



## 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 **300** distributions as of today e.g. **Dancer2**, **Dist::Zilla**, **Test::More** etc.
- Submitted over **600+** PullRequests.
- Over **1000+** consecutive days of releasing to CPAN.

**London Perl Workshop 2017**

([www.manwar.org](http://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	<b><u>London</u></b>	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

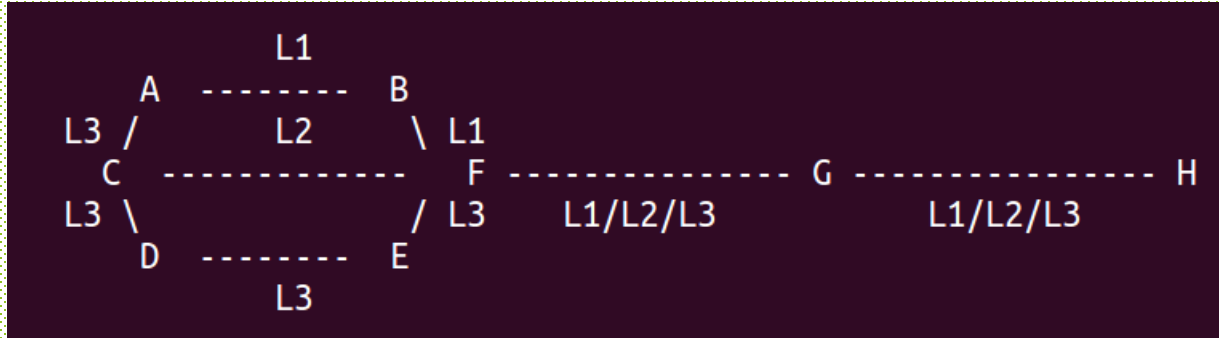
- ▶ Step 1: Collect the source data of the new map.
- ▶ Step 2: Decide the format of map data. e.g. ***JSON*** or ***XML***.
- ▶ Step 3: Build map data in the selected format.
- ▶ Step 4: Create package to consumes the role ***Map::Tube***.

## We will prepare the environment first

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

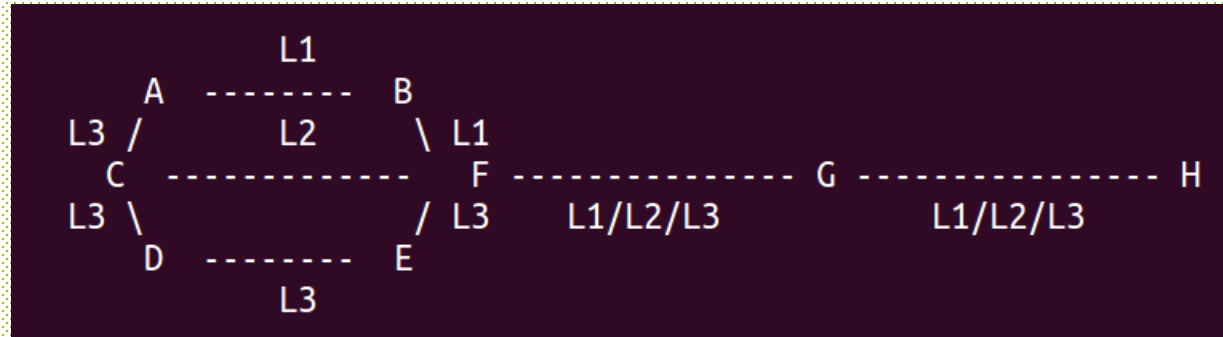
```
$ sudo cpanm -v Map::Tube::Plugin::Graph
```

## 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.

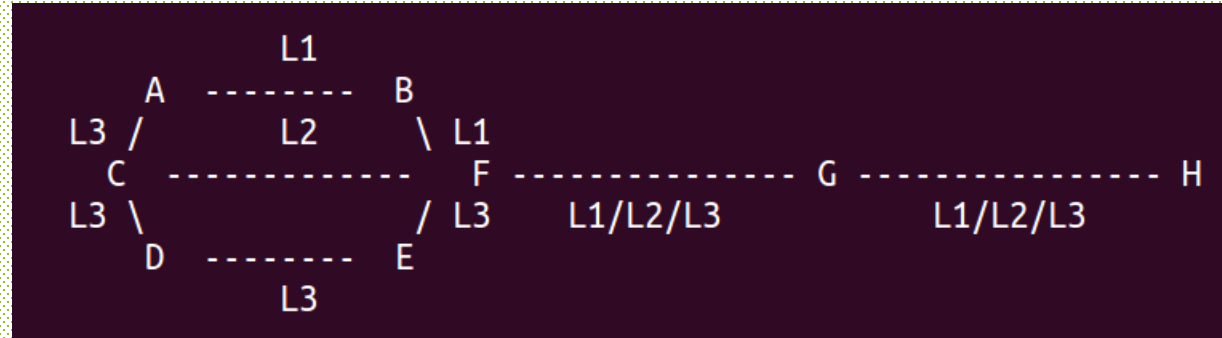
## Step 2: Decide the format of map data.



- 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

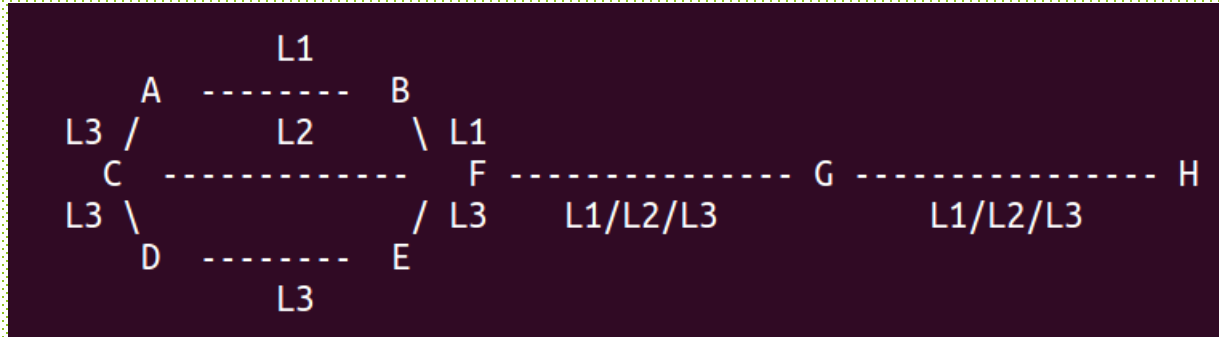


- Let us add the line information first.

```
{
  "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,F" },
      { "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 selected format

- This is the easiest step of all. The package Map::Tube::Trial has **6 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';
:
1;
```

## Create test script

```
#!/usr/bin/perl

use strict; use warnings;
use MIME::Base64;
use Map::Tube::Trial;

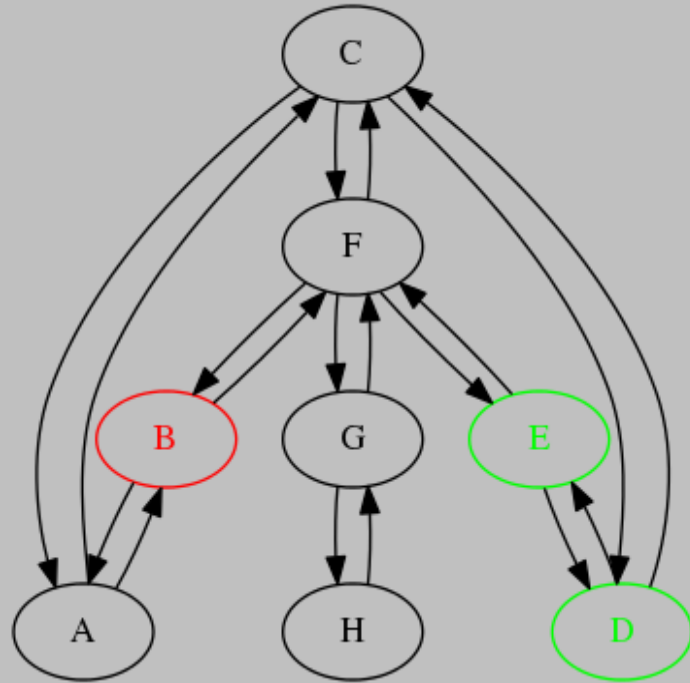
my $map = Map::Tube::Trial->new;
print $map->get_shortest_route('A', 'D'), "\n";
```

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

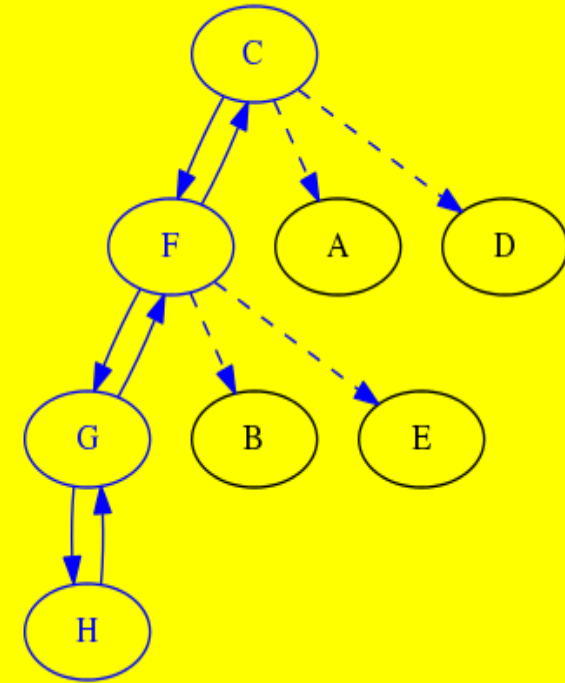
```
my $line = 'L2';
open(my $LINE_IMAGE, ">$line.png");
binmode($LINE_IMAGE);
print $LINE_IMAGE decode_base64($map->as_image($line));
close($LINE_IMAGE);
```

# Generated Map

Trial Map (Generated by Map::Tube::Plugin::Graph v0.28 at 2017-11-22 16:48:28)



Trial Map: L2 Line (Generated by Map::Tube::Plugin::Graph v0.28 at 2017-11-22 16:48:28)



## 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”.

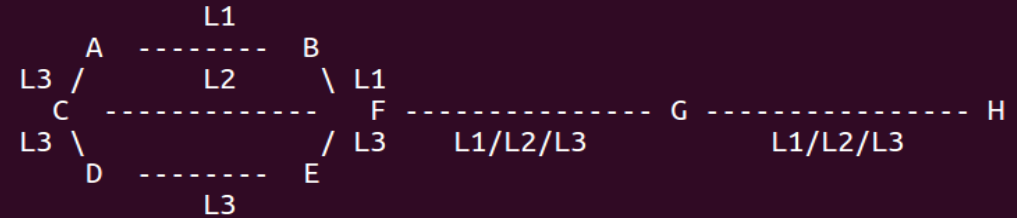
# Bonus Feature #1: Color code line

- ▶ 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,F" },
      { "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

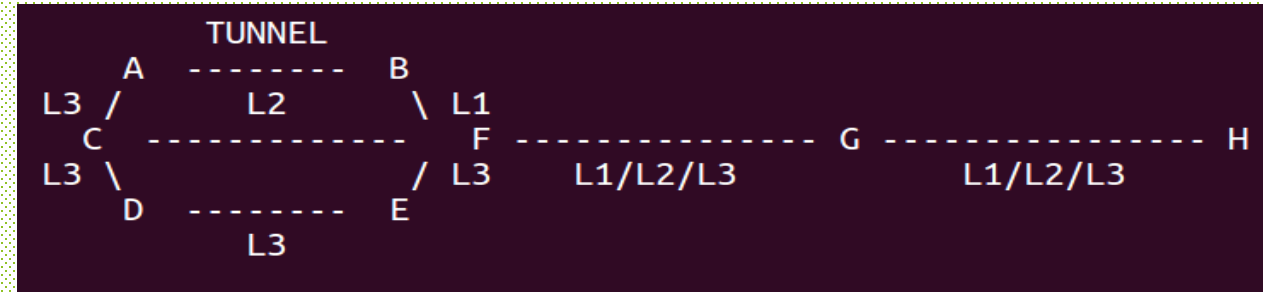
- ▶ This will be handy when fetching station lists for a particular line.
- ▶ Without index, result station list would be ordered alphabetically instead of how it appears in map.
- ▶ Here is the update sample data with station index.



```
{
  "name": "Trial",
  "lines":
  {
    "line":
    [
      { "id": "L1", "name": "L1", "color": "red" },
      { "id": "L2", "name": "L2", "color": "blue" },
      { "id": "L3", "name": "L3", "color": "green" }
    ]
  },
  "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,F" },
      { "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.



```
{
  "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": "L3:1", "link": "C", "other_link": "tunnel:B" },
      { "id": "B", "name": "B", "line": "L1:1", "link": "F", "other_link": "tunnel:A" },
      { "id": "C", "name": "C", "line": "L2:1,L3:2", "link": "A,D,F" },
      { "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 release it 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 Metro
    - ▶ Download sample data ( <http://www.manwar.org/talks/paris-metro.json> )
  - ▶ Madrid Metro
    - ▶ Download sample data ( <http://www.manwar.org/talks/madrid-metro.json> )
  - ▶ Mexico City Metro
    - ▶ 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 ?

## Before I end my talk ...

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



And finally Thank you to the sponsors, without which the London Perl Workshop would not be possible:

Eligo, Perl Careers,  
CV-Library, WCN,  
Adzuna, Bytemark, OpusVL, Booking.com,  
SureVoIP, Magnum Solutions,  
Perl 6, Geekuni,  
University of Westminster, Cogendo,  
Science Photo Library,  
The Enlightened Perl Organisation,  
Evozon, O'Reilly.