Cloud Interoperability

@zzzcn

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NIST's definition of CC

- 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.

Definition

- According to the European Commission (EC), interoperability is defined as the ability of Information and Communication Technology (ICT) systems and of the business processes they support to **exchange data and to enable the distribution of information and knowledge.**

Benefits of InterOp Clouds

- Monitoring of a distributed infrastructure scaled over several clouds can be achieved through a standardized communication mechanism.
- Consistent and uniform system management of multiple clouds.
  Secure verification and service discovery using standardized interfaces.
- SLA enforcement for the possibility of automatically reacting to a SLA
  violation.
- Fault tolerance by scaling over several clouds.
- Disaster recovery, where distributing information and components pre- vents complete data loss and reduces

Existing Surveys

- A. S. A. C. R. Ralf Teckelmann, "Chapter 3 A Taxonomy of Interoperability for IaaS", "Cloud Computing: Methodology, Systems, And Applications," pp. 1–27, Oct. 2011.
- R. Teckelmann, C. Reich, and A. Sulistio, "Mapping of Cloud Standards to the Taxonomy of Interoperability in IaaS," Cloud Computing Technology and Science(CloudCom), 2011 IEEE Third International Conference on, pp. 522–526, 2011.
- Cloud4SOA D1.1 Requirement Analysis Report (Reference Framework)

Table of Content(draft)

- **Introduction**
- **Overview of Cloud Interoperability**
- **Cloud InterOp Characteristics/Taxonomy**
- **Architectures** (Industry, Academia, R&D driven)
- **Intermediate Layer** (OpenStack, OpenNebula, Eucalyptus, CloudStack)
- **Standards** (DMTF, CDMI, CCIF, IEEE WG230{1,2})
- **Open API** (OCCI, libcloud, libvirt)
- **User-Centric Approach** (Xen Blanket, xCloud)
- **Conclusion**

Taxonomy

Access Mechanism

Virtual Appliance

Storage

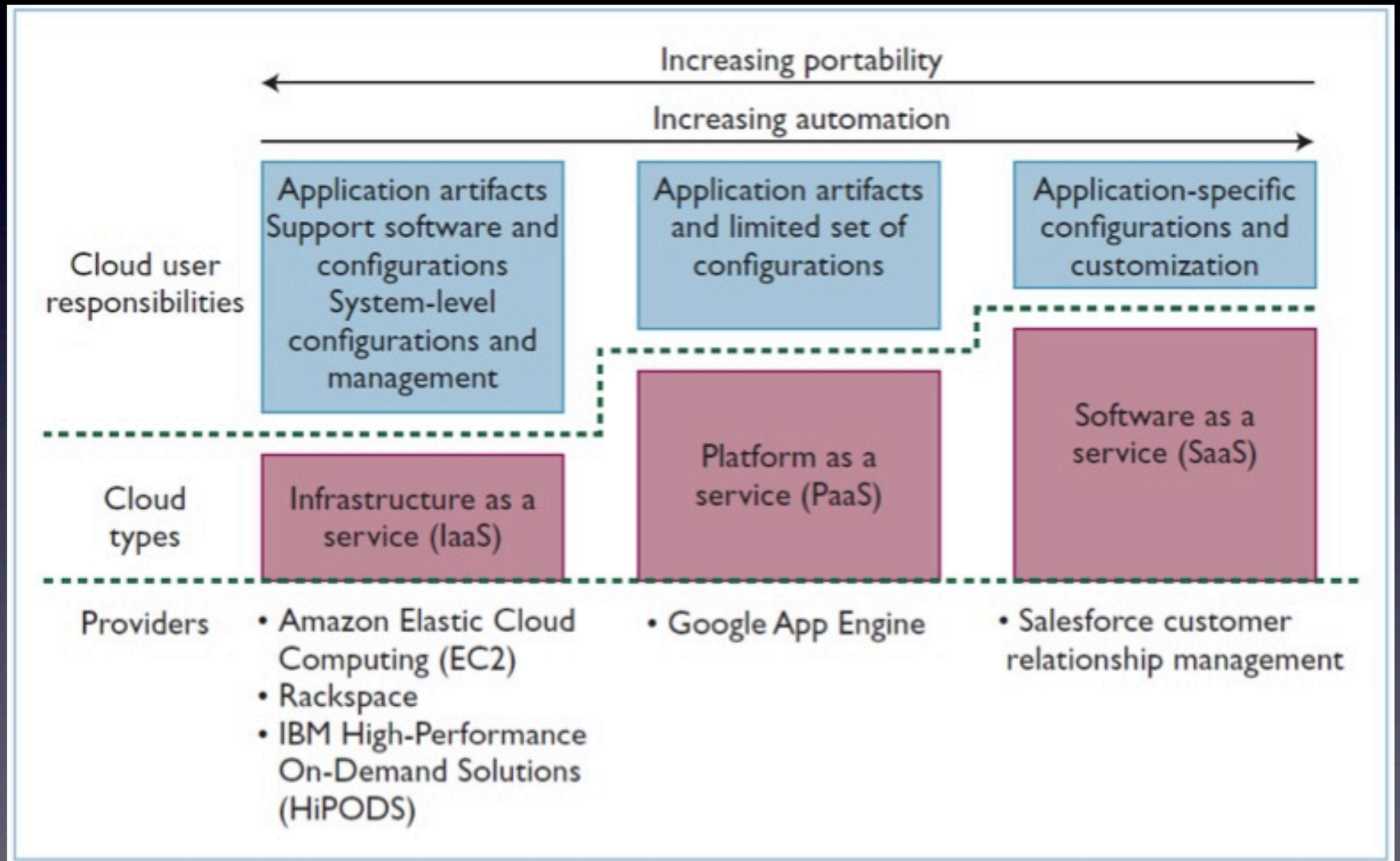
Network

Security

SLA

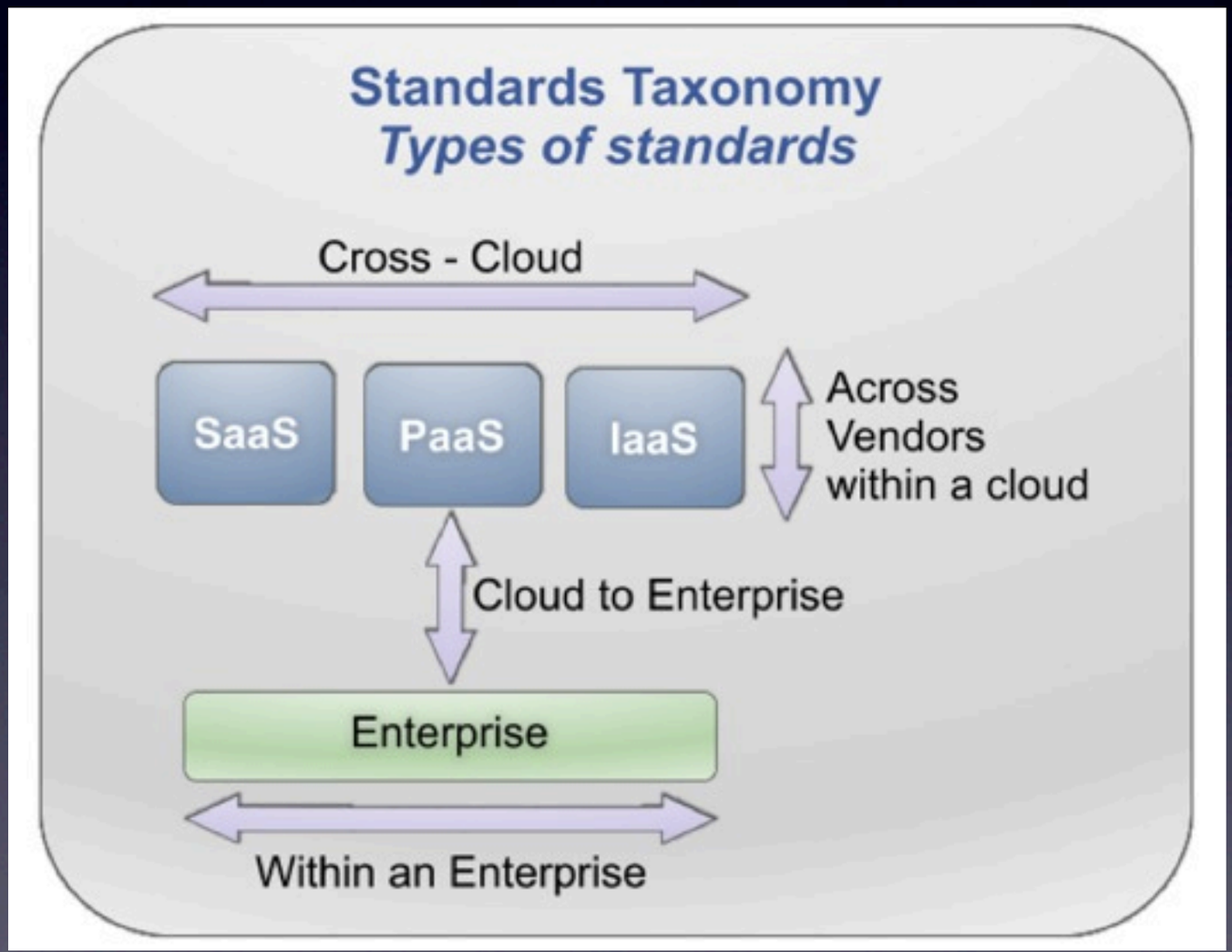
Others

Portability across Cloud Layers



Use Cases

- Integrate Enterprise with Cloud
- Migrate from Enterprise to Cloud
- Migrate from Cloud to another Cloud
- Hybrid Cloud



Migrate between Clouds

- "Copy and Paste" possible
- Open Virtualization Format (OVF)
  - Supports VHD, VMDK, VDI, QCOW2
  - Supports Xen, VMware ESX, KVM, Virtualbox, QEMU, etc.
  - OVF limitations.

Amazon's IaaS

VM Import/**Export**

Google's IaaS

- With Interoperability in mind
- Designed to run KVM workloads
- GAE to GCE seamlessly (PaaS to IaaS)
- Other IaaS to GCE via RightScale.
- Other partners: Puppet, OpsCode
- OpenAPI. Extend the stack at any level

Opscode Announces Integration with **Google Compute Engine ...**

www.prnewswire.com/.../opscode-announces-integration-with...
- Cached

6 days ago – Leveraging Opscode's knife plugin for **Google Compute Engine**, ... value, and its **architecture** is optimized for predictability, scalability, security, ...

You visited this page on 7/2/12.

Puppet Labs + **Google Compute Engine** | Puppet Labs

puppetlabs.com/solutions/**google-compute-engine**/ - Cached

Puppet Labs' integration with **Google Compute Engine** (GCE) enables system ... its **architecture** is optimized for predictability, scalability, security, and flexibility.

RightScale Joins **Google Compute Engine** for Launch Day ...

blog.rightscale.com/.../rightscale-joins-**google-compute-engin**...
- Cached

6 days ago – With the release of **Google Compute Engine**, the year 2012 is ... VMs to be the most consistent of any other virtualized **architecture** we've used.

Google Compute Engine Pricing

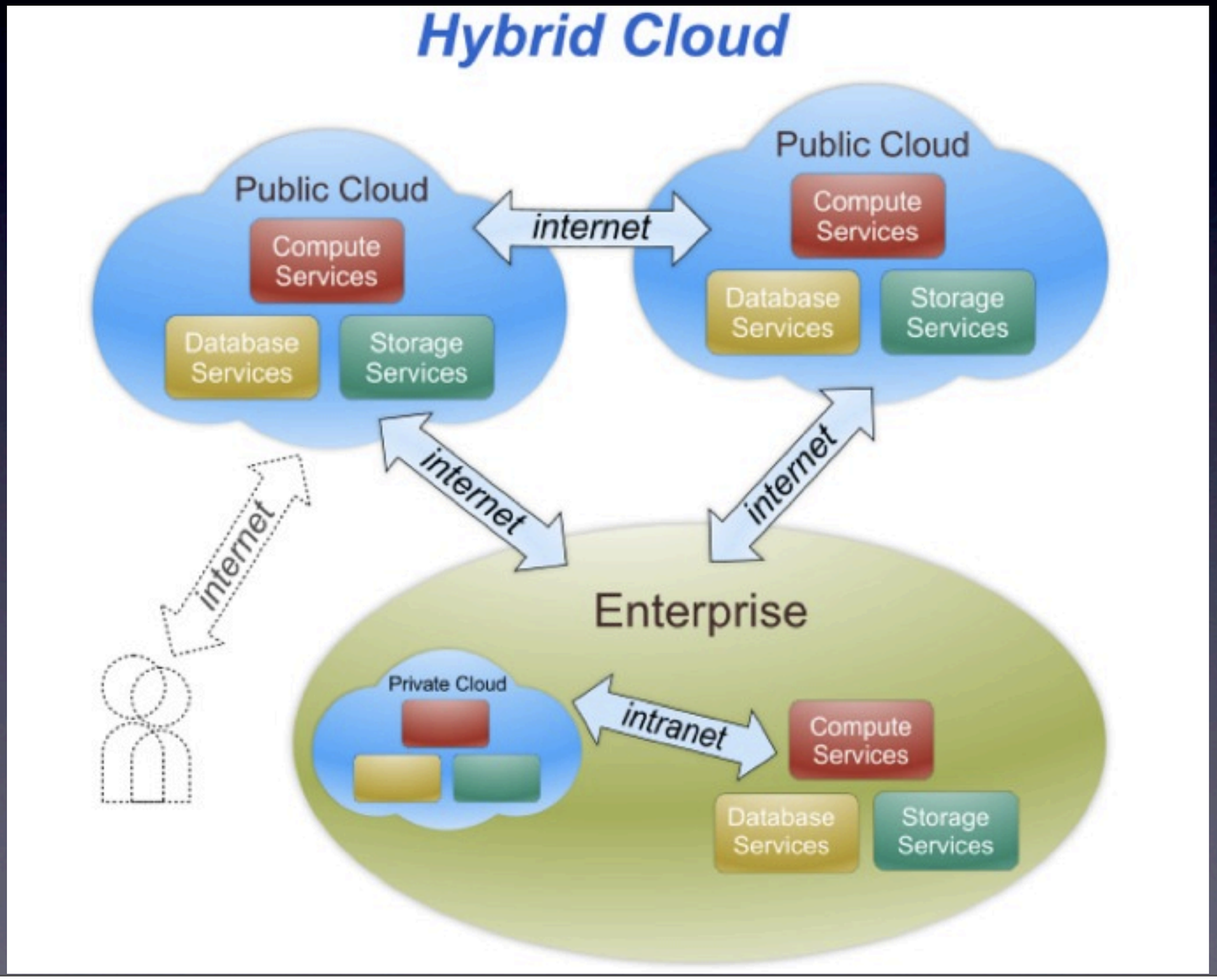
Pricing for virtual machine resources

ogle Compute Engine currently offers the following 4 machine types. We will be offering additional configurations in the future including smaller types to help developers get rted easily, as well as larger types to support more powerful scaling of applications.

Machine Type Pricing

Configuration	Virtual Cores	Memory	GCEU *	Local disk	Price/Hour	$/GCEU/hour
n1-standard-1-d	1	3.75GB ***	2.75	420GB ***	$0.145	0.053
n1-standard-2-d	2	7.5GB	5.5	870GB	$0.29	0.053
n1-standard-4-d	4	15GB	11	1770GB	$0.58	0.053
n1-standard-8-d	8	30GB	22	2 x 1770GB	$1.16	0.053

Hybrid Cloud



Brokers

- OpenStack
- CloudStack
- OpenNebula
- Eucalyptus

Standards (IaaS)

- OVF (DMTF)
- OCCI
- CDMI (SNIA)
- UCI (CCIF)
- (in progress) IEEE WG 2301, 2302
- Open Data Center Alliance
- Open Cloud Consortium

Standardization Bodies

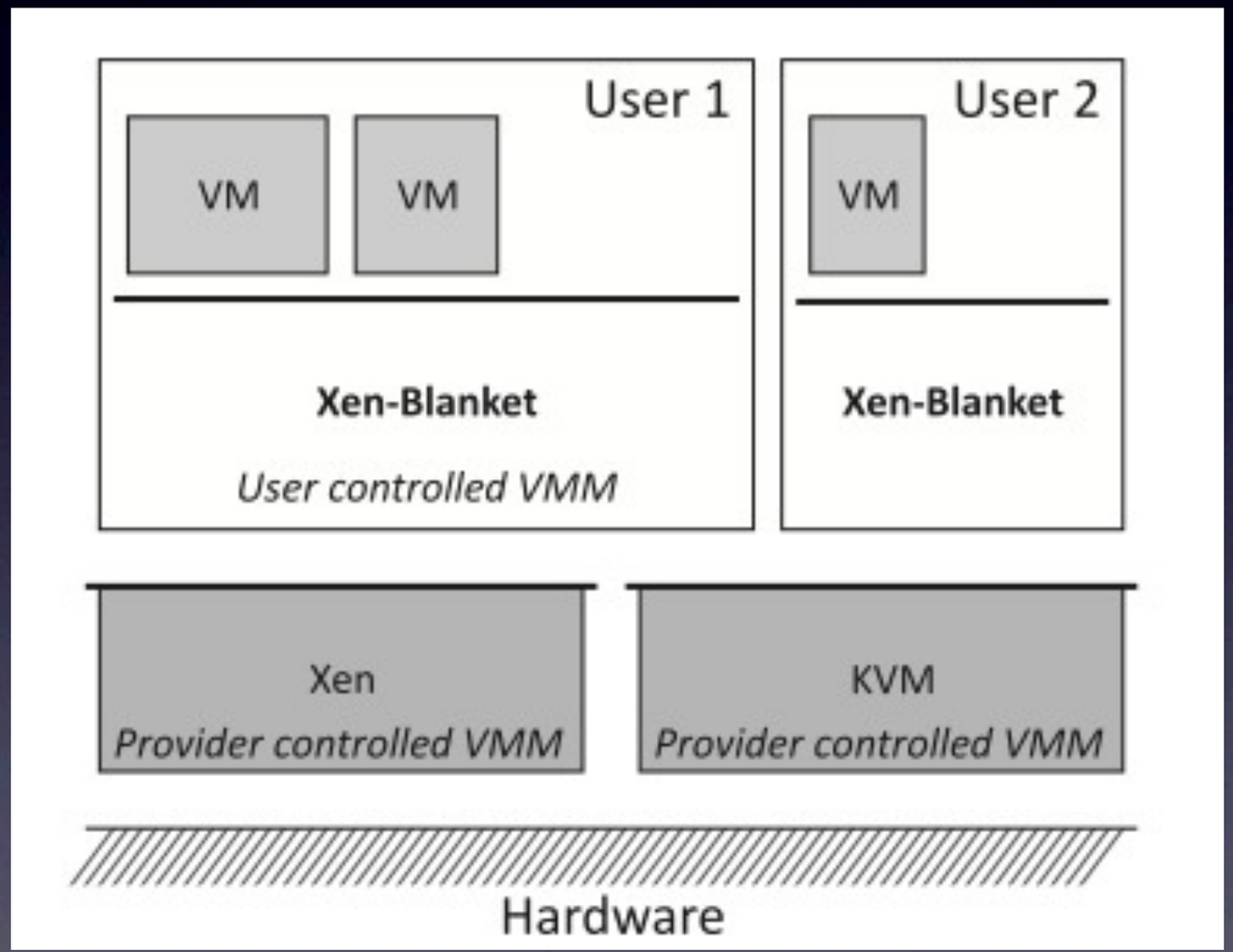
	IaaS	PaaS	SaaS
DMTF	√	√	√
Open Cloud Manifesto	√	√	√
OCC	√		
OASIS			√
Open Group Cloud			√
TM Forum			√
CCIF	√	√	
GICTF	√	√	
OGF/OCCI	√		
ETSI TC Cloud	√		
OMG			√
NCOIC			√
CIF			√
Open DataCenter Alliance	√		
IEEE WG 2301 2301	√	√	

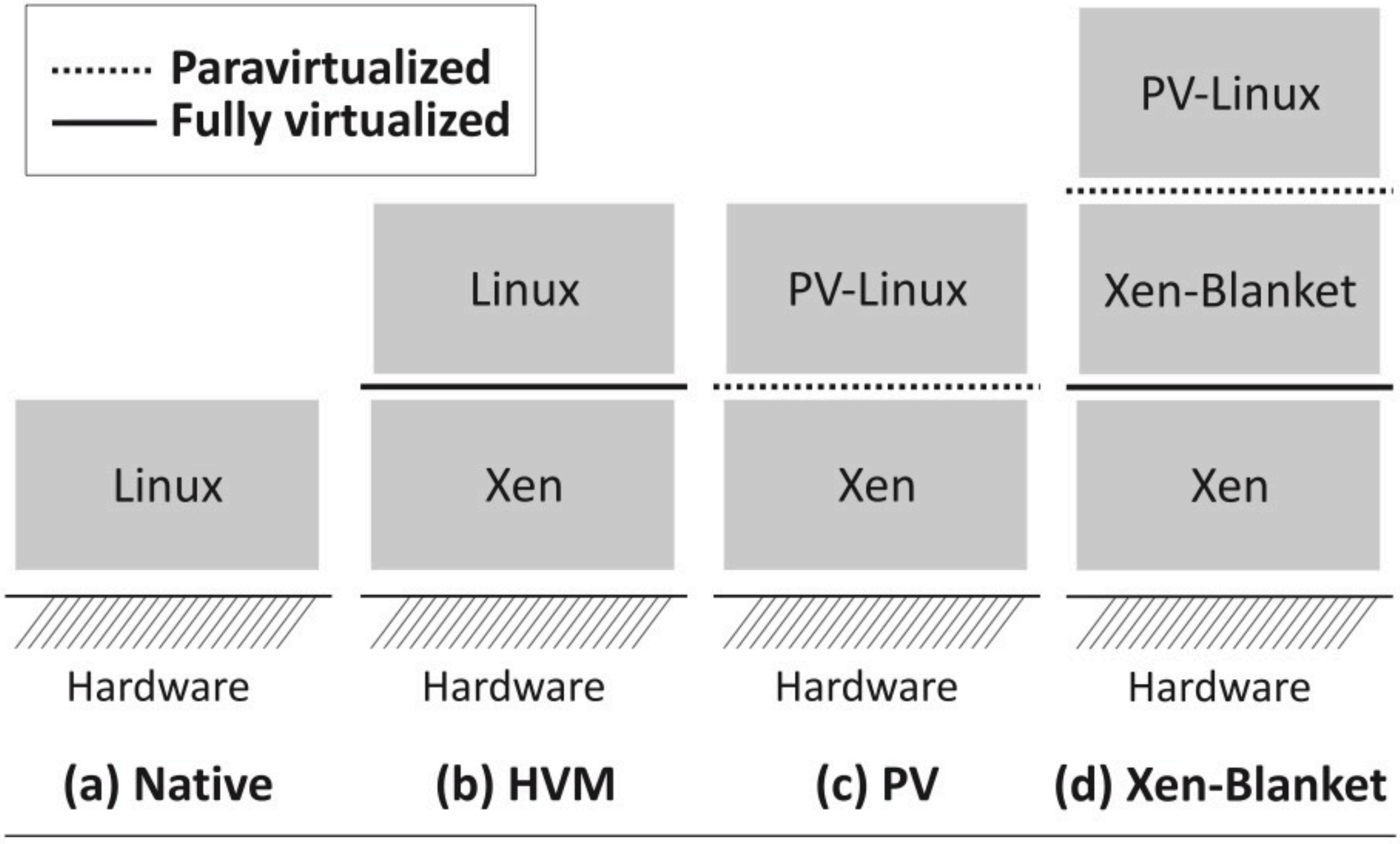
IEEE WG 2301,2302

- The IEEE Cloud Profiles Working Group/P2301 is working on a standard, "Draft Guide for Cloud Portability and Interoperability Profiles," for enabling a workload - say, a set of UC functions - operating in one cloud to be moved into another cloud.
- The IEEE Intercloud Working Group/P2302 is developing a standard, "Intercloud Interoperability and Federation," for enabling a system in one cloud to work with a system in a different cloud.

User-Centric

- Nested Virtualization
- Hypervisor level control
- Implementation: Xen-Blanket, xCloud




Paravirtualized
Fully virtualized
PV-Linux
Linux
PV-Linux
Xen-Blanket
Linux
Xen
Xen
Xen
Hardware
Hardware
Hardware
Hardware
(a) Native
(b) HVM
(c) PV
(d) Xen-Blanket

Research Challenges

- Common and Standard Interfaces
- Portability of Virtual Appliances
- User-centric Approach

Thank you!

Backup Slides

Challenges and future work

- How to write an Academic Survey?
- The scope?
- Mostly from industry; need to cite more academic papers.