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- Security
- Component Model
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**Outlook**

**References**

What is an RA?
A Reference Architecture (RA) provides a blueprint of a to-be-model with a well-defined scope, requirements it satisfies, and architectural decisions it realizes. By delivering best practices in a standardized, methodical way, an RA ensures consistency and quality across development and delivery projects. It consists of a set of formal Unified Method Framework models, defining requirements, functional and operational aspects.

What is the IBM Cloud Computing Reference Architecture?
It is a modular cross-IBM framework allowing to understand how different elements in a cloud environment relate to each other. It also allows to drill-down on each element (e.g. CCMP) making up the CC RA.

What is the Common Cloud Management Platform Reference Architecture – CCMP RA?
It is a cross-IBM effort for an RA enabling cloud economics by optimizing resource and labor utilization, and delivering the foundational cloud management infrastructure for both private and public clouds.

The CC & CCMP RA served as the basis for:
• CCMP implementation for “the IBM cloud”
• IBM Smart Business Development and Test on the IBM cloud
• IBM Smart Business Development and Test Cloud and its resulting private cloud customer projects
• Test Cloud reference implementation as created by the Cloud Center of Excellence
• …and many more
CCMP RA – Target Audiences

1. **IBM cloud development and operations teams**
   - Teams involved in planning, implementing, operating, etc.
     - IBM CCMP implementation
     - Cloud services exploiting CCMP
   - Access to _all_ CCMP RA information

2. **“Other” IBM-internal groups:**
   - **IBM field people**, implementing clouds for customers
     - GTS / GBS / SWG services practitioners implementing private or public clouds for IBM customers
   - **IBM internal account** working on IBM-internal clouds
   - **IBM SW & HW product development teams** to understand how their respective product offerings can fit into the overall CCMP context
   - **IBM market intelligence teams** using the CC & CCMP Reference Architecture as a basis for comparing different cloud offerings
   - Access to most parts of CCMP RA, but not to “IBM secret sauce” relevant as differentiators for IBM public cloud offerings

3. **IBM-external parties**
   - Anyone outside of IBM
   - CCMP RA can be used as guideline / blueprint by practitioners implementing clouds for IBM customers. The resulting implementation architecture can be passed to the customer, but not the RA by itself
   - The complete CCMP RA as-is will not be published externally, but this presentation and a planned high-level overview whitepaper are distributable.
CCMP Reference Architecture Summary

**CC & CCMP RA** =

**Refinement**
(“Improve the CCMP RA content presently available”)
- Continuous improvement of CCMP RA content based on feedback from CCMP RA exploiters & stakeholder
- Introduction of new work products as needed, such as ITD-relevant ones.

**Forward looking**
(“What are future topics relevant for CCMP”)
- Establish principles and guidance in new areas addressing future requirements for CCMP.
- Examples are:
  - generalization of CCMP services
  - layered cloud services
  - NFRs, e.g. high availability
  - Hybrid clouds

**Harvesting**
(“Learning from cloud deployments in the past?”)
- Harvest material from CCMP implementation, while factoring out short cuts taken by implementation team (e.g. due to constrained time lines). Based on learnings from on implementation experience
- Execute harvesting activities/tasks as part of each wave's development plans so the work is viewed/executed as mainstream to the project, not an after the fact activity.
Common Cloud Management Platform Reference Architecture – Overall Approach

**Input**

- Use cases (represent functional requirements)
- Non-functional Requirements

Use cases and NFRs from:
- Cloud Client Engagements
- Computing On Demand
- Desktop Cloud
- Developer Cloud
- ITD
- LotusLive
- Research Compute Cloud
- Test Cloud
- Virtual Storage Cloud
...

**Common Cloud Management Platform Reference Architecture**

- Application of cloud-specific architectural principles
- Make architectural decisions

Normalized, common definitions based on input from Cloud efforts:
- Use cases (represent functional requirements)
- Non-functional Requirements

Use cases and NFRs from:
- Architectural Overview Diagram
- Service Flows
- Component Model
- Operational Model
- Security Architecture

- Each technical work product (TWP) is a word document as defined in the Unified Method Framework (UMF)
- All CCMP RA TWPs should be used as guidance and a blueprint for actual CCMP implementations
CCMP RA – Content summary

- **Use Cases**: Defines CCMP-specific use cases for all roles defined in the CCMP RA. To be used by cloud service developers or CCMP implementation teams for defining their implementation-specific use cases.

- **Non-functional requirements**: Defines all non-functional requirements to be considered when creating a CCMP implementation or a cloud service on top of CCMP. Includes example values which can be used as guidelines.

- **Architecture Overview Diagram (AOD)**: Provides overview of the fundamental architectural building blocks making up the CC & CCMP RA and introduces basic terminology. Also includes guidance on how to exploit CCMP for implementing cloud services.

- **Architectural Principles**: Defines architectural principles serving as a guideline in the definition of all other work products (part of architecture overview TWP).

- **Component Model (CM)**: Constitutes the next-level-of-detail refinement of the architectural elements introduced in the AOD. Defines functional scope for each component and relationship to other components.

- **Operational Model (OM)**: Constitutes the refinement of the CM towards a physical architecture which can be implemented as a real-world deployment. Defined on both logical and physical level.

- **Security Architecture**: Cross-cutting work product encompassing all security aspects relevant in the context of the CCMP RA.

- **Service Flows**: Defines processes of how a CCMP implementation must be operated to achieve cloud-scale efficiencies.

- **Architectural Decisions**: All architectural decisions made across all work products. Very important to capture & convey expertise in building a CCMP implementation and enable revisiting decisions and to understand rationale in case they turn out to be non-optimal.
Cloud Computing & Common Cloud Management Platform Reference Architecture Details
Architectural Principles
Traditional Data Center Management vs. “Cloud-like” Management

The overall objective of Cloud-managed data centers is to automate any type of task or situation (by reducing manual intervention) for increasing flexibility and reducing operational expenses.

<table>
<thead>
<tr>
<th>Core Metrics</th>
<th>Traditionally managed Data Center</th>
<th>“Cloud-managed” data center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin/Server ratio ‡ Costs</td>
<td>1:50 – 1:100</td>
<td>1:100’s – 1:1000’s</td>
</tr>
<tr>
<td>Time to provide new service instances &amp; changing them ‡ Flexibility</td>
<td>Days / weeks</td>
<td>Hours / minutes / seconds</td>
</tr>
</tbody>
</table>

Core Disciplines

IT Management approach
Administration Tasks
Problem handling
Service Consumer <-> Service Provider interaction

For Cloud-like efficiencies and flexibility, it is not sufficient to have the right technology, but to also use it in the right way!
Architectural Principles for
Common Cloud Management Platform Reference Architecture

An architectural principle is an overarching guideline or paradigm driving architectural decisions across the entire architecture process on a more granular level.

1. Design for Cloud-Scale Efficiencies ("Efficiency Principle"):  
   Design for cloud-scale efficiencies, and time-to-deliver/time-to-change metrics, when realizing cloud characteristics such as elasticity, self-service access, and flexible sourcing.
   ‡ Overarching objective of Driving down costs (¢/ServiceInstanceHour) and time-to-response by orders of magnitude

2. Support Lean Service Management ("Lightweight Principle"):  
   Support lean and lightweight service management policies, processes, and technologies.
   ‡ Radical exploitation of high degree of standardization in cloud environments to reduce management costs, based on an Eliminate-Standardize-Optimize approach

3. Identify and Leverage Commonalities ("Economies-of-scale Principle"):  
   Identify and leverage commonality in cloud service design.
   ‡ Maximum sharing of mgmt components, infrastructure & infrastructure / platform cloud services across cloud services to reduce CapEx & OpEx and time-to-market

4. Define and Manage Cloud Services generically along their Lifecycle ("Genericity Principle"):  
   Define service templates and manage service instances generically along their lifecycle, across I/P/S/BPaaS.
   ‡ Support I/P/S/BPaaS cloud services in a generic fashion, with a single management platform

Details are available in CC & CCMP RA TWP: “Introduction, Architectural Principles, Policies, & Guidelines (ARC 309) and Architecture Overview (ART 0512)”
Lifecycle of a Cloud Service

IBM Cloud Computing & Common Cloud Management Platform Reference Architecture (CC & CCMP RA) 1.0

Service Subscription & Instantiation

Service Offering Creation & Registration

Service Template Definition

Offering

Definition

Cloud Service

Subscription & Instantiation

Production

Termination

Cloud Management Platform
Common Resource Pools

IBM / ISV / IT Dept

Subscriber (e.g. Line of Business)

Service Catalog Manager

Administrator / SLM

Subscriber (e.g. Line of Business)

Service Instance Termination

Service Operation
Roles & Use Cases
Common Cloud Use cases & Roles TWP:
Scope & Purpose

- Defines common set of roles present in any cloud computing environment
- Defines common set of use cases relevant for any cloud computing environment
- The common cloud use cases represent the functional requirements to be addressed in all other CCMP RA TWPs (except the NFR TWP).

For CCMP RA Consumers:
When developing a specific CCMP implementation …
- The Common Cloud Roles can either be reused as-is or be used as a framework to define specialized, implementation-specific roles
- Some Common Cloud Use Cases can be reused as-is; others have to be reused and detailed out in the context of the respective CCMP implementation. All use cases relevant for a specific CCMP implementation must be captured in the use cases TWP specific to the respective CCMP implementation.
Cloud Computing Roles – Overview

Cloud Service Consumer
- Business Manager
  - Business / financial (e.g. approval) responsibility for consumed services
  - Accounted for used services instances
- Consumer Administrator
  - Requests service instances and changes of service instances (typically on behalf of Consumer Business Manager)
  - Provides access to services for service users
- Consumer End User
  - Uses service instances provided by service provider

Cloud Service Provider
- Service Business Manager
  - Offers all types of services (SPI) developed by service developer
  - Accounts services consumers for services potentially offered by service provider themselves and services offered on behalf of service developer
- Service Security Manager
  - Responsible for ensuring that the Service Provider appropriately manages risks associated with development, delivery, support and use of services
- Service Operations Manager
  - Manages technical infrastructure required for providing cloud services
- Service Transition Manager
  - Responsible for enabling a consumer to use the cloud service, incl. boarding, integration, and process adoption

Cloud Service Developer
- Designs, implements, and maintains service templates (technical aspect)

Role + Use Case Definitions leveraged for DMTF Cloud Incubator

Details are available in CC & CCMP RA TWP: “Common Use Cases (ART 0510)”
Common Cloud Use Cases

Consultative Analysis; Self-guided information & education
Via F2F; Business portal; Web-based registration & ordering process
Enabling customers for managed services, ensuring steady-state access to resources

Desktop Cloud: Using virtual desktop resources
Developer Cloud: Developing Applications, using dev. tool instances
Test Cloud: Testing applications
Virtual Storage Cloud: Storing and retrieving information

Initiating service instances; Making changes to service instances; Approving / rejecting service instance requests; Decommissioning service instances

Details are available in CC & CCMP RA TWP: “Common Use Cases (ART 0510)”
CCMP RA: Use case details

CCMP RA Use case TWP describes 28 Use cases.

The CCMP RA use cases are split into two categories:
- “Concrete” use cases, which are independent of the cloud service exploiting CCMP

- “Abstract” use cases, which apply generically to any cloud service, but have to be specified in the context of the respective cloud service.
  - Examples:
    - “Updating existing service instances” would for example be specified to “change CPU/Mem capacity of a virtual machine” in a compute cloud context, “Change file set capacity” in a storage cloud context, “Change max. number of web conference participants” in a LotusLive context.
Non-Functional Requirements
CCMP RA – Non-functional requirements TWP:
Scope & Purpose

- Defines all non-functional requirements to be considered for the development of a CCMP implementation.

- Includes cloud-specific example values for each NFR, which can be used as a guideline for CCMP implementation teams.

- Represents the non-functional requirements to be addressed in all other CCMP RA TWPs (except the use cases TWP).

For CCMP RA Consumers:
When developing a specific CCMP implementation …
- Implementation-specific values must be specified in the NFR TWP specific to the respective CCMP implementation.
The NFRs to be taken into account are defined in the CCMP RA NFR TWP, incl. example values providing guidance.
The Non-Functional Requirements technical work product gives an idea of the new Cloud Computing stakes and challenges, for example ...

- **Internationalization / Globalization**: Basic support requirements address the fundamental need of consumers to use Cloud solutions to operate their business in their local language and locale. For example, we need to allow them to enter data, such as customer names and addresses, dates, and currency into their systems in their local language/locale.

- **RAS (Reliability, Availability, Serviceability)**: By definition, a Cloud Management Platform must be resilient to failure and to change. The architecture must assume that individual components will fail and that their failure must not compromise the availability of the Cloud service. This will require a level of built-in redundancy, self-correction, first-failure data capture, ‘hot-plug’ capabilities, and isolation/quarantine mechanisms. Taking advantage of virtualization and Virtualized System Pools allows the cloud service provider to provide advanced RAS characteristics by changing the approach to the problem.

- **Classes of service**: Individual service instances will probably have different classes of service depending on the service level agreements between the cloud service consumer and the cloud service provider.

- **Manageability**: For the Cloud Service Consumer, they expect their Service Level Agreements to be enforced. They also require the ability to easily create, use, manage, and potentially retire their service instances. The cloud infrastructure must provide management services sufficient to enable the service level agreements. In order to achieve this, no part of the architecture is managed as a stand-alone entity. All parts of the architecture must participate in an overall Management Stack infrastructure.
The Common Cloud Management Platform NFR work product addresses the Non-Functional Requirements of the Cloud managing environment.

**A.** The NFR TWP defines, in the context of CCM:

- **User Experience requirements**
  - Consumability
  - Integration/Embeddability
  - Internationalization/Globalization
  - Accessibility
  - Usability

- **Constraints**
  - Physical
  - Network

- **Green requirements**
  - Energy / Facilities

- **Extensibility/Flexibility reqs.**

- **Standards, Legal & Compliance reqs.**

- **RAS requirements**
  - Reliability, Availability, Serviceability
  - Backup and Recovery
  - Disaster Recovery
  - Failure Management

- **Performance requirements**
  - Response Time
  - Capacity Estimates and Planning
  - Scalability (scale-out, scale-up)

- **Security & Data Privacy reqs.**

- **Portability requirements**

- **Manageability requirements**

- **SLA management requirements**

**B.** Each NFR is illustrated with the choices made for IBM Cloud offerings.

**C.** Typical metrics are provided per NFR for SLA mgt purposes:

- Mean Time Between Failures (MTBF)
- Mean Up Time (MUT) – Value of service and infrastructure availability
- Mean Down Time (MDT) – Value of service and infrastructure unavailability
- Mean Time To Repair (MTTR)
- Mean Time To Failure (MTTF)
- Number of incidents opened, closed, and pending (by severity level)
- ...
Architecture Overview Diagram
1. As part of the CCMP RA effort, also the foundational & guiding Cloud Computing Reference Architecture (CC RA) was defined.

2. The IBM Cloud Computing Reference Architecture (CC RA) is structured in a modular fashion (similar to the SOA Reference Model)
   – On its highest level of abstraction, it defines a base set of architectural elements, which are refined to the next level of detail
   – This modular approach allows refinement of the CC RA architectural elements independent from each other by the respective SMEs.

3. The IBM Common Cloud Management Platform Reference Architecture (CCMP RA) is the reference architecture for the CCMP being one fundamental architectural elements of the IBM CC RA.
   † There are several more areas defined within the CC RA (e.g. virtualized infrastructure, I/P/S/BPaaS, service development tools, hybrid clouds, etc.). Each of them should be addressed by a similar architectural effort as the CCMP RA does for the CCMP aspects.

Details are available in CC & CCMP RA TWP: “Introduction, Architectural Principles, Policies, & Guidelines (ARC 309) and Architecture Overview (ART 0512)“
CC & CCMP RA – Architecture Overview Diagram: Scope & Purpose

Define the fundamental architectural building blocks making up the Cloud Computing Reference Architecture and introduce basic terminology.

- Define roles relevant for any Cloud Computing environment (Cloud Service Consumer/Provider/Developer)
- Define fundamental architectural elements required per role
  - Cloud Service Consumer: Cloud Service Integration Tools & Consumer In-house IT
  - Cloud Service Provider: CCMP (OSS, BSS, UI), (Virtualized) Infrastructure, Cloud Services
  - Cloud Service Developer: Cloud Service Development Tools

For CCMP RA Consumers:

When developing a specific CCMP implementation …
- Use the CC & CCMP RA Architecture Overview to get clarity on which CCMP components to implement first, how to realize the (virtualized) infrastructure and which cloud service to offer.
- Use the CC & CCMP RA Architecture Overview to position all elements of your cloud implementation.
CC RA – CCMP Details

Cloud Services
IT capability provided to Cloud Service Consumer

(Virtualized) Infrastructure – Server, Storage, Network, Facilities
Infrastructure for hosting Cloud Services and Common Cloud Management Platform

Common Cloud Management Platform

BSS
Business Support Services
- Offering Mgmt
- Order Mgmt
- General accounting
- Contract & agreement Mgmt

OSS
Operations Support Services
- Service Templates
- Service Request Management
- Provisioning
- Monitoring & Event Management

Service Delivery Portal
- API
- Service Delivery Catalog
- Service Automation Management
- Incident & Problem Management
- IT Asset & License Management
- Virtualization Mgmt

Service Provider Portal
- Service Business Manager
- Service Transition Manager
- Service Operations Manager

Security & Resiliency
- Service Security Manager

Cloud Service Consumer
- Consumer End user

Cloud Service Integration Tools

Consumer Business Manager
- Consumer In-house IT
- Consumer Administrator

Cloud Service Developer
- Developer

Service Development Tools
- Service Definition Tools
- Image Creation Tools
**CC RA – CCMP Focus Areas**

**Virtualized Resource Management**
- Deploy cloud services on virtualized resources
- Manage virtual resources

**Service Automation Management**
- Interpret and execute build- and management plans
- Orchestrate management componentry

**Image Management**
- Design, build, and manage images for cloud services

**Hybrid Cloud Management**
- Address Security, Monitoring, Connectivity, and Management Aspects in Hybrid Clouds

**Security**
- Design for Multi-Tenancy
- Protect assets through isolation, integrity, image-risk, and compliance management

**Usage Metering and Accounting**
- Flexible support of delivery models
CCMP RA – BSS Details

Cloud Services
IT capability provided to Cloud Service Consumer

(Virtualized) Infrastructure – Server, Storage, Network, Facilities
Infrastructure for hosting Cloud Services and Common Cloud Management Platform

Common Cloud Management Platform

BSS Business Support Services
- Offering Mgmt
- Order Mgmt
- General accounting
- Contract & agreement Mgmt
- Customer Mgmt
- Entitlement Mgmt
- Invoicing
- Billing
- Opportunity to Order
- Pricing & Rating
- Subscriber Mgmt
- Peering & Settlement
- Service Offering Catalog

OSS – Operational Support Services
Operational-level functionality for management of Cloud Services

Security & Resiliency
CCMP RA – BSS Details

Entitlement Management
- Sets up Account Quota and limits
- Roles and permissions

Subscriber Management
- Customer On-boarding
- Enable services for consumption

Usage Metering and Accounting
- Metered Data used for Chargeback and Billing
- Data insights to ensure success of a Cloud service

Services Catalog
- Publish list of offered services
- Track services for effectiveness, includes retirement of un-used services
CCMP RA – OSS Details

Cloud Service Provider

Cloud Services
IT capability provided to Cloud Service Consumer

(Virtualized) Infrastructure – Server, Storage, Network, Facilities
Infrastructure for hosting Cloud Services and Common Cloud Management Platform

Common Cloud Management Platform

BSS – Business Support Services
Business-level functionality for management of Cloud Services

OSS Operational Support Services

Service Delivery Catalog
Service Templates
Service Request Management
Change & Configuration Management
Provisioning
Incident & Problem Management
Monitoring & Event Management
IT Asset & License Management
Virtualization Mgmt

Security & Resiliency

Cloud Service Consumer

Cloud Service Integration Tools

Cloud Service Developer

Service Development Tools

Consumer In-house IT
CCMP RA – Security & Resiliency Details

Cloud Services
IT capability provided to Cloud Service Consumer

(Virtualized) Infrastructure – Server, Storage, Network, Facilities
Infrastructure for hosting Cloud Services and Common Cloud Management Platform

Common Cloud Management Platform

BSS – Business Support Services
Business-level functionality for management of Cloud Services

OSS – Operational Support Services
Operational-level functionality for management of Cloud Services

Service Security Manager
Command & Control
Data Policy Enforcement
Audit & Compliance Mgmt

Compliance Officer

Security Policy Mgmt
Identity Lifecycle Mgmt
Access Mgmt

Security Engineer

Software, System & Service Assurance
Threat & Vulnerability Mgmt
Security extension to IT Service Mgmt

Security Officer

Availability & Continuity Mgmt

Security & Resiliency

Cloud Service Consumer

Cloud Service Provider

Cloud Service Developer

Service Development Tools

Cloud Service Integration Tools
CC RA – Cloud Services Details

Cloud Services

- Business-Process-as-a-Service
- Software-as-a-Service
- Platform-as-a-Service
- Infrastructure-as-a-Service

Common Cloud Management Platform

- BSS – Business Support Services
  Business-level functionality for management of Cloud Services
- OSS – Operational Support Services
  Operational-level functionality for management of Cloud Services

(Virtualized) Infrastructure – Server, Storage, Network, Facilities
Infrastructure for hosting Cloud Services and Common Cloud Management Platform

Cloud Service Consumer

- Cloud Service Integration Tools
- Consumer In-house IT

Cloud Service Provider

- User Interface
- API

Cloud Service Developer

- Service Development Tools
CC RA – Virtualized Infrastructure Details

Cloud Services
IT capability provided to Cloud Service Consumer

(Virtualized) Infrastructure – Server, Storage, Network, Facilities
Infrastructure for hosting Cloud Services and Common Cloud Management Platform

Server
- Processor
- Memory
- Nodes

Storage
- Drives
- Ephemeral
- Persistent

Network
- Internal
- External
- Inter-site

Facilities
- Location
- Power

BSS – Business Support Services
Business-level functionality for management of Cloud Services

OSS – Operational Support Services
Operational-level functionality for management of Cloud Services
CCMP automatically delivers and manages cloud services using any level of virtualization …

Depending on non-functional requirements (isolation, performance, etc.) and technical constraints, cloud service implementers can choose from a variety of virtualization technologies.

CCMP can programmatically interface with virtualization technologies – from low-level infrastructure virtualization up to application level virtualization.
Typical Cloud Management Platform Middleware Stack based on the CCMP RA (Integrated Service Delivery Manager)

**Workloads**
- Service measurement
- Service reporting
- Usage accounting
- Auditing and controls

**Tivoli Service Automation Layer**
- Automate process of instantiating and managing a distributed IT environment.

**Virtualized Infrastructure Layer**
- Virtualized resources
- Virtualized aggregation
- Physical infrastructure

**Typical Cloud Management Platform Middleware Stack**

- **Web, Collaboration and Infrastructure**
  - Technology: Highly Threaded Throughput-oriented Scale Out Capable
  - Lower Quality of Service

- **Analytics and High Performance Computing**
  - Technology: Compute intensive High I/O Bandwidth High Memory Bandwidth Floating point Scale out Capable

- **Transaction Processing and Database**
  - Technology: Scale High Transaction Rates High Quality of Service Handle Peak Workloads Resiliency and Security

- **Business Applications**
  - Technology: Scale High Quality of Service Large Memory Footprint Responsive Infrastructure

- **Workloads**
- Service measurement
- Service reporting
- Usage accounting
- Auditing and controls

- **Virtualized Infrastructure Layer**
  - x86
  - VM
  - Hypervisor (KVM, VMware, Xen)
  - Storage
  - Network

- **System p / SUN**
  - HMC
  - NIM
  - System Partition
  - Storage
  - Network

- **System z**
  - HMC
  - VM Partition
  - Storage
  - Network

- **End to End Service Management**
  - TADDM
  - TSAM v7.2
  - TUAM
IBM Cloud Service Provider Platform

A comprehensive offering to create, deliver and manage cloud services

- Unmatched scalability to launch and maintain tens of thousands of VM’s concurrently
- Heterogeneous virtualized infrastructure for flexible platform choices
- Secure multi-tenancy
- Workload mobility and recoverability for superior management

More than just cloud provisioning – manages the cloud infrastructure AND what’s inside the cloud!
Delivers carrier-grade scale you can trust

Unmatched carrier-grade scalability and performance to deliver new services to market faster than anyone else

1 million+
Virtual machines running concurrently

<Tens of Thousands>
Virtual machines provisioned per hour

<1 minute
Predictive analytics to help create new services in less than one minute

1,000’s
Ready to use services and applications from partners and IBM

Carrier-grade
Built to help support the highest levels of availability

The most scalable, extensible and carrier-grade integrated cloud service management offering
Core Service Automation Management

*The only solution with the flexibility and choice of network and storage options and the ability to span platform architectures*

- Multi-tenant service catalog
- Advanced image management
- Extendable via an open API
- Automated service provisioning
- Web 2.0 self-service portal
- Wizard-like service creation

*Visibility, Control and Automation across the service delivery and business infrastructure*
Integrated Service Provisioning, Monitoring & Metering

*Improve OPEX and CAPEX by leveraging standards and economies of scale*

- Automated service de-provisioning
- Improved standardization
- Integrated usage metering
- Extendable to in-house BSS
- Out-of-the-box monitoring
- 10 clicks to IaaS!
- Energy efficient hardware

*Deliver new services in **days**… not weeks or months*
How to exploit CCMP for all management aspects of Cloud Services
CCMP RA – CCMP Exploitability Guide (part of Architecture Overview TWP): Scope & Purpose

- Audience is teams developing cloud services (not CCMP development-related teams, as addressed by all other work products)

- Defines considerations to be made when implementing a cloud service (I/P/S/BPaaS), across CCMP exploitation, (virtualized) infrastructure and cloud service specific aspects.

- Defines how a cloud service can be implemented by exploiting CCMP functionality.

For CCMP RA Consumers:
When developing a specific CCMP implementation …
- the CCMP Exploitation Guide helps understanding how elements of a CCMP implementation should be exploited by the respective cloud service. However, the main audience are Cloud service implementation teams, not CCMP implementation teams.
Exploitation of CCMP by Cloud Services

Each cloud service uses BSS and OSS functionality (besides cloud service-specific components), much of these functionalities is common across cloud services

† Sharing makes a lot of sense from a economies-of-scale / cost-sharing and increased time-to-market perspective
Cloud Service – Basic structure / “Anatomy of a cloud service”

For exposing cloud service specific information and functionality.

For offering and selling any cloud service, BSS functionality is needed. Examples are offering management, pricing and billing.

Any cloud service requires some level of OSS functionality such as service automation management, monitoring, metering, etc.

Cloud service specific management software

UI aspects

BSS aspects

OSS aspects

<Cloud service specific (management) component(s)>

<Cloud service name>

HW infrastructure

<Cloud service specific (management) component(s)>

HW Infrastructure

Cloud service specific software, e.g. any type of runtime software on the managed environment, e.g. hypervisors as IaaS-specific software, middleware platform SW for a PaaS cloud service or a SaaS application.

All involved software components – OSS, BSS and cloud service specific software – require an infrastructure to run. Depending on scope and purpose this can be a virtualized or non-virtualized infrastructure, run within the cloud service provider’s data center or be purchased as IaaS.

Any cloud service requires some level of OSS functionality such as service automation management, monitoring, metering, etc.
## Areas of consideration for implementing cloud services

<table>
<thead>
<tr>
<th>Aspect to be considered</th>
<th>Affected CCMP component</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do I want to expose as a cloud service / what is my “unit of delivery &amp; mgmt” and which (self-service) execution functionality?</td>
<td>OSS / Service Automation</td>
</tr>
<tr>
<td>What is the scope of management (mgmt up to hypervisor, OS, MW, App) and the associated management processes?</td>
<td>All BSS/OSS components, focus on Service Automation</td>
</tr>
<tr>
<td>Which underlying provisioning functionality do I need for my cloud service?</td>
<td>OSS / Provisioning</td>
</tr>
<tr>
<td>Which assets do I need to maintain (servers, storage, SW licenses, etc.)?</td>
<td>OSS / Asset Management</td>
</tr>
<tr>
<td>Which configuration items are relevant for my cloud service?</td>
<td>OSS / Configuration Management</td>
</tr>
<tr>
<td>Which resources / metrics have to be monitored?</td>
<td>OSS / Monitoring</td>
</tr>
<tr>
<td>Which metrics have to be collected historically?</td>
<td>Metering</td>
</tr>
<tr>
<td>Which consumer model should be applied (single person, complex org, etc.)</td>
<td>BSS / Customer Management</td>
</tr>
<tr>
<td>Which rates should be applied to the metered information?</td>
<td>BSS / Rating</td>
</tr>
<tr>
<td>Which golden master images do I need?</td>
<td>OSS / Image Lifecycle Mgmt</td>
</tr>
<tr>
<td>Which reports do I need internally &amp; which reports should be exposed to my customers?</td>
<td>Reporting</td>
</tr>
<tr>
<td>Which cloud service-specific UI panels do I want to expose to service consumers?</td>
<td>UI / Service Delivery Portal</td>
</tr>
<tr>
<td>Which cloud service-specific runtime functionality do I need?</td>
<td>Compute, Web conferencing software, analytics application, etc.</td>
</tr>
</tbody>
</table>
Security and Availability
CCMP RA – Security Architecture TWP (OPS316) : Scope & Purpose

§ Defines all (cloud) security-related aspects to be considered when building a CCMP implementation, the corresponding managed environment and cloud services on top (focus is on CCMP aspects).

§ Provides a consolidated view of all security-related information across all CCMP RA TWPs

For CCMP RA Consumers:
When developing a specific CCMP implementation …
- the CCMP RA Security Architecture should be used to understand all security-related concerns, requirements and guidance to be taken into account for the respective CCMP implementation.
Security in CCMP-RA

- Security touches all aspects and work products of the CCMP-RA

- A consolidated view of Security for the CCMP-RA can be found in the CCMP-RA OPS 316 Security Architecture Work Product

- The OPS 316 Work Product includes background information about Security and Risk Management, as well as, the following topics:
  - Security Requirements
  - Security Roles
  - Security Policies & Controls
  - Security Use Cases
  - Security Non-Functional Requirements
  - Component Model
  - Operational Model
  - Security Services and Service Flows

- Since the assumptions, requirements and componentry related to Security may vary from design to design, it will be prudent to produce a series of OPS 316 documents for common solution patterns:
  - Public Cloud pattern with Provider and Subscriber roles, risks and requirements
  - Private Cloud pattern with Enterprise roles, risks and requirements
  - Hybrid Cloud patterns with both Provider and Enterprise roles, risks and requirements
**Common Cloud Management Platform Reference Architecture:**

**Architecture Overview Diagram – Availability Needs**

**Cloud Services entry level with low availability guarantees**
- Consumer could create new cloud service in case of outage
- Additionally selected services will allow also to increase high availability (mid-term)

**Virtualized Infrastructure with very high availability requirements to prevent mass outage**
- Failure of a single blade not as critical as the failure of a complete blade landscape

**Common Cloud Management Platform with medium (to high) availability needs**
- In case of outage no new cloud services can be (but existing ones do not fail)
Component Model
CCMP RA – Component Model TWP: Scope & Purpose

Defines all components required for creating a CCMP implementation and their functional scope.
† The CCMP RA component model provides (product-neutral) guidance on how each functional CCMP component should be realized when developing a CCMP implementation.
Focus of CCMP RA Component Model is component definition in support of cloud-scale efficiencies and costs (CCMP RA architectural principles are applied) – and how components are different from the traditional enterprise mgmt scope.
– Based on coarse-grained architectural elements defined on CCMP RA AOD level

Serves as basis for CCMP RA operational model

For CCMP RA Consumers:
When developing a specific CCMP implementation …
- the CCMP RA Component Model should be used to understand how all components of a CCMP implementation should be scoped & realized in support of achieving cloud-scale (cost) efficiencies and agility.
The CM TWP describes the components & relationships related to CCM AOD services.

Details are available in CCMP RA TWP: “Component Model (ART 0515)”
The conceptual CM decomposes CCMP Services in components and sub-components or functions, and provides the related definitions.
The specified CM details the relationships and dependencies between CCMP Services, and between components.

- RSA diagrams and textual descriptions of the component interfaces are provided for OSS and BSS:

  **Provisioning - pCI2**

  Updates CMDB with results of provisioning activities, also updates change record with workflow status.

- For each category of CCMP Services the specified CM provides:
  - External component dependency descriptions
  - Internal component dependency descriptions
- At the end of the document is a component mapping with eligible tools
Operational Model
CCMP RA – Operational Model TWP: Scope & Purpose

Defines CCMP deployment units and how they should be deployed in the management environment to meet all (cloud-specific) NFRs such as performance, security, resiliency, minimal costs, etc.

Includes so-called “applied patterns” describing concrete, physical operational models serving as an example for how to deploy CCMP implementations.

For CCMP RA Consumers:
When developing a specific CCMP implementation …
- an implementation-specific operational model must be created. The CCMP RA Operational model (incl. applied patterns) provides guidance and serves as a blueprint for that.
Operational Modeling helps ensure the IT infrastructure’s non-functional requirements are delivered, within all constraints.

Note: Operational modeling does not cover operations management processes. Cloud-specific operations management processes and procedures (e.g., IPC, Metering, Monitoring & Event Mgmt, SLM, etc.) are covered in the services flows deliverable.

Details are available in CCMP RA TWP: “Operational Model (ART 0522)”
Attached View of CCMP ALOM

Since cloud service implementation architecture is beyond the scope of the CCMP RA, cloud service is modeled as a system actor.

RSA Topology “Group” is used to separate CCMP OSS, BSS, and utility services (e.g., reporting & analytics) nodes.

Note:
- Prefix “A_” is used to name a human/system actor, “ALN_” an ALOM node, and “L_” a location.
- CCMP ALOM DUs are not shown in the figure.
CCMP LOM Overview

The LOM nodes are defined based upon common tier-based implementation of an IT service.

Application DUs and data DUs are deployed on different LOM nodes based upon common infrastructure design practices.
Service Flows
CCMP RA – Service Flows TWP: Scope & Purpose

- Defines all operational processes (“service flows”) required for managing cloud services based on a CCMP deployment.
  - These service flows are focused on reducing labor costs for management to a minimum, by building on high degree of standardization present in any cloud environment.

- Service flows depend on service management components as defined in the CCMP RA component model – CCMP components are required for automating as many tasks as possible.

For CCMP RA Consumers:
When developing a specific CCMP implementation …
- the CCMP RA Service Flows TWP describes the management processes to be applied when managing cloud services via CCMP.
CCMP RA / Cleansheet Service Flows Content: Overview

Service flows processes differences from standard IT management processes
- Leverages reduced (eliminate) scope of management, standardization, and opportunity for optimization to dramatically reduce labor costs.
- Aimed at delivering cloud management processes for cost-competitive cloud infrastructures

- Implementation of cloud-optimized service management processes
  - Configuration and Asset Mgmt
  - Patch / Provisioning / Image Mgmt
  - Incident / Problem Mgmt, Monitoring
  - Performance and Capacity Mgmt
  - SLM/Metering
  - Service Request Management
  - Continuity Mgmt
Architectural Decisions
What are Architectural Decisions? Why Bother Capturing Them?

“"The design decisions that are costly to change” (Grady Booch, 2009)

Definition in SOA Decision Accelerator (part of GTS SOA Infrastructure RA):

“Architectural decisions capture key design issues and the rationale behind chosen solutions. They are conscious design decisions concerning a software system as a whole, or one or more of its core components, with impact on non-functional characteristics such as software quality attributes.”

From UMF work product description ART 0513 (was: IGS Method ARC 100):

“The purpose of the Architectural Decisions work product is to:
– Provide a single place to find important architectural decisions
– Make explicit the rationale and justification of architectural decisions
– Preserve design integrity in the provision of functionality and its allocation to system components
– Ensure that the architecture is extensible and can support an evolving system
– Provide a reference of documented decisions for new people who join the project
– Avoid unnecessary reconsideration of the same issues”
## Capturing Architectural Decisions

### Example (taken from the URL above):

<table>
<thead>
<tr>
<th>AD ID</th>
<th>Cmp-04</th>
<th>AD name</th>
<th>OssReach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject area</strong></td>
<td>Cloud computing</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Scope</strong></td>
<td>Data center</td>
<td>Phase</td>
<td>Solution outline</td>
</tr>
<tr>
<td><strong>Problem statement</strong></td>
<td>Should the OSS only support the management of Infrastructure services or also platform and software services? It often is necessary to manage IaaS/PaaS/SaaS within one data center environment and build them on each other. Motivation: Need to understand level on consistency in OSS-level mgmt of infrastructure, platform and software services.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Decision drivers</strong></td>
<td>Consistency desired when managing IaaS/PaaS/SaaS (education effort, licensing cost, etc.).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Alternatives** | [1] A single OSS for IaaS, PaaS and SaaS  
[2] One OSS for IaaS, a different one for PaaS + SaaS  
[3] Not applicable |
| **Recommendation** | A single OSS allows maximum consistency and enables simplified integration and combination of infrastructure, platform and software services. So option 1: start with IaaS, grow into PaaS and SaaS. |
| **Decision outcomes** | |
| **Background reading** | See CoP presentations and GTO 2009 for an introduction of the cloud/virtualization “stack”. See architecture overview diagram of emerging CC RA for introduction to OSS capabilities. |
| **Related decisions** | influences Cmp-05 OssMultitenancy  
is influenced by Cce-04 CloudVirtualizationLayers |
| **Editorial information** | Acknowledgements: original CDA content contributed by Michael Behrendt  
Last modification on 2009-06-17 17:09:25.347000  
Status: initial draft (desclet)  
Todo: harvest architectural knowledge from projects, align with other work products in GTS CC RA  
IPR level: COPYRIGHT-PROTECTED ASSET  
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Some Key Focus Areas for CCMP RA 2.0

- Hybrid Cloud Management
- Performance & Scalability
- Consumability
- Standardization
Hybrid Cloud Management, Security and Integration

- From the Enterprise Client’s perspective:

  - **Integration of applications**
    - On-premise to off-premise business application connectivity & governance

  - **Data Integration**
    - Information exchange and data integration across the enterprise and clouds

  - **Monitoring and Management of workloads running off-premise on clouds**
    - Monitoring on IaaS, PaaS and SaaS level
    - Policy based Workload Governance, Provisioning, Scheduling and Management
    - Metering, Accounting
    - Availability
    - Dashboard for service visibility

  - **Security for Hybrids**
    - Control security and resilience of services (identity management, compliance, isolation)

  - **Application and Workload migration workbench**
    - Tools to support the migration of workloads to the cloud

Initial focus for 'Hybrid Cloud':
'Provide clients the ability to manage and integrate workloads and resources on a cloud with their existing processes, management and business systems.'
# Open Cloud Standards Leadership

## Driving an Open Conversation
- **Promote reuse of existing standards**
- **Establish IBM as a Thought Leader for Open Cloud Solutions**
- Lead Open Cloud Manifesto with almost 400 companies
- Lead Open Cloud Use Case Project with 1500 world wide participants, including Chinese translation

## Prevent Proprietary Lock-in
- **Enable alternatives at the Virtualization layer**
- Drive a common VM API interfaces for management and image definitions
- Build open source adapters to existing hypervisor implementations

## Building a Strong Cloud Ecosystem
- **Drive Application Portability that establishes an ecosystem for the development community**
- Partner with industry leaders to define common APIs and an image format for IaaS, management, storage and beyond.
- Build open source adapters to existing implementations in Apache.

## Leading with IBM’s Core Strengths
- **Move Cloud Focus to Security and Management**
- DMTF Audit & Compliance WG, OASIS Identity Management WG
- Future Management Orchestration standardization in OASIS

## Engaging Industry Sector
- **Drive adoption of IBM Architecture and Vocabulary by Industry/Sector Standards Groups**
- World Wide partnership with Initial focus in Financial Services, Retail, Telco, Government, & Education.
- Lead SLA Discussions based on Enterprise requirements & trust in IBM
Literature
References

§ IBM Journal of Research and Development, Volume 53 Issue 4, Breiter, Gerd; Behrendt, Michael; Lifecycle and characteristics of services in the world of Cloud Computing
§ Tivoli Service Automation Manager Solution Guide by Thomas Spatzier
§ Service Management and Cloud Computing, IBM website:
  • http://www-01.ibm.com/software/tivoli/solutions/cloudcomputing/
Thank you!

For more information, please visit:
ibm.com/cloud

Or contact me at:
gbreiter@de.ibm.com