Introducing Hadoop, Hortonworks, and Big Data

Lesson 2

Learning Objectives

- After you complete this lesson you should be able to:
  - Describe three categories of data
  - Describe three characteristics of Big Data
  - Describe five kinds of data commonly found in Hadoop
  - Recognize use cases for Hadoop
  - Distinguish between Hadoop and the Hortonworks Data Platform
  - Recall that Hadoop is comprised of multiple Apache projects
  - List benefits of using HDP

Consider These Scenarios

- Researchers at a hospital collect billions of data points from patient sensors. How do they analyze this data in order to improve diagnostics and patient care?
- A large online travel company collects millions of log entries. How do they store and analyze these log entries in order to improve the hotel rankings they provide to their customers?
- A nationwide trucking company collects billons of data points from sensors on their trucks. How do they analyze this data in order save fuel costs?

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The Solution is Hadoop, so YAHOO!

- Many enterprises have already discovered this solution (including Yahoo!).

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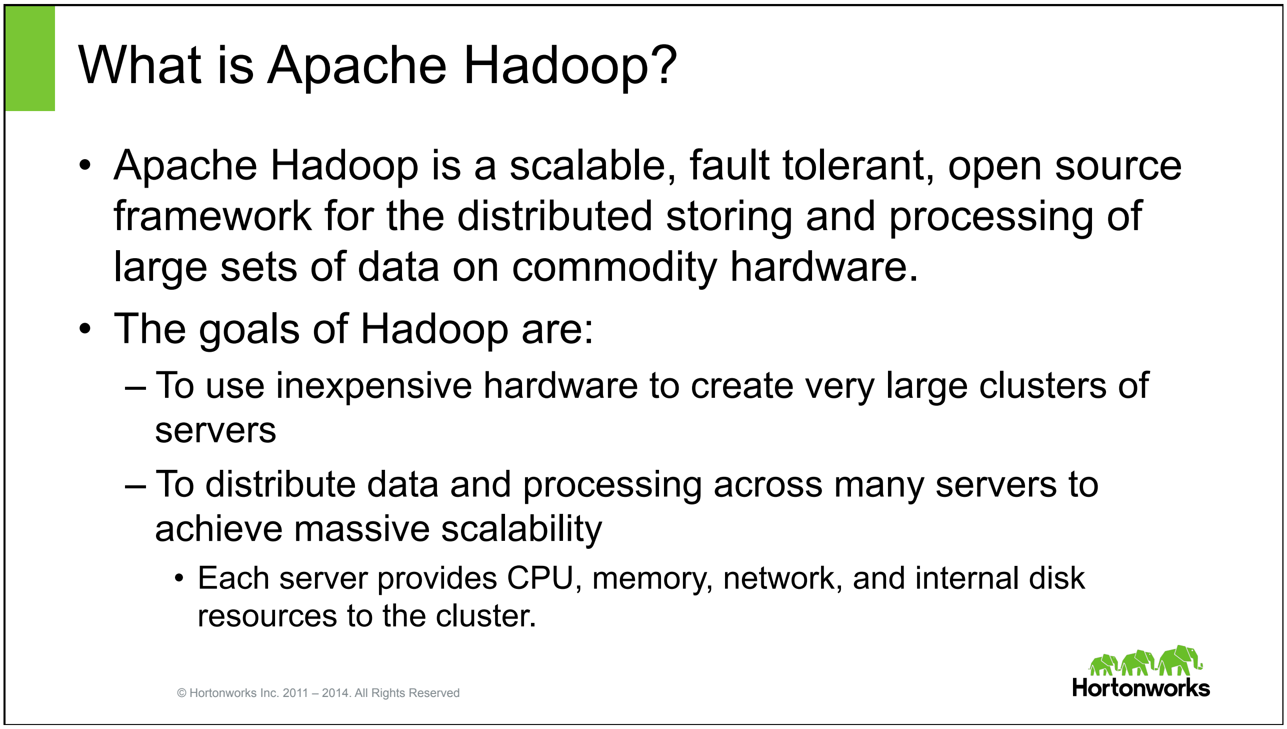

What is Apache Hadoop?

- Apache Hadoop is a scalable, fault tolerant, open source framework for the distributed storing and processing of large sets of data on commodity hardware.
- The goals of Hadoop are:
  - To use inexpensive hardware to create very large clusters of servers
  - To distribute data and processing across many servers to achieve massive scalability
    - Each server provides CPU, memory, network, and internal disk resources to the cluster.

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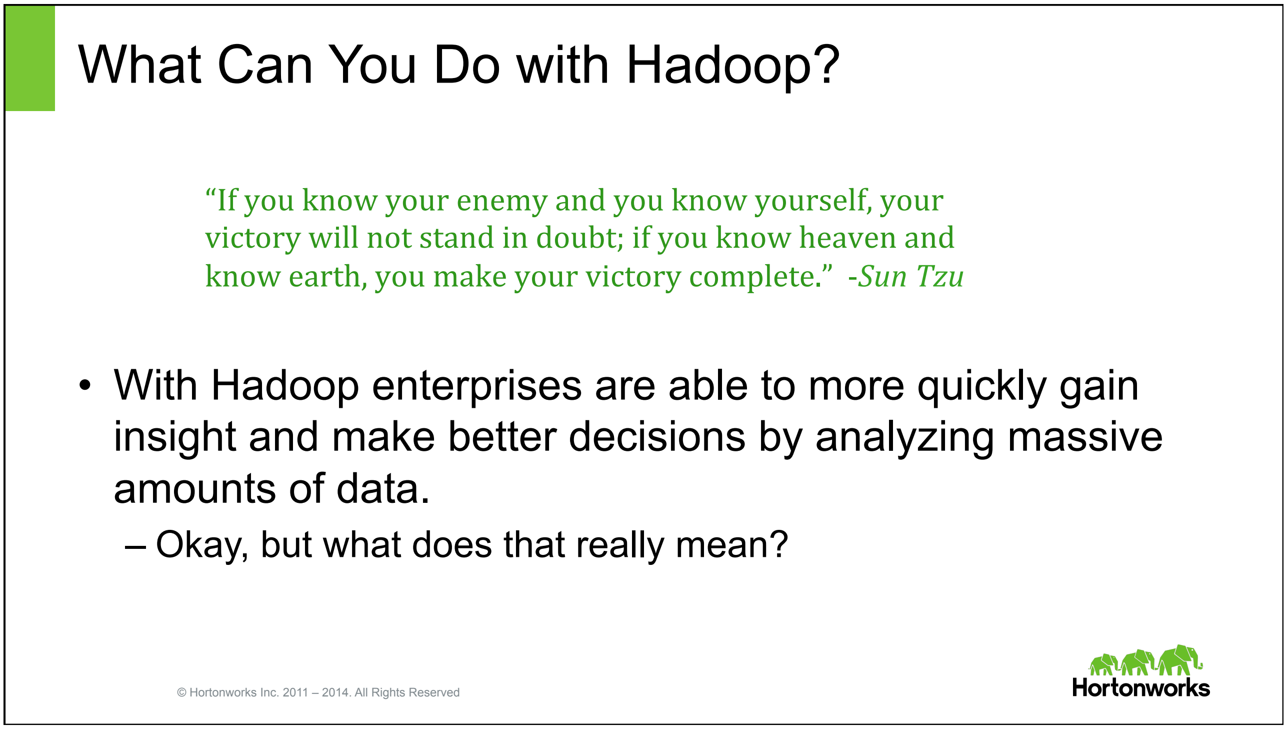

What Can You Do with Hadoop?

> "If you know your enemy and you know yourself, your victory will not stand in doubt; if you know heaven and know earth, you make your victory complete." -*Sun Tzu*

- With Hadoop enterprises are able to more quickly gain insight and make better decisions by analyzing massive amounts of data.
  - Okay, but what does that really mean?

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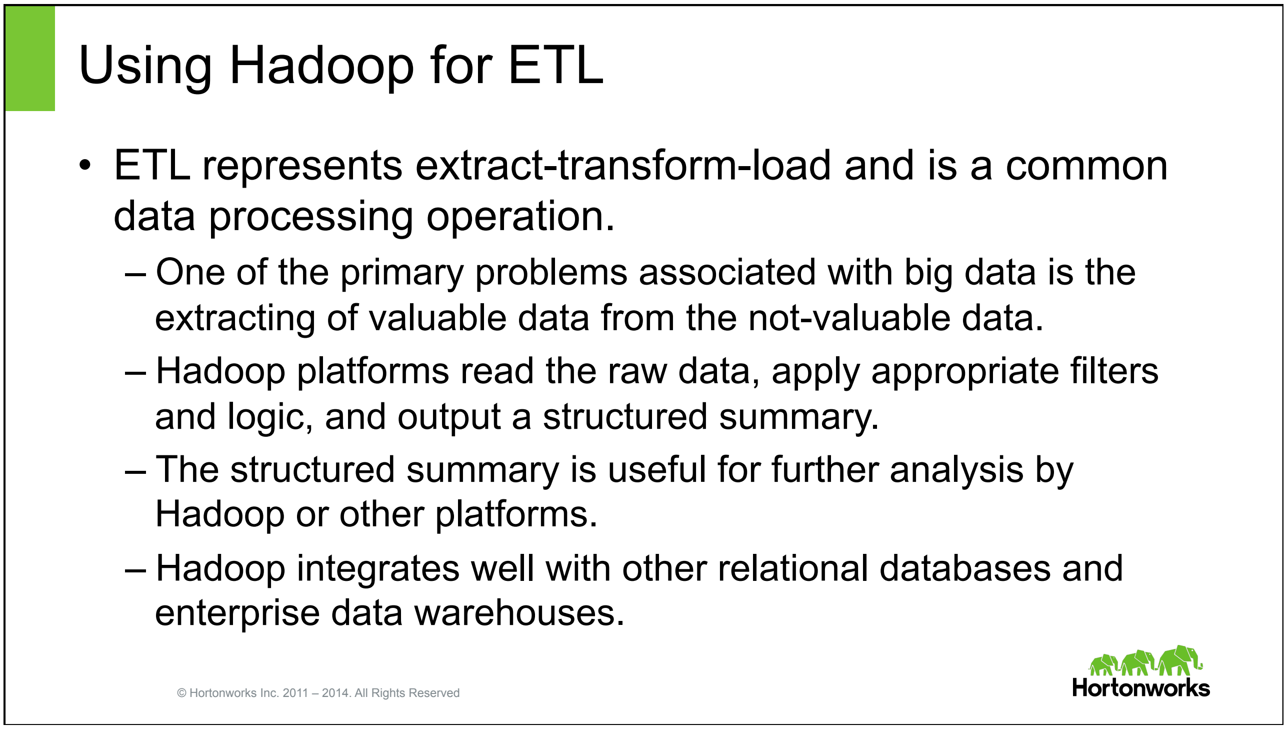

Using Hadoop for ETL

- ETL represents extract-transform-load and is a common data processing operation.
  - One of the primary problems associated with big data is the extracting of valuable data from the not-valuable data.
  - Hadoop platforms read the raw data, apply appropriate filters and logic, and output a structured summary.
  - The structured summary is useful for further analysis by Hadoop or other platforms.
  - Hadoop integrates well with other relational databases and enterprise data warehouses.

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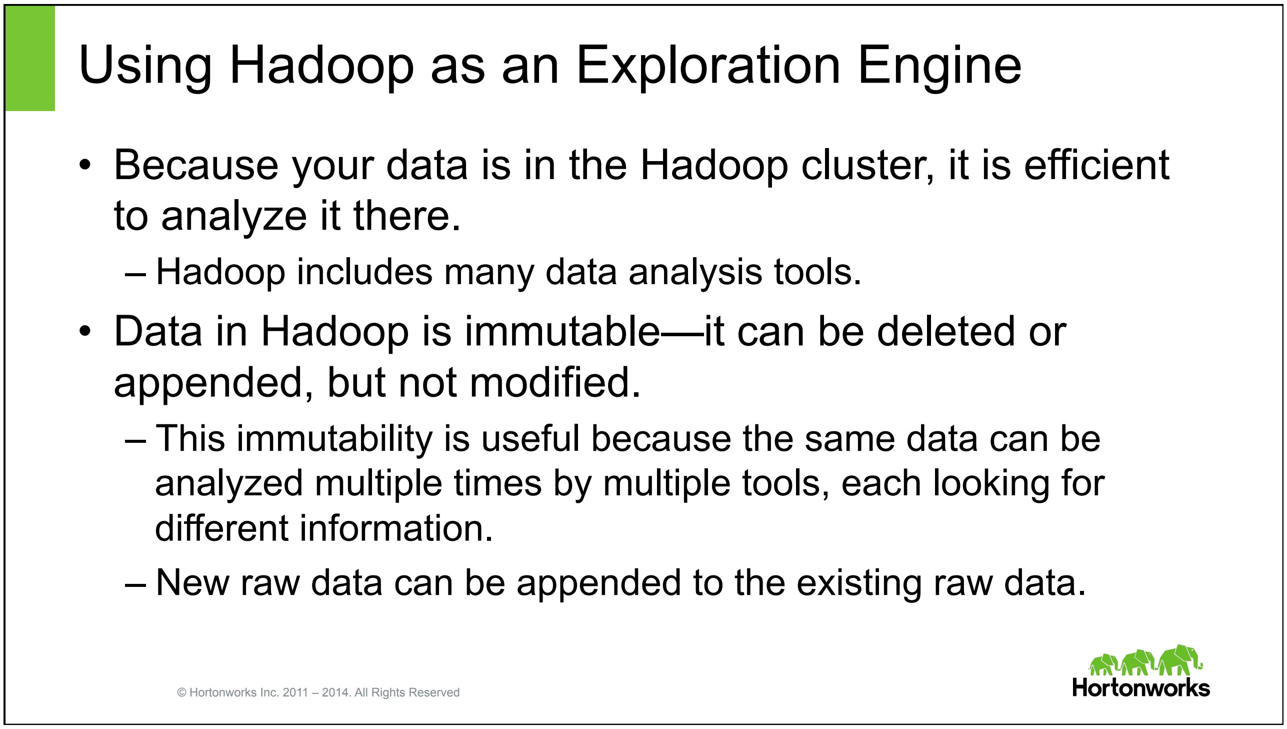

Using Hadoop as an Exploration Engine

- Because your data is in the Hadoop cluster, it is efficient to analyze it there.
  - Hadoop includes many data analysis tools.
- Data in Hadoop is immutable—it can be deleted or appended, but not modified.
  - This immutability is useful because the same data can be analyzed multiple times by multiple tools, each looking for different information.
  - New raw data can be appended to the existing raw data.

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But How Does Hadoop Really Work?

- To understand and recognize the benefits of Hadoop you must first understand data, and specifically *big* data.
- So let us talk about data.
- There are three categories of data:
  - Structured
  - Semi-structured
  - Unstructured

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Structured Data

- Structured data resides in a fixed field within a record or file.
  - An example would be data contained in a relational database or a spreadsheet.
- Structured data depends on creating a data model called a schema.
  - The schema defines the types of data that will be recorded and how that data will be stored, accessed, and processed.
  - This includes defining the fields of data to be stored along with the type of data in each field.
    - Types include strings, integers, floating point numbers, dates, and others.

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Advantages of Structured Data

- Structured data is:
  - Easily entered, stored, queried, and analyzed
  - Often managed using a structured query language (SQL)

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Semi-Structured Data

- Data that does not conform to a formal data model defined in a schema
- Data that does contain tags or other markers
  - These separate semantic elements and enforce hierarchies of records and fields within the data.
- Examples include XML, HTML, and Java Script Object Notation (JSON) files.
- It is sometimes called self-describing data.

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Unstructured Data

- Data that does not reside in fixed fields or records
- There is no data model, contained in a schema or tags, that defines how to store, access, or process the data.
- Examples include word processing documents, videos, photos, audio files, presentations, Web pages, and many other kinds of business documents.
  - These examples may have an internal structure, but they do not have schema, or internal tags or metadata, describing their fields of data.

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Disadvantages of Unstructured Data

- Unstructured data has irregularities and ambiguities that make it difficult to understand and analyze using traditional computer programs.
  - This data is often ignored or deleted which limits its business value.
  - Experts estimate that 80-90 percent of the data in any enterprise is unstructured.
    - Hadoop’s primary contribution has been the capability to extract value from this unstructured data.

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Unstructured Data and Hadoop

- Hadoop excels at analyzing unstructured data.
  - In some cases Hadoop tools can impose a structure on unstructured data so that it can be analyzed.
    - The structure is layered over the raw data and does not change the raw data.
    - Remember, data in Hadoop is immutable.
  - In other cases Hadoop tools transform the data to create structure.
    - Transformed data is saved as new data.
    - The transformed data is analyzed by Hadoop or other platforms.

Common Types of Data in Hadoop

- There are five types of data commonly found in Hadoop.
  - Sentiment data
  - Clickstream data
  - Sensor or machine data
  - Geolocation data
  - Server log data

What Makes Data BIG DATA?

- The term Big Data comes from the computational sciences.
- It is used to describe scenarios where the volume and types of data overwhelm the tools to store and process it.
- In 2001, industry analyst Doug Laney described Big Data using the three V's:

VOLUME *Velocity* Variety

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Volume

- Volume refers to the amount of data being generated.
  - Gigabytes, terabytes, petabytes…
  - Many factors contribute to the increase in data volume, including:
    - Transaction-based data stored through the years
    - Unstructured data streaming in from social media
    - Increasing amounts of sensor and machine-to-machine data being collected
  - Problems related to volume include:
    - Storage costs
    - Determining relevance within large data volumes
    - How to analyze data quickly to maximize business value

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Velocity

- Velocity refers the rate at which new data is generated.
  - Megabytes per second, gigabytes per second…
  - Data is streaming in at unprecedented speed and must be dealt with in a timely manner in order to extract the maximum value.
    - Sources include logs, social media, RFID tags, sensors, and smart metering
  - Problems related to velocity include:
    - Reacting quickly enough to benefit from the data
    - Inconsistent data flows with periodic peaks
      - Daily, seasonal, and event-triggered peak data loads
        - » A new trend in social media.

Variety

- Variety refers to the number of types of data being generated.
  - Varieties of data include:
    - Structured data in traditional databases
    - Semi-structured data like XML or JSON files
    - Unstructured text documents, email, video, audio, stock ticker data, and financial transactions
  - Problems related to variety include:
    - How to gather, link, match, cleanse, and transform data across systems
    - How to connect and correlate data relationships and hierarchies to extract business value

Hadoop Was Designed for Big Data

> "Big Data is high-volume, -velocity and -variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making." – *Gartner*

- Hadoop is the framework that provides a cost-effective, innovative form of information processing used to enhance business insight and decision making.

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So How Does Hortonworks Fit Into All of This?

- Hortonworks does Hadoop.
  - In fact, it does it very well.
- Hortonworks:
  - Was founded in 2011 by 24 engineers from the original Yahoo! Hadoop development and operations team
  - Has amassed more Hadoop experience under one organization than anyone else
  - Has team members who are active participants and leaders in Hadoop development
  - Has years of experience in Hadoop operations

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But Wait, There is More…

- Hortonworks is also:
  - Responsible for approximately 50 percent of core code base advances used to deliver Apache Hadoop as an enterprise data platform
  - Partnered with trusted data center companies like Microsoft, Red Hat, SAP, Teradata, Rackspace, and many more
  - Building Hadoop with the enterprise in mind, all tested and certified with real-world vigor in one of the world's largest Hadoop clusters
  - A source of world-class enterprise support, consulting, and training

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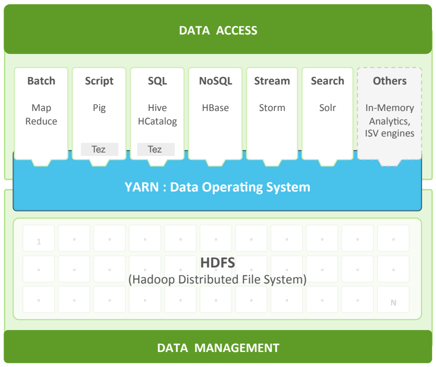
Hadoop and the Hortonworks Data Platform (HDP)

- What is the difference between Hadoop and HDP?
- To answer, we need more information about Hadoop.
- Hadoop is actually a framework that includes many components.
  - The components are a collection of other frameworks and tools that are managed as *projects* by the Apache Software Foundation.
  - A few projects are illustrated here.



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Why So Many Frameworks and Tools?

- There are so many tools because each tool was created to provide a specific solution.
- Some tools are easier to use in specific situations even though some tools have functional overlap.
  - As an analogy, a screwdriver can be used as a chisel but using a chisel is easier.
  - Likewise, Apache Storm and Apache Flume can be used to ingest data and perform real-time analysis, but real-time analysis is easier with Storm.

Installing and Using Hadoop Projects

- It is important to understand that each project is developed independently and has its own release schedule.
- Any organization is free to download, install, and test any version of a project from the Apache Software Foundation.
  - However, it takes a tremendous amount of skill and testing to find the right combination of project versions.
  - HDP exists to make it possible to avoid this scenario.

Getting Back to HDP – What is it?

- HDP is an enterprise version of Hadoop distributed by Hortonworks.
  - It includes a single installation utility that installs most of the Apache Hadoop software.
  - The benefit is that it has gone through rigorous system, function, and regression testing to ensure that versions of any projects included in the distribution work seamlessly together in a secure and reliable manner.
    - It is important for an enterprise version of Hadoop to use the best combination of the most stable, reliable, secure, and current projects.

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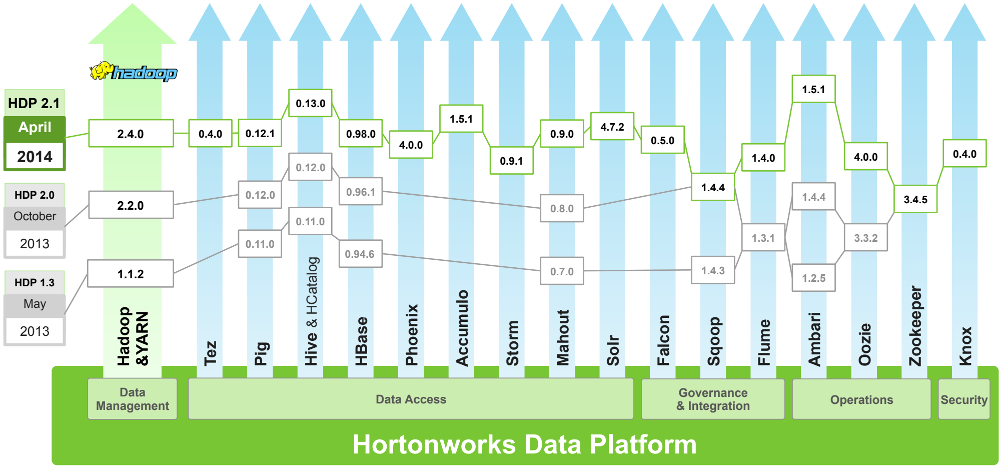
HDP and Apache Hadoop Project Versions



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HDP is 100 Percent Pure Hadoop

- HDP contains no proprietary software add-ons or extensions.
  - This ensures that you receive 100 percent Apache Hadoop software with no possibility of vendor lock-in.
  - You benefit from the latest enhancements and fixes developed by a worldwide set of developers.
    - You do not have to wait for a single company to add the enhancements and fixes to their proprietary software.
  - Other software often runs along side of Hadoop and might not work properly with proprietary extensions and features.

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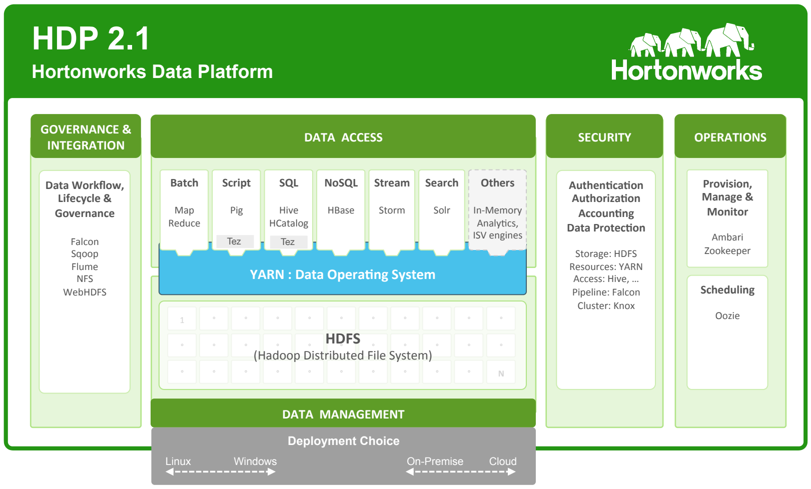
HDP Delivers a Comprehensive Data Management Platform



HDP includes projects for:

- Core Hadoop (HDFS and YARN)
- Data access and processing
- Data governance and integration
- Security
- Managing Hadoop operations

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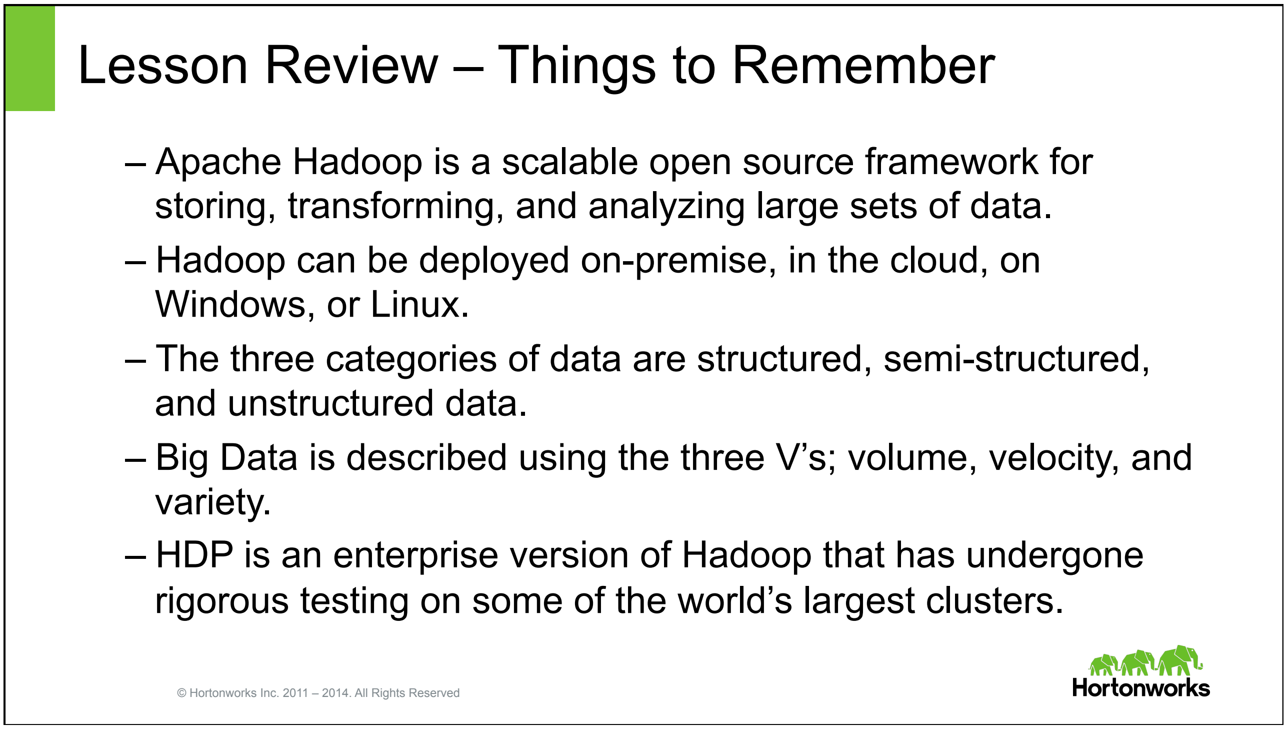

Lesson Review – Things to Remember

- Apache Hadoop is a scalable open source framework for storing, transforming, and analyzing large sets of data.
- Hadoop can be deployed on-premise, in the cloud, on Windows, or Linux.
- The three categories of data are structured, semi-structured, and unstructured data.
- Big Data is described using the three V's; volume, velocity, and variety.
- HDP is an enterprise version of Hadoop that has undergone rigorous testing on some of the world's largest clusters.

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