Cloud Computing Reference Architecture (CCRA) 4.0 Overview
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- CCRA provides prescriptive guidance on how to build IaaS, PaaS, SaaS and Service Provider cloud solutions with IBM technology.

- CCRA aggregates experience from hundreds of cloud client engagements and IBM-hosted cloud implementations.

- CCRA categorize the cloud business models and corresponding architecture by the following “cloud adoption patterns”:
  - Cloud Enabled Data Center (IaaS)
  - Platform-as-a-Service (PaaS) adoption pattern
  - Software-as-a-Service (SaaS)
  - Cloud Service Providers
  - Mobile
  - Analytics
  - Government - Cloud

- For each cloud adoption pattern, CCRA identifies:
  - Common architecture patterns that describe the business drivers, the use-cases and the technologies that underlie each type of cloud computing implementation.
  - Common architecture patterns for items that cut across all the adoption patterns including security, resiliency, performance, etc.
CCRA Structure

CCRA 4.0

Cloud-enabled data center / building IaaS
Platform Services
Cloud Service Provider
Building SaaS
Mobile & Cloud
Analytics & Cloud

Common Reference Architecture Foundation

Industry Focused Deliverables:
The CCRA **saves your business time and money** by providing detailed documentation on the steps and components required for constructing a Cloud implementation across all deployment models.

Your business can **benefit from IBM’s experience** in creating Public, Private, and Hybrid Clouds with one common architecture with reusable assets or product recommendations.

Your business **receives a quicker start** to create an industrial strength Cloud with predefined use cases and documentation on the architectural requirements or decisions that must be made for security, service management, performance scalability, and virtualization.

The CCRA utilizes sound architectural principles to **speed development and reduce errors** across the entire development process, ensuring designs can scale for efficiencies and can fulfill important Cloud requirements such as elasticity, self-service and flexible sourcing.

The CCRA provides **increased business flexibility** with a common Cloud reference architecture across all deployment models.
Introduction

Approach used to design Cloud Adoption Patterns

UNDERSTAND
the client’s business and needs

EXPLORE
options and approach

DEVELOP
and agree to client solution

IMPLEMENT
client solution

CONFIRM
dient value and experience

Understand Client

Define Client Requirements

Design Solution

Detail Design to Define BOM

Define Roadmap & First Project
The CCRA Adoption Pattern material is based on TeamSD and applies to the entire sales cycle.

1. **Business Drivers**
   - Describe the key business drivers for the project, the KPIs or CSFs, and how they align with cloud computing.

2. **Business Process**
   - Understanding the existing “As-is” process, and how this must change in order to meet the business drivers.

3. **Current IT Environment**
   - Understand the current environment where the Cloud will be deployed, what systems, technology, capacity, and constraints.

4. **Candidate Cloud Services**
   - 12-step process to defining the services and the attributes of the candidate Cloud services.

5. **Use Cases & Actors**
   - What are the functional requirements expected from the Cloud and who are the key actors? Expressed as Use Cases.

6. **Non-Functional Requirements**
   - NFRs should be outlined to cover the volumes, capacity, scale, availability, security, operational, and monitoring aspects of the Cloud.

7. **System Context**
   - The system context should define the boundary of the Cloud, and the integrations with OSS/BSS systems.

8. **Architecture Overview**
   - Architecture overview diagram should define the high-level components, their placement.

9. **Architecture Decisions**
   - Clearly documented decisions on key architectural points including the rationale for the decision.

10. **Operational Model**
    - Design and consider the components of the solution both at a physical and logical level.

11. **Roadmap**
    - Define the overall timeline, phases, and key milestones that will shape the plan and overall delivery.

12. **Scope**
    - Define the boundaries of the project, inclusions, exclusions, dependencies, and align phases with milestones in the roadmap.

Content provided by CCRA
- Business Drivers
- Use Cases and Actors
- Non-Functional requirements
- System Context
- Architecture Overview
- Architecture Decisions
- Operational Model
- Roadmap

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Introduction

CCRA 4.0 Cloud Adoption Patterns & Next Generation Platform

Workload definition, optimization, & orchestration
Resource abstraction & optimization
Software Defined Compute
Software Defined Storage
Software Defined Networking

External Ecosystem
Marketplace
Traditional middleware-based workloads

Solutions
App
Analytics API
Mobile API
Collaboration API
location API
data API
Services API

Software as a Service
BlueMix
Platform as a Service
Cloud API Economy

Cloud Service Provider
Infrastructure as a Service
SDE
Mapping of Cloud Adoption Patterns – IBM Cloud Capabilities

Cloud adoption patterns have emerged backed by proven best practices.

- **Cloud Enabled Data Center**: Cut IT expense, risk & complexity
- **Platform Services**: Accelerate time-to-market with new workloads
- **Cloud Service Providers**: Deliver innovative business Models
- **Building Software-as-a-Service**: Gain immediate access to applications

**Enabling business transformation**
- Business process solutions: Application, Application, Application, Application, Application

**Marketplace of high value consumable business applications**
- External ecosystem: Industry, Collaboration, Human resources
- Big Data & analytics: Commerce, Marketing, IT Management

**Composable and integrated application development platform**
- Build using open standards: Social, Mobile, Management, Infrastructure
- DevOps, Big Data & analytics, Security, Integration

**Enterprise class, optimized infrastructure**
- Built using open standards: Compute, Storage, Networking
Key concepts – adoption patterns / macro patterns / micro patterns

- **Adoption Pattern** – A collection of commonly observed functions and features that customers desire in their solution. Where a customer starts to solve a specific business problem, typically driven by the same business motivation. e.g. “Drive down IT costs by improving delivery time and quality, and lowering risks associated with delivery of new IT environments to business and software application development and delivery.”

- **Macro Pattern** – A collection of use-cases / micro-patterns commonly deployed together to achieve a level of service maturity. (e.g., simple VM-provisioning services; more advanced services for provisioning of VM, storage, and network elements; provisioning of services integrated with the enterprise ITIL enterprise processes; etc.).

- **Micro Pattern** – set of consistent use cases that relate to a specific cloud function. These use cases are best practice starting points for various aspects of cloud implementation.

- **Solution** – a combination of products and services integrated and deployed together. Typically sold as a “solution” in a single sales transaction.

- **Product** – single isolated software or hardware component, typically bounded by how it is sold. Note that a single product may actually cover one or more capabilities/micro patterns.
## Adoption Patterns - Prescriptive, Consumable IBM Solutions, driven by clients

### Cloud Enabled Data Center - IaaS
- **Enable IaaS** with Virtualization Management and Governance
- **Implement IaaS** with Advanced Service Automation & Orchestration
- **Extend IaaS** with Enterprise Service Management
- **Consume IaaS** using a Public or Managed Cloud Service
- **Integrate IaaS** to Support a Hybrid Environment

### Cloud Platform Services - PaaS
- **Implement PaaS** with Middleware Deployment and Management
- **Extend PaaS** with Programming Services
- **Implement Application Lifecycle Management (ALM) and DevOps**
- **Consume PaaS** using a Public or Managed Cloud Service
- **Integrate PaaS** to Support a Hybrid Environment

### Business Solutions on Cloud - SaaS
- **Implement Existing Applications** to be Delivered as SaaS
- **Implement Cloud Native Applications** to be Delivered as SaaS
- **Consume SaaS** Applications and Business Processes
- **Integrate SaaS** with Cloud and Enterprise Services

### Cloud Service Provider (MSP/CSP)
- **Implement IaaS for a Service Provider** to Deliver Cloud Services
- **Implement IaaS and PaaS for a Service Provider** to Deliver Cloud Services
- **Implement Storefront and Service Brokering for a Service Provider** to Deliver Applications and Business Processes
- **Consume Public or Managed Services to Resell as a Service Provider** (White Label)

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Cloud Enabled Data Center Adoption Pattern (IaaS)
What’s new in CeDC?

- UPDATED: CeDC Adoption pattern now based on SmartCloud Orchestrator 2.3 as the core cloud product

- NEW: Include Software-defined Environment (and OpenStack) concepts in CeDC

- NEW: Define integration points with Softlayer

- NEW: Define integration points with Bluemix

- NEW: Define managed services for cloud
IBM Cloud Reference Architecture – Cloud Enabled Data Center Pattern

**IaaS: Cut IT expense and complexity through a cloud enabled data center**

- **Enabling business transformation**
  - Business process solutions
  - Application
  - Application
  - Application
  - Application
  - Application

- **Marketplace of high value consumable business applications**
  - External applications
  - Industry
  - Collaborate
  - Human resources
  - Big Data & analytics
  - Commerce
  - Marketing
  - Management

- **Composable and integrated application development platform**
  - On-Grid
  - Big Data & analytics
  - Secure integration
  - Mobile
  - Social
  - Cloud
  - Hybrid

- **Enterprise class, optimized infrastructure**
  - Compute
  - Storage
  - Networking

**Key Business Drivers:**
- Decrease costs and delivery time for new services
- Align IT Services with business goals
- Increase service level compliance
- Centralized accounting & billing
  - Industrialization of IT
- Use other Clouds when I need extra capacity

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4. **Extend IaaS with Enterprise Service Management (integrated with ITIL processes)**

Allows to completely integrated the cloud world with the remaining part of the enterprise by including the cloud infrastructure and services in the enterprise ITIL processes.

3. **Implement IaaS with advanced Service Automation and Orchestration**

Allows creating a more sophisticated cloud infrastructure for the delivery of more complex and critical IaaS services in highly demanding environments.

2. **Enable IaaS with Governance**

Complements the first macro-pattern by adding governance capabilities that allow to effectively manage aspects like **SLAs, security, resiliency, capacity planning, etc...** for both the virtualized infrastructure that provides the cloud service as well as the cloud service itself.

1. **Enable IaaS with Virtualization Management**

The entry point in the IaaS cloud space since it allows to start building a multi-tenant cloud infrastructure and model for the delivery of simple VMS (configured with the proper network and storage) that covers the 70% of the requests coming from the different business lines.
CEDC use-cases

ITIL Process Integrated IaaS
- Problem & Incident Management
- IT Asset Management
- License Management
- Change & Configuration Management
- SLA Mgmt
- Service Desk
- Release Management

Advanced IaaS
- Storage Provisioning & Configuration Mgmt
- Network Provisioning & Configuration Mgmt
- Services Orchestration
- Hybrid Cloud Integration
- Threat & vulnerability, identity & access, Security information and events Mgmt.

Managed IaaS
- Cloud Infrastructure & services Monitoring
- Capacity Management & Planning
- Events Management
- Backup & Restore
- Patch Management
- Endpoint Compliance & Security Mgmt

Simple IaaS
- Cloud resources, management
- Authentication, Roles & Tenants management
- VMs provisioning & on-boarding
- VMs patterns provisioning
- Virtual Images Construction & Management
- Usage metering, accounting & chargeback

Infrastructure and Platform Virtualization, Software Defined Environment
- Hardware Management
- Storage Virtualization Management
- Network Virtualization Management
- Compute Virtualization Management
Different CeDC implementation models (CCRA 4.0)

- A CeDC can be implemented by using one of the following three models
  - On-premise-hybrid
  - Off-premise-hybrid
  - Full off-premise

<table>
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<th>Model Type</th>
<th>Manage-from</th>
<th>Manage-to</th>
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<tr>
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<td>On-premise</td>
<td>On-premise <em>and/or</em> on Softlayer</td>
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</tr>
<tr>
<td><strong>Full off-premise</strong></td>
<td>Softlayer</td>
<td>Softlayer</td>
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- Each model above is represented by a slightly different Architecture Overview Diagram (AOD) in this CeDC architecture
On-premise-hybrid model

This model is typically used to implement IT-transformation projects.

Allows to deliver IT services more efficiently through the adoption of a cloud delivery model.

Allows to leverage external cloud service providers (as for example Softlayer) to burst unplanned, peak or very dynamic workloads into a third party infrastructure in a very dynamic and cost-effective way.

Allows to reserve more performant on-premise resources for critical workload and run tier-2 or less-critical workloads (like for example dev&test environments) off-premise.
On-premise-hybrid model – Architecture overview Diagram

ITIL Process Integrated IaaS

SmartCloud Control Desk or «IT Service Management on IBMService Engage»

Advanced IaaS

SmartCloud Monitoring or SmartCloud APM
Tivoli NetCool
Tivoli Storage Manager
IBM Cloud Orchestrator *

Managed IaaS

SmartCloud Monitoring or SmartCloud APM
Tivoli NetCool
Tivoli Storage Manager
IBM Endpoint Manager (patch mgmt and security compliance)

Simple IaaS

SmartCloud Provisioning *

SmartCloud Cost Mgmt

Infrastructure and Platform Virtualization

On-premise Virtualization environment (VMWare, KVM, VMControl, zVM)

On-premise H/W resources (x86, Power, zSeries)

VMWare/VCenter
OpenStack
PureApps
SoftLayer Bare-metal or private cloud instances

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Off-premise-hybrid model

This model is the recommended approach to build a CeDC environment with the minimum investment in terms of H/W resources and total cost of ownership and to connect it to your on-premise resources, data and applications.

GTS Private Modular Cloud service offering allows to allocate (and deallocate) a ready to use «cloud management» and managed infrastructure in Softlayer in few hours.

Softlayer provides a set of secured network connectivity services that allows to safely allocate or connect to resources on-premise.
Full off-premise model

This model can be used to build a CeDC environment with the minimum investment in terms of H/W resources and total cost of ownership.

This cloud environment can be used to deliver specific services (like test&dev environments) or scale-out applications/services (like hadoop, HPC, etc..) to IT users and business lines.

This solution could be also used to build cloud-service-provider IaaS solutions where the service provider provides and sells additional value (e.g. Application templates) on top of the pure infrastructure provided by Softlayer.
Full off-premise-hybrid model – AOD

ITIL Process Integrated IaaS

IT Service Management on «IBMService Engage»
Softlayer Internal Management System (IMS)

Advanced IaaS

SL Storage mgmt APIs
SL network mgmt APIs
IBM Cloud Orchestrator
Tivoli Identity Manager
Security network intrusion Prevention
QRadar Log Manager
Virtual Storage protection VMWare
SL IMS, SL IEM, McAfee, Nessus

Managed IaaS

SmartCloud APM on «IBM Service Engage»
Nimsoft (SL IMS for capacity planning)
Tivoli NetCool
SL IMS
Tivoli Storage Manager
Symantec eVault
Idera CDP
IBM Endpoint Manager (patch mgmt and security compliance)

Simple IaaS

Softlayer Internal Management System (IMS)

SmartCloud Cost Mgmt
SL billing system

Infrastructure and Platform Virtualization
VMWare/VCenter
OpenStack
PureApps
SoftLayer Bare-metal or private-cloud instances
SoftLayer public cloud
Platform Services Adoption Pattern - PaaS
Business Challenges from Clients

“Drive innovation and differentiation of new services to the market.”

“Respond quickly to business events, to stay ahead or react to the competition.”

“Dramatically drive down the cost of introducing new applications.”

“Reduce the time it takes to develop, test and deploy new capabilities.”

“Improve the availability of our applications through standardisation.”

“Manage Compliance and Audit needs thru automation and orchestration of complex deployments.”

“Improve product quality and reduce risk thru rapid feedback thru entire delivery cycle.”
IBM Cloud Reference Architecture  
– PaaS Macro patterns

Accelerate time-to-market with new workloads with Cloud Platform Services

Key Business Drivers:
• Reduce CAPEX (Capital Expenditure) and OPEX (Operational Expenditure) to deliver business services.
• Drive down IT costs by improving delivery time and quality, and lowering risks associated with delivery of new IT environments to business and software application development and delivery. Increase flexibility and integration between middleware components.

Process Oriented PaaS
Allows to implement a DevOps process by creating a continuous delivery flow that automates the build, test and delivery of applications into a cloud environment.

Advanced PaaS Services
In addition to the managed middleware patterns, applications can leverage additional services like programming services (e.g. DB or data-caching services) or integration services that allow to integrate with external application or public clouds and to implement auto-scaling and cloud-bursting scenarios.

Managed PaaS
Complements the first macro-pattern by adding governance services that allow to effectively manage the SLA and QoS aspects of the provisioned middleware, like for example resiliency, application performance, security, etc..

Simple PaaS Services
The entry point into the PaaS space, it allows to model multi-tiered middleware patterns, expose them as services into a self-service catalogue, automate their deployment and meter the resources used by this service.
IBM Cloud Capabilities – PaaS Adoption pattern

**Process Optimized Platform as a Service**
- Application development
- Application testing
- Application lifecycle Management
- Application governance
- Application on-boarding
- Continuous delivery

**Advanced Platform as a Service**
- BlueMix
- Orchestration
- Data caching services
- Cloud bursting
- Workload automation & scheduling

**Managed Platform as a Service**
- Identity management & security
- Application monitoring
- Application performance monitoring
- License Management
- Mobile Management

**Simple Platform as a Service**
- Provisioning & automation services
- Middleware pattern deployment
- Application metering
PaaS Adoption pattern – Key Software Group products

- **Simple Platform as a Service**
  - PureApp Patterns
  - SmartCloud Cost Management

- **Managed Platform as a Service**
  - Tivoli Identity Manager
  - SmartCloud Application Performance Management
  - IEM Software Usage Analysis
  - Fiberlink IEM

- **Advanced Platform as a Service**
  - Bluemix
  - IBM Cloud Orchestrator
  - WebSphere eXtremeScale
  - Cast Iron
  - SmartCloud Workload Scheduler

- **Process Optimized Platform as a Service**
  - Rational Suite
    - RSA / RAD
    - RTW
    - CLM / RTC
    - RAM
    - RAF / AMC
  - UrbanCode uDeploy
DevOps Tool Chain (packaged)

Plan and Measure
- Rational Focal Point
- Rational Requirements Composer

Develop and Test
- Jenkins
- Rational Build
- Forge

Release and Deploy
- IBM Cloud Orchestrator
- IBM Pure Application System
- Openstack

Monitor and Optimize
- Rational Team Concert
- SmartCloud Control Desk
- SmartCloud Application Performance Management

IBM Cloud Orchestrator
IBM Pure Application System
Openstack

SmartCloud Control Desk
SmartCloud Application Performance Management
Developer centric platform, marketplace & services in a Cloud Operating Environment

Value
Fast, automated composition of services
Repeatable patterns-of-expertise

Capability
OPEN ecosystem of composable services
Optimized workload deployment
Integration patterns with systems of record

- BlueMix
- TOSCA
- cloudfoundry.org
- OASIS
- Chef
- W3C
- Java
- MQTT

Software Defined Environment

- Workload definition, Optimization, & Orchestration
- Resource Abstraction & Optimization

- Software Defined Compute
- Software Defined Storage
- Software Defined Networking

API Ecology
SaaS
PaaS
Hardware

Integrated Services & Composition Patterns
- Datastore
- Mobile
- Middleware
- Services
- Security
- Operations
- Development

Traditional Workloads
IBM embraces & invests in open source to foster innovation

**June 1998**: IBM enters into an engineering agreement with The Apache Group for development of the open-source Apache HTTP server software eventually becoming the leader of the new Application Server market.

**September 1999**: IBM capitalizes on an untapped market trend and begins participating in the community development of Linux with a $60M annual investment.

**November 2001**: IBM rallies 150 influential vendors and the development community around a new tools environment with a $40 Million software donation disrupting the leadership of the software development ecosystem.

**September 2012**: IBM orchestrates the launch of The OpenStack Foundation boasting $10 million in funding and 5,600 members changing the dynamics of the Cloud ecosystem.
Run Your Apps
The developer can choose any language runtime or bring their own. Just upload your code and go.

DevOps
Development, monitoring, deployment and logging tools allow the developer to run the entire application.

APIs and Services
A catalog of open source, IBM and third party APIs services allow a developer to stitch together an application in minutes.

Cloud Integration
Build hybrid environments. Connect to on-premises systems of record plus other public and private clouds. Expose your own APIs to your developers.

Extend SaaS Apps
Drop in SaaS App SDKs and extend to new use cases (e.g., Mobile, Analytics, Web)
BlueMix – DevOps services

DevOps in the Cloud
From idea to production in minutes

- Team Collaboration & Agile Project Management
- Continuous Delivery Pipeline
- Develop

Mobile Quality Assurance → Continuous Integration
Continuous Integration → Continuous Deployment

Submit defects → Retrieve code
Check in code → Explore Services

Jazz SCM or GitHub → Application Composition Environment

Test / Run

Runtimes & Frameworks

Operational services

Middleware services

Application services

Platform as a Service

Orion Web IDE
Eclipse IDE

 compli 
for defect s

Check in code

CLI, 3rd party

Collaboration

Planning

Tracking
Software as a Service Adoption Pattern
Through the IBM SmartCloud, clients tap into SaaS solutions aligned by role and collaboration between business functions

**SmartCloud for Human Resources**
- Talent Management
- Learning and Certification
- Employee Onboarding

**SmartCloud for Procurement**
- Contract Management
- Spend Analysis
- Strategic Sourcing

**SmartCloud for Legal**
- Contract Management
- Risk Analytics
- Document Management

**SmartCloud for Customer Care & Support**
- Engagement Advice
- Experience Management
- Client Success

**SmartCloud for Sales & Commerce**
- eCommerce
- Performance Analytics
- Quote Management

**SmartCloud for Marketing**
- Demand Generation
- Campaign Analytics
- Agency Collaboration

**SmartCloud for City Operations**
- Transportation Planning
- Water Management
- Utility Optimization
Introducing IBM Cloud Marketplace


- Over 200 IBM and Third-Party Software and Services
- Leverage world-class IBM partner ecosystem
- Curated solution pages with IBM expertise
- Easy access to build, consume, deploy and purchase services
Cloud Service Provider
IBM Cloud Reference Architecture - CSP Macro pattern

Deliver innovative business Models as a Cloud Services Provider

**Key Business Drivers:**

- Competitive environment to become CSP, cost effective delivery, Retain and enhance customer relationship, differentiation in products offered (value of the products in realizing market leadership)

- Differentiation in service provided (value of the Service Provider brand)

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**Advanced CSP Services**

Provides an highly customizable storefront that includes the most typical e-commerce features like shopping-kart, credit-card-payment, etc.. and that allows a cloud service provider to sell its own services or to resell, white-label or broker third-party cloud services to consumer users.

**Simple CSP Services**

Provides deployment, automation, security, customer management, metering and billing services that allow to delivery IaaS/PaaS services in a simple, repeatable and secure way to end-users inside or outside the enterprise boundaries and to account them for these services use.
What’s New in CCRA, CSP v4 …

Phase-1: Understand the Client
  - Added some customer segmentation insights based on the latest corporate Strategy Team work.

Phase-4: Detail Design
  - Restructured the section to include sample CSP Services, starting with two:
    1. IaaS (Infrastructure as a Service)
    2. VDI (Virtual Desktop Infrastructure)
  - Added some notes about Parallel’s Automation Platform – a partner solution recommended by IBM for large scale CSP implementations
  - Focus on service brokering
  - Also added some comparison between the legacy ISDM product and SCO (Smart Cloud Orchestrator) as an aid for customer migration scenarios
  - Refreshed the many pattern deployment examples to reflect the latest changes in IBM product line.
  - Updated the pattern material to be in line with the latest changes in CEDC v4 pattern.
There are several options to become a CSP

**Use 3rd Party**

**Hosted White Label**
- User
- CSP
- Rebranding Wrapper
- IBM Softlayer

**Hosted (Broker / Aggregator)**
- User
- CSP
- Brokering / Rebranding
- 3rd Party Cloud Services

**On-premise**
- User
- CSP
- IBM Softlayer POD

**Build it**

- User
- CSP

- Data Centre hosted with another CSP with rebranded front-end;
- Faster time-to-market, but less control
- **Example: White labeling IBM’s Softlayer**

- Similar to white labeling, but can aggregate one or more 3rd party Cloud Services with rebranding front-end;
- Faster time-to-market, but less control
- **Example: AppDirect.com (used by GTS), Jam Cracker, etc.**

- Similar to White labeling but with on-premise installation of a 3rd party design.
- Faster time-to-market with slightly more control
- **Example: IBM Softlayer POD (Point of Delivery)**

- From the ground-up design, build and installation of on-premise Cloud Data Center Solution.
- Takes more time to build; full control; possibly more profitable.
- More suitable for existing MSP’s and/or Enterprise and Government type CSP’s
CSP’s are not all created equal: CSP Maturity Model

**Maturity Level 1**
Basic resource management. Basic IaaS, PaaS. Basic metering and billing – small scale with low automation.

**Maturity Level 2**
Provide IaaS, PaaS with automation (like devOps, Patch Mgmt, snapshot, white label services. Process for on boarding.

**Maturity Level 3**
Library stack provides backup as service, storage as service etc. Basic storefront, DR. Basic aggregation (google apps, amazon apps), metering/charging support for B2B.

**Maturity Level 4**
Providing SaaS apps, vertical market opportunities. Advanced storefront, partner management, advanced metering, payment process, credit card processing, B2C element.

**Maturity Level 5**
Advanced library services (e.g., CDN, email). Fully automated OSS/BSS (e.g., Amazon).

Increased Capabilities

Advanced Full CSP/MSP

Simple Basic CSP/MSP
High-Level Deployment Model with Product Mapping

Access
- Access Domain (Edge and DMZ)
  - WAS, WebSeal
  - VPN
  - Firewall, SSL Accelerator
  - WebSphere DataPower
  - DNS, Web (Public Data), Reverse Proxy
  - AAA, Identity
  - TAM, TFIM

Service Automation
- IBM Cloud Orchestrator *
  - Tivoli Netcool Mgr
  - SmartCloud Virtual Storage Center

Metering to Payment
- SCCM (Chargeback)
  - Rating and Charging
  - Billing
  - Accounts Receivable
  - Balance Management
  - Payment Gateway
  - Chargeback

Cloud Services Hosting (1..n)
- IBM Cloud Orchestrator *
  - SmartCloud Monitoring
  - IBM Cloud Orchestrator *

Virtual Machines Hypervisor Hosts (ESXi and KVM)
- Network
- Tivoli Netcool Omnibus, Impact
- Storage Pool

* Refers to a common installation, used to address different capabilities
Federal Government – Business Drivers

1. Data Center Consolidation
2. Outsourcing Managed Services on the Cloud
3. Application Capitalization in the Cloud (PaaS, SaaS, BPaaS)
4. Increasing need of security compliance
5. Transformation – Delivery models from traditional to cloud
6. Decrease cost
7. Dynamically scalable data centers
8. Increase service level compliance, accuracy, repeatability, and traceability
9. Agility to deploy new capabilities
10. Enable to become a cloud service provider
11. Centralized accounting and billing
Federal Government – Cloud specific Standards

1. Digital Privacy Controls and Data Privacy
2. Digital Government Strategy
3. Cloud First in Federal
4. Open Data Policy
5. Cyber Security Policy
6. Standard Compliance
   1. Example Security FIPS 140-2, Accessibility, FedRAMP etc
7. Hybrid Cloud and Disaster recovery
8. Cost Effective Deployments and Interoperability
HOW IT ALL COMES TOGETHER WITH OUR PORTFOLIO
An Entire Continuum Working Together

Composable Services

Infrastructure Services

Systems of Record
Cloud Ready - CeDC

Defined Pattern Services

Business Services
## Architectural Model for Cloud Services and IBM capabilities

### Business Process as a Service

**Enabling business transformation**

- Business process solutions
  - Recruiting
  - Procurement
  - Help Desk
  - Payment Processing
  - Accounting

### Software as a Service

**Marketplace of high value consumable business applications**

- External ecosystem
  - Industry
  - Collaboration
  - Human resources
  - Talent management
  - Commerce
  - Marketing
  - IT Management

### Platform as a Service

**Composable and integrated application development platform**

- Built using open standards
  - DevOps
  - Big Data & analytics
  - Security
  - Integration
  - Mobile
  - Management
  - Social
  - Traditional workloads

### Infrastructure as a Service

**Enterprise class, optimized infrastructure**

- Built using open standards
  - Compute
  - Storage
  - Networking

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**Smarter Commerce**

Smarter **Analytics**

Smarter **Cities**

Smarter **Workforce**

Watson Solutions

**IBM Service Engage**

Software solutions

**API Economy**

**Marketing Services**

Maximo Solutions

**BlueMix PaaS Platform**

Open Standards-based Middleware solutions given by Pure App System, Pure Data System, DevOps portfolio

**IBM Cloud Orchestration, SoftLayer, IBM Cloud Management services**
Publically available material

Getting Cloud Computing Right (whitepaper about the CCRA)

Redguide about Cloud Enabled Data Center adoption pattern

Redguide about Cloud Service Provider adoption pattern

IBM PaaS PoV

Academy Technote about the CCRA