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This document, "NIST Cloud Computing Reference Architecture," outlines a framework for understanding and implementing cloud computing, particularly for the US Government.

**Overview of the NIST Cloud Computing Reference Architecture**

* It is based on the NIST definition of Cloud Computing and seeks to provide a common language for industry and government to discuss cloud offerings.
* The architecture is vendor-neutral and aims to encourage innovation rather than prescribe a specific technical solution.
* **It lays out the central elements of cloud computing using an Actor/Role based model.**
* **Five main actors are identified:** Cloud Consumer, Cloud Provider, Cloud Broker, Cloud Auditor, and Cloud Carrier.
  + Each actor has specific roles and responsibilities within the cloud computing ecosystem.
  + **Examples of interactions between actors:**
    - Cloud consumers may acquire services directly from a cloud provider or utilize a cloud broker as an intermediary.
    - Cloud auditors provide independent assessments of cloud service performance and security, interacting with both providers and consumers.
    - Cloud carriers, analogous to power distributors in the electric grid, ensure data transfer between providers and consumers.
    - Cloud brokers can aggregate, enhance, or arbitrage services, providing value-added services to consumers.

**Architectural Components of the Model**

* **Service Deployment:** Describes different cloud deployment models, including public, private, community, and hybrid clouds, each with varying levels of exclusivity for consumers.
* **Service Orchestration:** Explains how system components are arranged, coordinated, and managed to deliver cloud services, encompassing three layers:
  + **Service Layer:** Where consumers access cloud services through interfaces defined for each service model (SaaS, PaaS, IaaS).
  + **Resource Abstraction and Control Layer:** Utilizes software abstractions like hypervisors and virtual machines to manage physical computing resources, enabling resource pooling, dynamic allocation, and measured service.
  + **Physical Resource Layer:** Comprises the hardware infrastructure, including servers, networks, storage, and facilities.
* **Cloud Service Management:** Covers the functions required for the management and operation of cloud services, including:
  + **Business Support:** Addresses customer management, contract management, billing, reporting, pricing, etc.
  + **Provisioning and Configuration:** Deals with rapid deployment, resource adjustments, monitoring, metering, and SLA management.
  + **Portability and Interoperability:** Focuses on the ability to move data and applications across cloud environments and ensure communication between multiple clouds, which is crucial for government adoption.
* **Security:** A critical aspect addressed across all layers of the model, encompassing:
  + **Cloud Service Model Perspectives:** Recognizes that different service models offer varying levels of control and security implications.
  + **Implications of Cloud Deployment Models:** Acknowledges the impact of deployment models on workload isolation, access boundaries, and security requirements.
  + **Shared Security Responsibilities:** Emphasizes the shared responsibility between Cloud Providers and Cloud Consumers in implementing security controls based on the service model and respective control over resources.
* **Privacy:** Highlights the importance of protecting personal information (PI) and personally identifiable information (PII) in the cloud, a key business imperative for the Federal government.

**Cloud Taxonomy**

* **A four-level taxonomy is provided to define key cloud computing concepts:**
  + Role: Conceptual obligations and behaviors of actors.
  + Activity: General behaviors or tasks associated with a role.
  + Component: Specific processes, actions, or tasks within an activity.
  + Sub-Component: Modular parts of a component.

The document provides a foundational framework for navigating the complexities of cloud computing, enabling the US Government and other organizations to understand, implement, and manage cloud services effectively.