Map::Tube – Lightweight Routing Framework

About me:

- Perl & I, are in relationship for nearly 20 years.
- Published over 75 CPAN modules, pause id “MANWAR”.
- Maintains some of the most popular distributions e.g. PDF::Create, XML::XPath, SVG etc.
- Contributed to over 280 distributions.
- 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 148 releases so far.
- Have bunch of useful plugins.
  - Map::Tube::Plugin::Graph
  - Map::Tube::Plugin::FuzzySearch
  - Map::Tube::Plugin::Formatter
- Have command line tool ‘map-tube’ supplied by Map::Tube::CLI
- 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			

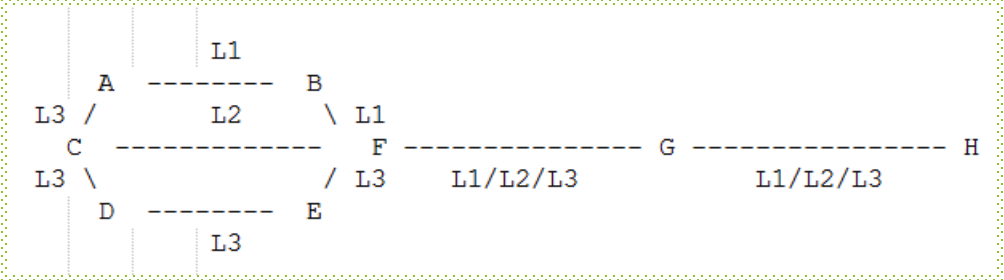
Main Features

- 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

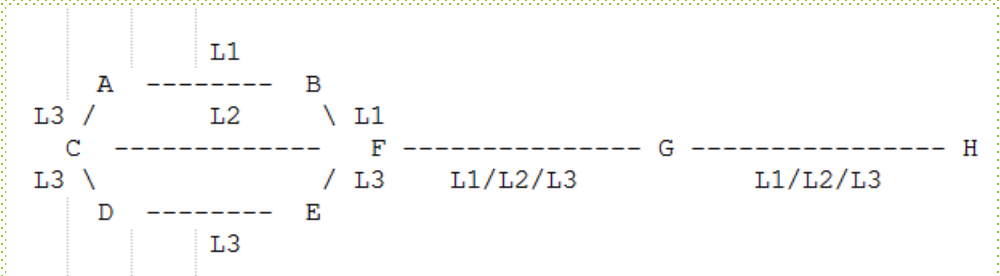
- Step 1: Collect the source data of the new map.
- Step 2: Decide the format of map data. E.g. XML or JSON.
- Step 3: Build map data in the selected format.
- Step 4: Create package to consumes the Map::Tube.

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 station named as A,B,C,D,E,F,G and H.
- The line named as L1,L2 and L3.

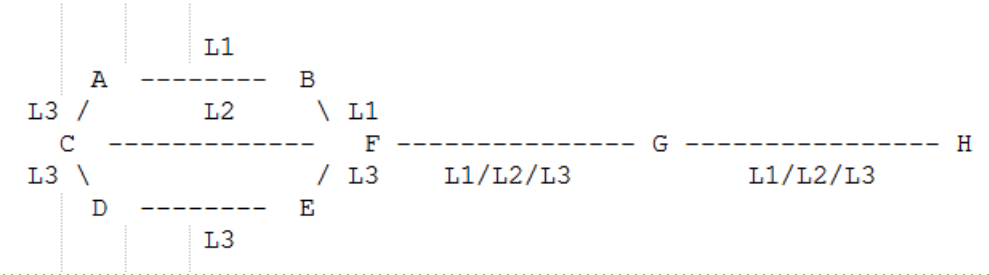
Step 2: Decide the format of map data.



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

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

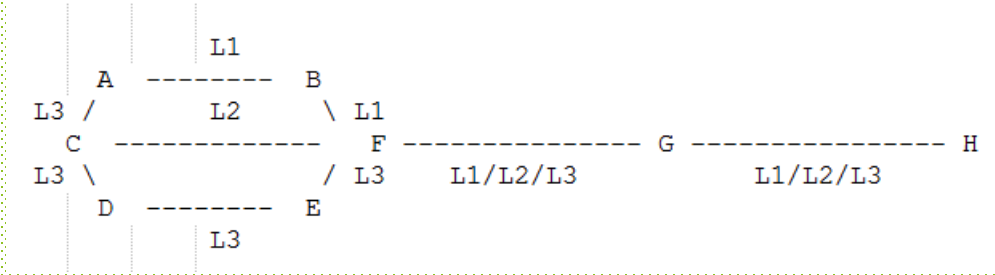
Step 3: Build map data in selected format



- 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":
        [
        ]
    }
}
```

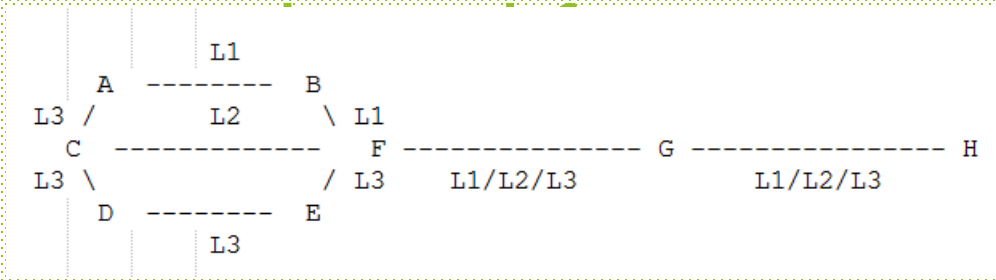
...continued (Step 3)



- 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

- Here is a basic script to find the shortest route between station ‘A’ and ‘D’.

```
#!/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";
```

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”.

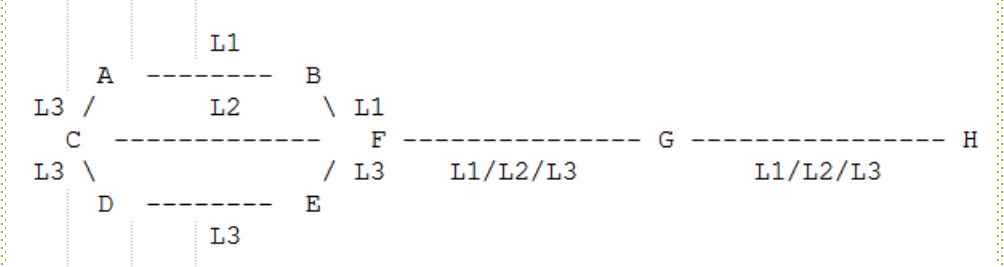
Bonus Feature #1: Color code line

- This will be handy when generating map image (graph).
- Here is the update 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

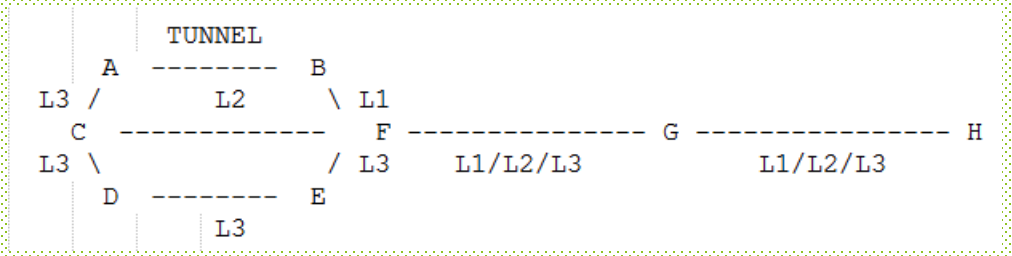
- This will be handy when fetching station lists for a particular line.
- Without index, result station list would be ordered alphabetically instead of how it appears in map.
- Here is the update sample data with station index.




```
{
    "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 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 please refer to the documentation of Map::Tube.
- In case you still have any questions, please free to contact me by email (mohammad.anwar@yahoo.com).

In the end…

- I would like to thank my wife and daughters for all the support.
- Last but not the least, I would like to thank my mom for everything.

Any Questions ?

Thank You