Machine Learing: Neural Networks: Tensorflow

CPSC 501: Advanced Programming Techniques
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Context (circa 2015)

- Deep learning already claiming big successes
- Number of developers/researchers exploding
- A “zoo” of tools and libraries, some of questionable quality…

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What is TensorFlow?

- Created by Google as an internal machine learning tool
- Open sourced under the Apache 2.0 License in November 2015
- An open-source software library for Machine Intelligence
  - numerical computation using data flow graphs
- Google maintains its own internal version.
- One of more than a dozen of machine intelligence libraries developed by big companies
- Other libraries
  - https://en.wikipedia.org/wiki/Comparison_of_deep_learning_software

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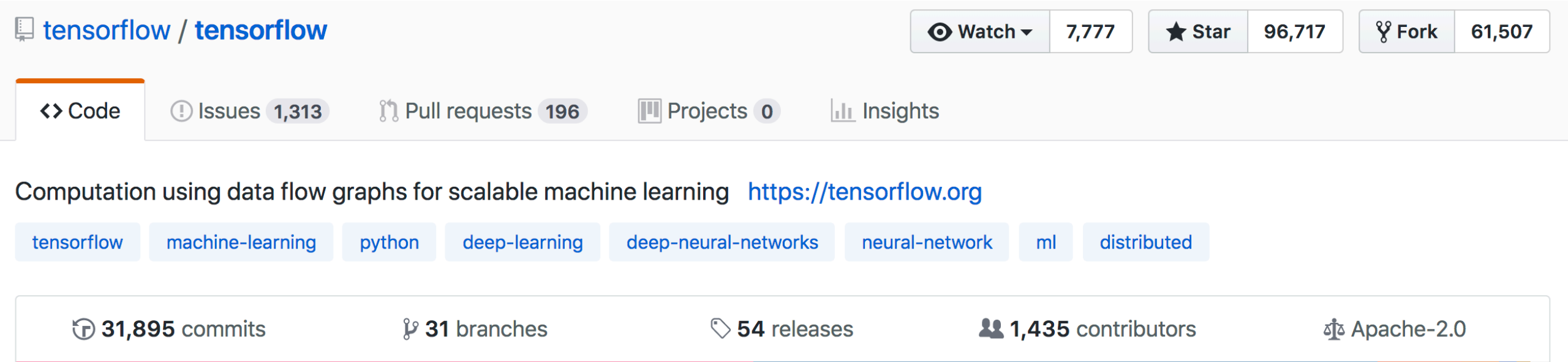
What is TensorFlow?

- Open source library for numerical computation using **data flow graphs**
- Developed by Google Brain Team to conduct machine learning research
  - Based on DisBelief used internally at Google since 2011
- "TensorFlow is an interface for expressing machine learning algorithms, and an implementation for executing such algorithms"



Why TensorFlow?

1. Popularity
   - Top are Theano, Torch, and TensorFlow.
   - Torch framework is written in Lua, which is a wonderful language but one most popular in game development and AI community. Most people use pytorch implementation.
   - Theano has an additional “graph compilation” step that took significant amounts of time and frustration
- TensorFlow has a much cleaner interface as compared to Theano.
- TensorFlow was built with production use in mind

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Why TensorFlow?

- The ability to run in mobile environments
- Easily build models that span multiple GPUs on a single machine
- Train large-scale networks in a distributed fashion

1. Python API
2. Portability: CPU/GPU
3. Flexibility: OS environments
4. Visualization (TensorBoard is very useful)
5. Checkpoints (for managing experiments)
6. Large community.

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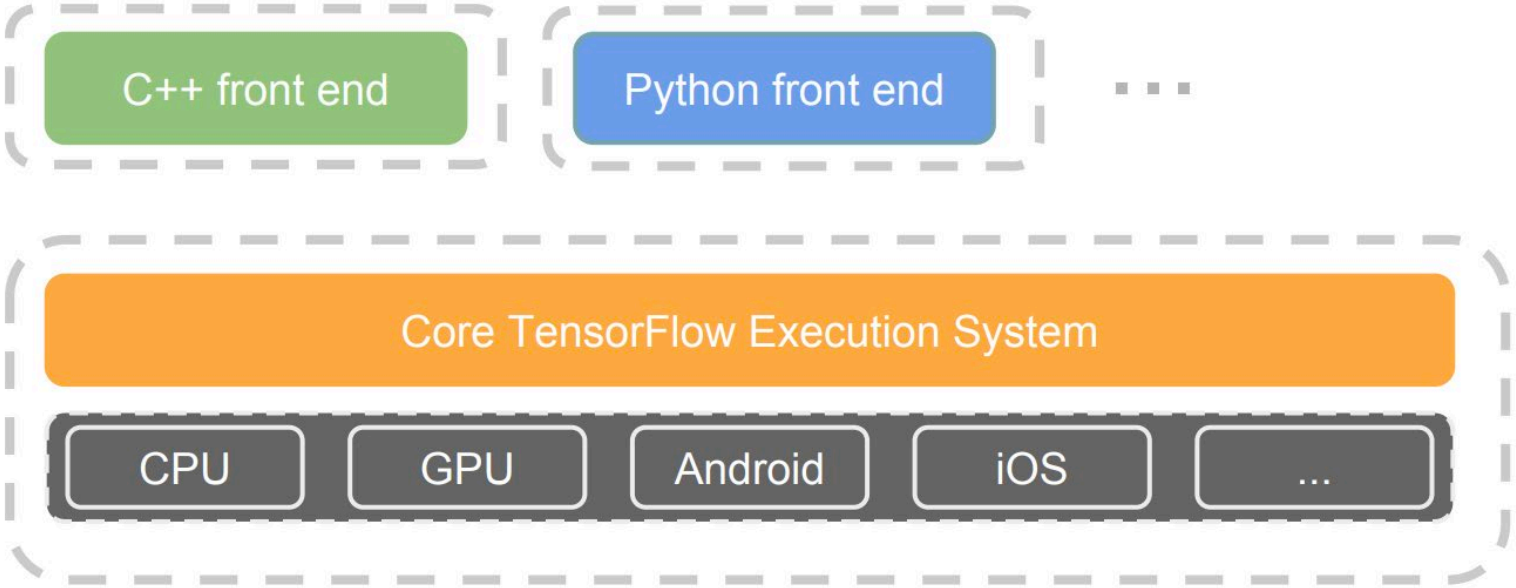
TensorFlow architecture

- Core in C++
  - Very low overhead
- Different front ends for specifying/driving the computation
  - Started with Python and C++



From: http://www.wsdm-conference.org/2016/slides/WSDM2016-Jeff-Dean.pdf

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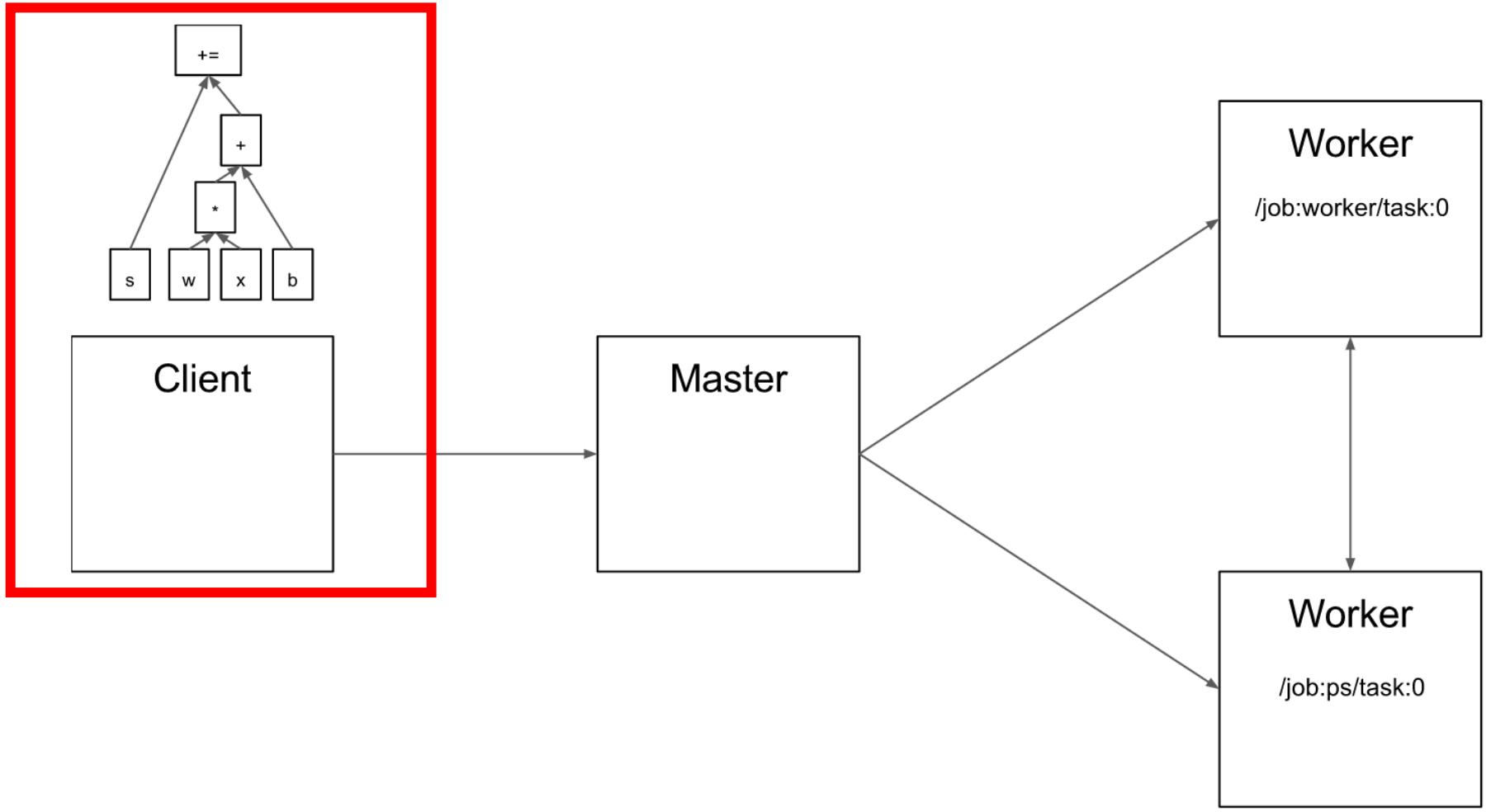
Client



From: https://www.tensorflow.org/extend/architecture

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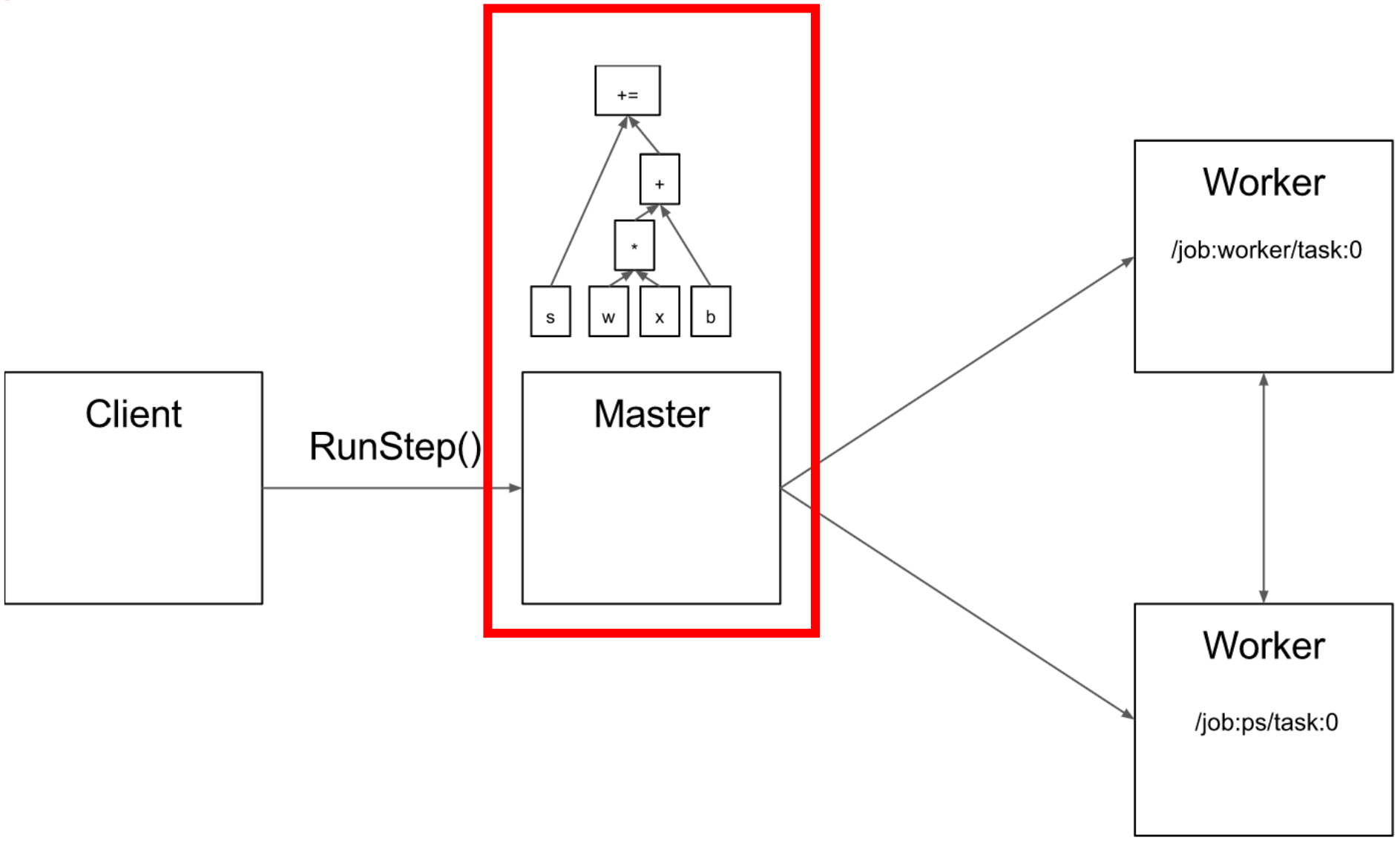
Master



From: https://www.tensorflow.org/extend/architecture

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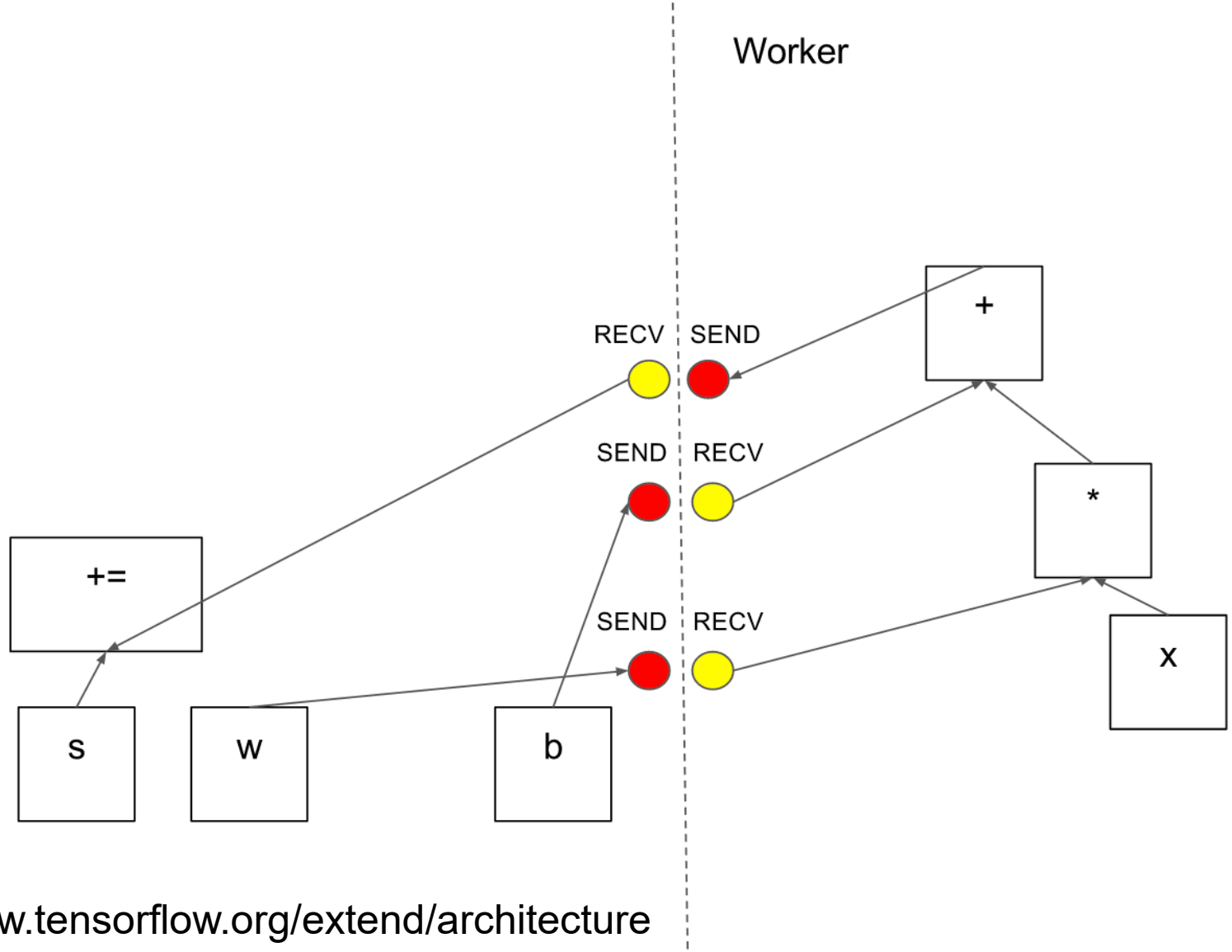
Computation graph partition



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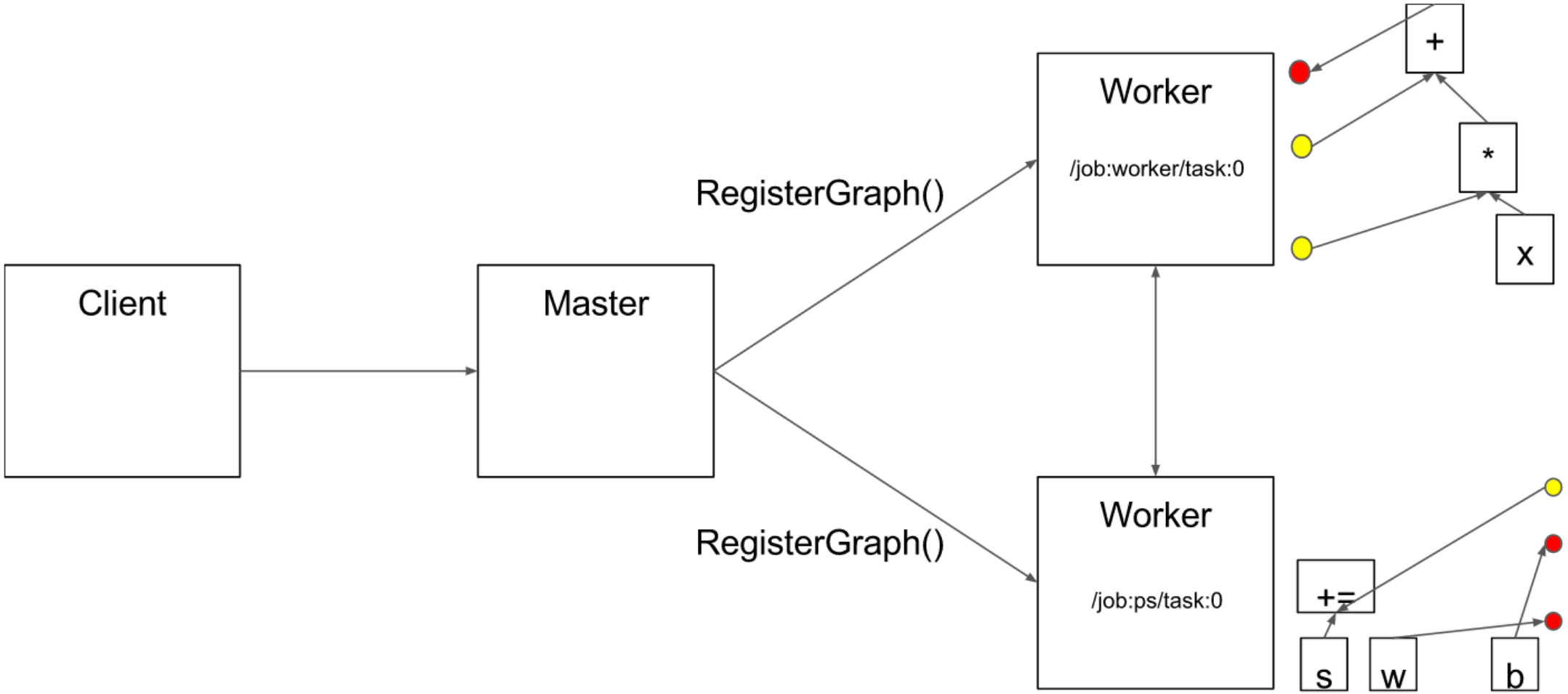
Computation graph partition



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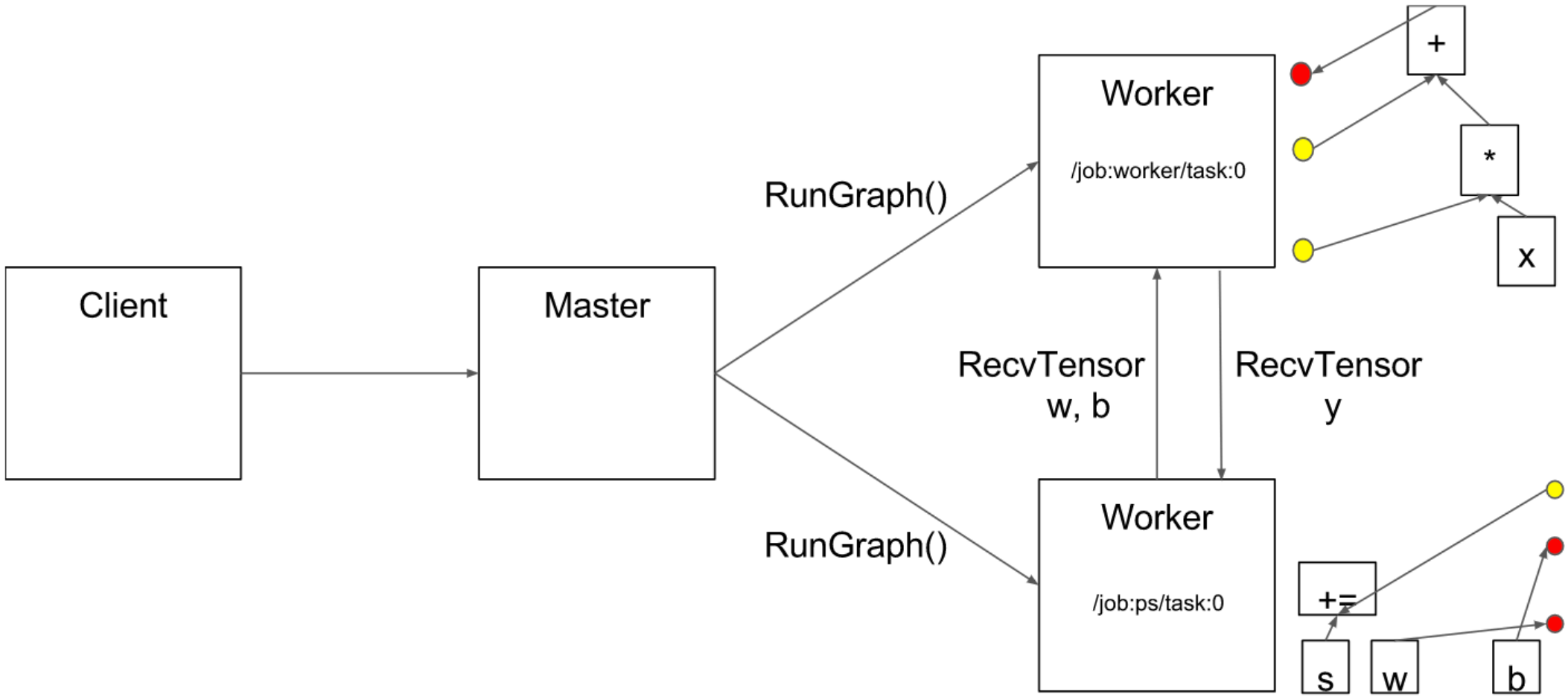
Execution



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Onward to … MNIST

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