



01 October 2014

JavaOne, San Francisco

Luis Rodríguez Fernández, CERN IT-DB-IMS, lurodrig@cern.ch

CERN Private Java Cloud: Deep Dive into On-Demand PaaS Internals



Outlook

- CERN
- PaaS. Motivation
- The Middleware Manager
- What's next?
- Key learnings

Your speaker...

- Luis Rodríguez Fernández
 - From Asturias, Spain
 - Likes bodyboard
 - Likes skate (longboard)
 - openlab fellow
 - At CERN: Weblogic as a Service Provider for CERN Web Applications: APEX & Java EE
 - Prior to CERN: Web applications and portals (OpenCMS, Vignette, Alfresco, Liferay)



The Middleware Manager

- Demo

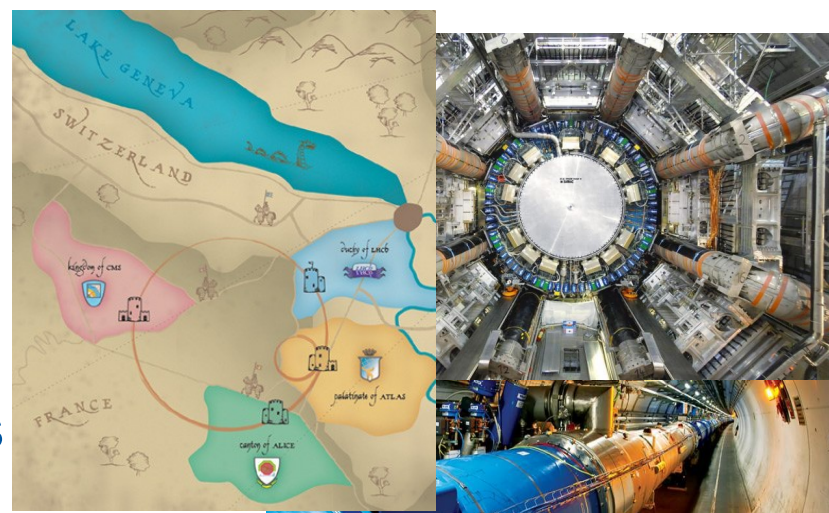


Outlook

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CERN

- Biggest Laboratory for Particle Physics (10000 people)
- Fundamental Research in Physics
 - Our mission is to understand the universe, how it works, what is made of?
 - The tools: accelerator particles and detectors



CERN



CERN



CERN



Outlook

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PaaS. Motivation

- The 90s were “*the good old days*”...
 - Relative Small number of boxes
 - Reduced community of developers



Demande Achat Interne - Microsoft Internet Explorer

Address: https://edv.cern.ch/Document/DAPPhone-88ED42

Demande Achat Interne (DAI)

Fields with asterisks (*) are obligatory and must be filled in. [Purchasing Guidelines](#)

General Description *: MAGNETIC SCREENING MATERIAL

Technical Contact *:

Supplier:

Country of Distribution: CH

Currency *: EUR Euro (1.57)

Total Value: €

Delivery Costs included *: No

Divisional Request (CEU) No.:

Articles appearing in the [CERN catalogue](#), or similar articles must be requisitioned from

Item	Quantity	Description
1	500	Nanocrystallin Imphy pour blindage Ruban en matière nanocrystallin Imphy avec adhésifs en polyester. 500 mètres selon échantillon déjà livré. Selon offre, 13034 Budget Codes: 96628, Country of origin: FR, Delivery: 866-1-A01, Activity Codes: 516, Enter goods in inventory: No Click to add a new line item

Additional information

Purchasing officer:

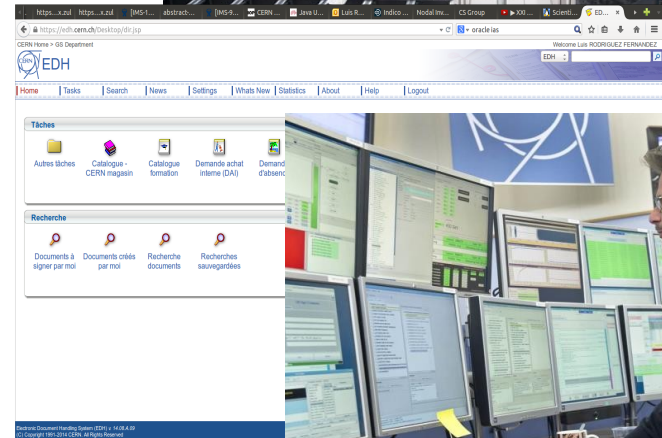
Comments to Purchasing officer:

This order concerns the



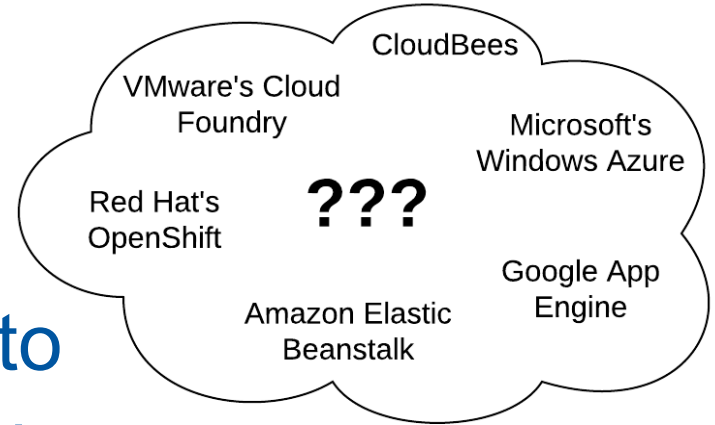
PaaS. Motivation

- ... but nowadays:
 - ~11.5K boxes
 - Cloud (Openstack + Puppet + Others)
 - ~3000 Hypervisors
 - ~8000 Virtual Machines
 - ~600 Users
 - And rapidly growing!
 - The developer community has exploded!



PaaS. Motivation

- Limited manpower:
 - No time and resources to invest in something new
- Custom PaaS:
 - Is not this reinventing the wheel?



PaaS. Motivation

- CERN IT provides us everything “out of the box”
 - Auth & AuthZ → CERN SSO (SAML2, ADFS2, Shibd, WLS)
 - Monitoring → EM & CERN monitoring infrastructure
 - Automatic DNS registration → CERN Web Services
 - User portal → CERN Web Services
 - Storage → CERN AFS & DFS Services (OpenAFS, WebDAV)
 - Machine provisioning and configuration → CERN Cloud (Openstack, Puppet)
 - Previous PaaS experience:
 - Database on Demand
 - CERN J2EE Public Service

The screenshot displays the Enterprise Manager Cloud Control 12c interface. At the top, there are navigation tabs for Enterprise, Targets, and Favorites. Below this is an 'Enterprise Summary' section with an 'Overview' tab. It shows 'Targets Monitored: 5409' and 'Status: Targets with Status 4019'. A pie chart indicates the status distribution: 90% Up (3,601), 7% Down (271), 2% Unknown (6), and 1% Under Blacklist. Below the chart is a 'Report Generator' section with options for Volumes Report, Servers Report, Partitions Report, and Pool Report. To the right, there are sections for 'Web Services' (Home, My websites, Service Status) and a 'Toolbox for current site' with various utility links like 'Delete lurodrig-mwmgr-examples', 'View site statistics', and 'Download site logs'. At the bottom, there is a 'Login information' section for 'Welcome Luis Rodriguez Fernandez (strong)' and an 'Instances overview' table.

DB Name	Host	Username	e-Group
mw_demo	db-S0021	lurodrig	mwm-administrators



Application details

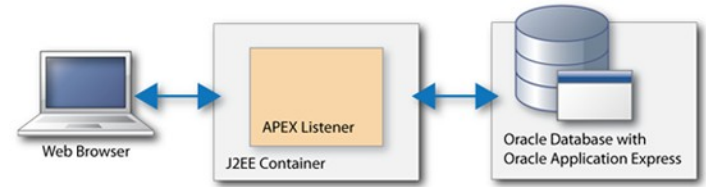
Application:	DBOnDemand
Owner:	goitardo
Created:	2011-08-25 16:37:27 093
Host:	j2ee13.cern.ch
Container:	102
Container type:	lvmca7054
AFS repository path:	/afs/cern.ch/project/j2ee/pep/DBOnDemand
Uses CERN Authentication:	yes
Container started:	yes

Application is available at the following URLs:

- <http://j2ee13.cern.ch/DBOnDemand/>
- <https://j2ee13.cern.ch/DBOnDemand/>

PaaS. Motivation

- CERN Oracle APEX integration
 - Current situation:
 - All applications shares the same infrastructure (Oracle Weblogic + Oracle HTTP server)
 - It is difficult to set different auth and authz settings
 - Oracle REST Data Services (formerly know as Oracle APEX listener)
 - Deploy it on demand

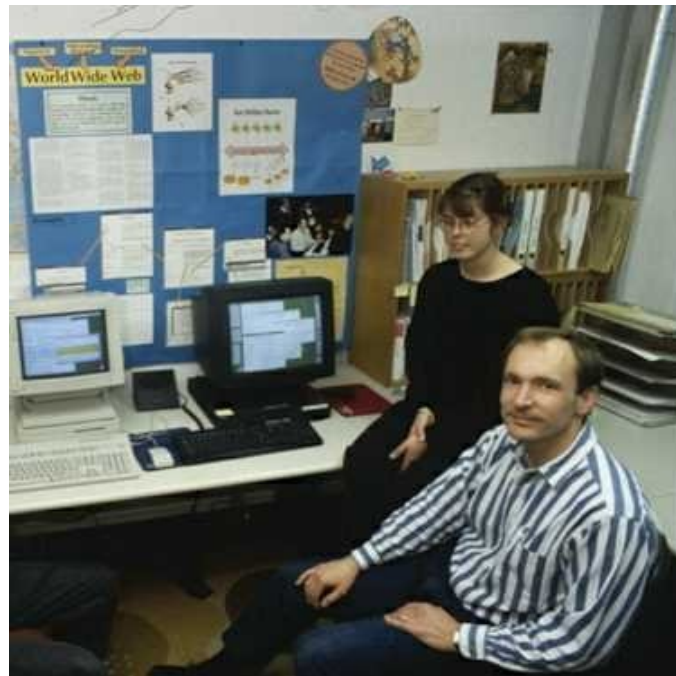


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The Middleware Manager

- Use case: Tim Berners Lee ask for three environments, dev, test and prod:
 - SSO integration
 - Federation
 - Manage authorization
 - Public and private access
 - Permanent storage
 - Third parties API connectivity
 - Customized keystores
 - Security policy customization
 - Third parties common libraries
 - Customized system classpath
 - “Exotic” JVM parameters
 - Multiple deployments
 - Different JVM versions

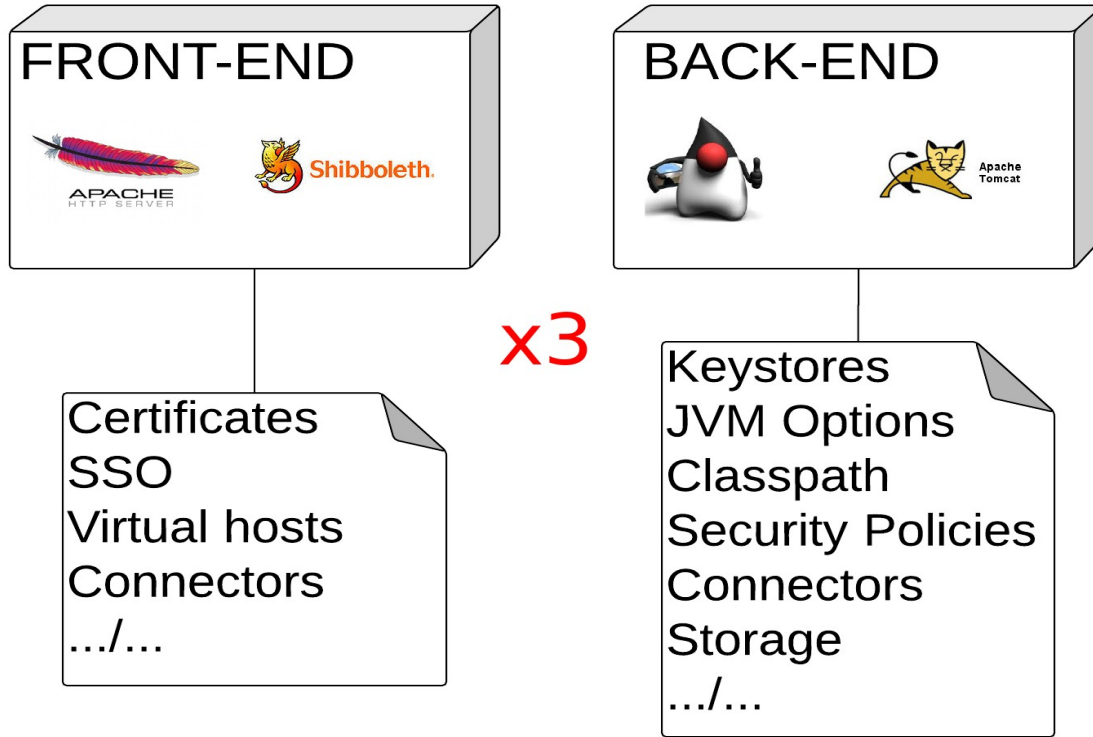


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The Middleware Manager



The Middleware Manager

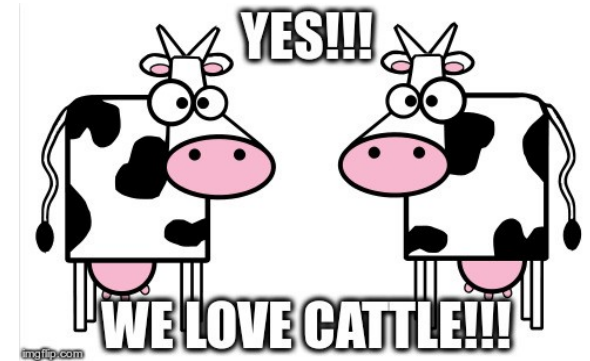


The Middleware Manager

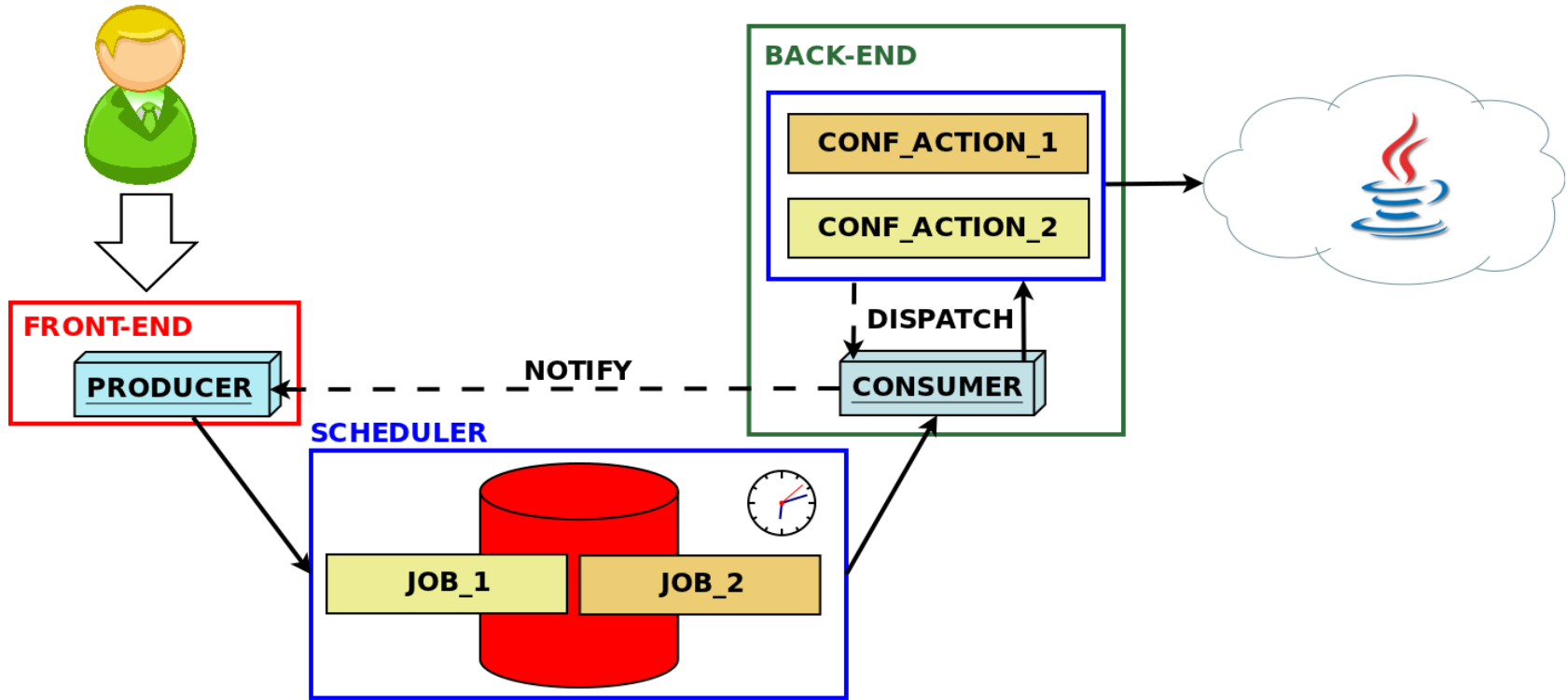


The Middleware Manager

- For the users:
 - Self selection of software type and version
 - Containers & applications configuration management
 - Auth & authz management
- For the administrators:
 - More control: who is the owner of, who is doing that...
 - No hand made installations: rpms and templates!!!
 - Easier migrations
- For both: one platform to rule them all!!!



The Middleware Manager



The Middleware Manager

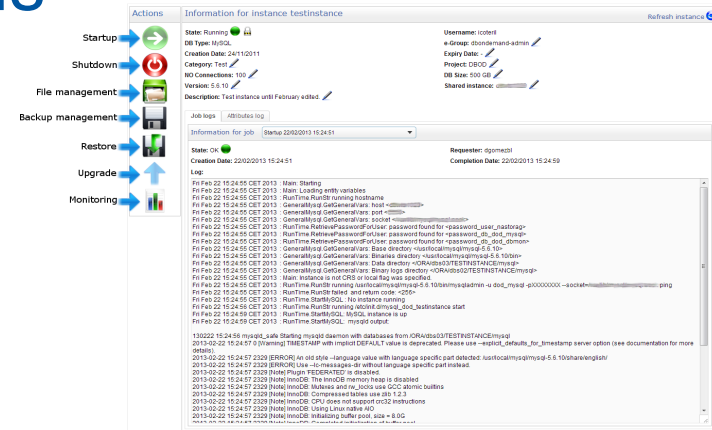
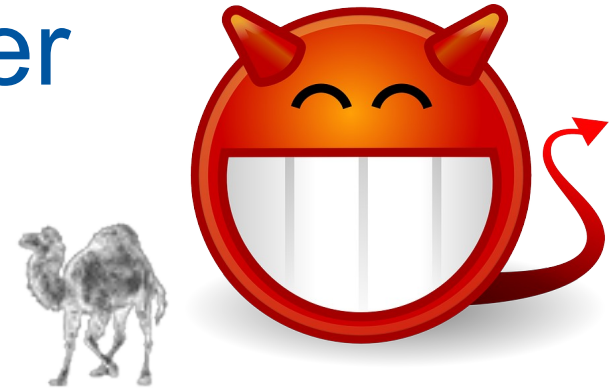


- Front end:
 - Java Web Application
 - Common user interface
 - Takes care of the system objects state
 - Provides API for third party systems

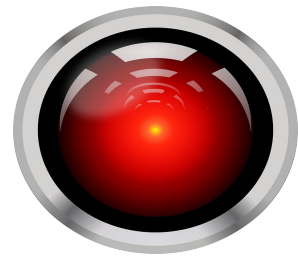


The Middleware Manager

- Scheduler:
 - Pick up the jobs, parse and transform them in commands
 - Send the commands to the back end.
 - Store the result in the jobs database



The Middleware Manager

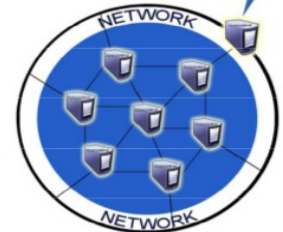


- Back end. Infrastructure System

Administration:

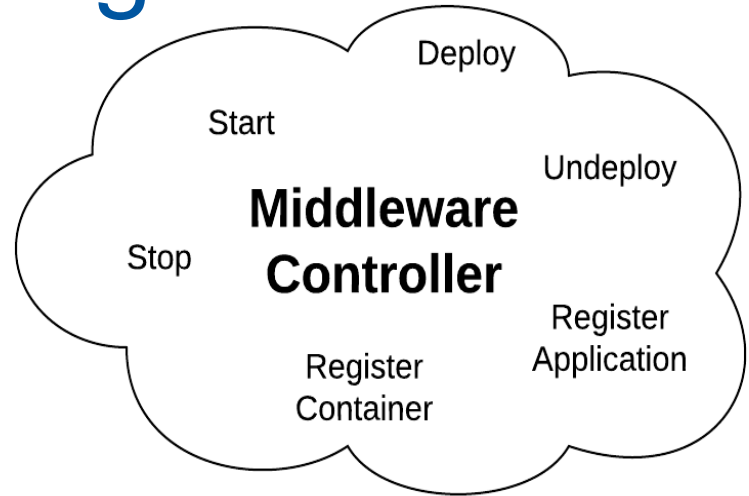
- Aka SYSCONTROL
- System object repository
 - Middleware
 - Databases
 - Storage
- Pick the command and deliver it to the right component

Attribute	Value
objectClass	SC-TOMCAT-SERVER
SC-TOMCAT-SERVER-NAME	default
SC-TOMCAT-SERVER-AJP-HOST	db-a0007
SC-TOMCAT-SERVER-AJP-PORT	10258
SC-TOMCAT-SERVER-AJPS-HOST	db-a0007
SC-TOMCAT-SERVER-AJPS-PORT	10259
SC-TOMCAT-SERVER-HTTP-HOST	db-a0007
SC-TOMCAT-SERVER-HTTP-PORT	10262
SC-TOMCAT-SERVER-HTTPS-HOST	db-a0007
SC-TOMCAT-SERVER-HTTPS-PORT	10263
SC-TOMCAT-SERVER-DEBUG-PORT	10260
SC-TOMCAT-SERVER-MULTICAST-PORT	10264
SC-TOMCAT-SERVER-JAVA-OPTIONS	%X:MaxPermSize=256m -Dch.cern.it.db.mw.agent.debug=false
SC-TOMCAT-SERVER-CATALINA-OPTIONS	-Dcom.sun.management.jmxremote -Dcom.sun.management.jmxremote.port=9000



The Middleware Manager

- Back end. Middleware controller:
 - Command implementation



Apache
Tomcat



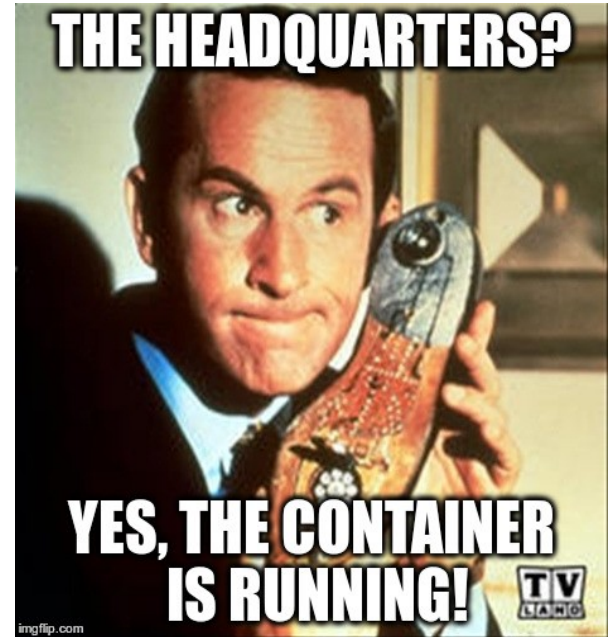
APACHE
HTTP SERVER



Shibboleth.

The Middleware Manager

- Back end. Application Server Agent:
 - Servlet
 - Container & applications status
 - JVM metrics

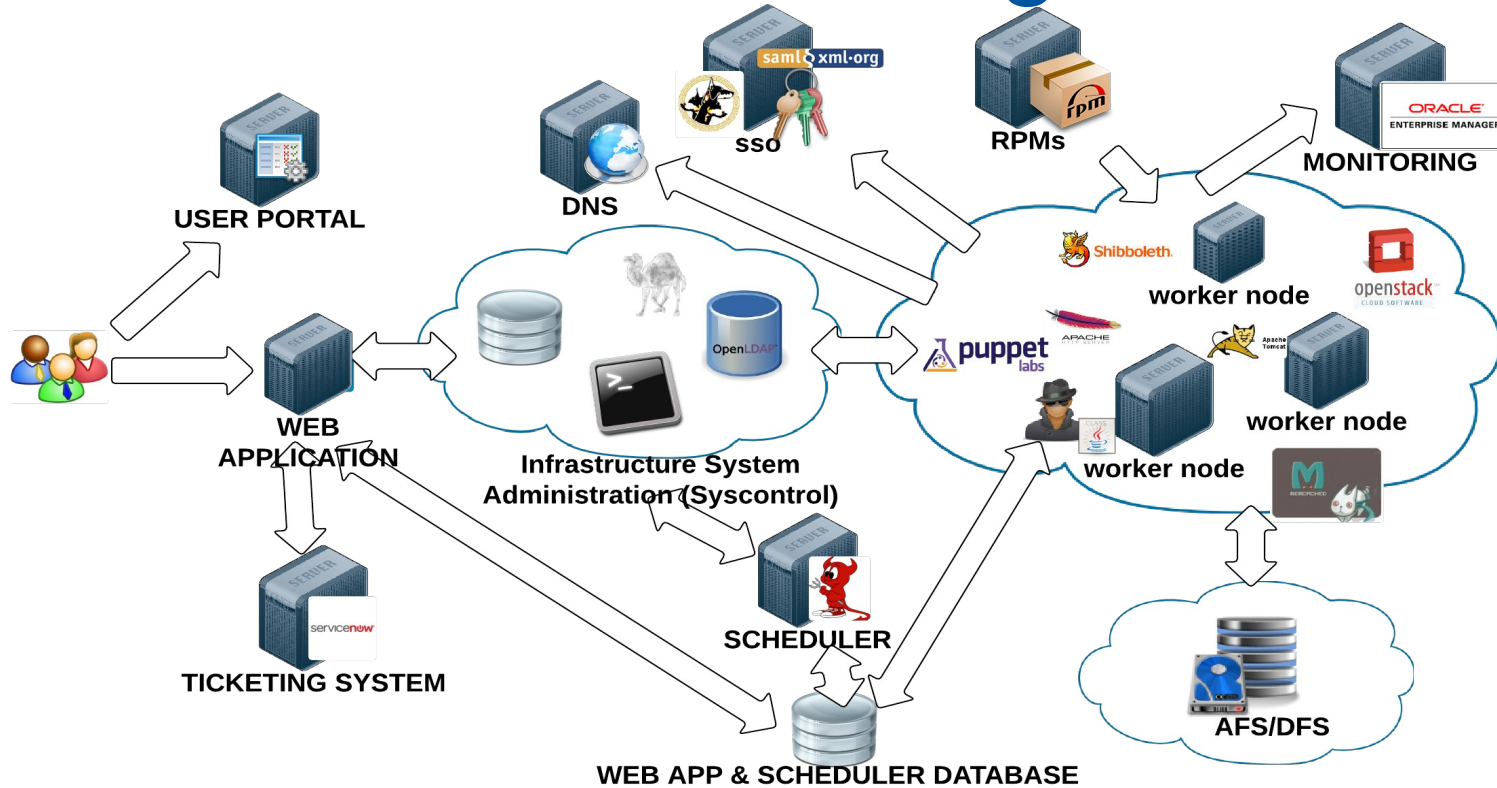


The Middleware Manager

- Infrastructure:
 - Set of pre-configured machines:
 - OpenStack + Puppet
 - RPMs
 - Templates



The Middleware Manager



The Middleware Manager

- Demo



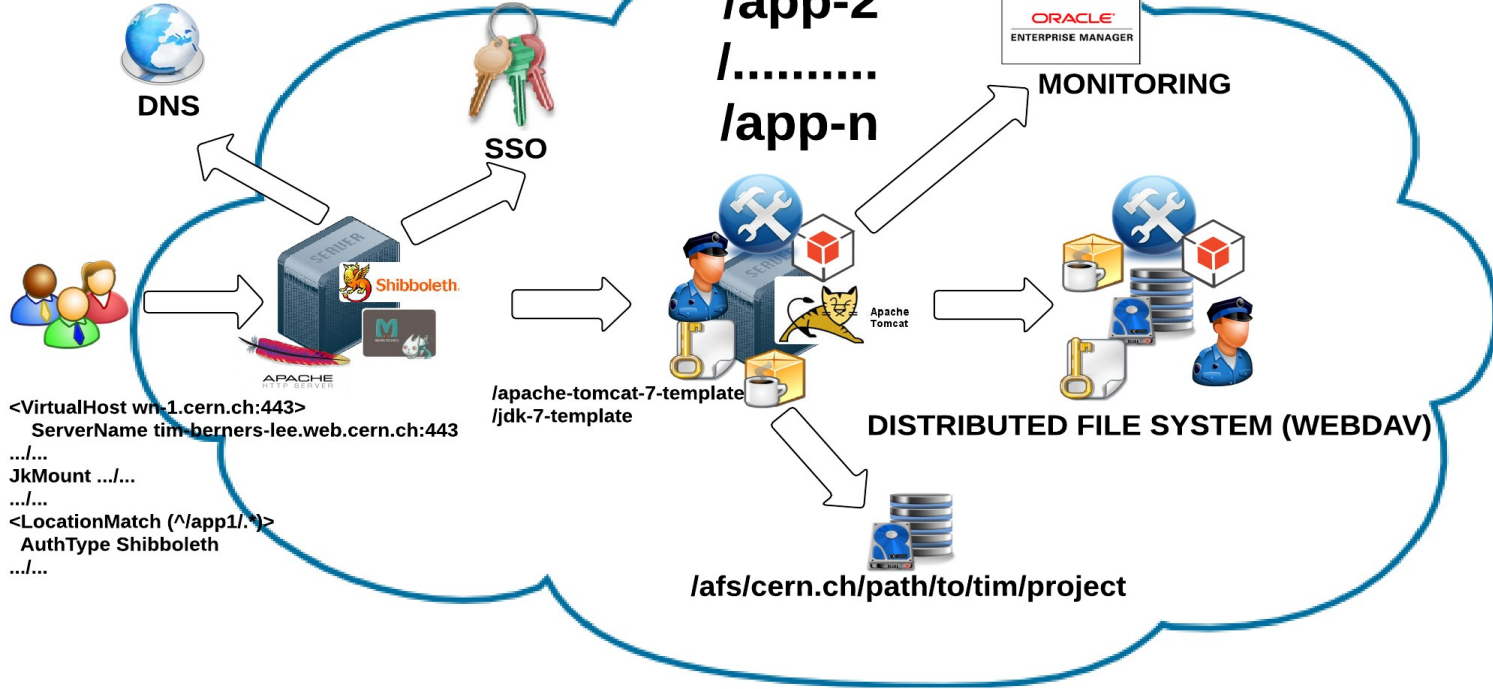
The Middleware Manager

tim-berners-lee.web.cern.ch/app-1

/app-2

/.....

/app-n



```
<VirtualHost wn-1.cern.ch:443>  
  ServerName tim-berners-lee.web.cern.ch:443  
  .../...  
  JkMount .../...  
  .../...  
<LocationMatch (^/app1/.*)>  
  AuthType Shibboleth  
  .../...
```

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What's next?

- New Application Servers:
 - Oracle Weblogic
- Cluster mode
- Re-factor the scheduler
- Full REST API
 - Command line interface
 - Integration in users scripts

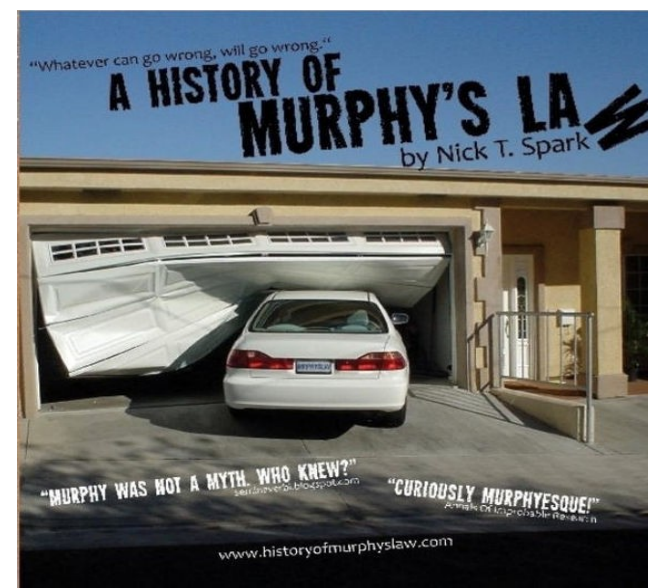


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Key learnings

- *“The Laws of the Cloud”*:
 - The flutter of a butterfly's wings can cause a hurricane on the other side of the world
 - *“Anything that can go wrong will go wrong”* (Murphy's law)
- *“Every shortcut has a price usually greater than the reward”* (Bryant McGill)
- Sometimes you have to find compromises
 - Move forward vs discussions
 - Developers vs administrators
- Give the power to the developers without give them the *“keys of the kingdom”*
- - Don't get your hands dirty. Build platforms that do it for you!!!



Acknowledgements

- **All the IT-DB** group members and especially
 - **IT-DB-IMS**: Paul Smith, Artur Wiecek, Giacomo Tenaglia, Nicolas Bernard Marescaux, Arash Khodabadeh and José Daniel Cano
 - **DBOD team**: Ruben Aparicio, Ignacio Coterillo, Daniel Gómez, David Collados, David Wojcik
- Borja Aparicio, Alvaro González and Nacho Barrientos: IT-PES
- Manuel de Malo, Mario Rey, Paolo Tedesco and Emmanuel Ormancey: IT-OIS
- Joao Silva, Derek Mathieson, David González and José Bobes: GS-AIS
- Aleksandra Wardzinska and Matthias Braeger: GS-ASE
- Donat Csikos: BE-CO

Acknowledgements



ORACLE®



HUAWEI



CERN
openlab

SIEMENS

Yandex

THANK YOU!!!



Contact: lurodrig@cern.ch

Databases at CERN blog:

- cern.ch/db-blog
- Check it out, there are Java and Middleware recipes as well!

Credits

- Presentations

- Derek Mathieson: CERN: Accelerating Java. JavaOne 2008
 - https://www.youtube.com/watch?v=byAqe5TG_uU
 - <https://www.youtube.com/watch?v=aZVwtVIGfg8>
- David González Maline and José Bobes Bascarán: A Common Development Framework: From JSP to GSP at CERN. JavaOne 2012
 - <https://www.youtube.com/watch?v=M6ySTiNKDsA>
- Tim Bell: Accelerating Science with Puppet. PuppetConf 2012
 - <http://puppetlabs.com/blog/watch-and-learn-puppetconf-2012-videos>
- Nacho Barrientos: Agile Infrastructure Project. JINR/CERN Grid and Advanced Information Systems, Dubna 2013
 - <http://ais-grid-2013.jinr.ru/docs/23/2-CERN%27s%20Agile%20Infrastructure%20project.pdf>
- Donat Csikos: How CERN scaled up Eclipse for the LHC. EclipseCon Europe 2013
 - <https://www.youtube.com/watch?v=XqvchlYeEmE>
- Derek Mathieson: History of Java @ CERN. A visit to CERN, Celebrating 25 years of WWW Java Swiss User Group 2014
- Joao Silva: A Web Application Framework for Administrative Applications. A visit to CERN, Celebrating 25 years of WWW Java Swiss User Group 2014
 - <http://www.jug.ch/html/events/2014/cern.html>
- Derek Mathieson and Joao Silva: CERN: from an IT Perspective. SINFO 2014
 - <https://www.youtube.com/watch?v=OFg9m81A-pl>

Credits

- Diagrams
 - Lucidchart
 - <https://www.lucidchart.com/>
 - Dia
 - <https://wiki.gnome.org/Apps/Dia/>
- Pictures
 - Luis R. bodyboard and skate pictures courtesy of **Tarek Halabi**
 - <http://tarekhalabi.blogspot.ch>
 - Twitter: @HalabiTarek

Credits

- Pictures
 - Memes
 - <https://imgflip.com/memegenerator>
 - Tim Berners-Lee with Nicola Pellow, the writer of the line-mode browser for the World Wide Web next to the NeXT computer in 1991.
 - <https://cds.cern.ch/record/1164401>
 - Daemon
 - <http://pixabay.com/en/devilish-devil-demonic-smiley-red-98451/>
 - Perl camel
 - http://st.pimg.net/perlweb/images/camel_head.v25e738a.png
 - Shell linux
 - <http://pixabay.com/en/bash-command-line-linux-shell-148836/>
 - OpenLdap
 - <http://upload.wikimedia.org/wikipedia/commons/7/71/Database-openldap.svg>
 - Work in progress
 - <http://pixabay.com/en/work-in-progress-sign-activity-24027/>
 - Computer Center in 1997
 - https://mediastream.cern.ch/MediaArchive/Photo/Public/1997/9707032/9707032_07/9707032_07-A5-at-72-dpi.jpg
 - Computer Center Nowadays
 - https://mediastream.cern.ch/MediaArchive/Photo/Public/2012/1207154/1207154_05/1207154_05-A5-at-72-dpi.jpg

Credits

- LHC
 - <http://home.web.cern.ch/topics/large-hadron-collider>
- ATLAS experiment
 - <http://home.web.cern.ch/sites/home.web.cern.ch/files/styles/medium/public/image/experiment/2013/01/atlas.jpeg?itok=hwJdplgu>
- Tim Berners Lee office
 - <http://davidgalbraith.org/blg/wp-content/uploads/2010/07/theroom.png>
- Tim Berners Lee
 - <http://home.web.cern.ch/sites/home.web.cern.ch/files/image/topic-stub/image/bernerslee.jpg>
- Square Wheel
 - https://c1.staticflickr.com/1/206/514733529_d024f328b5_z.jpg?zz=1
- Robots
 - http://upload.wikimedia.org/wikipedia/commons/5/5e/KUKA_Industrial_Robots_IR.jpg
- Murphy's law
 - http://upload.wikimedia.org/wikipedia/commons/thumb/1/1d/Book_cover_of_%22A_History_of_Murphy%27s_Law%22.jpg/575px-Book_cover_of_%22A_History_of_Murphy%27s_Law%22.jpg
- All openlab logos taken from:
 - <http://openlab.web.cern.ch/>
- Spain National Football Team
 - http://upload.wikimedia.org/wikipedia/commons/3/36/Spain_national_football_team_Euro_2012_trophy_02.jpg

Credits

- Llanes (Asturias) Port Lighthouse
 - http://upload.wikimedia.org/wikipedia/commons/c/cc/Faro_llanes_asturias.jpg
- Pearl Jam
 - <http://upload.wikimedia.org/wikipedia/commons/8/85/PearlJam-Oakland-2013.JPG>
- Apache-Tomcat logo
 - <http://upload.wikimedia.org/wikipedia/commons/6/66/Tomcat.svg>
- Apache HTTP Server logo
 - <http://upload.wikimedia.org/wikipedia/commons/b/b9/ASF-logo.png>
- Shibboleth logo
 - http://www.internet2.edu/media/medialibrary/2013/10/15/image_shibboleth_logowordmark_color.png
- ZK logo
 - <http://www.zkoss.org>
- Hibernate logo
 - <http://hibernate.org/>
- Bike2work
 - <http://cds.cern.ch/record/1710372?ln=en>
- Artificial Intelligence. Hal 9000
 - <http://pixabay.com/en/artificial-intelligence-155161/>
- Agent
 - https://c1.staticflickr.com/3/2185/2497643461_288bfb2f8c.jpg
- Oracle APEX listener
 - <http://michaelhichwa.blogspot.ch/2010/07/as-of-june-28-2010-oracle-apex-listener.html>



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