



# CernVM **WebAPI**

## Controlling VMs from the web

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# Trend in Volunteer Computing

- Get **free resources** and increase your **visibility**
- At CERN **new** projects joining lately
  - ATLAS@Home
  - CMS@Home
  - ATLAS “Find the higgs”
  - CERN Open Data

*Refer to 7<sup>th</sup> track presentations  
on Tuesday 14/4 (CHEP)*





# Trend in Volunteer Computing

- Used in HEP for **Monte-Carlo Simulations**
  - No need for high bandwidth
  - No need for real-time communication
- **Problem:**
  - Simulation packages specialized for **Linux**
  - Volunteers with **diverse** OS distributions
  - Huge effort to cross-compile





# Virtualization in V/C

- Solution? **Virtualization**
  - Cross-platform support out of the shelf
  - Simplified packaging & deployment
- In 2011 **LHC@Home 2.0 (Test4Theory)** was the first BOINC project to use virtualization
  - Using CernVM for the base OS
  - Co-Pilot for job distribution
- Became the **reference**

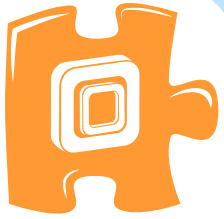




# Problems of Virtualization

- X** Extra **work** for the end-user
  - Install BOINC agent
  - Install & configure a hypervisor
- X** Manual **intervention** required in some cases
  - Misconfigured network
  - Improperly allocated resources
  - Improperly configured BIOS
- X** *A burden* to **non-technical** users

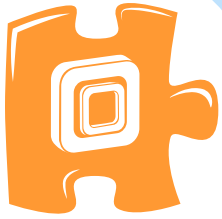




# CernVM WebAPI

- ✓ Offload **all possible** work from the users
- ✓ **Assist** them with manual interventions
- ✓ Eliminate **switching** between windows
- ✓ Provide a standard for interfacing with the application **inside** the VM





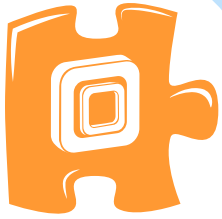
# CernVM WebAPI

- Development **effort?**
  1. Include the **cvmwebapi.js** library
  2. Use the following **code**

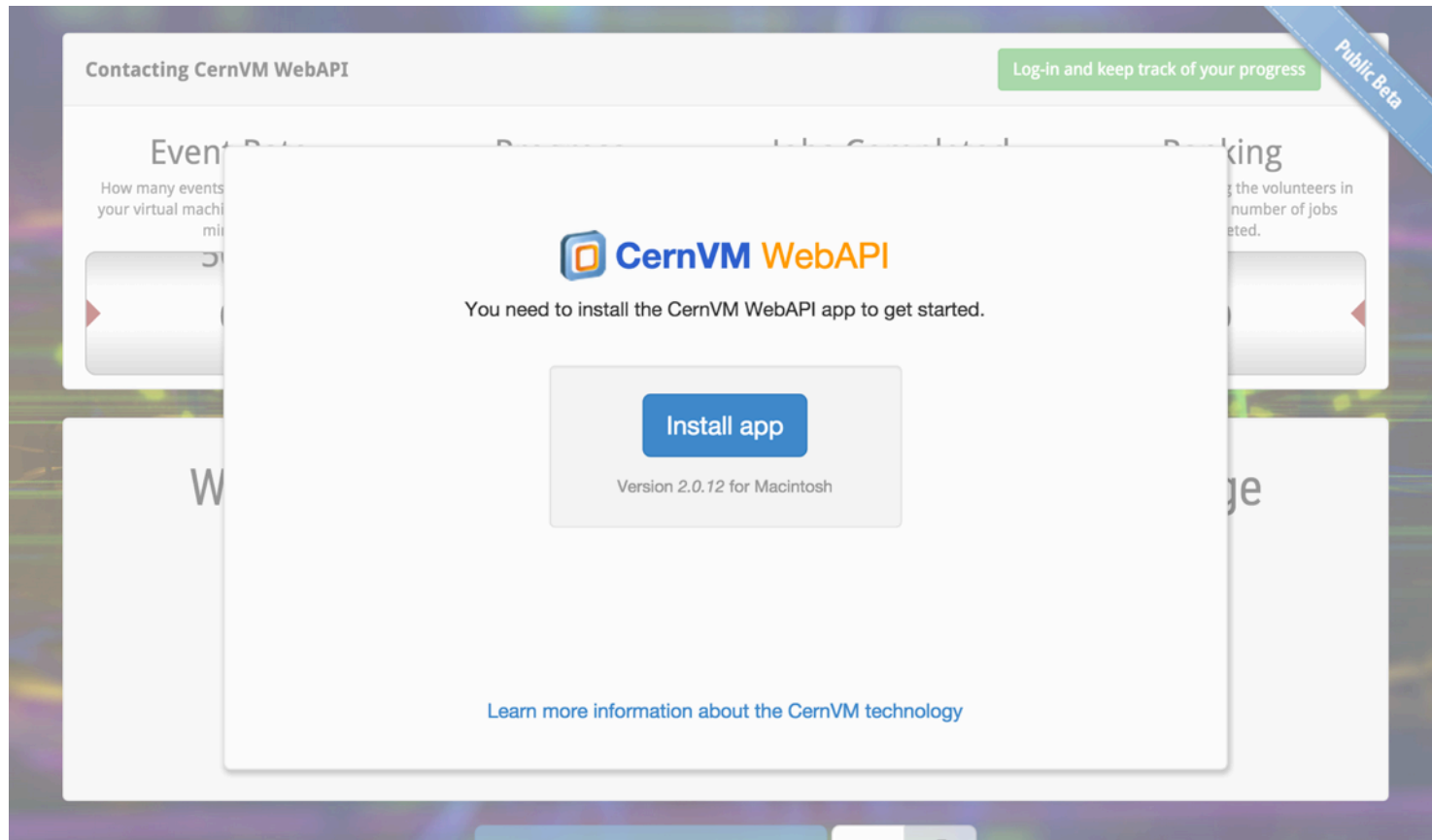
```
// Request API Access
CVM.startCVMWebAPI(function(plugin) {
  // Open Session
  plugin.requestSession("http://domain.com/vmcp?id=1", function(session) {
    // Start VM
    session.start();
  });
});
```

**3. EVERYTHING** else is taken care of





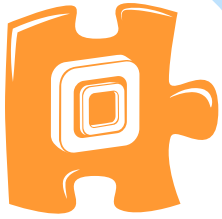
# CernVM WebAPI



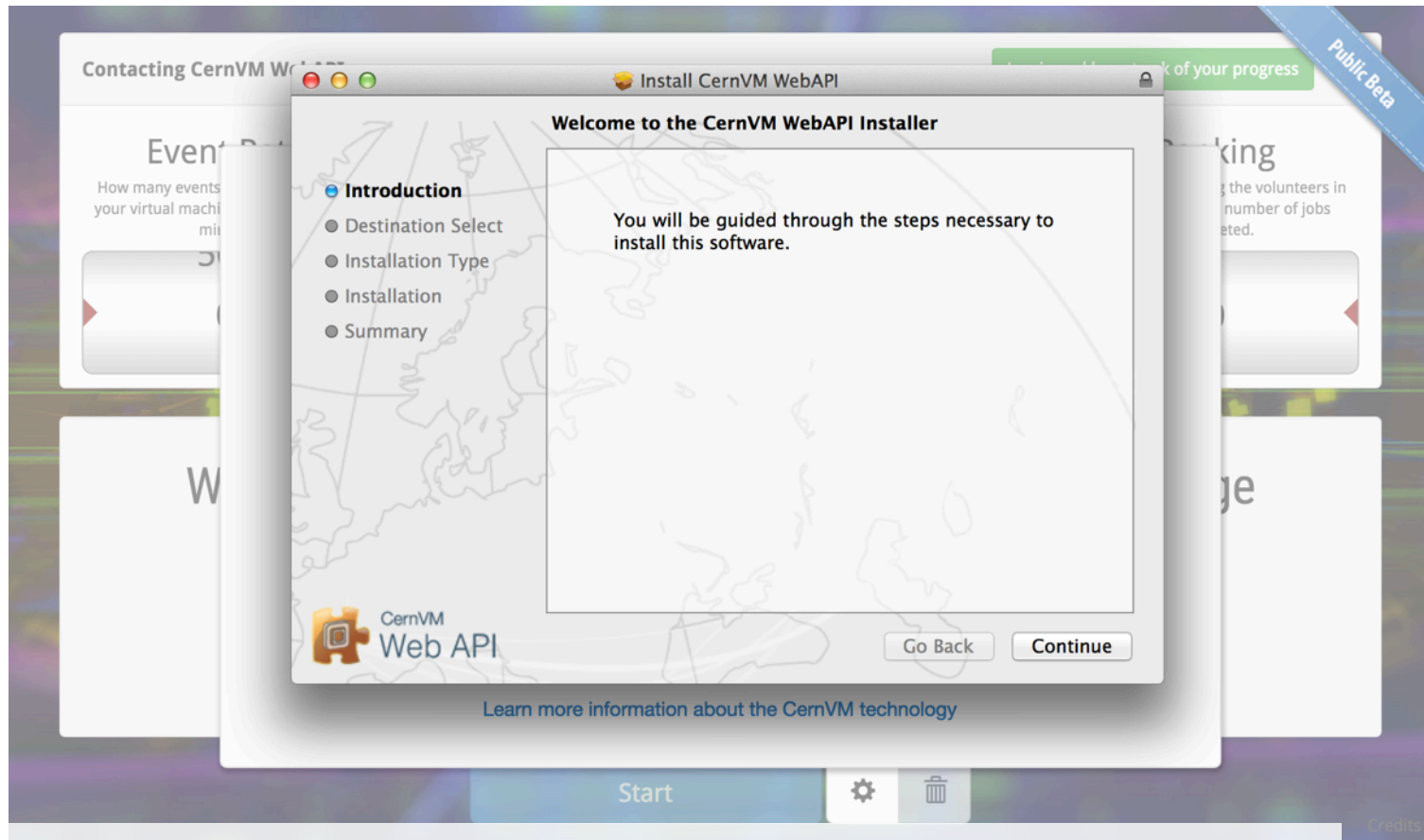
## Guided installation of WebAPI





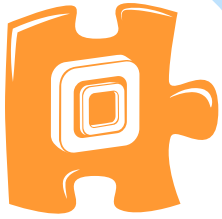


# CernVM WebAPI



## Installation in a pop-up window



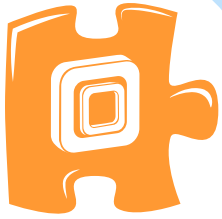


# CernVM WebAPI

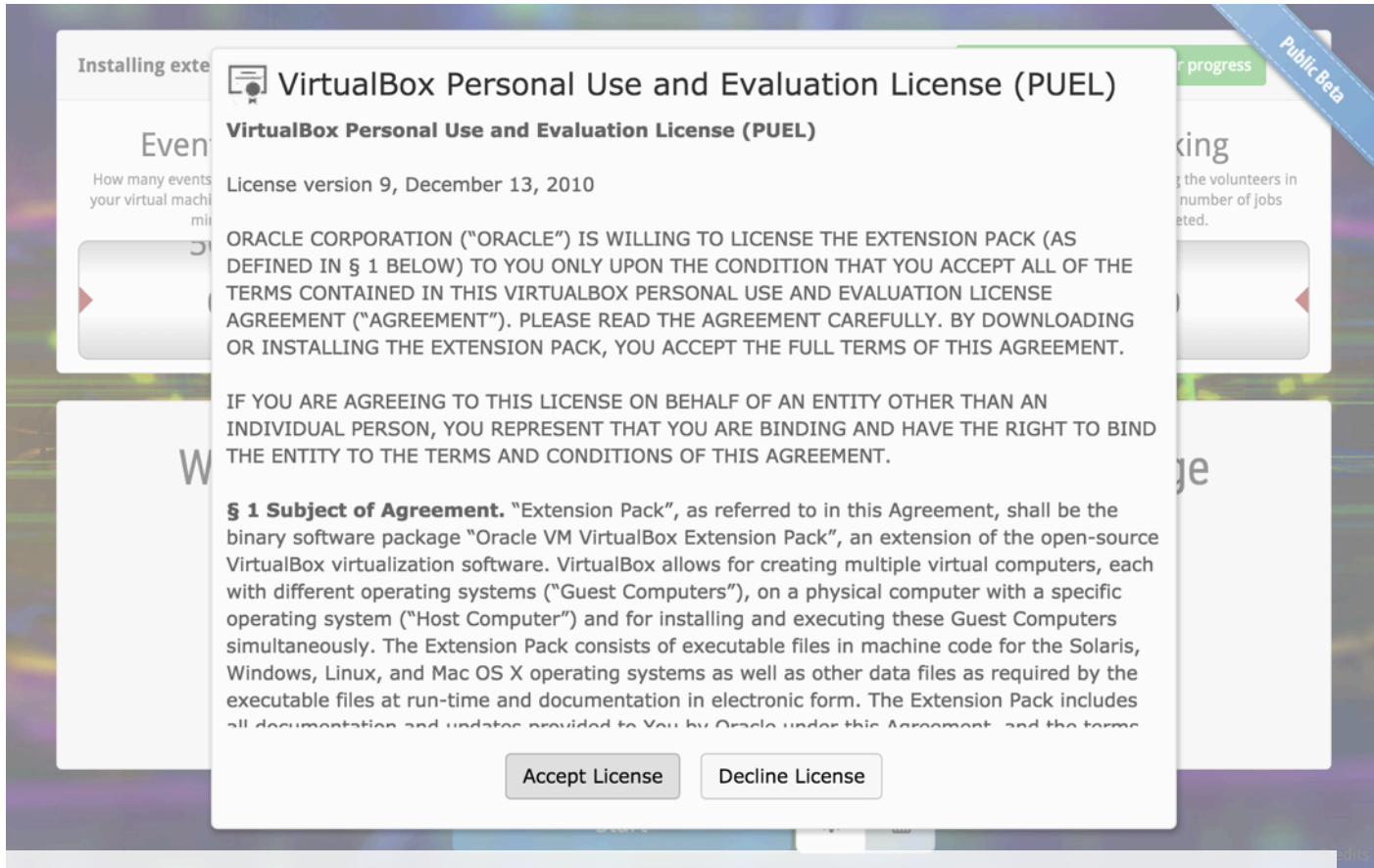
The screenshot shows the CernVM WebAPI interface. At the top, it says "Contacting CernVM WebAPI" and "Log-in and keep track of your progress". A "Public Beta" banner is in the top right. The main area has four panels: "Event Rate" (0), "Progress" (0%), "Jobs Completed" (0), and "Ranking" (0). A dialog box is overlaid with the title "Hypervisor required" and the message: "For this website to work you must have a hypervisor installed in your system. Would you like us to install VirtualBox for you?". The dialog has "Ok" and "Cancel" buttons. At the bottom, there is a "Start" button and a trash icon.

Install **Hypervisor** if missing



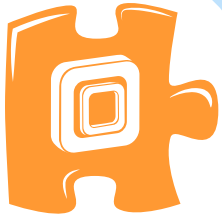


# CernVM WebAPI



Install **Extension Pack** if missing



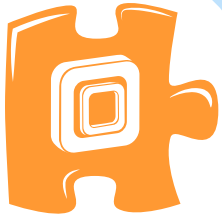


# CernVM WebAPI

The screenshot displays the CernVM WebAPI interface. At the top, a red and white striped banner reads "Session is new, asking user for confirmation". To the right, a green button says "Log-in and keep track of your progress" and a blue ribbon indicates "Public Beta". The main area features four panels: "Event Rate" (0), "Progress" (0%), "Jobs Completed" (0), and "Ranking" (0). A central dialog box with an information icon contains the text: "New CernVM WebAPI Session. The website test4theory.cern.ch is trying to allocate a virtualbox Virtual Machine 'VirtualLHC\_Challenge'. This website is validated and trusted by CernVM. Do you want to continue?". Below the dialog are "Ok" and "Cancel" buttons. At the bottom, there is a "Start" button and icons for settings and trash.

Confirm **Website Request**







# CernVM WebAPI

The Virtual Machine is ready Log-in and keep track of your progress Public Beta

Event Rate	Progress	Jobs Completed	Ranking
How many events (particle collisions) your virtual machine is simulating per minute.	What fraction of the current job is completed. (Typically, 1 job = 100,000 events)	How many simulation jobs your virtual machine has processed.	Your ranking among the volunteers in this challenge, by number of jobs completed.
0	0 %	0	0

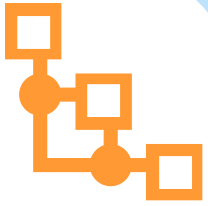
**You are now ready to start computing**

By clicking the *Start* button below, we are going to start a Virtual Machine in your computer, which is going to start performing virtual collisions and sending the statistics back to CERN. Click **Log-in to track your progress** on top right corner keep track of your progress!

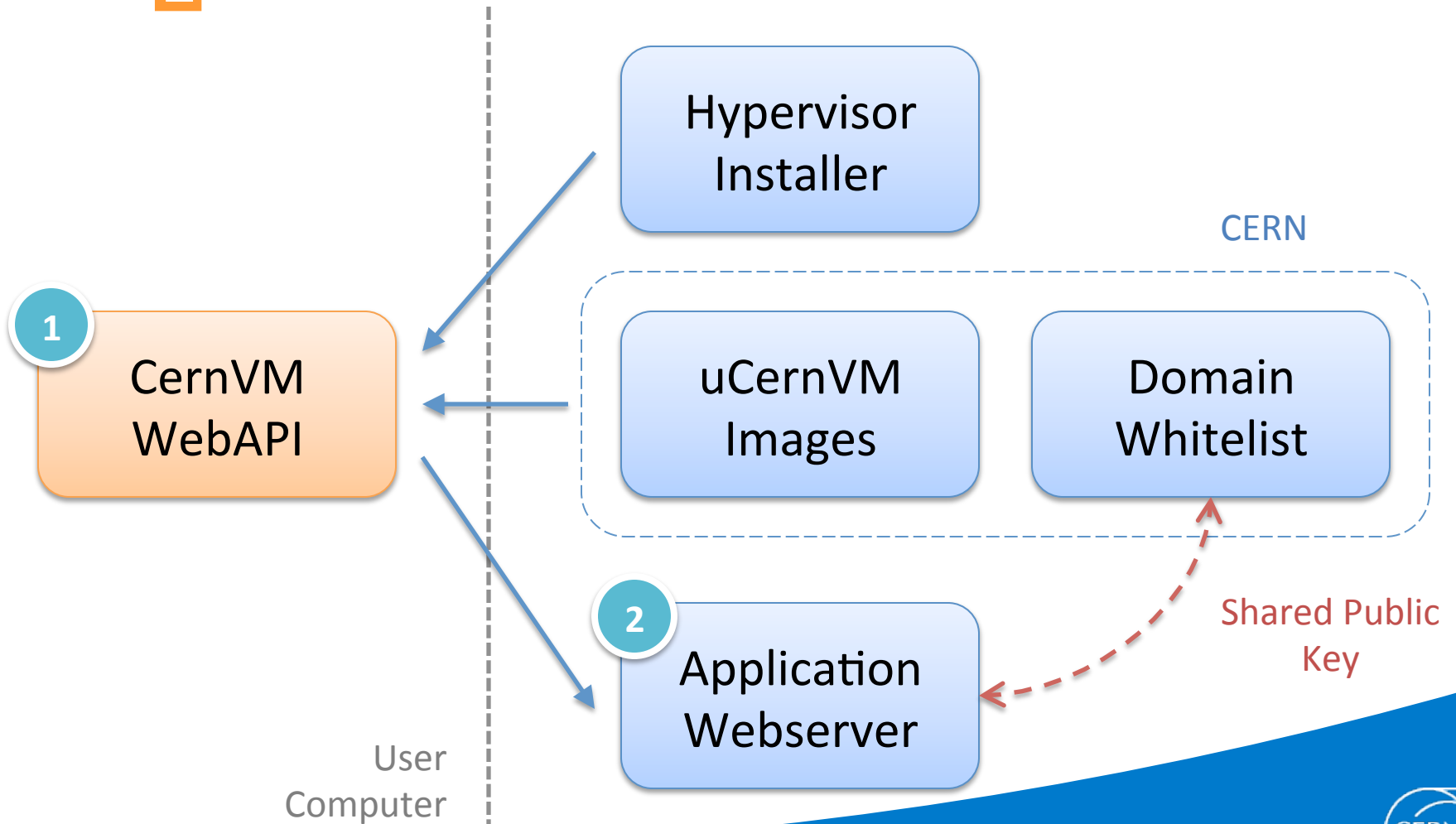
[Start](#)  

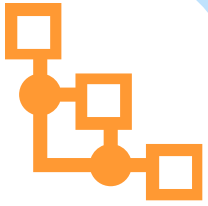
Ready to start computing



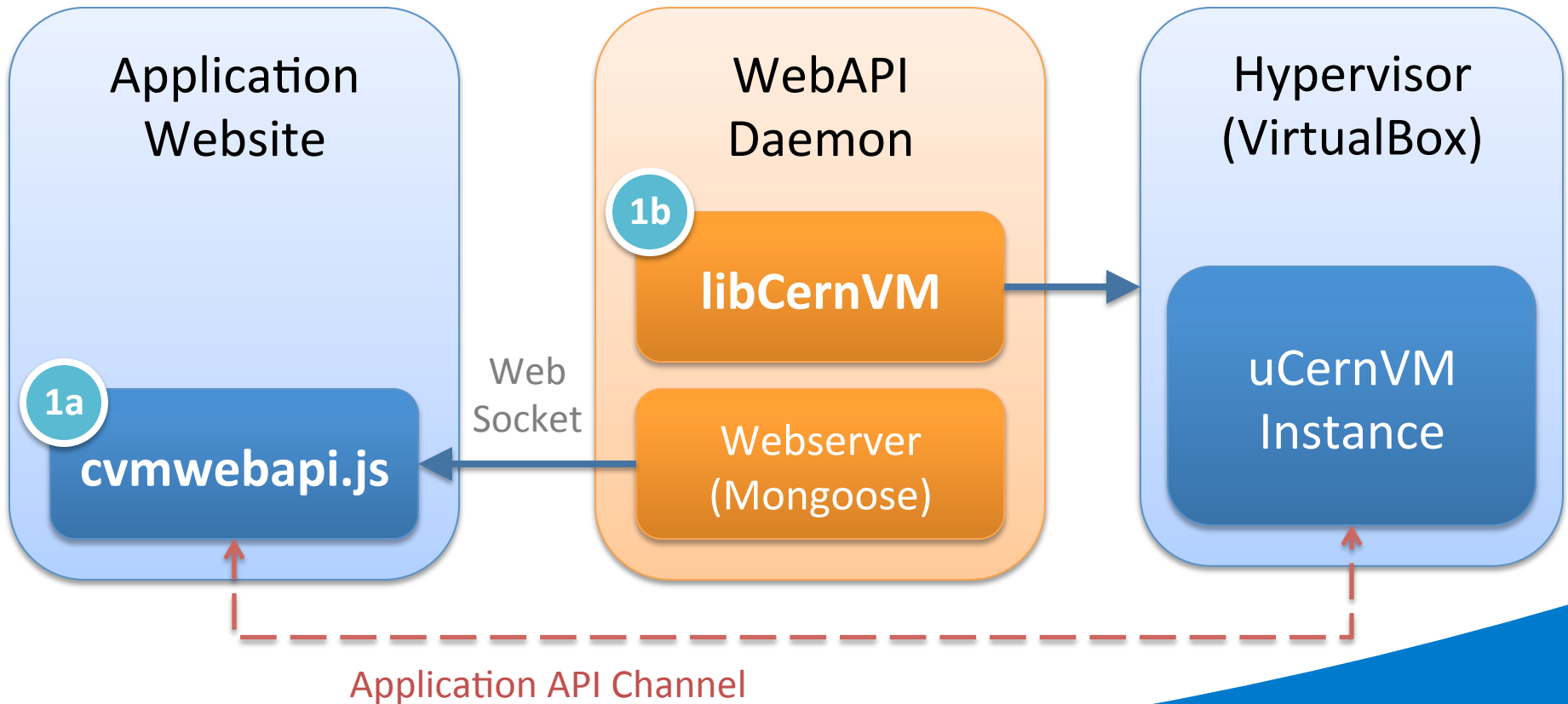


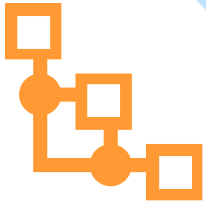
# WebAPI Components





# 1 CernVM WebAPI





1a

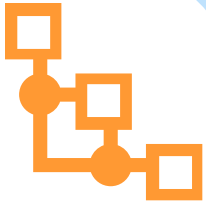
# cvmwebapi.js

- High-level abstraction API
  - Takes care of CernVM WebAPI **installation**
  - Takes care of **initiating** and **maintaining** a connection with the daemon
  - Provides **interface** with the app inside the VM
  - Injects discreet UI elements in the DOM when user **interaction** or **instructions** is required

```
<!-- Include the WebAPI library -->  
<script src="http://cernvm.cern.ch/releases/webapi/js/cvmwebapi-latest.js">  
</script>
```







# 1a cvmwebapi.js

Contacting CernVM WebAPI

Log-in and keep track of your progress

Public Beta

**CernVM WebAPI**

You need to install the CernVM WebAPI app to get started.

**Install app**

Version 2.0.12 for Macintosh

Learn more information about the CernVM technology

Start

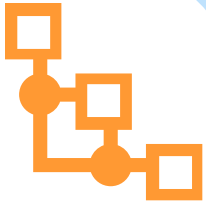
Embedded UI

First-time **install** instructions

1. Click the file at the lower-left of your browser window **cvmwebapi-2.0.12.pkg**.
2. Follow the on-screen instructions to install the CernVM WebAPI app.

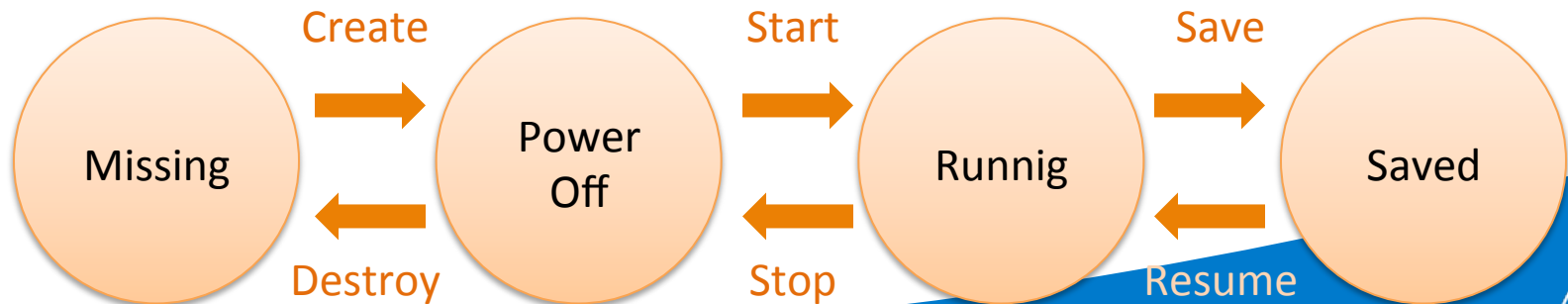
[Click here to retry the download if it failed.](#)

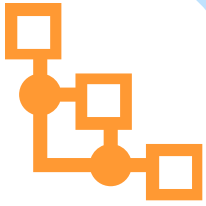




## 1b libCernVM

- Stand-alone C++ library for **interacting** with a local hypervisor
  - **Detect** or install hypervisor (currently VirtualBox)
  - **Fix** misconfigurations (ex. missing extension pack)
  - **High-level** session based API interface



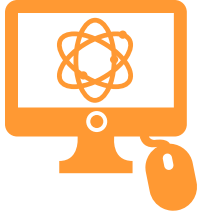


## 2 Application Webserver

- You need an endpoint to serve the VM **configuration** information (VMCP)
  - Signed with your domain's private key

```
{  
  "name": "MyAwesomeVM",  
  "secret": "s3cr3tk3y",  
  "vcpus": 1,  
  "ram": 512,  
  "version": "1.5",  
  "flags": 8,  
  "userData": "[cernvm]\nusers=user:users;password"  
}
```

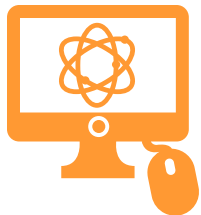




# Use Cases

- CernVM WebAPI is **already** in use in :
  - CernVM Online
  - CERN 60 Computing Challenge
  - Citizen Grid
- There is **interest** for use in:
  - CERN Open Data












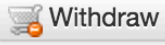



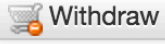











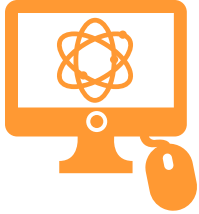
# The CernVM Online Interface

Dashboard

Your context definitions

Name	Operations	WebAPI
 CopilotVM	 Clone  Withdraw 	 Launch now ▾
 CopilotVM-Agent	 Clone  Withdraw 	1 CPU / 1 GB RAM / 10 GB disk 1 CPU / 2 GB RAM / 10 GB disk 2 CPU / 2 GB RAM / 20 GB disk
 LXC v5	 Clone  Withdraw 	
 T4T-Client-23	 Clone  Withdraw 	 Launch now ▾
 T4T-Client-44	 Clone  Withdraw 	 Launch now ▾





# The CERN60 Challenge

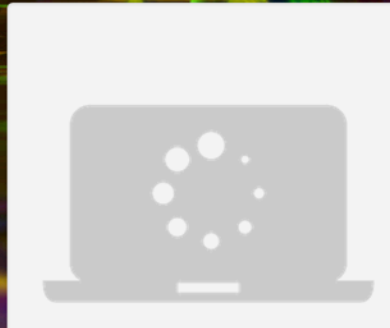
The Virtual Machine is booting

### Event Rate

How many events (particle collisions) your virtual machine is simulating per minute.

500

0



Starting virtual event generator John Charalampidis Progress details Public Beta

Event Rate	Progress	Jobs Completed	Ranking
How many events (particle collisions) your virtual machine is simulating per minute. 500 0	What fraction of the current job is completed. (Typically, 1 job = 100,000 events) 1 % 0 %	How many simulation jobs your virtual machine has processed. 1 0	Your ranking among the volunteers in this challenge, by number of jobs completed. 1 0

Learn more:

- Introduction to high energy physics simulations
- See the simulations produced by your computer
- Learn about the software that does the simulations

Generator: **pythia8**

Collisions analyzed with: **ATLAS\_2011\_S9131140**

Beams: Process: **z** Starting virtual event generator Energy: **2000.00 GeV**  
Producing: 100,000 events

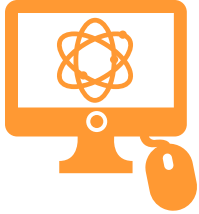
While waiting... wanna help ATLAS look for Higgs?

Stop

<http://test4theory.cern.ch/vlh>

“Let’s reach the **LHC** Event Rate”





# The CERN60 Challenge

## HALL OF FAME

Here is a name cloud of all the volunteers who signed in and contributed at least one job. Thanks to you, and t

Patrick Werber Hendrik Richter Michael Claes Indy Gilstrøm Jaime Farill Mike Hamilton Kirsten  
W Hallam Albert Booth Evert adsgafg Ryder Bluhm Harrison Totty Nicolò Gottardello Neil M  
Katz Wade Gillingham nekdo z jamian Dimock Michelle Greenlee Lex Imperatoris Billy Vier  
Damme Justin Pekular Jason Lorsung Joshua Lee AXfactOR AXfactOR Giovanni Siragusa Carson T  
Marek upinsmoke1973 Maelstrom Scott McDermott Ryan Ford Naomi Cathcart Brian Bond Geoffrey  
Blapkinz Ian Peter Braun RJ Hill Bertil Spolander Cody Wang Carl Michael Stojanovic duG Varrette Arturo Saura Ben Segal Eraip Ersoy Alex  
Copero Tim Weinert Jan Füsting thomas noé Leo Wright Joe Tursi david9000 Borja González Herrero Benjamin Bertrand Pieter  
Orlando Andrew Smith John Jones Rouslan Korneychuk Jasper Homann Matthew Snow Sylvain  
Manzi Elemental Brain Adam Paugh Ninette Kelly Cameron Phillips Erick Erickson Emma  
Bidema Ex Cool Francois Grey Clara Á. Luna Jim 'Artless' Merrill Mikey Babb Chris I  
Engebreetsen Adrian Ellingsgaard Jonathan Chan Aika Code Arthur Molnar Clemens Der-ganze  
Anhgarin Phil Webb Greg Lockett Dubois Alexandre Rohan Kundu Kostas Rakitzis Ayush Jha José Rafael  
(zeroXten) Amkazan Amkazan Jan-niclas Graumann Not Erison Veshi Matthew Gregg Simone G  
Poe Felix Wustrack Ivan Koeff Daniel Reynolds Jacob Wolf Nel-gez Andreas Roy van Olenbaekesymash10Robby Wilson Johan  
Torselius Alexandr Samsonov Steve Kuntz Mike Bentley Daniel Lindmark mininukewarrior Ivan Bisol Frederik Vander Biest Thomas  
Kristensen Marco Nardes Craig Pekar Mike Wilkinson John Smith Bernie Telalovic Kilazur Dargnaith Laurence Woolford Guillaume  
Toussaint Adam Wheeler Jade Woods Nicolas Segal Anders Hvidberg Frandsen James Alexander Gardner Efi Psomopoulou Kalle  
Bexhorn Joseph Flagler Ben Vaughn Anton Stensgaard Jakob Rigsby Eric Plummer Josh Robbins Ryan Moodey Kristof Ballet Jack Eden  
Patrick Dan Stenhouse Michael Ben Drake  
Isaza  
Boch Karevin Mads Kristensen Conny Francis Marco Vithuuh bunbv Joshua Karim (Samintell) Konstantin  
M

16.000 sessions

8.000 users

108 countries – 90 languages

Avg. of 400 sessions per day

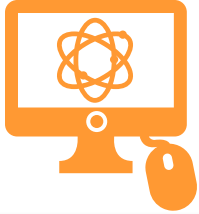
5,400 people booted a VM

1,100 had problems

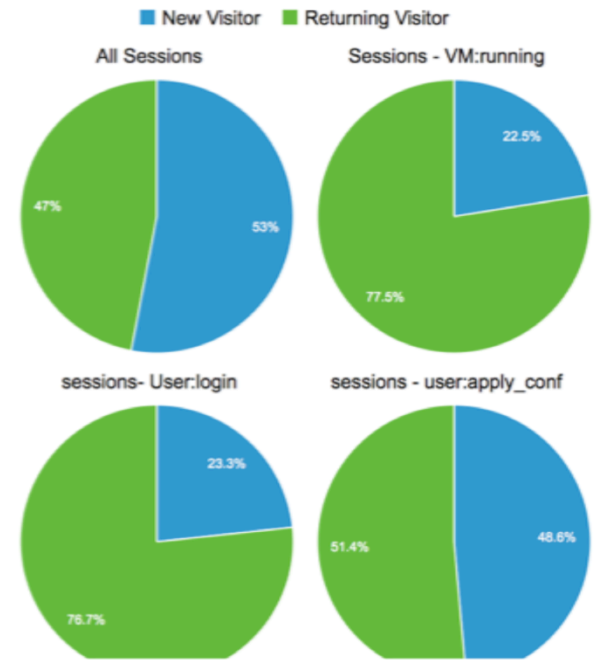
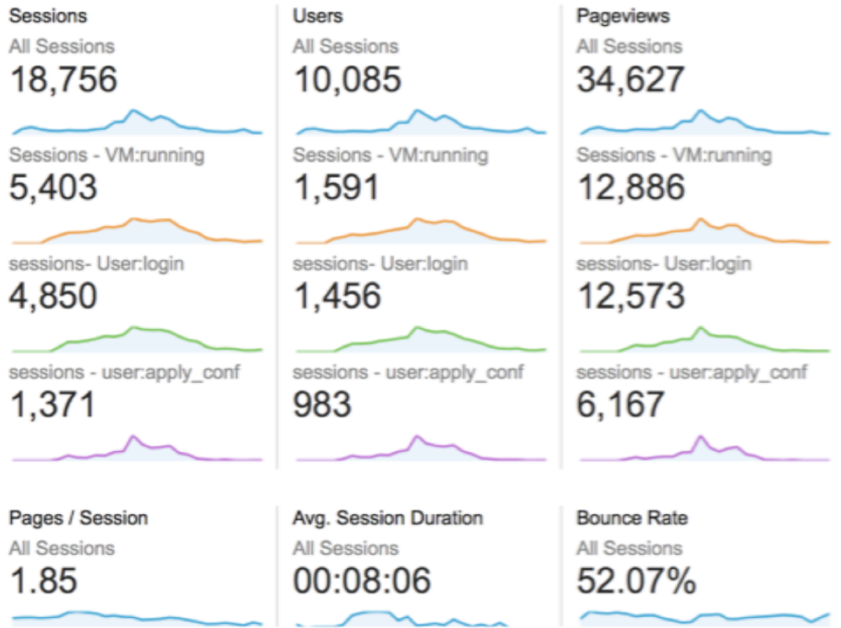
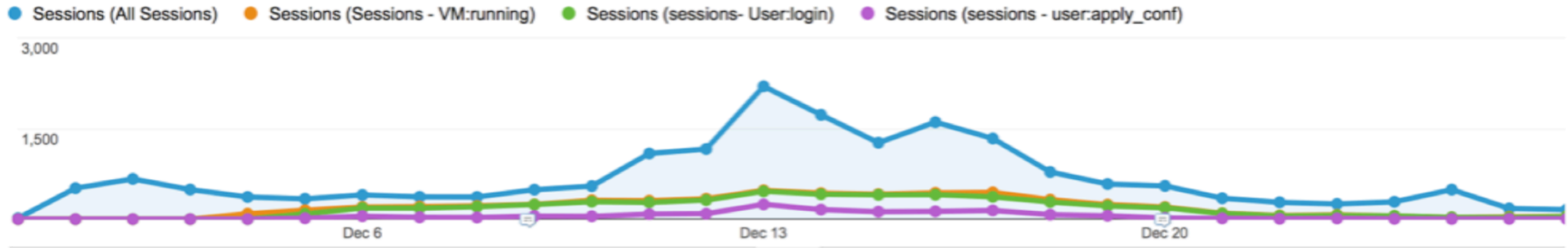
(about 80%: slow network)

During the challenge detailed analytics were collected





# The CERN60 Challenge





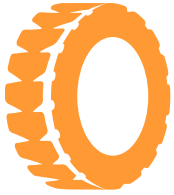


# Questions ?

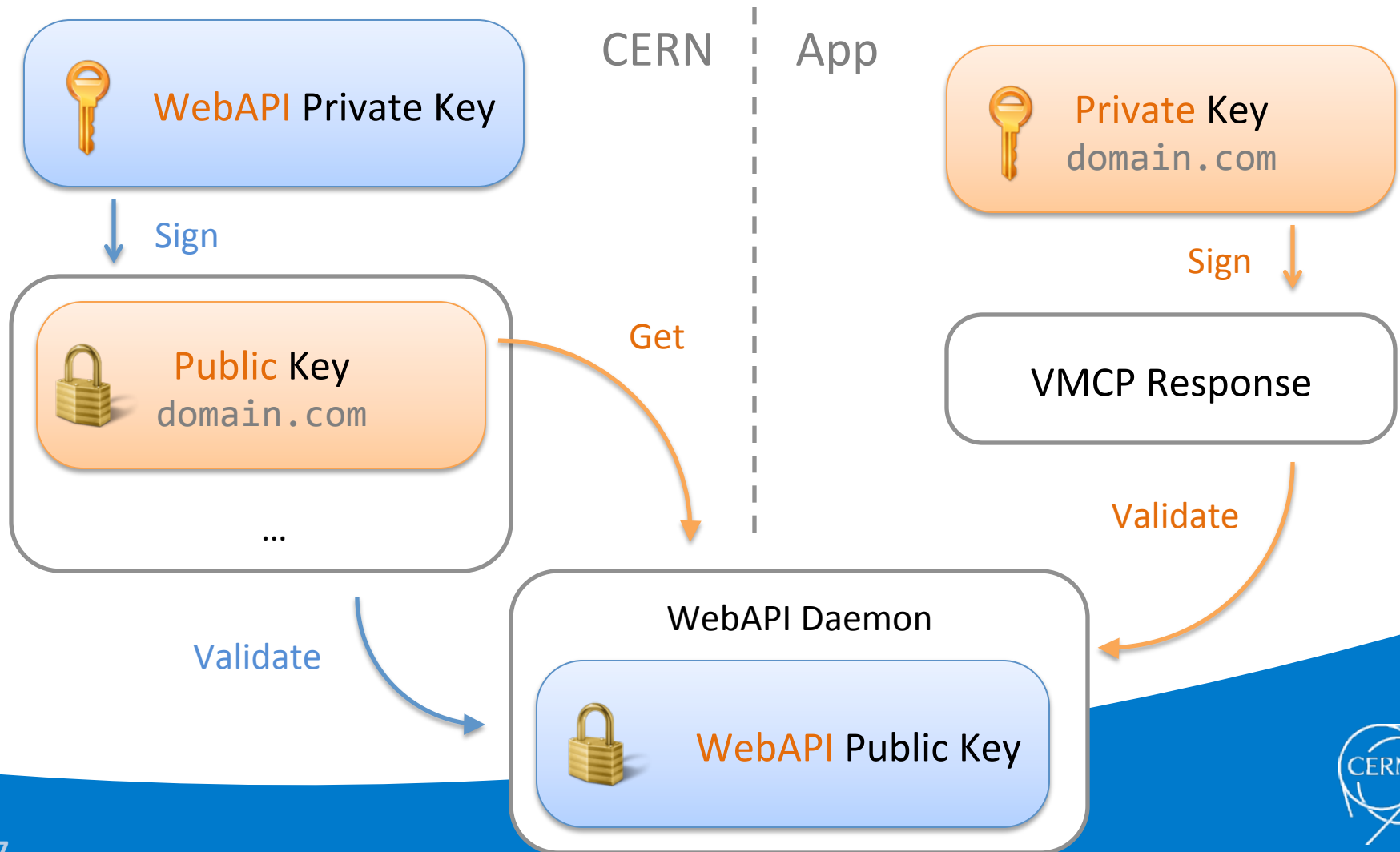
Hands-on step-by-step tutorial:  
<https://github.com/wavesoft/cernvm-webapi/wiki/Tutorial-Intro>

Offline questions: [icharala@cern.ch](mailto:icharala@cern.ch)

Spare Slides



# Security & Trust





# VMCP Handshake

## 1) Open Session

Referrer: `domain.com`

VMCP: `vmcp.domain.com/vm2`



WebAPI  
Daemon

## 2) Contact VMCP



{ .. }



Private Key  
`domain.com`



Web Server  
`vmp.domain.com`

## 3) Validate & Handle



libCernVM

## 4) Respond



Session ID: `#123456`

