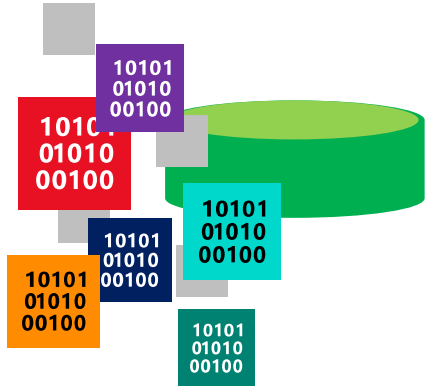
Introduction to Big Data and HDInsight

Microsoft

What is Big Data?

- Data that is too large or complex for analysis in traditional relational databases

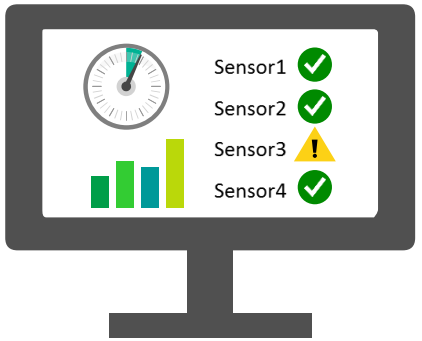


- Typified by the "3 V's":
  - *Volume* – Huge amounts of data to process
  - *Variety* – A mixture of structured and unstructured data
  - *Velocity* – New data generated extremely frequently

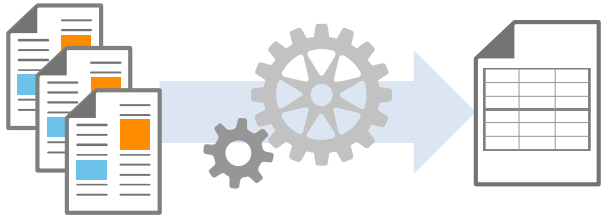
Web server click-streams

Social media sentiment analysis

Sensor and IoT Processing

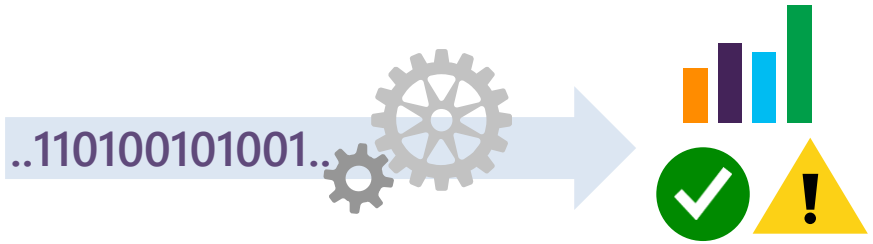


Batch Processing



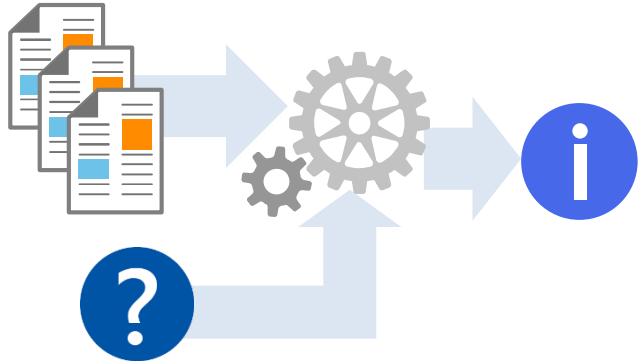
Filter, cleanse, and shape data for analysis

Real-Time Processing



Capture, filter, and aggregate streams of data for low-latency querying

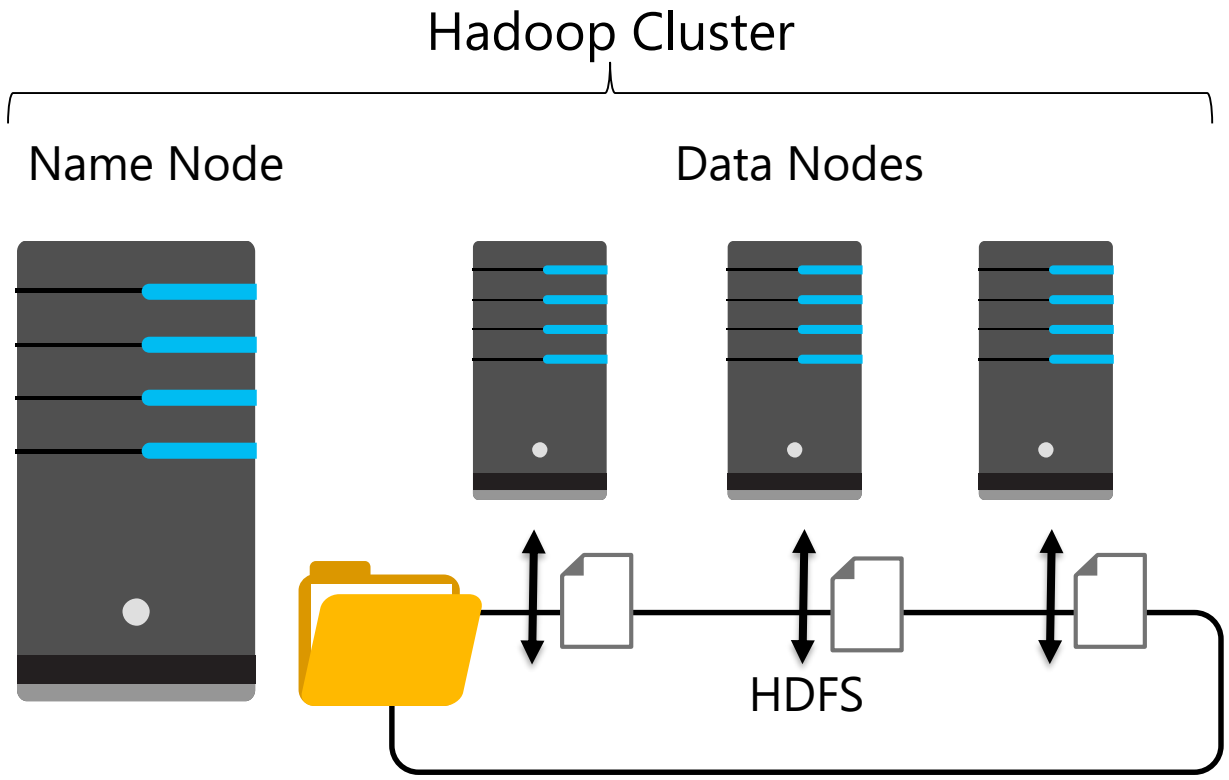
Predictive Analytics



Apply statistical algorithms for classification, regression, clustering, and prediction

What is Hadoop?

- Hadoop
  - Open source distributed data processing cluster
  - Data processed in Hadoop Distributed File System (HDFS)
  - Resource Management is performed by YARN
- Related projects
  - Hive
  - Pig
  - Oozie
  - Sqoop
  - Others



What is MapReduce?

Invoice	Date	Amount
1001	01-01-2016	$100.00
1002	01-01-2016	$95.00
1003	01-02-2016	$100.00
1003	01-03-2016	$75.00
1004	01-03-2016	$50.00

Map

Split data into Key/Value pairs

Key	Value
01-01-2016	{$100.00, $95.00}
01-02-2016	{$100.00}
01-03-2016	{$75.00, $50.00}

Operate on values for each key

Reduce

Key	Value
01-01-2016	∑ = $195.00

Key	Value
01-02-2016	∑ = $100.00

Key	Value
01-03-2016	∑ = $125.00

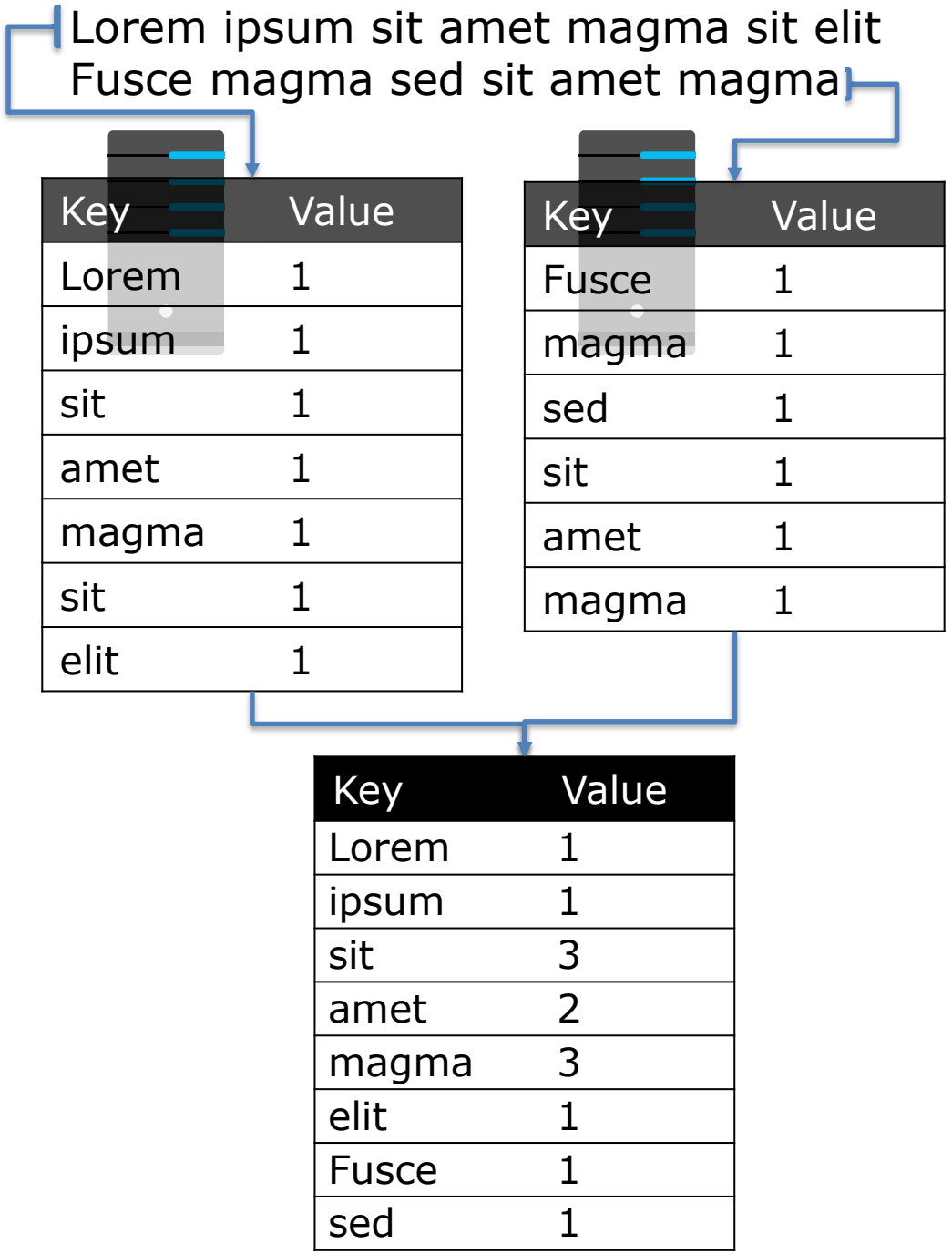
Output

Key	Value
01-01-2016	$195.00
01-02-2016	$100.00
01-03-2016	$125.00

Word Count

The "Hello World" of MapReduce

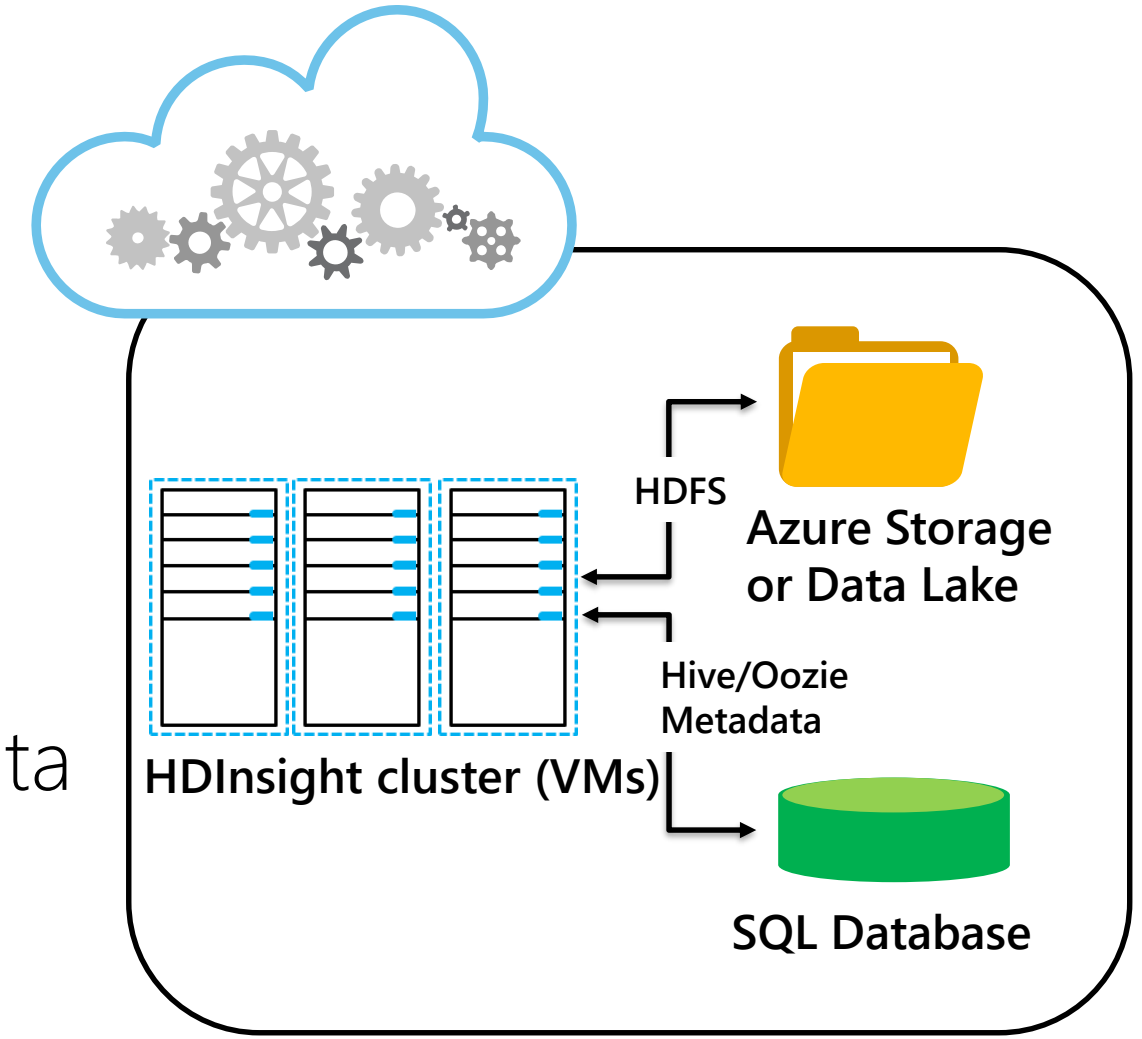
1. Source text is divided among data nodes
2. Map phase generates key/value pairs with words as keys and placeholder values of 1
3. Reduce phase aggregates values for each key by adding the values for each word



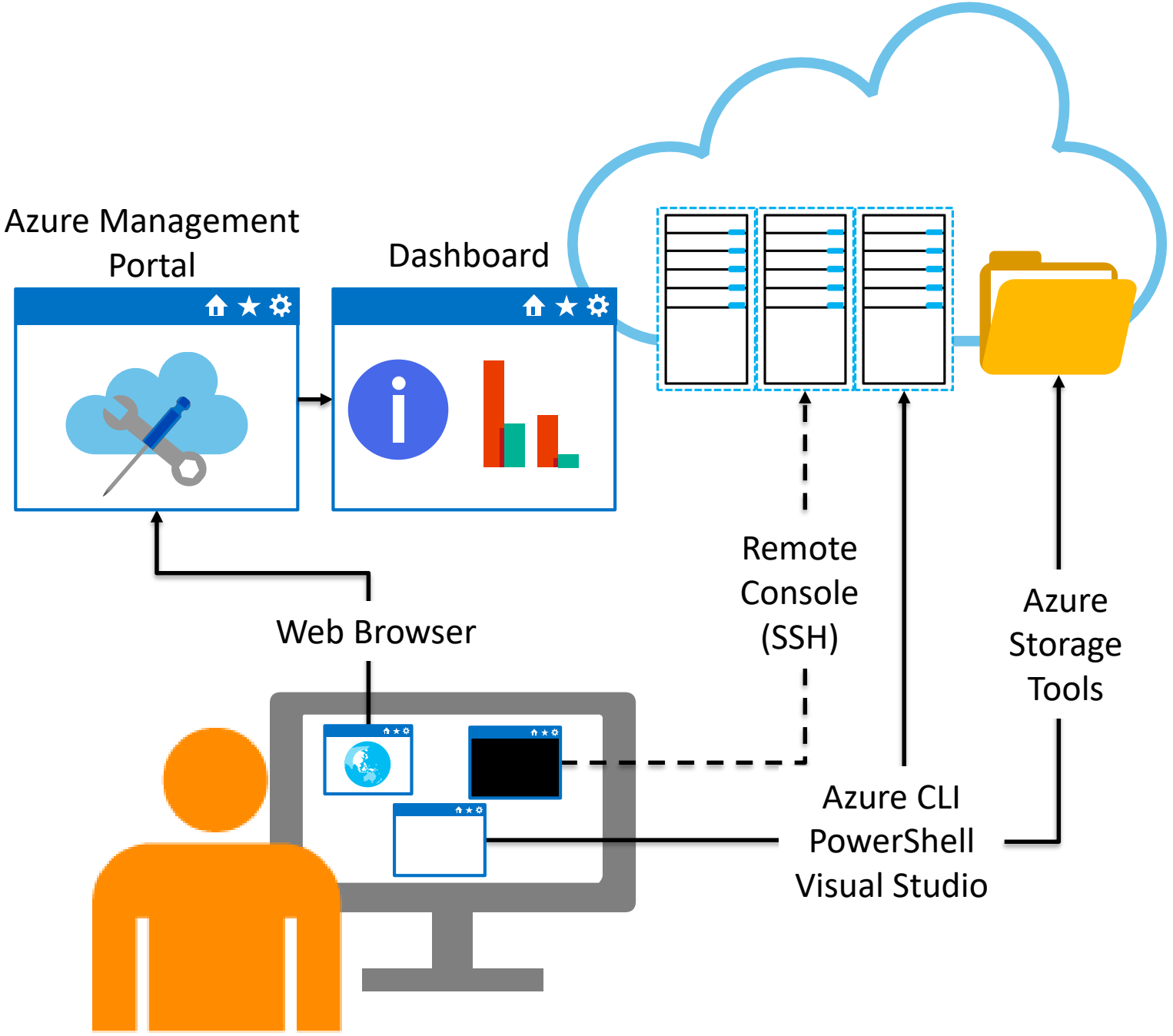
```
public static class Map extends Mapper<LongWritable, Text, Text, IntWritable> {
       private final static IntWritable one = new IntWritable(1);
       private Text word = new Text();
       public void map(LongWritable key, Text value, Context context) {
           String line = value.toString();
           StringTokenizer tokenizer = new StringTokenizer(line);
           while (tokenizer.hasMoreTokens()) {
               word.set(tokenizer.nextToken());
               context.write(word, one);
           }
       }
}


public static class Reduce extends Reducer<Text, IntWritable, Text, IntWritable> {
     public void reduce(Text key, Iterable<IntWritable> values, Context context){
       int sum = 0;
       for (IntWritable val : values) {
               sum += val.get();
       }
       context.write(key, new IntWritable(sum));
     }
}
```

What is HDInsight?

- Apache Hadoop on Azure
  - Hortonworks HDP on Azure VMs
- Azure Storage or Azure Data Lake provides the HDFS layer
- Azure SQL Database stores metadata



What client tools can I use?


Azure Management Portal
Dashboard
Remote Console (SSH)
Azure Storage Tools
Web Browser
Azure CLI
PowerShell
Visual Studio

File paths can be referenced using WASB(S) or native syntax

wasb://*container*@*account*.blob.core.windows.net/data/logs/file.txt

wasb:///data/logs/file.txt (default storage account and container)

or

/data/logs/file.txt

File paths are **case-sensitive**

HDFS shell commands

ls (list)

cp and **mv** (copy and move)

mkdir (make directory)

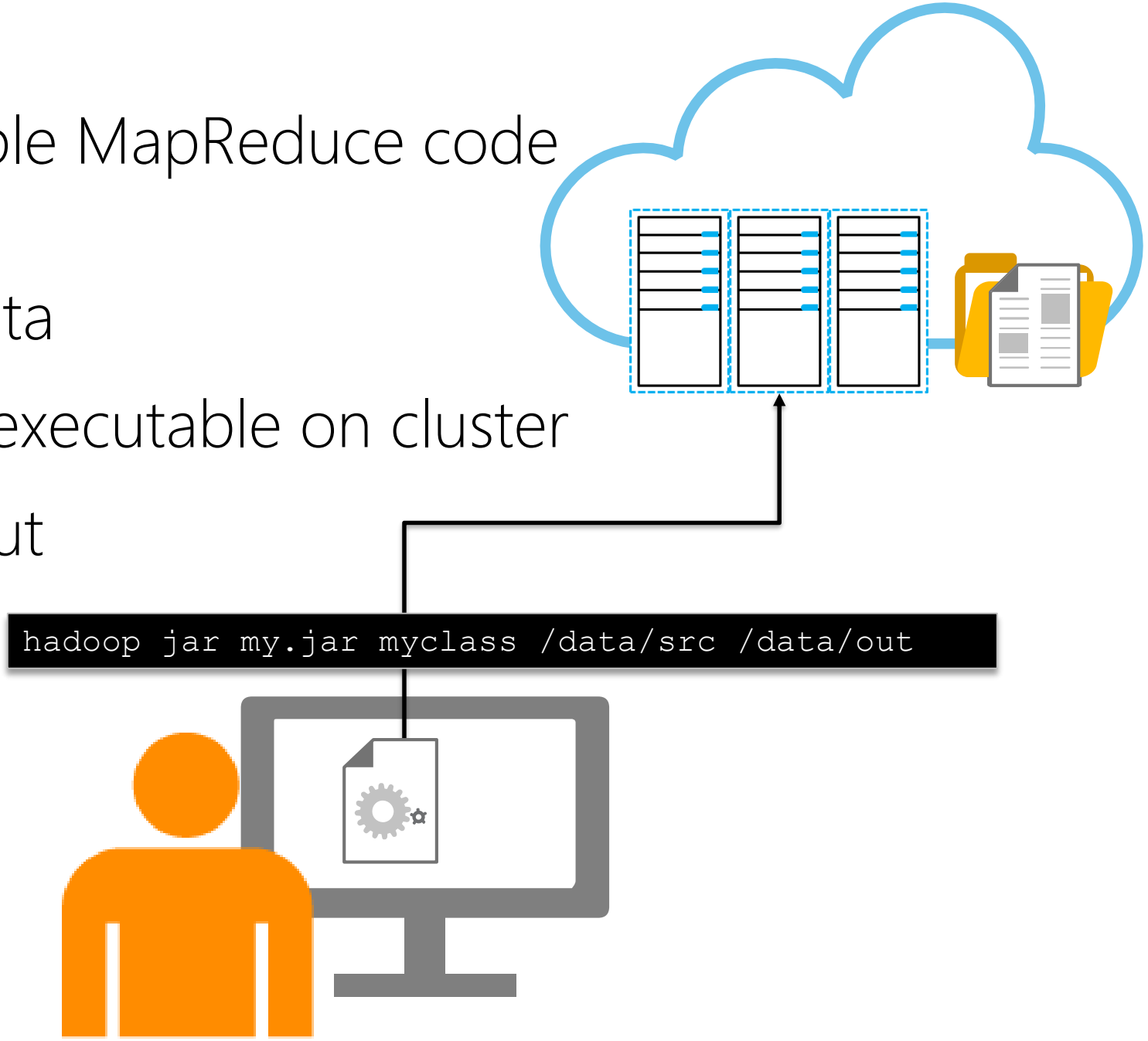
rm and **rm –r** (remove and remove recursive)

put and **get** (transfer files between local file system and HDFS)

text, **cat**, and **tail** (display contents of file)

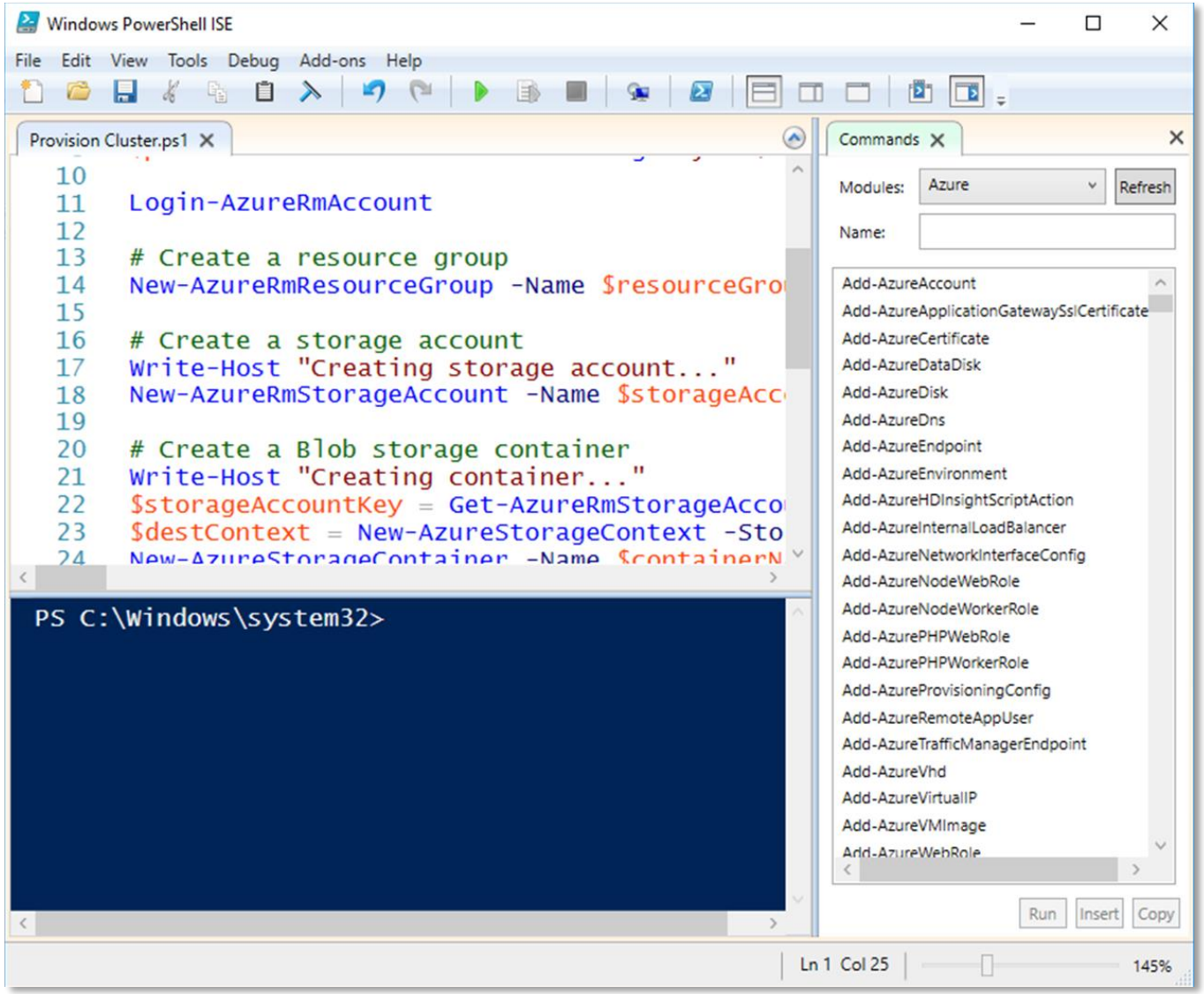
How do I Run a MapReduce Job?

1. Compile executable MapReduce code
   Commonly a Java jar
2. Upload source data
3. Run MapReduce executable on cluster
4. Retrieve job output



How do I use PowerShell with HDInsight?

- The Azure PowerShell module includes cmdlets to work with Azure services, including HDInsight
- Use PowerShell to:
  - Provision HDInsight clusters
  - Upload/download files
  - Submit jobs
  - Manage cluster resources



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