



Your Connection to **ICT** Research

De l'open source à l'open cloud

Rencontres Mondiales
du Logiciel Libre
Développement logiciel

Beauvais (France) – 08 juillet 2015

robert.viseur@cetic.be

FEDER



UNION EUROPÉENNE



Wallonie



LE FONDS EUROPEEN DE DEVELOPPEMENT REGIONAL
ET LA WALLONIE INVESTISSENT DANS VOTRE AVENIR.

- Je suis : Dr Ir Robert VISEUR.
- Ingénieur civil, Docteur en sciences appliquées de la Faculté Polytechnique de l'UMONS (www.umons.ac.be).
- Assistant dans le Service de Management de l'Innovation Technologique de la Faculté Polytechnique de l'UMONS(www.umons.ac.be).
- Senior R&D Expert au CETIC (www.cetic.be).
- Photographe indépendant (www.derrierelevisueur.be).

De l'open source à l'open cloud

- Cloud computing ?

*« Modèle de services IT dans lequel les services informatiques (à la fois matériel et logiciel) sont fournis à la demande aux clients, au travers d'un réseau, indépendamment du terminal et du lieu »
(Marston et al., 2011).*

- Modèles de service :
 - Software as a Service (SaaS) :
 - Application pour l'utilisateur final, hébergée dans le cloud.
 - Exemples : Google Mail, Google Documents,...
 - Platform as a Service (PaaS) :
 - Environnement de développement et de déploiement d'applications.
 - Exemples : Microsoft Azure, Google App Engine,...
 - Infrastructure as a Service (IaaS) :
 - Stockage et capacités de calcul.
 - Exemples : Amazon S3, Amazon EC2,...

- Modèles de déploiement :
 - Cloud privé :
 - Déploiement dans le réseau de l'entreprise.
 - Cloud public :
 - Déploiement sur une plate-forme externe.
 - Exemples : Amazon (EC2) ou Microsoft (Azure).

Deployment Models

Private Cloud

Community Cloud

Public Cloud

Hybrid Clouds

Service Models

Software as a Service (SaaS)

Platform as a Service (PaaS)

Infrastructure as a Service (IaaS)

Essential Characteristics

On Demand Self-Service

Broad Network Access

Rapid Elasticity

Resource Pooling

Measured Service

Common Characteristics

Massive Scale

Resilient Computing

Homogeneity

Geographic Distribution

Virtualization

Service Orientation

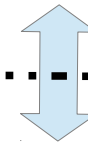
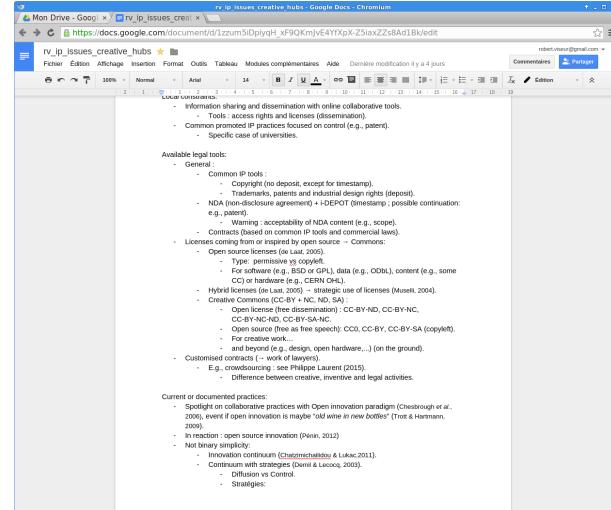
Low Cost Software

Advanced Security

- Selon le cabinet IDC (idc.fr), le cloud computing représentait en France (2012) :
 - un budget de près de 2 milliards d'euros,
 - 12% du total des dépenses informatiques des entreprises (hors tablettes et smartphones).
- Selon le cabinet PAC (www.pac-online.com), le marché du SaaS :
 - serait le plus développé,
 - représenterait 62% des utilisations du cloud computing en France.
- Le cloud computing touche aussi le grand public :
 - Services en ligne de type SaaS.
 - Exemples :
 - Services de messagerie offerts (e.g. Facebook),
 - Services de courrier électronique (e.g. Google Mail),
 - Outils de bureautique en ligne (e.g. Google Documents).

- 10 critères de l'Open Source Definition (opensource.org) :
 - redistribution libre,
 - **code source**,
 - œuvres dérivées,
 - intégrité du code source de l'auteur,
 - non-discrimination contre des personnes ou groupes,
 - non-discrimination contre des champs d'application,
 - distribution de licence,
 - la licence ne doit pas être spécifique à un produit,
 - la licence ne doit pas restreindre d'autres logiciels,
 - la licence doit être neutre sur le plan technologique.

Logiciel sur poste de travail vs SaaS



- Problèmes potentiels :
 - Continuité de service en cas de défaillance d'un fournisseur ?
 - Accès aux données ?
 - Exploitation ultérieure des données ?
 - Migration vers un fournisseur concurrent ou une infrastructure interne ?
 - ...

- Large éventail d'applications sur poste de travail.
- Versions cloud...
 - émergentes (utilisateur final) ou...
 - diffusées (professionnels).
- Modification des modèles d'affaires :
 - Etude sur Compiere, ERP5 (Nexedi), Magento, OpenERP et SugarCRM.
 - Développement d'une nouvelle source de revenu (abonnements).
 - Evolution des licences (davantage de projets sous OSL et AGPL).
 - Evolution du métier d'éditeur vers celui de fournisseur de services.
 - Faible adhésion aux définitions d'open cloud.
- Développement des logiciels PaaS / IaaS open source.
 - Exemples : OpenStack, Eucalyptus, OpenNebula, OpenShift,...
 - Logique industrielle
 - domination de la licence Apache.
- Labels « *open cloud* », label « *Offre Libre* » (offrelibre.com).



Open-Source Software

Azure supports a large and growing number of open-source applications, frameworks, and languages, as a result of Microsoft's collaboration with the open source community. We understand that developers want to use the tools that best fit their experience, skills, and application requirements, and our goal is to enable that choice.

Developers working in [.NET](#), [Java](#), [PHP](#), [Node.js](#), and [Python](#) can use the freely available SDKs for those languages to get started quickly and take full advantage of Azure services. Developers working in any language can use Azure services through established standards such as REST and HTTP as well as emerging standards such as AMQP and OData.

The open-source community also provides many technologies that developers can use to build on Azure. This page lists some of the most popular open-source software available for use on Azure today, and the list will continue to grow in the future.

Apache Ant

Apache Ant is a Java library and command-line tool for driving processes that can be described in build files as targets and tasks. Ant supplies a number of built-in tasks that programmers use to compile, assemble, test and run Java applications; it can also be used effectively to build applications written in languages other than Java, such as C or C++. The Azure Starter Kit for Java (wastarterkit4java.codeplex.com) provides an Ant task extension for building Azure packages.



[learn more](#) | [how to use](#)

ALT Linux

ALT Linux is a linux distribution founded by a Russian software organization. ALT Linux produces various distributions for different purposes, including: desktop for home or office, development, and corporate servers.



[learn more](#) | [how to use](#)

AppFog

AppFog provides a platform as a service (PaaS) infrastructure for web developers that can be hosted on any infrastructure as a service (IaaS) platform. Originally targeted at PHP, AppFog now supports PHP, Node.js, Ruby, Python, Java, .NET, MySQL and PostgreSQL.



[learn more](#) | [how to use](#)

- Exemple (Google Data Liberation Front) :

Download your data

You can download the data associated with your Google Account so that you can use it in another service or keep a copy for your records.

You can request this info using the "Download your Data" tool. Here's how:

Start your download

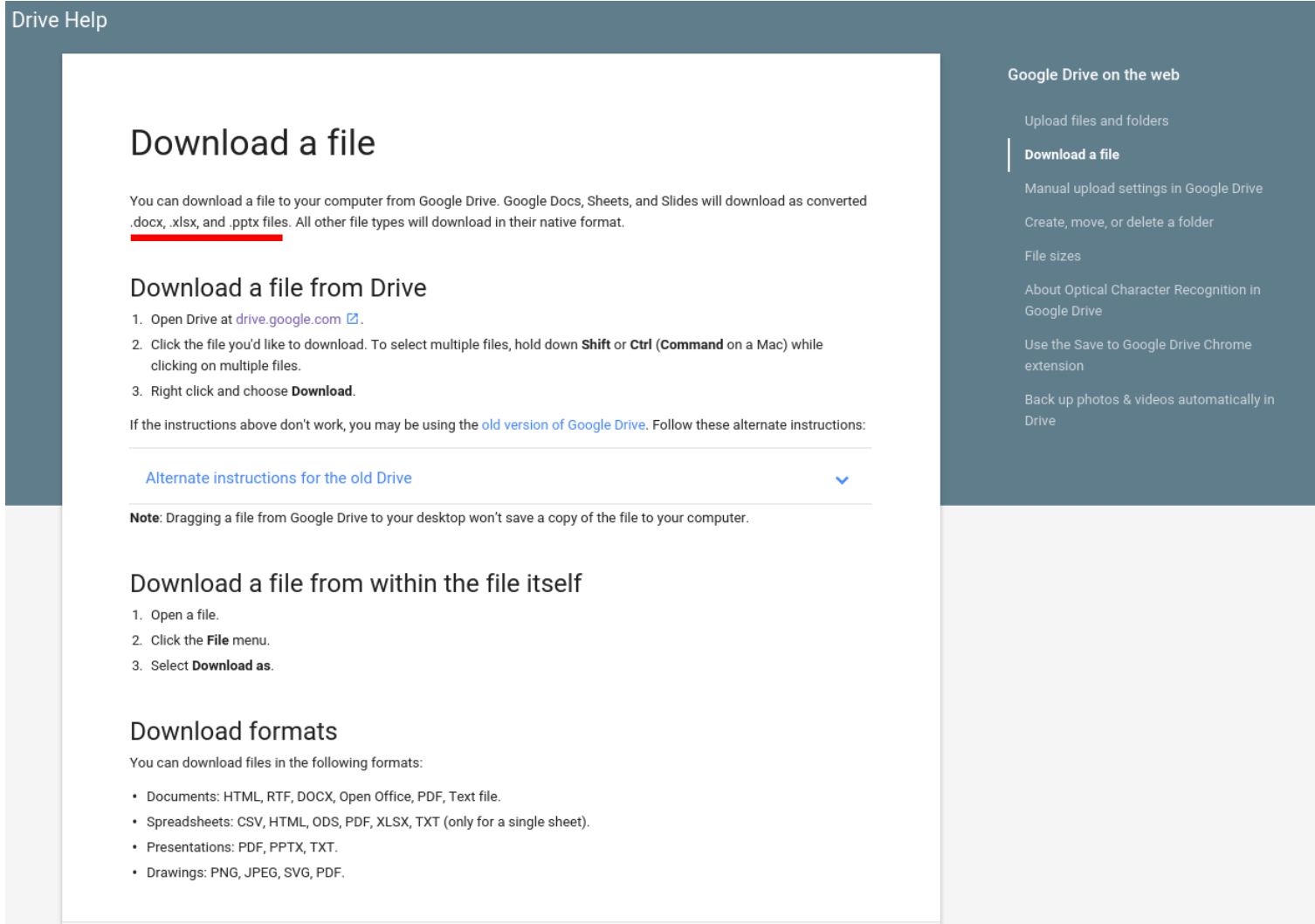
1. Sign in to [My Account](#).
2. In the "Personal Info & Privacy" section, select **Control your content**.
3. In the "Download your Data" box, select **Create Archive**.
4. Select the Google products you'd like to include in your download and select **Next**.
5. Choose the file type that you'd like your data in and how you want to get it (either by a download link or directly into your Google Drive).
6. Select **Create archive**.

Once the archive is created, you'll get an email to let you know it's ready. Depending on the amount of information in your account, this process could take a few minutes or several hours, but most people get their link the same day they request it.

Note: Your content from Google Play Music isn't included when you create an archive. To download your music, use the [Google Play Music Manager](#) [↗](#).

If you're missing a product that you use, [let us know](#) [↗](#). There is usually a way for us to get your data to you.

- Rien n'est jamais acquis (?)...



The screenshot shows the Google Drive Help page for "Download a file". The page is divided into a main content area and a right-hand sidebar. The main content area has a dark blue header with "Drive Help" and a white background for the rest. The sidebar is dark blue with white text. The main content area contains the following sections:

Download a file

You can download a file to your computer from Google Drive. Google Docs, Sheets, and Slides will download as converted .docx, .xlsx, and .pptx files. All other file types will download in their native format.

Download a file from Drive

1. Open Drive at drive.google.com.
2. Click the file you'd like to download. To select multiple files, hold down **Shift** or **Ctrl** (**Command** on a Mac) while clicking on multiple files.
3. Right click and choose **Download**.

If the instructions above don't work, you may be using the [old version of Google Drive](#). Follow these alternate instructions:

[Alternate instructions for the old Drive](#) ▼

Note: Dragging a file from Google Drive to your desktop won't save a copy of the file to your computer.

Download a file from within the file itself

1. Open a file.
2. Click the **File** menu.
3. Select **Download as**.

Download formats

You can download files in the following formats:

- Documents: HTML, RTF, DOCX, Open Office, PDF, Text file.
- Spreadsheets: CSV, HTML, ODS, PDF, XLSX, TXT (only for a single sheet).
- Presentations: PDF, PPTX, TXT.
- Drawings: PNG, JPEG, SVG, PDF.

The sidebar on the right is titled "Google Drive on the web" and contains a list of links: "Upload files and folders", "Download a file" (which is highlighted with a white bar), "Manual upload settings in Google Drive", "Create, move, or delete a folder", "File sizes", "About Optical Character Recognition in Google Drive", "Use the Save to Google Drive Chrome extension", and "Back up photos & videos automatically in Drive".

Définitions de l'open cloud

- Au moins trois tentatives de définition de l'open cloud :
 - Open Cloud Manifesto (www.opencloudmanifesto.org),
 - Open Cloud Principles (www.opencloudinitiative.org/principles),
 - TIO / Total Information Outsourcing (tio.ffii.org).

Top 5 Best Web Hosting Service Providers in 2015

May 19, 2015 by Aditya Soni

Top 5 Best Webhosting Service Providers in 2015 – what are the best web hosting services available on cheap price with greater bandwidth and space to manage heavy traffic and huge content. A detailed review of best web hosting service provider shared below.

When an individual is ready to host their data and operate their own blogs, photos and applications, he/she is required to find a good web hosting server, which will put all the individual items on the web, provide them with tools, bandwidth and storage needs. The service providers will also need to provide them with guidance when the users require assistance. There are many hosting service providers available all over the Internet and it is quite difficult to find a proper hosting service.

[\[Read more...\]](#)

Open Cloud Manifesto – White Paper

April 26, 2015 by Aditya Soni

The cloud computing manifesto is a compilation of proceedings and results of the cloud computing use case group that brought the cloud vendors as well as the cloud users on a single platform via use case scenarios that demonstrate the economic benefits as well as the performance on the cloud.

[\[Read more...\]](#)

- Open Cloud Principles (www.opencloudinitiative.org/principles),
- par l'Open Cloud Initiative (www.opencloudinitiative.org).

Open Cloud Principles (OCP)

Overview

Interoperability (the ability to exchange and use information) between cloud computing products and services is **required** for unfettered competition between vendors and unrestricted choice for users.

Users **must** be able to come (*no barriers to entry*) and go (*no barriers to exit*) regardless of who they are (*no discrimination*) and what systems they use (*technological neutrality*).

Supporting vendors **must** therefore cooperate on standards, implementing those that exist (where applicable) and collaborating via an *open process* to develop those that don't, with a view to competing fairly on quality.

Definitions

Open Cloud **must** meet the following requirements:

- **Open Formats:** All user data and metadata **must** be represented in *Open Standard* formats.
- **Open Interfaces:** All functionality **must** be exposed by way of *Open Standard* interfaces.

Standards

Open Standards **must** meet the following requirements:

- **Copyrights:** The standard **must** be documented in all its details, published and both accessible and [re]usable free of charge.
- **Patents:** Any patents possibly present on [parts of] the standard **must** be irrevocably made available on a royalty-free basis.
- **Trademarks:** Any trademarks possibly present on identifier(s) **must** be used for non-discriminatory enforcement of compliance only.
- **Implementations:** There **must** be multiple full, faithful, independent and interoperable implementations (for both client and server where applicable) and at least one such implementation **must** be licensed in its entirety under an [Open Source Initiative \(OSI\) approved license](#) or placed into the public domain.

- Caractéristiques :
 - Utilisation de standards libres (i.e. ouverts et gratuits)...
 - pour les formats de données et les interfaces.
 - Au moins une implémentation des standards doit être publiée sous une licence compatible OSI.

Open Cloud Principles (OCP)

Overview

Interoperability (the ability to exchange and use information) between cloud computing products and services is **required** for unfettered competition between vendors and unrestricted choice for users.

Users **must** be able to come (*no barriers to entry*) and go (*no barriers to exit*) regardless of who they are (*no discrimination*) and what systems they use (*technological neutrality*).

Supporting vendors **must** therefore cooperate on standards, implementing those that exist (where applicable) and collaborating via an *open process* to develop those that don't, with a view to competing fairly on quality.

Definitions

Open Cloud **must** meet the following requirements:

- **Open Formats:** All user data and metadata **must** be represented in *Open Standard* formats.
- **Open Interfaces:** All functionality **must** be exposed by way of *Open Standard* interfaces.

Standards

Open Standards **must** meet the following requirements:

- **Copyrights:** The standard **must** be documented in all its details, published and both accessible and [re]usable free of charge.
- **Patents:** Any patents possibly present on [parts of] the standard **must** be irrevocably made available on a royalty-free basis.
- **Trademarks:** Any trademarks possibly present on identifier(s) **must** be used for non-discriminatory enforcement of compliance only.
- **Implementations:** There **must** be multiple full, faithful, independent and interoperable implementations (for both client and server where applicable) and at least one such implementation **must** be licensed in its entirety under an [Open Source Initiative \(OSI\) approved license](#) or placed into the public domain.

Tio Libre Definitions

TIO Openness

A TIO service is said to be Open if the Service Level Agreement (SLA) contains the following:

- **Data Freedom:** it is possible to migrate all user data including configuration and logs to an infrastructure operated by any other party. Data must be provided in a format which is fully specified and documented, and which can be parsed by the user with common of the shelf software.

TIO Libre

A TIO service is said to be Free if the Service Level Agreement (SLA) contains the following dispositions.

- **Data Freedom:** it is possible to migrate all user data including configuration and logs to an infrastructure operated by any other party. Data must be provided in a format which is fully specified and documented, and which can be parsed by the user with common of the shelf software.
- **Software Freedom:** all software required for a client to leave and benefit from the same service on a standalone infrastructure operated by any other party is distributed as Free Software.
- **Competition Freedom:** no legal lock should prevent a competitor from copying and trying to provide the same service

TIO Libre guarantees to clients the possibility to change TIO provider or become their own TIO provider at any time.

TIO Loyalty

A TIO service is said to be Loyal if the SLA contains the following dispositions.

- **Access Right:** the service can be used by anyone anywhere with no discrimination.
- **Privacy Right:** no data in relation with the usage of the service can be provided to a third party either in verbatim or in anonymised form without prior explicit approval from the client on a case by case basis.
- **Notification Right:** client of the service is notified of any incidents or changes which may cause or have caused a security breach in the service or a change in the service.
- **Disclosure Right:** service provider must take appropriate measures to enforce the SLA through its staff or suppliers and disclose such measures upon request to clients.

TIO Loyalty provides a framework to reach the same level of trade secret and operational transparency as with their own staff.

- Questions à développer (en cours) :

Topics

- TioSecurity : what are the threats posed by TIO to corporate security or to national security
- TioTour: a tour of TIO practices such as SaaS (ex. Salesforce, co-ment, ERP5 Express), data aggregation services (ex. Lokad), hosting (ex. OVH, Amazon), social networks, etc.
- TioTaxonomy : a comprehensive set of abstractions which can be used to categorize the different kinds of TIO
- TioSwot : strength, weaknesses, opportunities and threats posed by TIO growth in companies and society
- TioNomics : the economy of TIO (competition, business models)
- TioPortability : keeping access to data structures and interoperability in a TIO context
- TioControl: keeping Information Systems under control in a TIO context
- TioHumanFactor: how can TIO provide the same guarantees in terms of loyalty as regular staff or civil servants
- [Tio Libre Definitions](#): what does Information Freedom mean in the context of TIO
- [TIO Guidelines](#): 3 easy steps to assess your TIO provider
- OpenSourceTio : what are the relations between open source and TIO
- TioSla : what should a TIO SLA (Service Level Agreement) contain to protect customers of TIO services
- SlaEffectiveness : how effective is an SLA
- SlaWorstPractice : examples of dangerous clauses in SLAs of certain TIO providers
- TioPrivacy : is privacy Law compatible with Freedom in the context of TIO
- TioDefinition : what is TIO ?

Causes, impacts et solutions au lock-in

- Lock-in ?

« Le lock-in existe lorsque le coût du changement de la plate-forme technologique d'un vendeur vers une autre est à ce point onéreuse que le client est incapable de quitter les offres du vendeur » (Viseur, 2014a).

- Degrés :

- « Light lock-in » (absence de lock-in) :

- Exemple : plate-forme utilisant des standards industriels.

- « Medium lock-in » :

- Exemple : plate-forme mettant à disposition des services non standards dont le caractère bloquant peut être limité par des règles de développement et d'architecture.

- « Hard lock-in » :

- Exemple : imposant la réécriture de parties de code (mais parfois associée à la mise à disposition d'innovations sources d'opportunités pour l'utilisateur).

- Quatre causes :
 - le rythme d'innovation et la recherche de différenciation vis-à-vis des concurrents,
 - la recherche de rendements croissants d'adoption (RCA),
 - l'utilisation par les prestataires de formats de données propriétaires,
 - les plates-formes cloud de type PaaS.

- Cinq impacts du lock-in :
 - le blocage des données des utilisateurs et l'allongement des durées de migration,
 - l'augmentation du tarif associé à l'utilisation du service de cloud computing,
 - la ralentissement du rythme d'innovation,
 - la réduction du cycle de vie des développements (positif),
 - les réductions de droits d'accès (e.g. DaaS et Web API).

- Six solutions pour éviter le lock-in :
 - le recours aux standards,
 - l'utilisation de logiciels FLOSS (Free Libre Open Source Software),
 - le développement d'applications reposant sur un socle fonctionnel générique,
 - le recours à des opérateurs techniques spécialisés,
 - la confiance envers les labels « open cloud »,
 - la mise en place d'une stratégie de sortie.

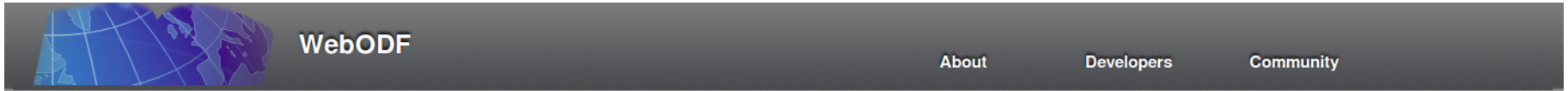
- Processus pour éviter le lock-in / gérer le risque de lock-in :
 - (1) dresser la liste des alternatives,
 - (2) identifier les causes de lock-in
 - (e.g. API ou formats de données propriétaires, volumes de données ou topologie de réseau),
 - (3) identifier les produits et services compatibles
 - (en particulier pour le transfert des données et les solutions SaaS),
 - (4) évaluer des coûts de sortie,
 - (5) évaluer les gains commerciaux liés aux fonctionnalités innovantes mais bloquantes,
 - (6) sélectionner une « short list » d'alternatives,
 - (7) valider les mécanismes de migration,
 - (8) réaliser le choix final de la solution.

Mise en oeuvre de l'open cloud

- Réponses de l'open source (résumé) :
 - disponibilité de logiciels d'infrastructure (e.g. OpenStack) et d'APIs (e.g. Deltacloud),
 - émergence de solutions collaboratives (e.g. Owncloud),
 - support de standards ouverts ou de facto (e.g. API Amazon),
 - licences copyleft avec réciprocité de réseau (e.g. AGPL ou OSL),
 - nouvelles approches (e.g. Docker).

Name	URL	Description	License	Responsible
OpenStack	http://www.openstack.org/	IaaS, described as cloud operating system.	Apache 2 license	By Openstack Foundation. Strong HP engagement.
Eucalyptus	https://www.eucalyptus.com/eucalyptus-cloud/iaas	IaaS.	Various with GNU GPL (+ commercial release).	By Eucalyptus company.
OpenNebula	http://opennebula.org/	IaaS, describe as management tool for virtualized datacenters.	Apache 2 license	Founded by European projects, now supported by C12G Labs.
CloudStack	http://cloudstack.apache.org/	IaaS. Management of large networks of virtual machines.	Apache 2 license	By Apache Software Foundation.
Deltacloud	http://deltacloud.apache.org/	Application Programming Interface (API) that abstracts differences between cloud computing implementations.	Apache 2 license	By Apache Software Foundation.
OpenShift	https://www.openshift.com/	PaaS.	Apache 2 license	By Red Hat.
AppScale	http://www.appscale.com/	PaaS, open source implementation of Google App Engine.	Apache 2 license	By Appscale Systems.
Stratos	http://stratos.apache.org/	PaaS framework based on Apache Tomcat, PHP and MySQL.	Apache 2 license	By Apache Software Foundation.
Tsuru	http://www.tsuru.io/	PaaS.	BSD 3-clauses	By Globo.com company.

Table 2. Characteristics of open source cloud projects

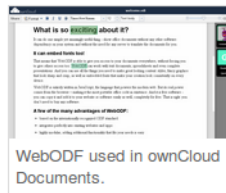


WebODF in use

This page lists uses of WebODF. If you would like to be showcased here, send a mail to the [mailing list](#).

ownCloud Documents

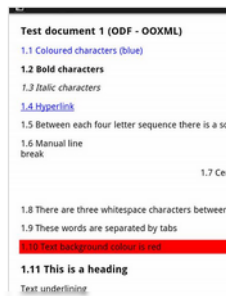
ownCloud, the open source file sync and share software for everyone, added "ownCloud Documents" in ownCloud 6. It enables collaborative editing of rich-text documents, based on WebODF technology. The documents can be created from within the web-interface or existing documents can be uploaded. Sharing and editing can be done securely in the browser and be shared inside ownCloud or via a public link. Users that have an account on the same server can be invited or public invitations can also be sent by email. The editing works on top of normal ODF files that are stored in ownCloud.



WebODF on Android

WebODF has an Android port. This port is part of the main WebODF repository. The version is easy to install via the [Android Market](#).

This OpenDocument viewer for Android weighs in at only 47 kilobyte, yet it gives you the ability to view all ODF office files on your Android device.



Tiki Docs

Since version 8.1 of [Tiki Wiki CMS Groupware](#) (usually simply called [Tiki](#)) was released, it is possible to edit ODF documents in Tiki. This is possible because

- Support de standards ouverts ou de facto
 - Support de standards ouverts ou de facto :

	OpenStack	Eucalyptus	OpenNebula	CloudStack
OVF	Yes	N/A	Yes	N/A
CDMI	Yes	N/A	Yes	N/A
OCCI	Yes	Yes	Yes	Yes
AMI	No	Yes	N/A	N/A
S3 API	Yes	Yes	No	Yes
EC2 API	Yes	Yes	Yes	Yes

- Combinaison standards RF/FRAND et implémentation OSS.
 - Explicitation progressive du standard.
 - Recherche d'effets d'auto-renforcement (diffusion, bascule).

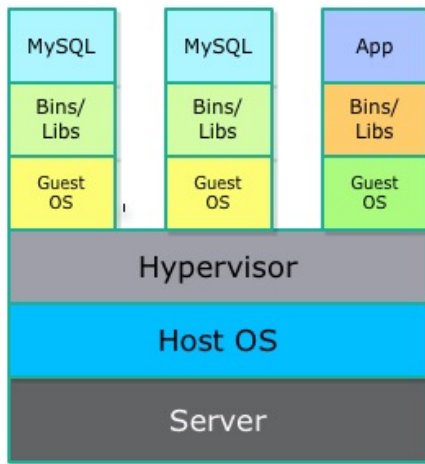
- Création des licences copyleft avec réciprocité de réseau.
 - Utilisation en croissance.

	Academic	Weak reciprocity (file-based)	Weak reciprocity	Strong reciprocity	Network reciprocity
BSD	x				
MIT	x				
Apache	x				
MPL		x			
EPL/CPL		x			
CDDL		x			
LGPL			x		
GPL				x	
AGPL					x
OSL					x

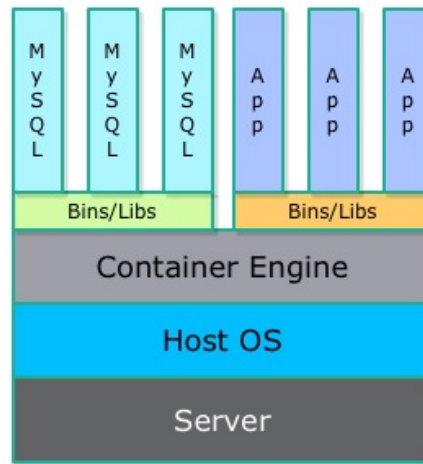
Table 1 - Major open source licenses by type.

- Nouvelles approches (e.g. Docker).

Virtual Machines



Containers



(crédit : <https://github.com/jancelin/rpi-docker-lizmap/wiki/1.-Docker-c%27est-quoi>)



- Cas pratique : « *reproducible research* » / « *executable papers* ».
 - Contexte : Open Science et Open Research Data.
 - Actuellement : 1 publication = 1 article.
 - Objectif : publication = article + données + code source.
 - Problème : compilation à long terme ?
 - Réalisation d'un état de l'art.
 - Que faire en cas de reprise d'un résultat de recherche 5 ou 10 ans après publication ?
 - Solution : publication = article + données + code source + « binaire » (e.g. machine virtuelle ou container).
 - Problème : comment assurer le bon fonctionnement du « binaire » après 5 ou 10 ans ?!

Conclusion

- Passage progressif des logiciels (*end-user*) du poste de travail vers le cloud computing (SaaS).
- Pénétration importante des logiciels open source IaaS (e.g. OpenStack) et développement de solutions open source PaaS (e.g. OpenShift).
- Support de solutions open source sur le cloud par d'anciens (?) leaders propriétaires (e.g. Microsoft).
- Développement des logiciels open source SaaS pour professionnels et...
- Emergence de solutions SaaS pour l'utilisateur final.

- Intérêt à mettre en place des stratégies de sortie dès l'implémentation pour éviter tout problème ultérieur non anticipé de lock-in technique.
- Différentes solutions apportées par l'open source : solutions techniques IaaS / PaaS / SaaS, standards ouverts, licences adaptées au cloud computing,...
- Intérêt de la définition TIO de l'open cloud mais, malheureusement, popularité très faible du concept.
- Modalités pratiques de mise en œuvre d'un open cloud encore floues.

- Robert Viseur (2014), Etienne Charlier, Michael Van de Borne, « Cloud Computing and Technological Lock-in: Literature Review » in « Data Technologies and Applications », Vienna, Austria.
- Robert Viseur (2014), « Web APIs: an Effective Tool for Co-creation in ICT Sector » in « Science-to-Business Marketing Conference », Winterthur, Switzerland.
- Robert Viseur (2014), Etienne Charlier, Michael Van de Borne, « Comment gérer le risque de lock-in technique en cas d'usage de services de cloud computing ? » in « Creis-Terminal », Nantes, France.
- Robert Viseur (2013), « Evolution des stratégies et modèles d'affaires des éditeurs Open Source face au Cloud computing » in « Terminal : Technologie de l'Information, Culture, Société », 113-114, pp. 173-193.

Merci !

Contact :

robert.viseur@cetic.be

Plus d'information :

www.roberviseur.be

twitter.com/roberviseur

www.linkedin.com/in/roberviseur



Aéropôle de Charleroi-Gosselies
Rue des Frères Wright, 29/3
B-6041 Gosselies
info@cetic.be

www.cetic.be

