

# **Common Standards in Cloud Computing**

1. Working Groups
2. Open Cloud Consortium
3. The Distributed Management Task Force
4. Standards for Application Developers
5. Standards for Messaging
6. Standards for Security

# Working Groups

1. A working group is an assembled, cooperative collaboration of researchers working on new research activities that would be difficult for any one member to develop alone.
2. A working group can exist for anywhere between a few months to many years.
3. Working groups generally strive to create an informational document a standard, or find some resolution for problems related to a system or network.
4. Working groups are sometimes also referred to as task groups or technical advisory groups.

# Working Groups

- Working groups support the interest and activities of OCC Members. The current working groups include:
- The Open Science Data Cloud (OSDC) Working Group
- Project Matsu
- The Open Cloud Testbed Working Group
- Biomedical Commons Cloud (BCC)
- Working Group on Standards and Interoperability for Clouds
- Working Group on Wide Area Clouds and the Impact of Network Protocols on Clouds.
- Working Group on Information Sharing, Security, and Clouds has a primary focus on standards and standards-based architectures for sharing information between clouds.

# Open Cloud Consortium

- The Open Cloud Consortium (OCC) is
  - A not for profit
  - Manages and operates cloud computing infrastructure to support scientific, medical, health care and environmental research.
- OCC members span the globe and include over 10 universities, over 15 companies, and over 5 government agencies and national laboratories.
- The OCC is organized into several different working groups.

# The OCC Mission

- The purpose of the Open Cloud Consortium is to support the development of standards for cloud computing and to develop a framework for interoperability among various clouds.
- The OCC supports the development of benchmarks for cloud computing.
- Manages cloud computing testbeds, such as the Open Cloud Testbed, to improve cloud computing software and services.
- Develops reference implementations, benchmarks and standards, such as the MalStone Benchmark, to improve the state of the art of cloud computing.
- Sponsors workshops and other events related to cloud computing to educate the community.

# **The Distributed Management Task Force (DMTF)**

- DMTF enables more effective management of millions of IT systems worldwide by bringing the IT industry together to collaborate on the development, validation and promotion of systems management standards.
- The group spans the industry with 160 member companies and organizations, and more than 4,000 active participants crossing 43 countries.
- The DMTF board of directors is led by 16 innovative, industry-leading technology companies.

# **The Distributed Management Task Force (DMTF)**

DMTF management standards are critical to enabling management interoperability among multi vendor systems, tools and solutions within the enterprise.

The DMTF started the Virtualization Management Initiative (VMAN).

The Open Virtualization Format (OVF) is a fairly new standard that has emerged within the VMAN Initiative.

Benefits of VMAN are

- \* Lowering the IT learning curve, and
- \* Lowering complexity for vendors implementing their solutions

# **Standardized Approaches available to Companies due to VMAN Initiative**

1. Deploy virtual computer systems
2. Discover and take inventory of virtual computer systems
3. Manage the life cycle of virtual computer systems
4. Add/change/delete virtual resources
5. Monitor virtual systems for health and performance



# **Open Virtualization Format (OVF)**

## **Features & Benefits**

- The OVF simplifies interoperability, security, and virtual machine life-cycle management by describing an open, secure, portable, efficient, and extensible format for the packaging and distribution of one or more virtual appliances.
- The OVF specifies procedures and technologies to permit integrity checking of the virtual machines (VM).
- The OVF also provides mechanisms that support license checking for the enclosed Vms.
- The OVF allows an installed VM to acquire information about its host virtualization platform and runtime environment.

# **Open Virtualization Format (OVF)**

## **Features & Benefits**

- One key feature of the OVF is virtual machine packaging portability.
- OVF is, by design, virtualization platform-neutral.
- The OVF streamlined & simplified installation and deployment process using metadata.
- The OVF is designed to be extended as the industry moves forward with virtual appliance technology.

# Standards for Application Developers

- The purpose of application development standards is to ensure uniform, consistent, high-quality software solutions.
- Programming standards help to improve the readability of the software, allowing developers to understand new code more quickly and thoroughly.
- Commonly used application standards are available for the Internet in browsers, for transferring data, sending messages, and securing data.

# Standards for Browsers (Ajax)

- AJAX (Asynchronous JavaScript and XML), is a group of interrelated web development techniques used to create interactive web applications or rich Internet applications.
- Using Ajax, web applications can retrieve data from the server asynchronously, without interfering with the display and behavior of the browser page currently being displayed to the user.
- The use of Ajax has led to an increase in interactive animation on web pages.

# Standards for Browsers (Ajax)

- Using Ajax, a web application can request only the content that needs to be updated in the web pages. This greatly reduces networking bandwidth usage and page load times.
- Sections of pages can be reloaded individually.
- An Ajax framework helps developers to build dynamic web pages on the client side. Data is sent to or from the server using requests, usually written in JavaScript.
- ICEfaces is an open source Ajax framework developed as Java product and maintained by <http://icefaces.org>.

# ICEfaces Ajax Application Framework

1. ICEfaces is an integrated Ajax application framework that enables Java EE application developers to easily create and deploy thin-client rich Internet applications in pure Java.
2. To run ICEfaces applications, users need to download and install the following products:
  - Java 2 Platform, Standard Edition
  - Ant
  - Tomcat
  - ICEfaces
  - Web browser (if you don't already have one installed)

# Security Features in ICEfaces Ajax Application Framework

- 1.ICEfaces is the one of the most secure Ajax solutions available.
- 2.It is Compatible with SSL (Secure Sockets Layer) protocol.
- 3.It prevents cross-site scripting, malicious code injection, and unauthorized data mining.
- 4.ICEfaces does not expose application logic or user data.
- 5.It is effective in preventing fake form submits and SQL (Structured Query Language) injection attacks.

# Data (XML, JSON)

- 1.Extensible Markup Language (XML) allows to define markup elements.
- 2.Its purpose is to enable sharing of structured data.
3. XML is often used to describe structured data and to serialize Objects.
- 4.XML provides a basic syntax that can be used to share information among different kinds of computers, different applications, and different organizations without needing to be converted from one to another.



# Data (XML, JSON)

JSON (JavaScript Object Notation ) is a lightweight computer data interchange format. It is a text-based, human-readable format for representing simple data structures and associative arrays (called objects).

- 1.The JSON format is often used for transmitting structured data over a network connection in a process called serialization. Its main application is in Ajax web application programming, where it serves as an alternative to the XML format.

# **Solution Stacks (LAMP and LAPP)**

- 1.LAMP is a popular open source solution commonly used to run dynamic web sites and servers. The acronym derives from the fact that it includes Linux, Apache, MySQL, and PHP (or Perl or Python) and is considered by many to be the platform of choice for development and deployment of high-performance web applications which require a solid and reliable foundation.
- 2.When used in combination, they represent a solution stack of technologies that support application servers.
- 3.

# **Linux, Apache, PostgreSQL, and PHP(or Perl or Python) (LAPP)**

- 1.The LAPP stack is an open source web platform that can be used to run dynamic web sites and servers. It is considered by many to be a more powerful alternative to the more popular LAMP stack.
- 2.LAPP offers SSL
- 3.Many consider the LAPP stack a more secure out-of-the-box solution than the LAMP stack.

# Standards for Messaging

- A message is a unit of information that is moved from one place to another.
- Most common messaging standards used in the cloud are
  1. Simple Message Transfer Protocol (SMTP)
  2. Post Office Protocol (POP)
  3. Internet Messaging Access Protocol (IMAP)
  4. Syndication (Atom, Atom Publishing Protocol, and RSS)
  5. Communications (HTTP, SIMPLE, and XMPP)

# Simple Message Transfer Protocol

1. Simple Message Transfer Protocol is arguably the most important protocol in use today for basic messaging. Before SMTP was created, email messages were sent using File Transfer Protocol (FTP).
2. The FTP protocol was designed to transmit files, not messages, so it did not provide any means for recipients to identify the sender or for the sender to designate an intended recipient.
3. SMTP was designed so that sender and recipient information could be transmitted with the message.
4. SMTP is a two-way protocol that usually operates using TCP (Transmission Control Protocol) port 25.

# Post Office Protocol (POP)

1. SMTP can be used both to send and receive messages, but the client must have a constant connection to the host to receive SMTP messages.
2. The Post Office Protocol (POP) was introduced to circumvent this situation.
3. POP is a lightweight protocol whose single purpose is to download messages from a server. This allows a server to store messages until a client connects and requests them.
4. Once the client connects, POP servers begin to download the messages and subsequently delete them from the server (a default setting) in order to make room for more messages.

# Internet Messaging Access Protocol

1. Once mail messages are downloaded with POP, they are automatically deleted from the server when the download process has finished.
2. Many businesses have compulsory compliance guidelines that require saving messages. It also becomes a problem if users move from computer to computer or use mobile networking, since their messages do not automatically move where they go.
3. To get around these problems, a standard called Internet Messaging Access Protocol was created. IMAP allows messages to be kept on the server but viewed and manipulated (usually via a browser) as though they were stored locally.

# **Syndication (Atom, Atom Publishing Protocol, and RSS)**

- In general, syndication is the supply of material for reuse and integration with other material, often through a paid service subscription.
- The most common example of syndication is in newspapers, where such content as wire-service news, comics, columns, horoscopes, and crossword puzzles are usually syndicated content.
- Newspapers receive the content from the content providers, reformat it as required, integrate it with other copy, print it, and publish it.



# Syndication (Atom, Atom Publishing Protocol, and RSS)

- Atom is an XML-based document format that describes lists of related information known as "feeds".
- Feeds are composed of a number of items, known as "entries", each with an extensible set of attached meta-data. For example, each entry has a title.
- The primary use case that Atom addresses is the syndication of Web content such as web logs and news headlines to Web sites as well as directly to user agents.

# Syndication (Atom, Atom Publishing Protocol, and RSS)

- The Atom Publishing Protocol (AtomPub) is an application-level protocol for publishing and editing Web resources.
- The protocol is based on HTTP transfer of Atom-formatted representations. The Atom format is documented in the Atom Syndication Format.
- The protocol supports the creation of Web Resources and provides facilities for:
  1. Collections: Sets of Resources, which can be retrieved in whole or in part.
  2. Services: Discovery and description of Collections.
  3. Editing: Creating, editing, and deleting Resources.

# **Syndication (Atom, Atom Publishing Protocol, and RSS)**

- RSS stands for Really Simple Syndication
- RSS allows you to syndicate your site content
- RSS defines an easy way to share and view headlines and content
- RSS files can be automatically updated
- RSS allows personalized views for different sites
- RSS is written in XML

# Why use RSS?

- RSS was designed to show selected data.
- Without RSS, users will have to check your site daily for new updates. This may be too time-consuming for many users. With an RSS feed (RSS is often called a News feed or RSS feed) they can check your site faster using an RSS aggregator (a site or program that gathers and sorts out RSS feeds).
- Since RSS data is small and fast-loading, it can easily be used with services like cell phones or PDA's.
- Web-rings with similar information can easily share data on their web sites to make them better and more useful.

# REST

REST stands for Representational State Transfer

It is an architectural ***pattern*** for developing web services as opposed to a ***specification***.

REST web services communicate over the HTTP specification, using HTTP vocabulary:

Methods (GET, POST, etc.)

HTTP URI syntax (paths, parameters, etc.)

Media types (xml, json, html, plain text, etc)

HTTP Response codes.

# REST

## Representational

- Clients possess the information necessary to identify, modify, and/or delete a web resource.

## State

- All resource state information is stored on the client.

## Transfer

- Client state is passed from the client to the service through HTTP.

# REST

The six characteristics of REST:

1. Uniform interface
  2. Decoupled client-server interaction
  3. Stateless
  4. Cacheable
  5. Layered
  6. Extensible through code on demand (optional)
- \* Services that do not conform to the above required constraints are not strictly RESTful web services.

# HTTP-REST Request Basics

The **HTTP request** is sent *from the client*.

- Identifies the location of a **resource**.
- Specifies the **verb**, or HTTP **method** to use when accessing the resource.
- Supplies optional **request headers** (name-value pairs) that provide additional information the server may need when processing the request.
- Supplies an optional **request body** that identifies additional data to be uploaded to the server (e.g. form parameters, attachments, etc.)



# HTTP-REST Response Basics

The **HTTP response** is sent *from the server*.

- Gives the **status** of the processed request.
- Supplies **response headers** (name-value pairs) that provide additional information about the response.
- Supplies an optional **response body** that identifies additional data to be downloaded to the client (html, xml, binary data, etc.)

# HTTP-REST Vocabulary

## HTTP Methods supported by REST:

- GET – Requests a resource at the request URL
  1. Should not contain a request body, as it will be discarded.
  2. May be cached locally or on the server.
  3. May produce a resource, but should not modify on it.
- POST – Submits information to the service for processing
  1. Should typically return the new or modified resource.
- PUT – Add a new resource at the request URL
- DELETE – Removes the resource at the request URL
- OPTIONS – Indicates which methods are supported
- HEAD – Returns meta information about the request URL

# Simple Object Access Protocol

SOAP is a lightweight protocol intended for exchanging structured information in a decentralized, distributed environment. SOAP uses XML technologies to define an extensible messaging framework, which provides a message construct that can be exchanged over a variety of underlying protocols. The framework has been designed to be independent of any particular programming model and other implementation-specific semantics.

It is a XML-based messaging framework that is

- 1) extensible
- 2) interoperable
- 3) independent

# Features of SOAP

Simplicity remains one of SOAP's primary design goals

SOAP defines a communication framework that allows for features such as security, routing, and reliability to be added later as layered extensions

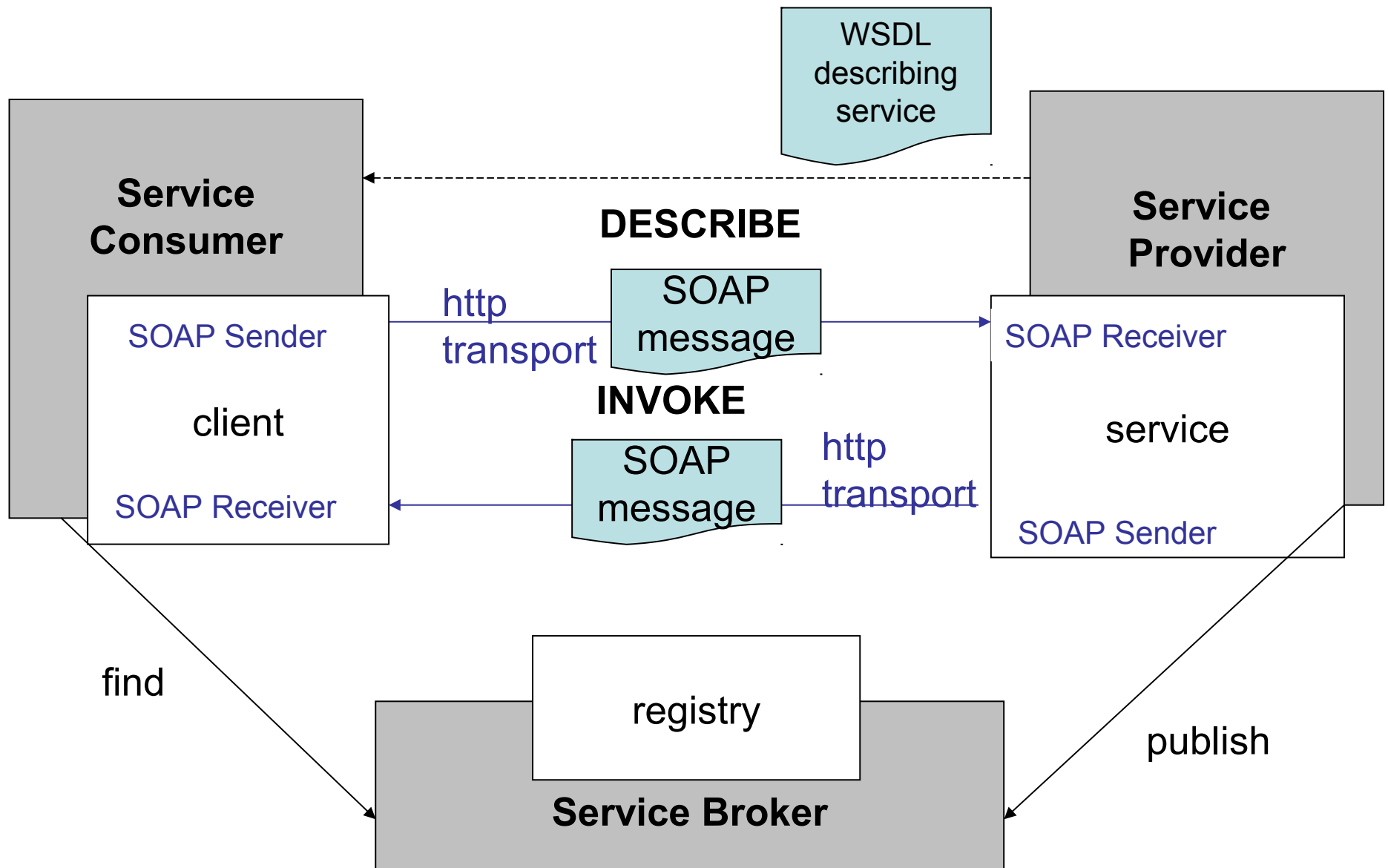
SOAP can be used over any transport protocol such as TCP, HTTP, SMTP

SOAP provides an explicit binding today for HTTP SOAP allows for any programming model and is not tied to RPC

SOAP defines a model for processing individual, one-way messages

SOAP also allows for any number of message exchange patterns (MEPs)

# Basic SOAP Message Exchange



# Communications (HTTP, SIMPLE, and XMPP)

- Hypertext Transfer Protocol (HTTP)
- Session Initiation Protocol for Instant Messaging and Presence Leveraging Extensions (SIMPLE) is an instant messaging (IM) and presence protocol suite based on the Session Initiation Protocol (SIP).
- Extensible Messaging and Presence Protocol (XMPP) is an XML-based protocol used for near-real-time, extensible instant messaging and presence information.

# Standards for Security

- Security standards define the processes, procedures, and practices necessary for implementing a secure environment that provides privacy and security of confidential information in a cloud environment.
- Security protocols, used in the cloud are
  - 1.Security Assertion Markup Language (SAML)
  - 2.Open Authentication (Oauth)
  - 3.OpenID
  - 4.SSL/TLS

# Security Assertion Markup Language (SAML)

- SAML is an XML-based standard for communicating authentication, authorization, and attribute information among online partners. It allows businesses to securely send assertions between partner organizations regarding the identity and entitlements of a principal.
- SAML allows a user to log on once for affiliated but separate Web sites. SAML is designed for business-to-business (B2B) and business-to-consumer (B2C) transactions.
- SAML is built on a number of existing standards, namely, SOAP, HTTP, and XML. SAML relies on HTTP as its communications protocol and specifies the use of SOAP.
- Most SAML transactions are expressed in a standardized form of XML. SAML assertions and protocols are specified using XML schema.



# Open Authentication (OAuth)

- OAuth is an open protocol, initiated by Blaine Cook and Chris Messina, to allow secure API authorization in a simple, standardized method for various types of web applications.
- OAuth is a method for publishing and interacting with protected data.
- OAuth provides users access to their data while protecting account credentials.
- OAuth by itself *provides no privacy at all* and depends on other protocols such as SSL to accomplish that.

# OpenID

- OpenID is an open, decentralized standard for user authentication and access control that allows users to log onto many services using the same digital identity.
- It is a single-sign-on (SSO) method of access control.
- It replaces the common log-in process (i.e., a log-in name and a password) by allowing users to log in once and gain access to resources across participating systems.
- An OpenID is in the form of a unique URL and is authenticated by the entity hosting the OpenID URL.

# SSL/TLS

- Transport Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL), are cryptographically secure protocols designed to provide security and data integrity for communications over TCP/IP
- TLS and SSL encrypt the segments of network connections at the transport layer.
- TLS provides endpoint authentication and data confidentiality by using cryptography.
- TLS involves three basic phases:
  1. Peer negotiation for algorithm support
  2. Key exchange and authentication
  3. Symmetric cipher encryption and message authentication