Cloud Computing

Dominique Rodrigues

dominique.rodrigues.contact@gmail.com

Échange avec les élèves

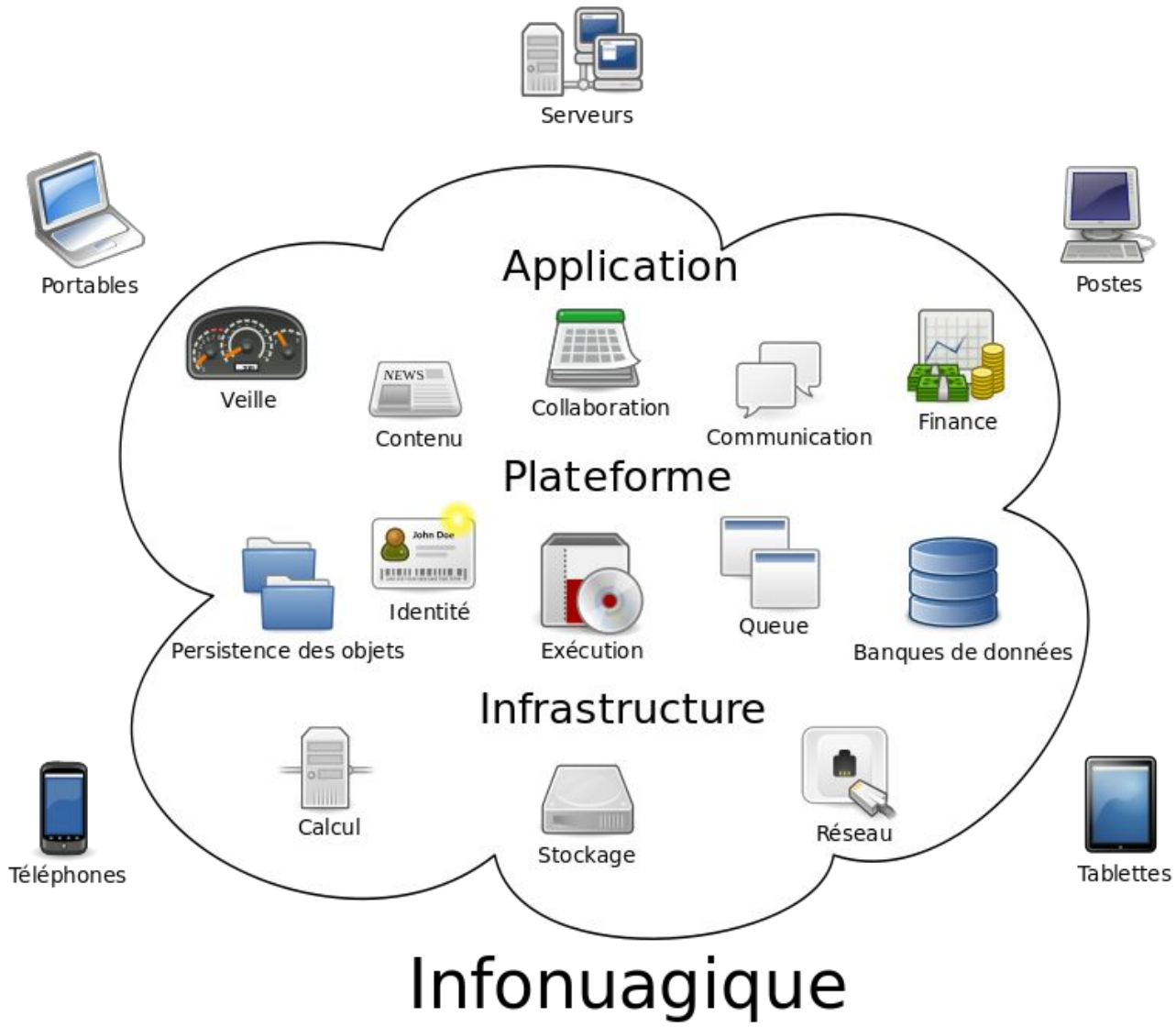
Qu’est-ce que le Cloud Computing ?

Définition québécoise

infonuagique \ɛ̃.fo.ny.a.ʒik\ ou \ɛ̃.fo.nɥa.ʒik\ *féminin*

1. *(Canada) (Néologisme) (Internet)* Informatique en nuage. Utilisation de la mémoire et des capacités de calcul de différents ordinateurs et serveurs reliés par un réseau, parfois répartis dans le monde entier.

https://fr.wiktionary.org/wiki/infonuagique


Serveurs
Portables
Postes
Application
Veille
Contenu
Collaboration
Communication
Finance
Plateforme
Persistence des objets
Identité
Exécution
Queue
Banques de données
Infrastructure
Calcul
Stockage
Réseau
Téléphones
Tablettes
Infonuagique

The NIST definition of Cloud Computing

Cloud computing is a model for enabling **ubiquitous**, **convenient**, **on-demand** network access to a shared pool of configurable **computing resources** (e.g., networks, servers, storage, applications, and services) that can be **rapidly provisioned** and released with minimal management effort or service provider interaction. This cloud model is composed of **five** essential characteristics, **three** service models, and **four** deployment models.

http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf

The NIST definition of Cloud Computing

5 essential characteristics

On-demand self-service

Broad network access

Resource pooling

Rapid elasticity

Measured service

The NIST definition of Cloud Computing

3 service models

Software as a Service (SaaS)

Platform as a Service (PaaS)

Infrastructure as a Service (IaaS)

The NIST definition of Cloud Computing

4 deployment models

Private cloud

Community cloud

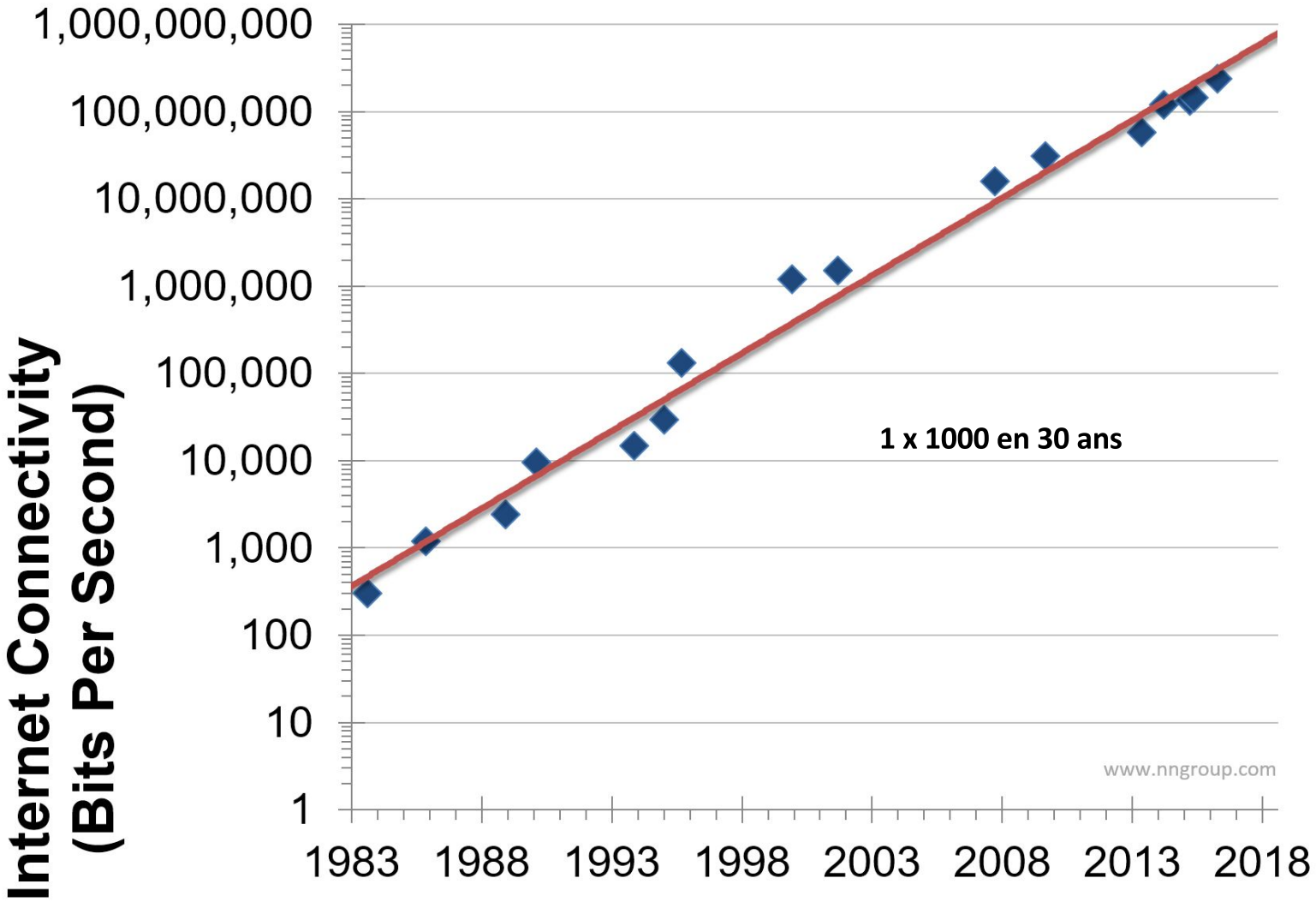
Public cloud

Hybrid cloud

Les origines du Cloud Computing

Quels furent les facteurs de son émergence ?

La croissance de la bande passante



Apport d’une grande bande passante

(in NIST 5 essential characteristics)

On-demand self-service

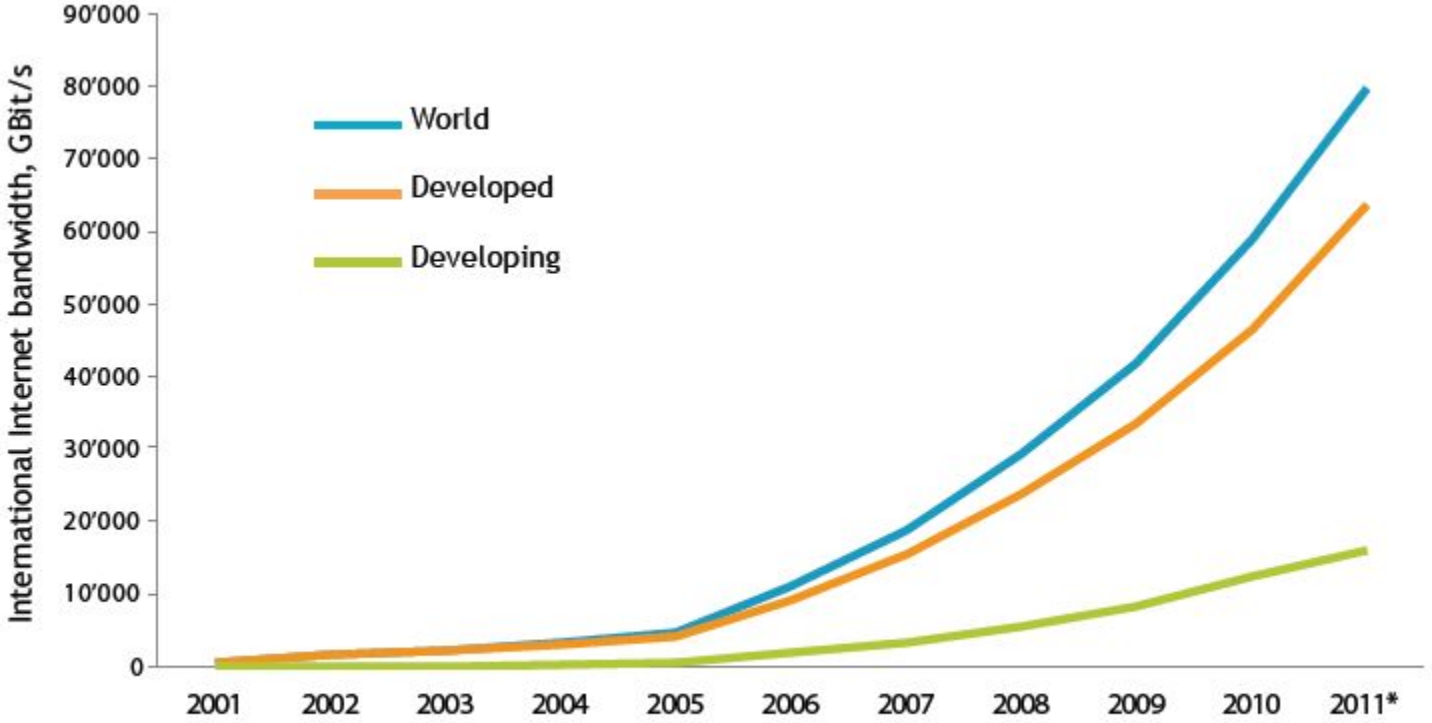
Broad network access

Resource pooling

Rapid elasticity

Measured service

Évolution de la bande passante globale dans le monde



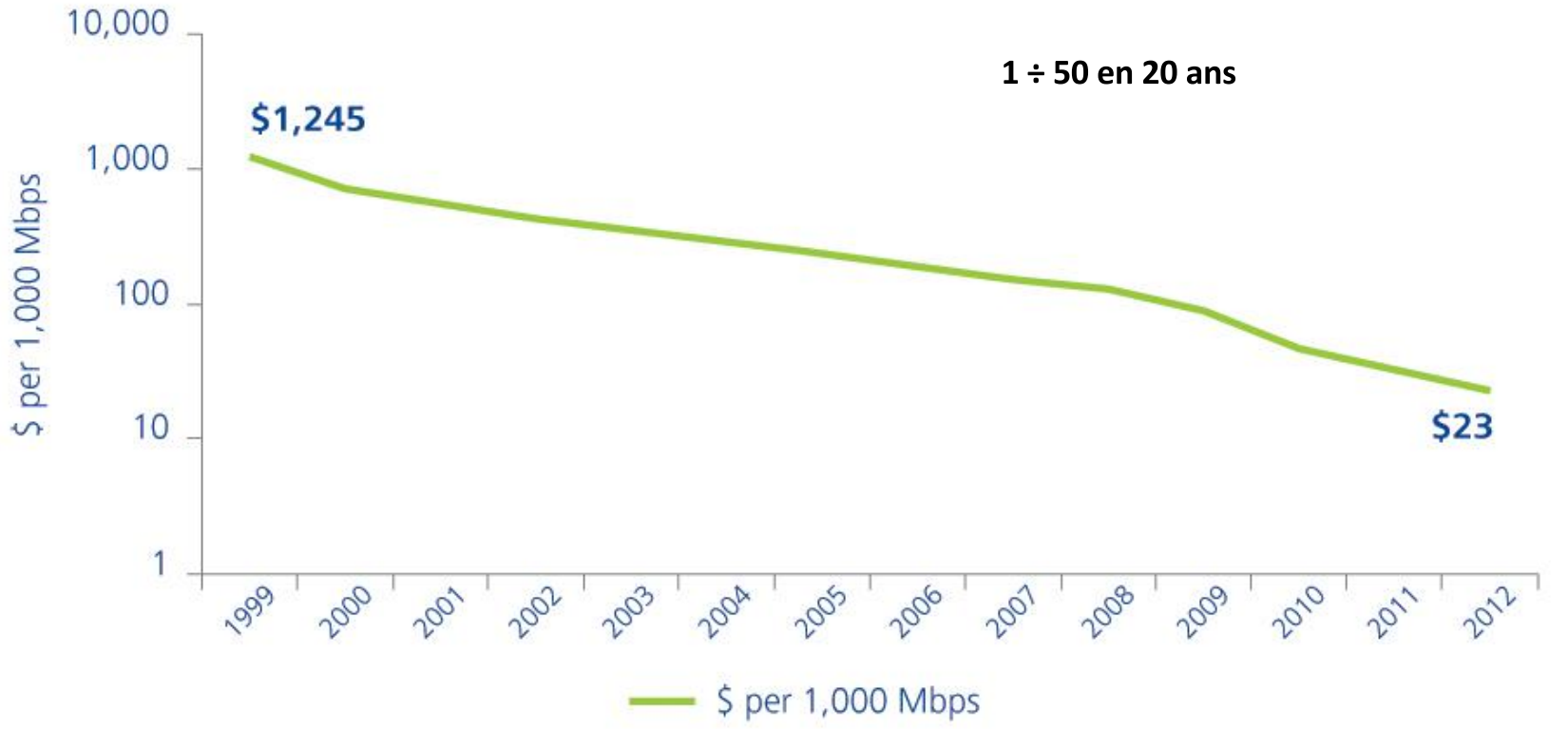
Note: * Estimate
Source: ITU World Telecommunication/ICT Indicators database

Annual global IP traffic … will reach **2.3 ZB*** per year by 2020 (* 1 ZB = 10^9 TB)

http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/vni-hyperconnectivity-wp.html

La décroissance du coût du trafic sur Internet

Figure 3. Bandwidth cost-performance (1999–2012)



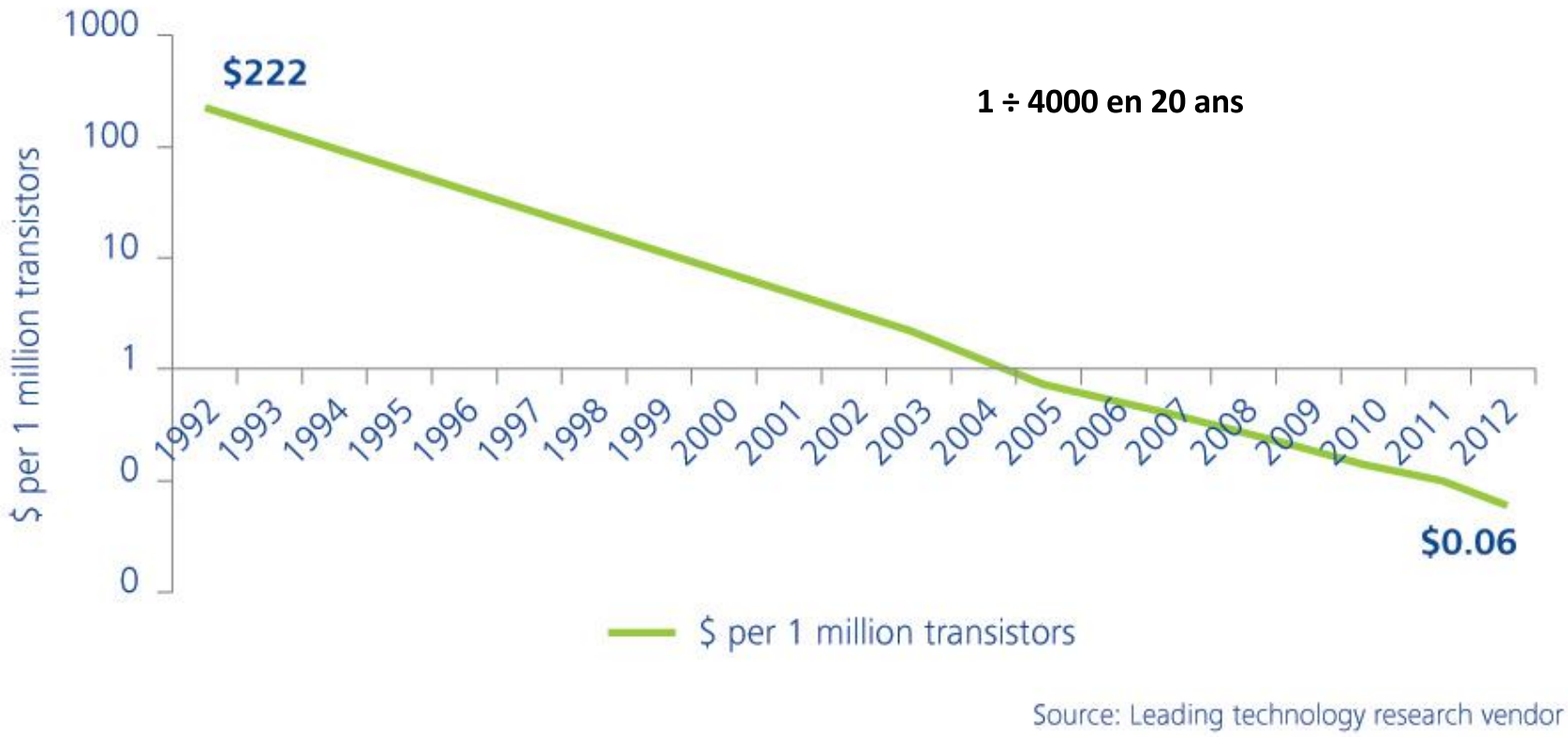
1 ÷ 50 en 20 ans

Source: Leading technology research vendor

Graphic: Deloitte University Press | DUPress.com

La décroissance du coût du CPU

Figure 1. Computing cost-performance (1992–2012)



1 ÷ 4000 en 20 ans

Source: Leading technology research vendor

Graphic: Deloitte University Press | DUPress.com

La décroissance du coût du stockage

Figure 2. Storage cost-performance (1992–2012)

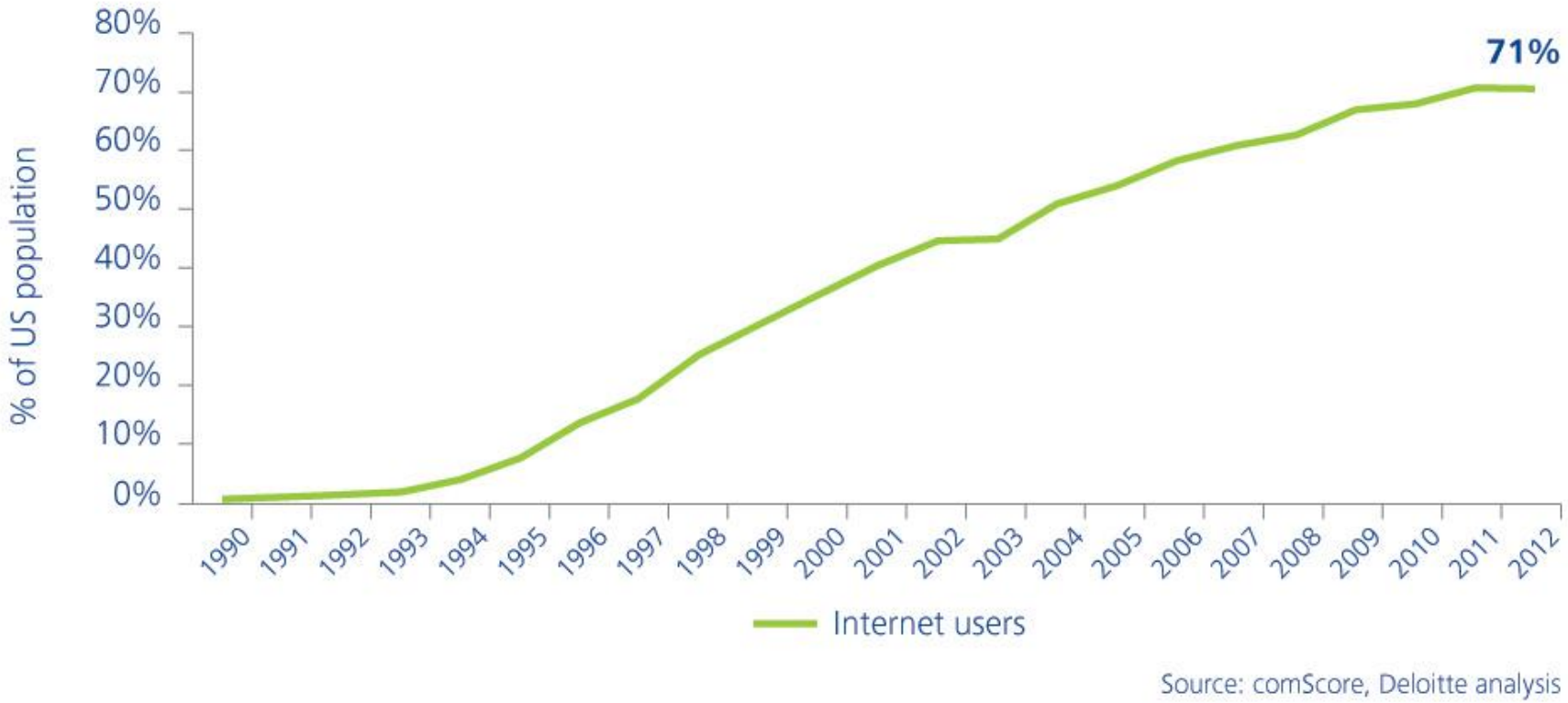
1 ÷ 20000 en 20 ans

Source: Leading technology research vendor

Graphic: Deloitte University Press | DUPress.com

L’accès à Internet banalisé

Figure 4. Internet users (1990–2012)



Graphic: Deloitte University Press | DUPress.com

La généralisation de la virtualisation

- 1960 → 2000 : IBM de CP/CMS à z/VM
- 1979 : chroot (Unix)
- 1982 : chroot (BSD)
- **1999** : VMware (virtualisation pour x86)
- 2000 : FreeBSD Jail (*BSD)
- **2003** : Xen (Linux)
- 2005 : Solaris Zones (Solaris et dérivés)
- **2005/2006** : Intel-VT et AMD-V (virtualisation matérielle)
- 2006 : OpenVZ (Linux)
- **2007** : KVM (Linux)
- 2008 : LxC (Linux)
- 2008 : Hyper-V (Microsoft)
- **2013** : Docker

Apports de la virtualisation

(in NIST 5 essential characteristics)

On-demand self-service

Broad network access

Resource pooling

Rapid elasticity

Measured service

Avantages du Cloud

Ne plus s'occuper de son infrastructure
(se concentrer sur son cœur de métier)

Ne plus nécessiter de personnel dédié

Bénéficier de ressources adaptables à ses besoins

Rapidité de mise en œuvre

Ne plus craindre de pertes de données

Les craintes du Cloud

Sécurité (exposition des données sur le Net)

Confidentialité (intégrité du prestataire)

Localisation des données

(type de loi applicable => cf Patriot Act)

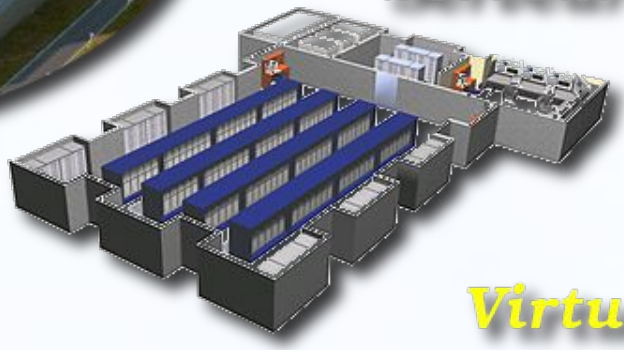
Prochaine loi européenne : Règlement Général de Protection des Données

http://data.consilium.europa.eu/doc/document/ST-5455-2016-INIT/fr/pdf

(notamment : responsabilités des entreprises et des prestataires)

Bases du cloud - IaaS

Datacenter



Serveurs

Virtualisation

The NIST definition of Cloud Computing

service model: IaaS

The capability provided to the consumer is to provision **processing**, **storage**, **networks**, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications.

The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls).

Naissance du IaaS : 2006

Amazon

d'une infrastructure pour la vente en ligne

à

AWS : une infrastructure mondiale

Region & Number of Availability Zones

AWS GovCloud (2)

US West
Oregon (3), Northern California (3)

US East
Northern Virginia (5), Ohio (3)

Canada
Central (2)

South America
São Paulo (3)

Europe
Ireland (3), Frankfurt (2), London (2)

Asia Pacific
Singapore (2), Sydney (3), Tokyo (3), Seoul (2), Mumbai (2)

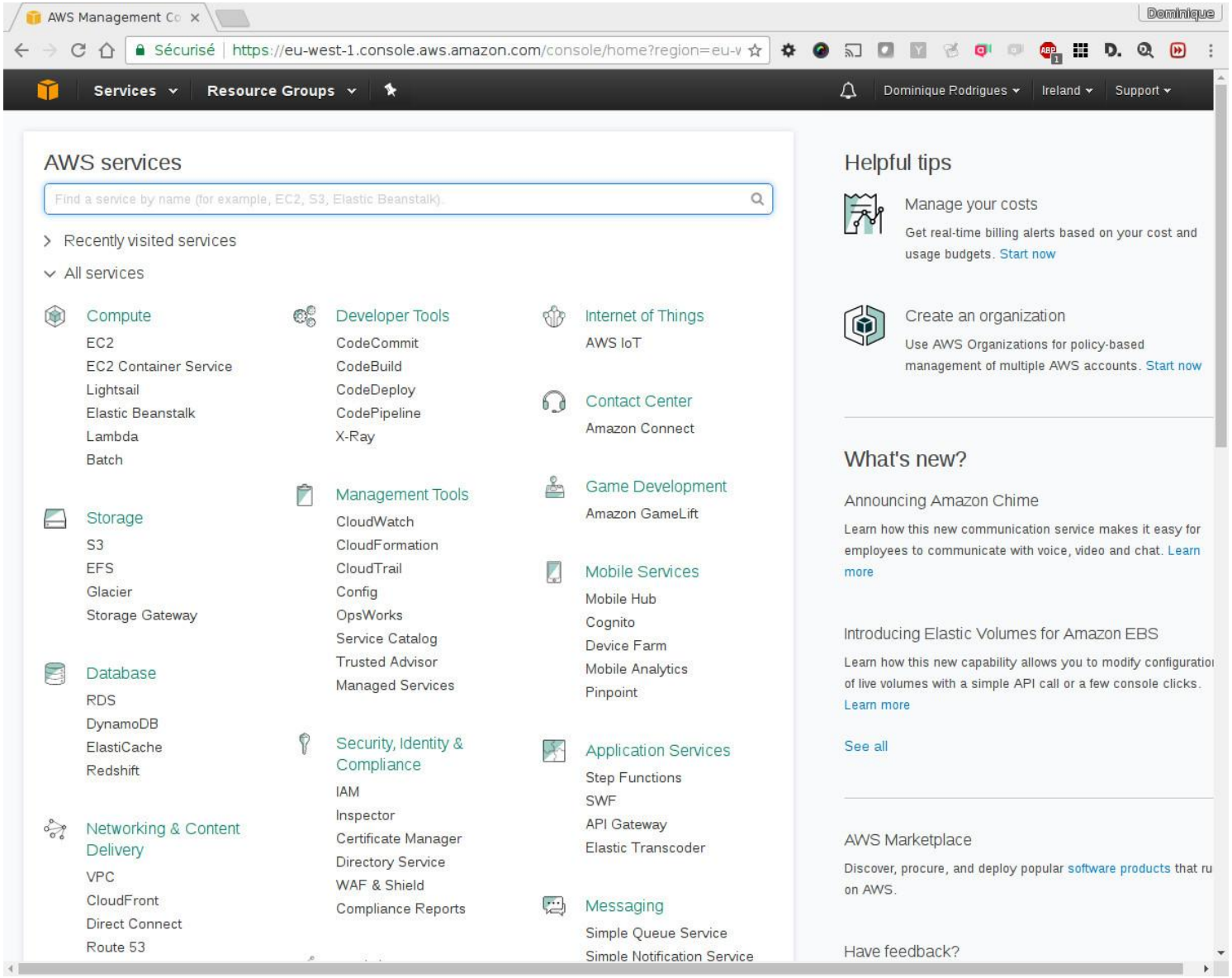
China
Beijing (2)

New Region (coming soon)

Paris

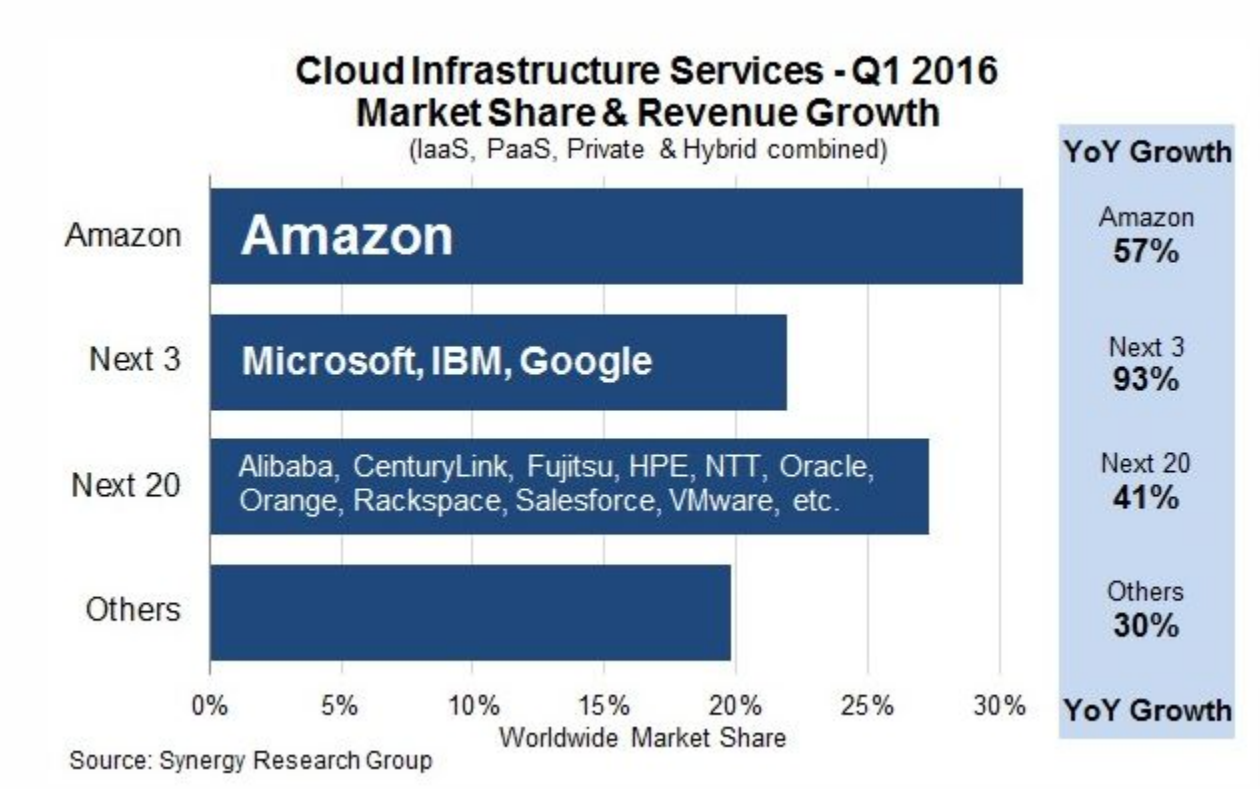
Ningxia

AWS : une offre de services pléthorique

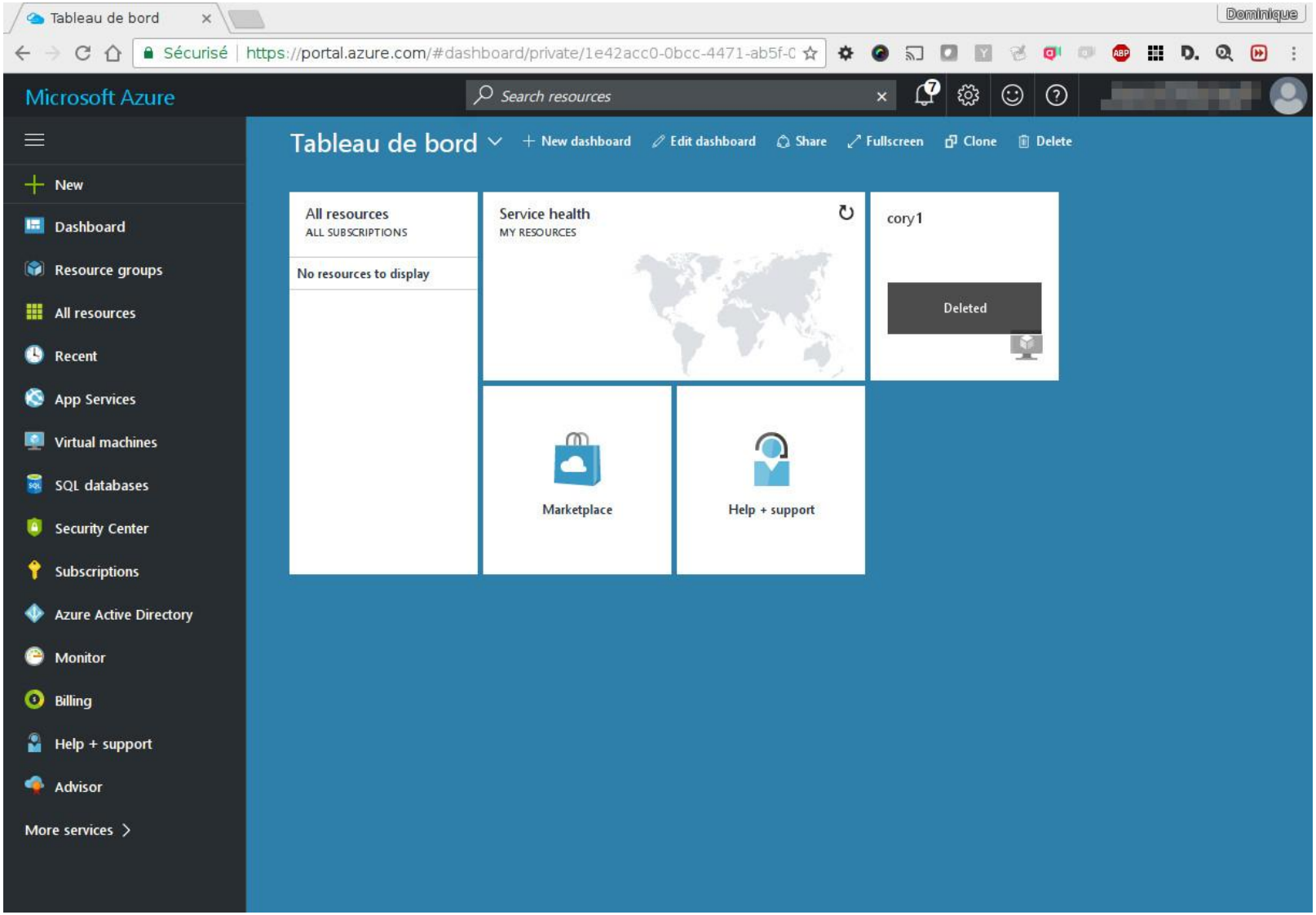


AWS : leader du marché IaaS

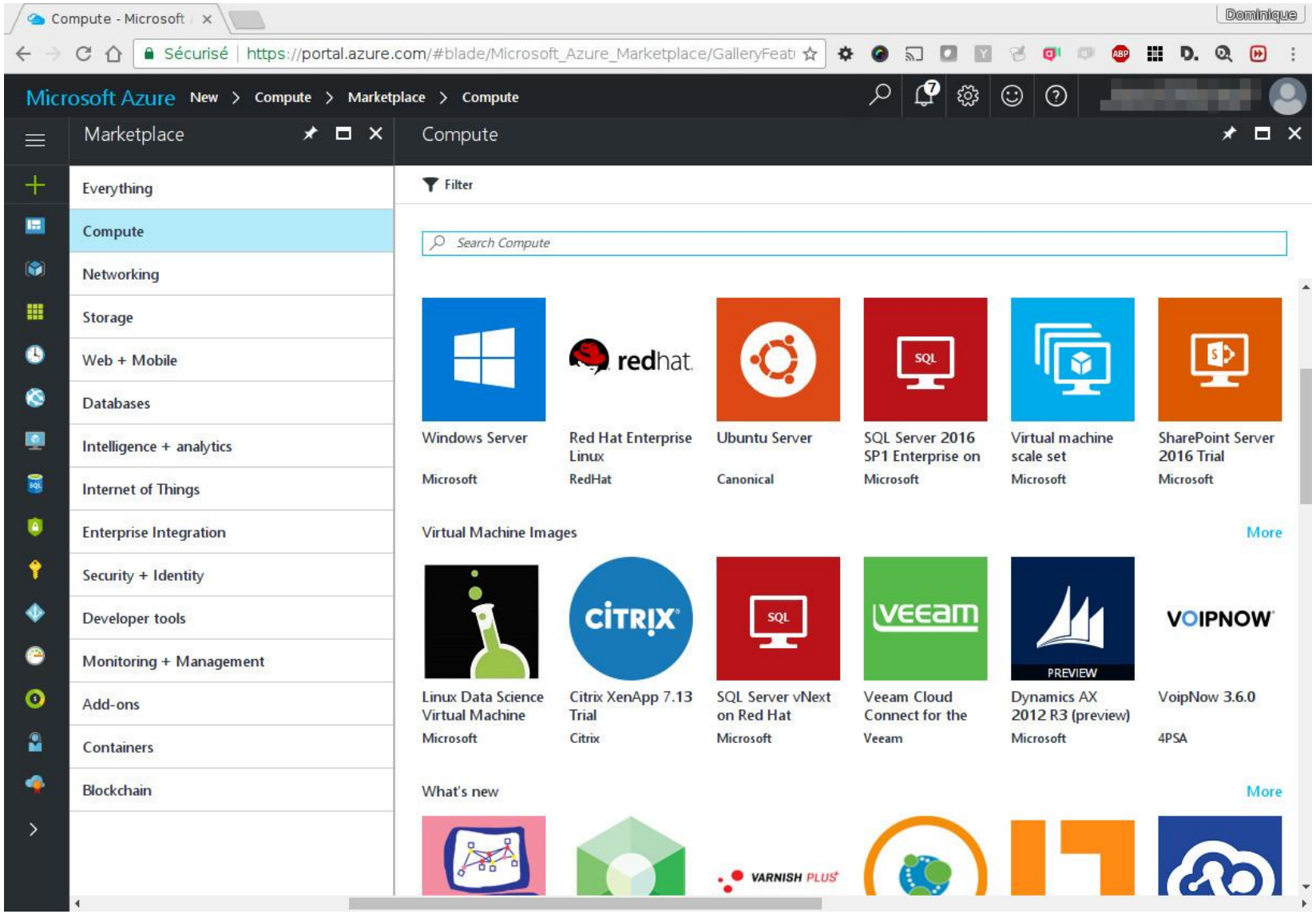
et des challengers en forte croissance



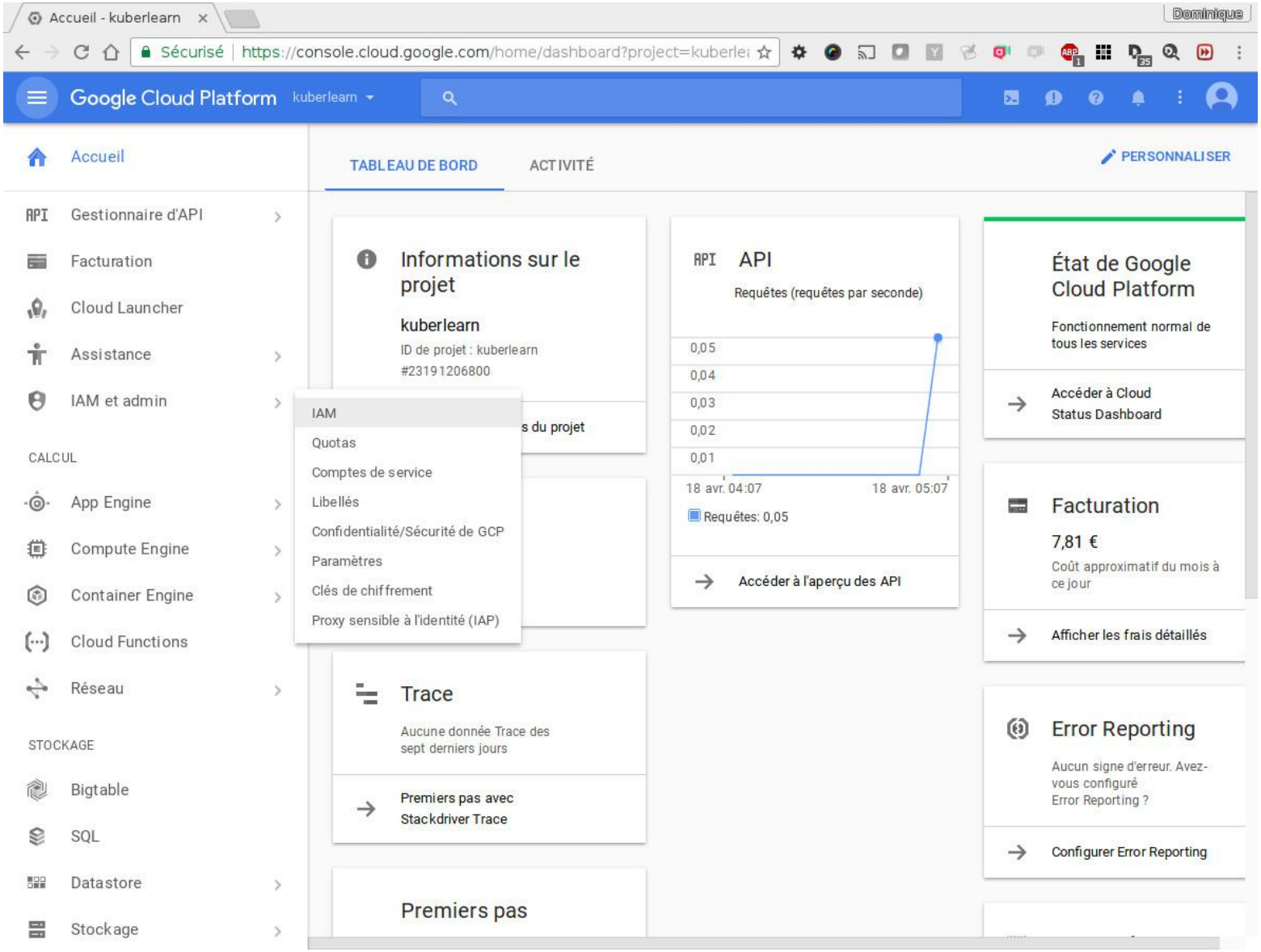
Azure : la riposte Microsoft



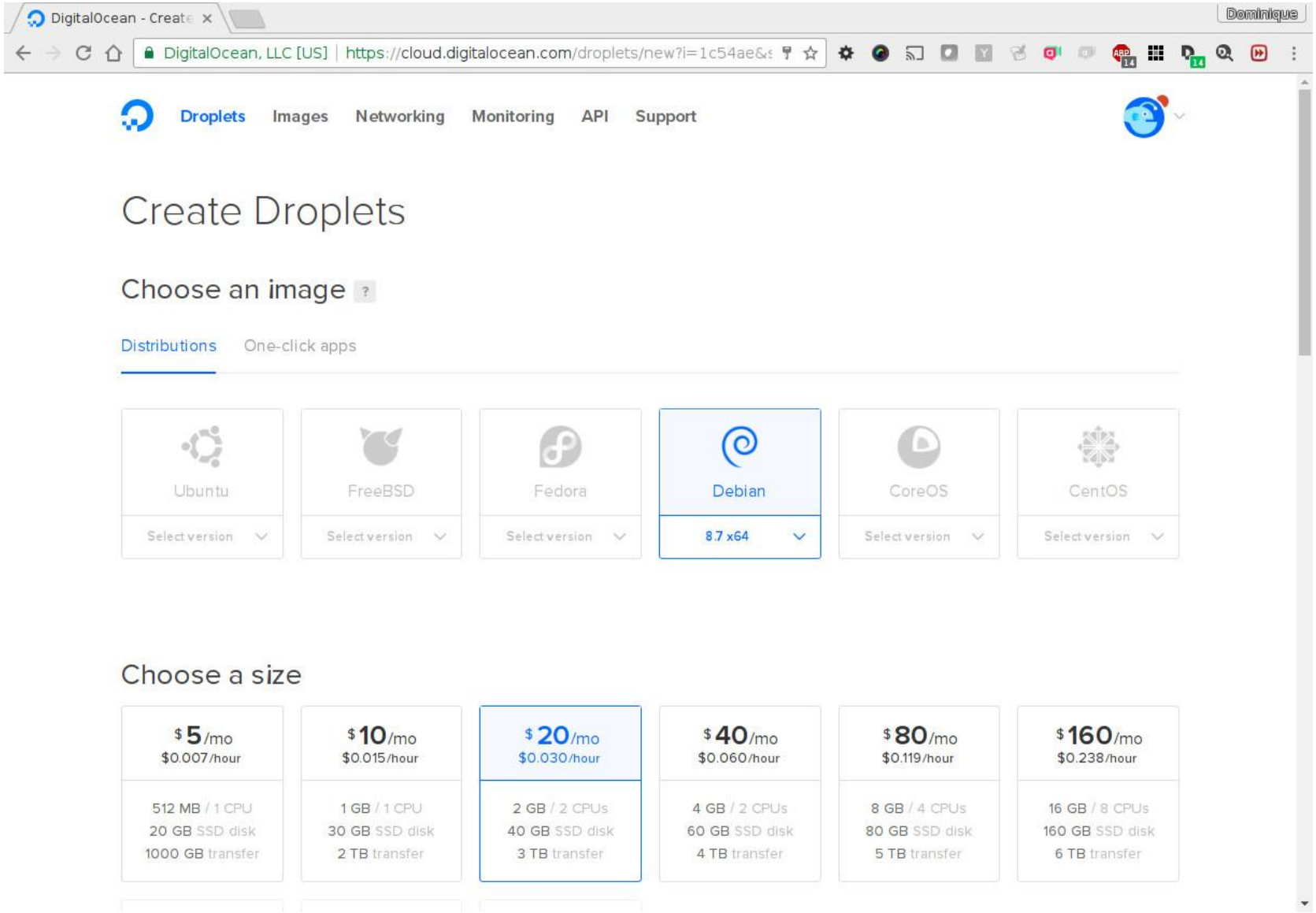
Azure : une stratégie “market place”



GCE : la concurrence de Google



Digital Ocean : le petit poucet qui monte



Les projets Open Source pour le IaaS

CloudStack

OpenNebula

OpenStack

The NIST definition of Cloud Computing

service model: PaaS

The capability provided to the consumer is **to deploy** onto the cloud infrastructure consumer-created or acquired **applications** created using programming languages, libraries, services, and tools supported by the provider.

The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

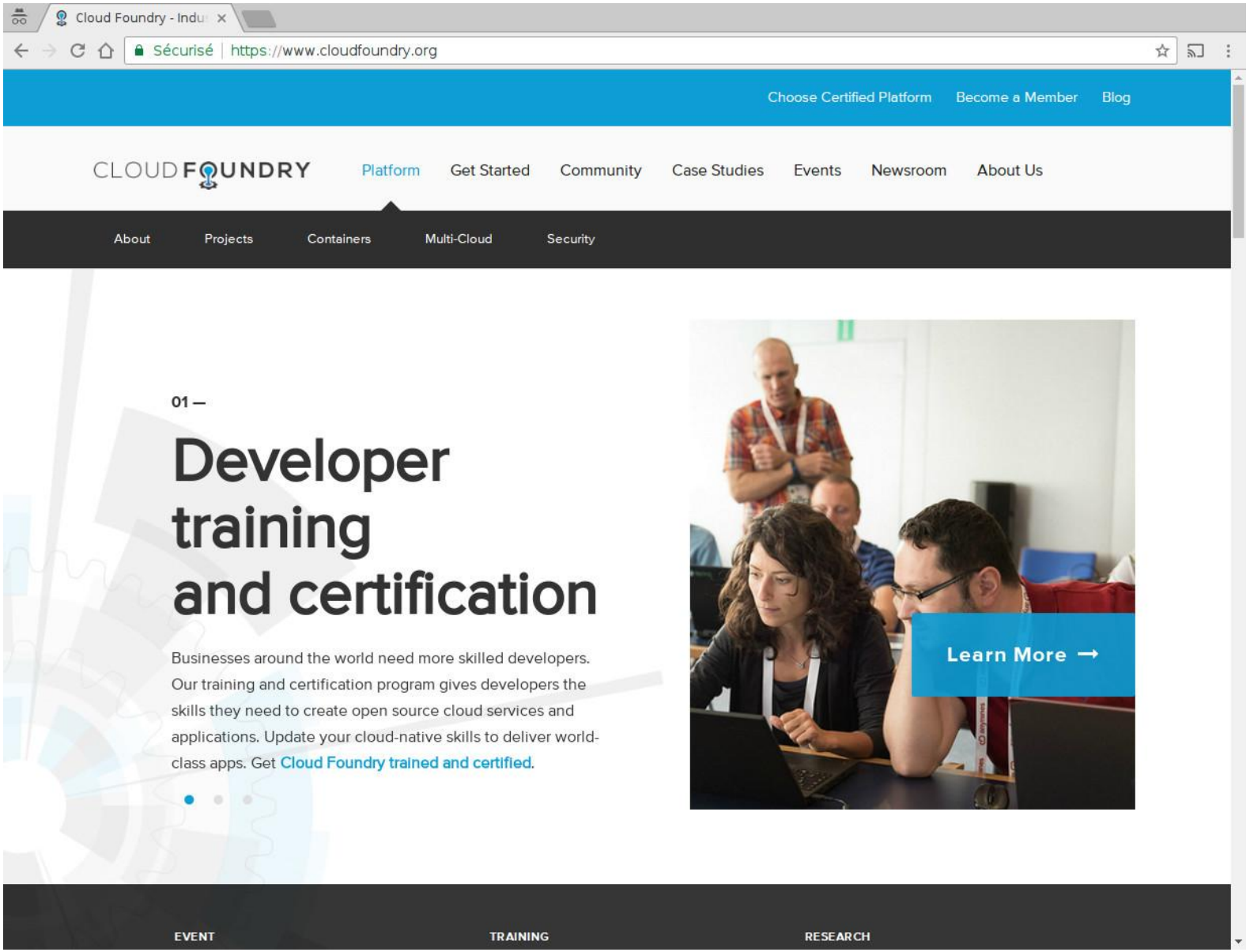
Quelques acteurs du PaaS

Cloud Foundry (VMware)

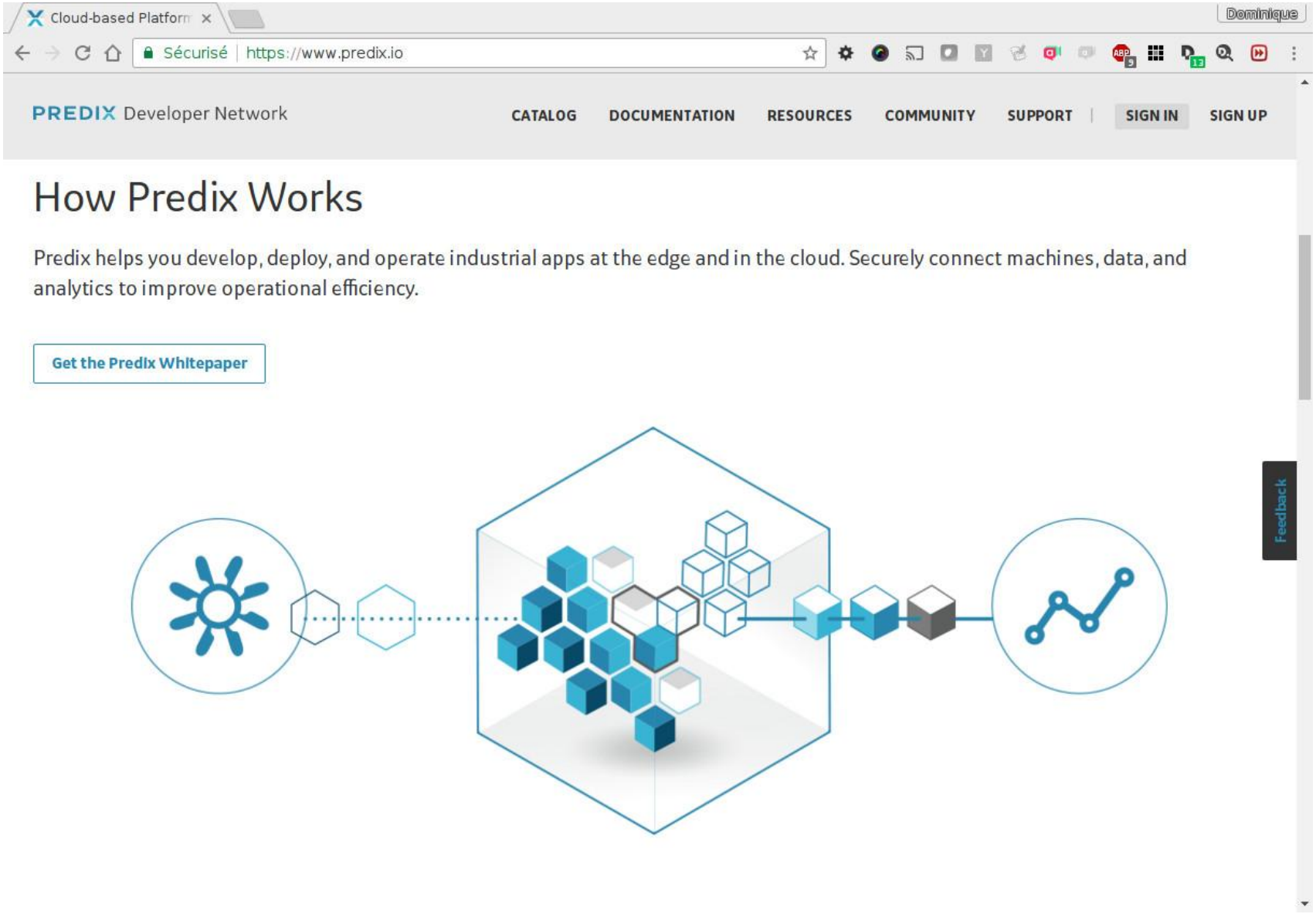
OpenShift (Redhat)

Heroku (Salesforce)

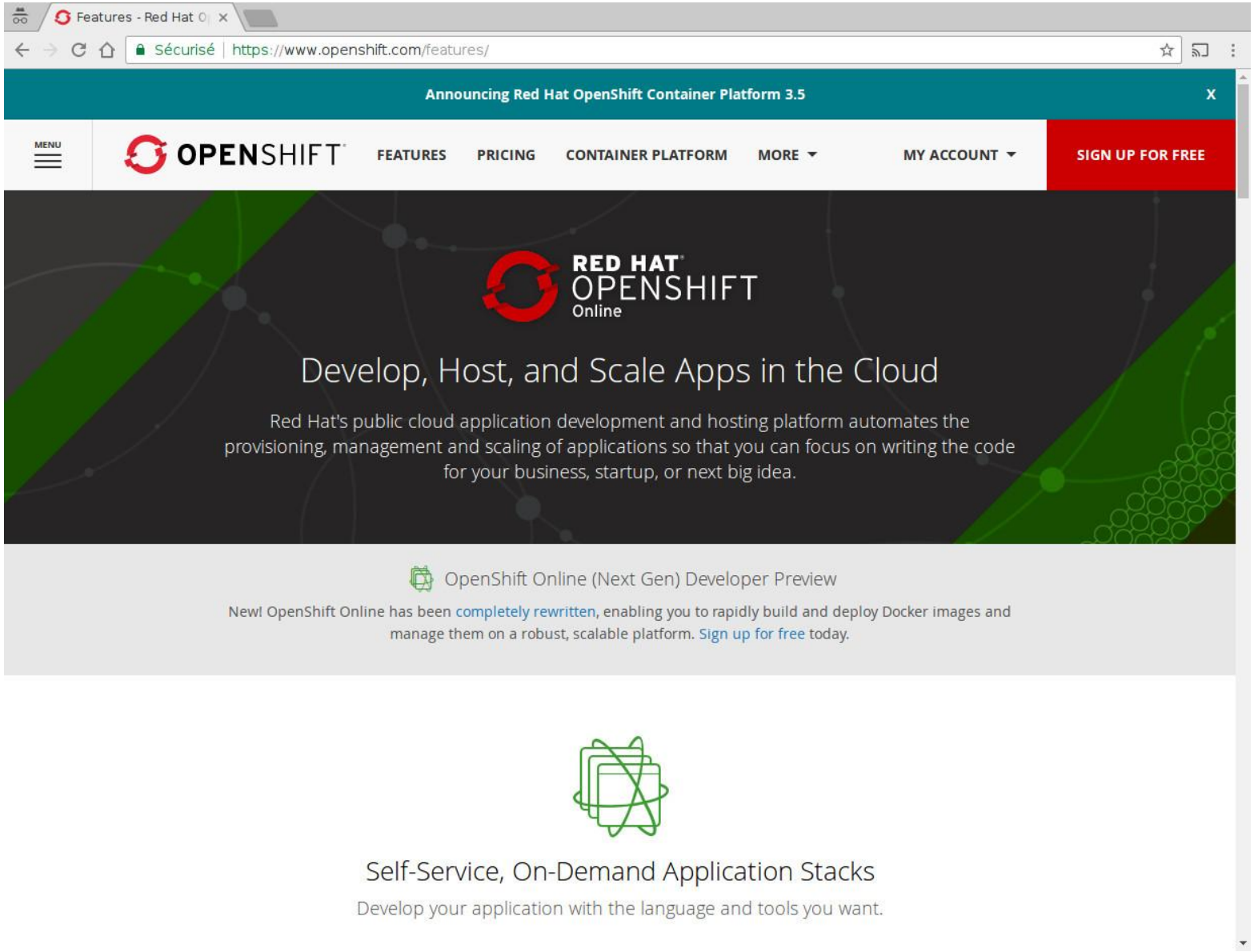
Cloud Foundry



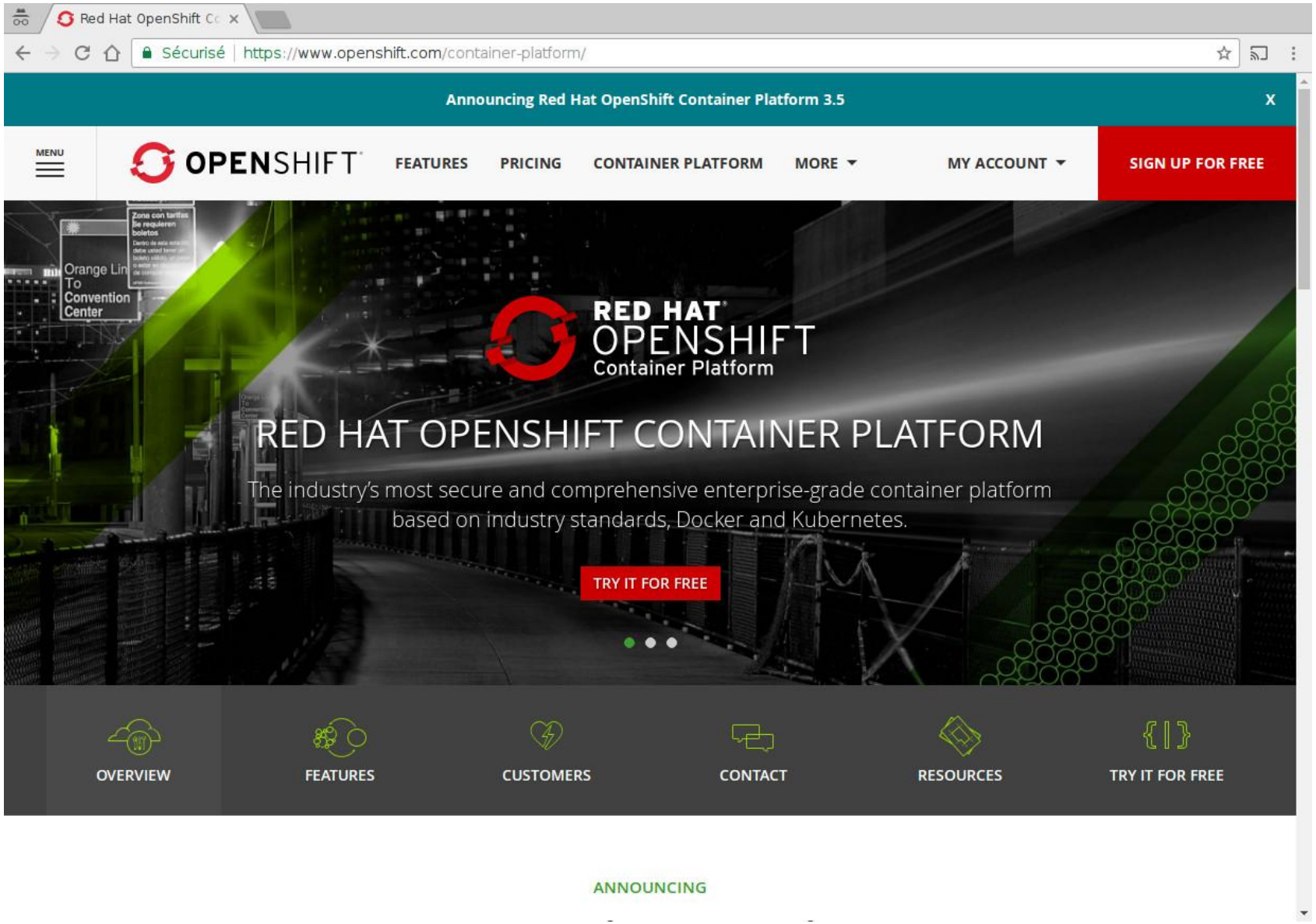
Cloud Foundry : moteur de Predix (GE)



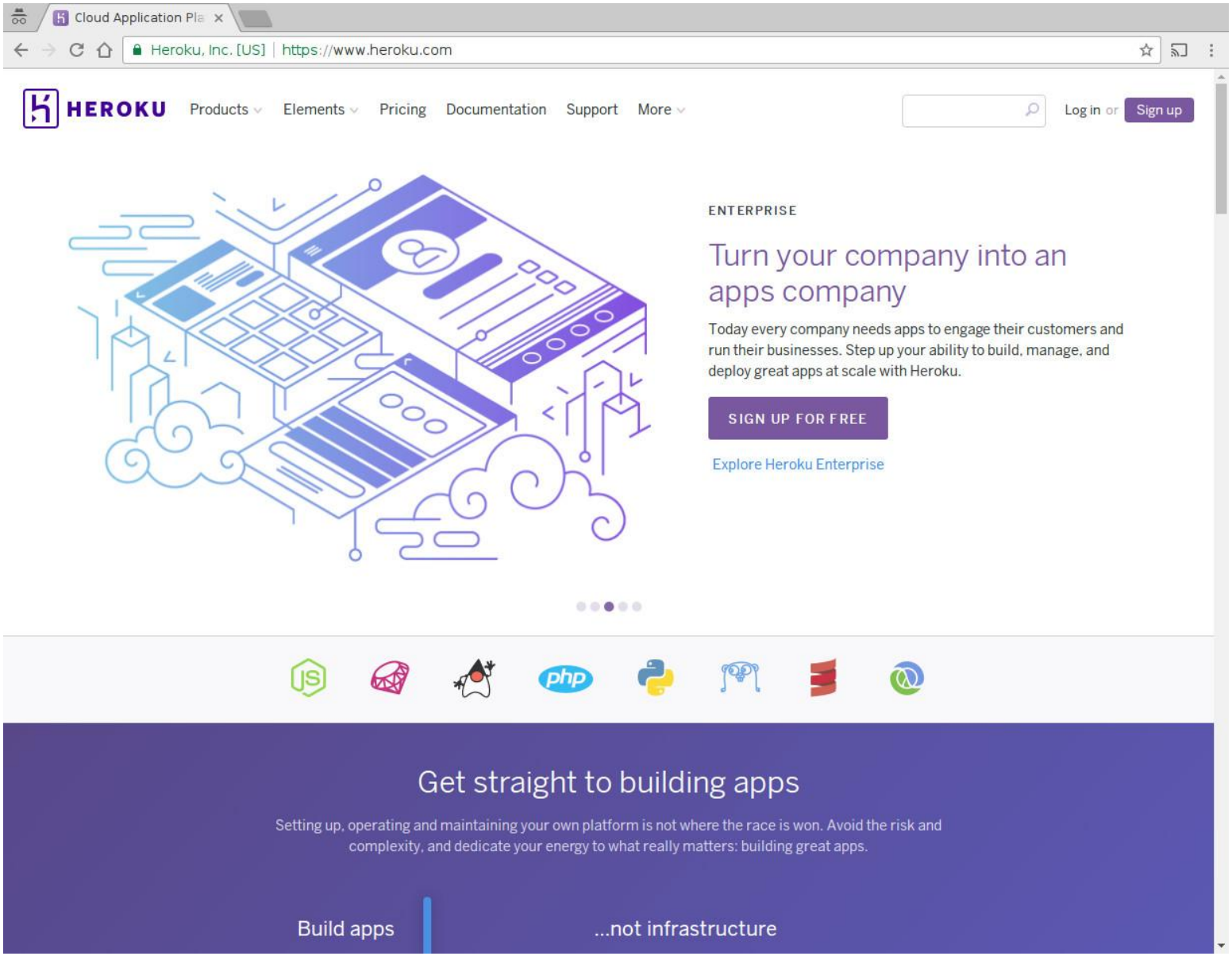
OpenShift


Features - Red Hat O
Sécurisé | https://www.openshift.com/features/
Announcing Red Hat OpenShift Container Platform 3.5
X
MENU
OPENSHIFT
FEATURES
PRICING
CONTAINER PLATFORM
MORE
MY ACCOUNT
SIGN UP FOR FREE
RED HAT
OPENSHIFT
Online
Develop, Host, and Scale Apps in the Cloud
Red Hat's public cloud application development and hosting platform automates the provisioning, management and scaling of applications so that you can focus on writing the code for your business, startup, or next big idea.
OpenShift Online (Next Gen) Developer Preview
New! OpenShift Online has been completely rewritten, enabling you to rapidly build and deploy Docker images and manage them on a robust, scalable platform. Sign up for free today.
Self-Service, On-Demand Application Stacks
Develop your application with the language and tools you want.

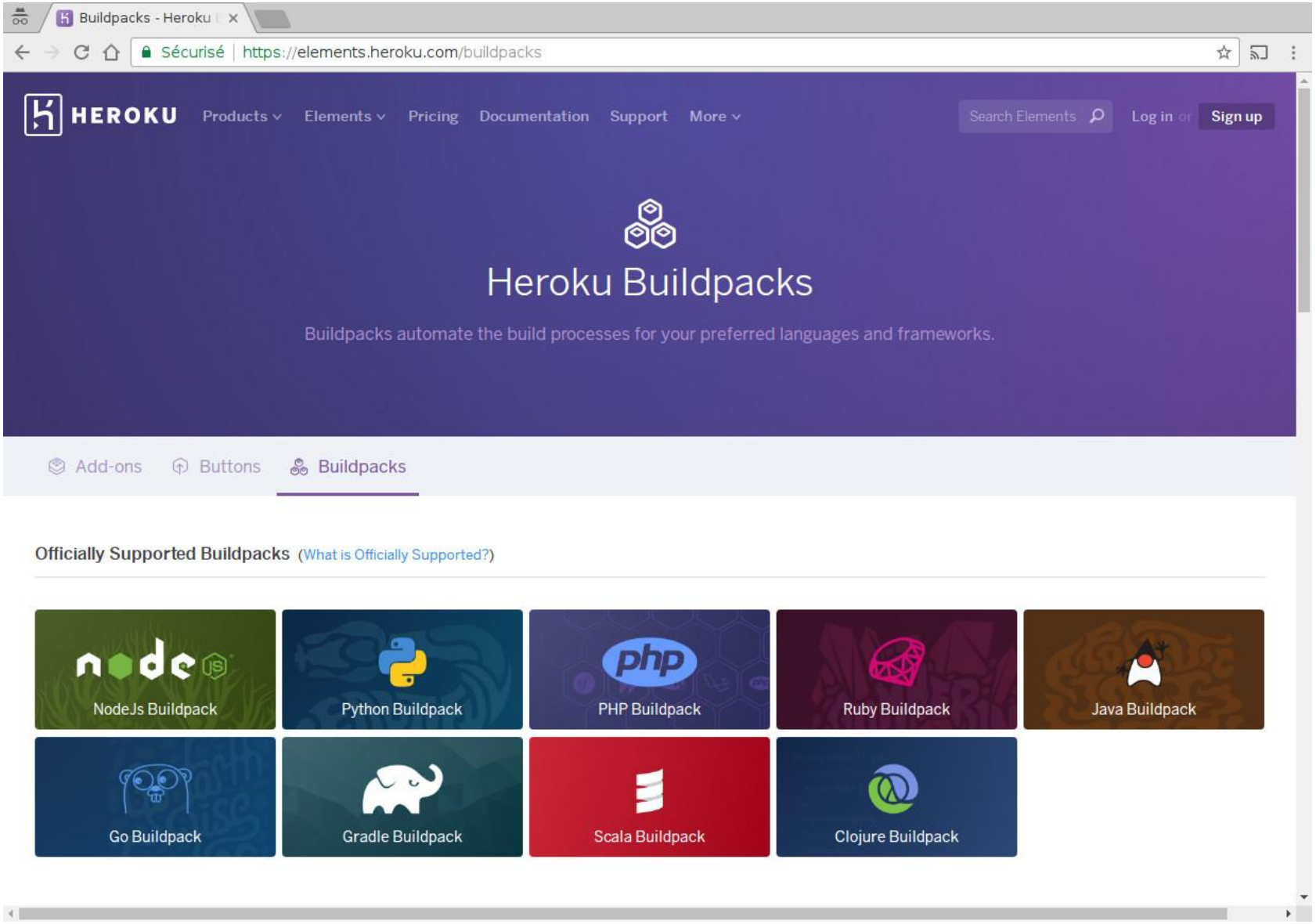
OpenShift : mise en avant des conteneurs



Heroku (le leader)



Heroku packs



The NIST definition of Cloud Computing

service model: SaaS

The capability provided to the consumer is to **use the provider's applications running on a cloud infrastructure** .

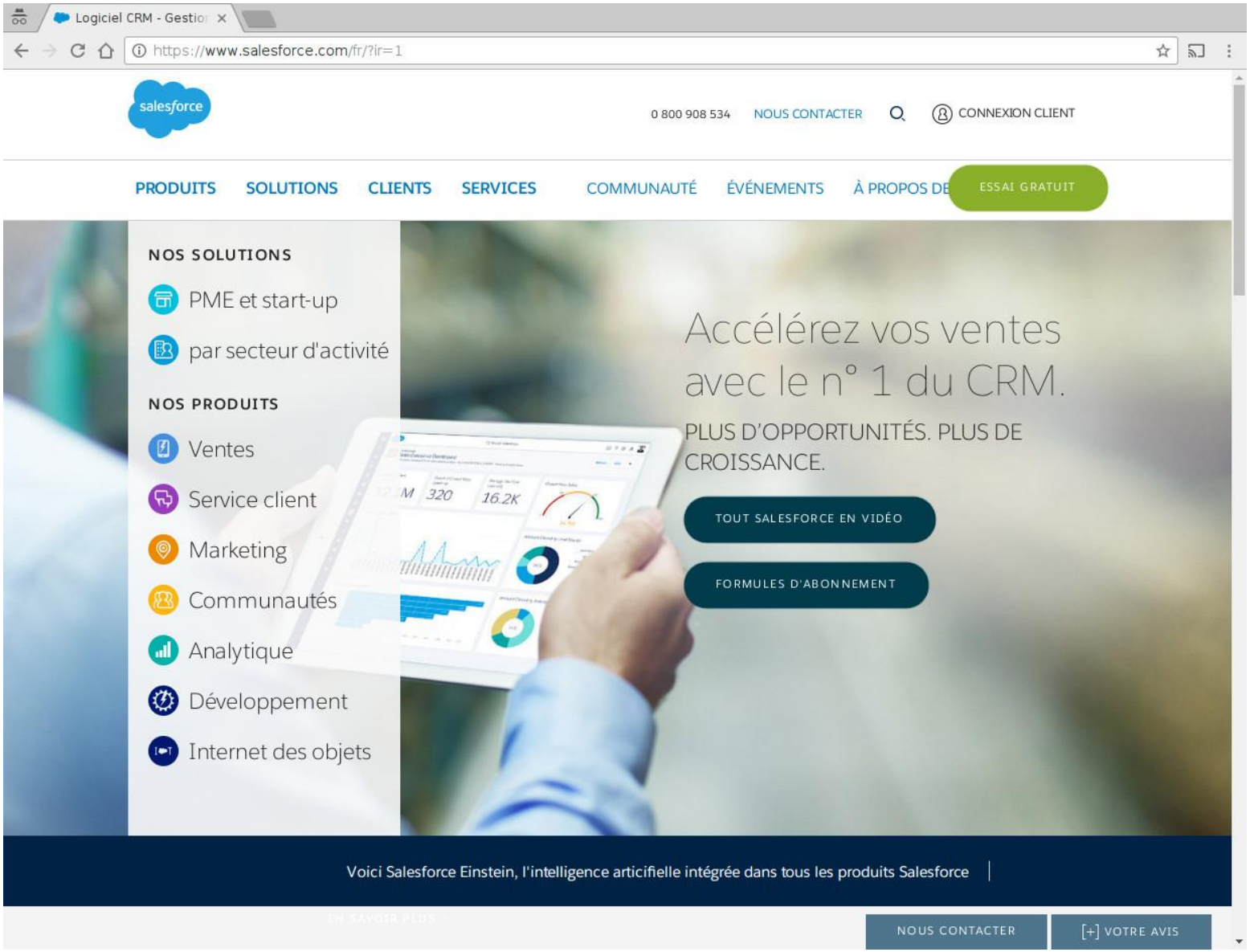
The applications are **accessible from various client devices** through either a thin client interface, **such as a web browser** (e.g., web-based email), or a program interface.

The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

Exemples de SaaS ?

(tout le monde en connaît)

Le pionnier : Salesforce



Salesforce en quelques chiffres

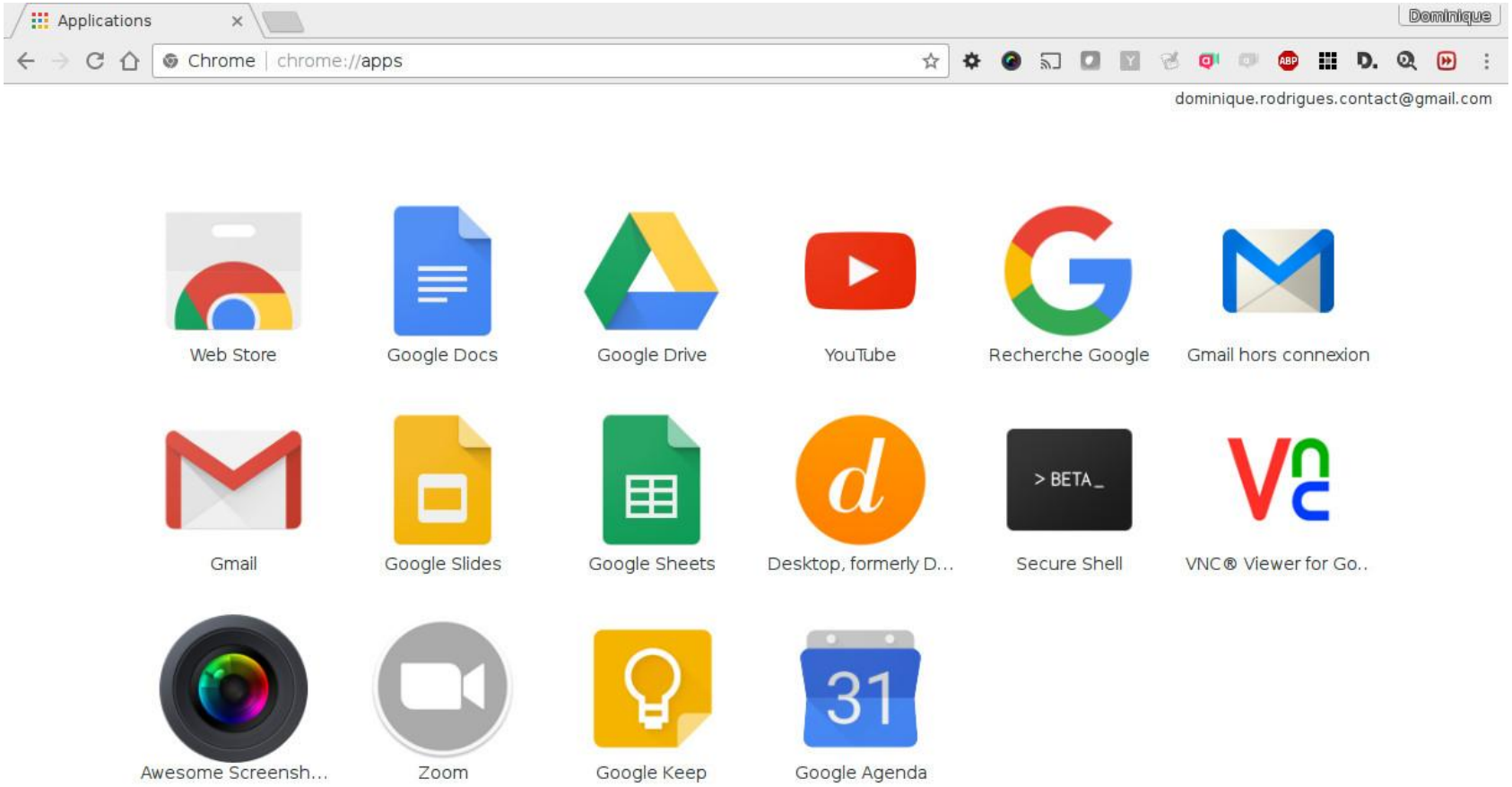
1999 : création par Mark Benioff

2004 : introduction au Nasdaq

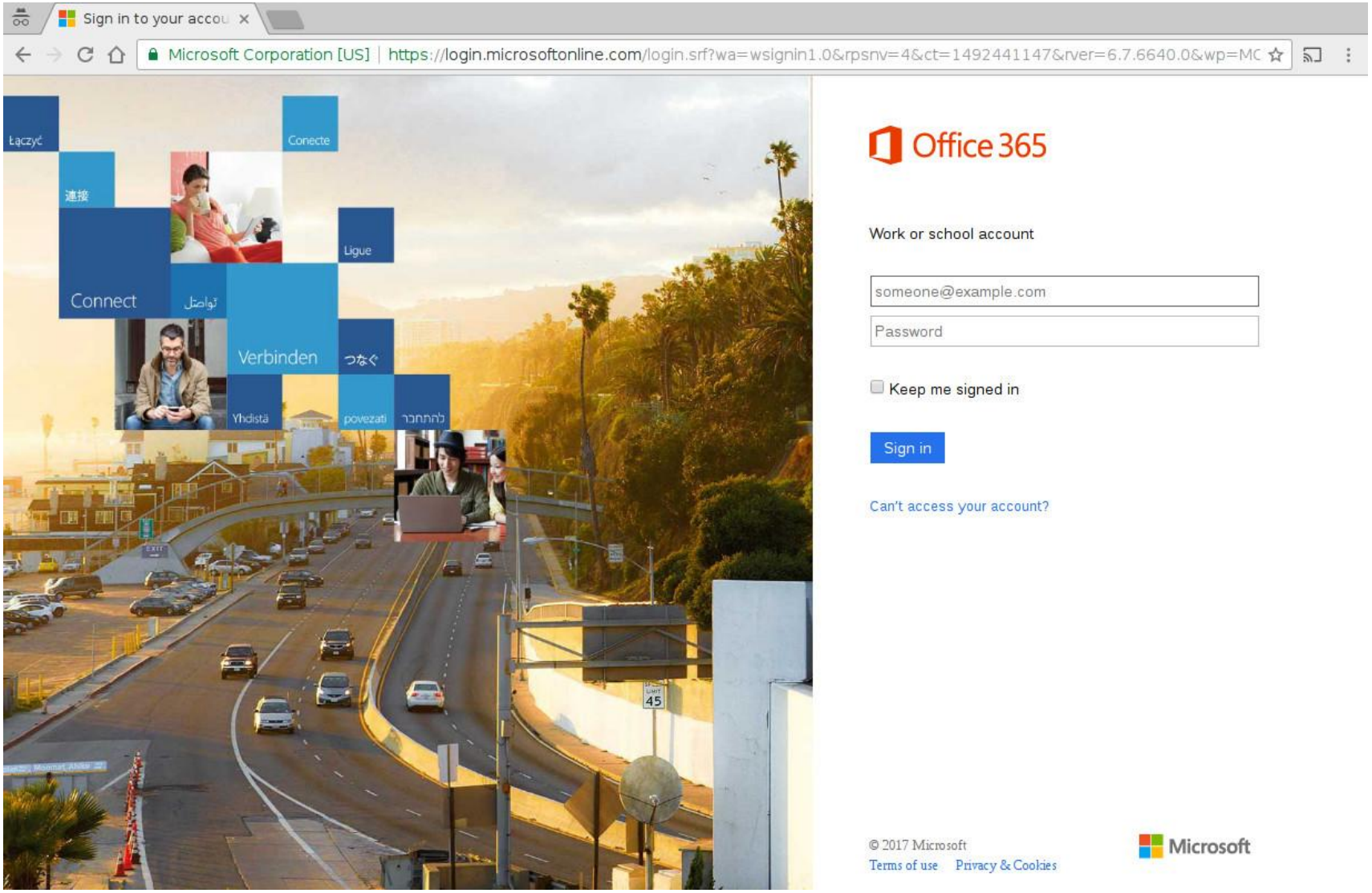
2014 : Salesforce est désignée par Forbes entreprise la plus innovante du monde pour la 4e année consécutive

2017 : valorisation $60 Md

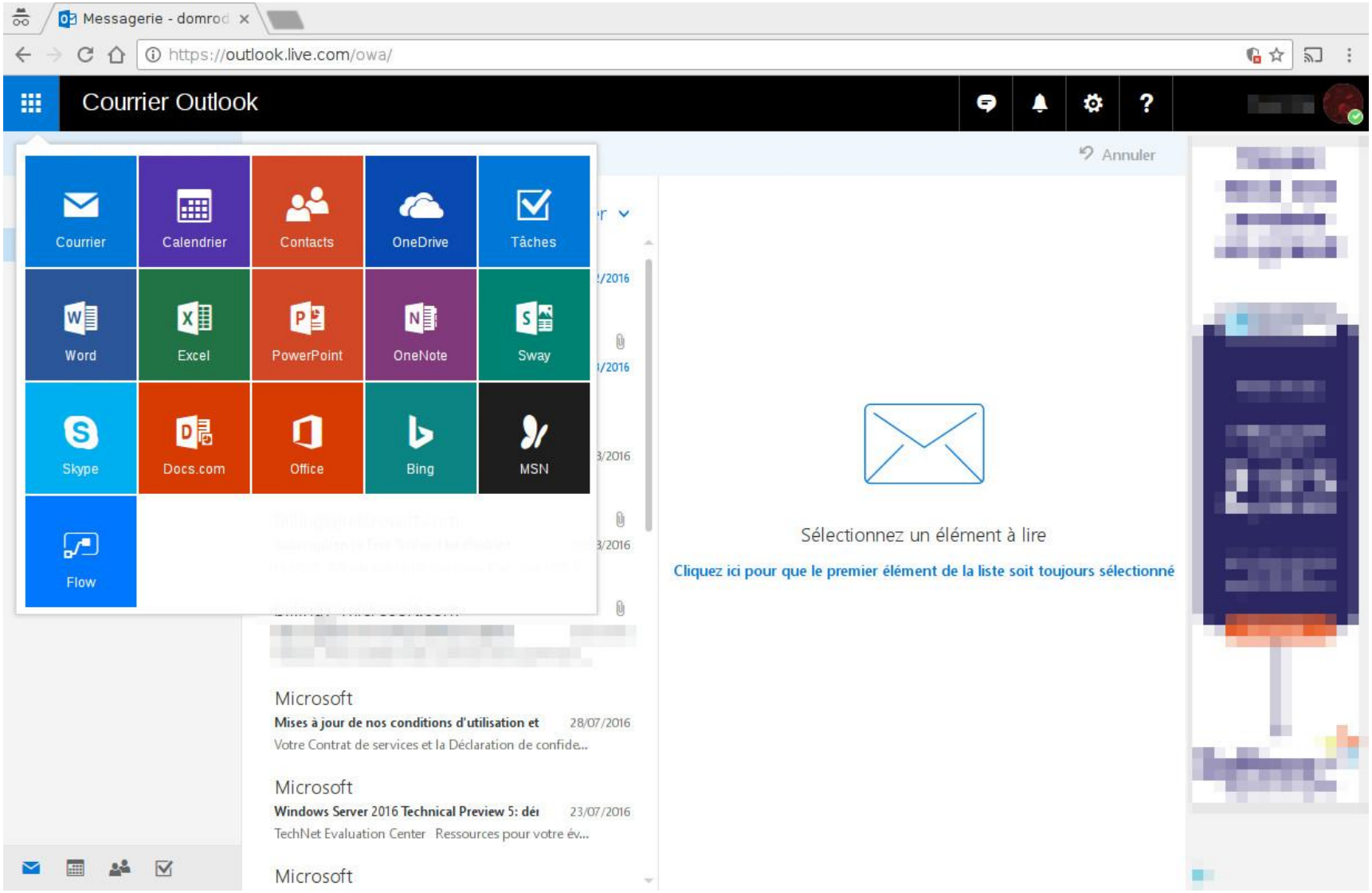
Google Apps : l'alternative à Office



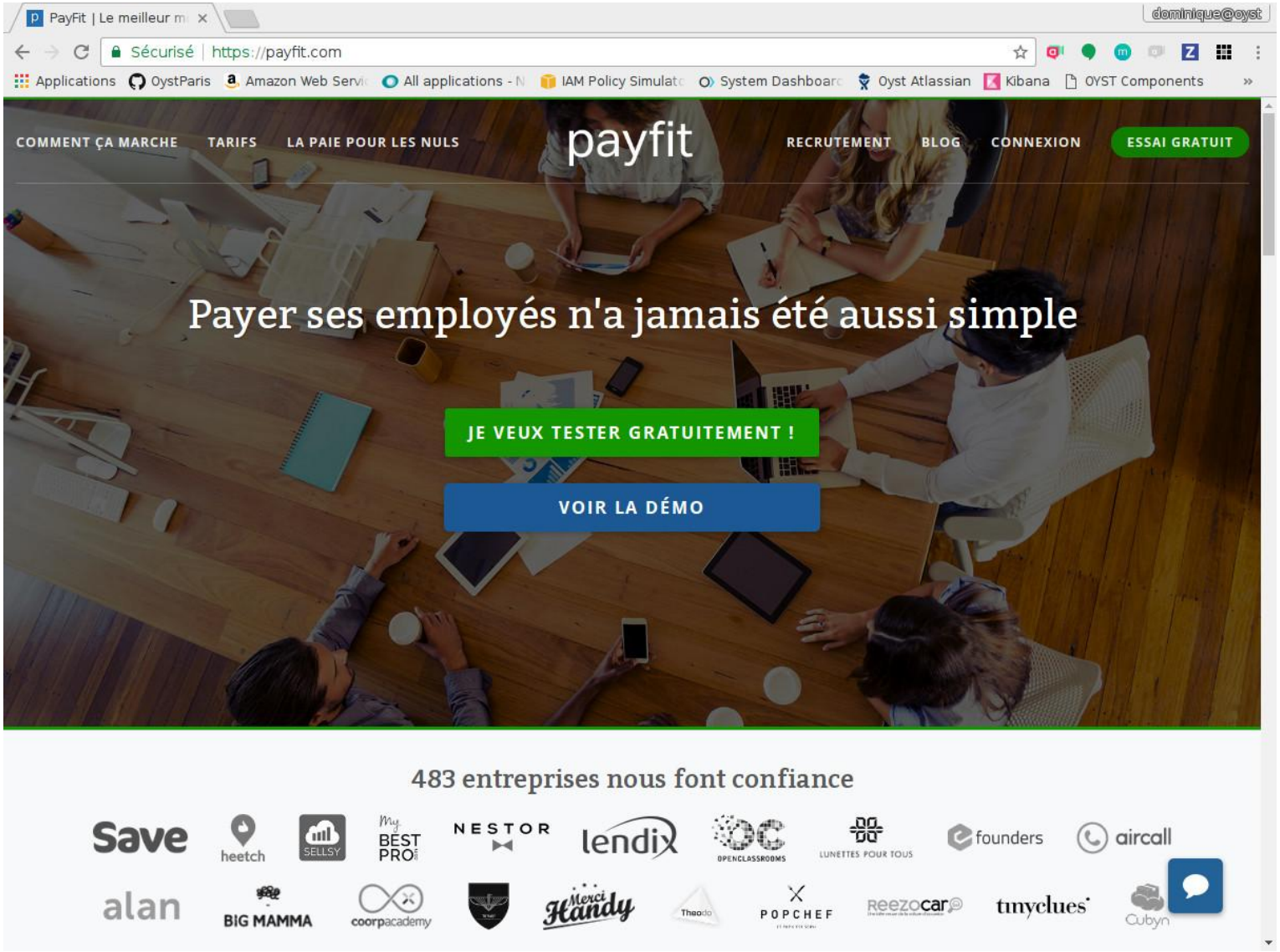
Office365 : la contre-alternative de Microsoft



Outlook.com : l'autre contre-alternative de Microsoft



Bureautique, comptabilité, CRM, ... tout devient SaaS



Évolution de l’édition de logiciels

Le SaaS est une lame de fond

Tous les éditeurs “on-premise” ont réalisé ou prévoient une version SaaS de leurs produits

Des outils pour le développement

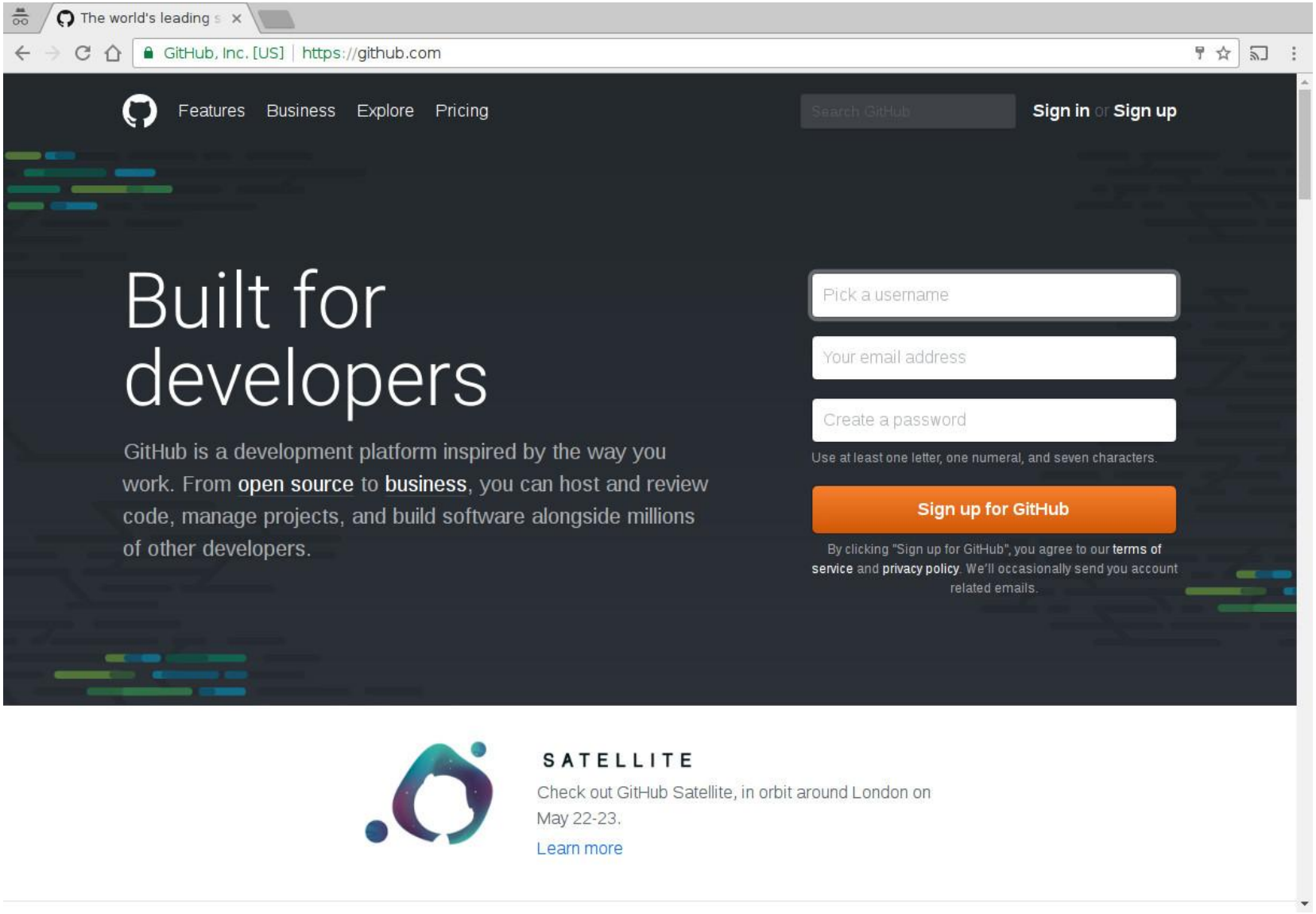
Github (gestion de version de code)

Jira (tickets de développement)

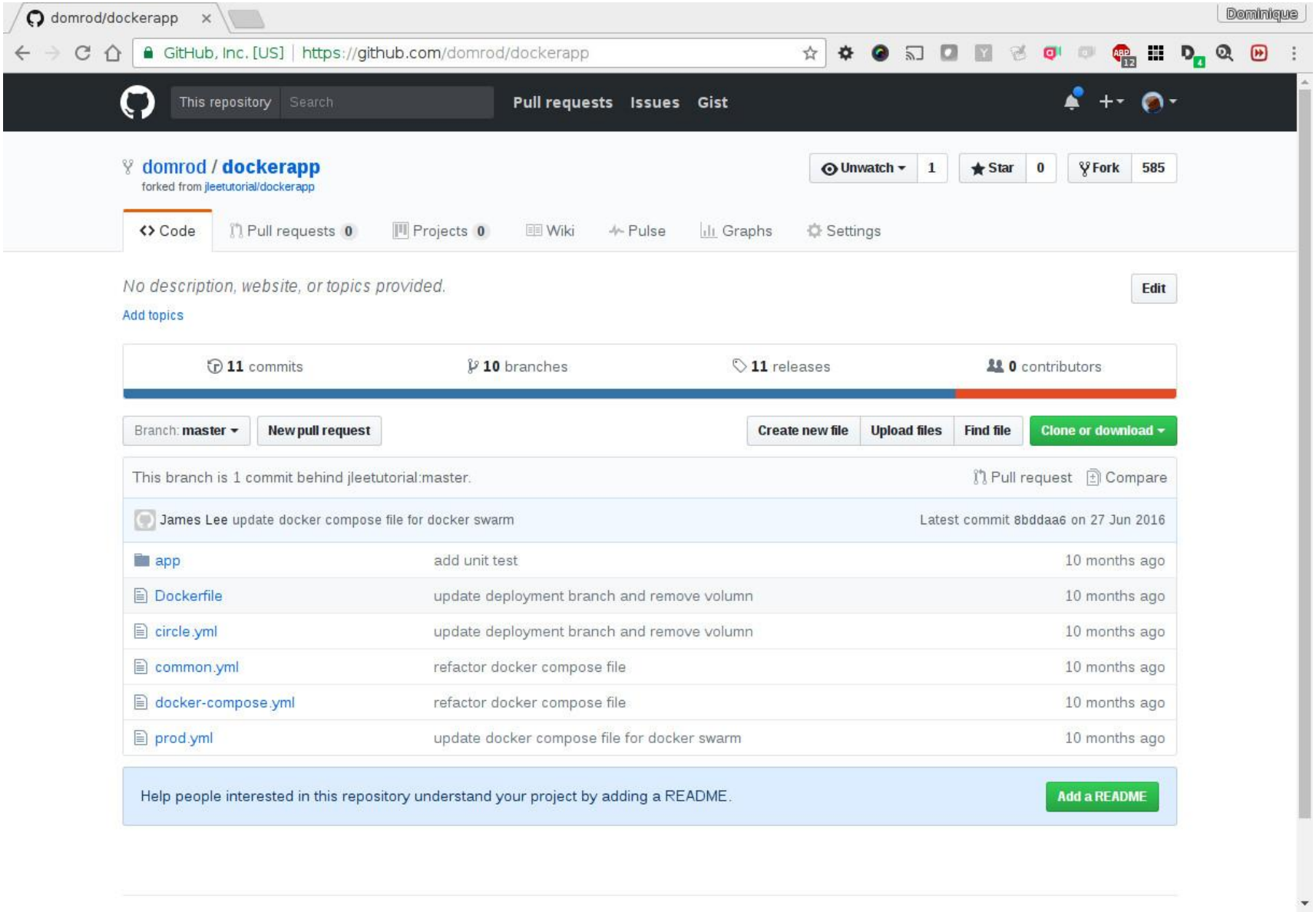
Travis, CircleCI, **Concourse** (tests)

Github : le standard pour Git

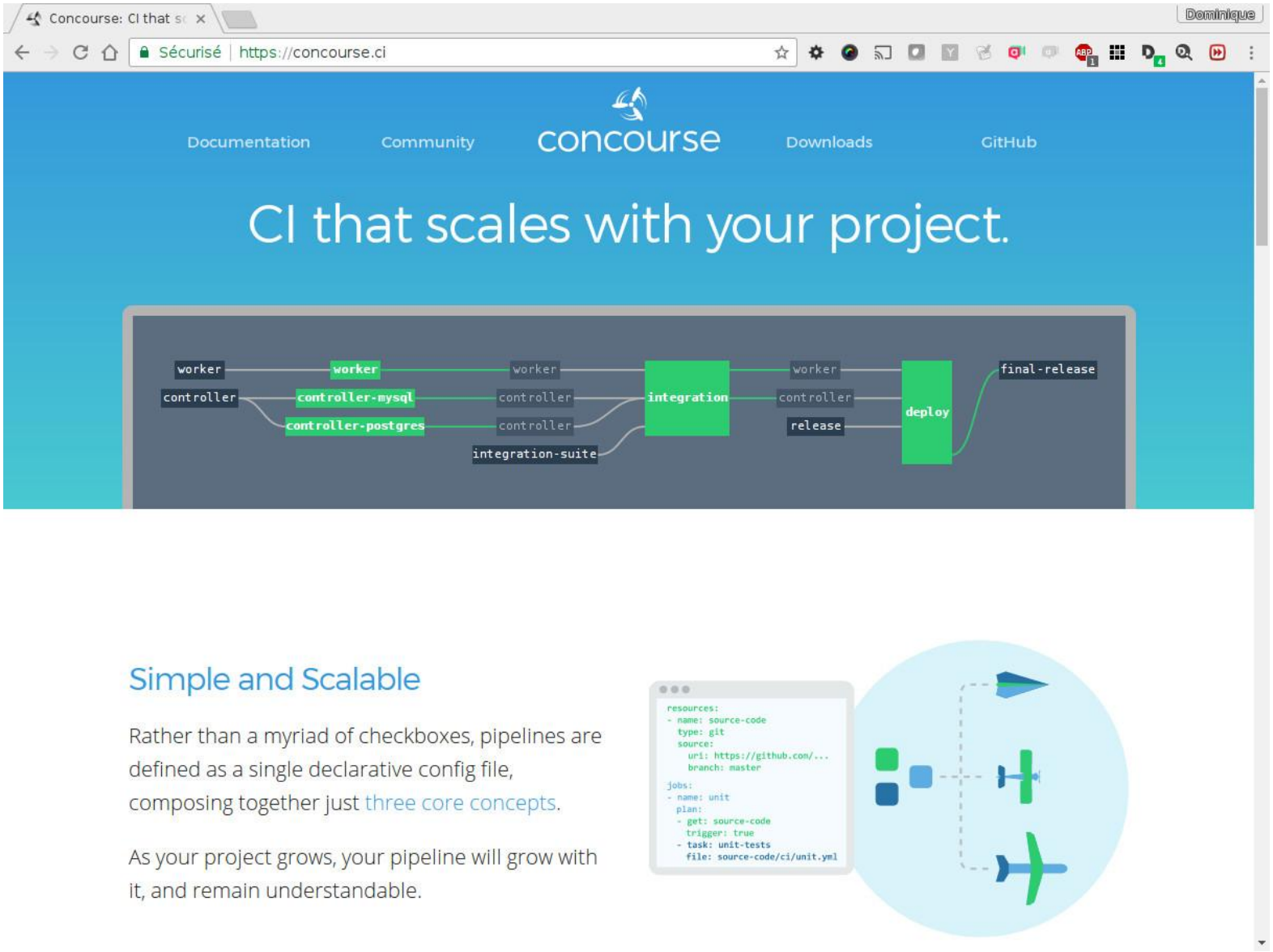
(gratuit pour les projets open source)



Github : le collaboratif avant tout



Concourse : les tests en continu



Le Cloud : avènement des API

SDK (AWS, Azure, GCE)

API REST (Consul, Restlet)

REST

Representational State Transfer

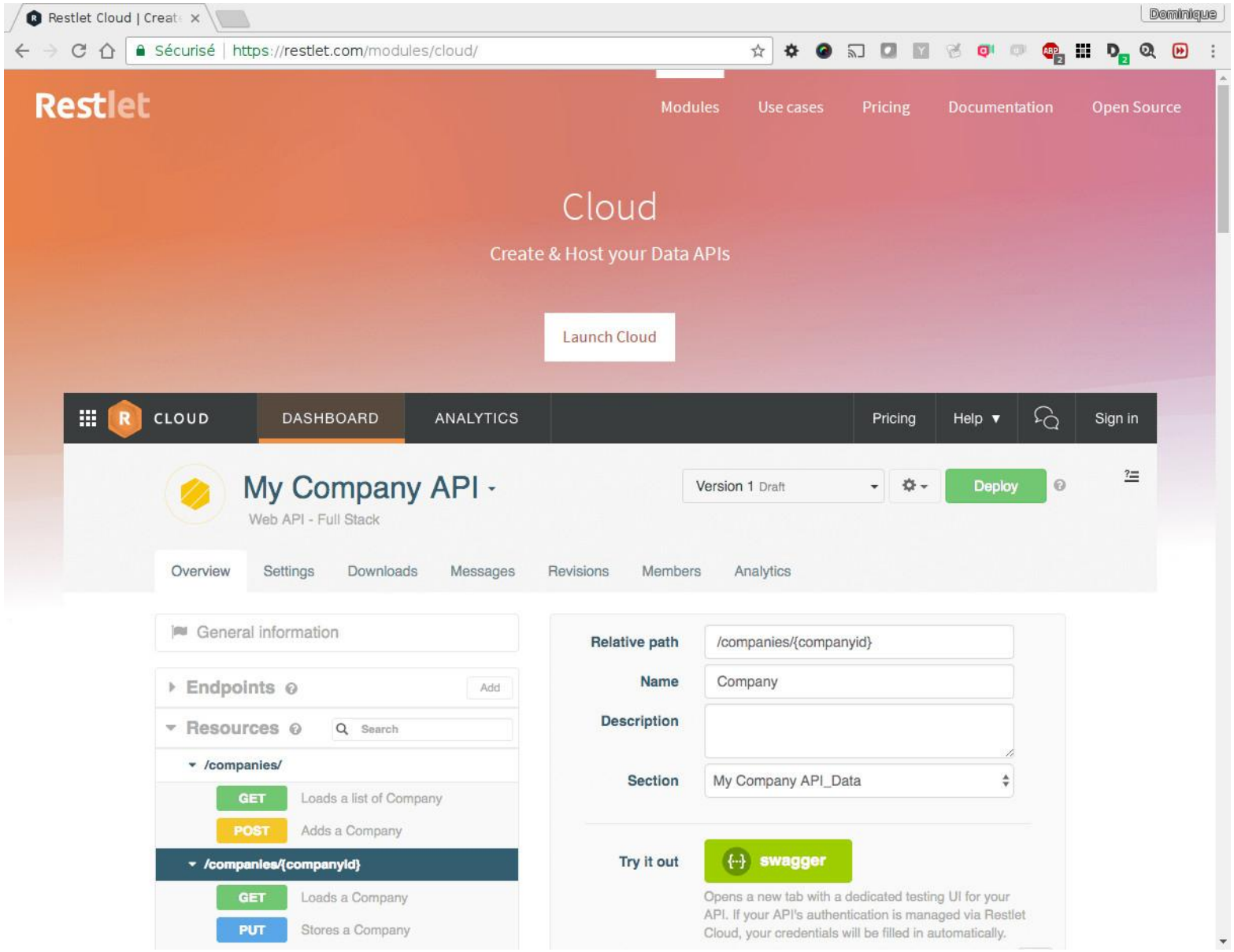
Utilisation de méthodes (verbes) tels que

GET / PUT / POST / DELETE

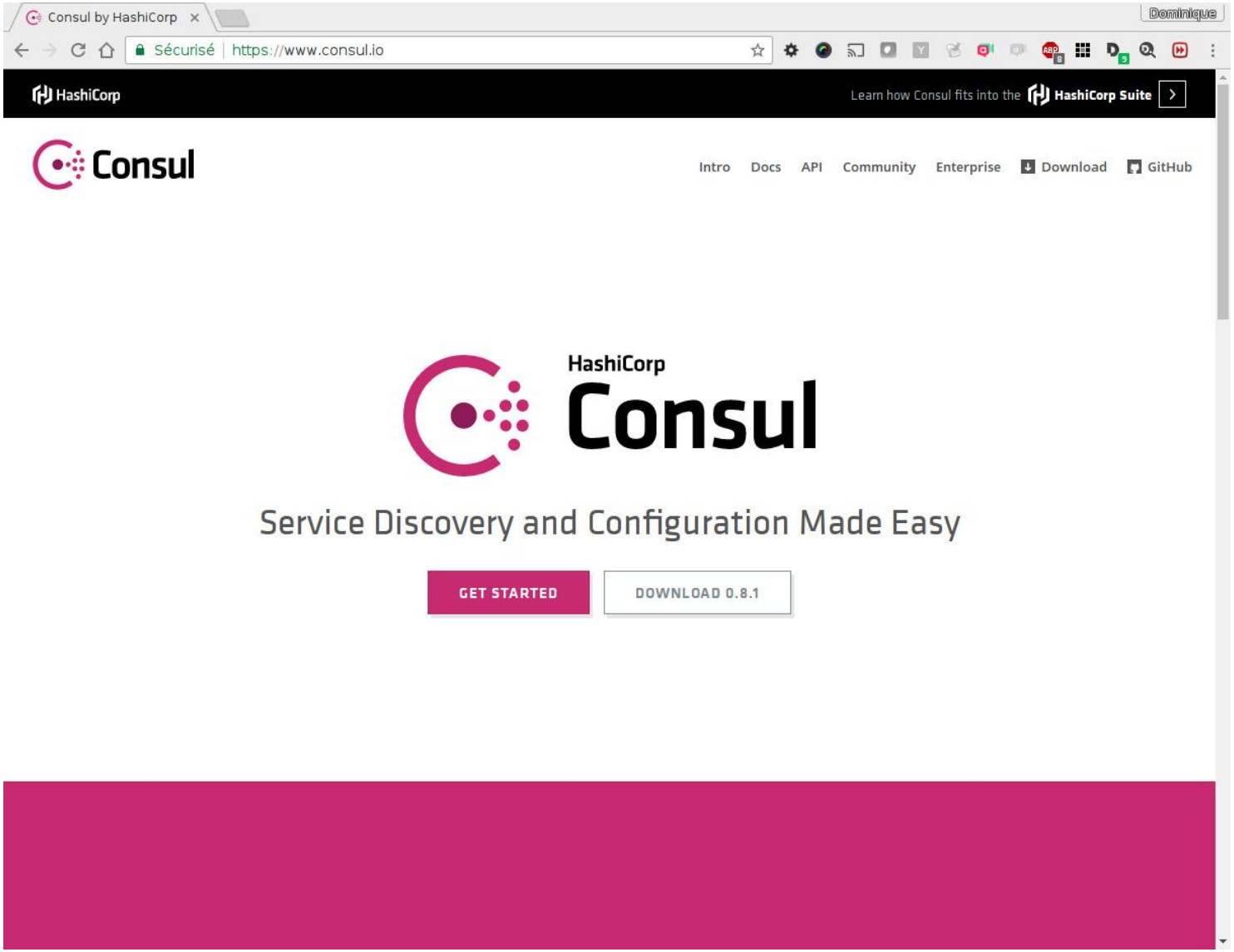
via HTTP/HTTPS

http://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm

Restlet : un fournisseur d'API REST



Consul
découverte de services et stockage K/V



Le Cloud : ère des orchestrateurs multi-cloud

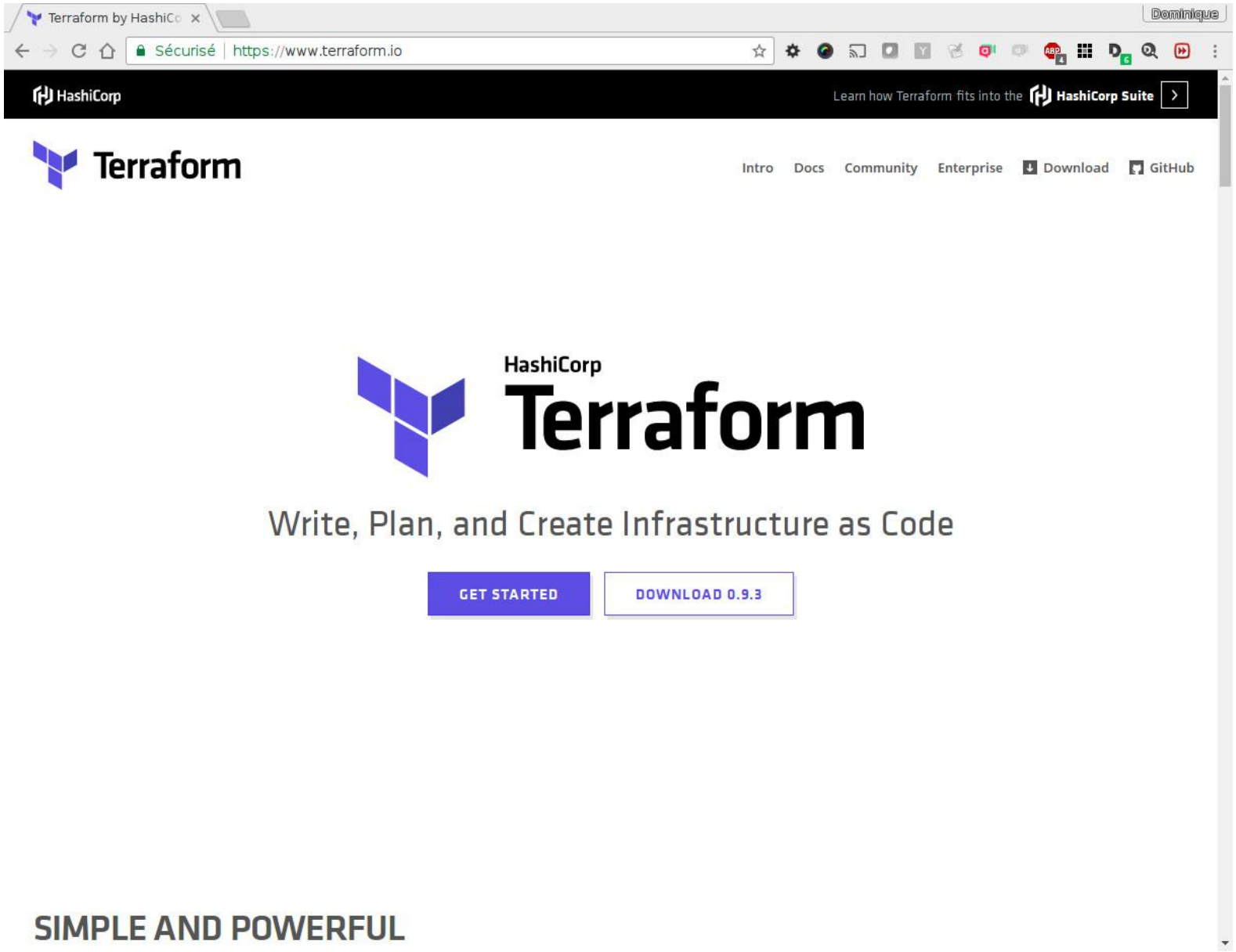
Swarm (Docker inc.)

Mesos

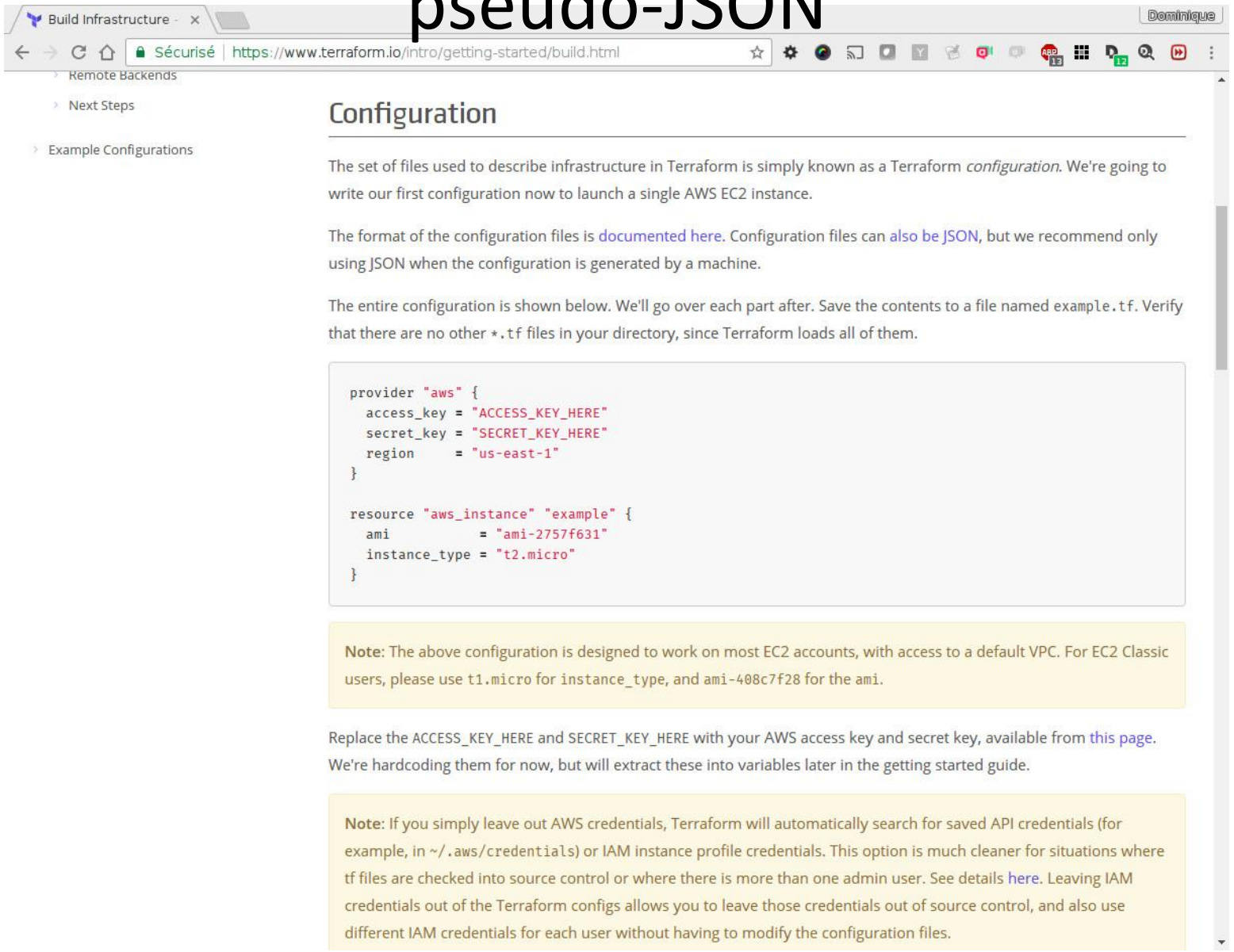
Terraform

Kubernetes

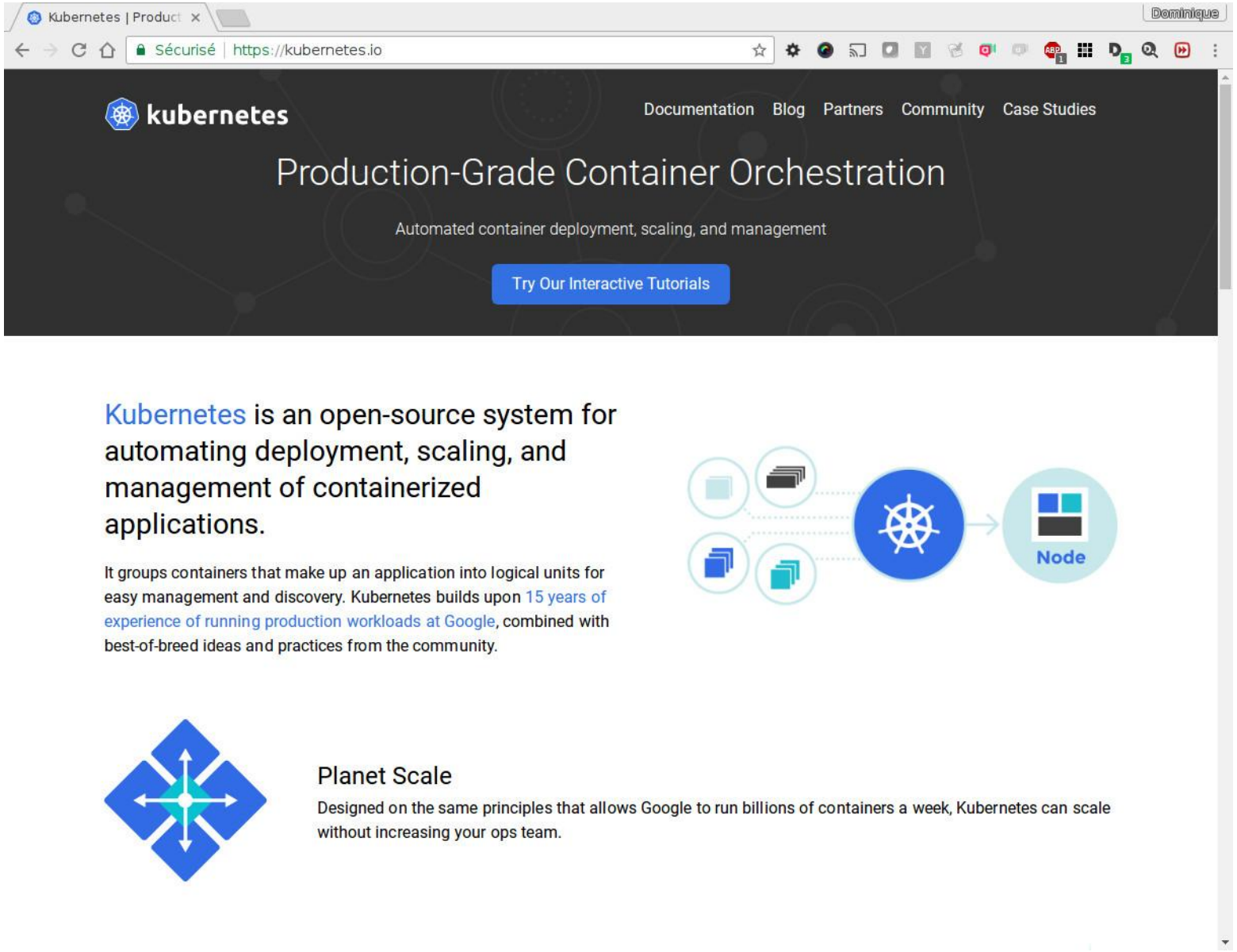
Terraform


Terraform by HashiCo
Dominique
Sécurisé | https://www.terraform.io
HashiCorp
Learn how Terraform fits into the HashiCorp Suite
Terraform
Intro
Docs
Community
Enterprise
Download
GitHub
HashiCorp
Terraform
Write, Plan, and Create Infrastructure as Code
GET STARTED
DOWNLOAD 0.9.3
SIMPLE AND POWERFUL

Terraform : infrastructure en pseudo-JSON



Kubernetes (k8s) par Google



DEMO

Digital Ocean

(web)

Google Compute Platform

(web)

AWS

(web, SDK, Terraform)