SERVICE-ORIENTED MODELING FRAMEWORK™ (SOMF™)

VERSION 2.1

CLOUD COMPUTING TOOLBOX MODEL

LANGUAGE SPECIFICATIONS

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INTRODUCTION

ABOUT THE SERVICE-ORIENTED MODELING FRAMEWORK (SOMF)

The service-oriented era has begun. New technologies have emerged to support the "service" notion that signifies, today more than ever, a shift in modern computing whose driving aspects are business imperatives and innovative technological implementations. The service paradigm is not a new concept; however, it emboldens the business perspective of every software development life cycle. Furthermore, unlike the object-oriented approach, which is founded to support modeling of object-based programming languages, the service-oriented modeling framework embodies distinct terminology to foster loose coupling of software assets, reuse of software components, acceleration of time-to-market, reduction of organizational expenditure, and more.

SUPPORTING THE SERVICE-ORIENTED MODELING NOTION

Thus, to support service-oriented modeling activities, SOMF depicts the term "service" as a holistic entity that may encapsulate business requirements, and from a technological perspective, is identified with a software component. This organizational software entity, namely a "service" that is subject to modeling activities, may be any software construct that the enterprise owns, such as an application, software system, system software, Web service, software library, store procedure, database, business process, enterprise service bus, object, cloud computing service, and more.

SO WHAT IS SOMF?

SOMF is a model-driven engineering methodology whose discipline-specific modeling language and best practices focus on software design and distinct architecture activities employed during stages of the software development life cycle. Moreover, architects, analysts, modelers, developers, and managers employ SOMF standalone capabilities or mix them with other industry standard modeling languages to enrich the language syntax, set software development priorities during life cycle stages, and enhance the 360º software implementation view.

SOMF DISCIPLINES AND MODELS

SOMF offers a 360º view of any software development life cycle, starting at the conceptualization phase, supporting design and architecture activities, and extending modeling best practices for service operations in a production environment. To achieve these underpinning milestones, six distinct software development disciplines offer corresponding models whose language notation guide practitioners in designing, architecting, and supporting a service ecosystem:

1. Service-Oriented Conceptualization Model
2. Service-Oriented Discovery and Analysis Model
3. Service-Oriented Business Integration Model
4. Service-Oriented Logical Design Model
5. Service-Oriented Software Architecture Model
6. Cloud Computing Toolbox Model

MODELING GENERATIONS

SOMF diagrams support three chief modeling generations, each of which shows a different time perspective of a software life cycle. These views help practitioners depict business and architectural decisions made at any time during the life span of a software product:

1. *Used-to-Be*. Design and architecture *past state* of a software product and its related environment that were deployed, configured, and operated in production

2. *As-Is*. Design and architecture *current state* of a software product and its corresponding environment that are being operated in production

3. *To-Be*: Design and architecture *future state* of a software product and its associated environment that will be deployed, configured, and operated in production

ABOUT THE CLOUD COMPUTING TOOLBOX MODEL

This specifications paper focuses on the Cloud Computing Toolbox Model notation whose language and best practices are devised to assist practitioners in conceptualizing, analyzing, designing, and architecting a cloud computing environment. A cloud landscape offers three rudimentary types of services: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). The Cloud Computing Toolbox Model, however, is not restricted to these traditional cloud offerings. Additional service categories can be added to a specific cloud environment, such as Data Storage as a Service (DSaaS), or Security Model as a Service (SMaaS), etc.

The Cloud Computing Toolbox Model introduces fundamental utilities that provide cloud-computing capabilities to any Service-Oriented Modeling Framework (SOMF) diagram. For example, Cloud toolbox utilities can be used in a SOMF Analysis Proposition Diagram that is a part of the Service-Oriented Discovery and Analysis Model. In the same fashion, cloud notation can also be employed to create a Logical Design Composition diagram, which is a part of the Service-Oriented Logical Design Model.

Consider the chief benefits of the Cloud Computing Toolbox Model language:

- Offering a cloud computing syntax and notation that can be used with any SOMF diagram in the space of service analysis, discovery, design, and architecture

- Creating a cloud computing delivery model that identifies service attributes to drive cloud-related projects and architecture initiatives

- Enabling return on investment (ROI) analysis that includes savings, overall resource utilization cost, and expenses affiliated with any cloud initiative

- Providing notation that can be used to describe a cloud deployment environment in three different geographical categories: Continent, Region, Zone

- Introduces cloud modeling spaces in which services are designed, such as IntraCloud, ExtraCloud, Organizational Boundary, and Service Containment area

- Provides distinct cloud tags to help categorize a cloud computing environment, such as Public, Private, Hybrid, and Community

- Offers service life cycle status notation that can depict the state of a service in a

  cloud

Remember, this specification document focuses merely on cloud toolbox features and does not provide examples for cloud conceptualization, discovery, analysis, design, and architecture modeling. To read more about the specifications that involve cloud computing modeling in these spaces, refers to the other published SOMF 2.1 specifications documents:

- SOMF_2.1_Conceptualization_Model_Language_Specifications.pdf

- SOMF_2.1_Discovery_and_Analysis_Model_Language_Specifications.pdf

- SOMF_2.1_Business_Integration_Model_Language_Specifications.pdf

- SOMF_2.1_Logical_Design_Model_Language_Specifications.pdf

- SOMF_2.1_Architecture_Model_Language_Specifications.pdf

NOTATION SECTION

CLOUD MODEL ASSETS

The Cloud Model Assets that are illustrated in Figure 1 pertain to cloud symbols that should be used when modeling a cloud environment. Each of these icons is dedicated to a specific SOMF model. For example, when creating an Analysis Proposition Diagram (a part of the Service-Oriented Discovery and Analysis Model), use the Analysis Cloud symbol. Similarly, use the Conceptual Cloud icon to denote a cloud computing landscape in a Conceptual Association Diagram (a part of the Service-Oriented Conceptualization Model). Again, the Design Cloud icon should illustrate a cloud environment in a Logical Design Relationship diagram (a part of the Service-Oriented Logical Design Model).
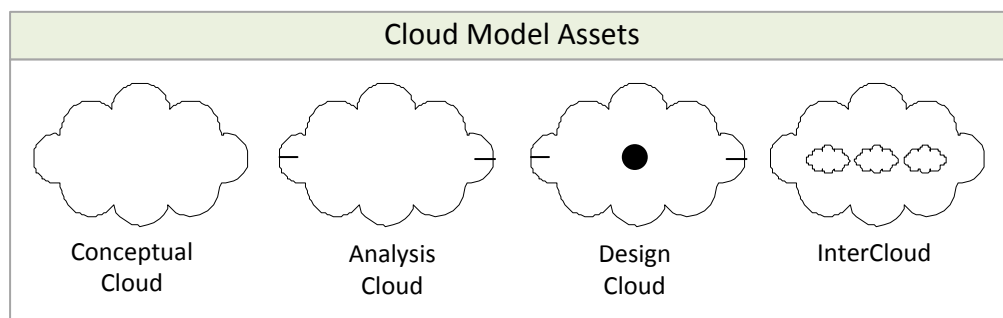

FIGURE 1: CLOUD MODEL ASSETS

- *Conceptual Cloud.* Represents a collection of conceptual services (used during the service conceptualization phase) in at least three different categories: Software as Service (SaaS), Platform as Service (PaaS), and Infrastructure as Service (IaaS). Additional types can be added on demand

- *Analysis Cloud.* Represents a collection of analysis services (used during the service discovery and analysis phase) in at least three different categories: Software as Service (SaaS), Platform as Service (PaaS), and Infrastructure as Service (IaaS). Additional types can be added on demand

- *Design Cloud.* Represents a collection of design services (used during the service design phase) in at least three different categories: Software as Service (SaaS),

Platform as Service (PaaS), and Infrastructure as Service (IaaS). Additional types can be added on demand

- *InterCloud.* Represents the term "cloud-of-clouds." A superior cloud that identifies a group of related clouds working together to offer collaborative solutions

MODELING SPACES

A modeling space (illustrated in Figure 2) is a defined area in which modeling activities take place. This area also identifies boundaries of organizations, containment scope of services, service clusters, or cloud computing environments.
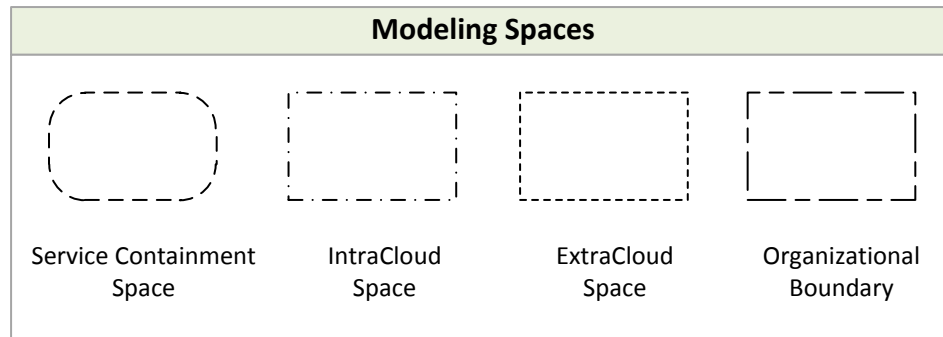

FIGURE 2: MODELING SPACES

- *Service Containment Space.* An area that identifies the aggregated child services contained in a parent composite service or service cluster. This space can also define any collaboration of a service groups that are gathered to offer a solution

- *IntraCloud Space.* A modeling area that shows services that operate in a cloud

- *ExtraCloud Space.* A modeling area that depicts services that operate outside of a cloud

- *Organizational Boundary.* A computing area of an organization, such as a division, department, company, partner company, consumer, or community

CLOUD TYPING TAGS

If a project or an architecture initiative involves cloud computing modeling activities, any individual cloud requires typing. The term "typing" pertains to cloud categorization to help understand the design model that is applied to a production environment. Tagging a cloud by the proper tag (illustrated in Figure 3) also indicates the types of consumers allowed to utilize a cloud facility and its offered services.
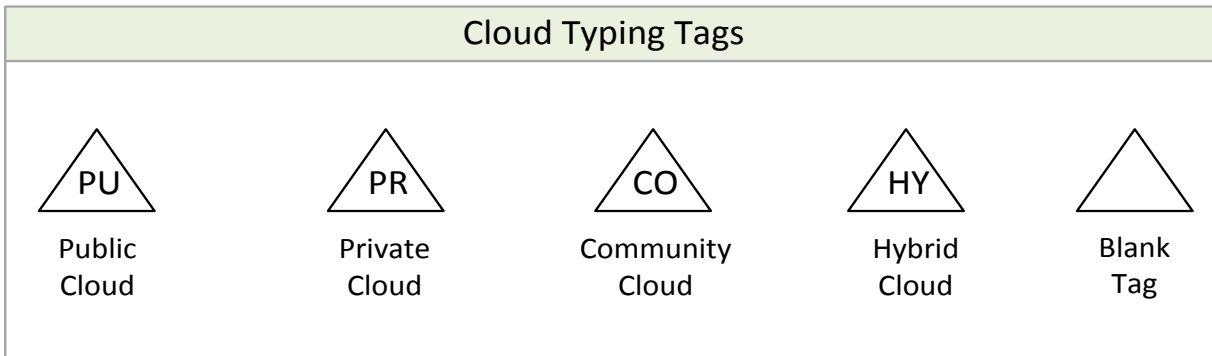

FIGURE 3: CLOUD TYPING TAGS

- *Public Cloud Tag.* Identifies a cloud that is maintained by an off-site party service provider that offers configurable features and deployments charged to subscribed Internet consumers

- *Private Cloud Tag:* Indicates a cloud of services that is sponsored, maintained, and operated by an organization, available only on private networks, and utilized exclusively by internal consumers

- *Community Cloud Tag.* Identifies a cloud whose services are consumed by two or more organizations that share similar business or technical requirements

- *Hybrid Cloud Tag.* Depicts a cloud that combines the properties of two or more cloud types described on this list

- *Blank Tag.* Additional tags can be defined on demand

CLOUD DEPLOYMENT LOCATIONS AND RELATED CONNECTORS

Services that are deployed in a cloud space should be positioned in the proper geographical location, typically identified in the Cloud Geographical Deployment diagram (refer to the Example Section to view this diagram). Figure 4 illustrates three locations that a service may reside in, and connectors that link a service to its deployment environment.
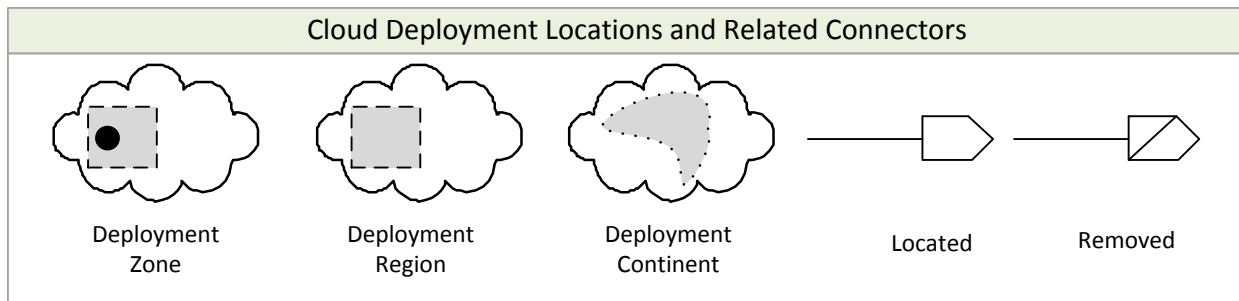

FIGURE 4: CLOUD DEPLOYMENT LOCATIONS AND RELATED CONNECTORS

- *Deployment Continent.* The largest geographical boundary of a cloud, such as Europe or Asia

- *Deployment Region.* An area that is defined in a Deployment Continent, such as US Northeast or Midwest

- *Deployment Zone:* An area that is defined in a Deployment Region, such as Northeast New England or Middle Atlantic

- *Located:* Denotes in which Deployment Zone a service resides. If a zone is not defined, a service can be affiliated with a Deployment Region or Deployment Continent directly

- *Removed.* Specifies the removal of a service from a Deployment Continent, Deployment Region, or a Deployment Zone

SERVICE LIFE CYCLE STATUS

A service life cycle status identifies an operational state of a service during its life span. Use the depicted connectors in Figure 5 to specify the functioning status of a service in a diagram. A service may be retired, suspended, or completely removed from a production environment.
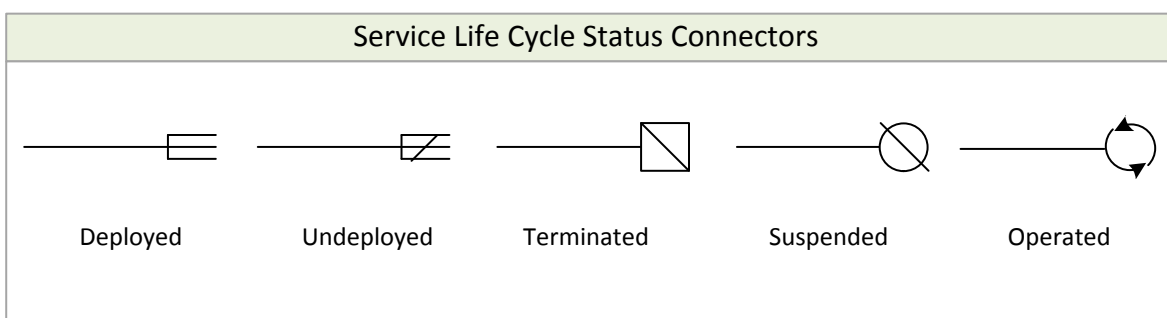

FIGURE 5: SERVICE LIFE CYCLE STATUS

- *Deployed.* Specifies the deployment and configuration location of a service (continent, region, or zone). This connector does not imply that a service is running

- *Undeployed.* Denotes that a service is physically removed from a deployment location (continent, region, or zone)

- *Terminated.* Identifies the discontinuation of service operations. This connector does not imply that a service has been physically removed from a production environment

- *Suspended.* Signifies that a service's operations have been stopped. This connector does not imply that the service has been terminated or retired

- *Operated.* Identifies regular and consistent service operations

CLOUD DELIVERY MODEL ELEMENTS

A cloud computing delivery model identifies types of service groups offered to subscribed consumers. A Cloud Delivery Model diagram, for example, that depicts Software as a Service (SaaS) and Platform as a Service (PaaS) models (refer to the Examples Section to view this diagram) indicates the type of services an organization utilizes. Thus, use the cloud delivery model elements illustrated in Figure 6 not only to specify which delivery model is available to consumers, but also to indicate the attributes of the extended services.
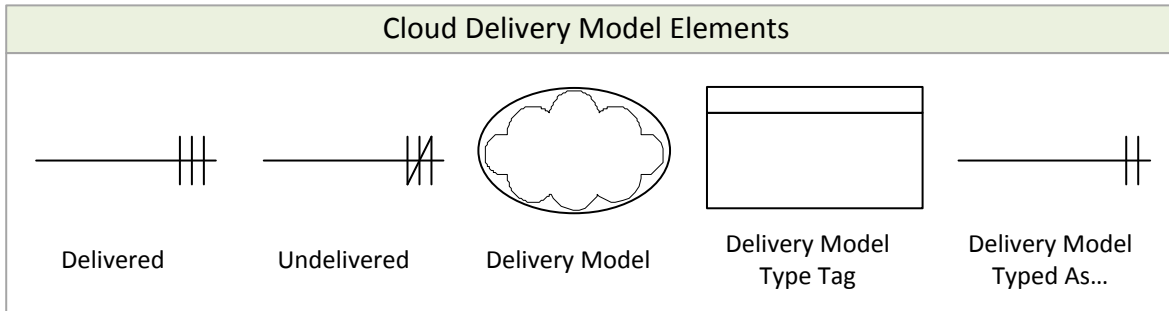

FIGURE 6: CLOUD DELIVERY MODEL ELEMENTS

- *Delivery Model.* Identifies a delivery model, a group of related services that is offered to consumers, such as Software as a Service (SaaS) or Infrastructure as a Service (IaaS)

- *Delivered.* A connector that links a cloud to a particular Delivery Model

- *Undelivered.* A connector that denotes discontinuation of a particular Delivery Model

- *Delivery Model Type Tag.* Dedicated to service specifications and attributes of a Delivery Model. For example, the delivery model PaaS may offer a standalone development environment and an open platform development environment

- *Delivery Model Typed As....* A connector that links a delivery model to a Delivery Model Type Tag

CLOUD ROI ANALYSIS ELEMENTS

A cloud computing environment should be subject to analysis of expenditure and examination of accumulated savings over time. These return-on-investment activities must persist periodically to insure that the overall savings exceed investments in the long run. Monitoring capital expenditure and operational expense would provide insight concerning projected savings and resource utilization cost. Therefore, use the ROI analysis elements depicted in Figure 7 to trace the financial state of a cloud computing landscape by delivering a Cloud ROI Analysis diagram illustrated in the Examples Section.
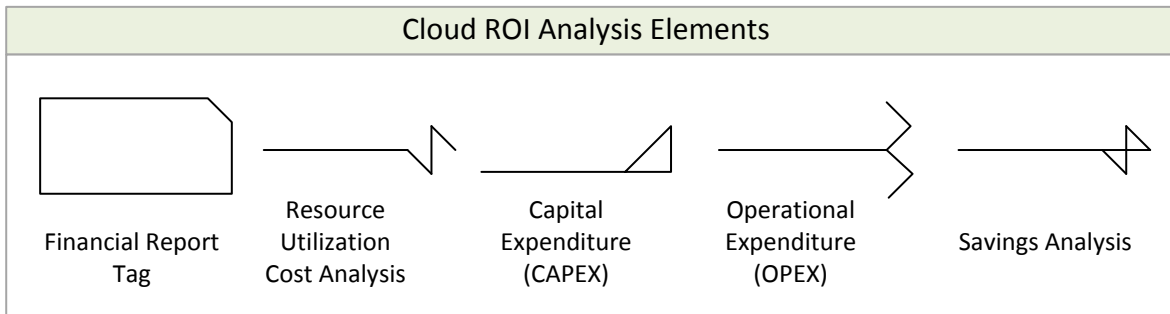

FIGURE 7: CLOUD ROI ANALYSIS ELEMENTS

- *Financial Report Tag.* An element dedicated to reports or line item expenses, savings, operational costs, etc. Reports in different formats can be attached to this tag

- *Resource Utilization Cost Analysis Connector.* Links a Financial Report Tag to a cloud icon (specified in the Cloud Model Assets Section) to indicate periodic or accumulated cost of cloud resources, such as CPU utilization, network utilization, memory utilization, and more

- *Capital Expenditure (CAPEX) Connector.* Links a Financial Report Tag to a cloud icon (specified in the Cloud Model Assets Section) to indicate periodic or overall accumulated investment in cloud operations

- *Operational Expenditure (OPEX) Connector.* Links a Financial Report Tag to a cloud icon (specified in the Cloud Model Asset Section) to indicate periodic or accumulated cost of ongoing cloud maintenance and support

- *Savings Analysis Connector.* Identifies the periodic or accumulated savings incurred by using cloud services

EXAMPLES SECTION

CLOUD GEOGRAPHICAL DEPLOYMENT DIAGRAM

A cloud computing environment may span multiple zones, regions, or even continents. To communicate a deployment scheme to the business and development organization, create a Cloud Geographical Deployment Diagram that specifies service deployment locations.

CLOUD GEOGRAPHICAL DEPLOYMENT DIAGRAM COMPONENTS (FIGURE 8)

a. Cloud type: Design, Private
b. InterCloud deployment locations
    i. Deployment Continent North America (as apparent, Europe has been removed from the deployment)
    ii. Deployment Region Northeast
    iii. Deployment Zones: New England, Middle Atlantic
c. Cloud location connectors: Located, Removed, Deployed, Undeployed
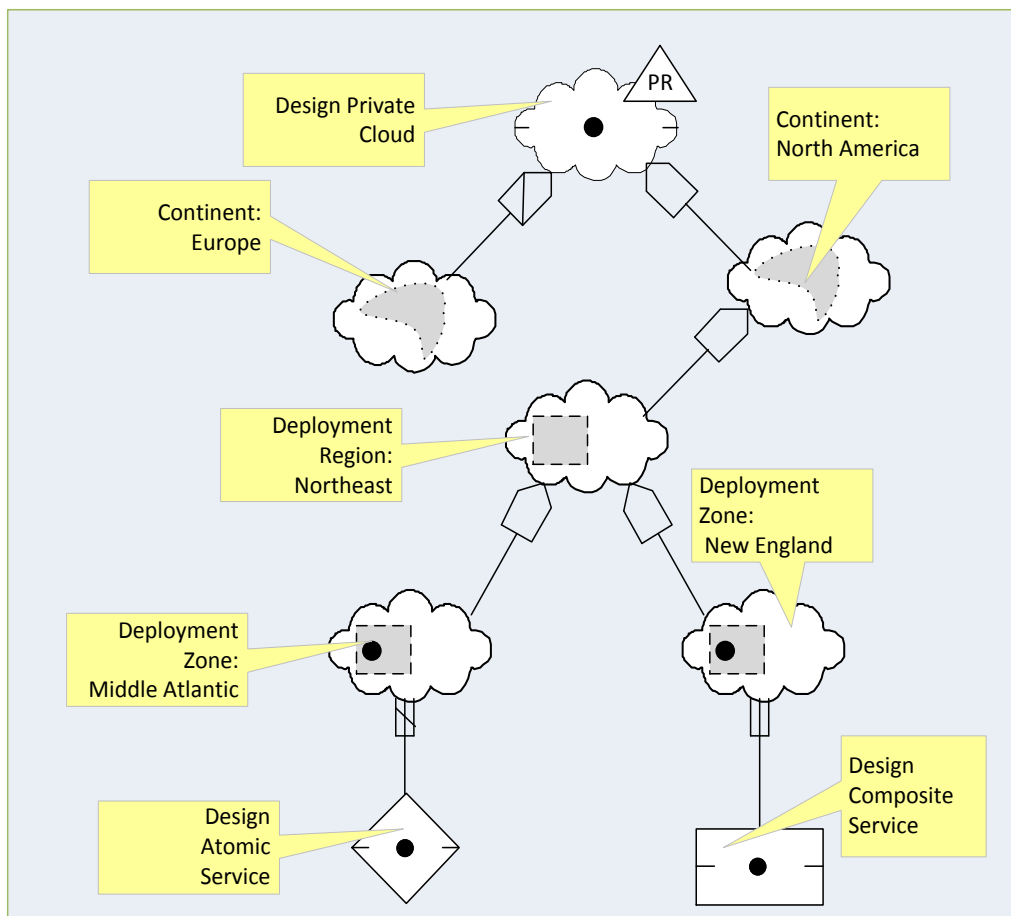d. Design services: Atomic service, Composite service

FIGURE 8: CLOUD GEOGRAPHICAL DEPLOYMENT DIAGRAM

SERVICE LIFE CYCLE STATUS DIAGRAM

If a diagram that involves a cloud environment focuses on the operational status of its services, create a Service Life Cycle Status diagram to denote the state of each service deployed to the cloud geographical locations.

SERVICE LIFE CYCLE STATUS DIAGRAM COMPONENTS (FIGURE 9)

a. Design services: Atomic Service, Composite Service, Service Cluster
b. Service deployment location: New England Deployment Zone
c. Service life cycle status connectors: Terminated, Operated, Suspended
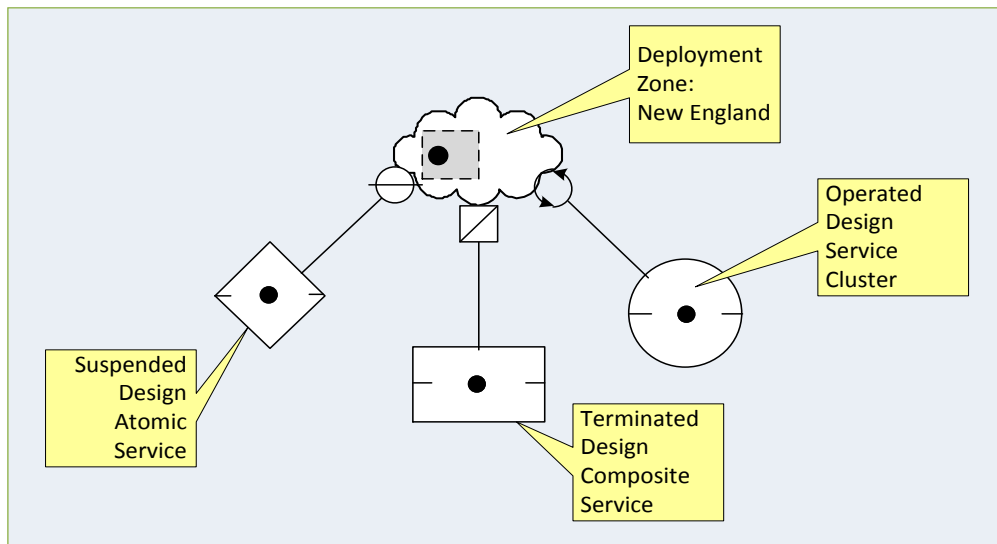

FIGURE 9: SERVICE LIFE CYCLE STATUS DIAGRAM

CLOUD DELIVERY MODEL DIAGRAM

The Cloud Delivery Model Diagram identifies the type of services a consumer is offered. Each group of services is named a cloud service model. Rudimentary models are traditional services, such as SaaS, PaaS, and IaaS. Practitioners may add models on demand.

CLOUD DELIVERY MODEL DIAGRAM COMPONENTS (FIGURE 10)

   a. Cloud type: Design, Private
   b. Delivery models: SaaS, PaaS, IaaS, and DSaaS
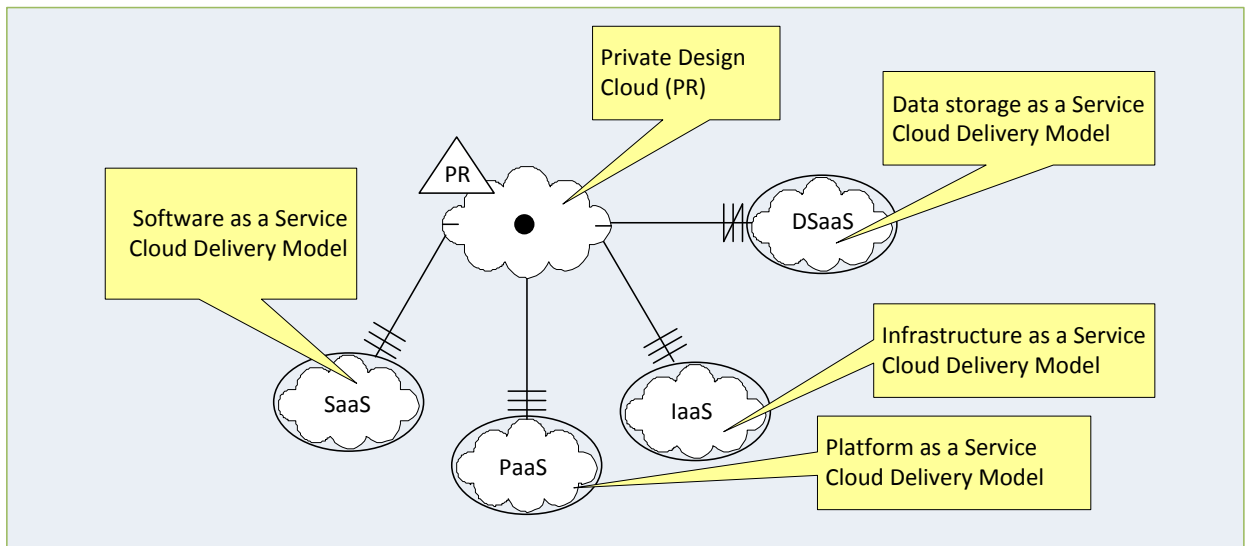   c. Delivery model connectors: Delivered, Undelivered

FIGURE 10: CLOUD DELIVERY MODEL DIAGRAM

    a. Cloud type: Analysis, Community
    b. Cloud delivery model: PaaS, SaaS
    c. Connectors: Delivered, Delivery Model Typed As…
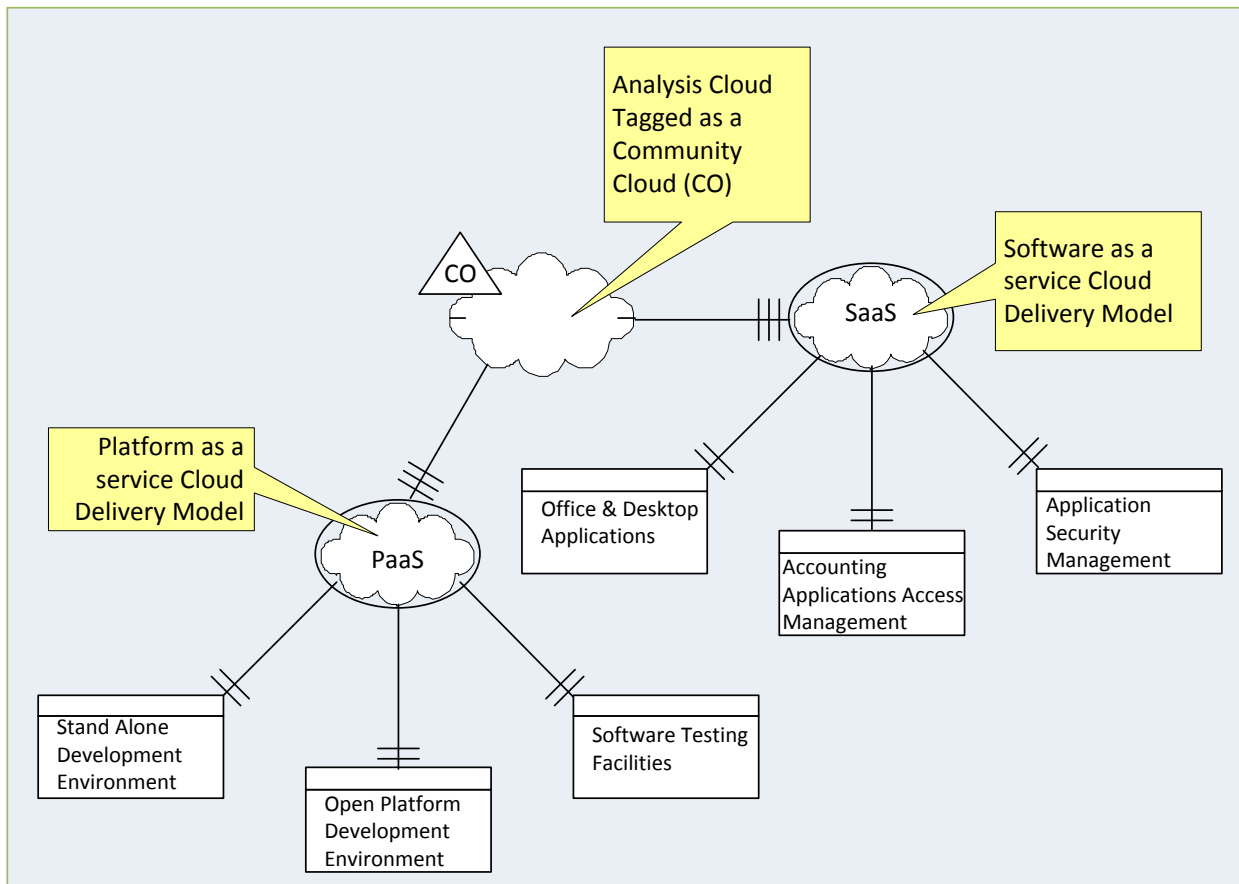   d. Delivery model tag: Delivery Model Type Tag

FIGURE 11: CLOUD DELIVERY MODEL DIAGRAM WITH SERVICE SPECIFICATIONS

CLOUD ROI ANALYSIS DIAGRAM

Use the Cloud RIO Analysis Diagram to examine periodic and accumulated capital expenditures (CAPEX), operations expenditure (OPEX), savings, and resource utilization figures, such as CPU, network utilization, I/O utilization, or memory utilization.

CLOUD ROI ANALYSIS DIAGRAM COMPONENTS (FIGURE 12)

    a. Cloud type: Analysis, Hybrid
    b. Tags: Financial Report Tag
    c. Connectors: Capital Expenditure (CAPEX), Operations Expenditure (OPEX), Resource Utilization Cost Analysis, Savings Analysis
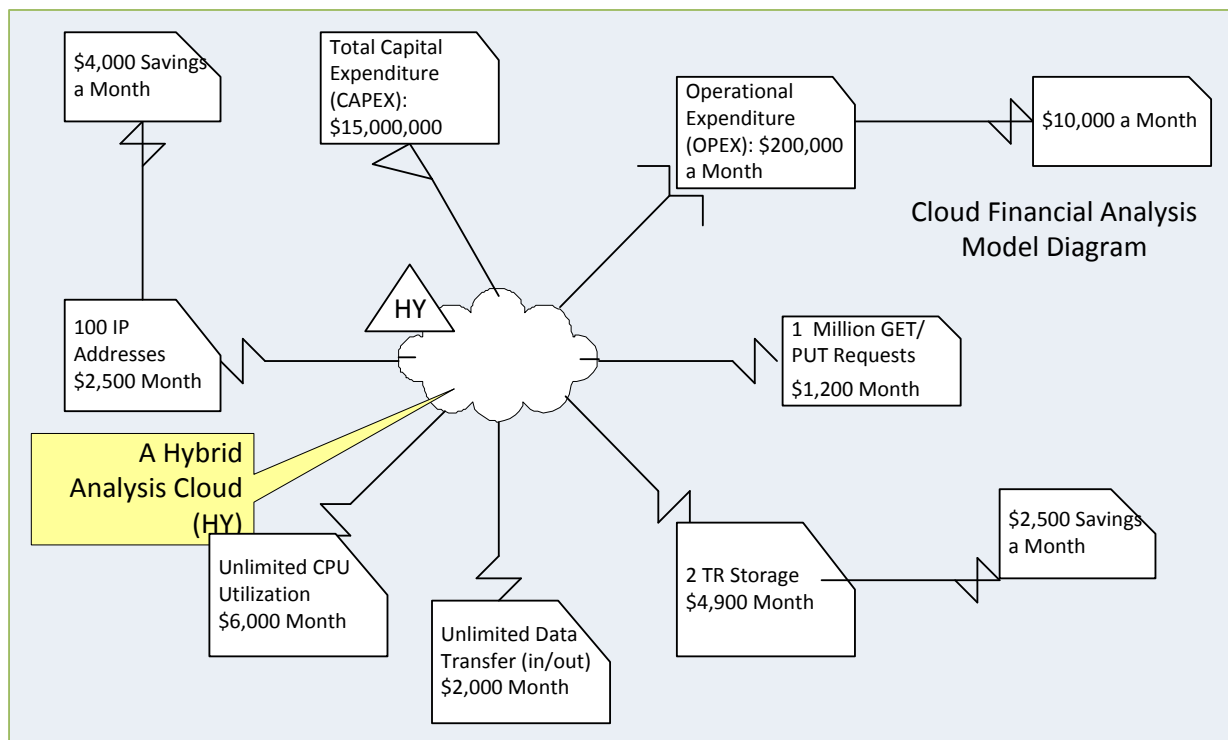

FIGURE 12: CLOUD ROI ANALYSIS DIAGRAM

OTHER RELATED CLOUD COMPUTING MODELING DIAGRAMS

Remember, each SOMF model offers a number of diagrams, each of which may include cloud computing modeling activities. For example, in the Service-Oriented Discovery and Analysis Model, a cloud entity may participate in an Analysis Proposition Diagram. Similarly, in the Service-Oriented Logical Design Model, a cloud computing environment may be illustrated to specify message exchanges that may take place between service providers and consumers in or outside a cloud. These interactions can be viewed in the Logical Design Relationship Diagram.

To read more about the specifications and view related diagrams that involve analysis, design, and architecture of cloud computing services, refer to other published SOMF 2.1 specifications documents:

- SOMF_2.1_Conceptualization_Model_Language_Specifications.pdf

- SOMF_2.1_Discovery_and_Analysis_Model_Language_Specifications.pdf

- SOMF_2.1_Business_Integration_Model_Language_Specifications.pdf

- SOMF_2.1_Logical_Design_Model_Language_Specifications.pdf

- SOMF_2.1_Architecture_Model_Language_Specifications.pdf