

Cloud Classic Security Patterns

Cloud Reference Architecture *

Concept / individual	Axioms	Description
CloudConsumer comp_CloudConsumer	SubclassOf CloudActor suggestsInteraction some Portal interacts value comp_Portal	
CloudAdministrator comp_CloudAdministrator	SubclassOf CloudActor suggestsInteraction Portal interacts value comp_Portal	
Portal comp_Portal	SubclassOf CloudComponent suggestsInteraction Cloud interacts value comp_Cloud suggestsInteraction some CloudConsumer suggestsInteraction some CloudAdministrator	"The way to access cloud services"
Cloud comp_Cloud	SubclassOf CloudComponent suggestsPart some CloudService suggestsPart some Cluster suggestsPart some SupportService hasPart value comp_CloudService hasPart value comp_Cluster hasPart value comp_SupportService suggestsInteraction some Portal	
CloudService comp_CloudService	SubclassOf CloudComponent	
SaaSService comp_SaaSService	SubclassOf CloudService suggestsProduction some SaaSApplication produces value comp_SaaSApplication	
PaaSService	SubclassOf CloudService	

comp_PaaSService	suggestsProduction some VirtualEnvironment produces value comp_VirtualEnvironment	
IaaSService comp_IaaSService	SubclassOf CloudService suggestsProduction some VirtualMachine produces value comp_VirtualMachine suggestsInteraction some VMImageRepository interacts value comp_VMImageRepository	
VMImageRepository comp_VMImageRepository	SubclassOf CloudComponent suggestsProduction some VMImage produces value comp_VMImage suggestsInteraction some IaaSService	Image repository produces VMImages and interacts with IaaSService
VMImage comp_VMImage	SubclassOf CloudComponent suggestsProduction some VirtualMachine produces value comp_VirtualMachine	
VirtualEnvironment comp_VirtualEnvironment	SubclassOf CloudComponent suggestsProduction some SaaSApplication produces value comp_SaaSApplication suggestsPart some VirtualMachine hasPart value comp_VirtualMachine	
VirtualMachine comp_VirtualMachine	SubclassOf CloudComponent	
Cluster comp_Cluster	SubclassOf HardwareComponent suggestsPart some Node hasPart value comp_Node	
Zone comp_Zone		
Node comp_Node	SubclassOf HardwareComponent suggestsPart some VMM hasPart value comp_VMM	also known as Hypervisor

	suggestsPart some Hardware hasPart value comp_Hardware	
VMM comp_VMM	SubclassOf CloudComponent suggestsPart some VirtualMachine hasPart value comp_VirtualMachine interacts value comp_Hardware suggestsInteraction some Hardware suggestsFunction some VMMFunction hasFunction value func_VMMigration	
Hardware comp_Hardware	SubclassOf HardwareComponent suggestsPart some Network hasPart value comp_Network suggestsPart some Server hasPart value comp_Server suggestsPart some Storage hasPart value comp_Storage suggestsInteraction some VMM	
Server comp_Server	SubclassOf HardwareComponent	
Network comp_Network	SubclassOf HardwareComponent	
Storage comp_Storage	SubclassOf HardwareComponent	
SupportService comp_SupportService	SubclassOf CloudComponent	

BusinessService comp_BusinessService	SubclassOf SupportService	
OperationalService comp_OperationalService	SubclassOf SupportService	
NonFunctionalService comp_NonFunctionalService	SubclassOf SupportService	
SaaSApplication	SubclassOf CloudComponent	

Functional model

Concept / individual	Axioms	Description
CloudFunction	SubclassOf SoftwareFunction	
VMMFunction	SubclassOf CloudFunction	
VMMigrationFunction func_VMMigration	SubclassOf VMMFunction	

Misuse patterns

Concept / individual	Axioms	Description
pattern_MaliciousVirtualMachineMigrationProcess *	subclassOf MisusePattern hasAffectedFunction func_VMMigration hasAffectedComponent comp_VMM hasThreat threat_Interception hasThreat threat_ManInTheMiddle (UC 1) hasThreat threat_ExcessiveAllocation (UC 2) relatesTo pattern_SecureVirtualMachineImageRepository	
pattern_ResourceUsageMonitoringInferenceinCloudComputing **	subclassOf MisusePattern hasAffectedComponent comp_VMM	

	hasThreat threat_SharedDataManipulation hasThreat threat_Interception	
pattern_MaliciousVirtualMachineCreation **	subclassOf MisusePattern hasAffectedComponent comp_VMImageRepository hasAffectedComponent comp_VMM hasThreat threat_Malware	*

Security patterns

Concept / individual	Axioms	Description
pattern_SecureVirtualMachineImageRepository *	subclassOf SecurityPattern hasAffectedComponent comp_VMImageRepository hasThreat threat_Malware hasSecurityConcern concern_AccessControl hasSecurityConcern concern_Accountability	

* Fernandez, E. B., Monge, R., & Hashizume, K. (2016). Building a security reference architecture for cloud systems. *Requirements Engineering*, 21(2), 225-249. <https://link.springer.com/article/10.1007/s00766-014-0218-7>

** Hashizume, K. (2013). *A reference architecture for cloud computing and its security applications*. Florida Atlantic University.
https://fau.digital.flvc.org/islandora/object/fau/%3A4099/datastream/OBJ/view/reference_architecture_for_cloud_computing_and_its_security_applications.pdf

subclassOf
hasAffectedFunction
hasAffectedComponent
hasThreat
hasSecurityConcern
relatesTo