Introduction to TensorFlow!

“Open source software library for
numerical computation using data flow graphs”

History!

Google wanted better support for its services like,

- Gmail
- Photo
- Google search engine

✓ They build a framework called **Tensorflow** to let researchers and developers work together on an AI model. Once developed and scaled, it allows lots of people to use it.

✓ It was first made public in late 2015, while the first stable version appeared in 2017. It is open source under Apache Open Source license.

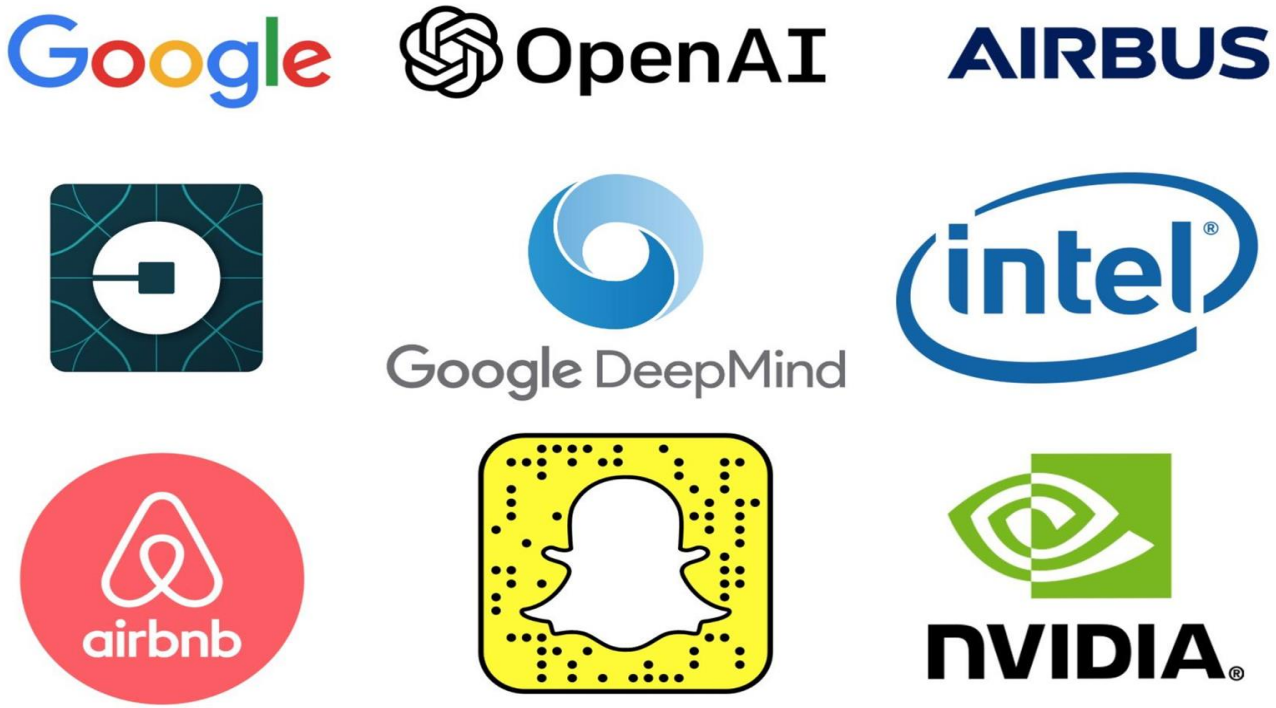
✓ You can use it, modify it and redistribute the modified version for a fee without paying anything to Google.

Why!

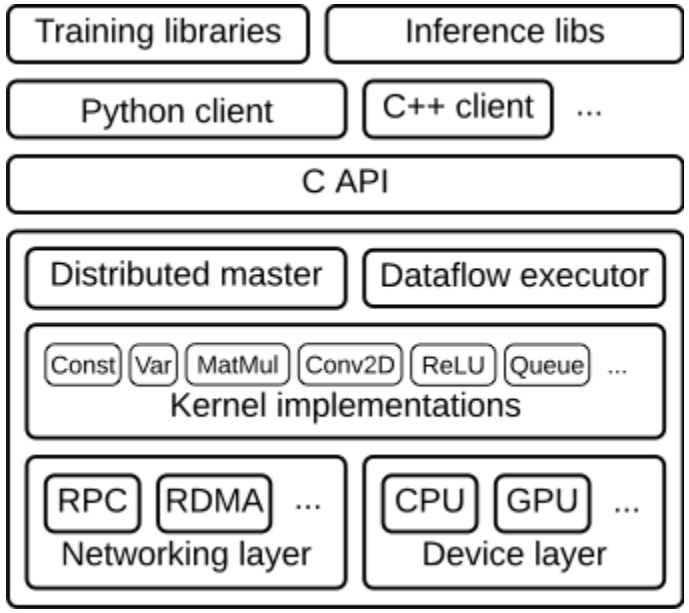
Flexibility + Scalability

Originally developed by Google as a single infrastructure for machine learning in both production and research

Companies using TensorFlow



TensorFlow Architecture



TensorFlow architecture works in three parts:

- Preprocessing the data
- Build the model
- Train and estimate the model

Getting Started!


```
import tensorflow as tf
```

Tensor!

- ✓ Tensorflow's name is directly derived from its core framework: **Tensor**.
- ✓ In Tensorflow, all the computations involve tensors.
- ✓ A tensor is a **vector** or **matrix** of n-dimensions that represents all types of data.
- ✓ All values in a tensor hold identical data type with a known (or partially known) **shape**.
- ✓ The shape of the data is the dimensionality of the matrix or array.
- ✓ A tensor can be originated from the input data or the result of a computation.

An n-dimensional array

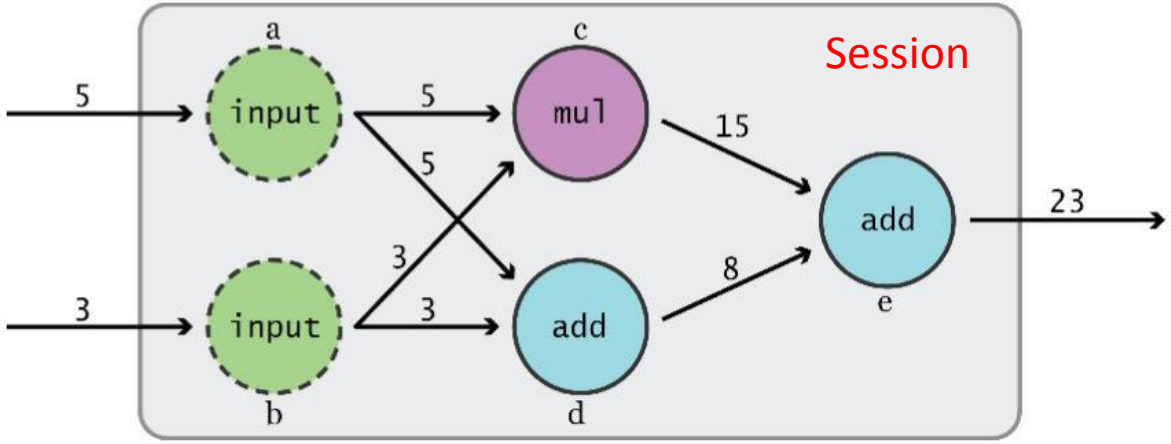
0-d tensor: scalar (number)

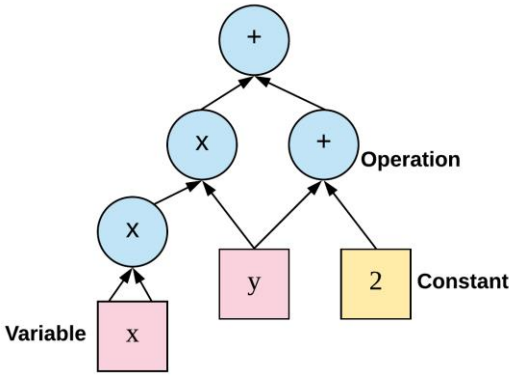
1-d tensor: vector

2-d tensor: matrix and so on

Graphs and Sessions!

TensorFlow separates definition of computations from their execution





TensorFlow makes use of a graph framework. The graph gathers and describes all the series computations done during the training. The graph has lots of advantages:

•It was done to run on multiple CPUs or GPUs and even mobile operating system
•The portability of the graph allows to preserve the computations for immediate or later use. The graph can be saved to be executed in the future.
•All the computations in the graph are done by connecting tensors together

- A tensor has a node and an edge. The node carries the mathematical operation and produces an endpoints outputs. The edges the edges explain the input/output relationships between nodes.

Placeholder!

In TensorFlow terminology, we then *feed* data into the graph through these placeholders

```
import tensorflow as tf

x = tf.placeholder("float", None)
y = x * 2

with tf.Session() as session:
    result = session.run(y, feed_dict={x: [1, 2, 3]})
    print(result)
```

More Insights!

- **Client**:
  - Defines the computation as a dataflow graph.
  - Initiates graph execution using a session.
- **Distributed Master**
  - Prunes a specific subgraph from the graph, as defined by the arguments to Session.run().
  - Partitions the subgraph into multiple pieces that run in different processes and devices.
  - Distributes the graph pieces to worker services.
  - Initiates graph piece execution by worker services.
- **Worker Services** (one for each task)
  - Schedule the execution of graph operations using kernel implementations appropriate to the available hardware (CPUs, GPUs, etc).
  - Send and receive operation results to and from other worker services.
- **Kernel Implementations**
  - Perform the computation for individual graph operations.