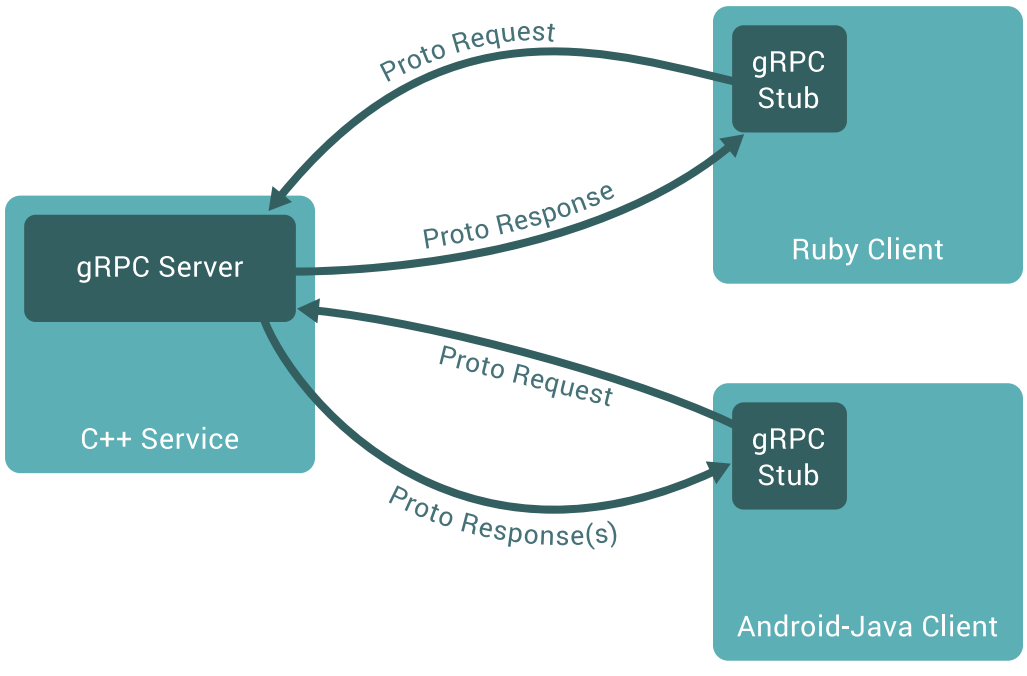
Introduction to gRPC

An introduction to gRPC and protocol buffers.

This page introduces you to gRPC and protocol buffers. gRPC can use protocol buffers as both its Interface Definition Language (**IDL**) and as its underlying message interchange format. If you're new to gRPC and/or protocol buffers, read this! If you just want to dive in and see gRPC in action first, select a language and try its **Quick start**.

Overview

In gRPC, a client application can directly call a method on a server application on a different machine as if it were a local object, making it easier for you to create distributed applications and services. As in many RPC systems, gRPC is based around the idea of defining a service, specifying the methods that can be called remotely with their parameters and return types. On the server side, the server implements this interface and runs a gRPC server to handle client calls. On the client side, the client has a stub (referred to as just a client in some languages) that provides the same methods as the server.



gRPC clients and servers can run and talk to each other in a variety of environments - from servers inside Google to your own desktop - and can be written in any of gRPC's supported languages. So, for example, you can easily create a gRPC server in Java with clients in Go, Python, or Ruby. In addition, the latest Google APIs will have gRPC versions of their interfaces, letting you easily build Google functionality into your applications.

Working with Protocol Buffers

By default, gRPC uses Protocol Buffers, Google's mature open source mechanism for serializing structured data (although it can be used with other data formats such as JSON). Here's a quick intro to how it works. If you're already familiar with protocol buffers, feel free to skip ahead to the next section.

The first step when working with protocol buffers is to define the structure for the data you want to serialize in a *proto file*: this is an ordinary text file with a `.proto` extension. Protocol buffer data is structured as *messages*, where each message is a small logical record of information containing a series of name-value pairs called *fields*. Here's a simple example:

```
message Person {
  string name = 1;
  int32 id = 2;
  bool has_ponycopter = 3;
}
```

Then, once you've specified your data structures, you use the protocol buffer compiler `protoc` to generate data access classes in your preferred language(s) from your proto definition. These provide simple accessors for each field, like `name()` and `set_name()`, as well as methods to serialize/parse the whole structure to/from raw bytes. So, for instance, if your chosen language is C++, running the compiler on the example above will generate a class called `Person`. You can then use this class in your application to populate, serialize, and retrieve `Person` protocol buffer messages.

You define gRPC services in ordinary proto files, with RPC method parameters and return types specified as protocol buffer messages:

```
// The greeter service definition.
service Greeter {
  // Sends a greeting
  rpc SayHello (HelloRequest) returns (HelloReply) {}
}

// The request message containing the user's name.
message HelloRequest {
  string name = 1;
}

// The response message containing the greetings
message HelloReply {
  string message = 1;
}
```

gRPC uses `protoc` with a special gRPC plugin to generate code from your proto file: you get generated gRPC client and server code, as well as the regular protocol buffer code for populating, serializing, and retrieving your message types. You'll see an example of this below.

To learn more about protocol buffers, including how to install `protoc` with the gRPC plugin in your chosen language, see the protocol buffers documentation.

Protocol buffer versions

While protocol buffers have been available to open source users for some time, most examples from this site use protocol buffers version 3 (proto3), which has a slightly simplified syntax, some useful new features, and supports more languages. Proto3 is currently available in Java, C++, Dart, Python, Objective-C, C#, a lite-runtime (Android Java), Ruby, and JavaScript from the protocol buffers GitHub repo, as well as a Go language generator from the golang/protobuf official package, with more languages in development. You can find out more in the proto3 language guide and the reference documentation available for each language. The reference documentation also includes a formal specification for the `.proto` file format.

In general, while you can use proto2 (the current default protocol buffers version), we recommend that you use proto3 with gRPC as it lets you use the full range of gRPC-supported languages, as well as avoiding compatibility issues with proto2 clients talking to proto3 servers and vice versa.

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