The Enterprise Architecture of Cloud Computing

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Enterprise Architecture is the alignment of IT to business requirements.

Cloud Computing is an enterprise scale Systems Architecture
Cloud Computing is an architecture that uses commodity hardware and virtualization to provide better performance and availability at lower cost.

Cloud computing is this generation's rediscovery of interchangeable parts.
Cloud Data Centers work differently

In a cloud data center a new “Gold” image is created and loaded on a shared Network Attached Storage device (not shown) and each box is simply re-booted, loading in the new image with all of the installed patches. Because of load-balancing, there is no downtime.

Only one staff is needed.
Sure this is architecture, but not Enterprise Architecture.

It is just as possible to procure services that do not support organizational goals with a cloud as not.

Replication multiplies effects, even bad ones.
To apply EA to a cloud first on must define what cloud is.

An Internet-based or intranet based computing environment wherein computing resources are distributed across the network (i.e.; the “cloud”) and are dynamically allocated on an individual or pooled basis as circumstances warrant, and are increased or reduced as circumstances warrant, to handle the computing task at hand” (Courtesy, Harry Newton, Newton’s Telecom Dictionary, 24th Ed.)
“Cloud computing is a model for enabling 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 promotes availability and is composed of five essential characteristics, three delivery models, and four deployment models.” (Peter Mell and Tim Grance, NIST)
**Essential Characteristics include:**
- On-demand self-service
- Ubiquitous network access
- Location independent resource pooling
- Rapid Elasticity
- Measured Service

**Delivery Models include:**
- Cloud Software as a Service (SaaS)
- Cloud Platform as a Service (PaaS)
- Cloud Infrastructure as a Service (IaaS)

(Peter Mell and Tim Grance, NIST)
What does this mean?

Services Associated with Cloud Computing

**Integration**
- SaaS
  - Web 2.0 Applications
    - Blogs
    - Meta-Data Mgt.
    - Wiki Services
    - Social Networking
    - Groupware
    - Portals
  - Enterprise Services
    - Work-Flow
    - Forms Mgt.
    - HR
    - Collaboration
    - Groupware
    - CRM
    - Desktop Software
    - Process Auto Svc.
    - Digital Mgt.
    - Financial Mgt.
    - Geospatial
    - Communications
    - Search

**Software as a Service (SaaS)**
- Devel. & Integr.

**Platform as a Service (PaaS)**
- Data Mart
- Instr. & Testing
- Devel. & Integr.
- Content Mgt.
- Knowledge Mgt.

**Infrastructure as a Service (IaaS)**
- Server Hosting
- Operating System
- Virtualization
- CDN
- Info. Sharing
- Web Services
- Web Servers
- Storage
- Remote Access

**Service Mgmt. & Provisioning**
- Service Provisioning
- Call Center
- Ops. Mgt.
- Tech Support
- Systems Mgt.
- CoS/GOS Mgt.
- Billing & Accr.g.
- Mgmt of Svcs.
- Asset Mgt.
- Trouble Ticket Mgt.
- Backup
- SLA Mgt.
- Investment Mgt.

**Security Mgmt.**
- Physical Security
- Id. & Authentic.
- Firewalls & Network Sec.
- Incident Response
- Access Control
- Audit Trail, etc.
- Audit Trail
- C. & A
- Intrusion Prevent.
- Cryptography
- Intrusion Detect.
- Virus Protec.
All of the services shown on this diagram are occurring in government data centers today.

Cloud architecture changes the acquisition strategy to focus on core technologies first and outsource the rest.
Cloud Architecture is an architecture built with commodity hardware and virtualization.

It’s ubiquitous
It’s this entire diagram

Although any of these services could be delivered from a single PC without a cloud.
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It’s this entire diagram

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Cloud Services mapped to the Federal Enterprise Architecture Framework’s Service Component Reference Model.

The numbers are the actual reference numbers from the SRM.

The black boxes were not in the SRM.
<table>
<thead>
<tr>
<th>Service Access and Delivery</th>
<th>Access Channels</th>
<th>850: Web Browser</th>
<th>851: Wireless / PDA</th>
<th>852: Collaboration / Communications</th>
<th>853: Other Electronic Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Internet Explorer</td>
<td>Palm Operating System</td>
<td>Electronic Mail (Email)</td>
<td>System to System</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Blackberry</td>
<td>Facsimile (fax)</td>
<td>Web Service</td>
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<td></td>
<td>Pocket PC Phone Edition</td>
<td>Kiosk</td>
<td>Uniform Resource Locator (URL)</td>
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<td>Pocket PC 2000</td>
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<td>Symantec Epoc</td>
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</tbody>
</table>

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The TRM Mapping Didn’t Work
Currently Identifying Standards for Each Service

http://sites.google.com/site/cloudarchitecture/

Cloud Architecture > terms > e-mail

Definition:
Wikipedia definition of e-mail is located at: http://en.wikipedia.org/wiki/E-mail

Pertinent Technical Standards:
- SMTP (Simple Mail Transfer Protocol) - RFC 5321
- POP3 (Post Office Protocol) - RFC 1939
- SASL (Simple Authentication and Security Layer) - RFC 5034
- MIME (Multipurpose Internet Mail Extensions) - RFC 2231
- IMAP (Internet Message Access Protocol - Version 4rev1) - RFC 3501

Climb up the tree by clicking on the links in the >> signs above or click here to be directed to the cloud Cloud Framework
As an IT Manager in the Federal Government, I look at this as a menu. But I need Standards and Metrics to know what I’m buying.
How does a Cloud Architecture differ from what I already have?

Data Centers built with Cloud Computing Architectures have the following five characteristics:

Architectural Tenets:

1. Open Architecture
2. Platform Independent
3. Scalable and Elastic
4. Shared Service Environment
5. Built with commodity products

By Patrick T. Stingley  The thoughts herein are not necessarily shared across the Federal Government (although they probably should be). Feel free to share with attribution CCO
Significant Cost Savings

Government Systems cost between $26K and 68K annually.

Equivalent cloud hosted systems cost around $8K
Ultimately the systems migrated to the cloud, whether internal clouds or external clouds should map to the same places in the BRM as current systems.

Similarly, the DRM in use today should be pretty close to the DRM with the cloud. (With one exception: Portability among cloud hosting situations will foster open data standards.)
We are just now developing the security models.

I am writing state diagrams from this picture.

Yes, each agency will have its own cloud(s).

• Development
• Testing
• COOP

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References and Questions

NIST definition of cloud computing:
http://csrc.nist.gov/groups/SNS/cloud-computing/

Wikipedia definition of cloud computing:
http://en.wikipedia.org/wiki/Cloud_computing

A model of cloud computing
(http://sites.google.com/site/cloudarchitecture/)

Mapping the Services Associated with cloud computing to the Service Component Reference Model (SRM):
http://sites.google.com/site/consolidatedreferencemodelv23/Home/service-component-reference-model