Cloud Portability and Interoperability Architecture Model and Best Practices Based on Open Group Guide

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Working Group on Cloud Computing Interoperability Standards,
Expert Group on Cloud Computing Services and Standards,
Office of the Government Chief Information Officer, Hong Kong SAR Government

Agenda

- Background and cloud portability and interoperability concepts
- Distributed computing reference model
- Recommendations for current practice and standards development
- Conclusions

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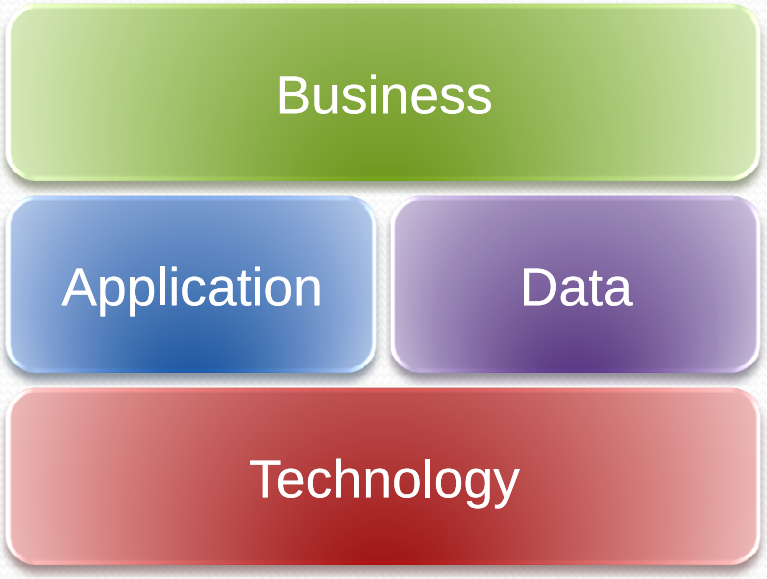
Background

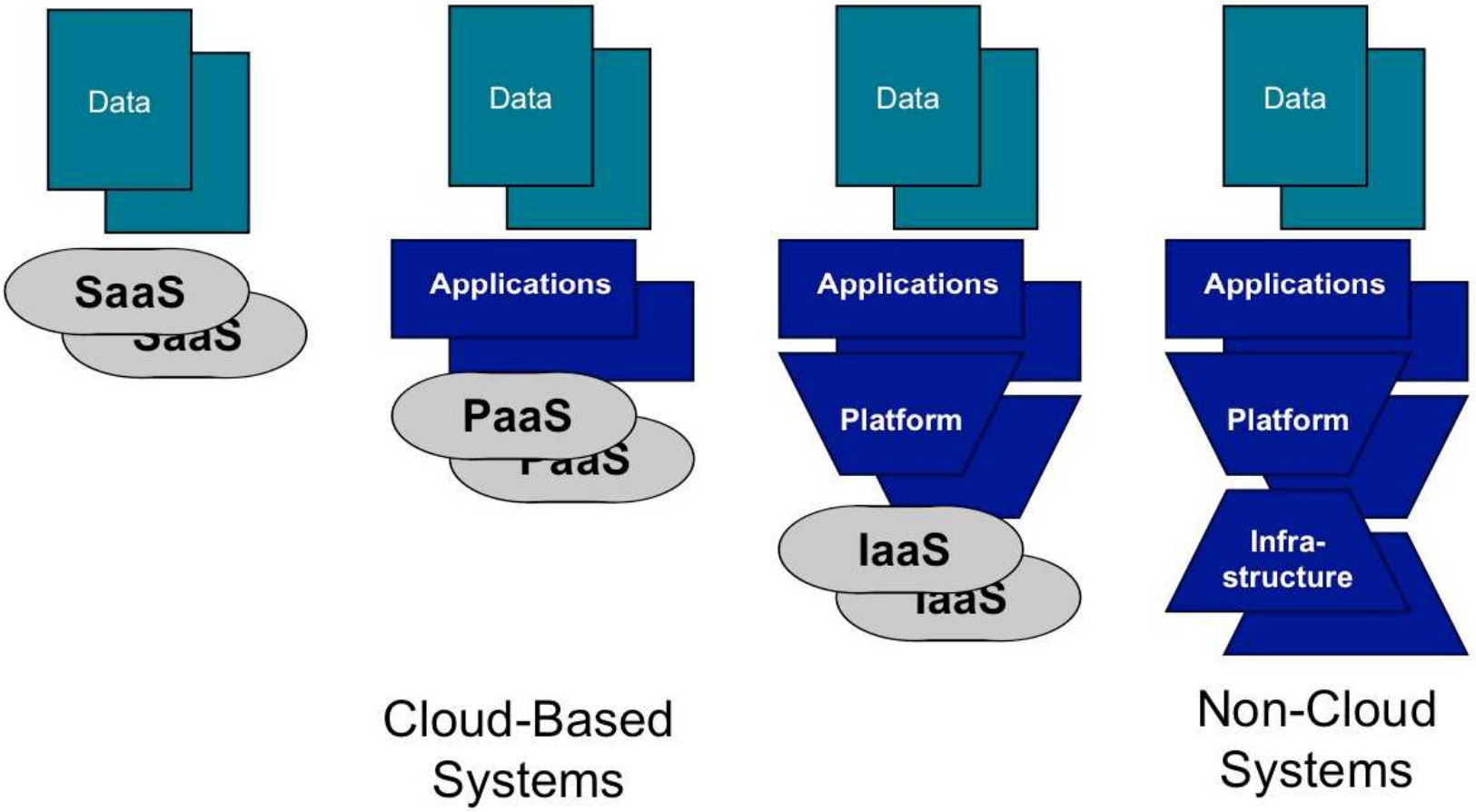
- Open Group Guide: Cloud Computing Portability and Interoperability by The Open Group, April 2013
  - Explains major cloud portability and interoperability issues
  - Recommends customers on how best to achieve portability and interoperability when using
  - Recommends suppliers and standards bodies on how standards and best practices should evolve
- Cloud computing enables massive economic activities and makes significant contribution to GDP
  - Like Internet yet with even greater potential
- Potential will not be realized without portability and interoperability
  - Growth of the Internet is largely due to high level of portability and interoperability

Architecture for Portability / Interoperability

- Business architecture
  - Business strategy, organization, functions, business processes and information needs
- Information systems architecture
  - Application architecture
    - Capabilities that provide business functions and manage data assets
  - Data architecture
    - Logical / physical data assets, data management resources
- Technology architecture
  - Platform services, logical / physical technology components



Cloud Service Models



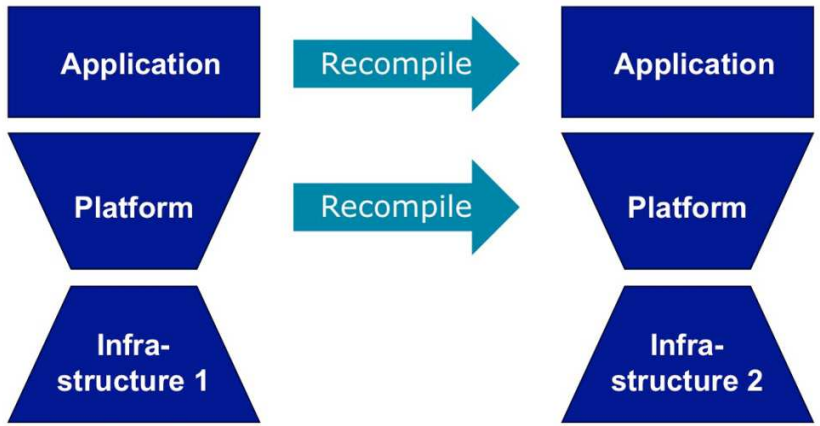
Source: Open Group Guide - Cloud Computing Portability and Interoperability

Cloud Portability

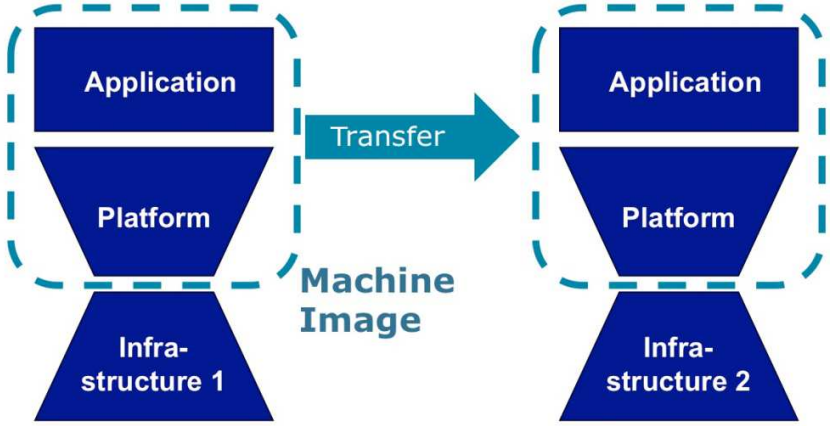
- Data portability
  - Reuse of data components across applications
- Application portability
  - Reuse of application components across PaaS's
- Platform portability
  - Platform source portability: reuse of platform components across IaaS's
  - Machine image portability: reuse of bundles of platform + application + data (i.e., VM image) across IaaS's

Platform Portability

Platform source portability



Machine image portability



Source: Open Group Guide - Cloud Computing Portability and Interoperability

Cloud Interoperability

- Application interoperability
  - Between different / identical application components, e.g., hybrid cloud
  - Data synchronization between components in different clouds
- Platform interoperability
  - Between platform components, e.g., database
  - Set-up and transfer of application session info:
    - User ID
    - Authentication level
    - User locale and preference

Cloud Interoperability (Cont')

- Management interoperability
  - On-demand self-service management of different clouds (SaaS, PaaS, IaaS)
  - E.g., manage cloud services together with in-house systems using generic system management COTS
- Publication and acquisition interoperability
  - Between marketplaces, app stores, etc.
  - Standard interfaces to different stores

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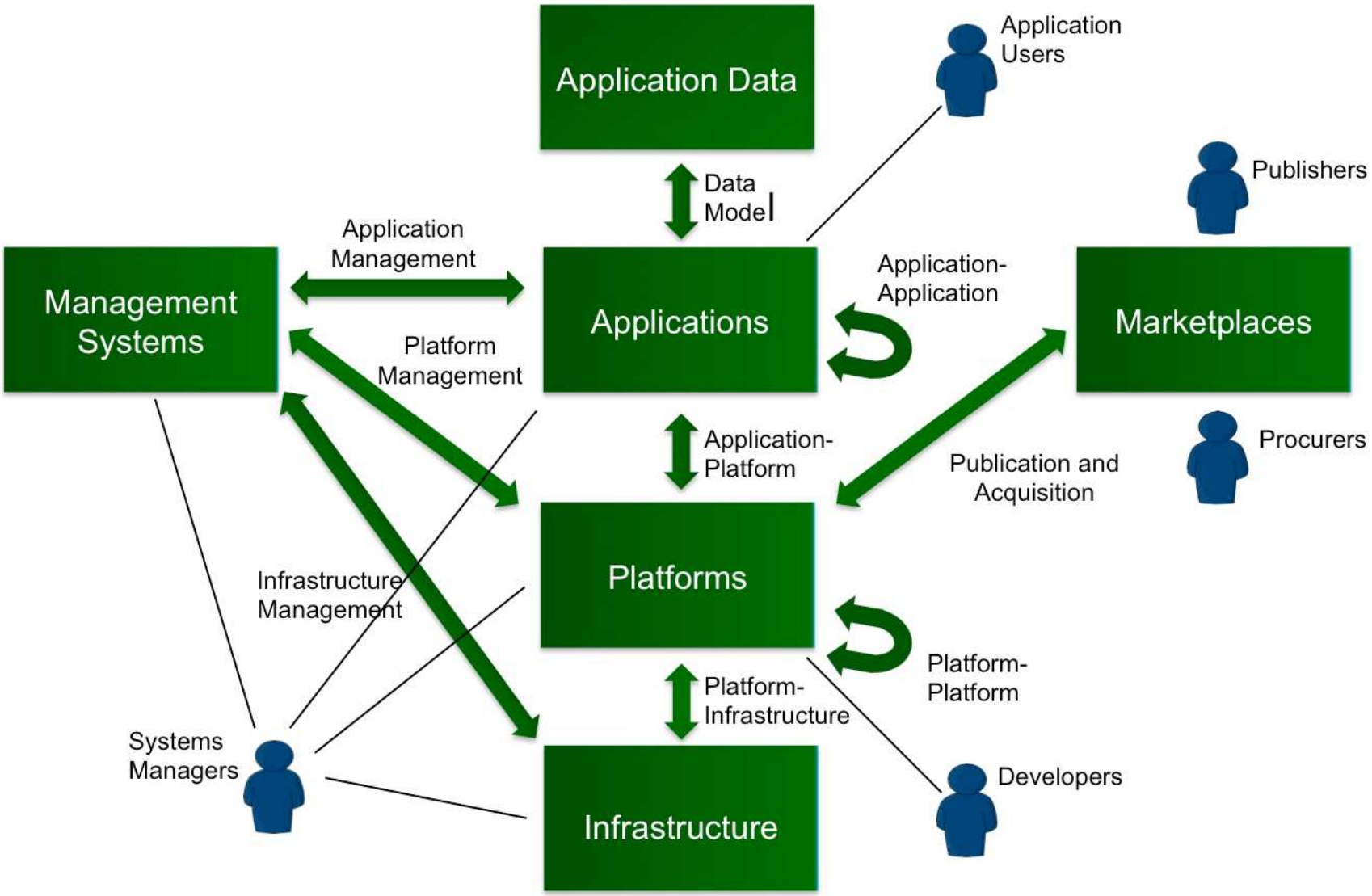
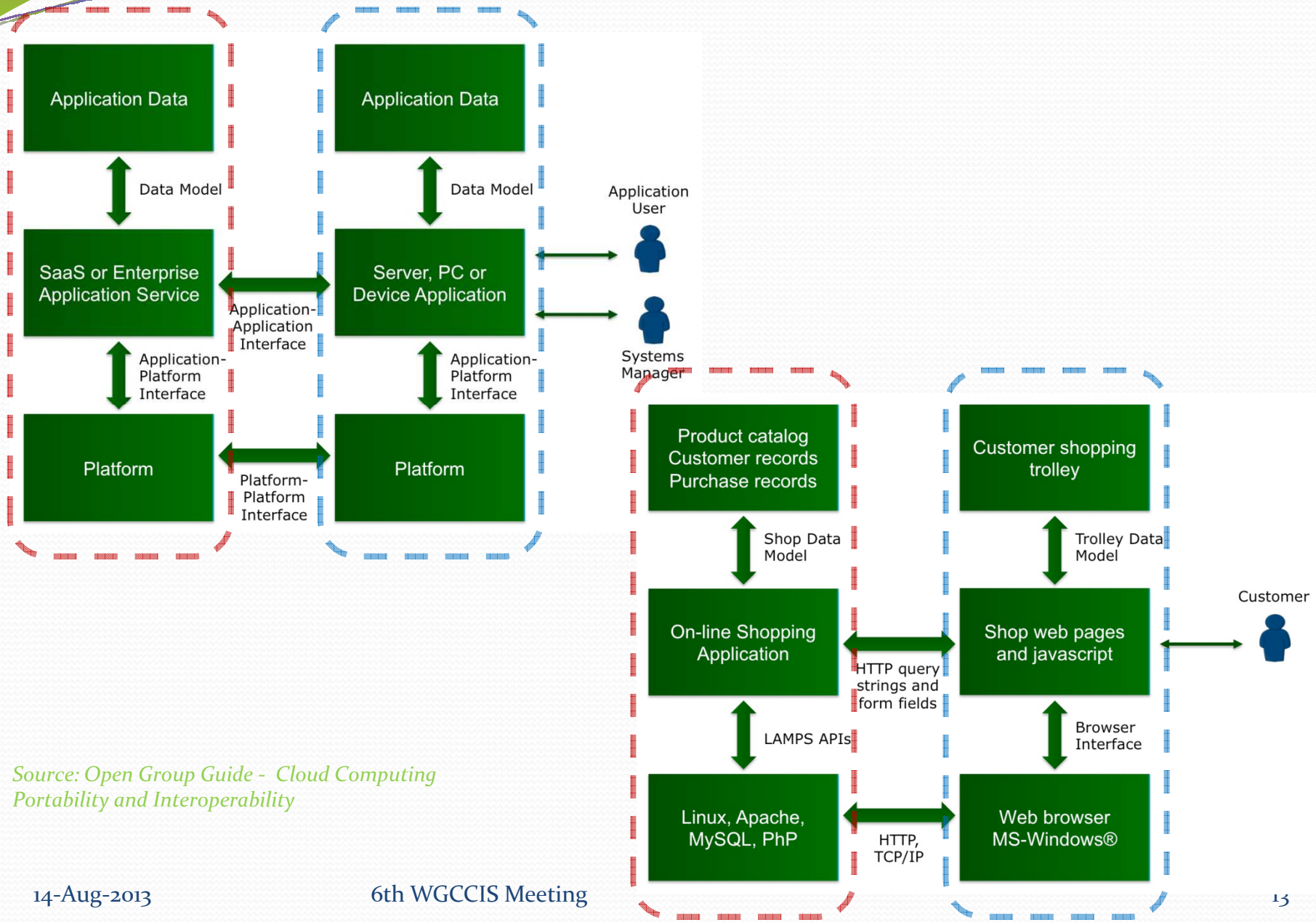
Distributed Computing Reference Model



Source: Open Group Guide - Cloud Computing Portability and Interoperability

Applications Mapping to DCRM

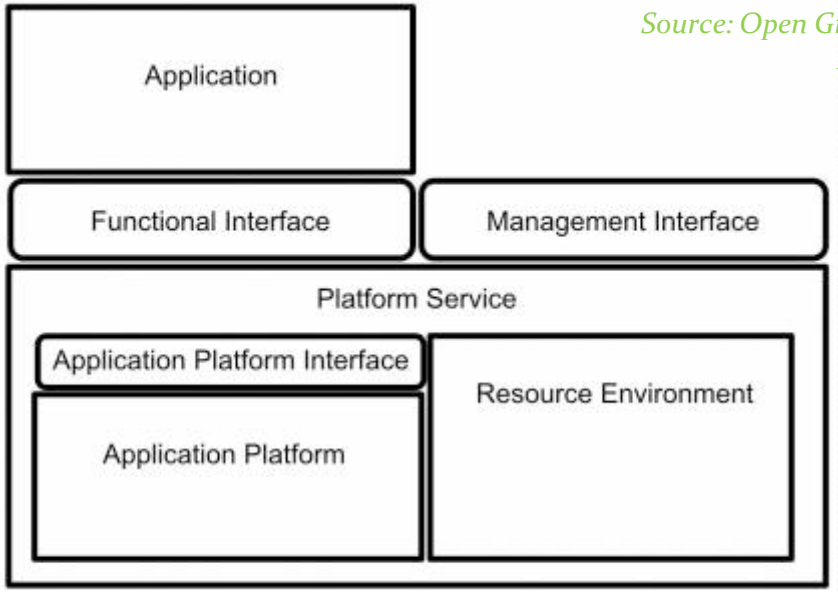


Source: Open Group Guide - Cloud Computing Portability and Interoperability

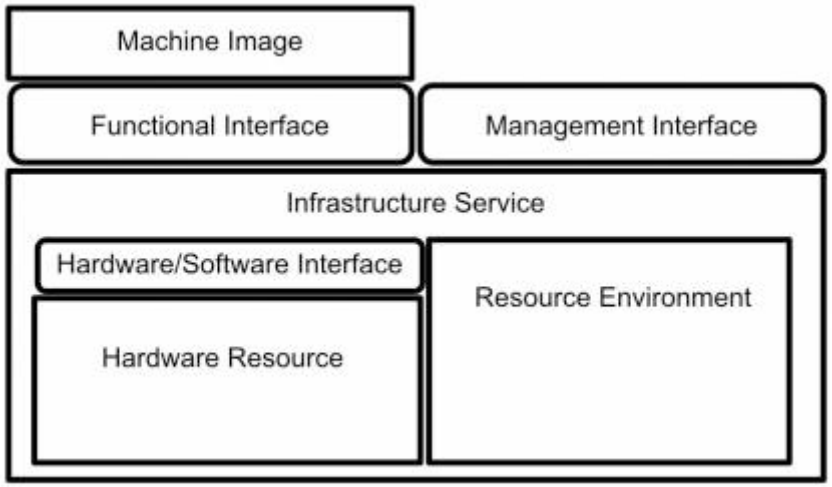
PaaS and IaaS on DCRM

Source: Open Group Guide - Cloud Computing Portability and Interoperability

- PaaS:



- IaaS:



Portability / Interoperability Interfaces

Interface	Exposed By	Used By	Type	Reason for Standardization	Standards
Data Model	Data	Applications	Description or Shared Understanding	Data Portability Application Interoperability	SQL XML RDF OWL UDEF
Application-Application Interfaces	Applications	Applications	Web Service API Content	Application Interoperability	N/A (but principles of arrangement are important)
Application Management Interfaces	Applications	Management Systems	Web Service API	Management Interoperability	CDMI TOSCA OCCI
Platform Management Interfaces	Platforms	Management Systems	Web Service API	Management Interoperability	CAMP TOSCA OCCI
Infrastructure Management Interfaces	Infrastructure	Management Systems	Web Service API	Management Interoperability Platform Portability (machine image)	CIMI-CIM VMAN OVF TOSCA OCCI Openstack
Publication Interfaces	Marketplaces	Platforms	Web Service API	Publication and Acquisition	ODCA SLA@SOI TOSCA

Source: Open Group Guide - Cloud Computing Portability and Interoperability

Portability / Interoperability Interfaces (Cont')

Interface	Exposed By	Used By	Type	Reason for Standardization	Standards
Platform-Infrastructure Interfaces	Infrastructure	Platforms	Various	Platform Portability (platform source)	Openstack
Acquisition Interfaces	Marketplaces	Platforms	Web Service API	Publication and Acquisition	HTTP OVF ODCA SLA@SOI TOSCA
Application-Platform Interfaces	Platforms	Applications	Programmatic	Application Portability	UNIX Linux MS Windows Android iOS Openstack
Platform-Platform Interfaces	Platforms	Platforms	Web Service API Envelope, HTTP and Internet Service Discovery	Platform Interoperability	TCP/IP HTTP SOAP WSDL WADL WS-I UDDI JSON

Source: Open Group Guide - Cloud Computing Portability and Interoperability

Security of WS-I and HTTP WS Styles

Characteristic	WS-I Style	Raw HTTP Style
Support	Mainly supported by W3C and many large enterprises.	Mainly supported by developers.
Security Architecture	SOAP has an underlying security architecture, WS-Security.	REST has no security architecture, and is primarily relying on HTTP security standards.
Standard-specific Exploitations	Susceptible to all XML-related exploitations, such as manipulation/injection.	Susceptible to all HTTP/HTTPS exploitations, such as session ID hijacking.
Denial of Service (DOS)	SOAP is more susceptible to DOS attacks.	Firewalls can be employed to combat DOS attacks.
Man-in-the-Middle Attack	The security standard imposed by WS-Security provides a fairly good protection for man-in-the-middle attacks. Think of source authentication and message payload integrity. However, SOAP headers can be altered along the way, introducing new man-in-the-middle attacks (for example, references to non-existing locations).	Depends on the authentication methods used between point-to-point communications.

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Application Design Principles

- Loose coupling
- Service-orientation
- Stable interfaces
- Described interfaces
  - Human / machine readable descriptions
- Use of marketplaces (a.k.a. app stores)
- REST (Representational State Transfer)
- BASE (Basically Available, Soft State, Eventual Consistency)
  - c.f. ACID (Atomicity, Consistency, Isolation Durability)

Recommendations

- Problem areas:
  - Platform-platform / application-platform interfaces
  - Service descriptions and management interfaces
  - Data models, machine image formats
  - Loose coupling, service-orientation, stable and described interfaces, marketplaces, REST, BASE
- Each area covers:
  - Problem summary
  - Recommendations for current practice
  - Recommendations for standards development

Application-Platform Interfaces

- Problem summary
  - Various programming languages to be chosen for the interface
  - No agreement on what functionality is needed
  - No commonly accepted application-platform interface standards
- Recommendations for current practice
  - Enterprises should seek to use cloud platforms with vendor-independent programming interfaces
  - PaaS vendors stating that they support .NET or J2EE should say which versions they support
- Recommendations for standards development
  - The industry should identify best practice in use of direct HTTP and JSON, including means of authentication and access control (such as OAUTH), and develop standard profiles for interoperability between service platforms using this approach.

Machine Image Formats

- Problem summary
  - A standard machine image format makes portability possible across different infrastructure service providers, as well as across infrastructure services of a single provider.
  - The DMTF OVF standard is designed to meet the need for a machine image format standard.
- Recommendations for current practice
  - Enterprises developing cloud infrastructure services should evaluate the OVF standard and support it if feasible.
  - Enterprises developing cloud management systems should evaluate the OVF standard and support it if feasible.
  - Enterprises procuring cloud infrastructure services or cloud management systems should evaluate the OVF standard and look for support for it as appropriate.
- Recommendations for standards development
  - The industry should work to ensure that the OVF standard is and remains fit for purpose, and to encourage its use.

BASE Transactions

- Problem summary
  - There is a need for robust and scalable services that are loosely-coupled and have stable interfaces that are easy to describe.
- Recommendations for current practice
  - Applications should be designed using the Representational State Transfer (REST) style, though without insisting on its full rigor.

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- Important technical resource for enterprise users and cloud vendors to understand different aspects and current status of cloud portability and interoperability
- May serve as a base for enterprises to develop their own cloud adoption strategy
- Cloud vendors should develop products that can address these portability and interoperability issues
  - In the long run, these features will become a competitive advantage
- Portability and interoperability will become a determinant of success when the cloud technology becomes mature
  - Like what happened to the Internet / Web

End of Presentation

Thank You