Encrypt Your Cloud

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RSA CONFERENCE
CHINA 2012
RSA信息安全大会2012

AGENDA

- Introduction
- Cryptography in Clouds
- Examples

Introduction

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flying \fly"ing\, a. [From fly, v. i.]

moving with, or as with, wings; moving lightly or rapidly; intended for rapid movement

penguin \pen"guin\, n.

short-legged flightless birds of cold southern especially Antarctic regions having webbed feet and wings modified for water

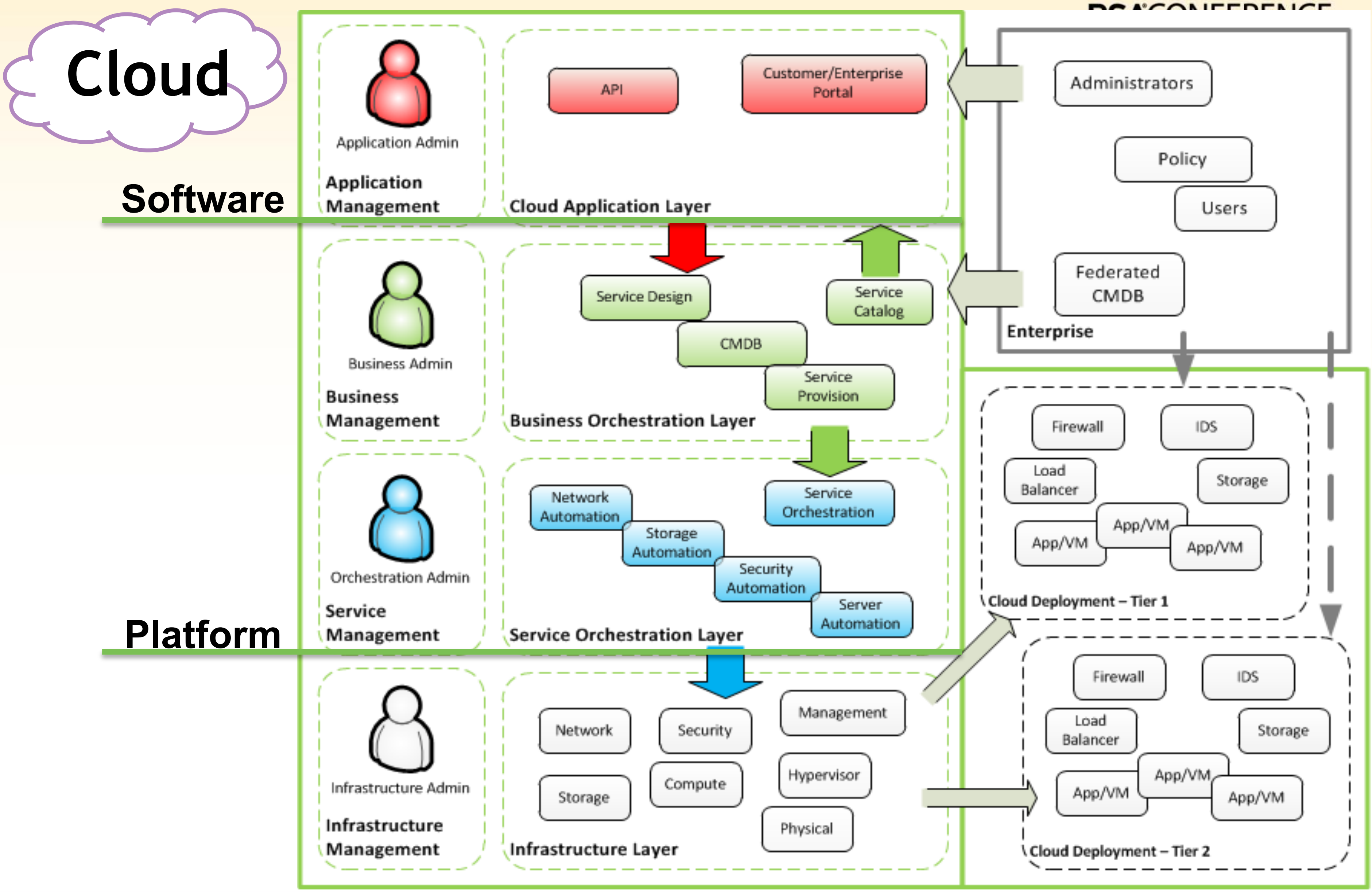
Cloud

- “The web’s household names got where they are today by mining the information that their users generate and turning it into business advantage.”

  The Harsh Light of Data Presentation, O’Reilly Strata Jumpstart 2011 conference

- “The top issue overall was a perceived lack of security and service level agreements (SLAs), with 45% of respondents referring to it.”

  http://www.interxion.com/cloud-insight/index.html



Cloud

Software

Platform

Application Admin

Application Management

API

Customer/Enterprise Portal

Cloud Application Layer

Business Admin

Business Management

Service Design

CMDB

Service Catalog

Service Provision

Business Orchestration Layer

Orchestration Admin

Service Management

Network Automation

Storage Automation

Security Automation

Server Automation

Service Orchestration

Service Orchestration Layer

Infrastructure Admin

Infrastructure Management

Network

Security

Management

Storage

Compute

Hypervisor

Physical

Infrastructure Layer

Administrators

Policy

Users

Federated CMDB

Enterprise

Firewall

IDS

Load Balancer

Storage

App/VM

App/VM

App/VM

Cloud Deployment – Tier 1

Firewall

IDS

Load Balancer

Storage

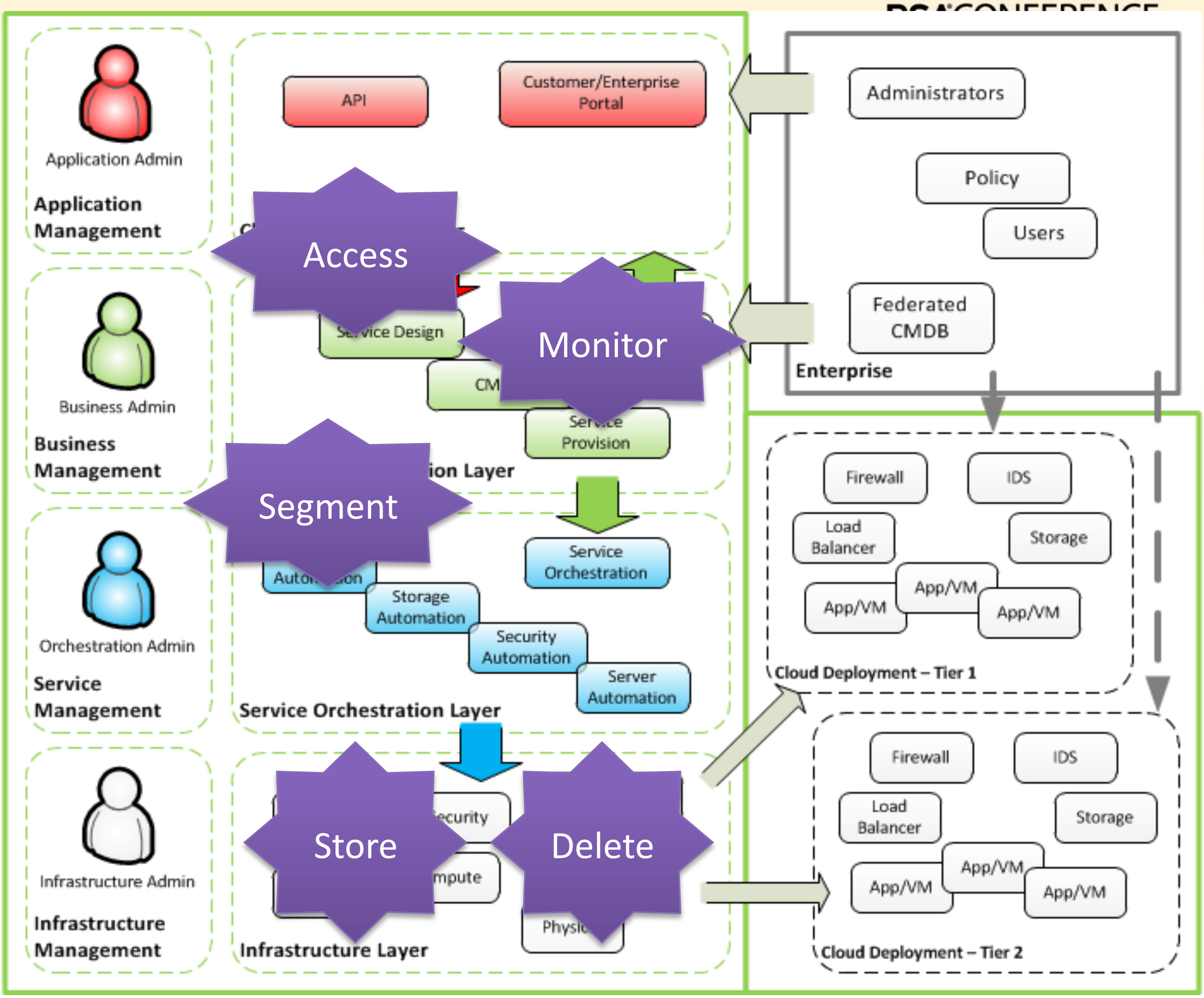
App/VM

App/VM

App/VM

Cloud Deployment – Tier 2

Cloud



Application Admin

Application Management

API

Customer/Enterprise Portal

Access

Business Admin

Business Management

Service Design

CM

Monitor

Service Provision

ion Layer

Segment

Orchestration Admin

Service Management

Service Orchestration

Automation

Storage Automation

Security Automation

Server Automation

Service Orchestration Layer

Infrastructure Admin

Infrastructure Management

Store

Security

mpute

Delete

Physic

Infrastructure Layer

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Enterprise

Firewall

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Cloud Deployment – Tier 1

Firewall

IDS

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App/VM

Cloud Deployment – Tier 2

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Cloud

CIOs Worry About…

Outsourced Responsibilities

- “Due-diligence”
- Reasonable

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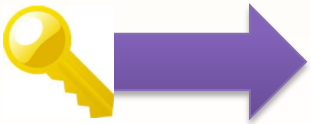
CIOs *Need* Cloud Controls

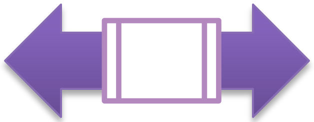
	Want	Need
1	Data Deletion	Secure Wipe (Key Deletion)
2	Boundary Definition	Segmentation (Encryption)
3	Data Access (Apps)	Input Validation
4	Access Monitoring	Log Management
5	Data Storage	Encryption (Key Management)

Crypto Terminology

- **Encryption**: *reversible* operation, cryptographically turns input into illegible cipher text



- **Hashing**: *non-reversible* operation, cryptographically transforms input to illegible message



- **Tokenization**: reversible operation, substitutes input with data that has no inherent value

- **Key management**: life-cycle of a secret including creation, distribution, use and deletion

Crypto Considerations

- **Encryption**: *reversible* operation, cryptographically turns input into illegible cipher text
- **Hashing**: *non-reversible* operation, cryptographically transforms input to illegible message
- **Tokenization**: reversible operation, substitutes input with data that has no inherent value
- **Key management**: life-cycle of a secret including creation, distribution, use and deletion

Cryptography in Clouds

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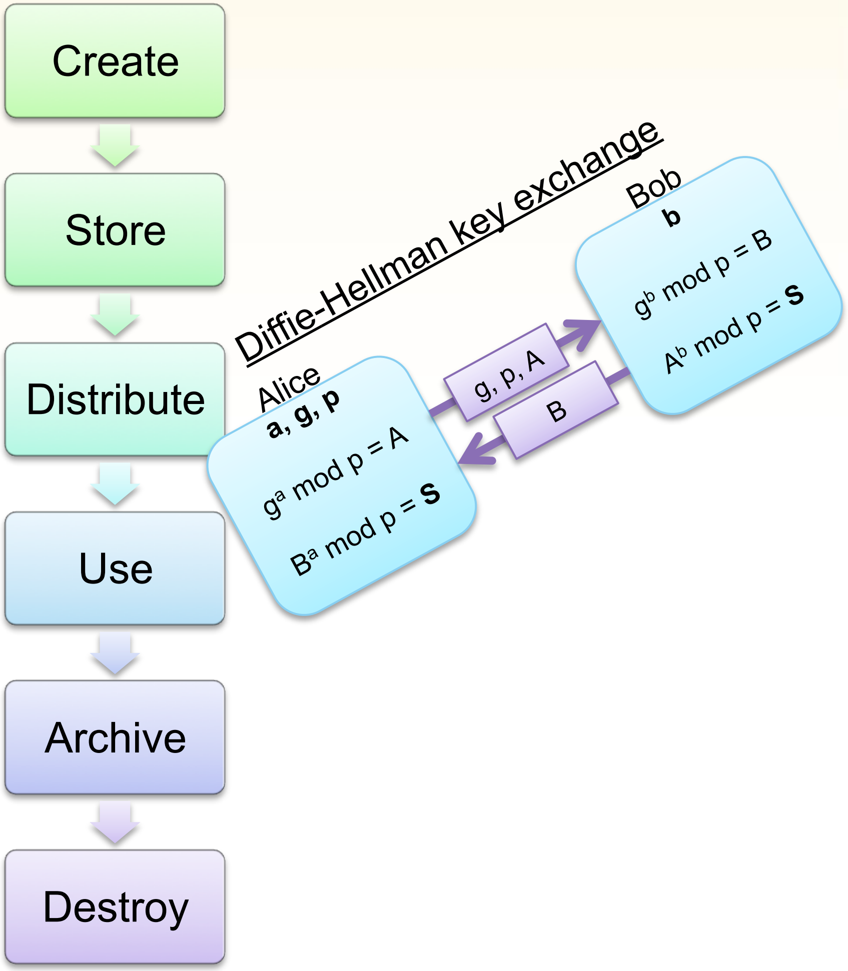
Crypto Considerations

- Human/Social element
  - People
  - Process
  - Policy
- Location element
  - Border restrictions
  - Standards (U.S. NIST)
    - SP 800-57
    - SP 800-131A
    - SP 800-130



Create

Store

Distribute

Use

Archive

Destroy

Diffie-Hellman key exchange

Alice

a, g, p

g^a mod p = A

B^a mod p = **S**

g, p, A

B

Bob

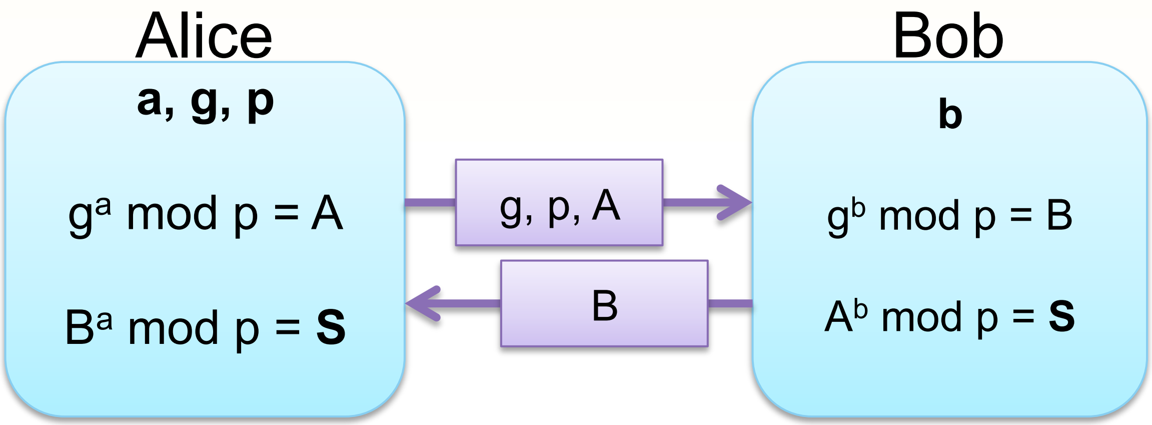
b

g^b mod p = B

A^b mod p = **S**

Crypto Considerations

Diffie-Hellman key exchange



Alice

a, g, p

$g^a \bmod p = A$

$B^a \bmod p = \mathbf{S}$

g, p, A

B

Bob

b

$g^b \bmod p = B$

$A^b \bmod p = \mathbf{S}$

Cloud Crypto Considerations

Who has your keys?

- Human/Social element
  - People
  - Process
  - Policy
- Location element
  - Border restrictions
  - Standards (U.S. NIST)
    - SP 800-57
    - SP 800-131A
    - SP 800-130

Trusted Service Provider

Architecture

Large / Global Presence

Interoperability

Cloud Crypto Considerations

- "Portable device" technology (MA 201 CMR 17)
- Multi-tenant
- Open interfaces
  - Consumer
  - Management
  - Partner
  - Development / Application
- Multi-jurisdiction
  - Who/when
  - Where

Encryption as a Service

- Key management
  - Generation
  - Protection (key encryption key)
  - Expiration and Rotation
  - Deletion
- Key architecture
  - Management integration
  - Interoperability
  - Meta-data

Standards:
ISO 11568
ISO 11770
NIST SP 800-57
IETF Keyprov
OASIS EKMI
OASIS KMIP

Examples

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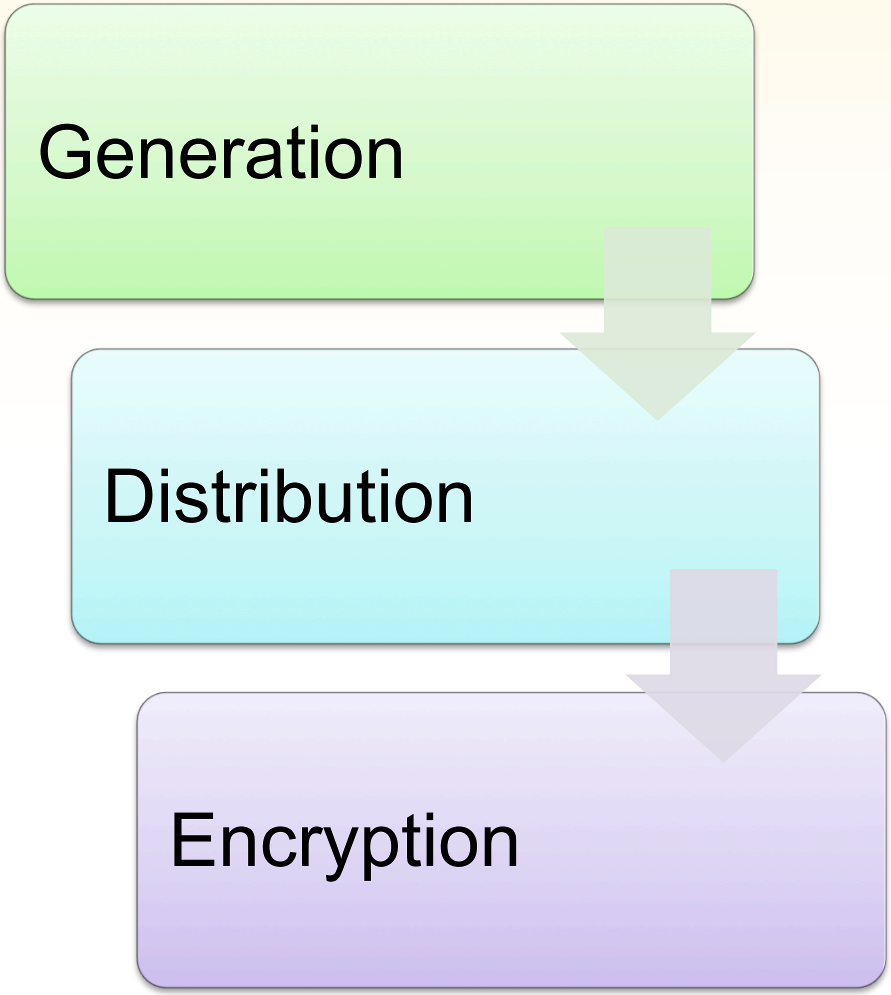
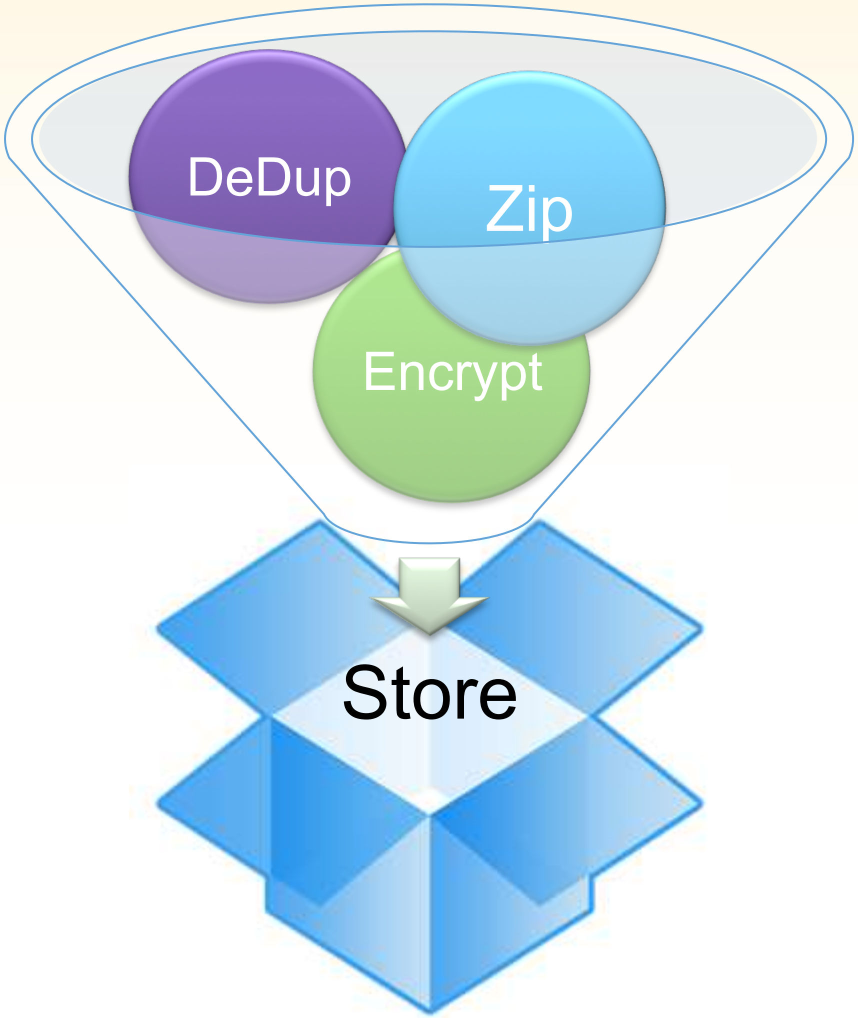
Example #1



- Key Rotation
  - Templates
  - Snapshots
  - Offline
- Key Persistence
  - Templates
  - Snapshots
  - Reboot
  - SAN
  - Backup
  - Archive

Example #2

1. Encrypt Data
2. “Manage” Data…?
   - Analysis
   - Reports
   - Compression
   - De-duplication



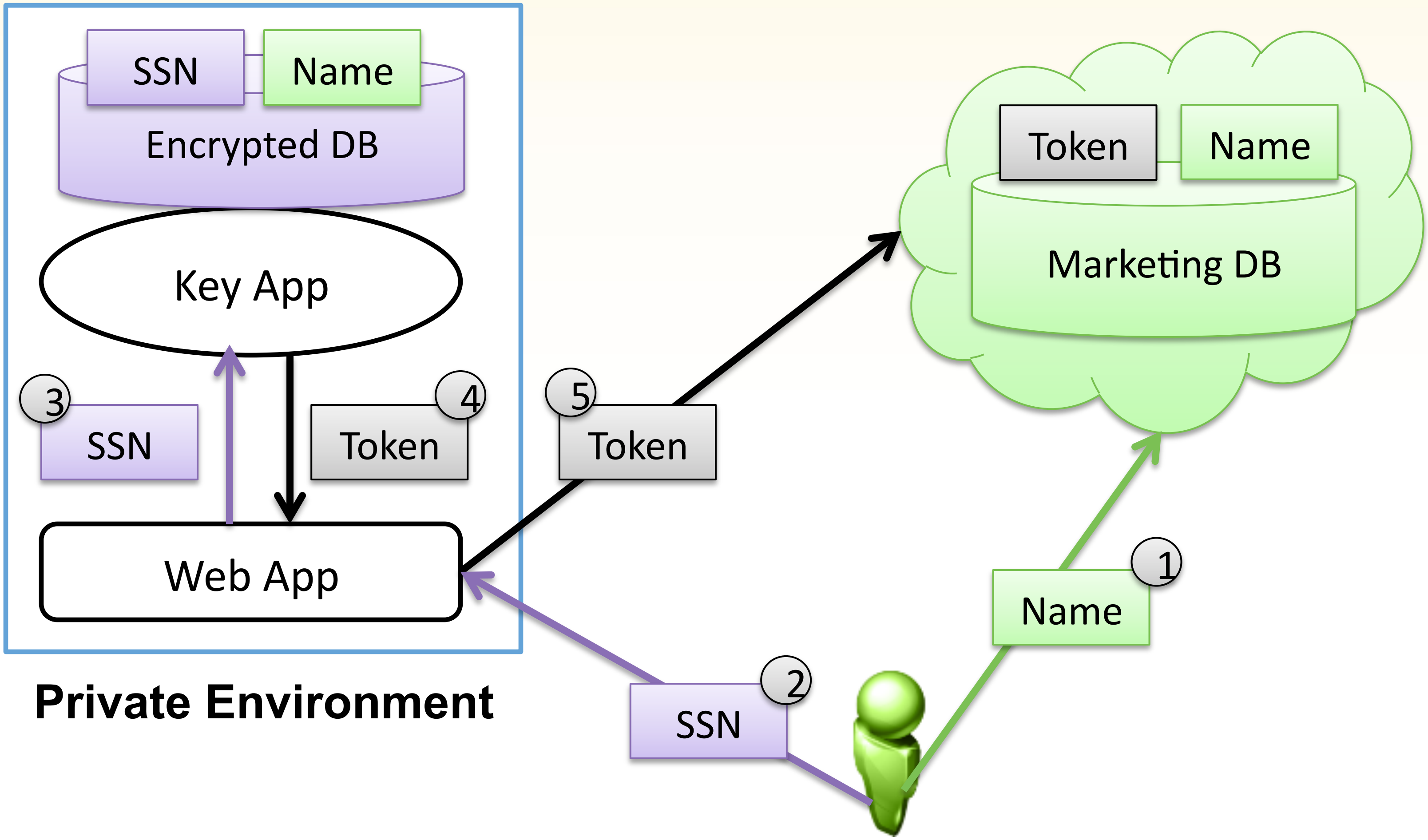
Example #3

Segmentation

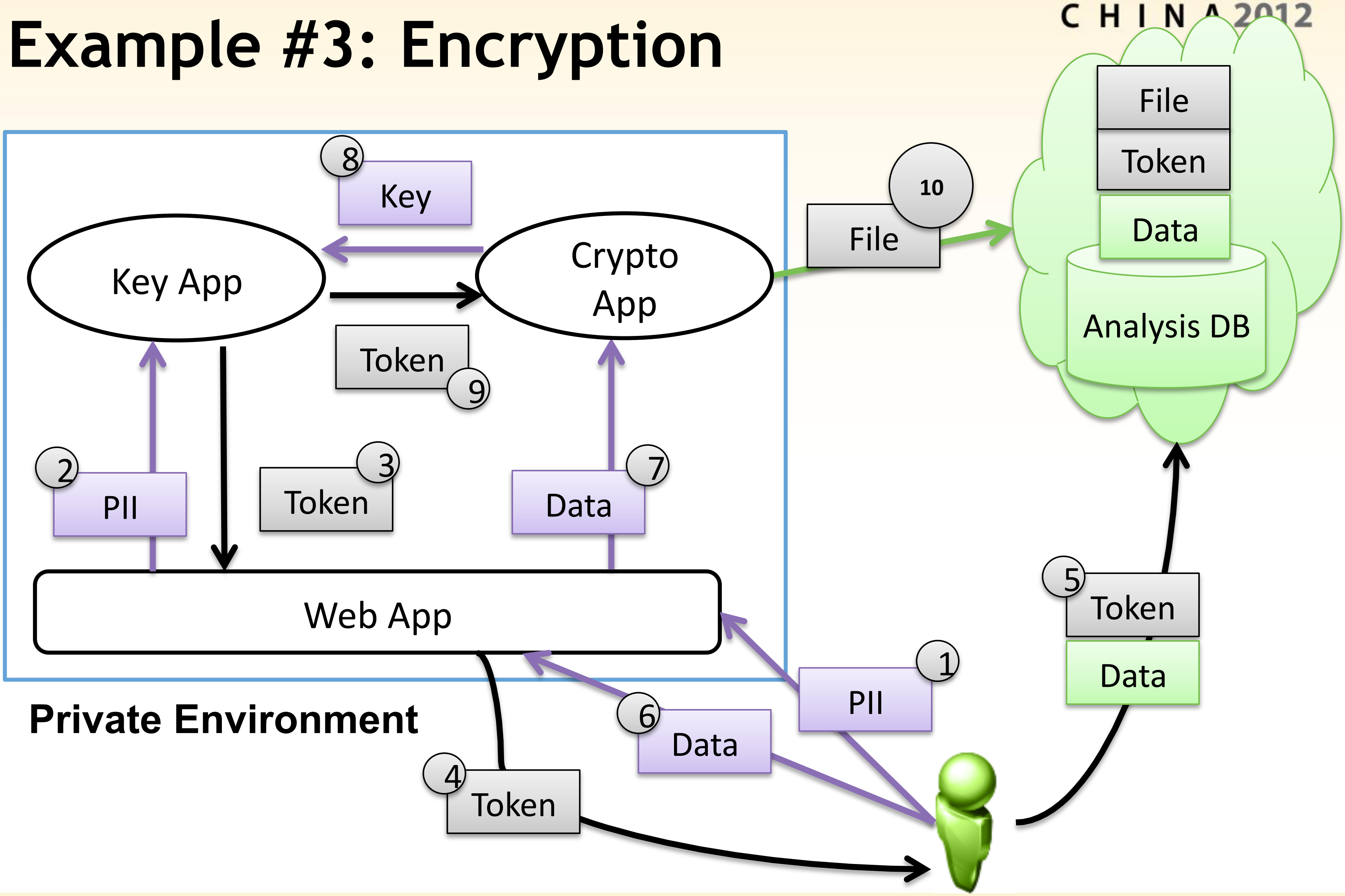
- Default
- Sensitive un-regulated (e.g. non-“material”)
- Sensitive regulated (e.g. PII, CCN, “material”)

Data Level	Treatment
3	Clear
2	Token or Encrypted
1	Token, Hashed or Encrypted

Example #3: Token



Example #3: Encryption



Private Environment

Encrypt Your Cloud

- Next 3 months
  - Classify data for segmentation
  - Setup key management policy and procedures
  - Select standards for interoperability
- Next 6 months
  - Configure apps for key and crypto management
  - Select a key app and crypto app solution
  - Plan and initiate a project to protect data in cloud

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