



Map::Tube - Lightweight Routing Framework



About me:

- Perl & I, are in relationship for nearly **20** years.
- Published about **78** CPAN modules, pause id “**MANWAR**”.
- Maintains some of the most popular distributions e.g. **PDF::Create**, **XML::XPath**, **SVG** etc.
- Contributed to **289** distributions as of today e.g. **Dancer2**, **Dist::Zilla**, **Test::More** etc.
- Over **1000** consecutive days of releasing to CPAN.

London Perl Workshop 2017

(www.manwar.org)

Background of Map::Tube

- ▶ Lightweight **Moo-based** role.
- ▶ Actively maintained for the last **8 years**. There have been **152** releases so far, last being Map::Tube **v3.40**.
- ▶ Supports the following plugins.
 - ▶ **Map::Tube::Plugin::Graph**
 - ▶ **Map::Tube::Plugin::FuzzySearch**
 - ▶ **Map::Tube::Plugin::Formatter**
- ▶ Supports command line tool '**map-tube**' supplied by **Map::Tube::CLI**
- ▶ Provides command line tool '**map-data-converter**', that can help you change the map data format between **JSON** and **XML**.
- ▶ Contributors
 - ▶ Michal Špaček (**SKIM**)
 - ▶ Gisbert W. Selke (**GWS**)
 - ▶ Slaven Rezic (**SREZIC**)

Maps Available

Barcelona	Beijing	Berlin	Bucharest	Budapest	Delhi
Dnipropetrovsk	Glasgow	Kazan	Kharkiv	Kiev	Koeln Bonn
Kolkatta	Kuala Lumpur	London	Lyon	Malaga	Minsk
Moscow	New York	Nanjing	Nizhny Novgorod	Novosibirsk	Prague
Saint Petersburg	Samara	Singapore	Sofia	Tbilisi	Tokyo
Vienna	Warsaw	Yekaterinburg			

Main Features

- ▶ Find the shortest route between two stations.
- ▶ Plot nice map using the plugin **Map::Tube::Plugin::Graph**
- ▶ Allow fuzzy search of station name using the plugin **Map::Tube::Plugin::FuzzySearch**
- ▶ Get the search result in many formats using the plugin **Map::Tube::Plugin::Formatter**

Lets build a new map

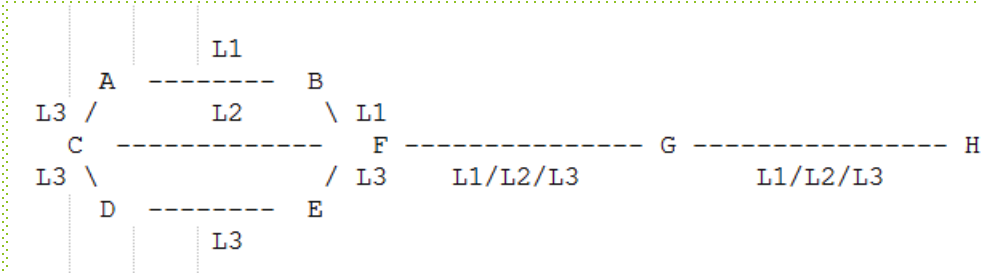
- ▶ Step 1: Collect the source data of the new map.
- ▶ Step 2: Decide the format of map data. e.g. **JSON** or **XML**.
- ▶ Step 3: Build map data in the selected format.
- ▶ Step 4: Create package to consumes the role **Map::Tube**.

We will prepare the environment first

```
$ sudo cpanm -v Map::Tube
```

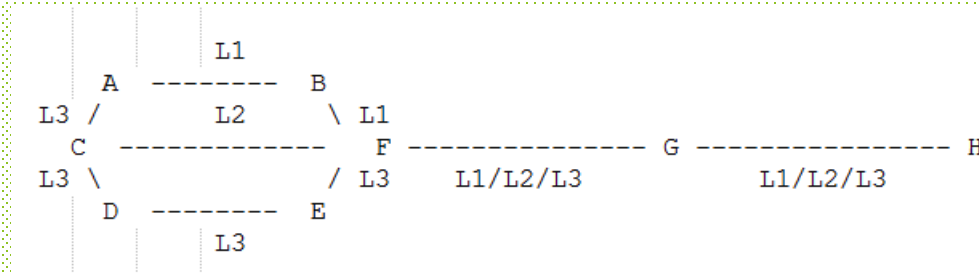
```
$ sudo cpanm -v Map::Tube::Plugin::Graph
```

Step 1: Collect the map data.



- For this short talk, let us take simple map like above, named “Trial”.
- In the above map, we have stations named as A,B,C,D,E,F,G and H.
- The lines are named as L1,L2 and L3.

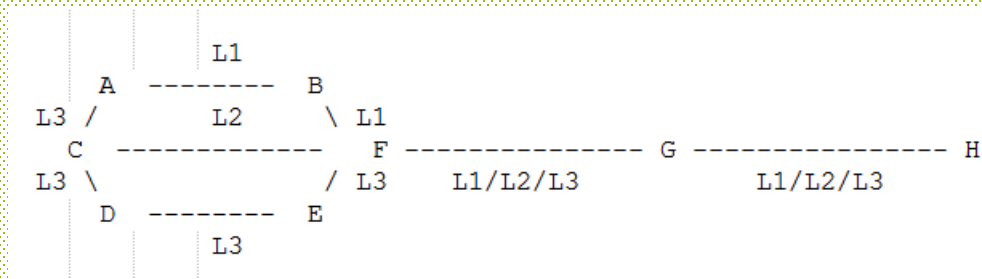
Step 2: Decide the format of map data.



- ▶ Let us assume we decided on JSON format.
- ▶ Let us build the skeleton of map data as below:

```
{
  "name": "Trial",
  "lines":
  {
    "line":
    [
    ],
  },
  "stations":
  {
    "station":
    [
    ]
  }
}
```

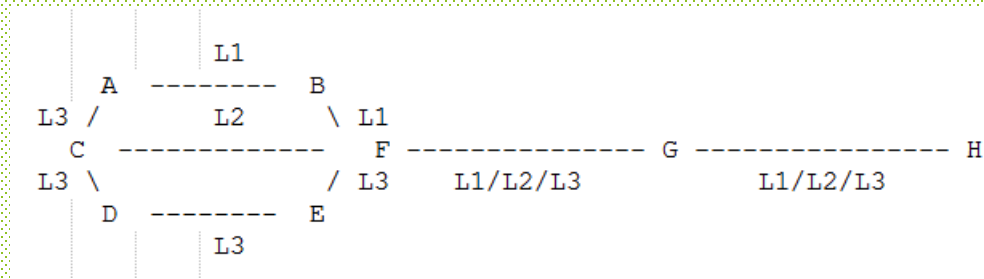
Step 3: Build map data in selected format



- Let us add the line information first.

```
{
  "name": "Trial",
  "lines":
  {
    "line":
    [
      { "id" : "L1", "name" : "L1" },
      { "id" : "L2", "name" : "L2" },
      { "id" : "L3", "name" : "L3" }
    ]
  },
  "stations":
  {
    "station":
    [
    ]
  }
}
```

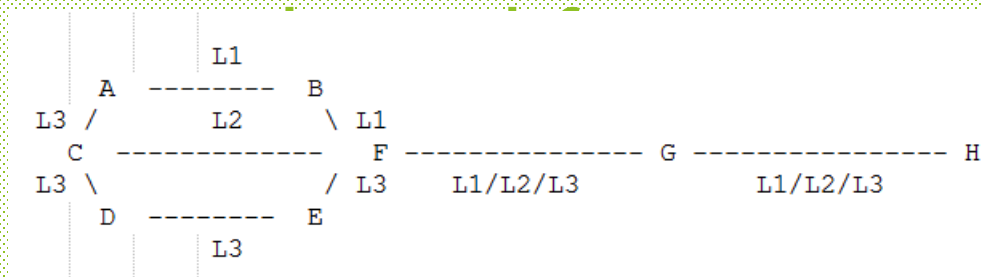

...continued (Step 3)



- Finally we will now add the station details.

```
{
  "name": "Trial",
  "lines":
  {
    "line":
    [
      { "id": "L1", "name": "L1" },
      { "id": "L2", "name": "L2" },
      { "id": "L3", "name": "L3" }
    ]
  },
  "stations":
  {
    "station":
    [
      { "id": "A", "name": "A", "line": "L1,L3", "link": "B,C" },
      { "id": "B", "name": "B", "line": "L1", "link": "A,F" },
      { "id": "C", "name": "C", "line": "L2,L3", "link": "A,D" },
      { "id": "D", "name": "D", "line": "L3", "link": "C,E" },
      { "id": "E", "name": "E", "line": "L3", "link": "D,F" },
      { "id": "F", "name": "F", "line": "L1,L2,L3", "link": "B,C,E,G" },
      { "id": "G", "name": "G", "line": "L1,L2,L3", "link": "F,H" },
      { "id": "H", "name": "H", "line": "L1,L2,L3", "link": "G" }
    ]
  }
}
```

Step 4: Create package to consumes Map::Tube



- This is the easiest step of all. The package Map::Tube::Trial has 5 lines of code in total.

```
package Map::Tube::Trial;

use Moo;
use namespace::autoclean;

has json => (is => 'ro', default => sub { 'trial.json' });
with 'Map::Tube';
```

Create test script

```
#!/usr/bin/perl

use strict; use warnings;
use Map::Tube::Trial;

my $map = Map::Tube::Trial->new;
print $map->get_shortest_route('A', 'D'), "\n";
```

```
my $name = $map->name;
open(my $MAP_IMAGE, ">$name.png");
binmode($MAP_IMAGE);
print $MAP_IMAGE decode_base64($map->as_image);
close($MAP_IMAGE);
```


```
my $line = 'L3';
open(my $LINE_IMAGE, ">$line.png");
binmode($LINE_IMAGE);
print $LINE_IMAGE decode_base64($map->as_image($line));
close($LINE_IMAGE);
```

Bonus Features

- ▶ Lines can be color coded as most maps do use color code.
- ▶ Stations can be indexed per line.
- ▶ Stations can be linked by “other think”.

Bonus Feature #1: Color code line

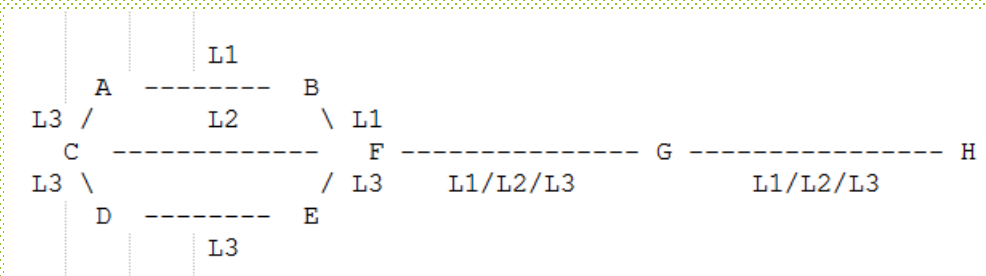
- ▶ This will be handy when generating map image (graph).
- ▶ Here is the updated sample data with line color code.



```
{
  "name": "Trial",
  "lines":
  {
    "line":
    [
      { "id": "L1", "name": "L1", color: "red" },
      { "id": "L2", "name": "L2", color: "blue" },
      { "id": "L3", "name": "L3", color: "green" }
    ]
  },
  "stations":
  {
    "station":
    [
      { "id": "A", "name": "A", "line": "L1,L3", "link": "B,C" },
      { "id": "B", "name": "B", "line": "L1", "link": "A,F" },
      { "id": "C", "name": "C", "line": "L2,L3", "link": "A,D" },
      { "id": "D", "name": "D", "line": "L3", "link": "C,E" },
      { "id": "E", "name": "E", "line": "L3", "link": "D,F" },
      { "id": "F", "name": "F", "line": "L1,L2,L3", "link": "B,C,E,G" },
      { "id": "G", "name": "G", "line": "L1,L2,L3", "link": "F,H" },
      { "id": "H", "name": "H", "line": "L1,L2,L3", "link": "G" }
    ]
  }
}
```

Bonus Feature #2: Index station per line

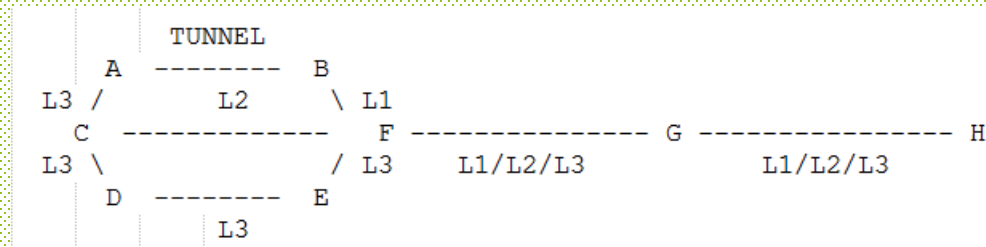
- ▶ This will be handy when fetching station lists for a particular line.
- ▶ Without index, result station list would be ordered alphabetically instead of how it appears in map.
- ▶ Here is the update sample data with station index.



```
{
  "name": "Trial",
  "lines":
  {
    "line":
    [
      { "id": "L1", "name": "L1" },
      { "id": "L2", "name": "L2" },
      { "id": "L3", "name": "L3" }
    ]
  },
  "stations":
  {
    "station":
    [
      { "id": "A", "name": "A", "line": "L1:1,L3:1", "link": "B,C" },
      { "id": "B", "name": "B", "line": "L1:2", "link": "A,F" },
      { "id": "C", "name": "C", "line": "L2:1,L3:2", "link": "A,D" },
      { "id": "D", "name": "D", "line": "L3:3", "link": "C,E" },
      { "id": "E", "name": "E", "line": "L3:4", "link": "D,F" },
      { "id": "F", "name": "F", "line": "L1:3,L2:2,L3:5", "link": "B,C,E,G" },
      { "id": "G", "name": "G", "line": "L1:4,L2:3,L3:6", "link": "F,H" },
      { "id": "H", "name": "H", "line": "L1:5,L2:4,L3:7", "link": "G" }
    ]
  }
}
```

Bonus Feature #3: Link station by “other link”

- ▶ In some map, two stations are linked by “tunnel” or by some other link. For example, in London tube map, the “Bank” station is also linked to “Monument” station by “tunnel”.
- ▶ Here is how it can be represented in the map data.



If you have noticed, I have removed "L1:1" from "line" as now "A" is no longer on line "L1".

```
{ "id": "A", "name": "A", "line": "L3:1", "link": "C", "other_link": "tunnel:B" },  
{ "id": "B", "name": "B", "line": "L1:1", "link": "F", "other_link": "tunnel:A" },
```

This would now change the sequence of other stations as well.

```
{ "id": "C", "name": "C", "line": "L2:1,L3:2", "link": "A,D" },  
{ "id": "D", "name": "D", "line": "L3:3", "link": "C,E" },  
{ "id": "E", "name": "E", "line": "L3:4", "link": "D,F" },  
{ "id": "F", "name": "F", "line": "L1:2,L2:2,L3:5", "link": "B,C,E,G" },  
{ "id": "G", "name": "G", "line": "L1:3,L2:3,L3:6", "link": "F,H" },  
{ "id": "H", "name": "H", "line": "L1:4,L2:4,L3:7", "link": "G" }
```

Need more information?

- ▶ I would recommend **Map::Tube::Cookbook** documentation for detailed description of internals of Map::Tube.
- ▶ For all other details, please refer to the documentation of **Map::Tube**.
- ▶ In case you still have any questions/suggestions, then please free to contact me by email (**mohammad.anwar@yahoo.com**).

Mini Challenge

- ▶ I would like to give you all a mini challenge to create simple map, having at least 2 lines with stations for now, and published to CPAN.
- ▶ Whoever do this first by end of today's workshop will receive a gift from me.
- ▶ To help you in your challenge, I have picked few maps that are still missing:
 - ▶ Paris
 - ▶ Download sample data (<http://www.manwar.org/talks/paris-metro.json>)
 - ▶ Madrid
 - ▶ Download sample data (<http://www.manwar.org/talks/madrid-metro.json>)
 - ▶ Mexico
 - ▶ Download sample data (<http://www.manwar.org/talks/mexico-city-metro.json>)
- ▶ Download source: (<http://www.manwar.org/talks/Map-Tube-Trial-0.01.tar.gz>)

Any Questions ?

In the end...

I would like to thank all my friends and families, especially ...



Thank You
for
attending my talk.