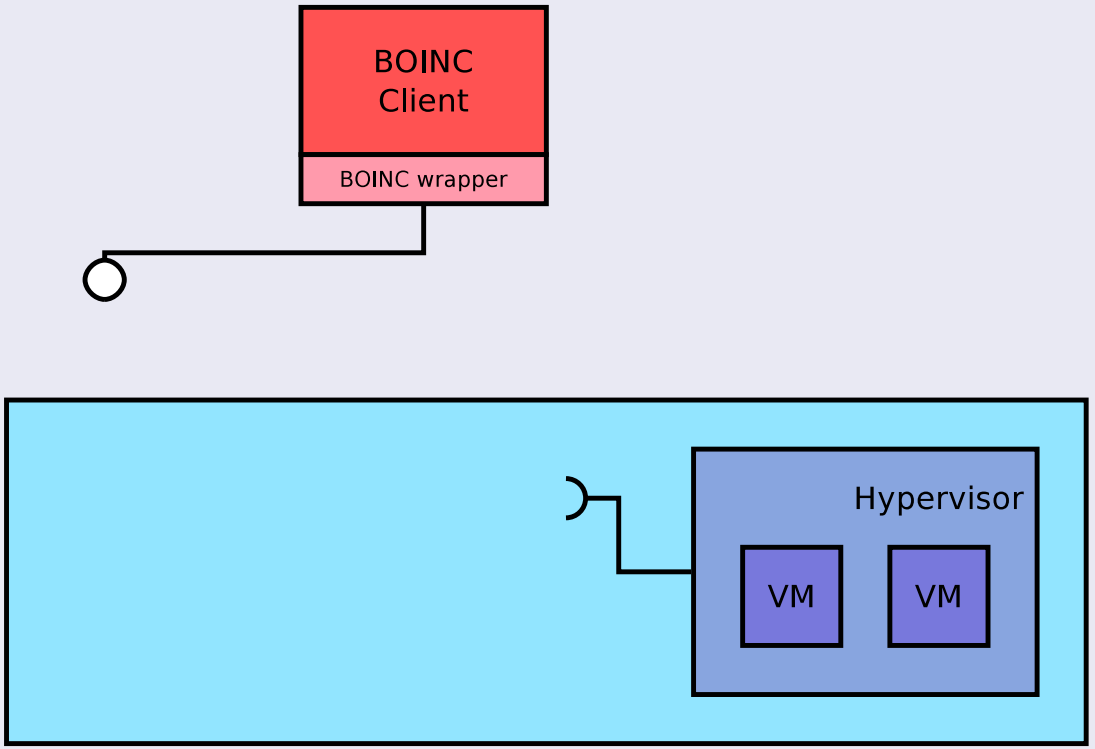
Going For It

Conclusions

How does all this fit into BOINC?

The Overall Picture

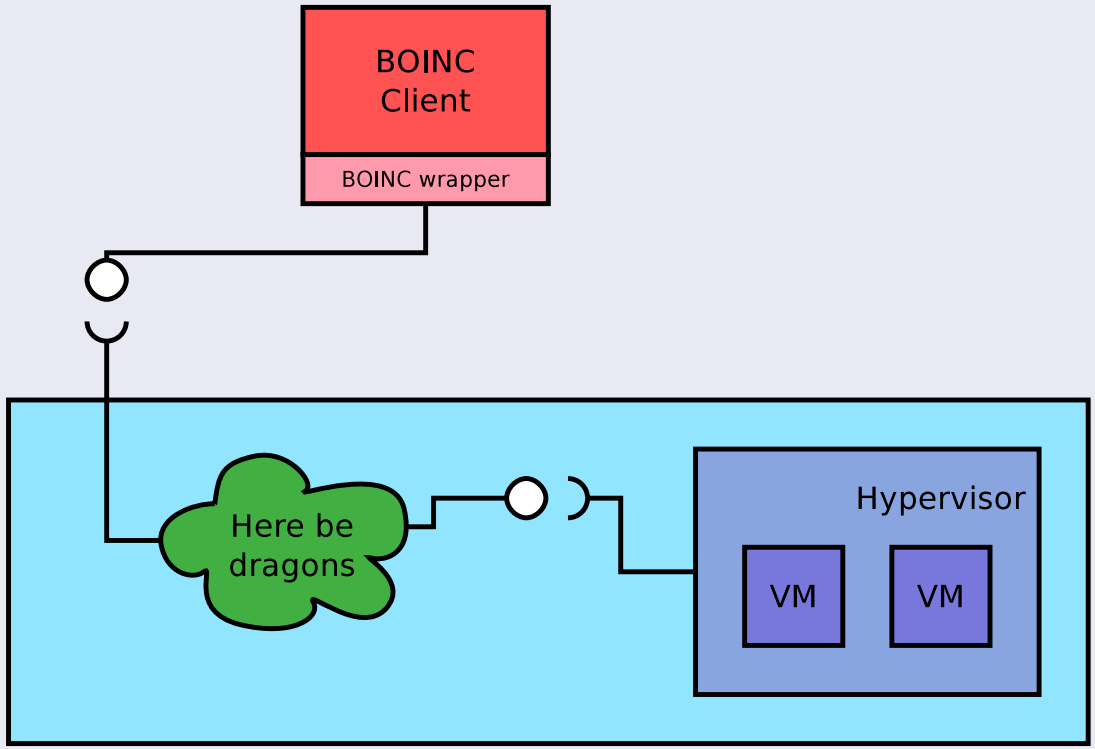
Where Do We Fit?



- BOINC (wrapper) exports an API.
- The Hypervisor exports an API.

The Overall Picture

Where Do We Fit?

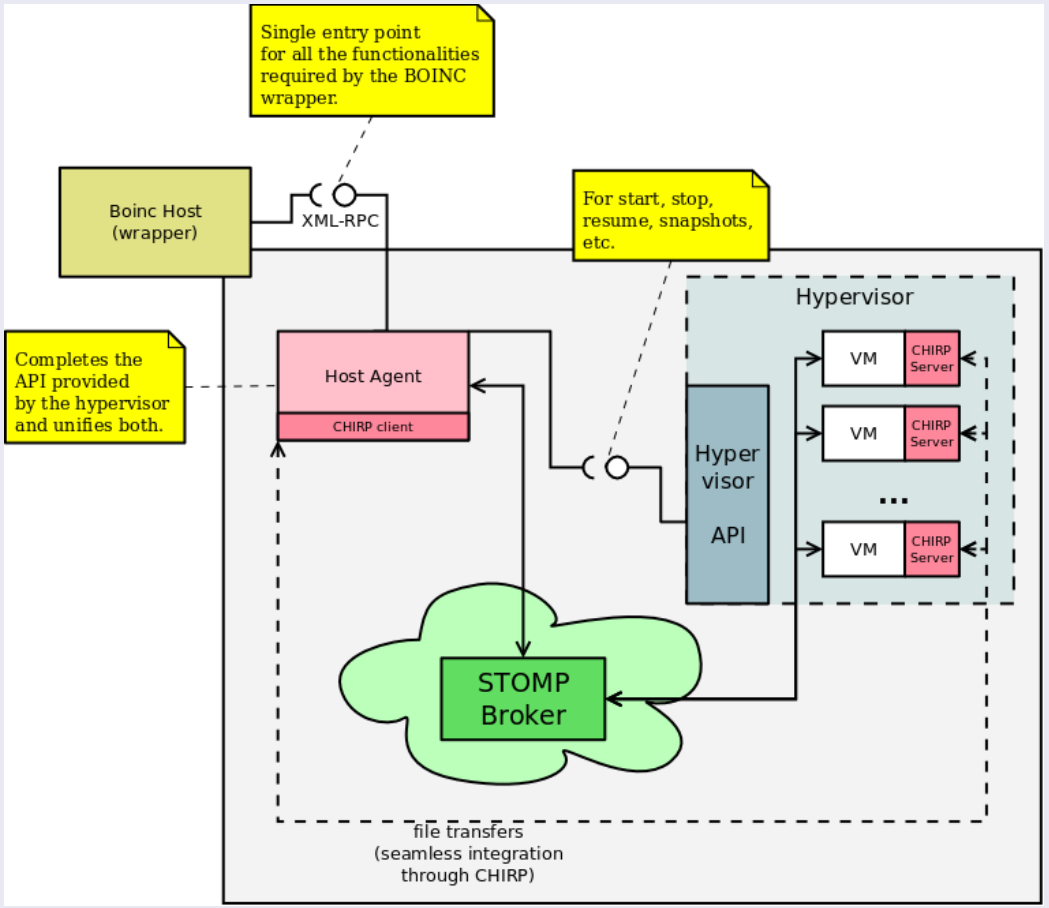


All that's left to do is to interface both APIs, providing them with what they need from each other.

In Detail

And this is how this interfacing is realized:

Architecture



What we get out of all this

Main advantages of doing things this way:

- A highly decoupled system (could be “clouded”).
- Easily extensible.
- Multiplatform.
- Scalable (basically, as much as the broker).
- Hypervisor agnostic.

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Let's Get Technical

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Our Proposed Solution

Getting Technical

Going For It

Conclusions

Enough with the marketing!

Index

1 Introduction
- What?
- Why?

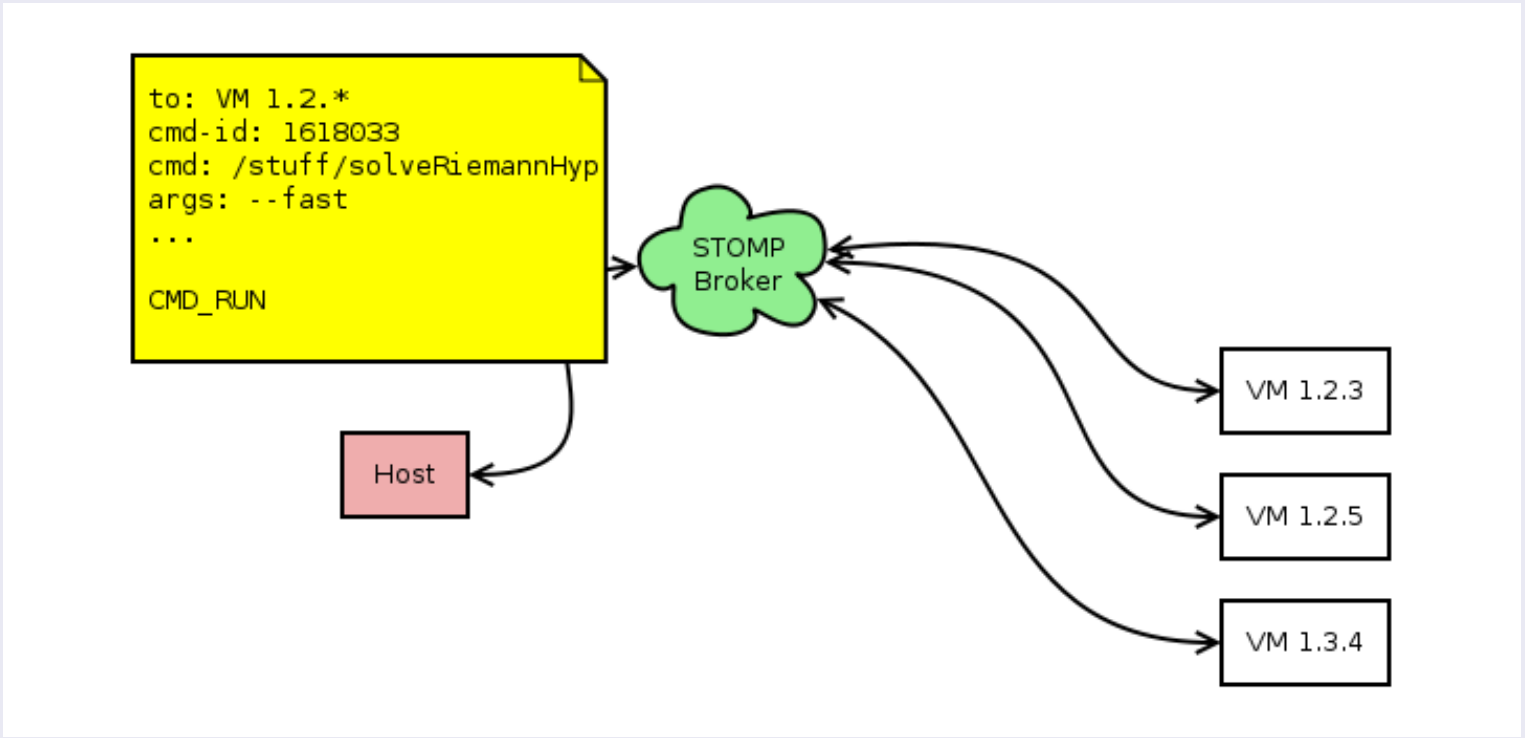
2 Development (ie, How?)
- Our Proposed Solution
- Getting Technical

3 Going For It

4 Conclusions

A Simple Example

A Simple Example



Host (VM Controller) requests to *some* of the VMs the execution of a command.

A Simple Example

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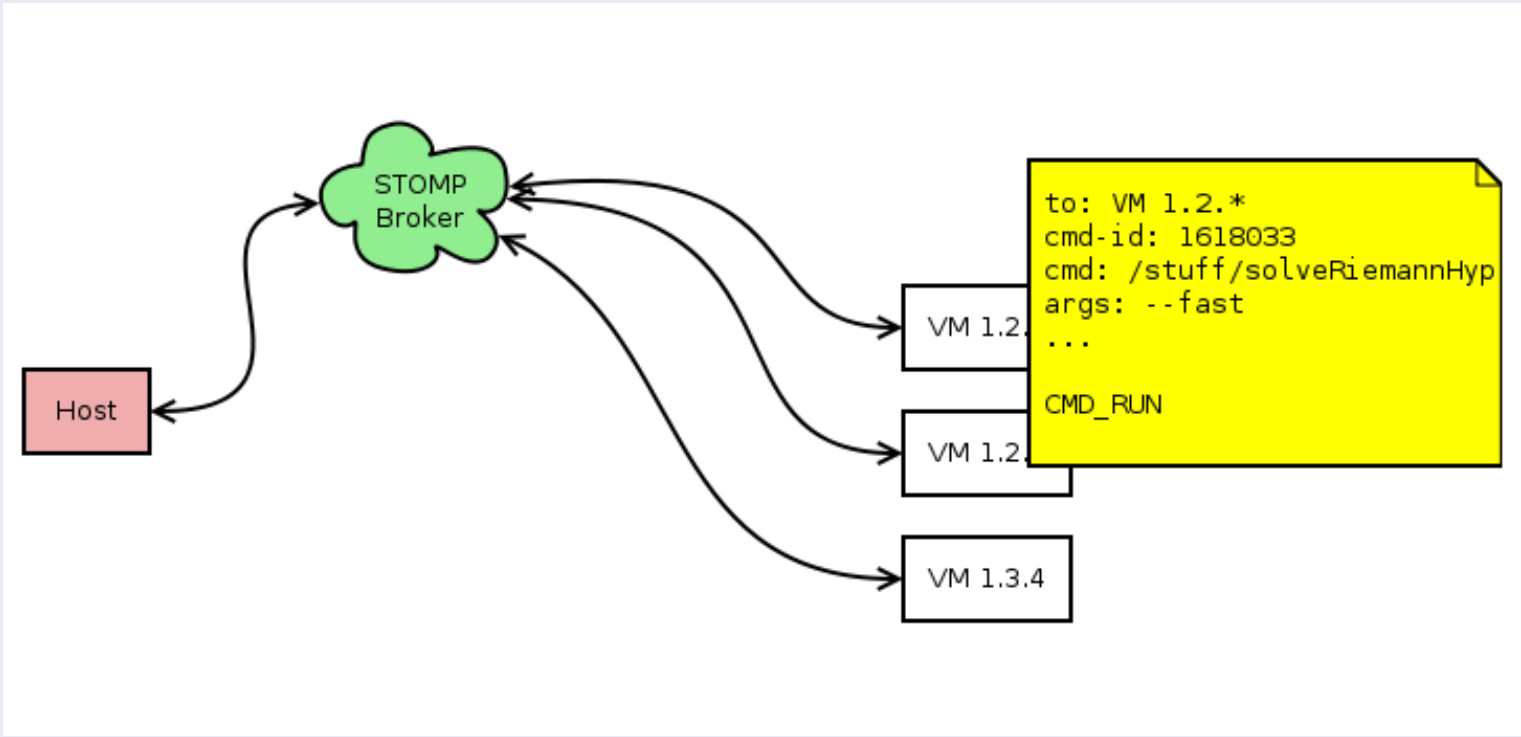

The addressed VMs process the incoming msg.

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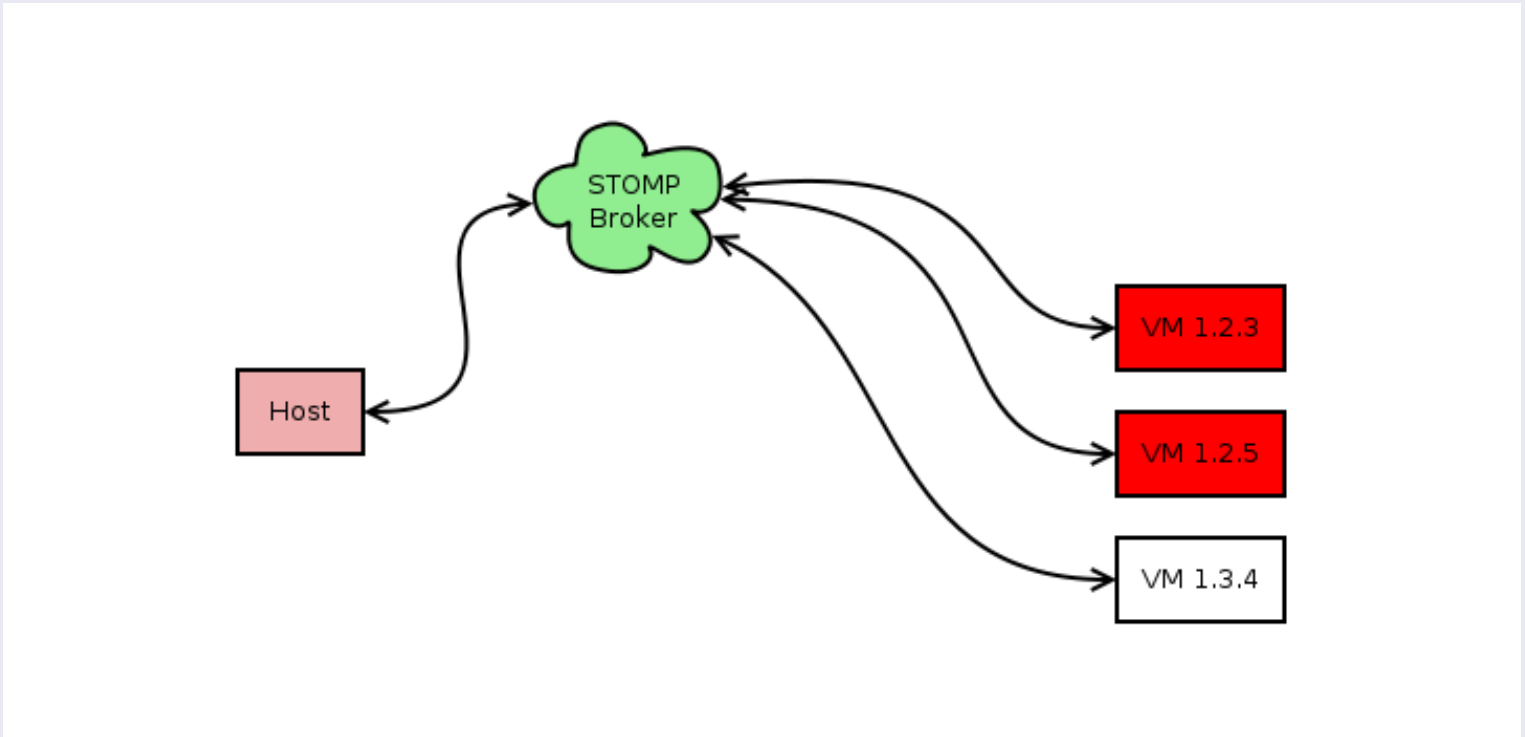

They stay busy for a while...

A Simple Example

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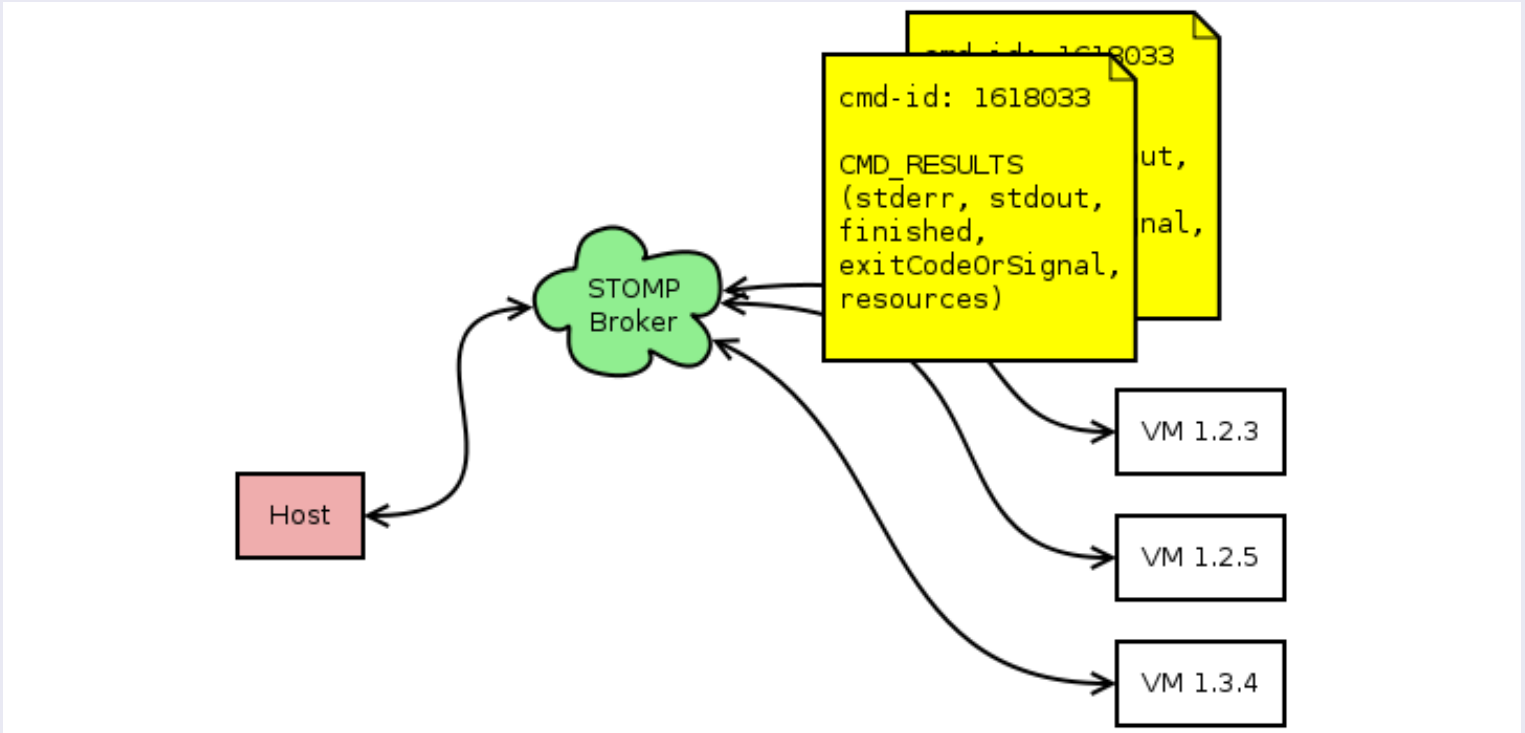

... and eventually they come up with something. At any given moment! All operations are asynchronous.

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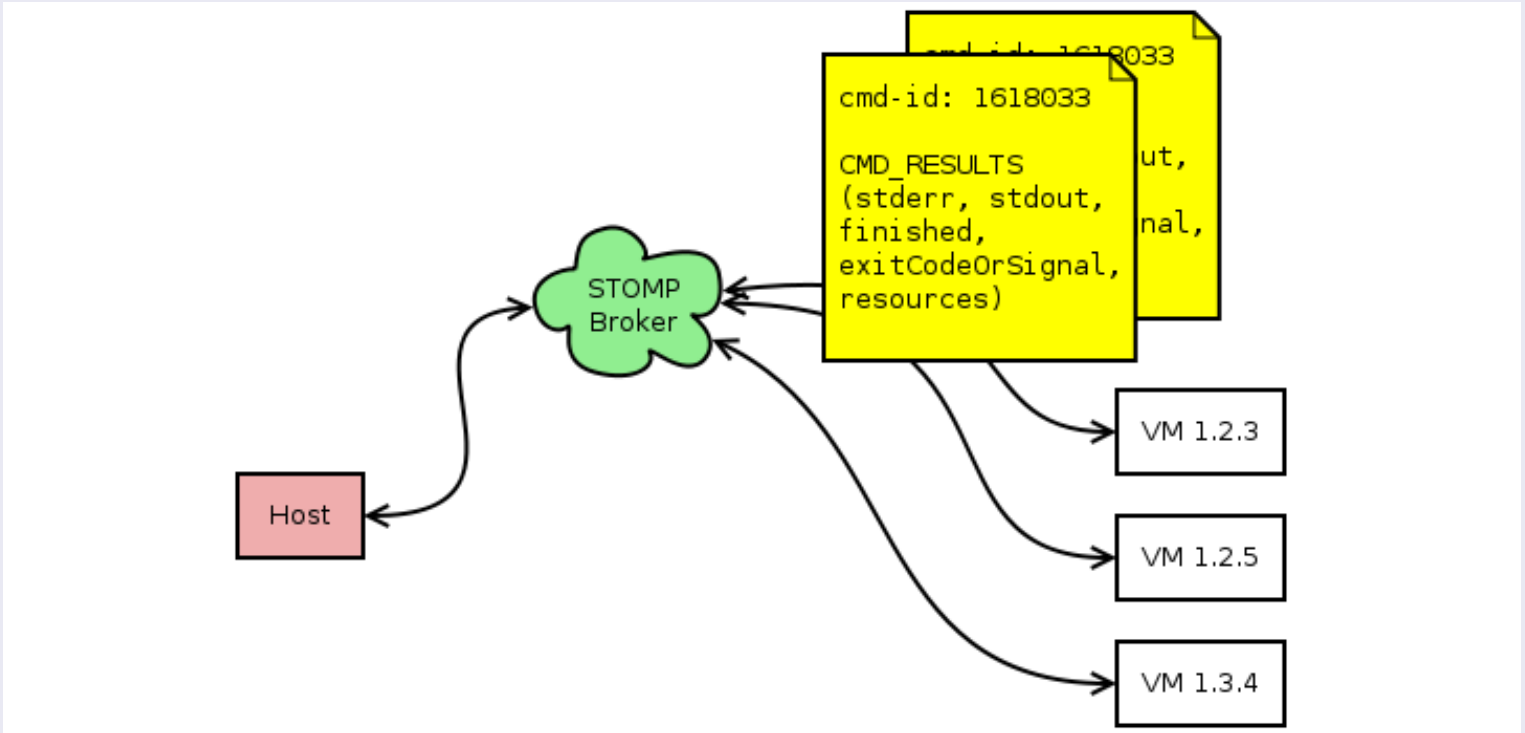

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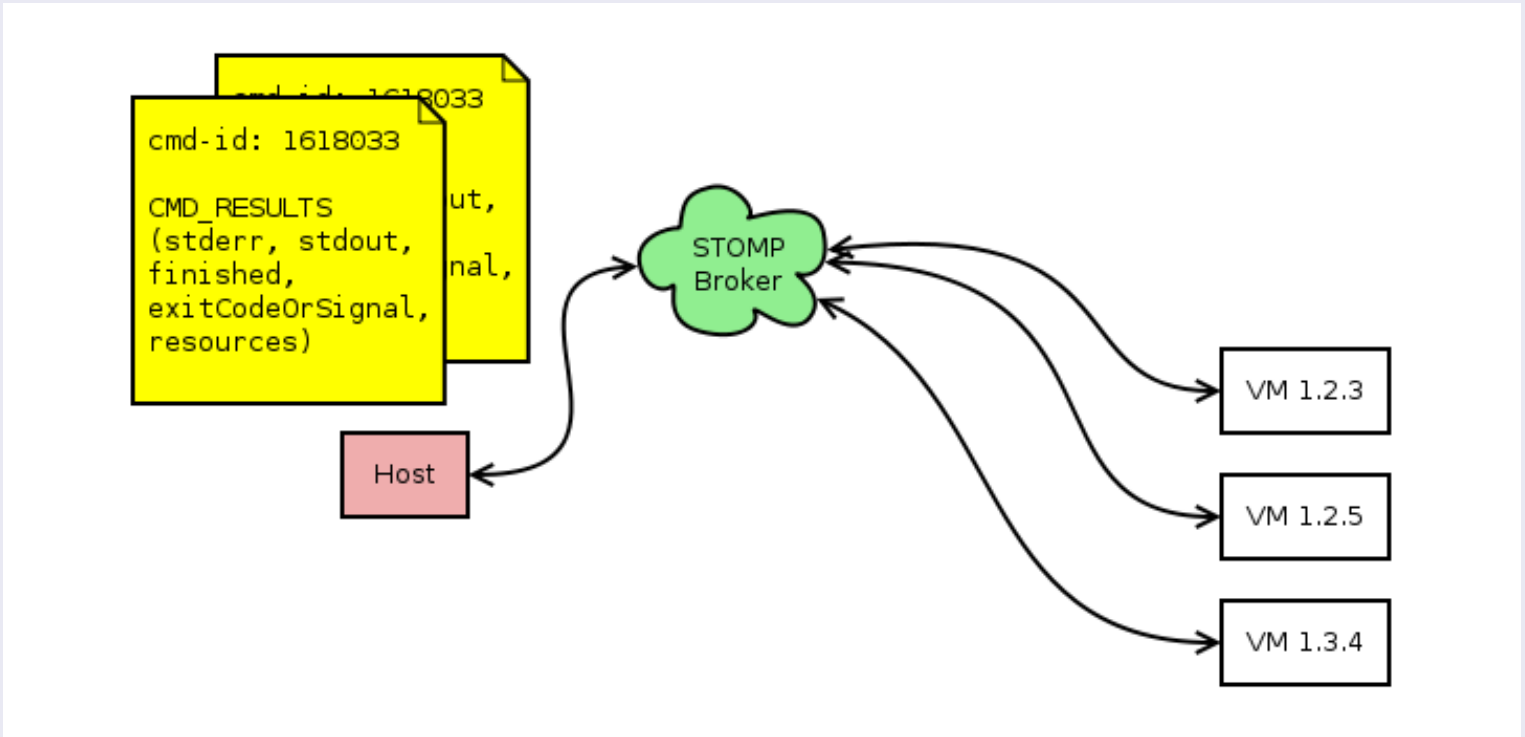

The VM controller (thus the BOINC client) eventually receives the result(s) of the computation (together with some extra data).

Index

1 Introduction
- What?
- Why?

2 Development (ie, How?)
- Our Proposed Solution
- Getting Technical

3 Going For It

4 Conclusions

Going For It

How much is it going to cost me?

On the VM image:

- Python Runtime ($\geq$ 2.4. 2.6 recommended).
- Twisted Framework.
- Zope Interfaces.
- Stomper.
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Trials at CERN

No vaporware!

Put to the test in the context of the ALICE experiment at CERN.

(successfully so)

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Index

1 Introduction
- What?
- Why?

2 Development (ie, How?)
- Our Proposed Solution
- Getting Technical

3 Going For It

4 Conclusions

Wrapping up

Something to take away from this talk:

- Virtualization eases the deployment of certain computations. In some cases, making them possible altogether.
- It is now possible to BOINC-ify applications strongly tied to a certain environment (by virtualizing it).
- You're not limited by your choice of hypervisor.

Wrapping up

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It's even documented!

`http://boinc.berkeley.edu/trac/wiki/VmApps`

Overall architecture and VirtualBox specific details:

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BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Going For It

Conclusions

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- Support for more hypervisors.
- Automate the installation process, on both sides.
- Testing, testing, testing!

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The End

BOINC Virtual Machine Controller Infrastructure

David García Quintas

Introduction

Development (ie, How?)

Going For It

Conclusions

Thank you!