Technology Exploration Workshop on CLOUD COMPUTING : SECURITY (?)

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WHAT IS SECURITY ?

Data

Process

Confidentiality

Integrity

Availability

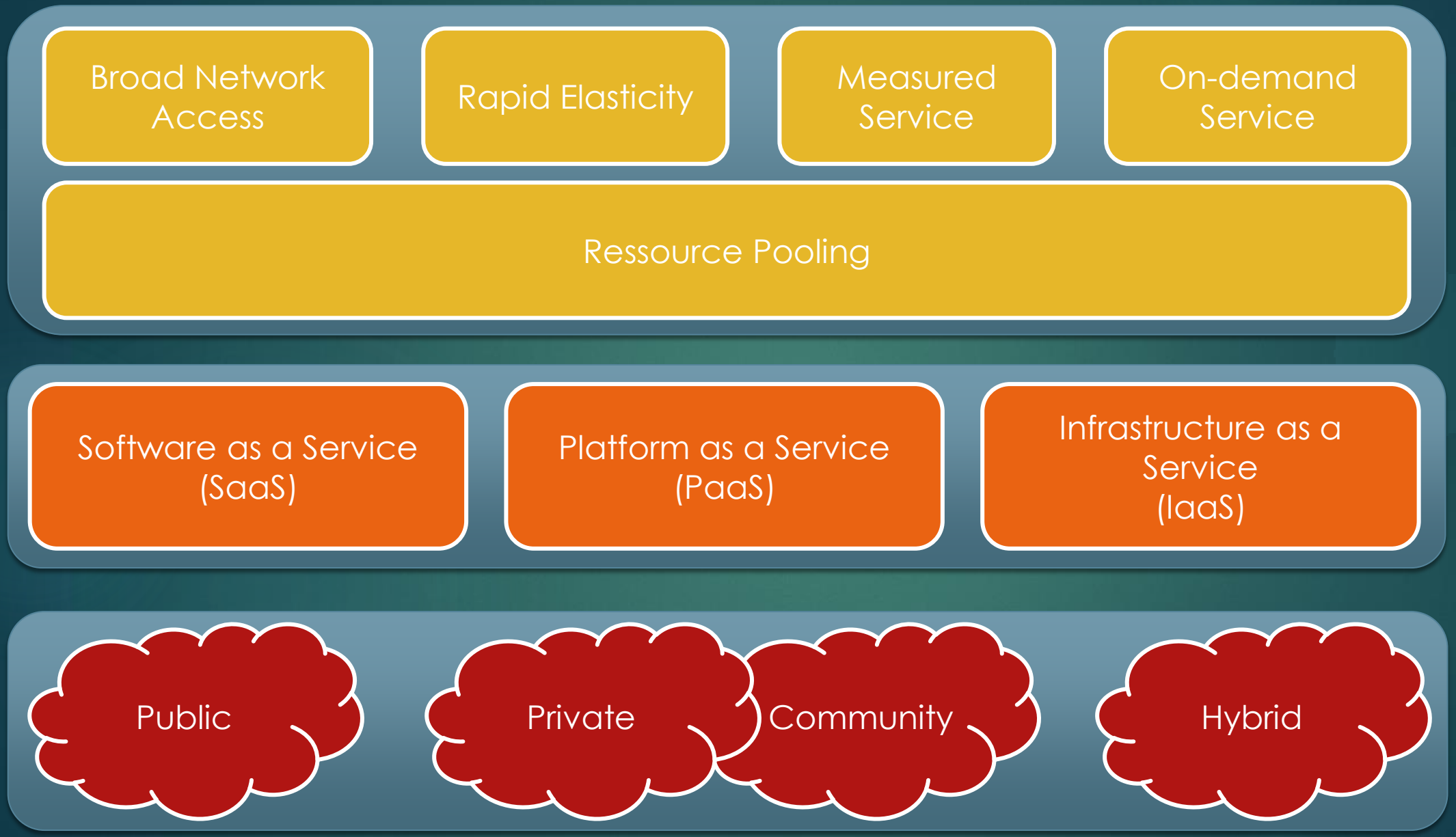
NIST
National Institute of
Standards and Technology
U.S. Department of Commerce

Special Publication 800-145

The NIST Definition of Cloud Computing

Recommendations of the National Institute of Standards and Technology

Peter Mell
Timothy Grance



NIST Visual Model of Cloud Computing Definition

Is « the cloud » secure ?

Well…it depends

Cloud

- Operational model
- There are lots of different types of cloud (and they are not created equal)

Use cases

- Data processing, off-loading, analytics, etc.
- All uses cases are differents

How does cloud computing affect our security practices ?

Security driver (short version)

Providers are usually good at security (compared to what SME or equal size organizations can afford).

Cloud characteristics : Scale

- Locations
- Elasticity means better availability

Azure regions

Azure is generally available in 30 regions around the world, and has announced plans for 4 additional regions. Geographic expansion is a priority for Azure because it enables our customers to achieve higher performance and it support their requirements and preferences regarding data location.

Explore products per region ►

Azure Status

Last updated 21 seconds ago

RSS

Refresh every 2 minutes

✓ Good ⚠ Warning ! Error i Information

Americas | Europe | Asia

PRODUCTS	GLOBAL	EAST US	EAST US 2	CENTRAL US	NORTH CENTRAL US	SOUTH CENTRAL US	WEST CENTRAL US	WEST US	WEST US 2	CANADA EAST	CANADA CENTRAL	BRAZIL SOUTH
IMPACTED SERVICES												
Visual Studio Team Services					⚠	⚠						✓
COMPUTE												
Virtual Machines		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cloud Services		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Batch		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RemoteApp		✓	✓	✓	✓	✓		✓				✓
Service Fabric		✓			✓	✓		✓		✓	✓	
Virtual Machine Scale Sets		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Azure Container Service		✓	✓	✓	✓	✓		✓				✓
Functions			✓	✓	✓	✓		✓	✓			✓

Cloud characteristics

- Scale
  - Locations
  - Elasticity means better availability
- Deployment
  - Robust templates for virtualization
  - Automation + orchestration = security miracles
- Audit and Incident Management

CLOUD INCIDENTS

Incidents topology

Accidents
Errors
Malicious

+

Internal
External

+

Skill

« ACCIDENTS »

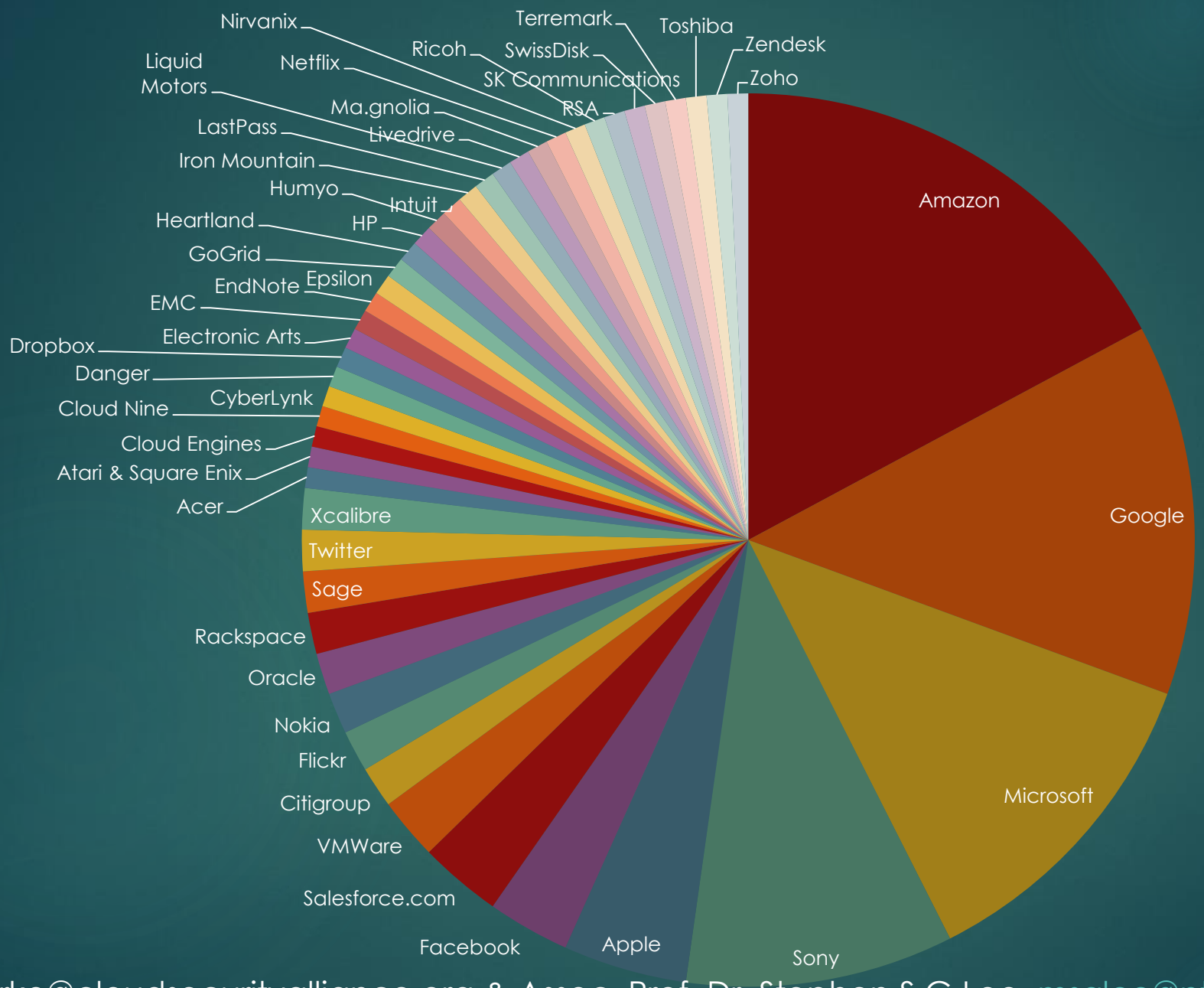
- 9/9/2014 : Amazon rebooted 10% of EC2 instances to patch a Xen vulnerability.
- 18-19/11/2014 : Microsoft Azure was down for 40 hours
- 01/2015 : Verizon planed a 48 hours maintenance shutdown of all systems.

EXPLOITING THE CLOUD

- 01/2014 Bitcoin rush : AWS xl instances + GPU service (cudaminer).
  - Caused by careless users putting credentials on GitHub,
  - Detected by Amazon thanks to Github's repositories monitoring
  - Amazon reversed the charges

- Defcon 2015 : Cloud Computing : A weapon of Mass Destruction ? (Netspi)
  - Cloud Usage for DDoS, Botnets C & C,
  - Easy due to automation, plentiful bandwidth

Breakdown of Cloud Provider - Incidents



Dr. Ryan Ko – rko@cloudsecurityalliance.org & Assoc. Prof. Dr. Stephen S G Lee msglee@ntu.edu.sg in

Cloud Computing Vulnerability Incidents: A Statistical Overview

CLOUD FOR SPACE ?

CCSDS

Consultative Committee for Space Data Systems

cnes

- Use case :
  Standards interoperability testing between spa ce agencies
- First test : Space Data Link Security testing within ESA's provider :
  CloudSigma
- Three cases :
  - One cloud, one shared VM
  - One cloud, one VM per agency
  - Multiple clouds linked though VPN over public space

CCSDS

- NASA
  - Only FEDRAMP services can be used:
    - AWS FedRAMP zones,
    - VMware vCloud Government Service
  - Only US datacentres
- ESA
  - Interoute / Cloud Sigma / OBS
  - Specific requirements on security & privacy
- UK Space Agency
  - No cloud, no policy
- DLR
  - T-System but difficult to open

PLANING FOR THE CLOUD

Guidance

cnes

enisa European Network and Information Security Agency

NIST

cloud CSA security alliance®

Bundesamt für Sicherheit in der Informationstechnik

FedRAMP

GOV.UK

ORGANISATIONAL SECURITY CONCERNS

Organisational Security Concerns

- Governance = contract

ORG risks – Contract ?

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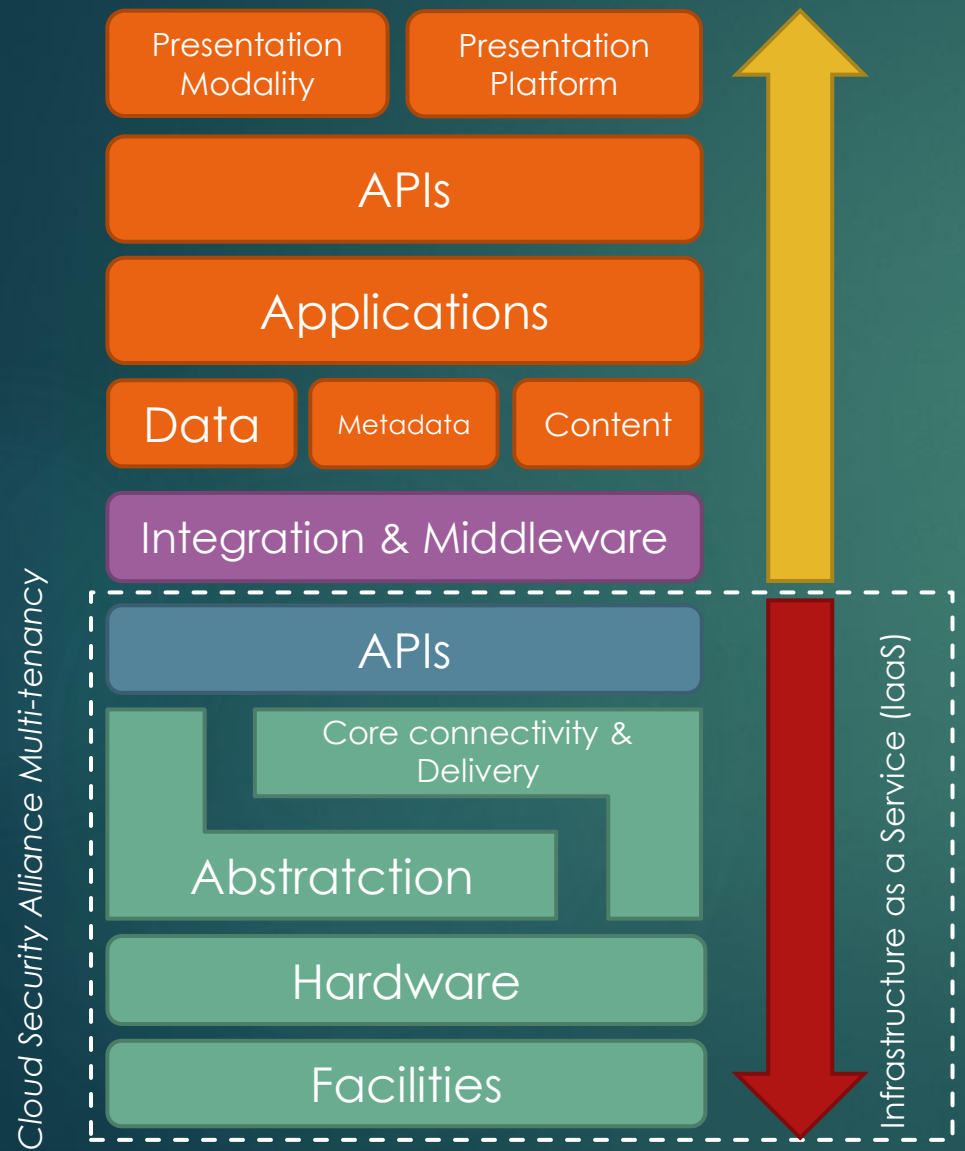
Organisational Security Concerns

- Governance
- Security responsibility

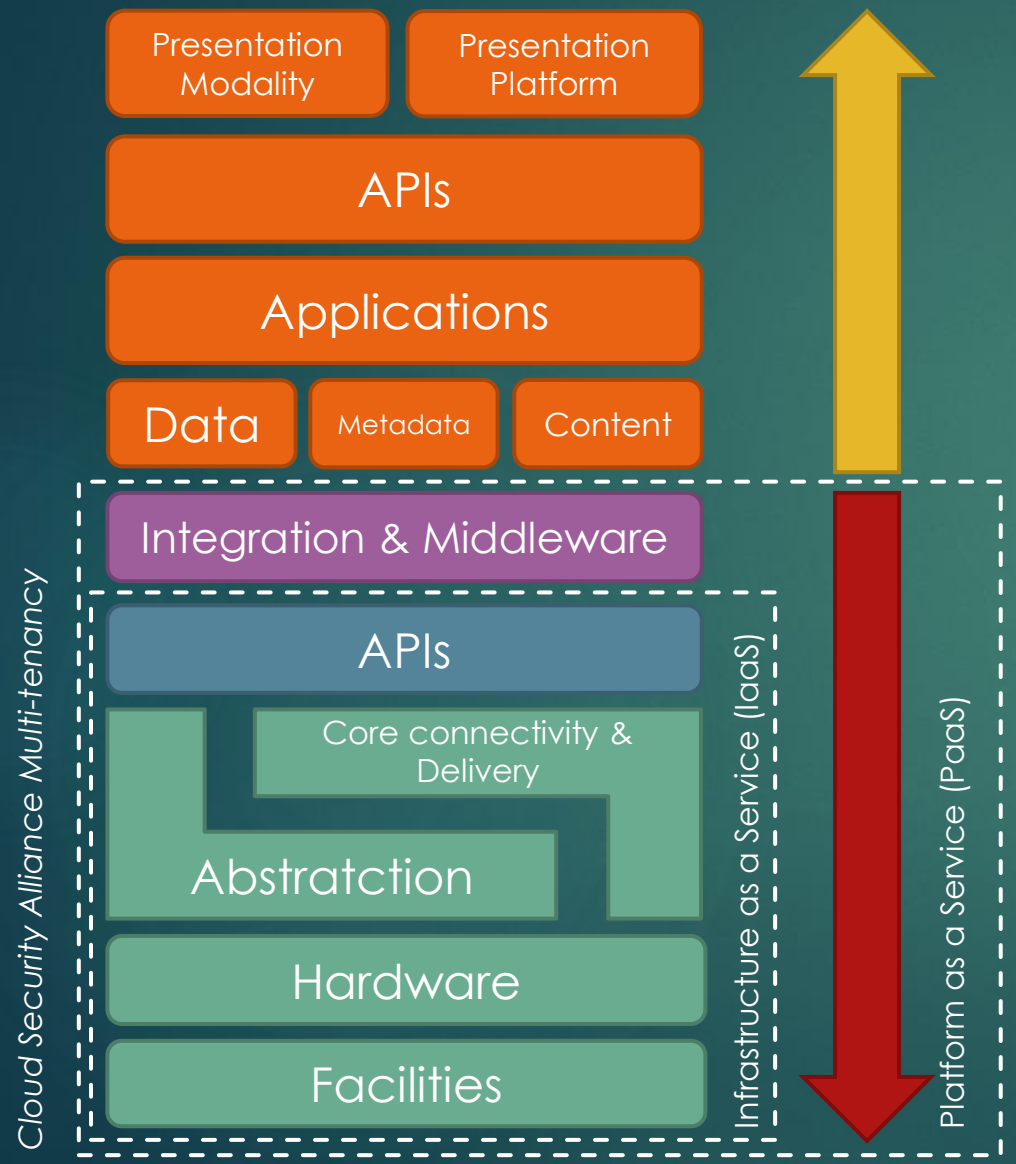
Shared responsibility – IaaS



User is responsible for confidentiality and integrity (security starts at the guest/VM)

Provider secures the infrastructure to cover availability and multi-tenancy.

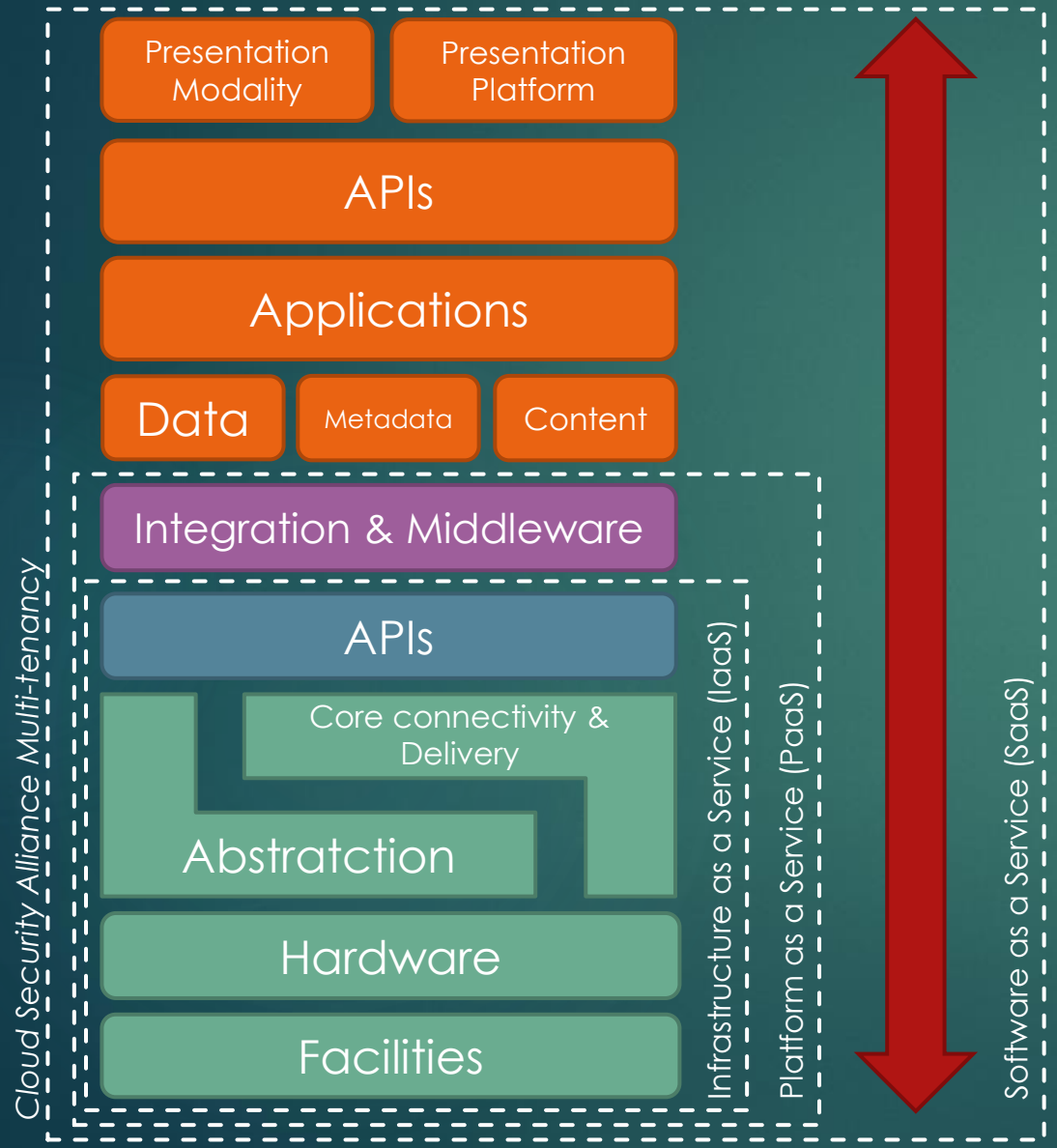
Shared responsibility – PaaS



User creates the application. Writing secure applications and ensuring your data is safe is your responsibility

Provider secures compute, network, storage layers & programmatic interface

Shared responsibility – SaaS



Contract / Access

Provider secures everything

Organisational Security Concerns

- Governance
- Security responsibility
- Compliance to legal and sectorial regulations

COMPLIANCE

- Security of information and computer systems

- Privacy of personal data
  - EU Data Protection Regulation
- Zone selection

Solutions

- Contracts
- Supplier Assessments
- Compliance, audits of control
- Risk management

Cloud Computing risks

Everything old is new again

- Information system security
  - Management
  - Data security
  - Infrastructure
- Cloud layers
- DDoS : Distributed Denial of Service
- EDos : Economical Denial of Service

Management Plane

- Although abstracted, the management plane is there, web or API based.
- Centralisation of everything owned

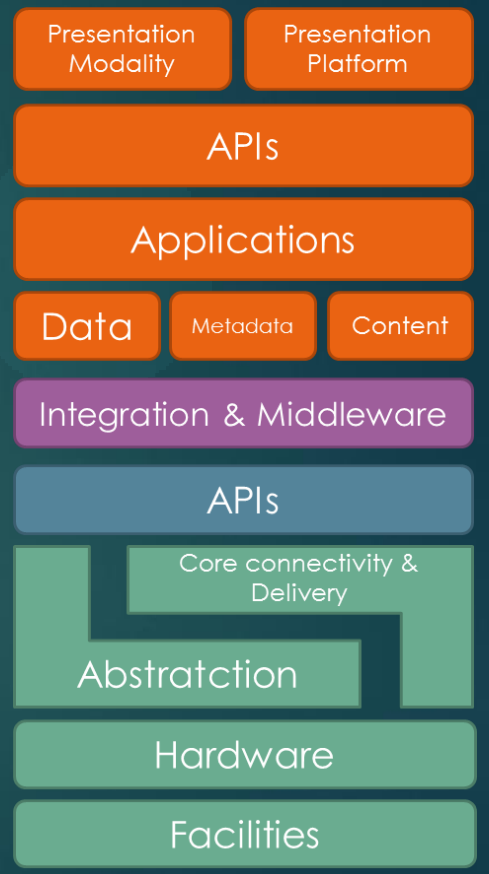
- Malicious insider from the back-office, with high privileges
- Management interface is only as secure as your secret credentials
- Compromise of the service engine

Data

- Data can be intercepted in transit to or from the cloud, or when moving inside
- Data at rest
- Data erasing
  - No guarantee (tapes, hard disk, etc.)
  - No real tool can be used

Computations

- Infrastructure is based on virtualization, abstraction layers, automation technologies and secret sauce.
- Vulnerabilities apply to compute, network and storage (and secret sauce)
- A compromised node in a processing infrastructure can lead to :
  - data leakage,
  - incorrect output,
  - Infrastructure attacks (man in the middle, DoS)



SECURITY NEEDS

DATA PROCESSING USE CASE

- Availability and Integrity are the primary needs.
  - The common requirement we have is no interruption shall exceed 5 min.
- Confidentiality comes after and is often limited to the Intellectual Property (algorithm or a subset of the data) – classified missions excluded.

So…

- Data processing solutions or architectures are built with performance in mind.
- Security is left to the surrounding infrastructure

« By default Hadoop runs in non-secure mode in which no actual authentication is required. »
https://hadoop.apache.org/docs/current/hadoop-project-dist/hadoop-common/SecureMode.html

Security features of Hadoop consist of authentication, service level authorization, authentication for Web consoles and data confidentiality.

And…

- Data processing infrastructure is connected to untrusted resources (multi-tenancy in community/public deployment).
- One component can compromise the entire « cluster », the provider can't be trusted.
- The Virtual Machine or computing node is the new boundary of the system.
- **So security must be integrated in the design pattern of the system.**
- Bonus : you have got new tools on your side (automation, APIs…)

SECURING THE CLOUD

Infrastructure Security

- Infrastructure needs to be trusted :
  - Use node authentication and configuration control
  - Private networks are required for non public facing resources
  - Automate deployment of security
- The code needs to be developed with multi-tenancy in mind (see OWASP for guidelines)
- Kill the resources you don't need

Data Security

- Information architectures
  - IaaS, PaaS and SaaS provides different solutions to store information
- Data Dispersion
- Information Management and lifecycle
- Confidentiality

Data Security

- Encryption for data at rest and in transit
  - Use client, servers or app encryption capabilities
  - VPN to the cloud, TLS for transports
  - Keep the control of encryption keys (prefer to use your own PKI)
- Data erasing
  - Provider's responsibility (certifications like SAS-70 cover this)

Access controls

- Use Identity & Access Management
- Maintain least privilege
- Create suitable roles for users and multiple access keys, security groups
- Identity federation & SSO from internal sources.
- Trace actions

Security monitoring

- The usual + cost monitoring
- Be prepared and ready for the coming incidents

Thanks.

CNES ?

- As a CNI operator, we are constrained by regulations.
- ANSSI will publish a cloud reference, applicable to FR public entities.
- Close to FEDRAMP and based on ISO 27002 security controls tailored to cloud.
- Two qualification levels
  - Secure Cloud : regular data → Suitable for mots Data processing cases.
  - Secure Cloud Plus : RESTRICTED SYSTEMS

Cloud Access Security Brokers