CLOUD ADOPTION STRATEGY AND PROCESS

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MODULE OBJECTIVE

- Learn best practices of cloud strategy planning and cloud adoption process.
- Learn how to check the readiness for cloud adoption.
- Learn how to build a private cloud successfully.
- Learn how to analyze use cases and business cases for cloud adoption.

CLOUD ADOPTION STRATEGY

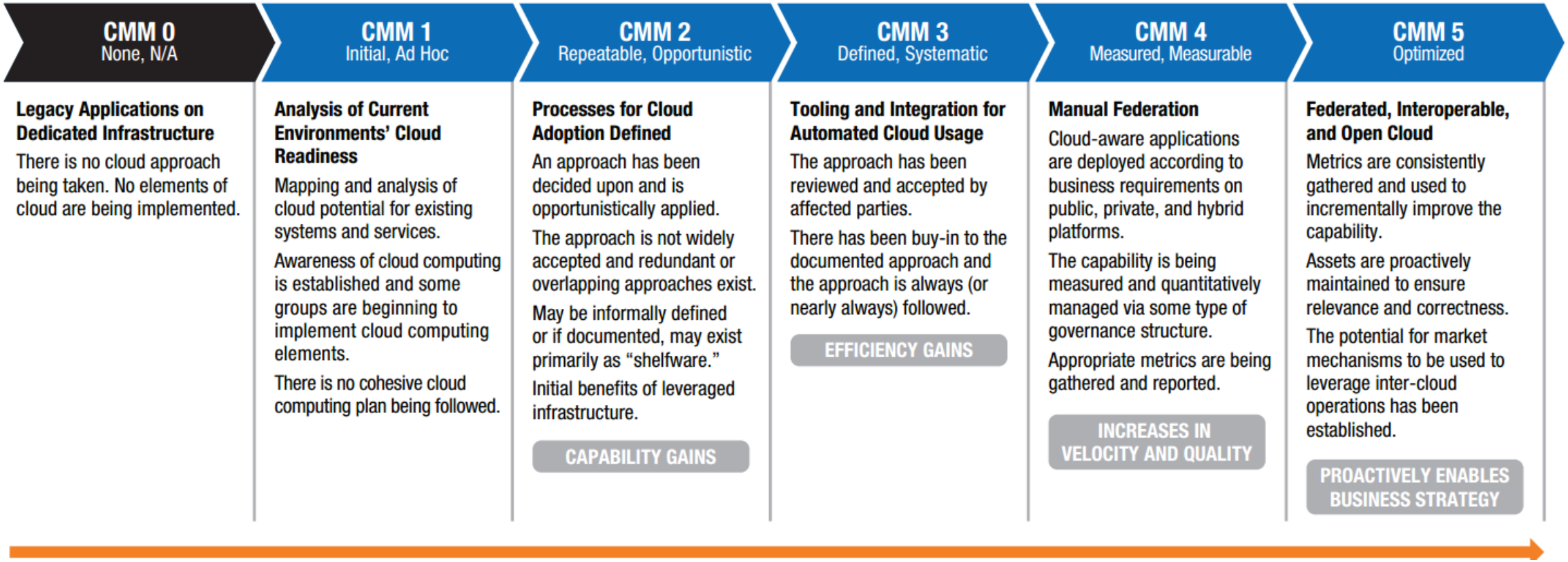
CLOUD ADOPTION PROCESS

1. Understand value propositions and architectures of cloud services and skills necessary for adopting them.
2. Scan the cloud market and understand providers, offerings and the trend of cloud services.
3. Develop a cloud adoption strategy 
4. Assess your applications and workloads for cloud readiness.
5. Develop use cases for cloud services in consideration for adoption.
6. Assess key IT capabilities necessary for cloud migration and identify capability gaps.
7. Build the business case.
8. Reengineer business processes if necessary.
9. Develop the technical approach including a flexible integration model and a security-and-privacy protection model.
10. Manage the migration to public clouds.

Cloud Standards Customer Council, Migrating Applications to Public Cloud Services: Roadmap for Success, 2013.

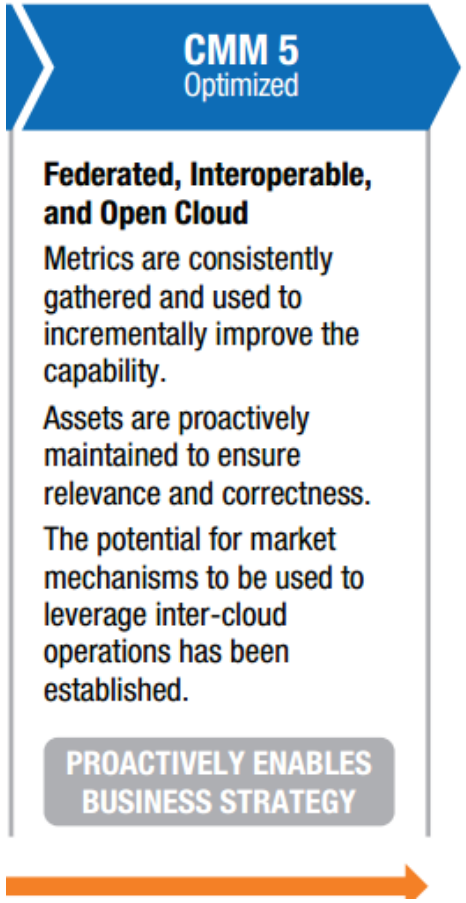
CLOUD MATURITY MODEL

- ODCA Cloud Maturity Model (CMM)



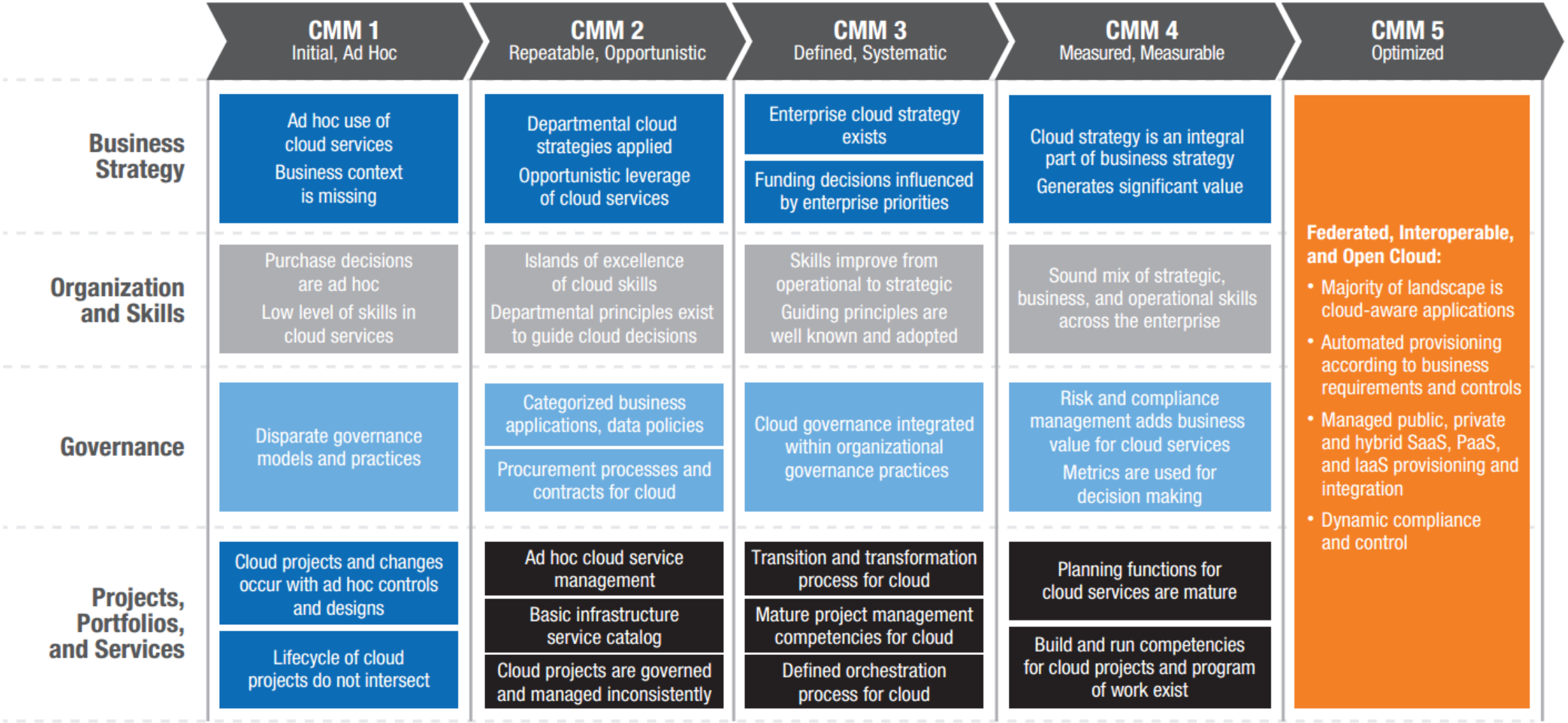
Open Data Center Alliance, Open Data Center Alliance Usage Model: Cloud Maturity Model Rev. 2.0, 2013. (http://www.opendatacenteralliance.org/docs/Cloud_Maturity_Model_Rev_2.0.pdf)

CLOUD MATURITY MODEL



- Federated
  - The ability of identity and access management software to be able to securely share user identities and profiles. This ability allows users to utilize resources located in multiple clouds without having to generate separate credentials in each cloud individually.
- Interoperable
  - The ability to connect two systems that are concurrently running in cloud environments, and the ability to easily port a system from one cloud to another. Both involve the use of standard mechanisms for service orchestration and management, enabling elastic operation and flexibility for dynamic business models, while minimizing vendor lock-in.
- Openness
  - The ability to use open source software. OSS operates at a fast rate of change supported by diverse, vibrant community updates. These frequent update cycles provide access to the latest features and capabilities, including performance and efficiency improvements.
  - The ability to use common APIs or abstraction layers easy for end users to rapidly consume cloud services from different providers to meet business requirements. Even if the software is not open source, it should adhere to open standards, in order to maximize the benefits of cloud deployment.

CLOUD CAPABILITY MATURITY MODEL



CLOUD CAPABILITY MATURITY MODEL

- Cloud-Aware Applications
  - Applications that maximizes cloud advantages, such as self-service provisioning, elasticity, run-anywhere design, multi-tenancy, stateless computing, and composable design in SOA utilizing Web Services and RESTful Services APIs.
- Automated Provisioning
  - Consumer-focused self service portal enabled by a hosting automation framwork
- Hybrid Cloud
  - A mix of public and private clouds achieving high levels of agility and scalability while maintaining security, control and cost. The choice between public and private clouds is made for each use case.
- Dynamic Compliance and Control
  - Capabilities related to the governance structures and processes including policy management, risk management, and auditing capabilities

Intel IT Consumable Web Services Guidelines

All software products and infrastructure services should include a consumable API (web services) to automate and integrate the capabilities within more complex business workflows. This applies to the following types of software:

- Software acquired by Intel and hosted at Intel to construct an enterprise private cloud
- Software hosted by a cloud provider and consumed by Intel in either a standalone or hybrid cloud model
- Software services internally developed by Intel
- Infrastructure services running at Intel or consumed by Intel, including all hardware solutions that IT developers consume, regardless of their location or their authorization to use it

We expect all web services to be written in a manner consistent with good API design and cloud computing practices.

- Functionality provided through a command line interface (CLI) or graphical user interface (GUI) must also be available through an API. Furthermore, CLIs and GUIs are implemented as wrappers for public APIs instead of relying on private APIs or other mechanisms not available to application developers.
- APIs are discoverable at runtime with clear service descriptions, versioning, and published service-level agreements. Ideally, these are exposed through a service catalog.
- Programming examples are made available and in commonly used languages. Developers are encouraged to provide client libraries (bindings, proxies) for various commonly used languages to accelerate adoption.

Intel IT, Maximizing Cloud Advantages through Cloud-Aware Applications, 2013.
(http://www.intel.com/content/www/us/en/it-management/intel-it/intel-it-best-practices.html)

WEB SERVICES GUIDELINE FOR CLOUD-AWARE APPLICATIONS

Intel

- We encourage use of the representational state transfer (REST)-based architecture model, including conventional uniform resource identifier (URI) design, and standard HTTP methods (Post, Get, Put, Delete) and security (encrypted Secure Sockets Layer, Open Authorization). APIs are logically layered to provide useful abstraction from the core capabilities of the software and simplify their usage.
- APIs support role-based access with proper authentication, authorization, and accounting controls in place. Resources being managed by an API are further restricted to allow access to only appropriate owners and approved delegates. Operations are logged such that the system can be reviewed to identify who accessed what and when.
- Developers can select from a list of available output data types, such as JavaScript* Object Notation (JSON), XML, YAML, and HTML. We prefer the JSON format.

- APIs do not limit potential cloud users by requiring special licenses or through cost limitations on the use of the interface.
- There is a loose association between the client application and web API where calls do not depend on the prior API call (stateless compute), all state data is returned to the client, and all dynamic memory is released.
- Web services provide mechanisms to support asynchronous call back, such as publishing results to the message queue where the consumer is listening, email notification, or other forms of call back, for long-running tasks. The task is identified by a globally unique identifier. Consumers can query for status or progress of the task using this identifier.

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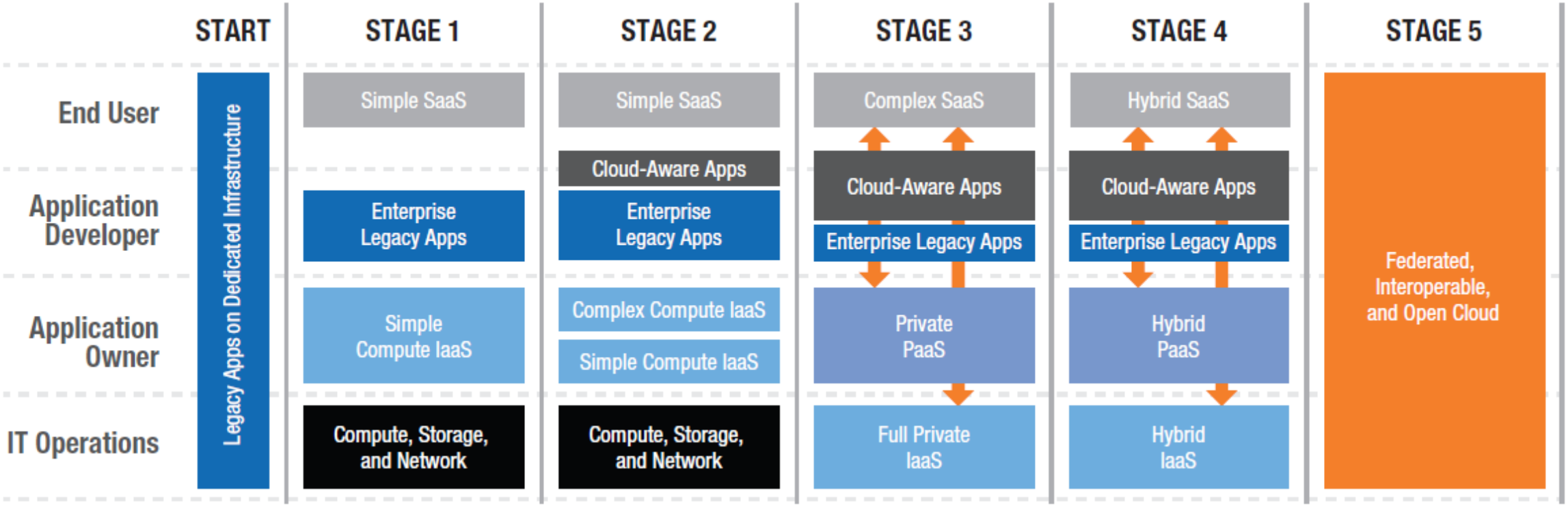
- Web services are designed for failure, such as anticipating infrastructure failures and maintaining uptime across multiple availability zones, preferably through an active/active model.

WEB SERVICES GUIDELINE FOR CLOUD-AWARE APPLICATIONS

Intel

CLOUD ADOPTION ROADMAP

- The cloud adoption roadmap provides an end-to-end visualization for how the technical use of cloud technologies in the enterprise develops over time.
- As technical implementation matures, the use of cloud becomes more sophisticated, comprehensive, and optimized.



- Cloud Adoption Strategy was set up to answer two related questions:
  - Which workloads should we move to cloud and when?
  - How do we map a path to cloud computing from out current environment?
- Cloud Adoption Strategy Planning Process
  - Conducted an environment scan.
  - Created cloud definitions, attributes and taxonomy.
  - Identified potential benefits and risks of cloud services.
  - Developed a cloud use case model.
  - Revised the enterprise architecture to accommodate cloud services.
  - Developed cloud adoption roadmap.

"For 2014, we have aligned our IT priorities to Intel's key focus areas. Building on 2013, we will extend our investments in SMAC to accelerate Intel products TTM, grow revenue and improve operational efficiency."

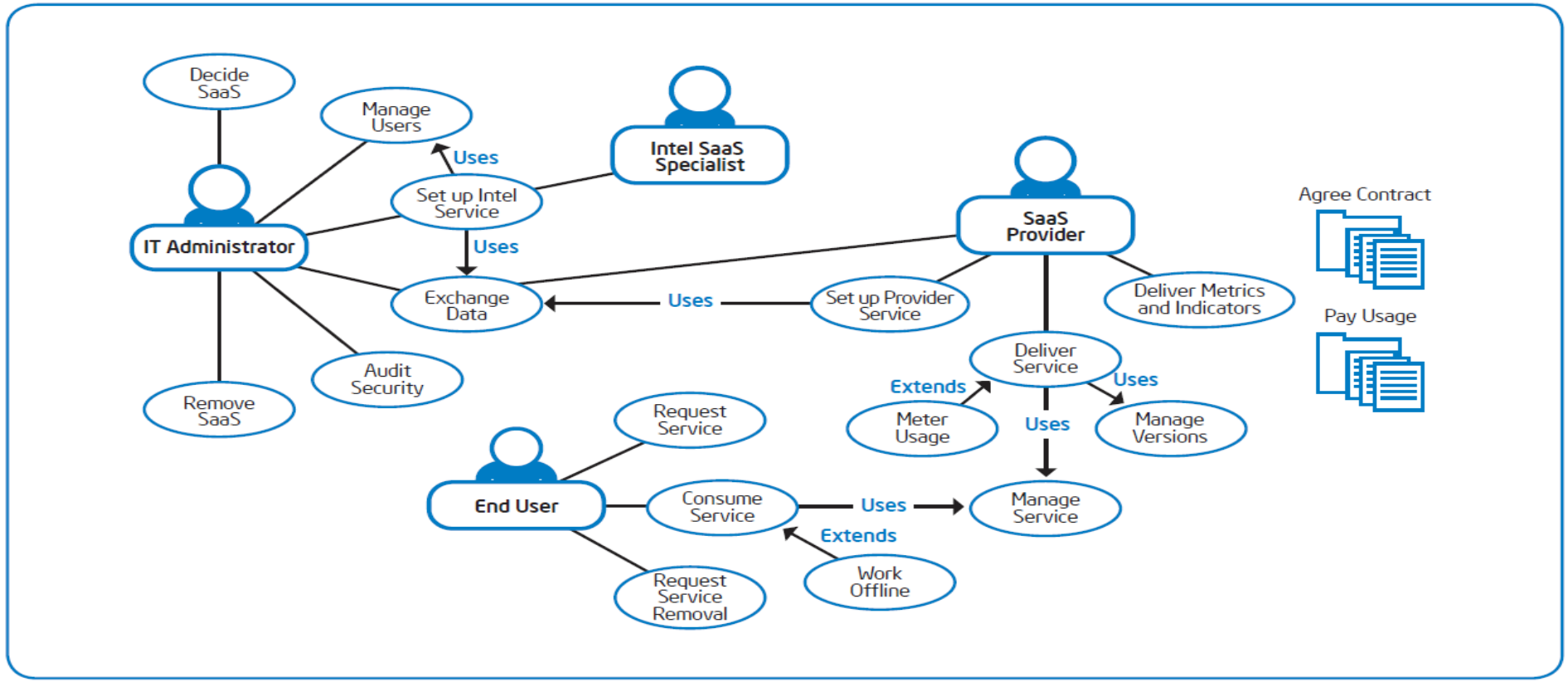
Kim Stevenson, Intel CIO

Intel IT, Devloping an Enterprise Cloud Computing Strategy, 2009.
(http://www.intel.com/content/www/us/en/it-management/intel-it/intel-it-best-practices.html)

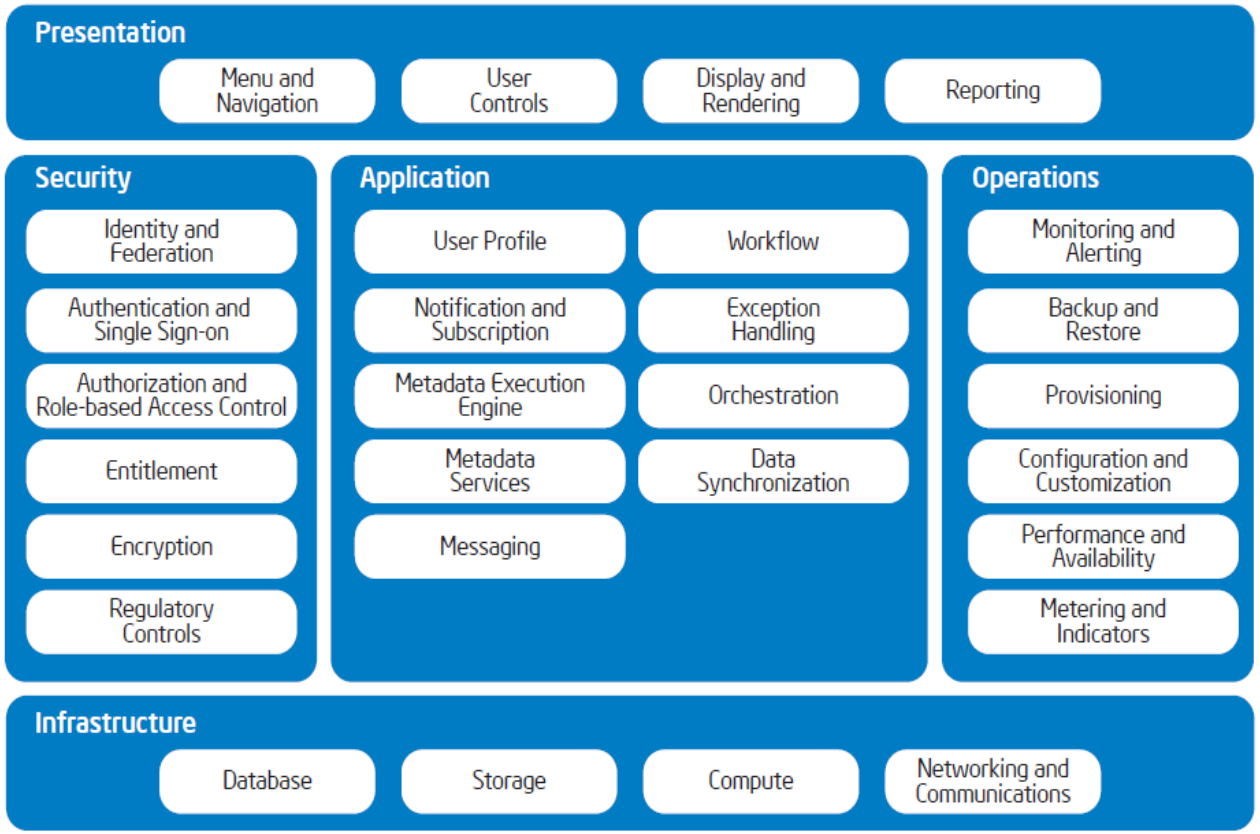
CLOUD ADOPTION STRATEGY

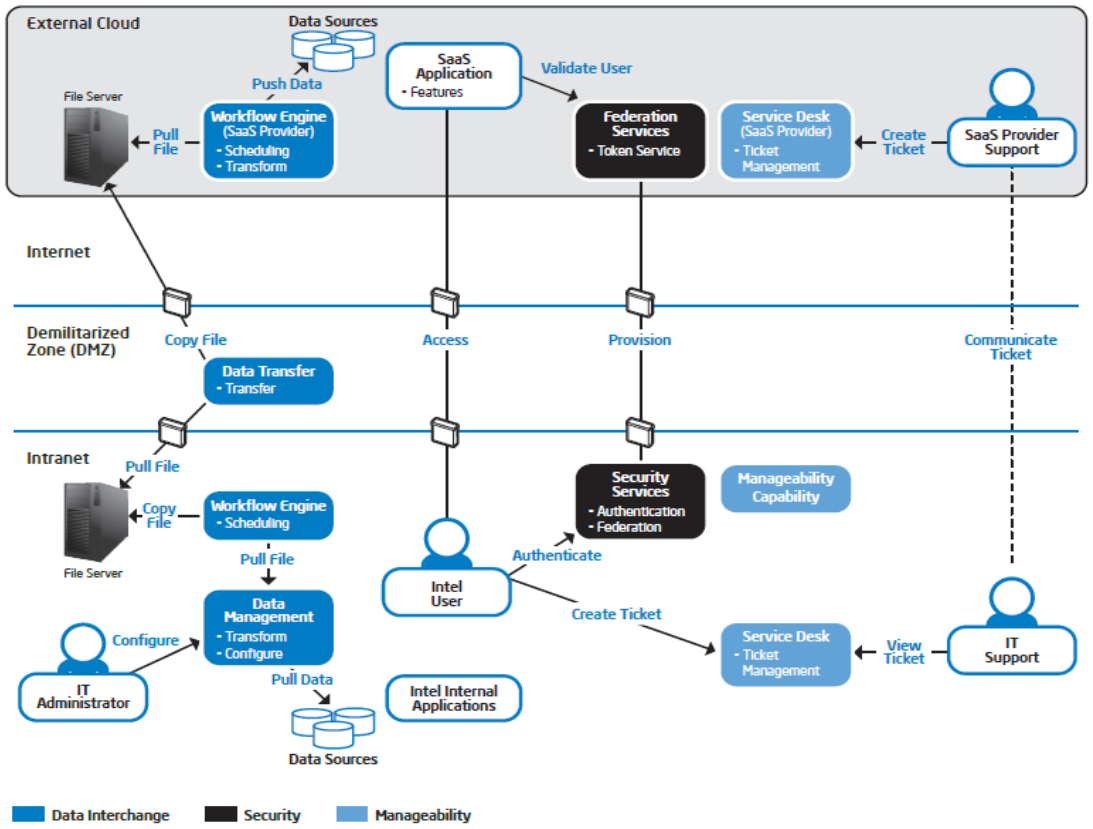
Intel

- Intel's Cloud Use Case Model

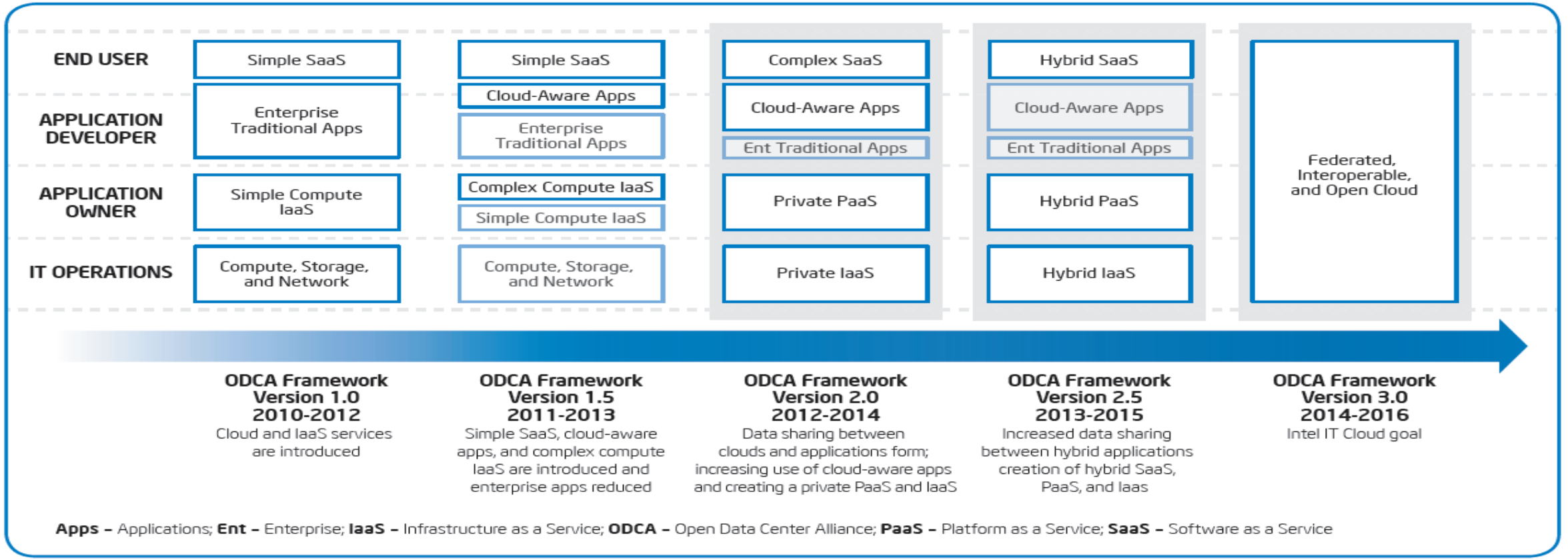


- Intel's Cloud-Enabled Enterprise Architecture





- Intel's Cloud Adoption Roadmap



CLOUD ADOPTION STRATEGY

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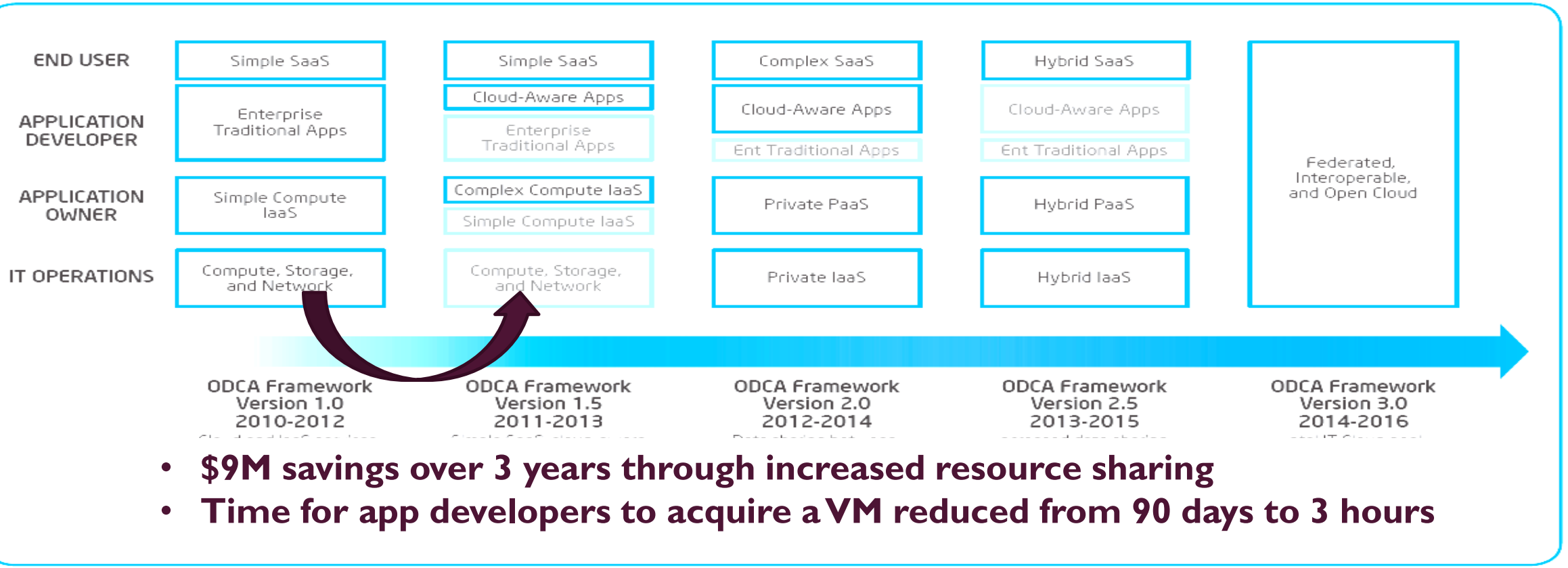
- Intel's Cloud Adoption Roadmap



- **$9M savings over 3 years through increased resource sharing**
- **Time for app developers to acquire a VM reduced from 90 days to 3 hours**

ADOPTING PUBLIC CLOUDS

CLOUD ADOPTION PROCESS

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Cloud Standards Customer Council, Migrating Applications to Public Cloud Services: Roadmap for Success, 2013.

APPLICATIONS READY FOR MIGRATION TO PUBLIC CLOUD

- Business processes that are not competitive differentiators, but can be standardized on industry best practice
- Business processes not under restrictions to cloud migration
  - Business culture resistant to outsourcing and/or cloud migration
  - Immature business architecture
  - Extremely sensitive data
  - Extreme performance required
  - Switching costs, Community relations
  - Labor contracts, Long-term lease, Fixed assets with depreciation value
  - Sovereignty rules, Industry regulation, Compliance audit rules
- Business processes without cloud-incompatible business objectives
  - Increase in-house capacity, Build in-house domain-expertise, Cut short-term costs, Shift from OpEx to CapEx, Recognize depreciation for tax reduction, Job creation, etc.

"Entrenched behaviors are very difficult to change. Some individuals and groups don't want to give up administrative control. Others don't want to give up their physical servers. Things like cloud and self-service are in everyone's best interest. We have had to sell the notion."

Das Kamhout, Principal Engineer and Cloud Lead for Intel IT

The Open Group, Cloud Buyers' Decision Tree, 2010.
Cloud Standards Customer Council, Migrating Applications to Public Cloud Services: Roadmap for Success, 2013.

APPLICATIONS READY FOR MIGRATION TO PUBLIC CLOUD

- Candidate for IaaS
  - Applications not dependent on specific infrastructure not supported by cloud service vendors (such as supercomputer)
- Candidate for PaaS
  - Applications not dependent on specific platforms or infrastructure that are not supported by cloud service vendors (such as UNIX, real-time OS)
- Candidate for SaaS
  - Applications not dependent on specific platforms or infrastructure that are not supported by cloud service vendors
  - Applications not database-centric
  - Applications not tightly coupled with other applications (such as stand-alone applications, SOA applications with ESB for integration)
  - Applications without complex mashups in UI
  - Applications insulated from or not subject to business process changes (such as SOA applications with process orchestration)

Business Process

UI

Application

Middleware

Database

OS

VM

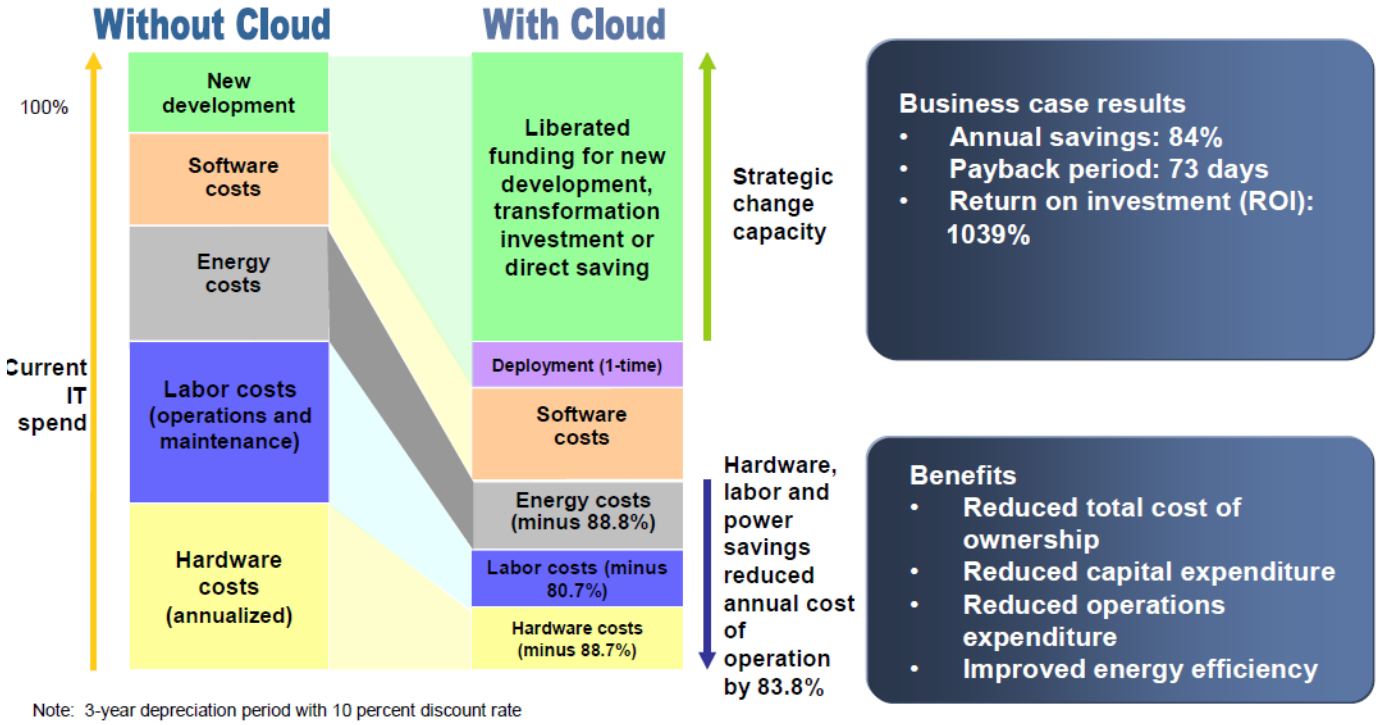
Server

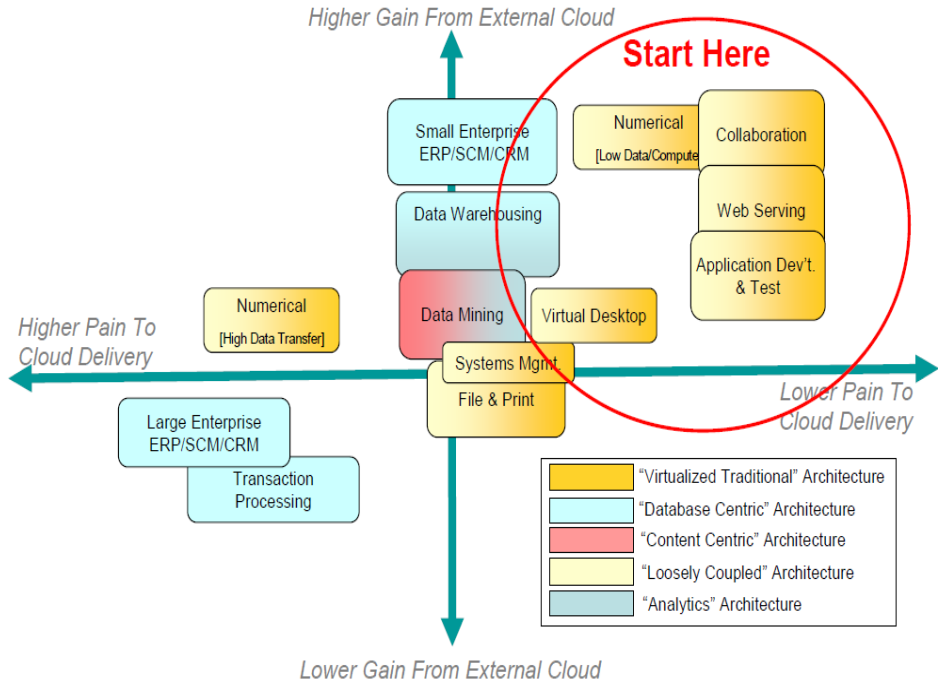
Storage

"*The pace of change and the traditionally siloed nature of IT are the hardest things to deal with.*"

Glenn Rudolph, Director of Data Centers and Hosting for Intel IT

- Migration of Collaborative Development and Test Tools to Cloud (dPaaS)





IBM, Leveraging Cloud Services-Application Selection for Migration to a Cloud, 2011.

WORKLOAD SELECTION FOR MIGRATION TO PUBLIC CLOUD

IBM

Typical Attributes of Applications Suitable for External Clouds	Additional Typical Attributes of Applications Suitable for Software as a Service
▪ Do not deliver competitive advantage ▪ Are not mission-critical ▪ Are not core business applications ▪ Contain less-sensitive data ▪ Are minimally affected by network latency or bandwidth	▪ Are at a natural re-engineering point in their lifecycles ▪ Have minimal customization ▪ Have industry-standard workflow

Intel IT, Developing an Enterprise Cloud Computing Strategy, 2009.
(http://www.intel.com/content/www/us/en/it-management/intel-it/intel-it-best-practices.html)

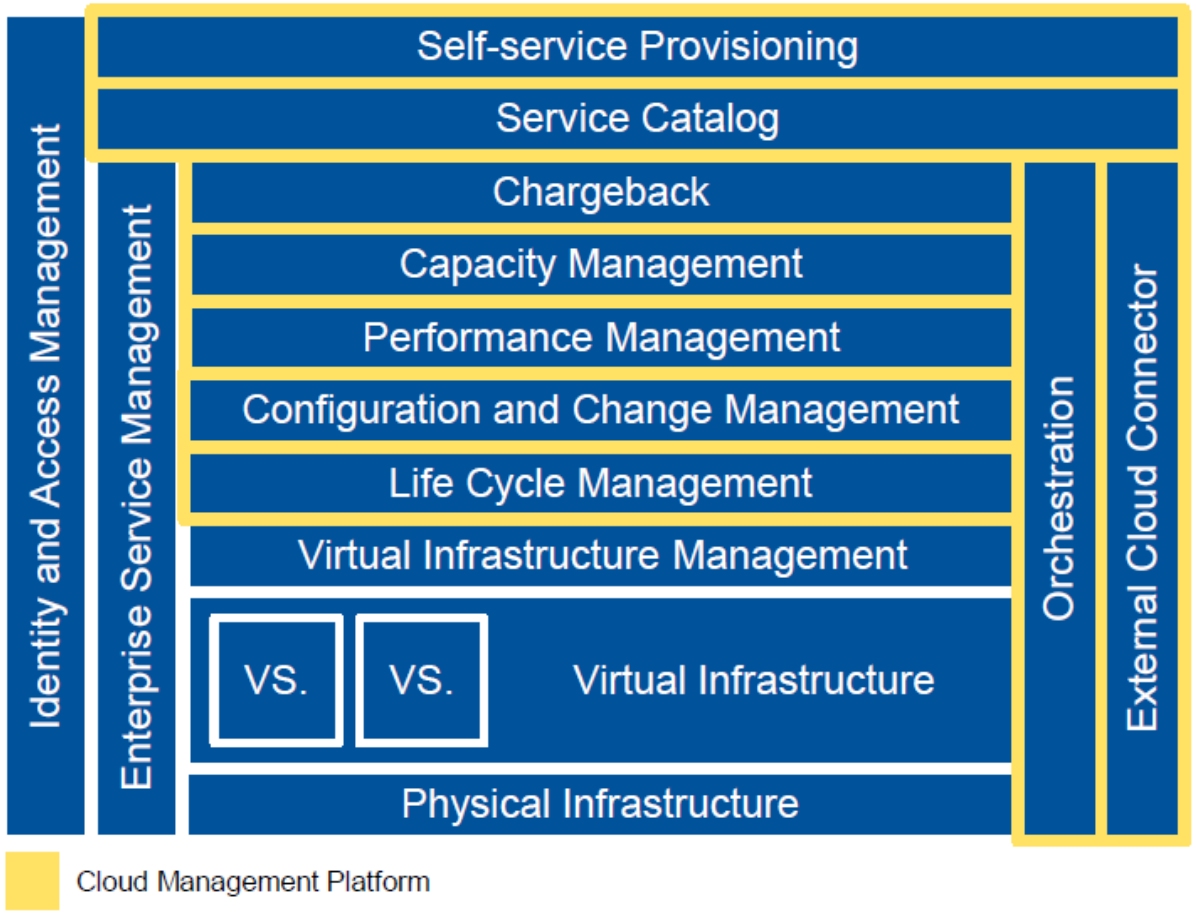
WORKLOAD SELECTION FOR MIGRATION TO PUBLIC CLOUD

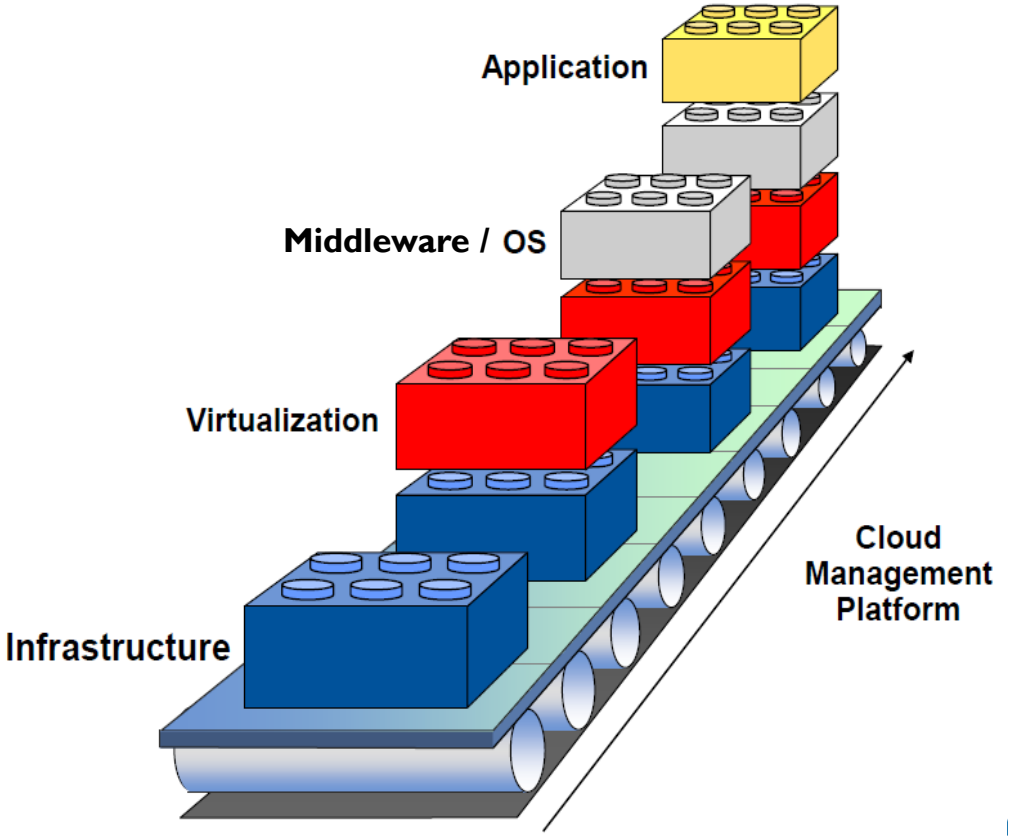
Intel

BUILDING PRIVATE CLOUDS

PRIVATE CLOUD

Private IaaS Architecture



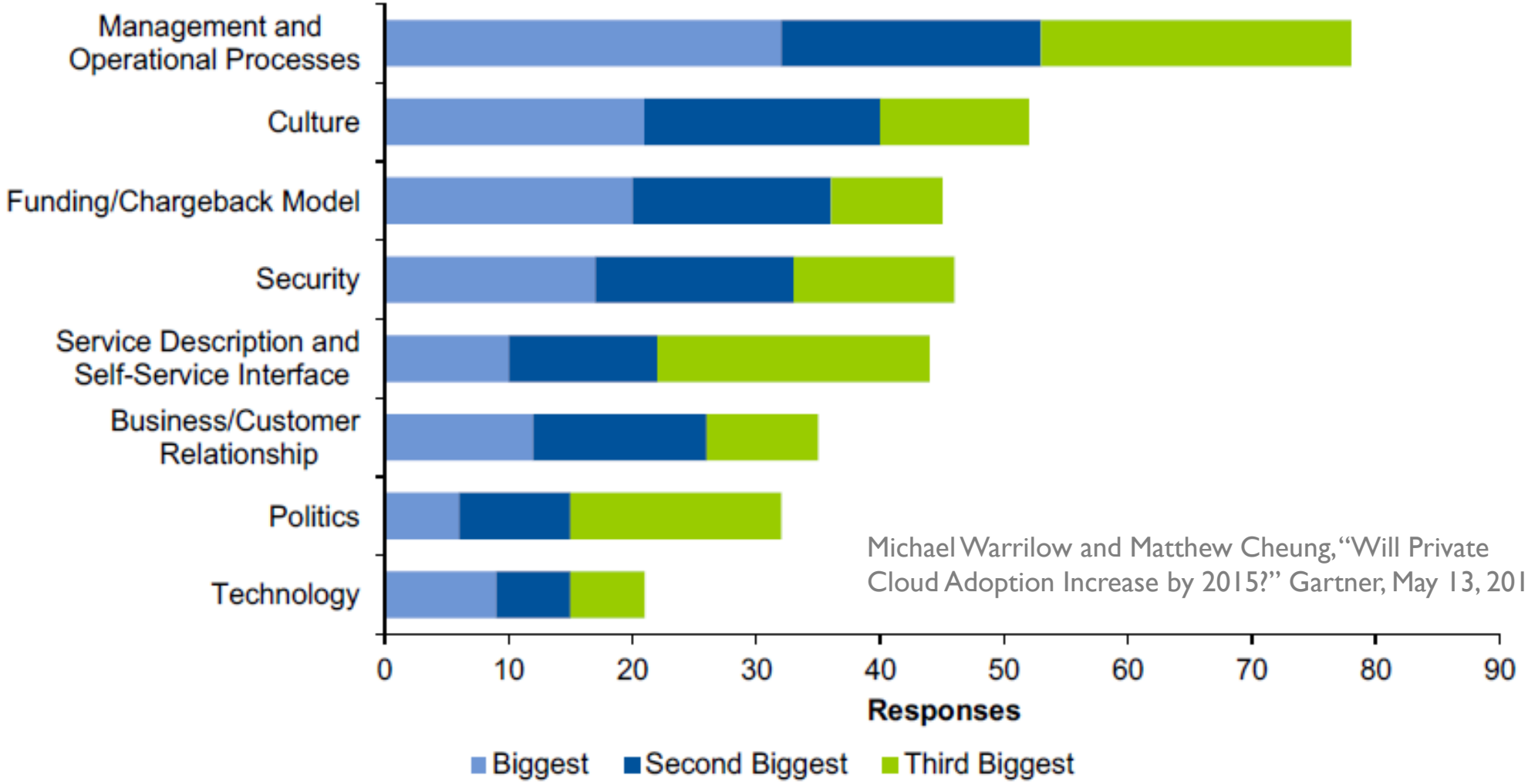


Alan D. Waite, "Why Private Clouds Keep Failing (And What To Do About It)" Gartner, 2014.

PRIVATE CLOUD BENEFITS

Rapid/Automated provisioning	Dynamic workload placement	HA/DR capability
IT self-service	User self-service	Chargeback/ Showback
Hardware independence	Holistic management	External resource integration
Developer agility	Data center consolidation	Cost reductions

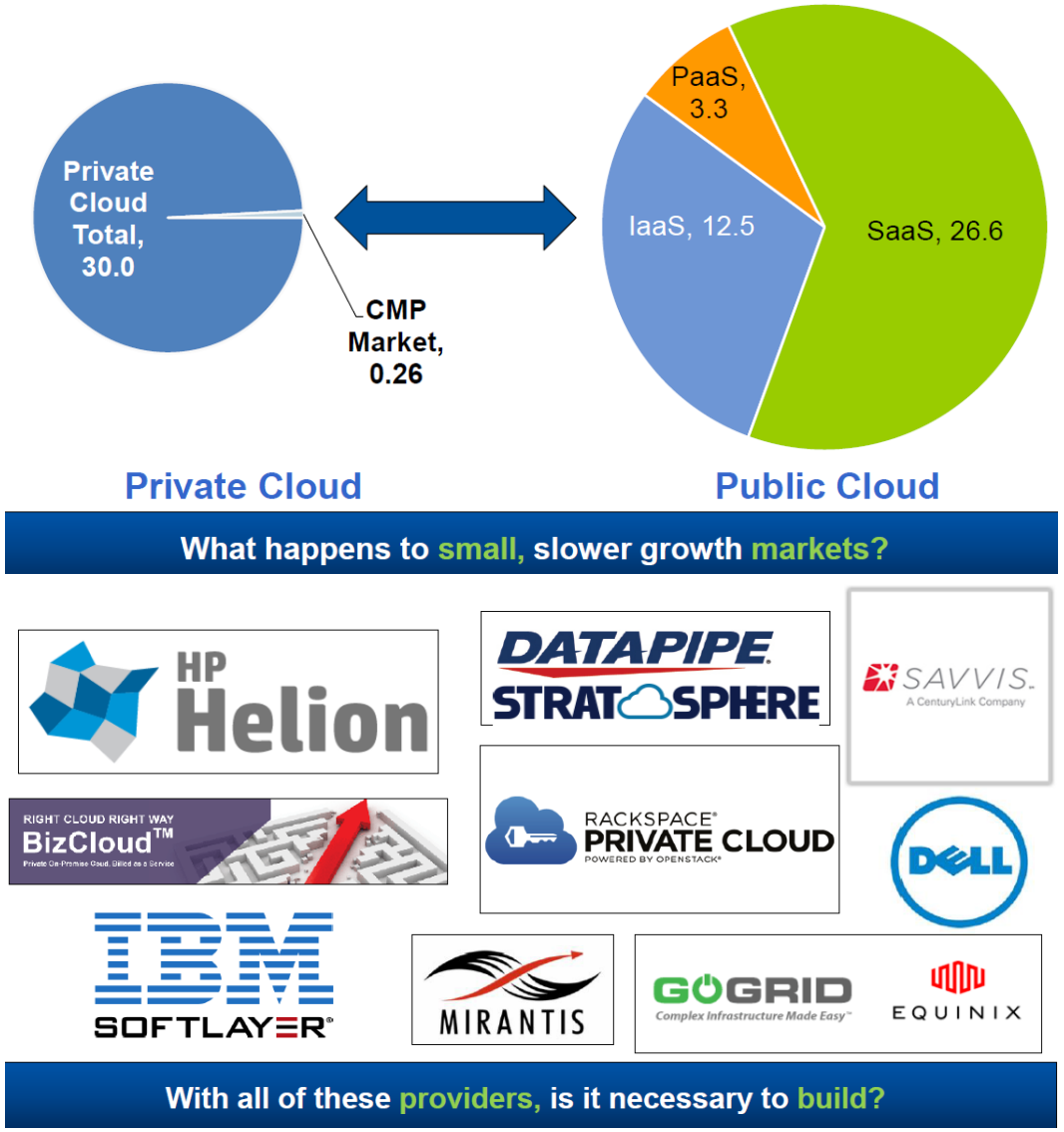
PRIVATE CLOUD CHALLENGES



Michael Warrilow and Matthew Cheung, "Will Private Cloud Adoption Increase by 2015?" Gartner, May 13, 2013.

PRIVATE CLOUD CHALLENGES

- Cloud management platform (CMP) software is IaaS focused, and CMP market has limited growth potential.
- Open source IaaS stacks have lots of fragmented components driven by vendor priority, often requiring development or software to fill gaps.
- Furthermore, private clouds require significant integration and development. Private cloud software must integrate with enterprise IT service management.
- Do you have the skills to fill the gaps of open source platforms, to develop private clouds and automate the management of clouds and legacy systems? Buy instead of build; Hosted private cloud vendors abound.



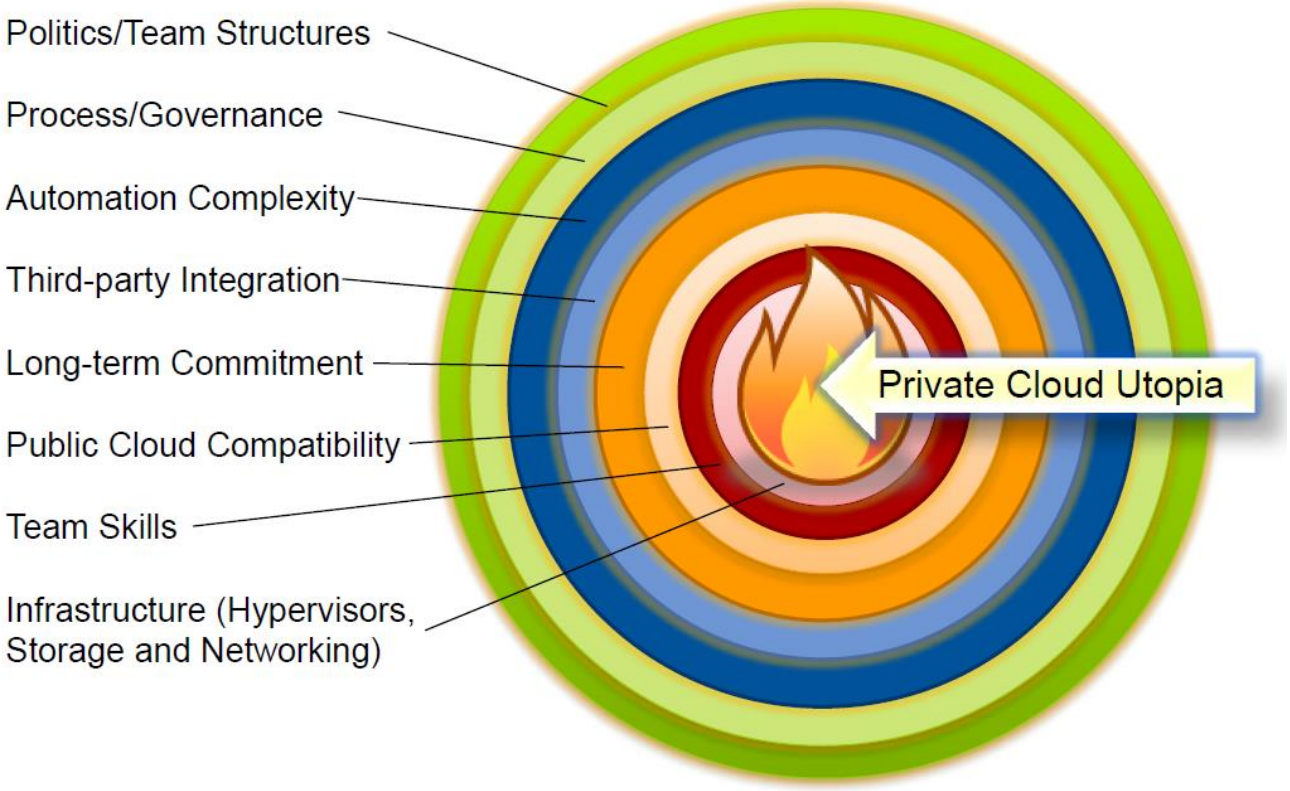
Drue Reeves, "Top Ten Reasons Not to Build a Private Cloud," Gartner, 2014.

DEVELOPMENT OF PRIVATE CLOUD

- You don't need to build an AWS/Google clone internally.
- Failure happens because you try to automate too much, too soon.
- Enterprises should focus on delivering the value and the benefits they need, regardless of whether that fulfills the "definition" of private cloud.

Start Small, Think Big	• Exponential complexity will kill you • Automate a few, most provisioned workloads
Set the Process and Structure First	• "Who owns this?" • Silos trying to run a cloud doesn't work • Automating a broken process won't fix it
Define the Success Criteria	• E.g. "Reduce deployment time to less than 3 days"

Reasons Why Private Cloud Fails

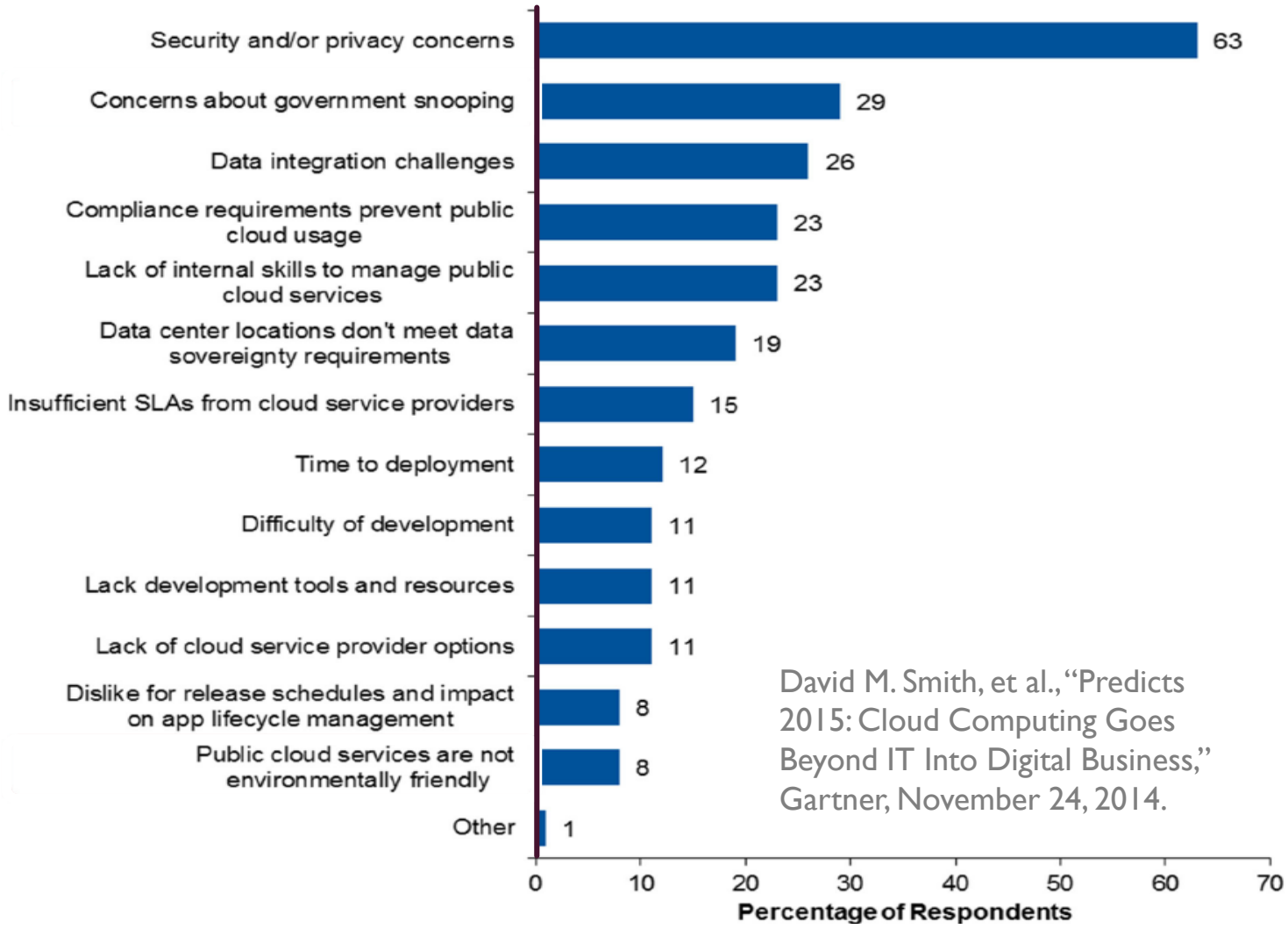


Alan D. Waite, "Why Private Clouds Keep Failing (And What To Do About It)" Gartner, 2014.

DEVELOPMENT OF PRIVATE CLOUD

- Give preference to available public cloud or hosted private cloud services.
- Choose private cloud when public cloud services are not suitable.
- Use open source software and open standards to build private clouds as long as you have sufficient skills to do that.
- Use cloud-in-a-box, providing prepackaged integrated cloud stacks, available from companies such as Cisco, Dell, HP, IBM, Microsoft and VMware, to build private clouds if you have less skills.
- Build the skills of your IT staff necessary to build and operate private cloud. These skills are difficult to acquire fast.
- Bear in mind that private cloud requires not just technological, but also cultural and organizational, changes.

Reasons for Not Considering Public Cloud



David M. Smith, et al., "Predicts 2015: Cloud Computing Goes Beyond IT Into Digital Business," Gartner, November 24, 2014.

DEVELOPMENT OF PRIVATE CLOUD

	Private Cloud-in-a-can	DIY
Acquisition costs	✗	✓
Integration costs	✓	✗
Operational costs	✓	✗
Proprietary lock-in	✗	✓
Maintain integration skills	✗	✓
Fit with existing environment	✗	✓
Time to value	✓	✗
Vendor support	✓	✗
Vendor risks	◐	✓

- ✓ Define which workloads are targeted for your private cloud:
  - Focus on the most provisioned workloads where agility is required
- ✓ Fix the provisioning process before you start:
  - Change management and process governance will be critical
  - Enforce SLAs for approval requests
- ✓ Appoint a single cloud "owner":
  - Invest in dedicated staff and skill set
- ✓ Standardize the hypervisor, servers, network and storage
- ✓ Use out-of-the-box automation capabilities provided by commercial CMPs:
  - Drive value through "just enough" customization
- ✓ Build your private cloud strategy around a few key vendor/provider partners

Alan D. Waite, "Why Private Clouds Keep Failing (And What To Do About It)" Gartner, 2014.

ADVANTAGE OF USING OPEN TECHNOLOGIES

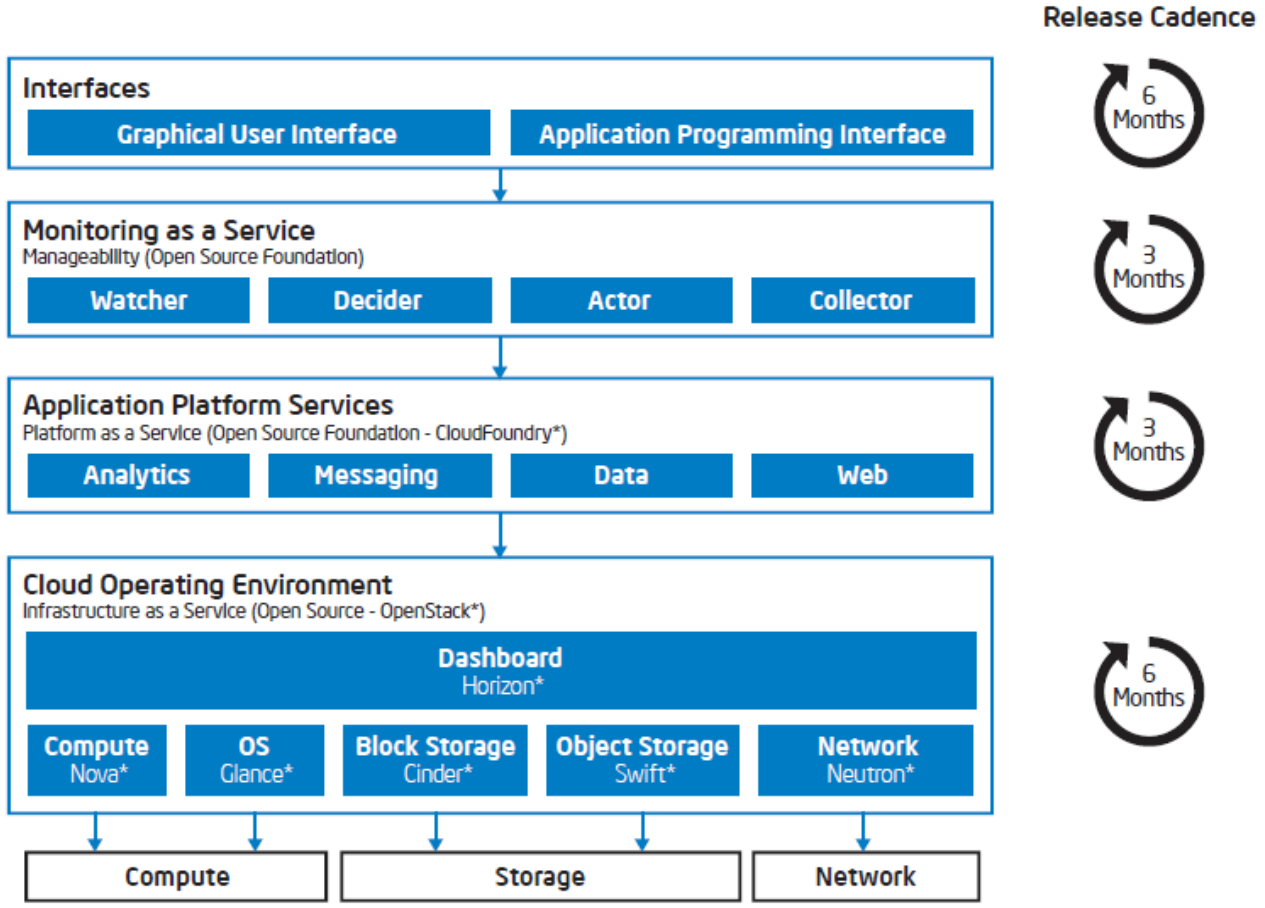
- Eliminates having to write, test, and implement our own cloud software
- Avoids the high switching costs and licensing costs associated with proprietary sources
- Lets you take advantage of the many open source options and the frequent update cycles of the open source community creating fast implementation of the latest features, capabilities, and performance improvements
- Enables you to benefit from and participate in the strong, vibrant open source community and enterprise-level support options available through third-party companies
- Enables us to write core code with other members of the community and share that code to move faster

KEY TO SUCCESS OF PRIVATE CLOUD

- Understand the current maturity level of your company's IT and business users.
- Take the next step to improve IT capabilities and business-IT alignment with a long-term roadmap to cloud.

	Maturity Level			
Business	Process Reengineering	Process Integration	Enterprise Architecture	Process Orchestration
Application / Platform	Application Silos	Application Integration	Service-Oriented Architecture	SaaS / PaaS
Infrastructure	Local Data Centers	Data Center Consolidation	Virtualization	IaaS
IT Service Management	No IT Service Process	ITIL-Based ITSM	Virtual Infra Mgmt Platform	Cloud Mgmt Platform

- To operate our private cloud like a cloud service provider requires maximizing our resource efficiency while providing on-demand, self-service PaaS and IaaS. To achieve these objectives, Intel used OpenStack, making it the single control plane for all our hosting virtualization environments.
- Intel also took advantage of Cloud Foundry to implement PaaS.
- To manage our cloud operations at each level of the cloud capability stack, Intel followed Information Technology Infrastructure Library* (ITIL) standards.

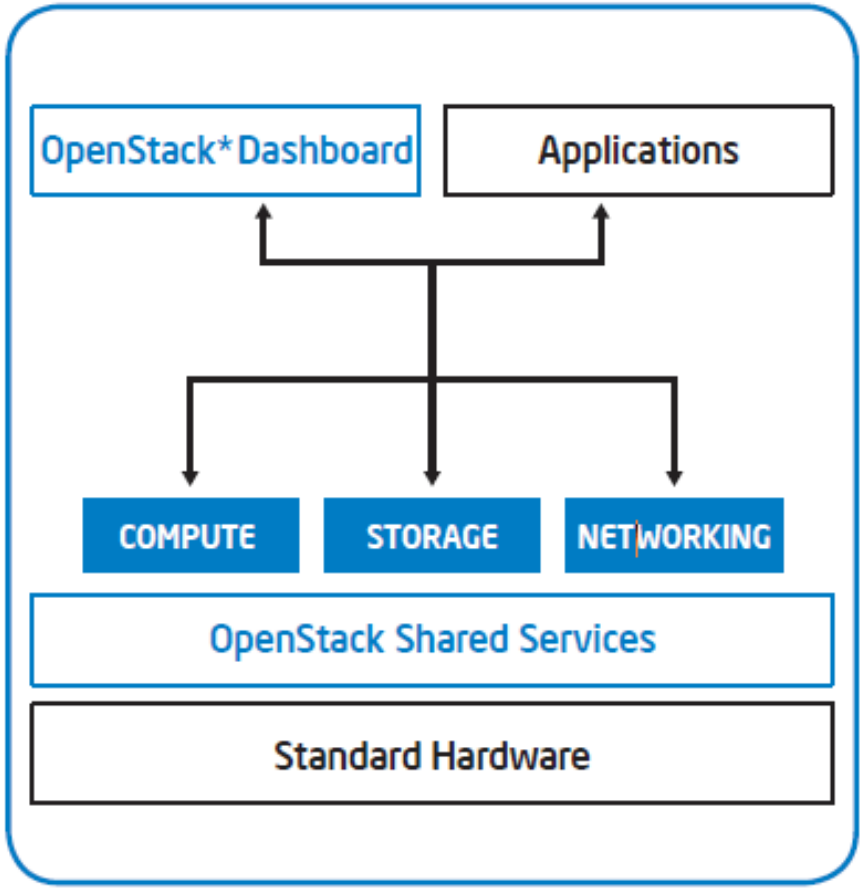


Intel IT, Simplifying the Path for Building an Enterprise Private Cloud, 2014. (http://www.intel.com/content/www/us/en/it-management/intel-it/intel-it-best-practices.html)

BUILDING PRIVATE CLOUD

Intel

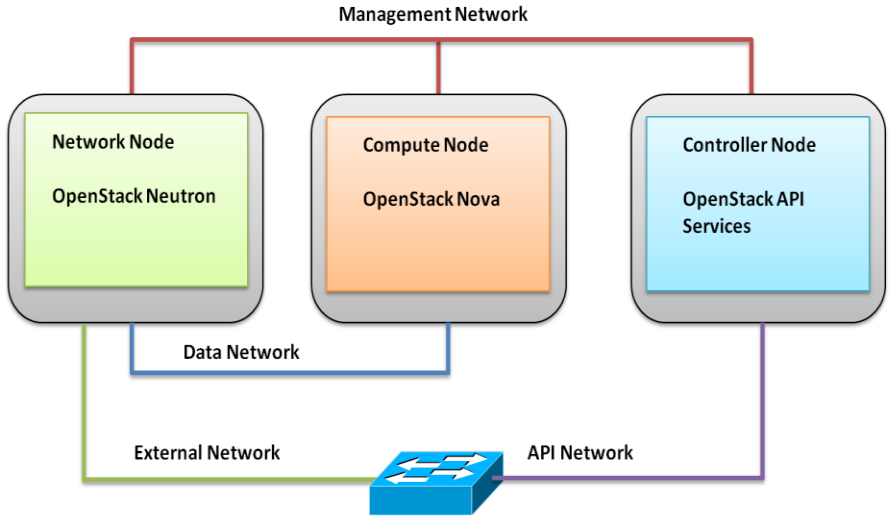
- Intel uses OpenStack as the single control plane for the entire virtualization environment. OpenStack provides a dashboard that gives administrators control.
- It also empowers end users to provision resources through a web portal, APIs, or OpenStack command line interface (CLI).
- Instances of PaaS are provisioned on top of IaaS through the control plane.
- Under the OpenStack layer is the hosting environment which can be based on a commercial hypervisor or OpenStack hypervisor.
- Intel is a Gold member of the OpenStack community, providing funding, strategic alignment, and expertise with the OpenStack mission. Intel IT staff is closely involved, contributing code, documentation, and reporting bugs and vulnerabilities—efforts all aimed at improving OpenStack's usefulness to Intel and other IT organizations.
- Intel participates in the Cloud Foundry community as a Gold Member as well. In addition, as a member of the Cloud Foundry Community Advisory Board, Intel IT provides strategic technical feedback on the Cloud Foundry roadmap, advocates for enterprise requirements, and provides more tactical input on the day-to-day operation of the Cloud Foundry project.



BUILDING PRIVATE CLOUD - IAAS

Intel

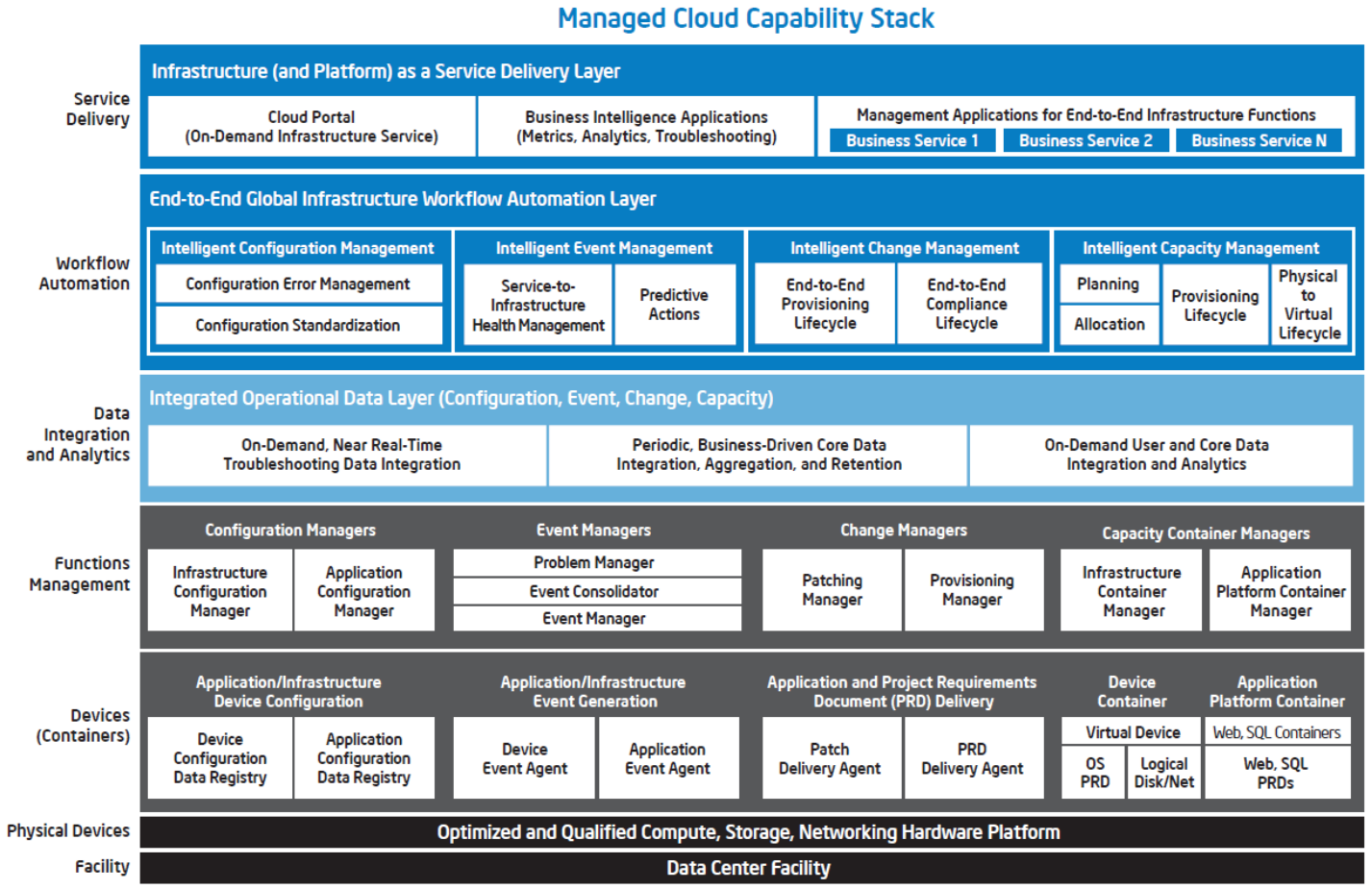
- Having automated the provisioning of compute and storage, Intel is implementing software-defined networks (SDN) to make the network component self-service.
- SDN separates the control plane (the element of the network used to configure the network) from the data plane (where the actual packet flow and traffic traverse the network).
- A key advantage of SDN is that it moves management of the data center network away from each individual switch, enabling configuration from centralized controllers.
- This centralization means users can now either go to a web portal or use APIs to request network services on their own and make them part of their application environment.
- Intel is integrating SDN as an overlay network on top of the virtual environment and providing core network connectivity (routing, switching, and network access control) for VMs in the cloud environment.
- The SDN solution, once deployed, integrates with OpenStack's Neutron APIs and can be configured programmatically and on-demand using those APIs.



BUILDING PRIVATE CLOUD - SDN

Intel

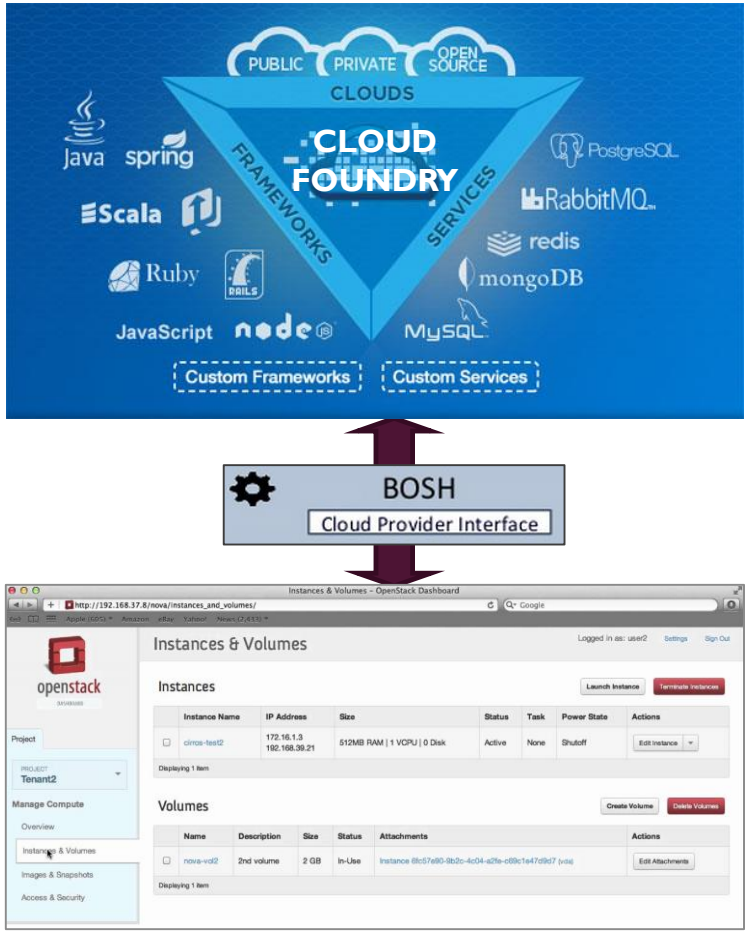
- Implementing ITIL standards enabled Intel to enhance the use of automated monitoring and configuration tools and improve on-demand service.
  - Service delivery. Provides IaaS and PaaS.
  - Workflow automation. Provides an on-demand, highly available, and scalable cloud computing infrastructure for rapid VM provisioning and deprovisioning.
  - Data integration and analytics. Integrates data from all containers as well as from the functions management layer.
  - Functions management. Watches and acts on configuration management, event management, change management, and capacity management.
  - Device or container. Includes VMs, storage containers, and agents.



BUILDING PRIVATE CLOUD - ITIL

Intel

- Cloud Foundry is used as PaaS and Iron Foundry extends Cloud Foundry for .NET applications.
- Intel participates in the Cloud Foundry community as a Gold Member as well. In addition, as a member of the Cloud Foundry Community Advisory Board, Intel IT provides strategic technical feedback on the Cloud Foundry roadmap, advocates for enterprise requirements, and provides more tactical input on the day-to-day operation of the Cloud Foundry project.
- The Cloud Foundry PaaS stack delivers even more agility benefits than the IaaS because it requires no server provisioning step and significantly reduces the amount of support that developers perform as part of self-service hosting.
- Cloud Foundry contains a CLI and APIs that enable developers to interact with PaaS instances. Intel developed a PaaS portal that used Cloud Foundry APIs to make it even easier for developers.



BUILDING PRIVATE CLOUD - PAAS

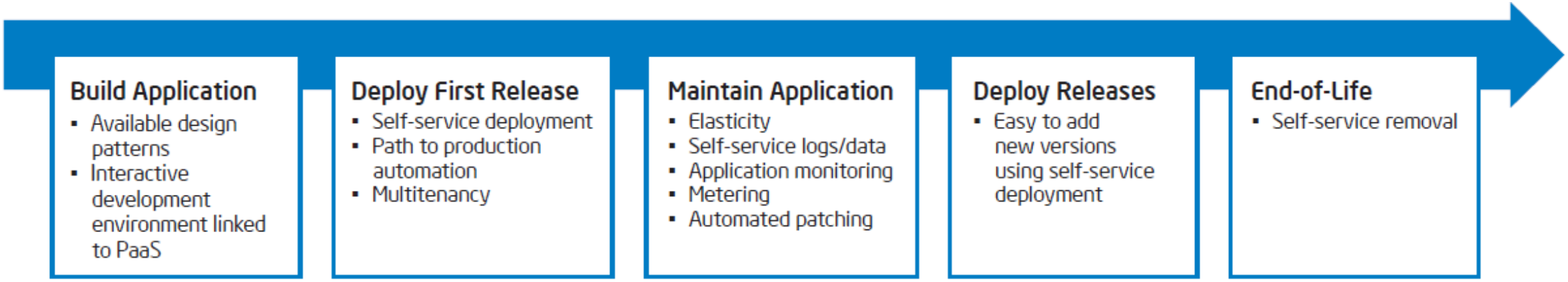
Intel

- DBaaS is an important subset in Intel's PaaS offering. If an application requires a database, it can be provisioned through the DBaaS portal.
- This process involves specifying the database type (MySQL, MongoDB), and embedding the returned connection string in the application code and/or used with database management tools to create and manage application tables and data.
- Each database in DBaaS automatically inherits many standard features: high availability, security, disaster recovery, monitoring, elasticity, index tuning, and maintenance.

BUILDING PRIVATE CLOUD - DBAAS

Intel

- With the use of PaaS, Intel developers are in control from development to deployment—exponentially reducing time to production, optimizing the use of resources, and encouraging the development of cloud-aware applications.
- Applications built using PaaS get inherent cloud benefits, such as elasticity, high availability, on-demand access, and a metered, multitenant environment.
- PaaS makes it possible for developers to secure infrastructure in 45 minutes and to transition from innovative idea to production in a single day.
- Intel architects and developers are learning to design cloud-aware applications that maximize cloud advantages, such as self-service provisioning, elasticity, run-anywhere design, multitenancy, and design for failure.
- They are also increasingly using agile methodologies, taking advantage of the growing number of self-service tools and self-service data available in the PaaS offerings.



BUILDING PRIVATE CLOUD – CLOUD-ENABLED APPLICATION DEVELOPMENT

Intel

CLOUD USE CASES

CLOUD ADOPTION PROCESS

1. Understand value propositions and architectures of cloud services and skills necessary for adopting them.
2. Scan the cloud market and understand providers, offerings and the trend of cloud services.
3. Develop a cloud adoption strategy
4. Assess your applications and workloads for cloud readiness.
5. Develop use cases for cloud services in consideration for adoption. 
6. Assess key IT capabilities necessary for cloud migration and identify capability gaps.
7. Build the business case.
8. Reengineer business processes if necessary.
9. Develop the technical approach including a flexible integration model and a security-and-privacy protection model.
10. Manage the migration to public clouds.

Cloud Standards Customer Council, Migrating Applications to Public Cloud Services: Roadmap for Success, 2013.

CLOUD USE CASE

- **Use Case Identification**
  - Use Case Name: State a concise, results-oriented name for the use case.
  - Model Matrix: Identify which intersections of the service/deployment matrix the use case addresses.

		Cloud Service Models		
		SaaS	PaaS	IaaS
Cloud Deployment Models	Private			
	Community			
	Public			
	Hybrid			

- **Background**: An abstract describing the purpose of the business use case.
- **Definitions**: Definitions of terms used in the business use case that require explanation.
- **Service model**: Why were the particular service models (SaaS, PaaS, IaaS) selected for this implementation? What benefits are expected for the particular chosen service models, and what are some of the shortcomings of the service models not selected?
- **Deployment model**: What drove the selection of the particular deployment model (Private Cloud, Community Cloud, Hybrid Cloud, Public Cloud)? What are the benefits of the selected model, and drawbacks of the models not selected?

NIST, Cloud Computing Business Use Case Template v3, 2015.

CLOUD USE CASE

- **Concept of Operations**
  - Current System: Describe at a high level how the current system works. Does the system integrate with other systems, what are security requirements, do network considerations vary among users (local versus remote, for example), etc.
  - Desired Cloud Implementation: Describe how a cloud implementation of the system should work, whether or not capabilities currently exist.
- **Primary Actors**: Provide a concise description of the primary roles in the use or delivery of the system or service.
- **Business Goal**: Describe what should be expected from the implemented system or service, and how the actors identified above would use or benefit. What benefits does the cloud solution bring that a traditional implementation would not?
- **Necessary Conditions**: Identify the conditions that must be met for the system or service to be implemented successfully
  - Security: What security requirements must be met for successful implementation, and how do they address business needs?
  - Interoperability: Describe any interoperability requirements (public APIs, data exchange formats, standard file formats, etc.) What are the business needs that drive these requirements?
  - Portability: Explain any portability requirements (for example, the ability to seamlessly and transparently change email providers in the future) and the business need driving the requirements.
  - Other: Categorize and describe any other business needs not addressed above.

CLOUD USE CASE

- **Priorities and Risks**: Describe the priority of this project in your organization. What risks are there in using cloud computing for this solution?
- **Essential Characteristics**: Describe how the system meets the five essential characteristics of a cloud computing system along with the benefits provided by each of these characteristics.
  - On-demand self service
  - Broad network access
  - Resource pooling
  - Rapid elasticity
  - Measured service
- **Normal Flow**: Provide a description of the primary user actions and system responses that will take place during execution of the use case under normal, expected conditions. How is the task in the use case name accomplished?
- **Frequency of Use**: Estimate the number of times this use case will be performed by the actors per some appropriate unit of time.

CLOUD USE CASE

- **Special Requirements**: Identify any additional requirements for the use case that need to be addressed. Examples include performance or availability requirements.
- **Notes and Issues**: List any additional comments about this use case or any remaining open issues.
- **Risk Register**: This section is optional, or can be a separate appendix. A list of known risks, their likelihood, impact, and status. An excel spreadsheet can be used to track this.
  - Date: Record the date that a risk is identified or modified.
  - Description of the Risk: A phrase that describes the risk.
  - Likelihood of Occurrence: Provides an assessment on how likely it is that this risk will occur.
  - Severity of Effect: An assessment of the impact that the occurrence of this risk would have on the project.
  - Countermeasures: Actions that can be taken to prevent, reduce, or transfer the risk.
  - Status: Indicates whether this is a current risk or if risk has been resolved.

BUSINESS CASE FOR CLOUD ADOPTION

CLOUD ADOPTION PROCESS

1. Understand value propositions and architectures of cloud services and skills necessary for adopting them.
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Cloud Standards Customer Council, Migrating Applications to Public Cloud Services: Roadmap for Success, 2013.

BUSINESS CASE FOR CLOUD ADOPTION

- **Value Proposition**: Individual business problems with existing applications that cloud computing can potentially address need to be identified, and specific business justification must prove that cloud computing is the right strategic alternative.
- **Cost Analysis**: Once an application is identified as a potential candidate for migration to cloud computing, a thorough cost analysis must be performed. In order for meaningful comparisons to be made, one must have specific baseline costs for the current environment. The overall cost of application migration to cloud computing must include the following elements:
  - **On-going cloud service costs**: The cloud service provider fees must be taken into account, including the effects of variable demand, such as extra fees to handle peak loads.
  - **Service management**: Managing services and service providers is a skill that is often not well developed in firms, and yet it is of critical importance to the success of cloud computing.
  - **License management**: It is important to understand third-party software dependencies and impact to licensing contracts (and ongoing management of these licenses) when migrating an application to cloud computing.
  - **Application re-designs**: The application may require design changes in order to be compatible with or to take full advantage of cloud deployment.

Cloud Standards Customer Council, Migrating Applications to Public Cloud Services: Roadmap for Success, 2013.

BUSINESS CASE FOR CLOUD ADOPTION

- **Cost Analysis**:
  - **Application deployment and testing**: Once the application has gone through design changes it must be configured, deployed, and tested in the cloud environment.
  - **Application maintenance and administration**: Ongoing maintenance and administration of the cloud-based application will remain the client's responsibility.
  - **Application integration**: In many cases, there will be a need for connections between the migrated application and applications and data that remain in-house, potentially requiring new integration software.
  - **Cost of developing cloud skills**: Internal personnel may need to be trained to support the migration to cloud computing.
  - **Human resources and talent management implications**: New skills and abilities such as preparation and deployment of virtual machine images may require changes to supervisory, control and compensation systems. Job descriptions, bonus plans, etc. may change.

BUSINESS CASE FOR CLOUD ADOPTION

- **Service Levels**: In addition to assessing the costs of application migration, it is equally important to ensure that the level of service provided by the cloud-based application will be comparable to current service levels. The required service levels should be agreed with the cloud service provider and explicitly documented in the cloud service agreement.
  - **Application availability**: The criticality of the application to business operations will determine the availability requirements that must be clearly specified in the cloud SLA.
  - **Application performance**: Depending on the performance requirements of the application, specific performance targets may need to be achievable with the cloud service.
  - **Application security**: Moving an application to the cloud will require due diligence on the part of the cloud service customer to ensure proper security controls are in place and operating effectively.
  - **Privacy**: Personally Identifiable Information (PII) handled by a cloud-based application must be properly stored and maintained. Access to PII stored in a cloud service must be restricted as required, including from cloud service provider personnel.
  - **Regulatory compliance**: Government and industry regulations may require additional measures, such as restricting the migrated applications and data to reside in a specific geographic region.

BUSINESS CASE FOR CLOUD ADOPTION

- **Business Impact**: Assuming the cost and service analyses described above are favorable, then additional business factors must be weighed in order to develop a complete business analysis, and should be monitored on an ongoing basis.
  - **Revenue impact**: If the application is used to generate revenue, is the move to cloud computing expected to increase that revenue?
  - **Customer acquisition or engagement impact**: For a customer-facing application, is the move to cloud computing expected to increase the number of customers accessing it?
  - **User satisfaction**: Does one expect an improvement in availability or response times that will result in increased user satisfaction?
  - **Time to market improvements**: Will the move to cloud computing shorten the time it takes to deliver functional enhancements to end users?
  - **Cost of handling peak loads**: The cost of scaling server capacity up and down to match spikes in demand for the cloud-based application should be compared with similar costs before migration.
- **Executive support for the initiative**: Executives from IT, Lines of Business (LOBs), procurement and executive management must review and approve the business plan before proceeding. Getting key executives on-board early in the process will help alleviate potential issues down the line.

	Question?	A	B	C	D
1	Which of the following represents the vale chain of cloud service providers?	service requirement -> service architecture -> service acquisition and implementation -> service operation	service strategy -> service infrastructure and offering -> service fulfillment -> service assurance and billing	service strategy -> service design -> service transition -> service operation	inbound logistics -> operations -> outbound logistics -> marketing and sales -> service
2	Which of the following is not a foundational technology enabling cloud computing?	IT service management technology	service-oriented architecture	mobile computing	virtualization
3	What is the main source of revenue for Salesforce.com?	software license sales	service subscription fees	advertisement fees	professional IT services
4	What does Microsoft's "Software plus Service" strategy mean?	selling its software products both as licenses and cloud services	selling its software product licenses and their maintenance service contracts	selling professional IT services related to its software products	selling both SaaS and IaaS
5	Accenture's current strategic position on cloud computing is:	to help enterprises adopt public cloud services effectively	to provide a marketplace where public cloud services can be traded	to develop and sell its own public cloud services	to help enterprises build private cloud services effectively

QUIZ

	Question?	A	B	C	D
6	Which of the following component of the reference cloud architecture provides real-time provisioning of cloud services?	business support services	operation support services	cloud services (SaaS/PaaS/IaaS)	service delivery portal
7	Which of the following component of the reference cloud architecture provides billing and payment for cloud services?	business support services	operation support services	cloud services (SaaS/PaaS/IaaS)	service delivery portal
8	Which of the following is a correct description of IaaS?	Each enterprise's unique infrastructure is hosted in the IaaS vendor's data center based on a customized outsourcing contract.	Multiple enterprises share the same pool of infrastructure, but the contract is negotiable to meet each enterprise' unique requirement.	No negotiation over service definition is possible and the IaaS provider can optimize everything below the service boundary.	Each enterprise can keep direct control of the architecture design, technology platforms and operating processes deployed by the IaaS vendor.
9	Which of the following capabilitiues is not required for IaaS service?	self-service interface portal for subscribers	customization of infrastructure configurations for each subscriber	automation of resource provisioning for each subscriber	automation of usage metering and billing

QUIZ

	Question?	A	B	C	D
10	Which of the following is not correct about infrastructure virtualization?	Virtualization improves Power to Performance Effectiveness (PPE) contributing to Green IT.	With virtualization, availability management and disaster recovery become more costly.	Virtualization can be done for desktops, servers, storage and networks.	Virtualization requires new capabilities of IT staff for its deployment and management.
11	Which of the following is not a desirable functionality of SaaS platform?	one customized application instance for each tenant	usage tracking and billing	real-time provisioning	tenant-aware privacy
12	Which of the following is among the capabilities that is aimed to be provided by the multitenancy architecture of SaaS?	The SaaS code base can be upgraded without breaking tenant-specific customization.	The SaaS response time scales as more tenants subscribe to the service.	The SaaS provides programmatic access to its APIs.	The SaaS can be integrated with a tenant's legacy applications.
13	Which of the following is the least important marketing techniques for SaaS vendors?	search engine optimization	monetization built into service design	one-on-one pre-consulting	churn management
14	What is the main difference between CRM solutions hosted by application service providers (ASP) in late 1990s and those provided as SaaS today?	customer-owned infrastructure vs. hosted infrastructure	license sales vs. pay-per-use	single-tenant vs. multi-tenant application	Customization disallowed vs. customization allowed

QUIZ

	Question?	A	B	C	D
15	Which of the following software engineering practices is the least appropriate for SaaS development and maintenance by the SaaS vendors?	agile development process	extreme programming	Sequential development process (a.k.a. water fall process)	sprint planning
16	Which of the following software architectural styles is mostly used for SaaS?	Model-View-Controller (MVC) architecture	service-oriented architecture	pipeline architecture	publish-and-subscribe architecture
17	Application development platforms as a service usually supports _____ where a virtual project team consisting of members geographically and organizationally distributed interact with each other in such ways as collaborative authoring, distributed configuration management, social networking and social object sharing.	dynamic programming	domain-specific programming	social programming	object-oriented programming
18	_____ is(are) the major method for front-end application composition today based on Web-oriented architecture and RIA/Ajax technologies.	mashup	Web services	enterprise service bus	user experience modeling

QUIZ

	Question?	A	B	C	D
19	Which of the following architectures is the best option for large enterprises to run shared applications (such as salesforce automation, procurement, portals and email) for multiple divisions or companies where security and privacy are of concern?	single-tenant applications on private IaaS	multi-tenant applications on private IaaS	single-tenant applications on public IaaS	multi-tenant applications on private IaaS
20	One of the concerns about cloud services is _____ which means the ability to move data and services from one cloud service provider to another.	interoperability	disaster recovery	e-discovery	portability
21	Which of the following is not a characteristic of the techniques used to develop a SaaS application?	iterative	model-driven	metadata-based	inheritance-based
22	Expectations on quality and support of cloud services should be defined in terms of _____ between cloud service providers and consumers.	end user lisence agreements	service level agreements	operation level agreements	outsourcing contracts

QUIZ

	Question?	A	B	C	D
23	Which of the following cost items are common between application packages and SaaS from the enterprise' TCO viewpoint?	user license cost	maintenance and tech support cost	customization and integration cost	data center operation cost
24	_____ provides an integrated environment for development, execution and management of mobile applications. _____ allows companies to develop a mobile application once and deploy it to a variety of mobile devices, mobile OS, networks and user groups.	mobile enterprise application platform (MEAP)	mobility as a service	mobile cloudlet	HTML5
25	Ford car software generates data on its location, speed, braking and wiper use. It then correlates the data with live information from the Web about traffic and weather, and sends messages about road conditions via Twitter to other motorists in the same area. Which type of enterprise mobile cloud application is this?	mobile SaaS	mobile content streaming	context-aware mobile service	social sensing

QUIZ

	Question?	A	B	C	D
26	Which of the following industry shows top use of social business so far?	healthcare service	professional service	media and publishing	education
27	_____ scours and analyzes a huge variety of sources of content such as news, blogs, tweets and other online media across the Internet. For example, Marriott Hotel scans the public social cloud for customer feedback and if a customer posts a complaint, the local hotel is alerted to address the problem.	social marketing	social innovation	social operation	social analytics
28	The migration to a cloud-based business is a journey of intense change and discovery both for IT and the business as a whole. Which of the following represents such changes to enterprise IT?	build and manage custom solutions --> select and manage pre-built cloud services	design and build databases --> share metadata across cloud services	connect silo applications --> integrate cloud services	all of the above
29	Adidas Latin America implemented cloud-based procurement software to improve internal compliance and consolidate spending management. What was the greatest challenge in this project?	selecting a SaaS vendor and a product	customizing the SaaS	integration with the existing ERP system	change management to get buy-in of the full organization

QUIZ

	Question?	A	B	C	D
30	_____ management disciplines, including value management, demand management, architecture management and project portfolio management, should be applied to the selection, acquisition and implementation of cloud services.	enterprise architecture	business process management	IT strategy	business case analysis
31	Which of the following is not a typical benefit of SaaS over packaged applications?	Needed solutions can be up and running much more quickly, taking only days or weeks	Better usability with more self-service-oriented UI, reducing training time and increasing end user productivity	Cloud apps can run standalone without the need for complex integrations with existing apps	Cloud apps offer seamless, automatic upgrades giving access to the latest features and functionality faster
32	Which of the following provides the reference process for managing cloud services by cloud service providers as well as enterprise IT?	CMMI-DEV	eTOM	ITIL	SCOR
33	With _____ the internal IT of an enterprise assumes the greatest responsibilities for IT service management.	IaaS	PaaS	SaaS	BPaaS

QUIZ