# Postgre SQL,

PostgreSQL is a powerful, open source object-relational database system that uses and extends the SQL language combined with many features that safely store and scale the most complicated data workloads. The origins of PostgreSQL date back to 1986 as part of the **POSTGRES** project at the University of California at Berkeley and has more than 30 years of active development on the core platform.

PostgreSQL has earned a strong reputation for its proven architecture, reliability, data integrity, robust feature set, extensibility, and the dedication of the open source community behind the software to consistently deliver performant and innovative solutions. PostgreSQL runs on **all major operating systems**, has been **ACID**-compliant since 2001, and has powerful add-ons such as the popular **PostGIS** geospatial database extender. It is no surprise that PostgreSQL has become the open source relational database of choice for many people and organisations.

**Getting started** with using PostgreSQL has never been easier - pick a project you want to build, and let PostgreSQL safely and robustly store your data.

PostgreSQL comes with many features aimed to help developers build applications, administrators to protect data integrity and build fault-tolerant environments, and help you manage your data no matter how big or small the dataset.

***features found in PostgreSQL:***

- **Data Types**
  - Primitives: Integer, Numeric, String, Boolean
  - Structured: Date/Time, Array, Range, UUID
  - Document: JSON/JSONB, XML, Key-value (Hstore)
  - Geometry: Point, Line, Circle, Polygon
  - Customizations: Composite, Custom Types
- **Data Integrity**
  - UNIQUE, NOT NULL
  - Primary Keys
  - Foreign Keys
  - Exclusion Constraints
  - Explicit Locks, Advisory Locks
- **Concurrency, Performance**
  - Indexing: B-tree, Multicolumn, Expressions, Partial
  - Advanced Indexing: GiST, SP-Gist, KNN Gist, GIN, BRIN, Covering indexes, Bloom filters
  - Sophisticated query planner / optimizer, index-only scans, multicolumn statistics
  - Transactions, Nested Transactions (via savepoints)

- o Multi-Version concurrency Control (MVCC)
- o Parallelization of read queries and building B-tree indexes
- o Table partitioning
- o All transaction isolation levels defined in the SQL standard, including Serializable
- o Just-in-time (JIT) compilation of expressions
- **Reliability, Disaster Recovery**
  - o Write-ahead Logging (WAL)
  - o Replication: Asynchronous, Synchronous, Logical
  - o Point-in-time-recovery (PITR), active standbys
  - o Tablespaces
- **Security**
  - o Authentication: GSSAPI, SSPI, LDAP, SCRAM-SHA-256, Certificate, and more
  - o Robust access-control system
  - o Column and row-level security
  - o Multi-factor authentication with certificates and an additional method
- **Extensibility**
  - o Stored functions and procedures
  - o Procedural Languages: PL/PGSQL, Perl, Python (and many more)
  - o SQL/JSON path expressions
  - o Foreign data wrappers: connect to other databases or streams with a standard SQL interface
  - o Customizable storage interface for tables
  - o Many extensions that provide additional functionality, including PostGIS
- **Internationalisation, Text Search**
  - o Support for international character sets, e.g. through ICU collations
  - o Case-insensitive and accent-insensitive collations
  - o Full-text search

# Oracle:

Oracle database is a relational database management system. It is known as Oracle database, OracleDB or simply Oracle. It is produced and marketed by Oracle Corporation.

Oracle database is the first database designed for enterprise grid computing. The enterprise grid computing provides the most flexible and cost effective way to manage information and applications.

Following are the four editions of the Oracle database.

- o **Enterprise Edition:** It is the most robust and secure edition. It offers all features, including superior performance and security.

- o **Standard Edition:** It provides the base functionality for users that do not require Enterprise Edition's robust package.
- o **Express Edition (XE):** It is the lightweight, free and limited Windows and Linux edition.
- o **Oracle Lite:** It is designed for mobile devices.

## IBM DB2 Universal Database:

DB2 is a database product from IBM. It is a Relational Database Management System (RDBMS). DB2 is designed to store, analyze and retrieve the data efficiently. DB2 product is extended with the support of Object-Oriented features and non-relational structures with XML.

- Reduces deployment and management costs
  - o Design Advisor
  - o Automated statistics collection and object maintenance
  - o Self-tuning backup and restore
- Increases programmer productivity
  - o Microsoft.NET integration
  - o Java enhancements, including thin client and integrated help
- Provides a robust infrastructure
  - o High Availability Disaster Recovery (HADR)
  - o Automated client reroute
  - o Linux scalability
  - o Security
- Extends the value of information
  - o New queue-based replication architecture
  - o Geodetic Extender

## SQL standards:

Oracle strives to comply with industry-accepted standards and participates actively in SQL standards committees. Industry-accepted committees are the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO), which is affiliated with the International Electrotechnical Commission (IEC). Both ANSI and the ISO/IEC have accepted SQL as the standard language for relational databases. When a new SQL standard is simultaneously published by these organizations, the names of the standards conform to conventions used by the organization, but the standards are technically identical.

- **1999:** ANSI publishes SQL3, or ANSI/ISO SQL: 1999, with new features, like support for objects. The replaced the levels of compliance with core specifications, as well as additional specifications for nine more packages.

- **2003:** ANSI publishes SQL: 2003, introducing standardized sequences, XML-related features and identity columns. The creator of the first RDBMS, Dr. E.F.Codd, passes away on April 18 of the same year.

## SQL1999:

The SQL:1999 object model also allows you to declare that a UDT is the type of an entire table. Each row is an instance of the type. Each attribute of the type is transformed into a column of the table. The methods associated with the type are also associated with the table. Typed tables can have an additional self-referencing column. This is similar to the object identification (OID) used in classical object models. See object identification. The self-referencing column holds a value that uniquely identifies that row of the table.

In SQL:1999, instead of using the term OID, it uses REF value with a special data type called REF type. One type can contain a REF to another type, similar to the way OIDs are used in object models. REFs can only reference rows in typed tables and cannot reference type instances in cells of a table, in variables, or anywhere else.

The SQL:1999 object model also provides for table hierarchies in addition to type hierarchies. The relationships of the table hierarchy and the type hierarchy are not necessarily one-to-one. Basically, table hierarchies allow you to modify the behavior and appearance of the default behavior for typed tables. For example, most object models assume that if you query a super type, you will also get results from any of its subtypes. Table hierarchies allow you to modify that behavior so that when you query on the super type, you do not get results from any of its subtypes.

## SQL: 2003:

SQL:2003 retains all data types that existed in SQL:1999 with the exception of the BIT and BIT VARYING data types. Those two were removed from the standard due to the lack of support in existing SQL database engines, and the lack of expected support in the future. SQL:2003 introduces three new data types: BIGINT, MULTISET, and XML. Since the XML data type is part of SQL/XML.

The new data types are first class data types, meaning they can be used in all the contexts that any other (existing) SQL data type can be used; e.g., as column types, parameter and return types of SQLinvoked routines, etc.

Table functions are new in SQL:2003, though many users might already be familiar with them, since they have been available in SQL products for a quite some time. A table function is an SQL-invoked function that returns a "table". For specification purposes in the standard, the return type is equivalent to a multiset of rows (i.e., a MULTISET type whose element type is a ROW type) and not a real table, but it can be queried just like a table. Table functions are useful in their own right and consequently, the standard does not mandate support of multisets in order to support table functions. It should be obvious where table functions get their name.

**Standards for interoperability and integration:**

## Defining Interoperability

Interoperability is more advanced and meaningful than integration. Interoperability incorporates content from multiple disparate and entirely independent systems to advance the effective delivery of solutions to the market. With standards-based interoperability, vendors can provide solutions in an efficient and repeatable manner without deep customization efforts between the connecting vendor systems. It's a way of connecting key systems, people, and information in a way that brings about new meaning, context, and clinical insights through a combination of multiple diverse sources of data.

## Defining Integration

**Integration is the process of combining multiple applications to function together as a unified whole**. When available, an integrated solution is a powerful thing. A good example of this is a company combining multiple purchased technologies into a singular application that solves a focused problem or set of problems. Spok and others have been doing this for years to improve our applications with the goal of providing a complete communication and collaboration suite to our customers.

Integration is the ideal that many organizations search for. The concept of a "completely integrated solution offering" from a single company that just does it all would make life simple for everyone, right? However, with such a broad focus in the healthcare space that includes records keeping, analytics, connectivity, communications, inpatient or outpatient workflows, personal health practices, and

many more functions, one solution to rule them all is impossible to deliver with quality.

Additionally, a more integrated application environment with proprietary methods of connectivity or data sharing can slow the proliferation of the many innovative, disruptive point technologies we see produced from new vendors without a clear and easy path to connect them with other systems.

## XML related specifications:

## Rules for well formed XML

- It must begin with the XML declaration.
- It must have one unique root element.
- All start tags of XML documents must match end tags.
- XML tags are case sensitive.
- All elements must be closed.
- All elements must be properly nested.
- All attributes values must be quoted.
- XML entities must be used for special characters.

## XML DTD

- A DTD defines the legal elements of an XML document
- In simple words we can say that a DTD defines the document structure with a list of legal elements and attributes.
- XML schema is a XML based alternative to DTD.
- Actually DTD and XML schema both are used to form a well formed XML document.
- We should avoid errors in XML documents because they will stop the XML programs.

## XML schema
- It is defined as an XML language
- Uses namespaces to allow for reuses of existing definitions
- It supports a large number of built in data types and definition of derived data types
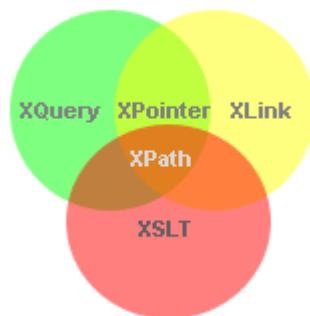
## X-Query:

XQuery is a functional query language used to retrieve information stored in XML format. It is same as for XML what SQL is for databases. It was designed to query XML data.

XQuery is built on XPath expressions. It is a W3C recommendation which is supported by all major databases.

The as it is definition of XQuery given by its official documentation is as follows:

"XQuery is a standardized language for combining documents, databases, Web pages and almost anything else. It is very widely implemented. It is powerful and easy to learn. XQuery is replacing proprietary middleware languages and Web Application development languages. XQuery is replacing complex Java or C++ programs with a few lines of code. XQuery is simpler to work with and easier to maintain than many other alternatives."



## What does it do

XQuery is a functional language which is responsible for finding and extracting elements and attributes from XML documents.

It can be used for following things:

- o   To extract information to use in a web service.
- o   To generates summary reports.
- o   To transform XML data to XHTML.
- o   Search Web documents for relevant information.

## X-Path:

XPath is a major element in the XSLT standard.

XPath can be used to navigate through elements and attributes in an XML document.

- XPath is a syntax for defining parts of an XML document

- XPath uses path expressions to navigate in XML documents

- XPath contains a library of standard functions

- XPath is a major element in XSLT and in XQuery

- XPath is a W3C recommendation
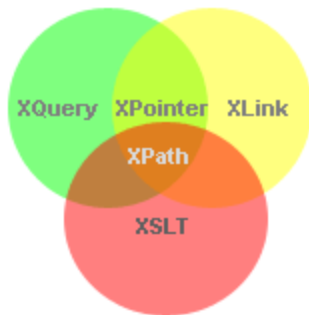


| /bookstore/book[1] | Selects the first book element that is the child of the bookstore element |
|---|---|
| /bookstore/book[last()] | Selects the last book element that is the child of the bookstore element |

| Index | XQuery | XPath |
|---|---|---|
| 1) | XQuery is a functional programming and query language that is used to query a group of XML data. | XPath is a xml path language that is used to select nodes from an xml document using queries. |
| 2) | XQuery is used to extract and manipulate data from either xml documents or relational databases and ms office documents that support an xml data source. | XPath is used to compute values like strings, numbers and boolean types from another xml documents. |
| 3) | xquery is represented in the form of a tree model with seven nodes, namely processing instructions, elements, document nodes, attributes, namespaces, text nodes, and comments. | xpath is represented as tree structure, navigate it by selecting different nodes. |
| 4) | xquery supports xpath and extended relational models. | xpath is still a component of query language. |
| 5) | xquery language helps to create syntax for new xml documents. | xpath was created to define a common syntax and behavior model for xpointer and xslt. |

# Web Services:

A web service is any piece of software that makes itself available over the internet and uses a standardized XML messaging system. XML is used to encode all communications to a web service. For example, a client invokes a web service by sending an XML message, then waits for a corresponding XML response. As all communication is in XML, web services are not tied to any one operating system or programming language—Java can talk with Perl; Windows applications can talk with Unix applications.

**Components of Web Services**

The basic web services platform is XML + HTTP. All the standard web services work using the following components −

- SOAP (Simple Object Access Protocol)
- UDDI (Universal Description, Discovery and Integration)
- WSDL (Web Services Description Language)

A web service enables communication among various applications by using open standards such as HTML, XML, WSDL, and SOAP. A web service takes the help of −

- XML to tag the data
- SOAP to transfer a message
- WSDL to describe the availability of service.

You can build a Java-based web service on Solaris that is accessible from your Visual Basic program that runs on Windows.

You can also use C# to build new web services on Windows that can be invoked from your web application that is based on JavaServer Pages (JSP) and runs on Linux.
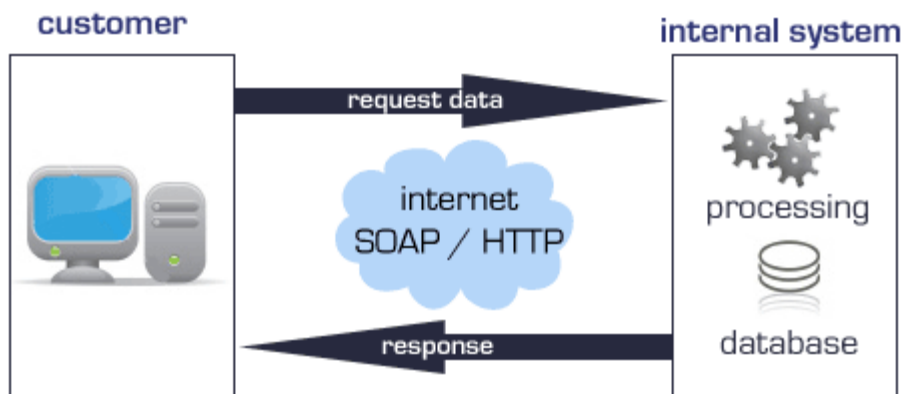


## Web Service Roles

There are three major roles within the web service architecture −

### Service Provider

This is the provider of the web service. The service provider implements the service and makes it available on the Internet.

### Service Requestor

This is any consumer of the web service. The requestor utilizes an existing web service by opening a network connection and sending an XML request.

### Service Registry

This is a logically centralized directory of services. The registry provides a central place where developers can publish new services or find existing ones. It therefore serves as a centralized clearing house for companies and their services.
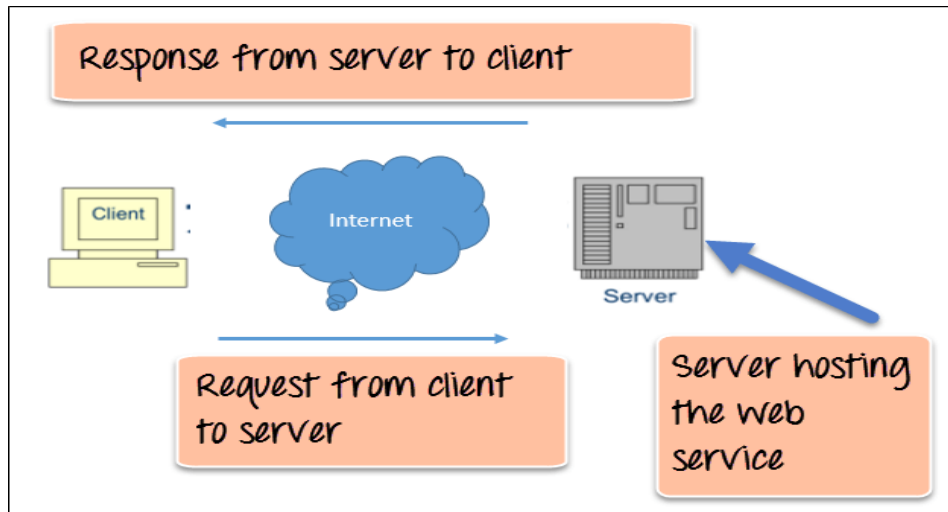
## SOAP:

SOAP is an acronym for Simple Object Access Protocol. It is an XML-based messaging protocol for exchanging information among computers. SOAP is an application of the XML specification.
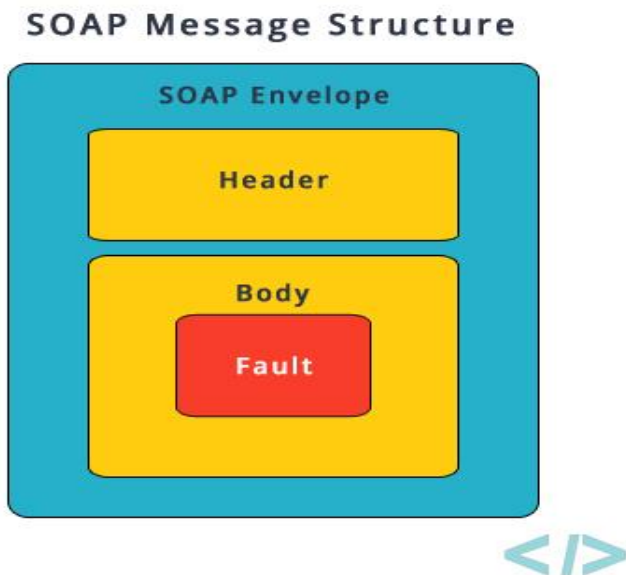


### Points to Note

- SOAP is a communication protocol designed to communicate via Internet.
- SOAP can extend HTTP for XML messaging.
- SOAP provides data transport for Web services.
- SOAP can exchange complete documents or call a remote procedure.
- SOAP can be used for broadcasting a message.

- SOAP is platform- and language-independent.

- SOAP is the XML way of defining what information is sent and how.

- SOAP enables client applications to easily connect to remote services and invoke remote methods.

Although SOAP can be used in a variety of messaging systems and can be delivered via a variety of transport protocols, the initial focus of SOAP is remote procedure calls transported via HTTP.

Other frameworks including CORBA, DCOM, and Java RMI provide similar functionality to SOAP, but SOAP messages are written entirely in XML and are therefore uniquely platform- and language-independent.

## Advantages of SOAP

SOAP is the protocol used for data interchange between applications. Below are some of the reasons as to why SOAP is used.

- When developing Web services, you need to have some of language which can be used for web services to talk with client applications. SOAP is the perfect medium which was developed in order to achieve this purpose. This protocol is also recommended by the W3C consortium which is the governing body for all web standards.

- SOAP is a light-weight protocol that is used for data interchange between applications. Note the keyword 'light.' Since SOAP is based on the XML language, which itself is a light weight data interchange language, hence SOAP as a protocol that also falls in the same category.

- SOAP is designed to be platform independent and is also designed to be operating system independent. So the SOAP protocol can work any programming language based applications on both Windows and Linux platform.

- It works on the HTTP protocol –SOAP works on the HTTP protocol, which is the default protocol used by all web applications. Hence, there is no sort of customization which is required to run the web services built on the SOAP protocol to work on the World Wide Web.