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In Context
Context-Aware systems provide value-added functionality to business applications by capturing, integrating, and consolidating intelligence about users and their endpoint devices from various points in the network. They are highly user responsive and can cope well in dynamic execution environments.

A ubiquitous learning environment automatically senses the type of work you’re doing and displays information relevant to that task, without requiring you to search for information and store the results.

Context learning is characterized by intuitive ways for identifying
- Right **Collaborators**
- Right **Contents**
- Right **Services**
- Right **Place**
- Right **Time**
To match sensory information with contexts, a mapping has to be performed. These perception tasks are done by using means of **machine learning** and **data mining**.
Examples

Source: IBM; Infor ming.le; https://www.appearnetworks.com
Open Source
Postgres

- Postgres (also known as PostgreSQL) is the world’s most advanced open source relational database management system (RDBMS) with the primary function to store data securely, and allow for its retrieval at the request of other software applications.

- Postgres was created at University of California, Berkeley by Michael Stonebraker who started Postgres in 1986 as a follow-up project to its predecessor, Ingres. Postgres used QUEL query language until 1994. In 1996, the first official open-source version of PostgresSQL was released that supports structured query language (SQL).

- Major open source peers are MySQL, MariaDB, and SQLite and major commercial peers are Oracle Database, Microsoft SQL, IBM DB2, SAP Adaptive Server and Teradata.

- Supports almost all relational database features and certain critical features are similar to Oracle DB and others.

- Runs on all major operating systems, including Linux, UNIX (AIX, BSD, HP-UX, SGI IRIX, Mac OS X, Solaris, Tru64), and Windows.

- License for software is available to all at no charge and strong support offerings also available.

Source: PostgreSQL; DB-Engines
Linux

- Linux is a freely distributable, cross-platform operating system based on Unix that enables applications and the computer operator to access the devices on the computer to perform desired functions.

- Linux was first released on October 5, 1991 by Linus Torvalds.

- 95% of super computers and 36% of public servers run on Linux and many of the popular Web 2.0 services on the Internet, such as Twitter, Linked In, YouTube, and Google all rely on Linux as their operating system.

- Linux can be installed on PCs, laptops, netbooks, mobile and tablet devices, video game consoles, servers, and supercomputers.

- Important features of Linux Operating System are:
  - Works on different types of hardwares in same way
  - Freely available and community based project
  - Multiple users can access system
  - Multiple applications can run at same time
  - Hierarchical file system
  - Provides user security with authentication features

Source: Linux; Linux Foundation
Apache ESB (Enterprise Service Bus)

- Established in 1999, Apache Software Foundation (ASF) provides software for the public good and funded by individual donations and corporate sponsors.

- More than 500 individual members and 4,500 committers successfully collaborate to develop freely available enterprise-grade software, benefiting millions of users worldwide. All-volunteer board oversees more than 350 leading Open Source projects, including Apache HTTP Server, the world's most popular Web server software.

- Apache ESB projects includes Apache Synapse, Apache ServiceMix, and Apache Camel.

- Apache Synapse is a easy-to-use and lightweight ESB which offers a wide range of management, routing and transformation capabilities with support for HTTP, SOAP, SMTP, JMS, FTP and file system transports.

- Apache ServiceMix is a flexible, open-source integration container that unifies the features and functionality of Apache ActiveMQ, Camel, CXF, and Karaf into a powerful runtime platform to build own integrations solutions.

- Apache Camel is an open-source framework to exchange, route and transform data using various protocols.

Source: Apache
User Experience
User Experience

User Experience (abbreviated as UX) refers to every aspect of the user’s interaction with application and contributes to the user’s overall perception.

Elements of User Experience
- Layout
- Visual clarity
- Content
- Functionality
- Consistency
- Navigation
- Interaction

Significance
- Increased staff productivity
- Increased user satisfaction
- Decreased training and support costs

Source: [http://uxpa.org](http://uxpa.org), Industry news
SoHo experience refers to the holistic, user-centered design vision with three basic principles:

- **Meaningful**: Deliver information at the right time to enable faster, better decision making
- **Natural**: Intuitive and self-explanatory interface
- **Enjoyable**: Push past the functional, and create emotionally powerful experiences that inspire

### SoHo Vision

<table>
<thead>
<tr>
<th>User-centered Design Process</th>
<th>Design with Mobile in Mind</th>
<th>Accessible &amp; Inclusive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure solving right problems in the most effective way</td>
<td>Create responsive and adaptive experiences across devices and environments</td>
<td>Ensure applications are usable by all people of all activities</td>
</tr>
<tr>
<td>Tailor-made experience for specific roles and tasks</td>
<td>Optimized controls for more seamless input on tablets and phones</td>
<td>Universal and regulated compliance standards</td>
</tr>
</tbody>
</table>

Source: Infor Sales Portal
**HTML5**

**HTML5** is a markup language used for **structuring** and **presenting content** on the World Wide Web. This is the **fifth revision** of the HTML standard since the inception of the World Wide Web.

**Video and audio support without third party plug-ins:**
HTML5 provides native support for audio and video elements. HTML5 embedded video and audio files use less battery on mobile devices.

**Mobile ready tool for developing mobile sites and apps:**
With Adobe announcing end of support for mobile Flash, can count on HTML5 for mobile web app development.

**Geolocation support:**
Makes location, whether generated by GPS or other methods, directly available to any browser based application.

**Multi-platform and multi-browser support:**
Built to make things easier and more cross browser friendly. Content to be accessible anytime and anywhere.

**Semantic enrichment:**
Provides new, meaningful ways to organize content and makes it easier to present additional relevant results based on context.

Infor Ming.le brings social collaboration, analytics and business process management into one single platform

**Guiding Principles:**

**Act Faster:** Tasks are sorted by time, escalation and category such that users can quickly approve or reject

**Contextual Work:** Context apps such as Twitter tracker, Package tracker allow task categorization

**Analytics at the Core:** Captures end-to-end business collaboration between structured and unstructured business processes

**Work Anywhere:** Accessible across platforms to support user tasks

**Ming.le Benefits:**

- Increase productivity
- Retain Vital Corporate Knowledge
- Attract and Retain Top Talent
- Improve and Speed Decision Making

Source: Infor Sales Portal
Mobile applications are particularly good at providing context, both location and activity of the user, key components to better experiences and decision making.

Mobility offer companies the chance to maximize the value made in other technology investments such as cloud, big data and other disruptive technologies.

**Key Considerations for Mobility:**

**The right cases for mobility:**
Not every application should be mobilized, but mobilizing the right parts and pieces benefits all phases of the enterprise value chain.

**Enterprise vs. BYOD (Bring Your Own Device):**
Varying mobile management policies and governance, especially in highly regulated industries.

**Beyond single apps:**
Rather than developing single apps in a knee-jerk response, apps should be developed as suites of interconnected components that can fulfill specific tasks and work together to support users and processes.

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**Why Mobile Enterprise Applications?**

Q: Select the most important benefit that your organization expects to gain from current or future mobile enterprise application deployments.

- Improve/enhance worker productivity
- Increase sales/revenue
- Improve customer service/support
- Improve competitive advantage/market share
- Provide ease of information access
- Enhance portability within the office or work environment
- Decrease costs
- Increase customer retention
- Speed the sales process
- Offer employees more flexibility
- Provide perception of an advanced company to customers
- Improve field service response time
- Eliminate paperwork

**Productivity**
- Information
- Context
- Ability to Act

Source: IDC’s 2014 MEA Survey
N=407

Source: https://www.enterpriseirregulars.com/74514/biggest-benefits-mobile-enterprise-applications/
Responsive Design

The goal of **responsive design** is to build web applications that detect the user’s screen size and orientation and change accordingly by making use of flexible layouts and images.

**Advantages**

- **Less maintenance**: one site, instead of multiple sites to design and maintain.
- **Better search engine optimization (SEO)**: one site means one set of URLs, which makes SEO more manageable.
- No need to worry about whether or not your site will be compatible with the dozens of new devices that continually hit the market.

**Disadvantages**

- **Implementation** can take longer than expected.
- Technology is still developing.
- Since images are just scaled down, rather than resized, this can negatively affect page load time, upsetting visitors.

Source: http://www.webjuicers.com/
IAPI
Stateless Applications

The trend toward cloud computing is driving interest in stateless apps

- Stateless protocol is a communications protocol that treats each request as an independent transaction that is unrelated to any previous request so that the communication consists of independent pairs of request and response.

- In contrast, a protocol which requires keeping of the internal state on the server is known as a stateful protocol.

- A stateless app is an application program that does not record data generated in one session – such as information about user settings and events that occurred -- for use in the next session with that user.

- “Stateless model facilitates much greater scalability than conventional computing and can be used in conjunction with virtualization to achieve maximum data center utilization. Stateless will emerge as a core, basic tenet of what's in the cloud”, Jeffrey Birnbaum, Merrill Lynch's chief technology architect.

Sources: https://en.wikipedia.org/wiki/Stateless_protocol; http://whatis.techtarget.com/definition/stateless-app;
Stateless vs. Stateful Applications

**Stateless Service**
- Subsequent requests to the service depend on the results of the first request
- Requires deployment of more application servers and webservers in the system
- A single action typically involves more than one request
- Resource allocation needs meticulous planning

**Stateful Service**
- Provides a response after the request
- Requires no further attention
- A perfect load balance for redundant services is needed

Sources:
- http://www.authorstream.com/Presentation/sarajstanford-2552022-cloud-computing/
Representational State Transfer (REST)

- REST is a simple **stateless** architecture that generally runs over HTTPS/TLS

- The REST style emphasizes that interactions between clients and services are enhanced by having a limited number of operations

- REST’s decoupled architecture, and lighter weight communications between producer and consumer, make REST a **popular building style** for **cloud-based APIs**, such as those provided by Amazon, Microsoft, and Google

- When Web services use REST architecture, they are called RESTful APIs (Application Programming Interfaces) or REST APIs

- The new style of "RESTful" interfaces are more lightweight, well-suited, and supported by modern programming languages and frameworks

Source: [http://searchsoa.techtarget.com/definition/REST](http://searchsoa.techtarget.com/definition/REST)
How does REST work?

Example for a successful REST call
- No application state is stored on the client
- The client uses hypermedia links to instruct the server what to execute
- The server performs the GetCustomer operation and returns XML as requested

How does RESTful services get by without maintaining state?
- By leveraging hypermedia as the engine of application state (HATEOAS)
- HATEOAS means that state is represented by a series of links (URIs) much like following the site map of a website by following the URLs

Source: http://www.kavistechnology.com/blog/restful-services-the-key-to-cloud-computing/
Advantages of REST

- RESTful Web services are easy to leverage by most tools, including those that are free and inexpensive.

- REST is becoming the dial tone for systems interaction, including the use of RESTful Web services, which are, for the most part, the way cloud providers externalize their cloud services.

- **Reduction in the learning curve**: Developers are able to make use of REST from within applications faster than they can with SOAP (Simple Object Access Protocol) that saves time and money on training.

- REST uses a smaller message format than SOAP. SOAP uses XML for all messages, which makes the message size much larger, and thus less efficient. This means REST provides better performance, as well as lowers costs over time. Moreover, there is no intensive processing required, thus it’s much faster than traditional SOAP.

- REST is designed for use over the Open Internet/Web. This is a better choice for Web scale applications, and certainly for cloud-based platforms.

- Moving forward, REST is likely to continue its growth as enterprises seek to provide open and well-defined interfaces for application and infrastructure services. The growth of public and private cloud computing is driving much of this demand, and will continue to drive growth into the future.
Application Programming Interface (API)

A set of routines, protocols, and tools for building software applications.

Cloud Storage API
- A cloud storage API is a gateway or interface that provides direct and indirect cloud infrastructure and software services to users. It connects a locally-based application to a cloud-based storage system, so that a user can send data to it and access and work with data stored in it.

- A cloud API is the core component behind any public cloud solution and is generally based primarily on the REST and SOAP frameworks, as well as cross-platform and vendor specific APIs.

Infor XI
- Infor XI manages single set of APIs to support its cloud suite services.

- API-based web applications of Infor makes integration of its Infor applications with other solutions easier compared to current legacy approaches that are batch based and hard to implement.

- This approach will also allow customers to open up their capabilities and assets via APIs to business partners that want to digitally innovate on their ERP platform.

Sources: https://www.techopedia.com/definition/26437/cloud-application-programming-interface-cloud-api, and Infor.com
Cloud Architected
What is it?
- Cloud computing refers to storing and accessing data and programs over the Internet instead of one’s own computer
- Cloud computing lets you keep information on a remote server (the cloud), instead of a local computer

Features:
- Cloud services are available on-demand and often bought on a "pay-as-you go" or subscription basis
- Data is managed by third party providers in data centers located across the world

Advantages:
- Lower upfront costs and reduced infrastructure costs
- Scale up or down at short notice
- Pay on subscription basis
- Strict adherence to committed levels of service (SLAs)
Multi-tenancy

What is it?

- Multi-tenancy is an architecture in which a single instance of a software application serves multiple customer organizations.
- Each customer is called a tenant. Tenants may be given the ability to configure some parts of the application, such as color of the user interface (UI) and business rules, but they cannot customize the application's code.
- Each tenant sees their own organization's data and customizations, and are walled off from the other tenants' data and customizations.

Significance:

- Decreased Costs: Reduces the cost of ownership for tenants given the lack of code modifications and the sharing of infrastructure of costs among of tenants.
- Lower Risk: Lack of code modifications significantly reduces the complexity of implementation and ensures faster time to value.

Features:

- Centralization of infrastructure in areas with lower costs (such as real estate, electricity, etc.)
- Peak-load capacity increases (users need not plan for highest possible loads).
- Utilization and efficiency improvements for systems that would otherwise be utilized only 10-20%.
Amazon Web Services (AWS)

What is it?
A secured cloud services platform, offering compute power, database storage, content delivery and other functionality to help businesses scale and grow

- Powers hundreds of thousands of businesses in 190 countries around the world
- With data center locations in the U.S., Europe, Brazil, Singapore, Japan, and Australia, and customers across all industries

Benefits of AWS?
- Low Cost: Offers low, pay-as-you-go pricing with no up-front expenses or long-term commitments
- Agility and Scalability: Allows to quickly innovate, experiment and iterate
- Open and Flexible: Helps in choosing the development platform or programming model that makes the most sense for business
- Secure: With multiple layers of operational and physical security to ensure the integrity and safety of your data

Source: https://aws.amazon.com/about-aws/
Auto Scaling*

What is it?
Auto scaling is a method used in cloud computing, whereby the amount of resources or instances in a server, typically measured in terms of the number of active servers, scales (increases or reduces) automatically based on the load.

Auto Scaling helps in ensuring the required number of instances (i.e. computing power) are available to handle the load for running applications.

Features:
- Increases instances seamlessly and automatically when demand increases
- Shutdown unused cloud instances automatically and save money when demand subsides

Benefits:
- Better fault tolerance: Auto Scaling can detect when an instance is unhealthy, terminate it, and launch an instance to replace it
- Better availability: Can configure Auto Scaling to use multiple Availability Zones. If one Availability Zone becomes unavailable, Auto Scaling can launch instances in another one to compensate
- Better cost management: Auto Scaling can dynamically increase and decrease capacity as needed. Because payment will be made on the instances used, can save money by launching instances when they are actually needed and terminating them when they aren't needed

* - Feature of AWS platform

What is it?

- "Provisioning" specifically refers to the act of setting up or configuring the necessary hardware and software to activate a customer's purchased services
- Automated provisioning, also called self-service provisioning, is the ability to deploy, update, and repair application infrastructure using only pre-defined and automated procedures

Benefits:

- **One single, connected platform**: Instead of a manual process driven by paperwork and/or disconnected software and product catalogue systems, a single and connected platform that manages everything
- **Instant propagation**: Changes are distributed and synchronized in real time across all resources

* - Feature of AWS platform
Zero Downtime Upgrades

What is it?

- Downtime is the period during which the system upgrade tools perform the upgrade process, with the system being unavailable for end users.
- Zero Downtime is an upgrade method that ensures no service disruption to the user during the time of period of upgrade process.

Benefits of Zero Downtime:

To provide effective and non-disruptive deployment and rollback, a Platform as a Service (PaaS) should possess these two characteristics:

- Best utilization of resources to minimize deployment downtime as much as possible
- Instant deployment and rollback

* - Availability depends on platform and also varies between different Infor products. Please check with solution architects prior to customer communications.
Commerce enabled computer networks allow businesses to collaborate, connect and integrate to a trading partner through a single platform in the cloud.

These networks help simplify business processes such as sourcing, trade finance and logistics operations while enhancing supply chain visibility and streamlining inter-enterprise commerce.

Benefits that can be achieved include easy connectivity with partners, efficient cash-flow management, cost savings, expense management, and revenue enhancement.

Some of the prime examples of commerce computer networks: **GT Nexus (Infor)**, Ariba (SAP), Concur (SAP).

Most networks are pre-wired with commerce integration capabilities which facilitate them to undertake financial and business activities.

This integration allows the organization to perform their regular business activities through their computer network in a “ready to deliver” mode.

This helps to save on time and integration costs.

Some network providers not only give access through web, but also on smartphones and tablet devices.

Computer networks provide easy collaboration of software applications, technology and partner community to give network advantage to companies.

These networks offer in a single platform the ability to manage orders, shipments, products, invoices, payments and other complex and dynamic business objects.

This eliminates time consuming, error-prone and costly paper-based processes and enables safe, risk free transactional payment activities.

It is then possible to optimize business operations and spend coverage for ERP and back office systems, resulting in improved supplier connectivity, cost savings and control on goods and services.

Integration
What is an Enterprise Service Bus?

- Enterprise Service Bus (ESB), is a set of rules and principles for integrating numerous applications together into a common infrastructure that avoids many of the disadvantages of a Point-to-Point integration architecture.
- It assists in application integration and provides the necessary infrastructure to implement routing, translation, and other integration facilities.
- It simplifies integration and flexible reuse of business components using standard service-oriented architecture (SOA), providing a responsive, low-cost, high-impact framework for the technology.
- It provides one of the keys to help achieve the goals of a service oriented architecture. It is at the heart of service oriented architecture, reducing the number, size, and complexity of interfaces and connections that must be defined and maintained over the entire life of the application infrastructure.

Source: IBM, Oracle and MuleSoft
Point-to-Point Application Integration

• Easiest and cheapest approach when connecting your first few applications – already used by many Infor customers and prospects

• One dedicated connector between each pair of connected applications (e.g., A↔B, A↔C, B↔C in Fig. 1)

• Each connector requires detailed knowledge of both connected applications, and must transform in-flight data as required in order for applications to “understand” each other

• For each new application added to the integration network, a new connector must be developed for every existing application that will be integrated with the new one (e.g., if Application D is added to Fig. 1, as many as 3 new connectors may be required: D↔A, D↔B, and D↔C)

• More significantly, changes to any one application’s API may require modifications to every connector for the respective application pair

• Complexity increases dramatically when the number of connected applications increases (see Fig. 2)

(Return to ‘Enterprise Service Bus’ topic)
Capabilities of Enterprise Service Bus

Enterprise services bus (ESB)

- Routing
- Security
- Transaction management
- Message transformation
- Message enhancement
- Protocol transmission
- Service mapping
- Message processing
- Service orchestration
- Process choreography

Source: Oracle Corporation
Greater flexibility and responsiveness to changing requirements of the business
In software architecture, publish–subscribe is a messaging pattern where senders of messages, called publishers, do not program the messages to be sent directly to specific receivers, called subscribers, but instead characterize published messages into classes without knowledge of which subscribers, if any, there may be. Similarly, subscribers express interest in one or more classes and only receive messages that are of interest, without knowledge of which publishers, if any, there are.

**Key Characteristics:**
- Publisher and subscriber do not know about the existence of one another
- Third component, called broker, which is known by both the publisher and subscriber, filters all incoming messages and distributes them
- Broker filters all messages based on subject, content and type so each subscriber only gets messages it is interested in
- Subscribers typically receive only a subset of the total messages published
- Provides a greater scalability than the traditional client-server approach
- Decoupling of publisher and receiver based on three dimensions: Space, Time, and Synchronization

Source: Wikipedia and MQTT(formerly MQ Telemetry Transport)
A message channel is a logical channel which is used to connect the applications. One application writes messages to the channel and the other one (or others) reads that message from the channel. Message queue and message topic are examples of message channels.

It has one input channel that splits into multiple output channels, one for each subscriber. This type of channel broadcasts an event or notification to all subscribed receivers. This is in contrast with a point-to-point channel. Each subscriber receives the message once and next copy of this message is deleted from channel.

The Business Object Document (BOD) is a common horizontal message architecture to achieve interoperability.

BODs are business messages or business documents that are exchanged between software applications or components; between companies; across supply chains; and between supply chains.

The BOD Message Architecture is independent of the communication mechanism. It can be used with simple transport protocols such as HTTP and SMTP but it also can be used in more complex transport protocols such as SOAP, ebXML Transport and Routing, or any other Enterprise Application integration system.

Source: HR-XML Consortium
Basic BOD Architecture Applied to HR

In an actual BOD, the generic names (BusinessObjectDocument, Verb, Noun) are replaced by specific names. For example, the figure below shows a simplified representation of ProcessCandidate BOD, combining the OAGIS verb "oa:Process" with HR-XML's Candidate noun. Note that the use of the "oa:" prefix on the Process verb indicates the element is within the OAGIS namespace.

As shown in the diagram above, the BOD structure contains an application area and a data area. As shown in the diagram right, the verb and noun are part of the data area.

Source: HR-XML Consortium
Science
Big Data

What is it?
- Big data is a term that describes very large volumes of data - both structured and unstructured – that can be analyzed for insights that lead to better decision making and strategic business moves

Why is Big Data Important?
- Determining root causes of failures, issues and defects in near-real time
- Detecting fraudulent behavior before it affects the organization
- Increasing retail sales by analyzing consumer purchasing patterns

3V’s of Big Data:
- Big data can be characterized by 3V’s:
  - The extreme volume of data
  - The wide variety of types of data
  - The velocity at which the data must be processed

Source: SAS Institute Inc. – Website, SearchCloudComputing.com
Business Drivers Behind The Push Towards Big Data

Desire to gain a better understanding of customers (companies want to find ways to reduce customer churn and improve profit per customer)

Quest for operational efficiency (companies want to gain complete view into business processes to improve efficiency and flow)

Need for risk management (companies want to improve IT security and reduce fraud, such as spotting advanced network threats and transaction anomalies)

Opportunity to innovate (companies want to discover new products, services, and business opportunities)

Source: White Paper - Big Data, Big Demands
Business Vault / Sky Vault

Meets Enterprise Requirement For Big Data

What is it?
Business Vault is an operational data store that collects, stores, and manages information published to ION to help improve decision making and business insight.

Significance:
Business Vault, a big data initiative that leverages Infor ION, micro-vertical expertise, and dashboards developed by Infor ION BI experts. It is the foundation of real-time big data that can be used for business intelligence.

Features:
- **Easier search:** When data resides in one place, there's no need to index the transactional systems
- **Better reporting:** Business Vault features a master data reference to ensure that the data is always consistent and relevant across entire organization
- **Up-to-date data:** Business Vault uses event-driven synchronization to ensure that data is up-to-date as soon as each transaction occurs in the originating system

Source: Infor Website and Sales Portal
Analytics information is structured and published to target systems
Predictive Analytics

Meets Enterprise Requirement For Big Data

What is it?
- Predictive analytics is the practice of extracting information from existing data sets in order to determine patterns and predict future outcomes and trends
- It forecasts what might happen in the future with an acceptable level of reliability, and includes what-if scenarios and risk assessment

Significance:
- Predictive analytics is an enabler of big data: Businesses collect vast amounts of real-time customer data and predictive analytics uses this historical data, combined with customer insight, to predict future events
- Predictive analytics enable organizations to use big data (both stored and real-time) to move from a historical view to a forward-looking perspective of the customer

Features:
- **Deploy insights into business processes**: Build and deploy predictive models directly into business processes
- **Hands-on predictive analytics**: Easy to use, powerful tools of all phases of analytical projects
- **Full breadth of analytics techniques**: Use multi-faceted predictive analytics capabilities in a single solution
- **Embrace and extend open-source**: Amplify the power of analytics by leveraging open source big data tools such as R and Python

Source: Webopedia
Scale out Storage

Meets Enterprise Requirement For Big Data

What is it?
- Scale-out storage is a new category of storage system that addresses the storage challenges created by legacy systems in the modern, dynamic data center

Significance:
- The goal of scale-out storage is to allow the user to grow storage resources in-line with data center demands as business needs change over time
- The key for IT storage managers for using these storage systems is to meet the challenges and address infrastructure growth without the need for additional IT staff; in short, to keep costs down but services up

Scale-Out Storage Software:
Scale-out storage systems are typically made up of individual storage components called “nodes”. The key ingredient is the software that enables these nodes to be interconnected and referenced as a single object by the storage administrators and connecting servers, essentially making the nodes into a single cluster or grid.

Source: Storage Switzerland – Article, Mitigating Risk With Scale-Out Storage
# Scale out Storage Platform

Meets Enterprise Requirement For Big Data

**Built to:**
- Simplify management of the big data storage infrastructure
- Deliver a flexible and scalable platform for Big Data
- Increase efficiency and reduce costs

**Ideal for:**
- Enterprise Companies

<table>
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<tr>
<th>Simplicity</th>
<th>Scalable</th>
<th>Efficiency</th>
<th>Data Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Streamline the management of a massive data environment without additional IT staff</td>
<td>• Delivers enormous room for growth and accommodates very large and growing data stores including the ability to easily add additional storage resources as needed</td>
<td>• Reduces capital expenditure and operating costs</td>
<td>• Highly resilient and offer robust options to meet data availability requirements including fast, efficient data backup and recovery</td>
</tr>
<tr>
<td>• Provides enormous room for unstructured, big data storage and analytics needs</td>
<td>• Scales capacity and performance to meet the specific business requirement, all without any additional IT burden</td>
<td>• Optimizes resources and provides automated storage tiering for increased performance and economy</td>
<td>• Provides write once, read many (WORM) protection to prevent accidental, premature, or malicious alteration of critical data.</td>
</tr>
<tr>
<td>• Scales capacity and performance without incurring an increase to OPEX</td>
<td></td>
<td>• Set policies to automatically move inactive data to more cost-effective storage</td>
<td></td>
</tr>
</tbody>
</table>

Source: White Paper - Big Data, Big Demands
Data Optimization:

- An important aspect in database management in particular and data warehouse management in general
- Most commonly known to be a non-specific technique used by several applications in fetching data from data sources so that the data can be used in data view tools and applications, such as statistical reporting

How it works?

- Predictive analytics compresses large data volume, abstracts data variety, and aggregates data in motion
- Data optimization helps in design and implementation of robust reporting and analytics infrastructure that will transform big data into intelligence, and subsequently into action

Source: Blog – Optimization is Ready for Big Data, Big Data & Analytics
Industry Security Certifications
Health Insurance Portability and Accountability Act

HIPAA

Purpose:
- HIPAA was passed in the US to ensure confidentiality and safety of individual healthcare information, called protected health information (PHI)
- HIPAA aims to make it easier for people to keep health insurance, protect confidentiality, security of healthcare information of patients and control administrative expenses in healthcare industry

Types of entities covered:
- HIPAA Classifies two entities dealing with PHI of individuals:
  - **Covered entities**: Healthcare providers engaged in electronic transactions, health plans, healthcare clearinghouses
  - **Business associates**: Entities providing services to covered entities, which include access, creation, maintenance and transmission of PHI on behalf of business associates

Source: Health Insurance Portability and Accountability Act of 1996, Page 91
HIPAA: Enforcement and Non-compliance

HIPAA Privacy & Security Rule Complaint Process

Complaint
- Possible Criminal Violation
- Possible Privacy or Security Rule Violation

Intake & Review
- Acceptance by DOJ
- DOJ enters case & notifies OCR

DOJ

Investigation

Resolution
- OCR finds no violation
- OCR obtains voluntary compliance, corrective action, or other agreement
- OCR issues formal finding of violation

Resolution
- The violation did not occur after April 14, 2003
- Entity is not covered by the Privacy Rule
- Complaint was not filed within 180 days and an extension was not granted
- The incident described in the complaint does not violate the Privacy Rule

Civil monetary penalties

<table>
<thead>
<tr>
<th>Tier</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Covered entity or individual did not know (and by exercising reasonable diligence would not have known) the act was a HIPAA violation.</td>
<td>$100-$50,000 for each violation, up to a maximum of $1.5 million for identical provisions during a calendar year</td>
</tr>
<tr>
<td>2. The HIPAA violation had a reasonable cause and was not due to willful neglect.</td>
<td>$1,000-$50,000 for each violation, up to a maximum of $1.5 million for identical provisions during a calendar year</td>
</tr>
<tr>
<td>3. The HIPAA violation was due to willful neglect but the violation was corrected within the required time period.</td>
<td>$10,000-$50,000 for each violation, up to a maximum of $1.5 million for identical provisions during a calendar year</td>
</tr>
<tr>
<td>4. The HIPAA violation was due to willful neglect and was not corrected.</td>
<td>$50,000 or more for each violation, up to a maximum of $1.5 million for identical provisions during a calendar year</td>
</tr>
</tbody>
</table>

Criminal penalties

<table>
<thead>
<tr>
<th>Tier</th>
<th>Potential jail sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknowingly or with reasonable cause</td>
<td>Up to one year</td>
</tr>
<tr>
<td>Under false pretenses</td>
<td>Up to five years</td>
</tr>
<tr>
<td>For personal gain or malicious reasons</td>
<td>Up to ten years</td>
</tr>
</tbody>
</table>

Cloud service providers (CSP) should comply with HIPAA regulations published by US Department of Health

- A CSP is a “business associate” that “creates, receives, maintains, or transmits protected health information (PHI)” and is required to execute business associate agreements (BAA) with “covered entities” for permitted usage and disclosure of PHI

- US Department of Health & Human Services has published a list of audit protocols, which should be adhered to by a CSP

- A CSP must comply with technical safeguards –access control, audit control, integrity of PHI in transmission (encryption, authentication)

Source: FAQ: HIPAA AND "CLOUD COMPUTING" (v1.0), Center for Democracy & Technology
**Illustrative HIPAA Checklist for Cloud Service Provider**

<table>
<thead>
<tr>
<th>HIPAA Compliance Checklist</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Support for Data Encryption (Encrypt Stored Data)</td>
<td>Advanced 24/7 Data Center Security &amp; Access Control</td>
</tr>
<tr>
<td>Unmetered Encrypted Data Backups Stored Offsite</td>
<td>Virus, Worm, Trojan &amp; Malware Protection</td>
</tr>
<tr>
<td>Support for Two-Factor Authentication</td>
<td>Monitored Intrusion Detection Systems (IDS)</td>
</tr>
<tr>
<td>Sign Business Associate Agreement (No 3rd Parties)</td>
<td>Blocking &amp; Logging of Unauthorized Access Attempts</td>
</tr>
<tr>
<td>In-house Security Services (No 3rd Parties)</td>
<td>Notification of Identified Security Incidents</td>
</tr>
<tr>
<td>Data Destruction Services</td>
<td>Network &amp; Server Intrusion Prevention</td>
</tr>
<tr>
<td>Recording of Data Movements of Removable Media</td>
<td>Full Remote Console</td>
</tr>
<tr>
<td>Detailed Audit Tracking</td>
<td>100% Network &amp; Security Guarantees</td>
</tr>
<tr>
<td>Independent Assessment of 100% HIPAA Compliance</td>
<td>99.9% Server Uptime Guarantee</td>
</tr>
<tr>
<td>SASE Certified Data Centers</td>
<td>SSH or Remote Desktop Access</td>
</tr>
<tr>
<td>Managed Firewall Protection &amp; VPN Access</td>
<td>Automated O/S Installs &amp; Updates</td>
</tr>
<tr>
<td>Managed SSL Certificates (Encrypt Transmitted Data)</td>
<td>Managed DNS</td>
</tr>
<tr>
<td>Proactive Operating System Security Patching</td>
<td>Log Monitoring &amp; File Integrity Management</td>
</tr>
</tbody>
</table>

International Traffic in Arms Regulations

ITAR

Meaning:
- ITAR is the International Traffic in Arms Regulations, which is a set of United States government regulations that control the export and import of defense-related articles and services on the United States Munitions List (USML) and related technical data. This includes information within blueprints, technical drawings, photographs, mechanical plans, instructions, software and other sensitive defense-related documentation.
- ITAR requires, in relevant part, that covered material (items listed on the USML) only be shared with U.S. persons absent special authorization or exemption.

Enforcement:
- The Department of State Directorate of Defense Trade Controls (DDTC) interprets and enforces ITAR

Cost of Non-Compliance:
- Penalties
- Civil and administrative remedies (example: debarment as an exporter)
- Criminal sanctions

Source: brainloop.com, aws.amazon.com
ITAR and Cloud Computing

- Under ITAR, unless an exemption exists, such information must be stored in a U.S.-located environment physically and logistically accessible only to U.S. citizens or permanent residents (U.S. persons).

- For a public cloud solution to meet these rigorous demands, all installation, support, ongoing maintenance and system upgrades must be supported exclusively by U.S. persons, employed by U.S. employers and supervised by other U.S. persons.

- Additional security features not mandated specifically by ITAR but certainly part of a comprehensive approach are:
  - **Full encryption,**
  - **Tamper-proof audit trails,**
  - **Two-factor authentication and operators, as well as**
  - **Provider shielding**

- ITAR-compliant solutions are not available to the general public. Those wishing to utilize ITAR-compliant solutions must guarantee that users are limited to U.S. persons and, ideally, such organizations would maintain a valid Directorate of Defense Trade Controls exporter registration with full, unsanctioned U.S. export privileges, among other requirements.

Source: brainloop.com, aws.amazon.com
Federal Information Security Management Act

FISMA

Definition:

- The Federal Information Security Management Act of 2002 (P.L. 107-347) (FISMA) provides a comprehensive framework for supporting the effectiveness of information security controls over information resources that support Federal operations and assets.
- From this Federal Policy, the National Institute of Standards and Technology (NIST) published infrastructure and implementation standards including management, operational, and technical controls for securing data.
- Every year Federal Agencies must certify their IT operations comply with FISMA security standards, whether on-premise or hosted by a third party provider.

Agencies subject to FISMA:

- FISMA applies to all agencies within the U.S. federal government.
- Since, the law was enacted in 2002, the government expanded FISMA to include state agencies administering federal programs such as unemployment insurance, student loans, Medicare, and Medicaid.
- The federal government further expanded the reach of FISMA into the private sector and dramatically increased implementation oversight. Now, any private sector company that has a contractual relationship with the government, whether to provide services, support a federal program, or receive grant money, must comply with FISMA.

Source: csrc.nist.gov, skylightnetworks.com