CernVM **WebAPI**

Controlling VMs from the web

I.Charalampidis, J.Blomer, D.Berzano,
P.Buncic, G.Ganis, R.Meusel (CERN)

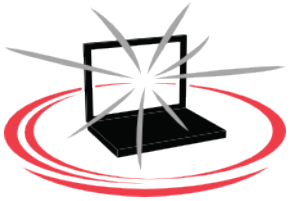
CHEP, Okinawa, 16 April 2015

CERN

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 7th track presentations on Tuesday 14/4 (CHEP)



Trend in Volunteer Computing

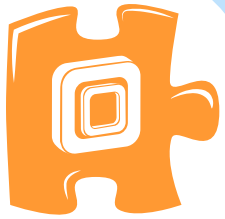
- Used in HEP for Monte-Carlo Simulations
  - No need for high bandwidth
  - No need for real-time communication
- Problem:
  - Simulation packages specialized for **Linux**
  - Volunteers with **diverse** OS distributions
  - Huge effort to cross-compile

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

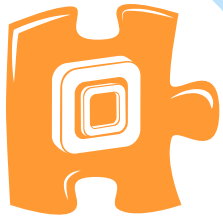
Problems of Virtualization

- ✗ Extra work for the end-user
  - Install BOINC agent
  - Install & configure a hypervisor
- ✗ Manual intervention required in some cases
  - Misconfigured network
  - Improperly allocated resources
  - Improperly configured BIOS
- ✗ 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



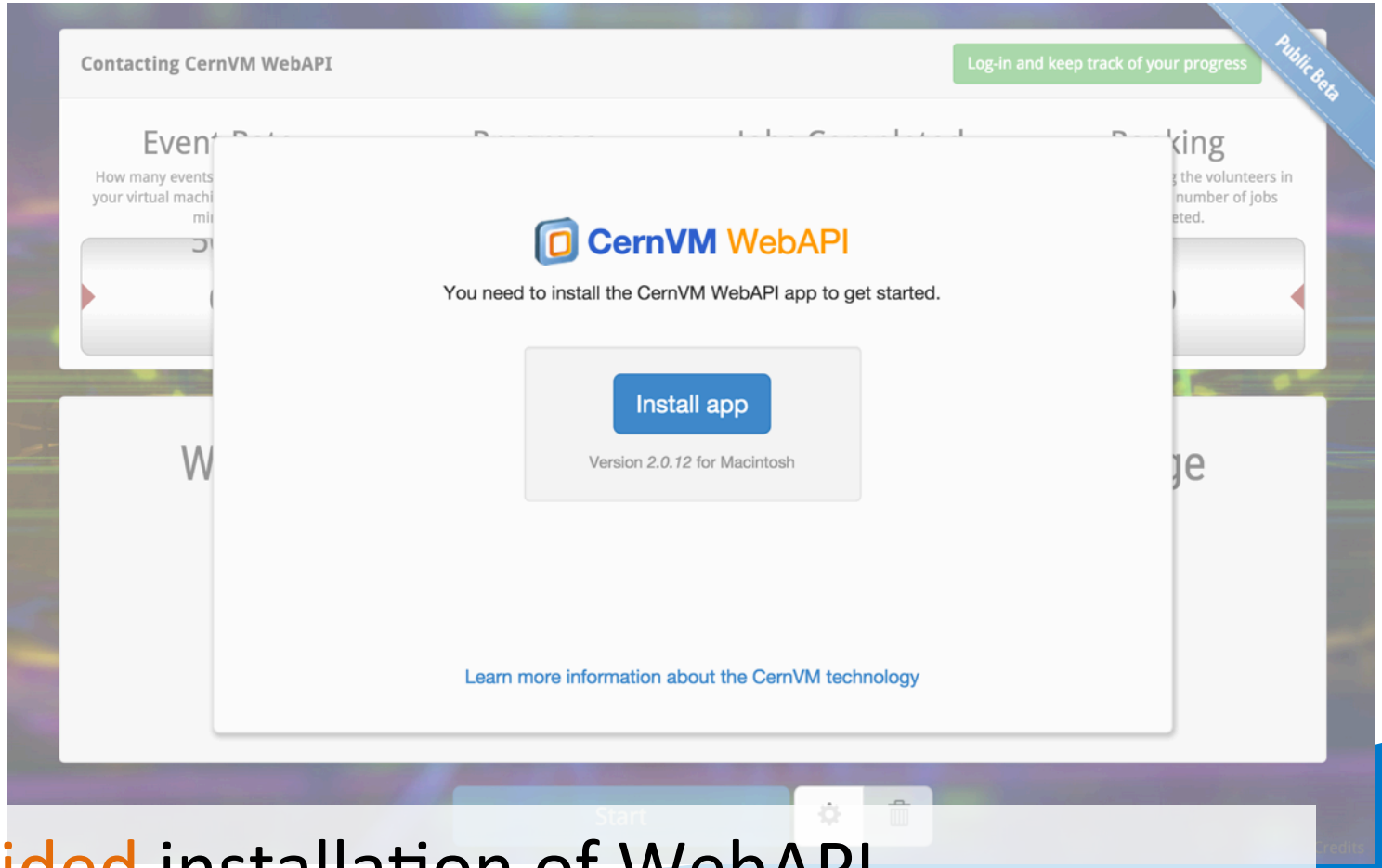
CernVM WebAPI

- 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();
  });
});
```

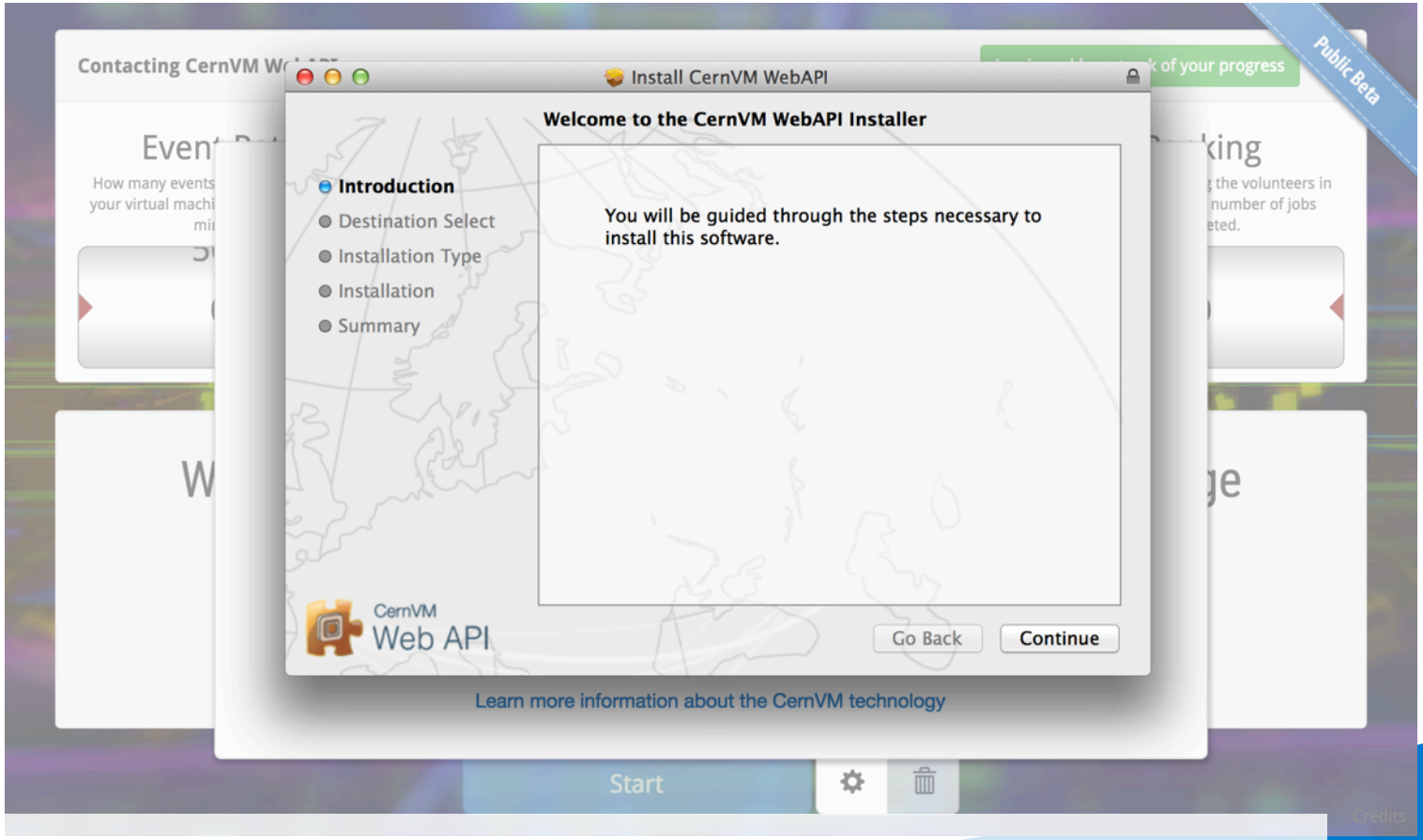
  3. **EVERYTHING** else is taken care of

CernVM WebAPI



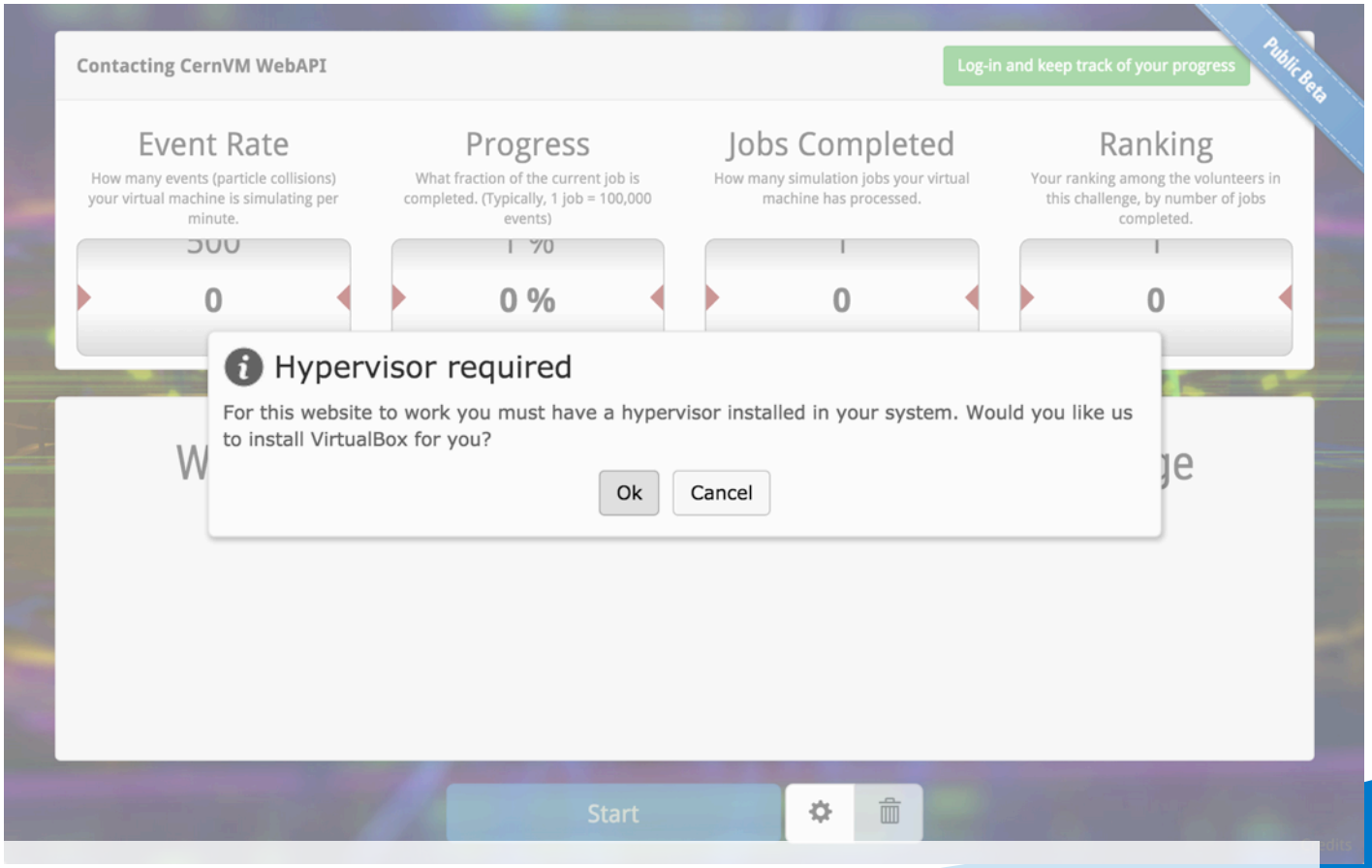
Guided installation of WebAPI

CernVM WebAPI



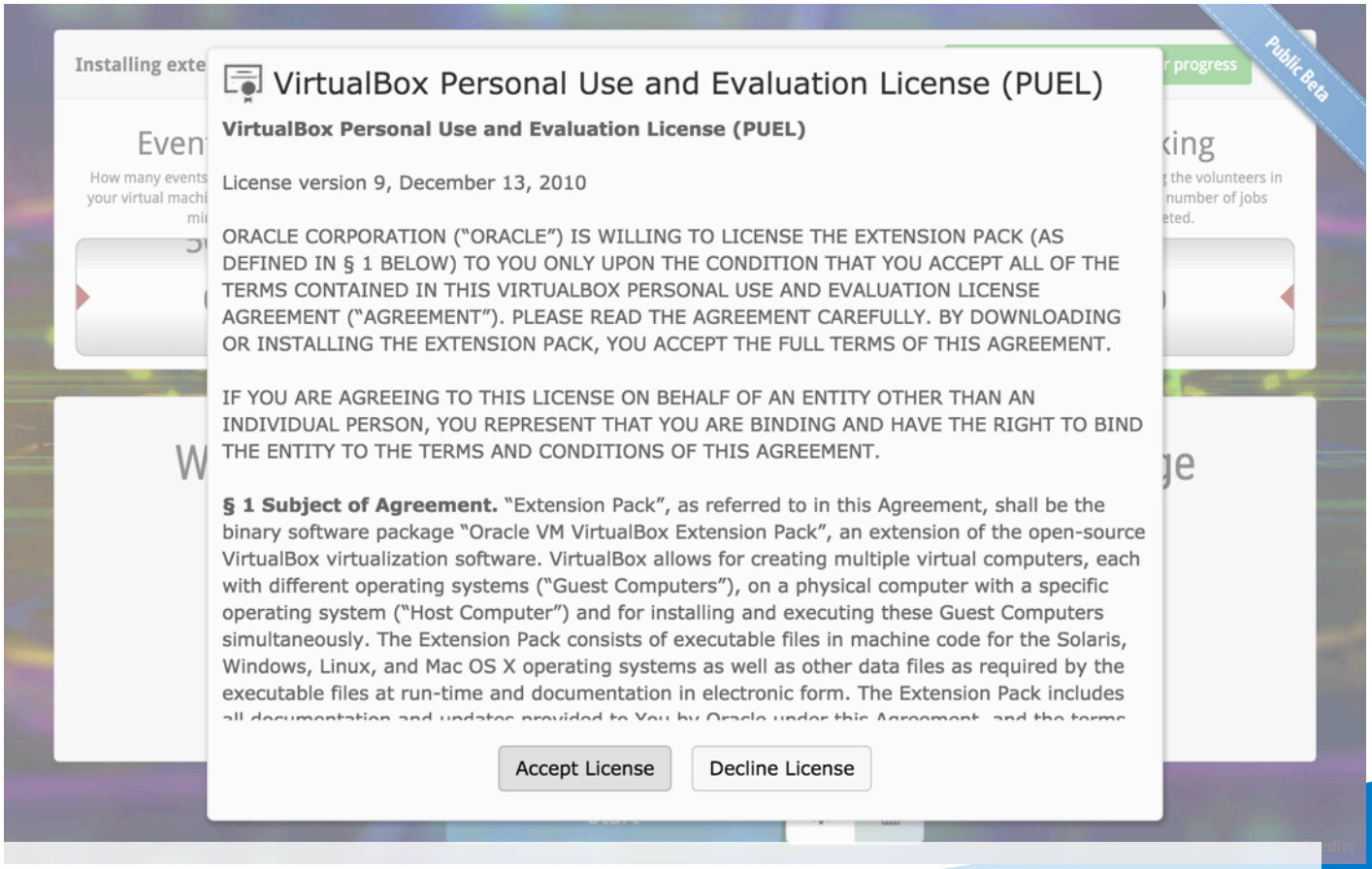
Installation in a pop-up window

CernVM WebAPI



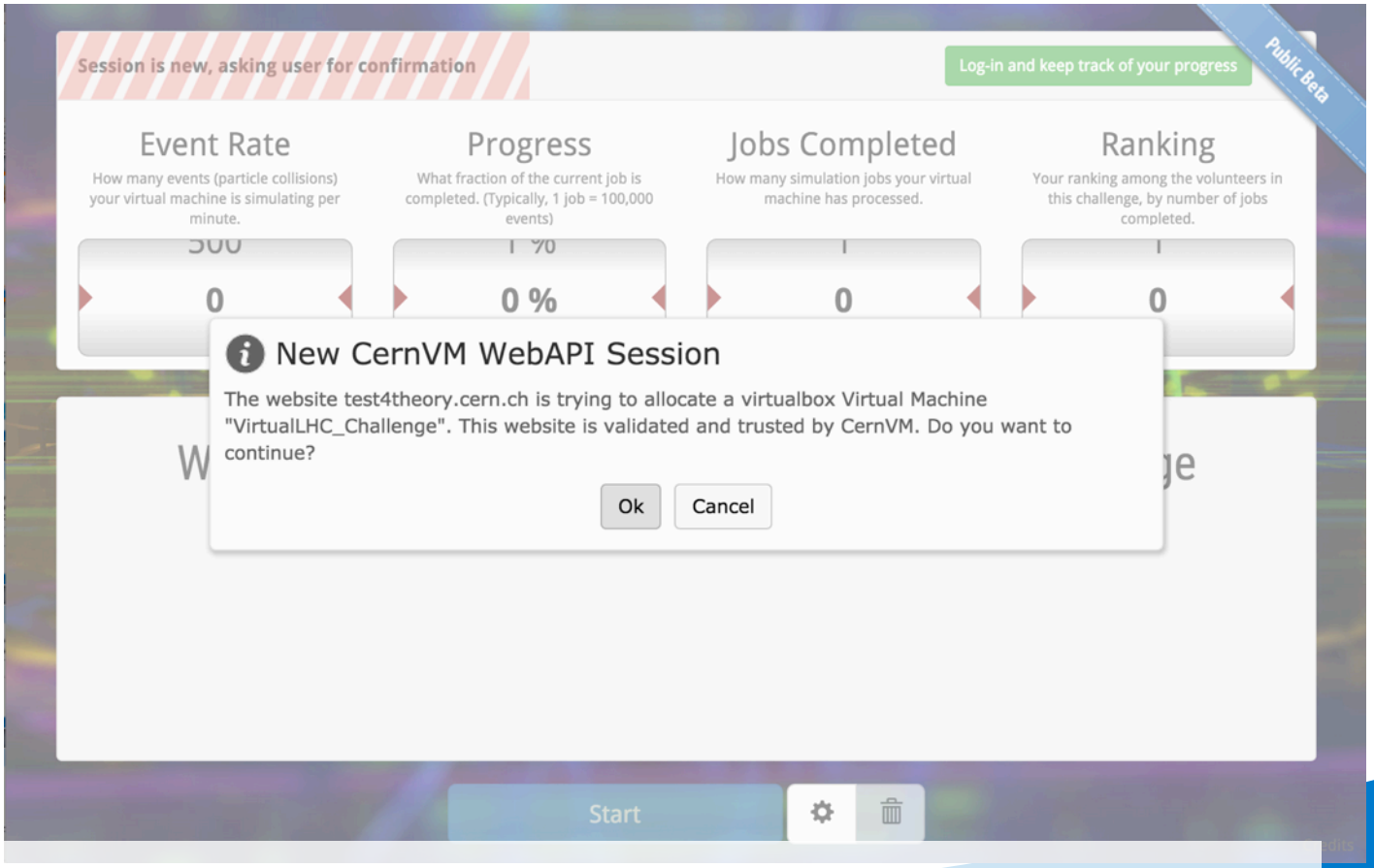
Install Hypervisor if missing

CernVM WebAPI

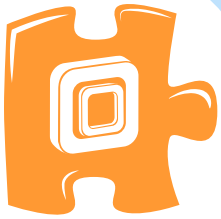


Install Extension Pack if missing

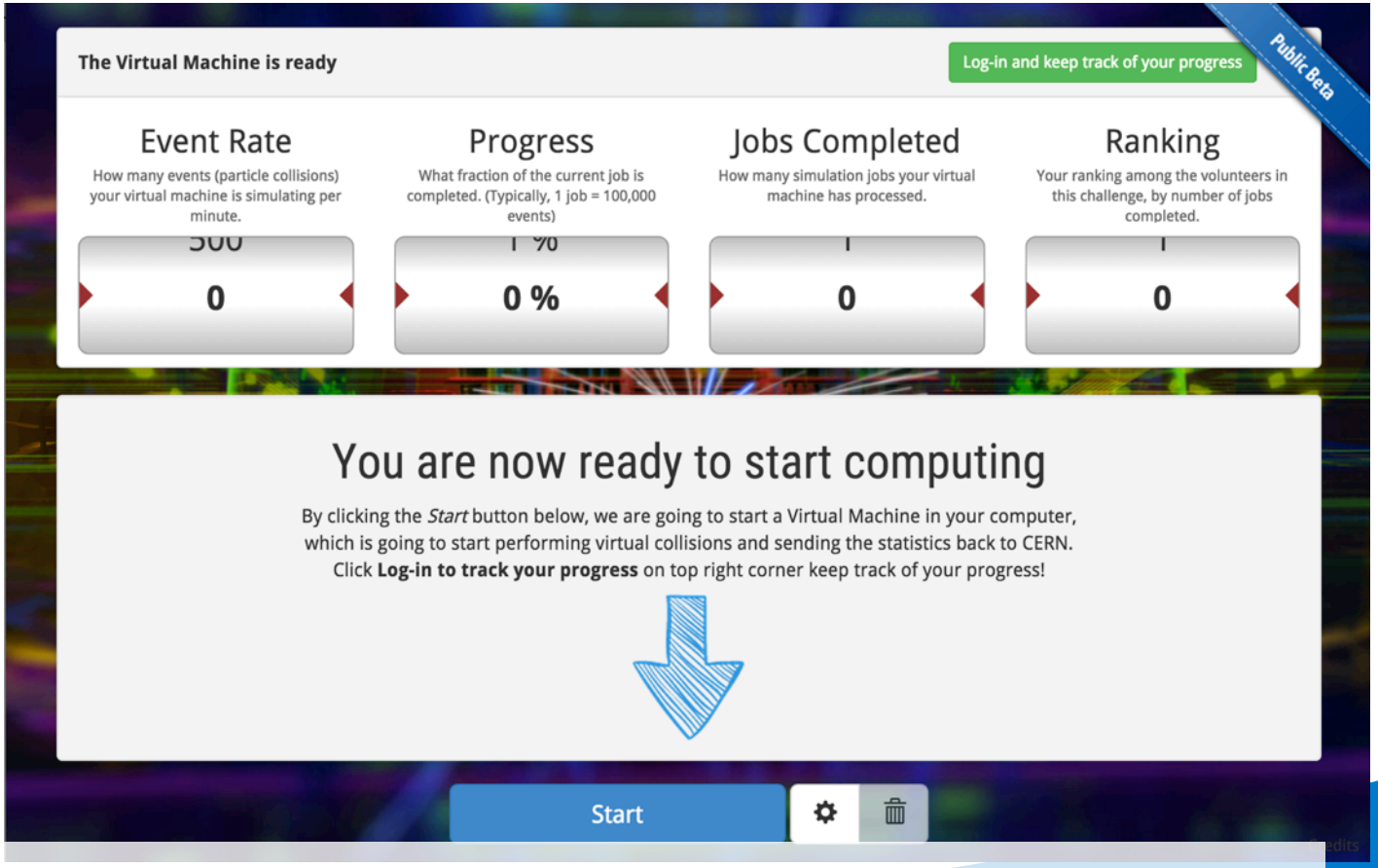
CernVM WebAPI



Confirm Website Request

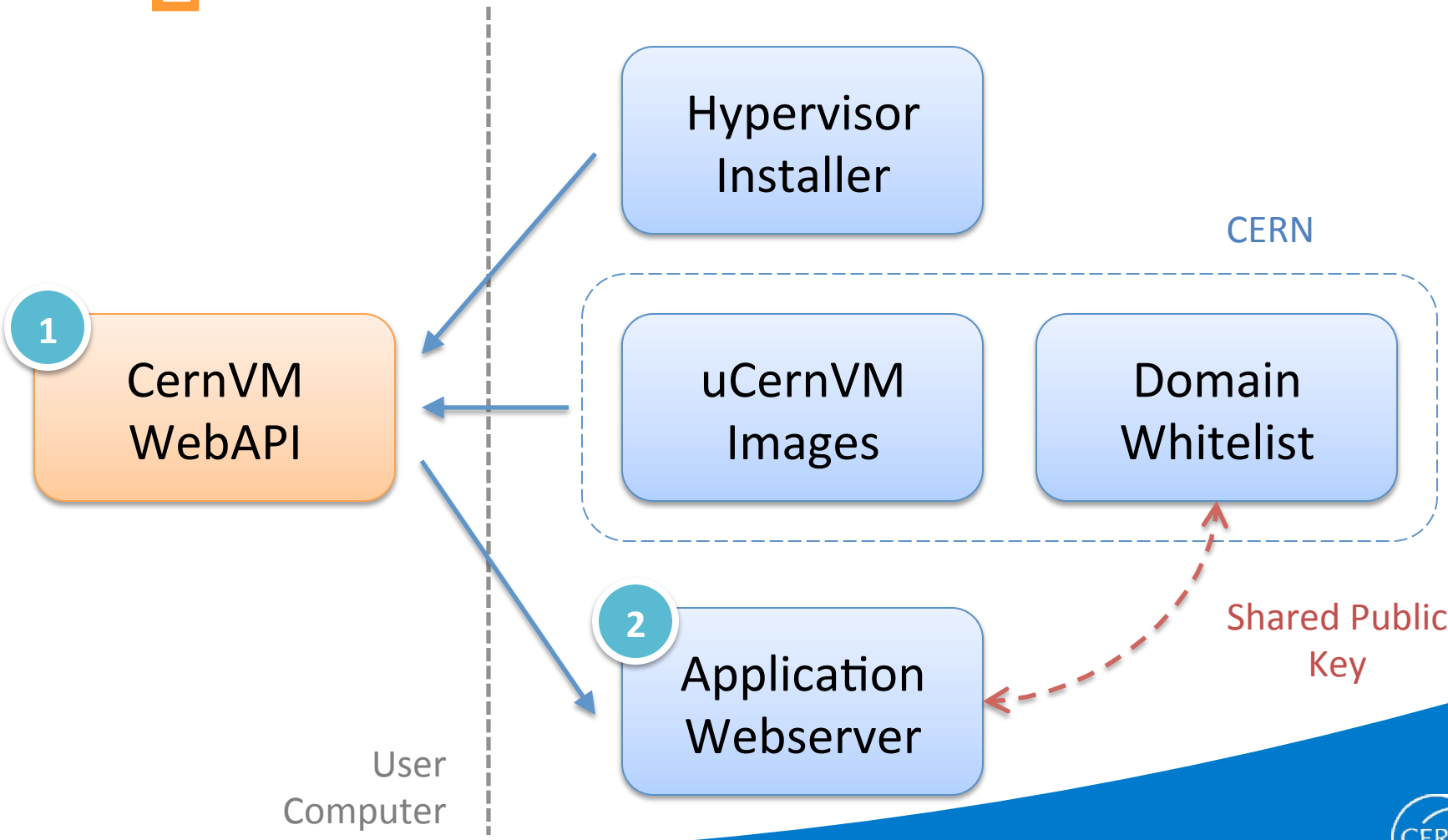


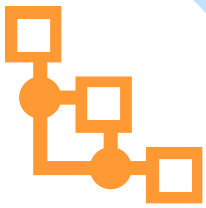
CernVM WebAPI



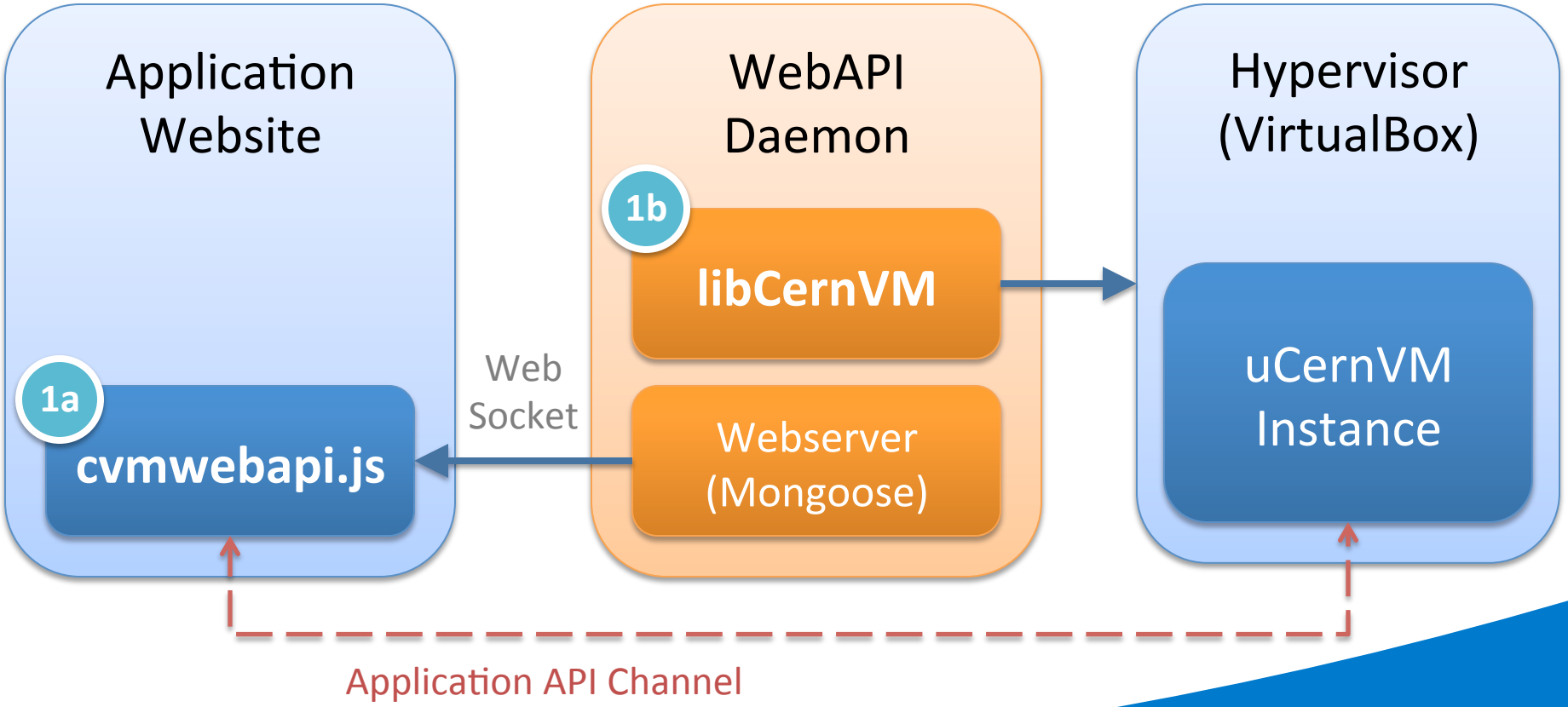
Ready to start computing

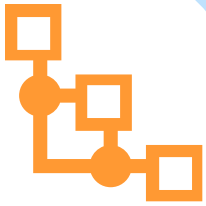
WebAPI Components





1 CernVM WebAPI



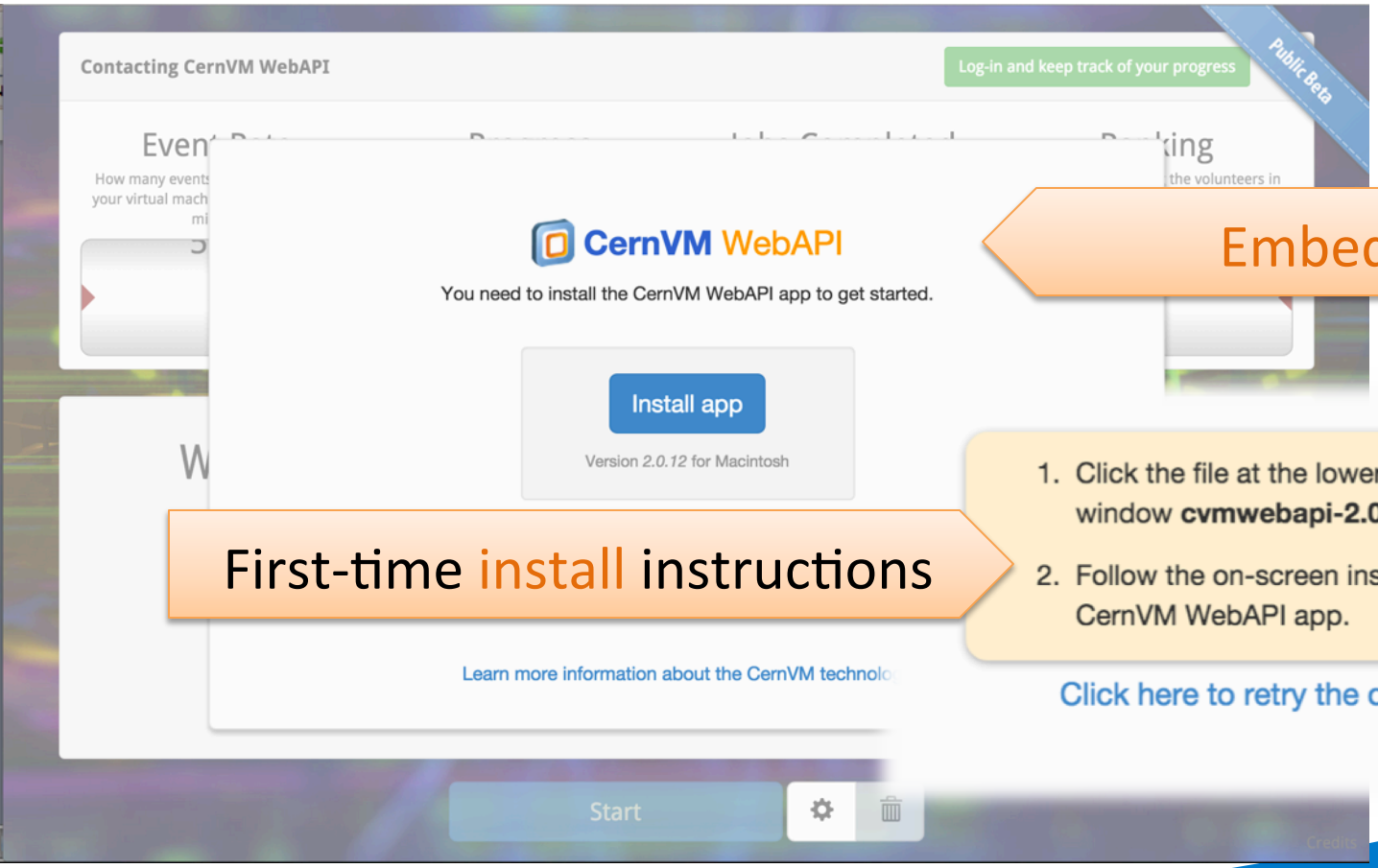


1a cvmwebapi.js

- 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

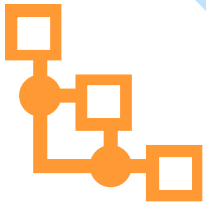


Embedded UI

First-time install instructions

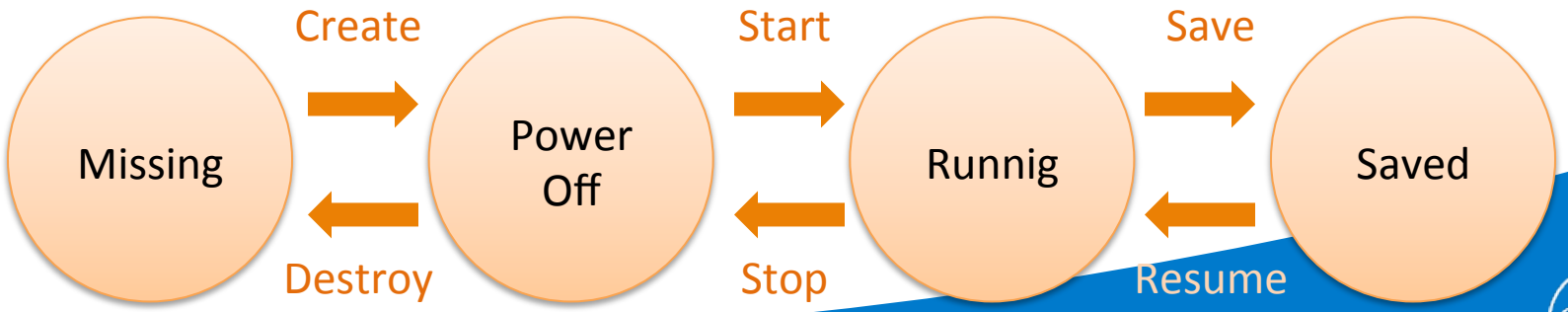
1. Click the file at the lower-left of your browser window **cvmwebapi-2.0.12.pkg**.
2. Follow the on-screen instructions to install the CernVM WebAPI app.

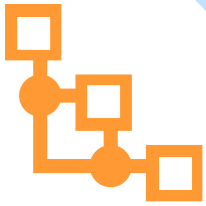
Click here to retry the download if it failed.



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

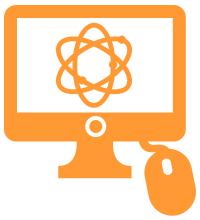




2 Application Webserver

- 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"
}
```



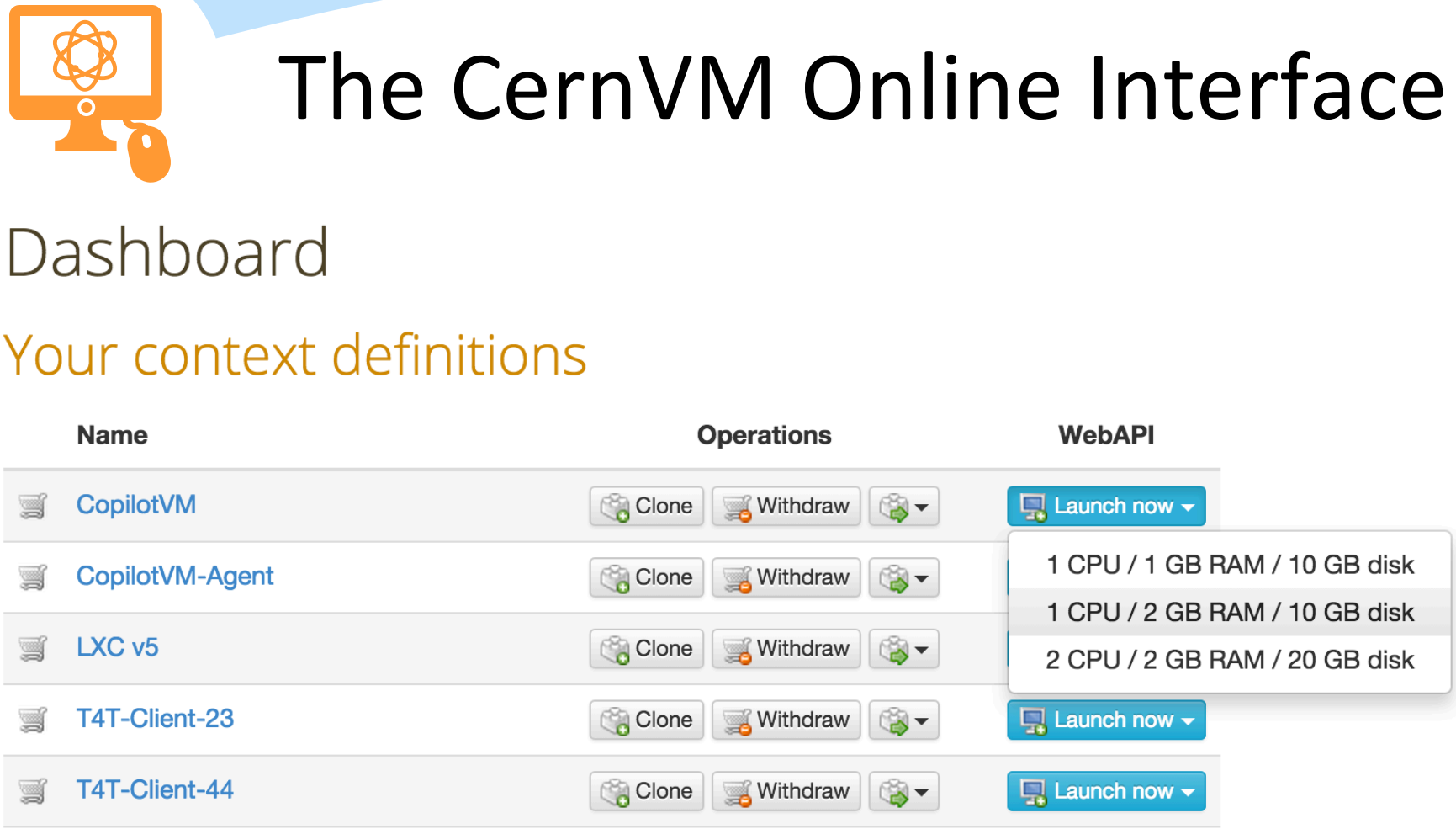
Use Cases

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

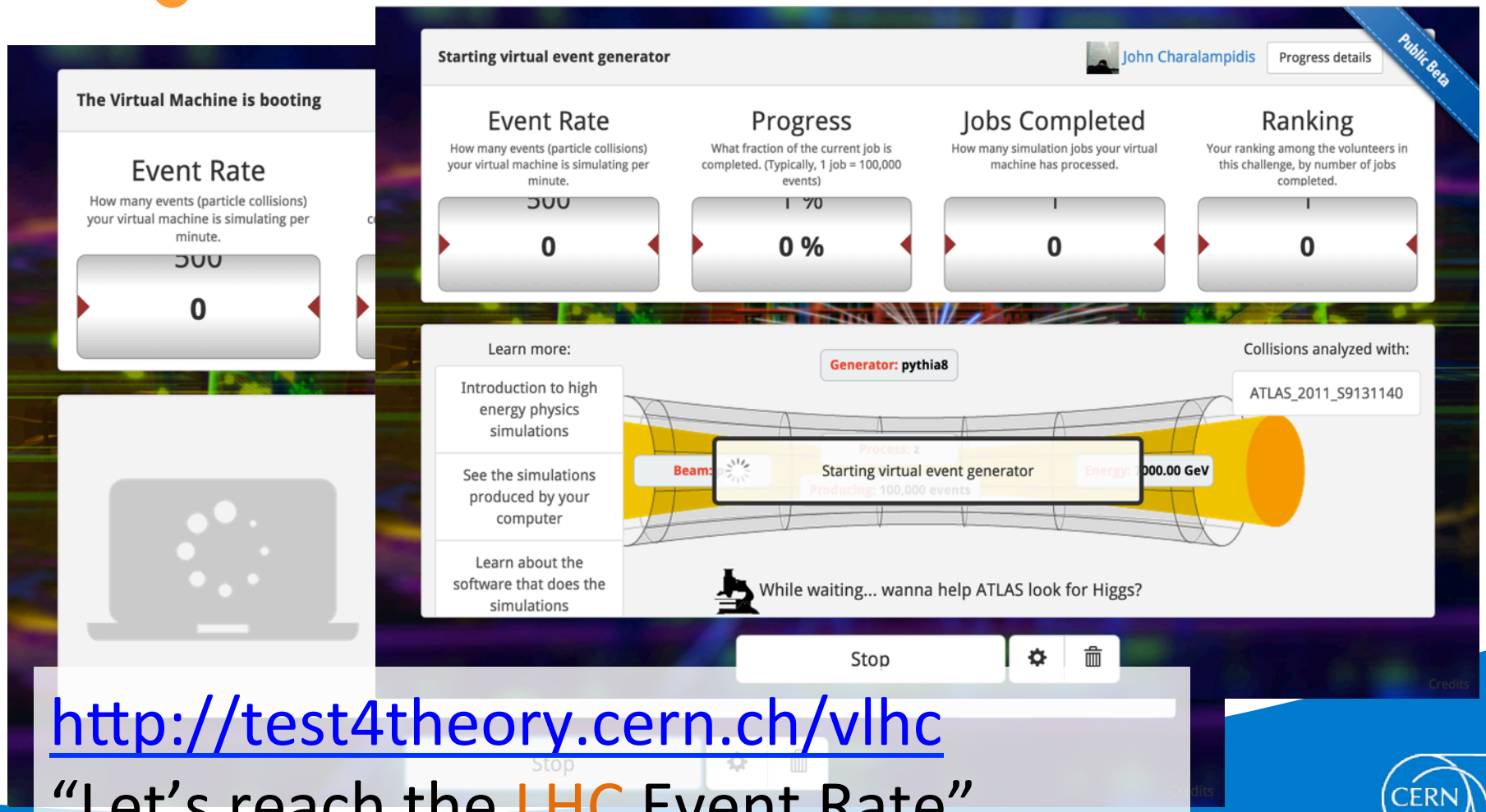
The CernVM Online Interface

Dashboard

Your context definitions



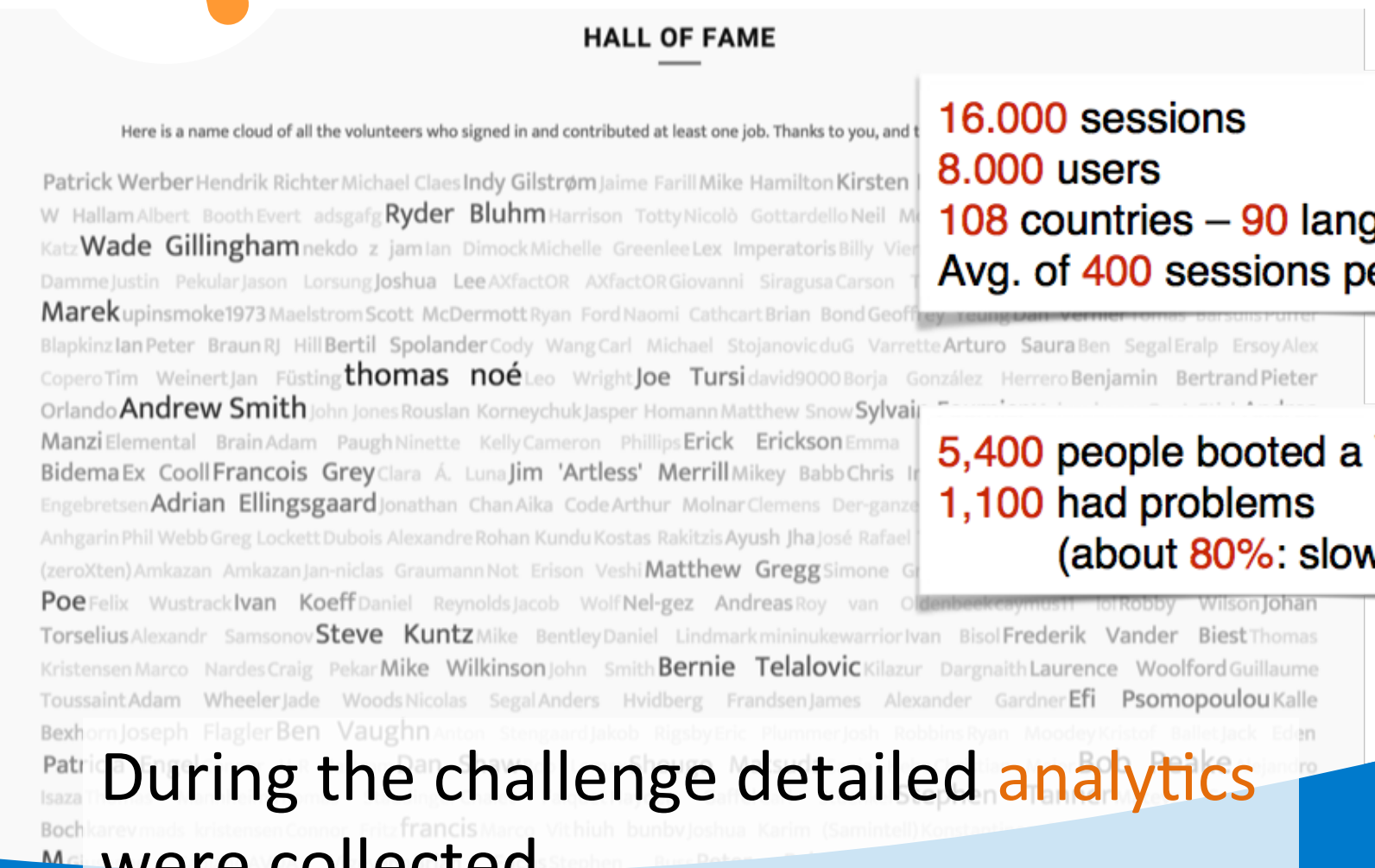
The CERN60 Challenge



http://test4theory.cern.ch/vlhc

"Let's reach the LHC Event Rate"

The CERN60 Challenge

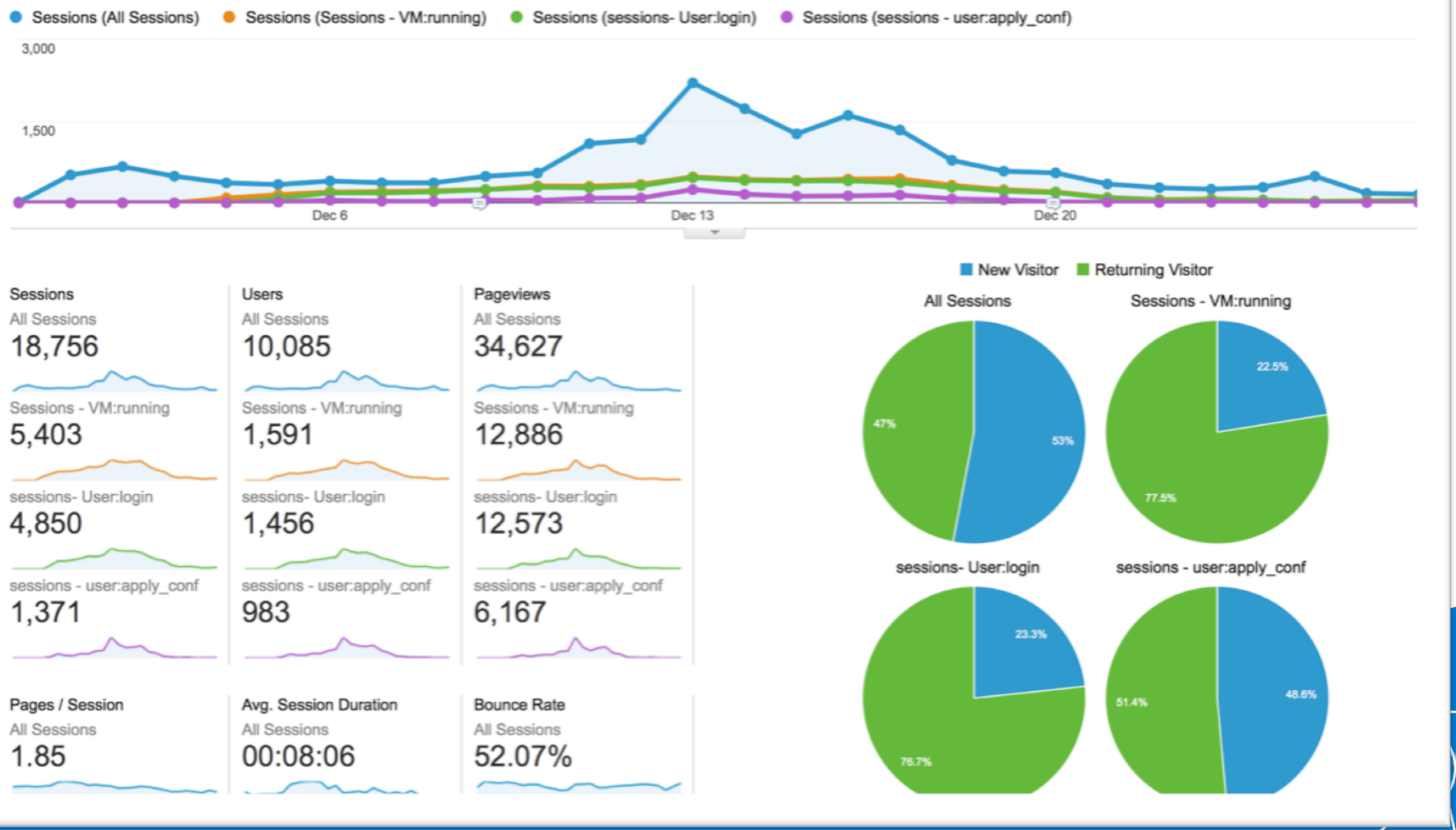


16.000 sessions
8.000 users
108 countries – 90 languages
Avg. of 400 sessions per day

5,400 people booted a VM
1,100 had problems
(about 80%: slow network)

During the challenge detailed analytics were collected

The CERN60 Challenge



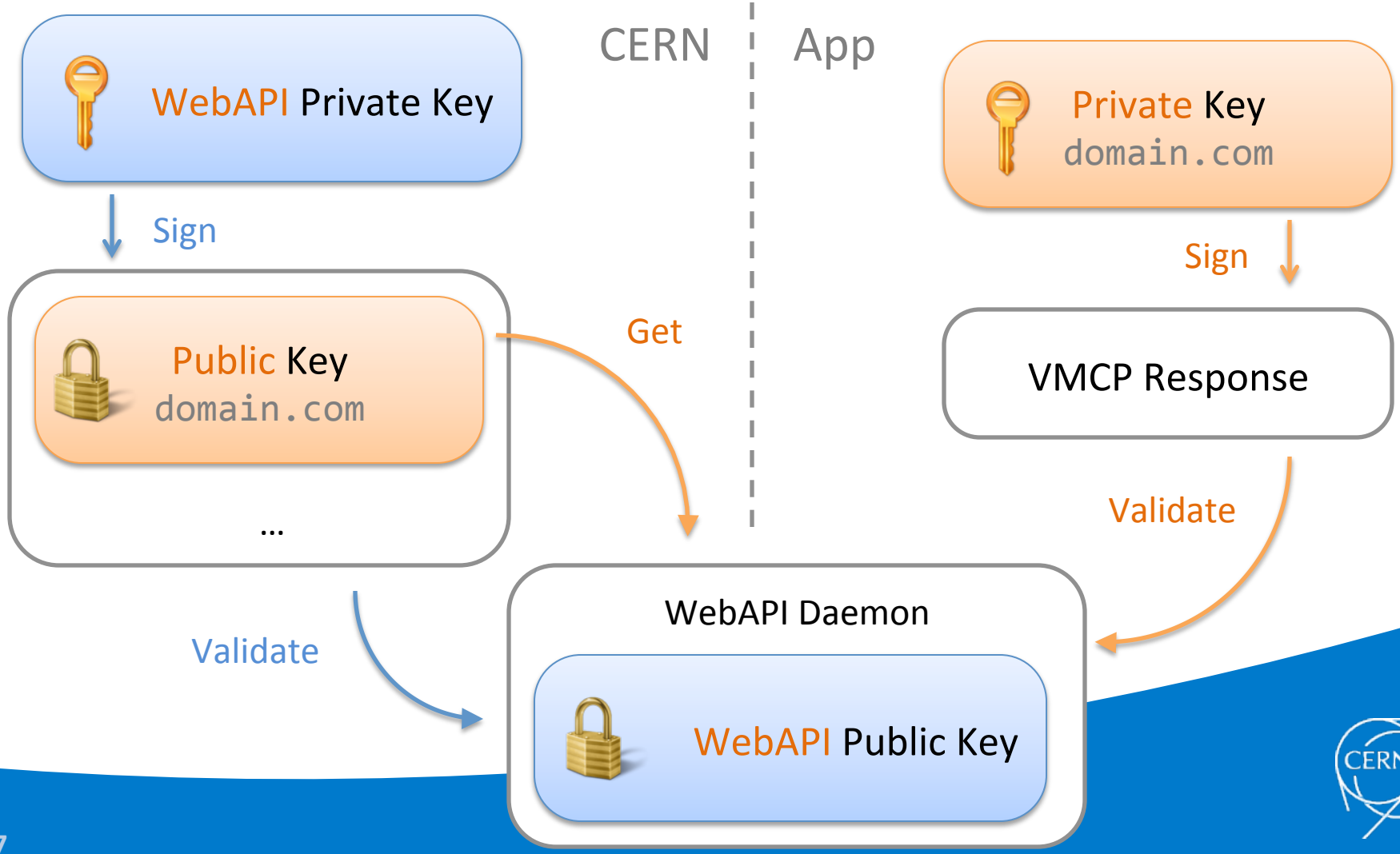
Questions ?

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

Offline questions: icharala@cern.ch

Spare Slides

Security & Trust



VMCP Handshake

Private Key
domain.com

1) Open Session

Referrer: **domain.com**

VMCP: **vmcp.domain.com/vm2**

WebAPI
Daemon

2) Contact VMCP

{ .. }

Web Server
vmp.domain.com

3) Validate & Handle

libCernVM

4) Respond

Session ID: **#123456**