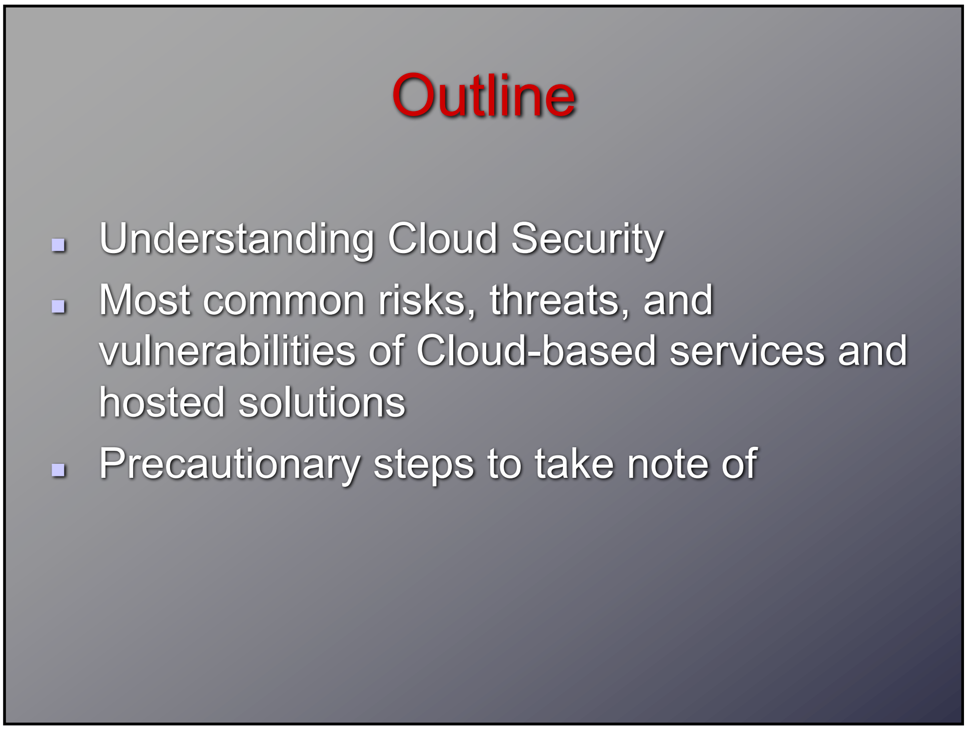
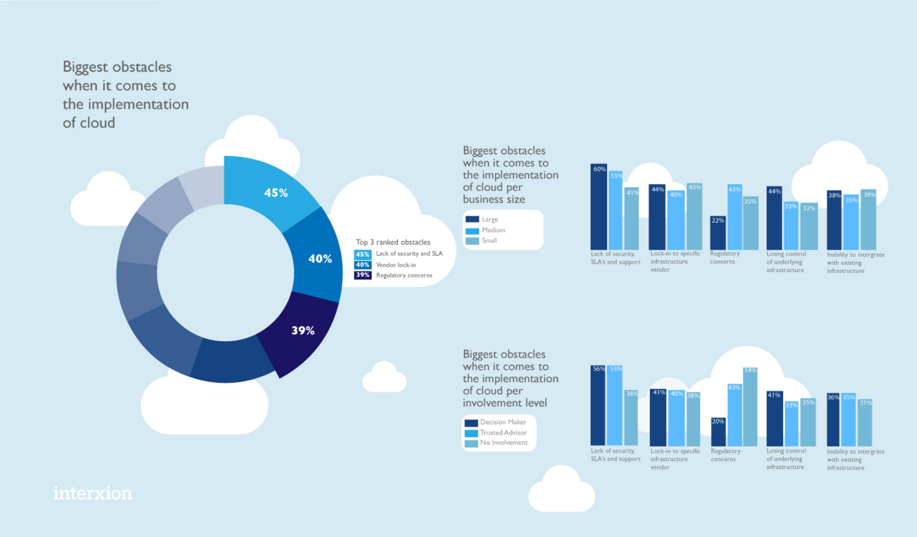
Cloud Security



Outline

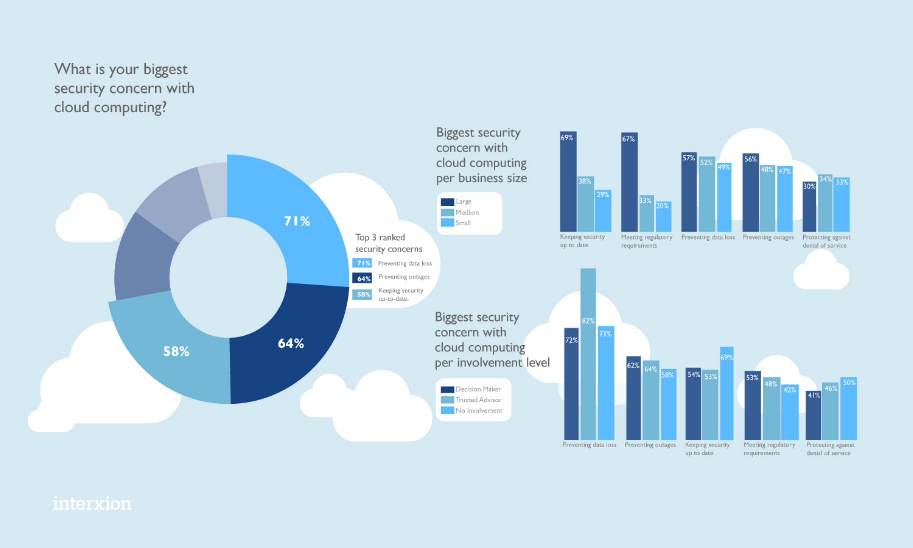
- Understanding Cloud Security
- Most common risks, threats, and vulnerabilities of Cloud-based services and hosted solutions
- Precautionary steps to take note of

Security – the major concern



Source: http://www.interxion.com/cloud-insight/

Main security concerns



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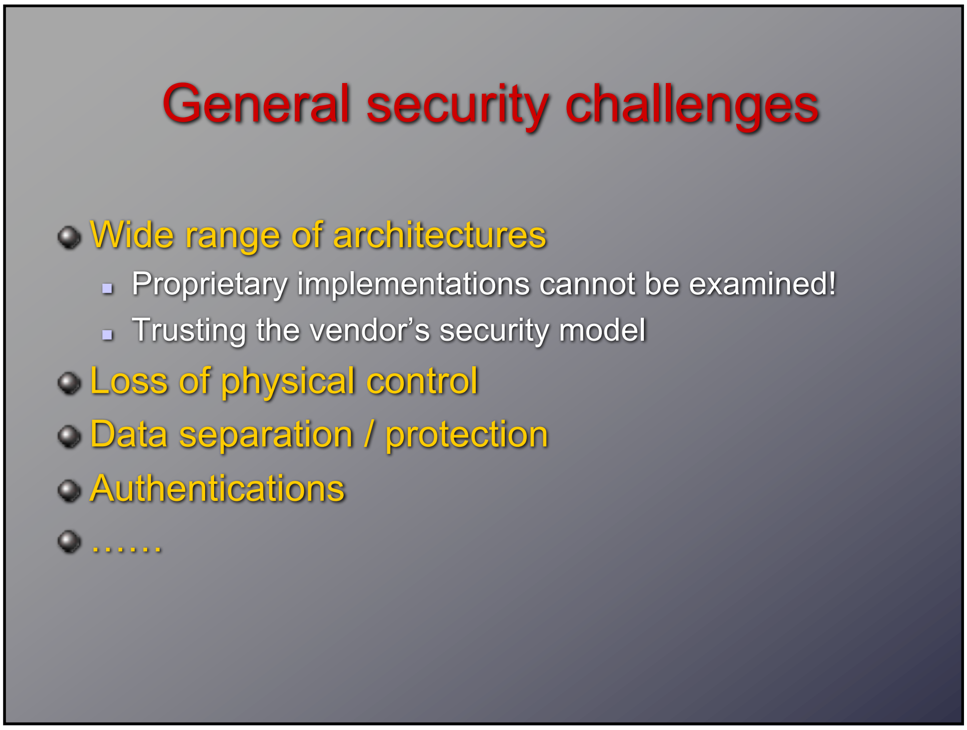
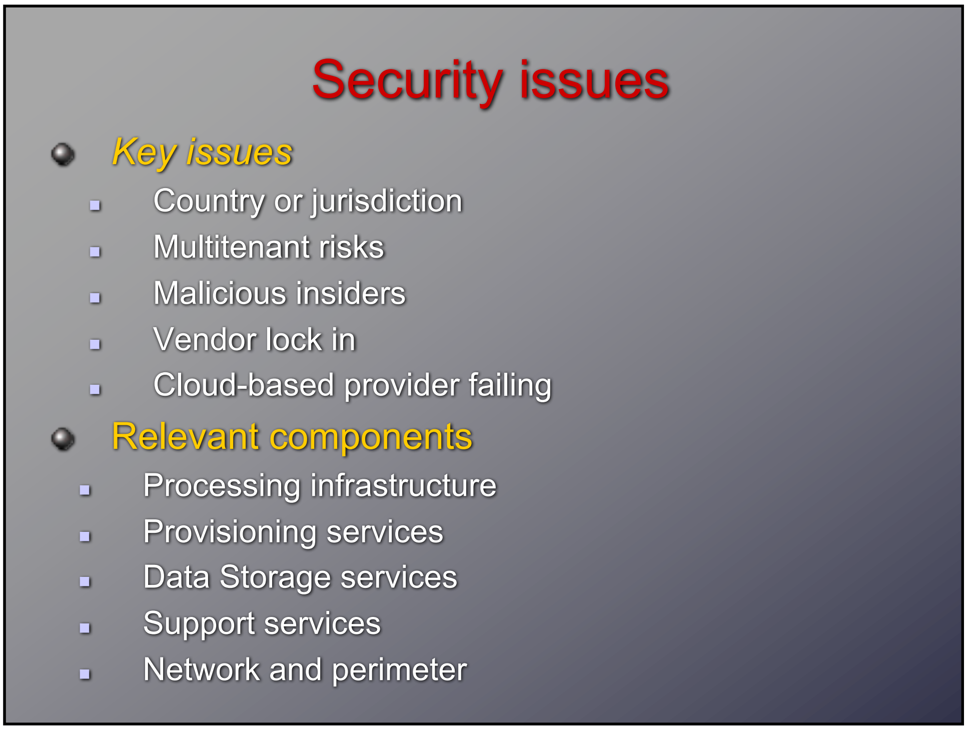


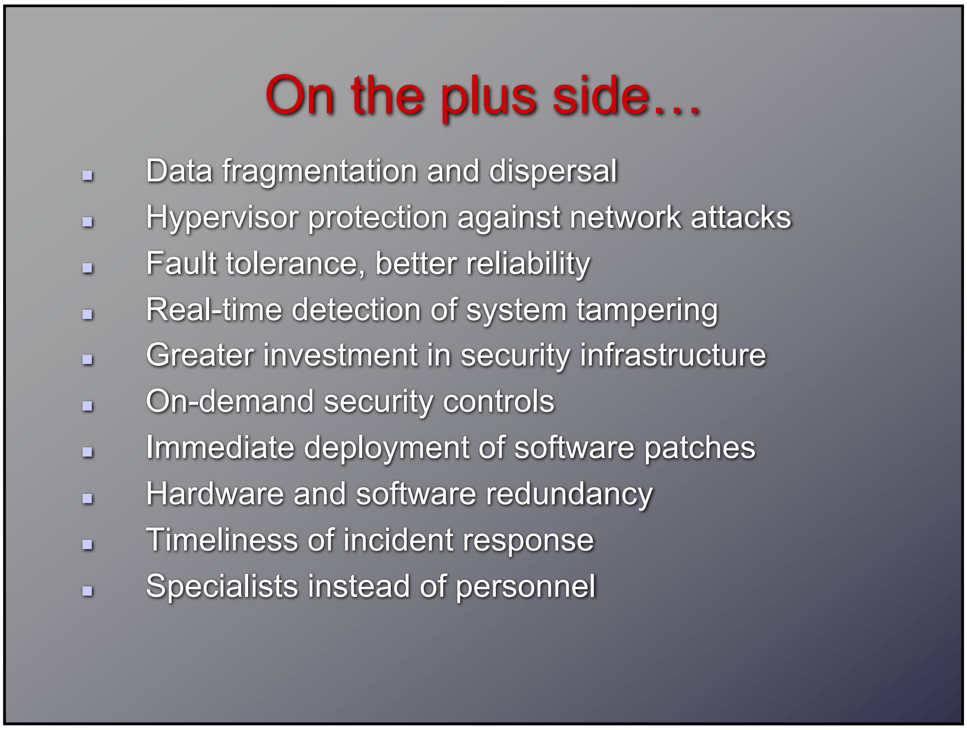
General security challenges

- Wide range of architectures
  - Proprietary implementations cannot be examined!
  - Trusting the vendor’s security model
- Loss of physical control
- Data separation / protection
- Authentications
- ……



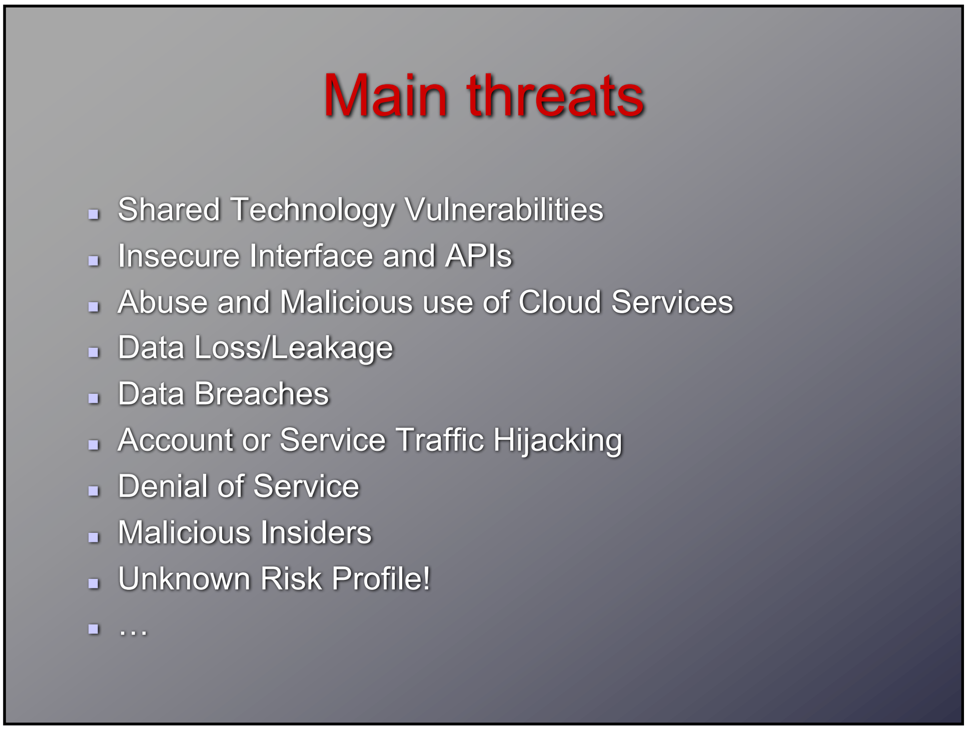
Security issues

- *Key issues*
  - Country or jurisdiction
  - Multitenant risks
  - Malicious insiders
  - Vendor lock in
  - Cloud-based provider failing
- Relevant components
  - Processing infrastructure
  - Provisioning services
  - Data Storage services
  - Support services
  - Network and perimeter



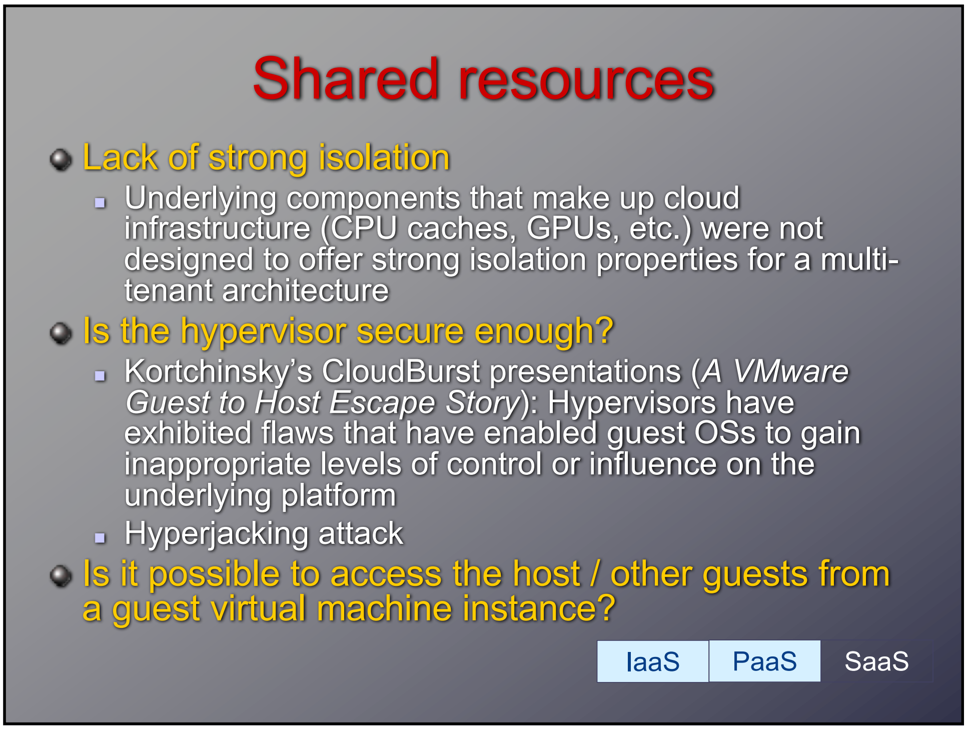
On the plus side…

- Data fragmentation and dispersal
- Hypervisor protection against network attacks
- Fault tolerance, better reliability
- Real-time detection of system tampering
- Greater investment in security infrastructure
- On-demand security controls
- Immediate deployment of software patches
- Hardware and software redundancy
- Timeliness of incident response
- Specialists instead of personnel



Main threats

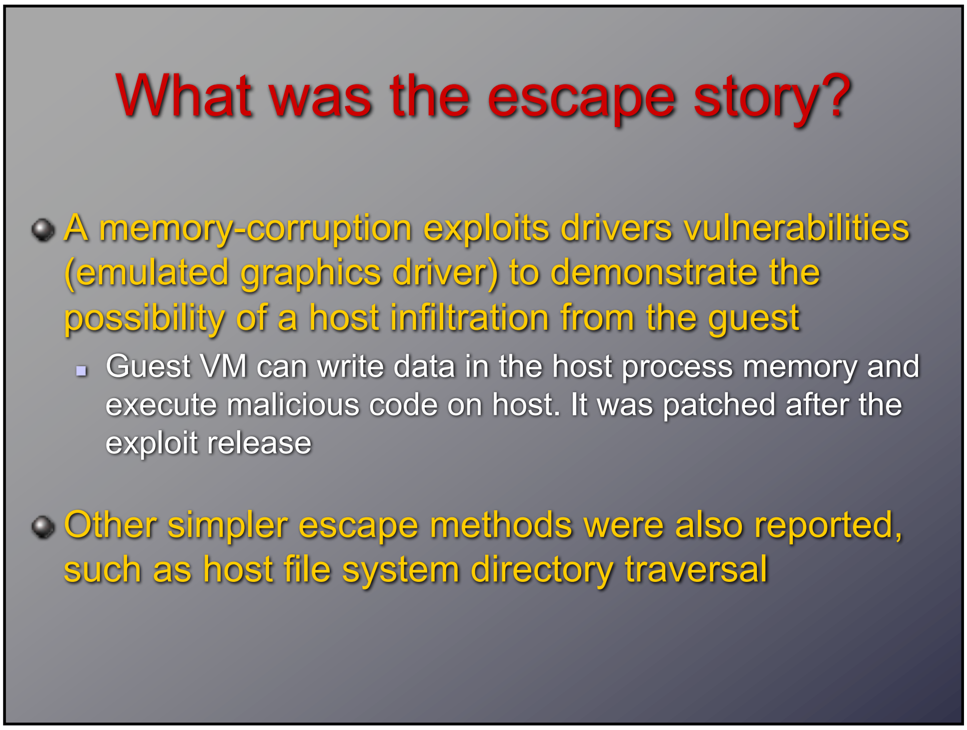
- Shared Technology Vulnerabilities
- Insecure Interface and APIs
- Abuse and Malicious use of Cloud Services
- Data Loss/Leakage
- Data Breaches
- Account or Service Traffic Hijacking
- Denial of Service
- Malicious Insiders
- Unknown Risk Profile!
- …



Shared resources

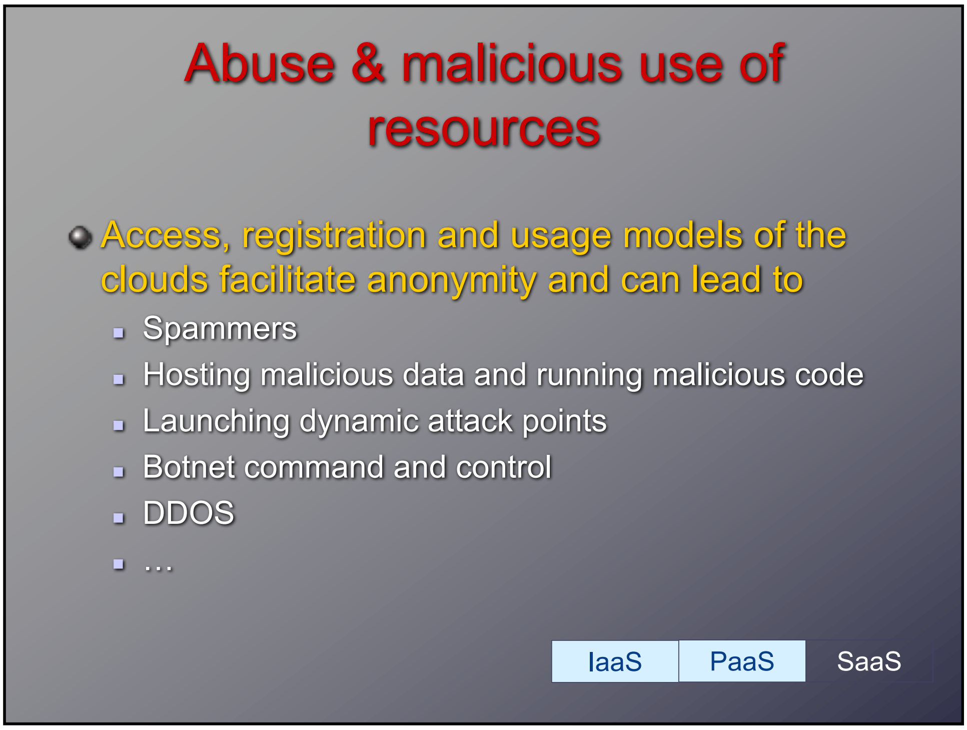
- Lack of strong isolation
  - Underlying components that make up cloud infrastructure (CPU caches, GPUs, etc.) were not designed to offer strong isolation properties for a multi-tenant architecture
- Is the hypervisor secure enough?
  - Kortchinsky's CloudBurst presentations (*A VMware Guest to Host Escape Story*): Hypervisors have exhibited flaws that have enabled guest OSs to gain inappropriate levels of control or influence on the underlying platform
  - Hyperjacking attack
- Is it possible to access the host / other guests from a guest virtual machine instance?

IaaS PaaS SaaS



What was the escape story?

- A memory-corruption exploits drivers vulnerabilities (emulated graphics driver) to demonstrate the possibility of a host infiltration from the guest
  - Guest VM can write data in the host process memory and execute malicious code on host. It was patched after the exploit release
- Other simpler escape methods were also reported, such as host file system directory traversal



Abuse & malicious use of resources

- Access, registration and usage models of the clouds facilitate anonymity and can lead to
  - Spammers
  - Hosting malicious data and running malicious code
  - Launching dynamic attack points
  - Botnet command and control
  - DDOS
  - …

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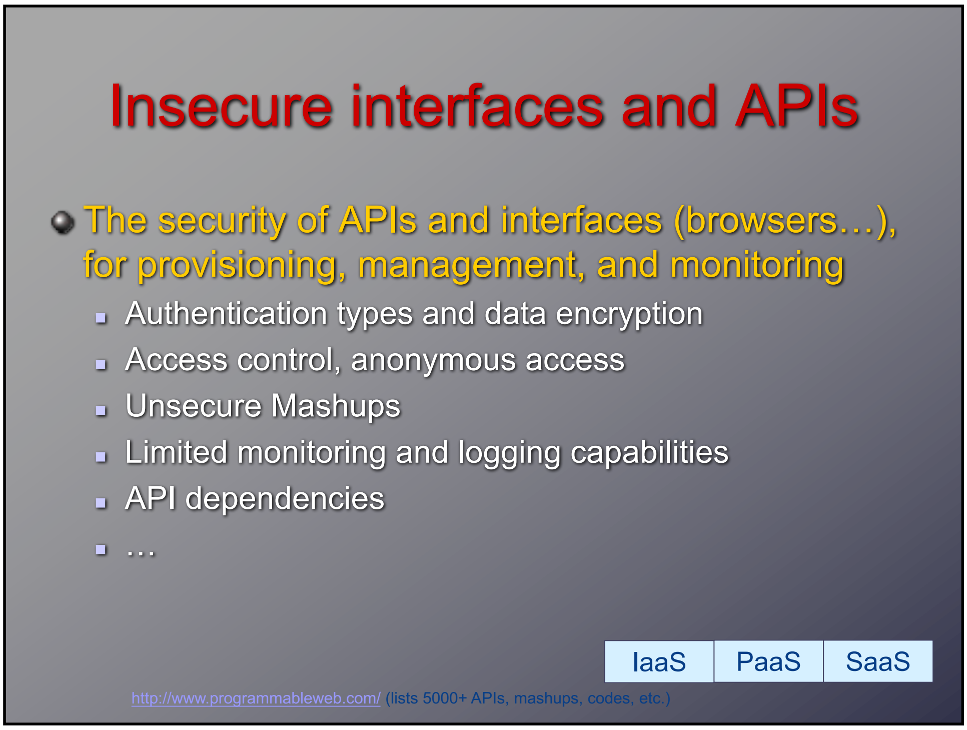
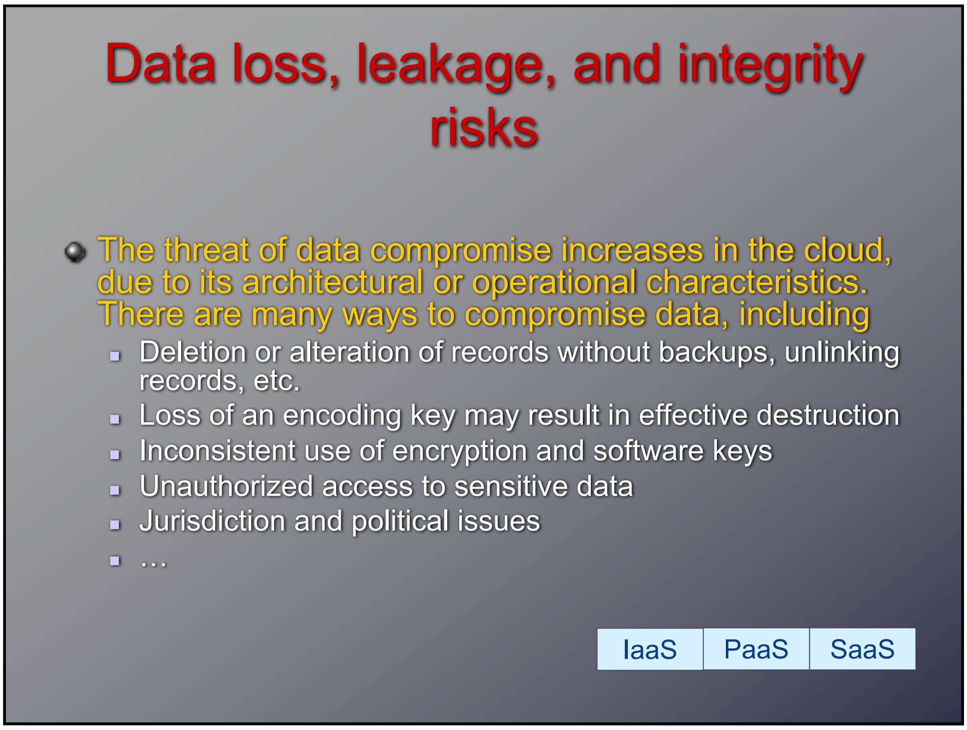


Insecure interfaces and APIs

- The security of APIs and interfaces (browsers…), for provisioning, management, and monitoring
  - Authentication types and data encryption
  - Access control, anonymous access
  - Unsecure Mashups
  - Limited monitoring and logging capabilities
  - API dependencies
  - …

IaaS PaaS SaaS

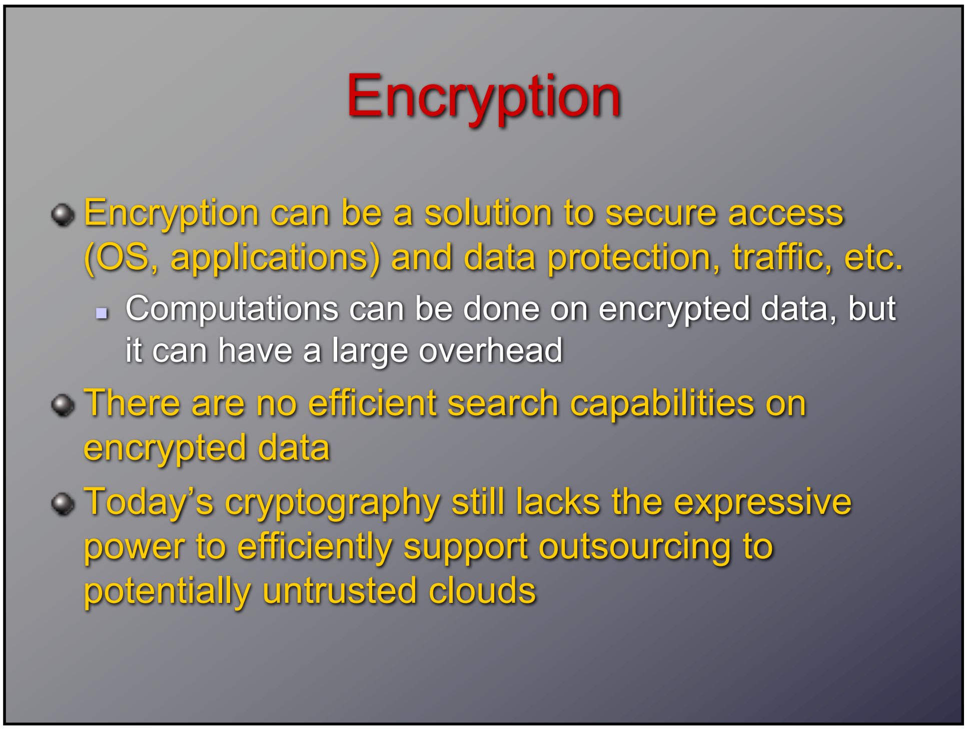
http://www.programmableweb.com/ (lists 5000+ APIs, mashups, codes, etc.)



Data loss, leakage, and integrity risks

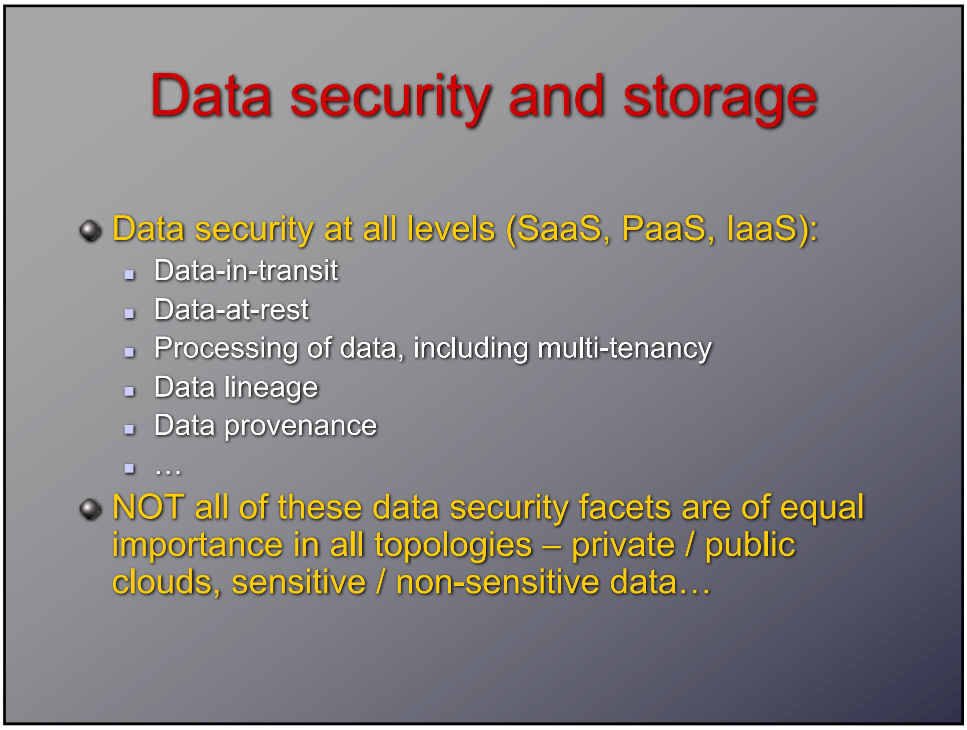
- The threat of data compromise increases in the cloud, due to its architectural or operational characteristics. There are many ways to compromise data, including
  - Deletion or alteration of records without backups, unlinking records, etc.
  - Loss of an encoding key may result in effective destruction
  - Inconsistent use of encryption and software keys
  - Unauthorized access to sensitive data
  - Jurisdiction and political issues
  - …

IaaS	PaaS	SaaS



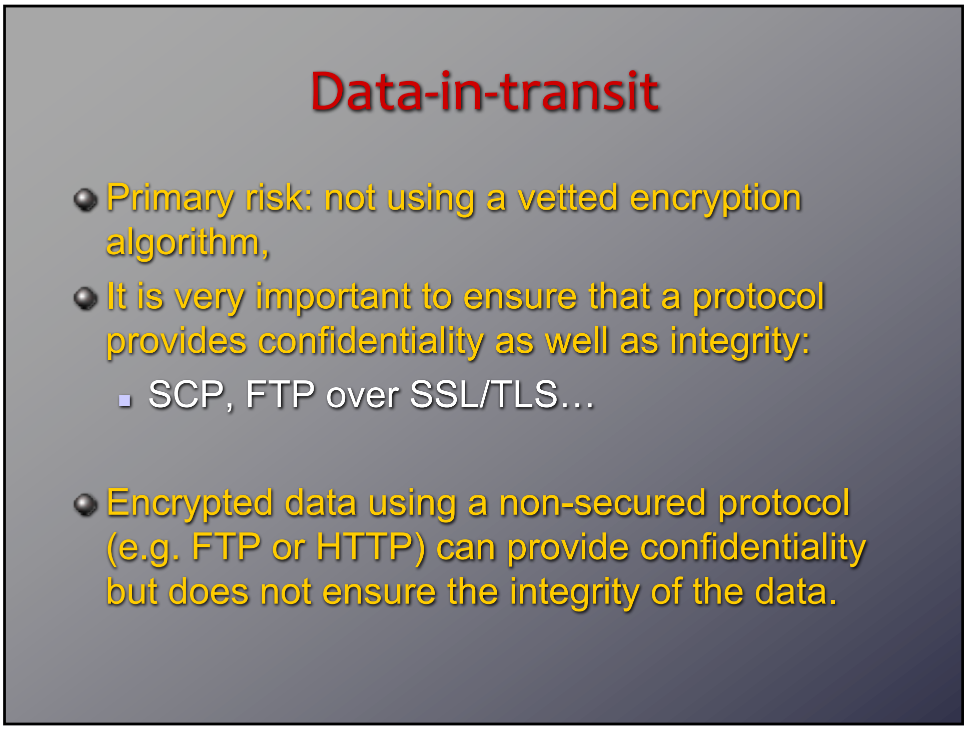
Encryption

- Encryption can be a solution to secure access (OS, applications) and data protection, traffic, etc.
  - Computations can be done on encrypted data, but it can have a large overhead
- There are no efficient search capabilities on encrypted data
- Today's cryptography still lacks the expressive power to efficiently support outsourcing to potentially untrusted clouds



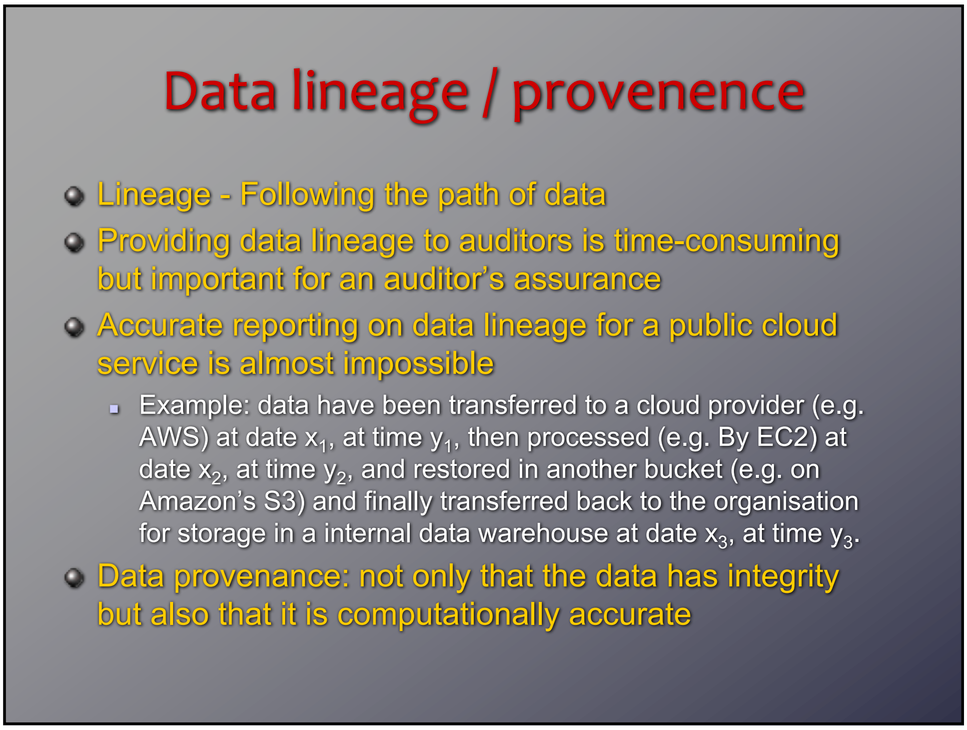
Data security and storage

- Data security at all levels (SaaS, PaaS, IaaS):
  - Data-in-transit
  - Data-at-rest
  - Processing of data, including multi-tenancy
  - Data lineage
  - Data provenance
  - …
- NOT all of these data security facets are of equal importance in all topologies – private / public clouds, sensitive / non-sensitive data…



Data-in-transit

- Primary risk: not using a vetted encryption algorithm,
- It is very important to ensure that a protocol provides confidentiality as well as integrity:
  - SCP, FTP over SSL/TLS…
- Encrypted data using a non-secured protocol (e.g. FTP or HTTP) can provide confidentiality but does not ensure the integrity of the data.



Data lineage / provenence

- Lineage - Following the path of data
- Providing data lineage to auditors is time-consuming but important for an auditor's assurance
- Accurate reporting on data lineage for a public cloud service is almost impossible
  - Example: data have been transferred to a cloud provider (e.g. AWS) at date x_1, at time y_1, then processed (e.g. By EC2) at date x_2, at time y_2, and restored in another bucket (e.g. on Amazon's S3) and finally transferred back to the organisation for storage in a internal data warehouse at date x_3, at time y_3.
- Data provenance: not only that the data has integrity but also that it is computationally accurate

Account or Service Hijacking

- As applies to traditional systems and web services
  - Phishing / Stolen credentials
  - Data manipulation
  - Services redirection
  - Return falsified information
  - Exploitation of software vulnerabilities
  - …

IaaS	PaaS	SaaS

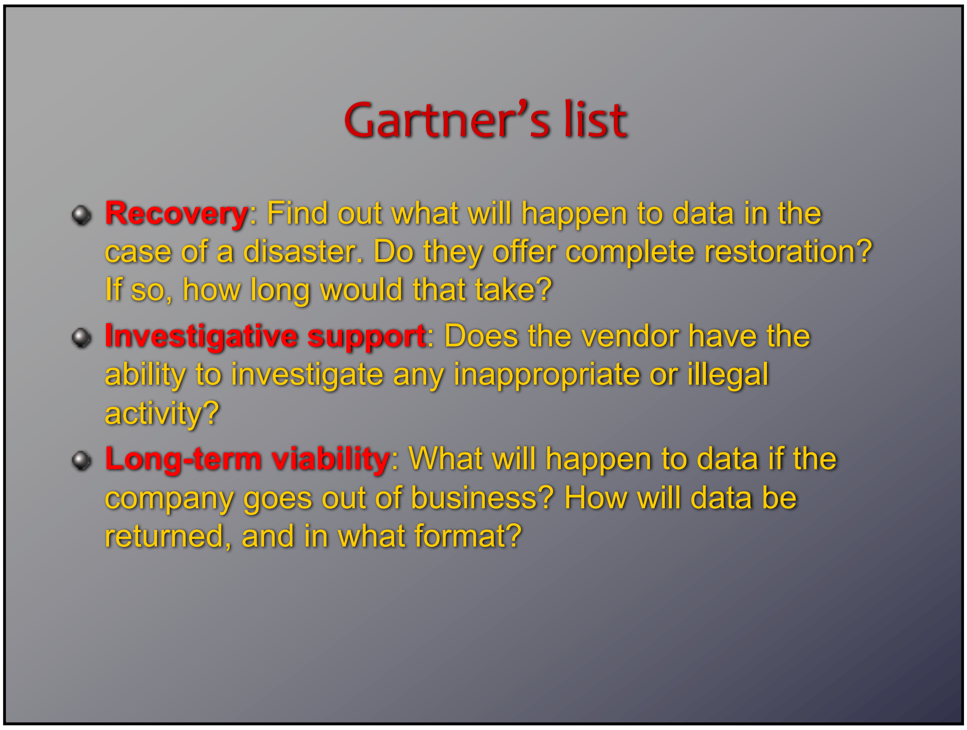
Unknown risk profile!

- Applications depends (critically!) on the trustworthiness of your cloud providers
- Security by obscurity may be low effort, but it can result in unknown exposures. It may also impair the in-depth analysis required highly controlled or regulated operational areas
- Information about who is sharing your infrastructure, network intrusion logs, redirection attempts and/or successes, and other logs, may all be pertinent

IaaS	PaaS	SaaS

Gartner's list

- **Privileged user access**: Inquire about who has specialised access to data, and about the hiring and management of such administrators.
- **Regulatory compliance**: Make sure that the vendor is willing to undergo external audits and/or security certifications.
- **Data location**: Does the provider allow for any control over the location of data?
- **Data segregation**: Make sure that encryption is available at all stages, and that these encryption schemes were designed and tested by experienced professionals.



Gartner's list

- **Recovery**: Find out what will happen to data in the case of a disaster. Do they offer complete restoration? If so, how long would that take?
- **Investigative support**: Does the vendor have the ability to investigate any inappropriate or illegal activity?
- **Long-term viability**: What will happen to data if the company goes out of business? How will data be returned, and in what format?