



SAS® FORUM
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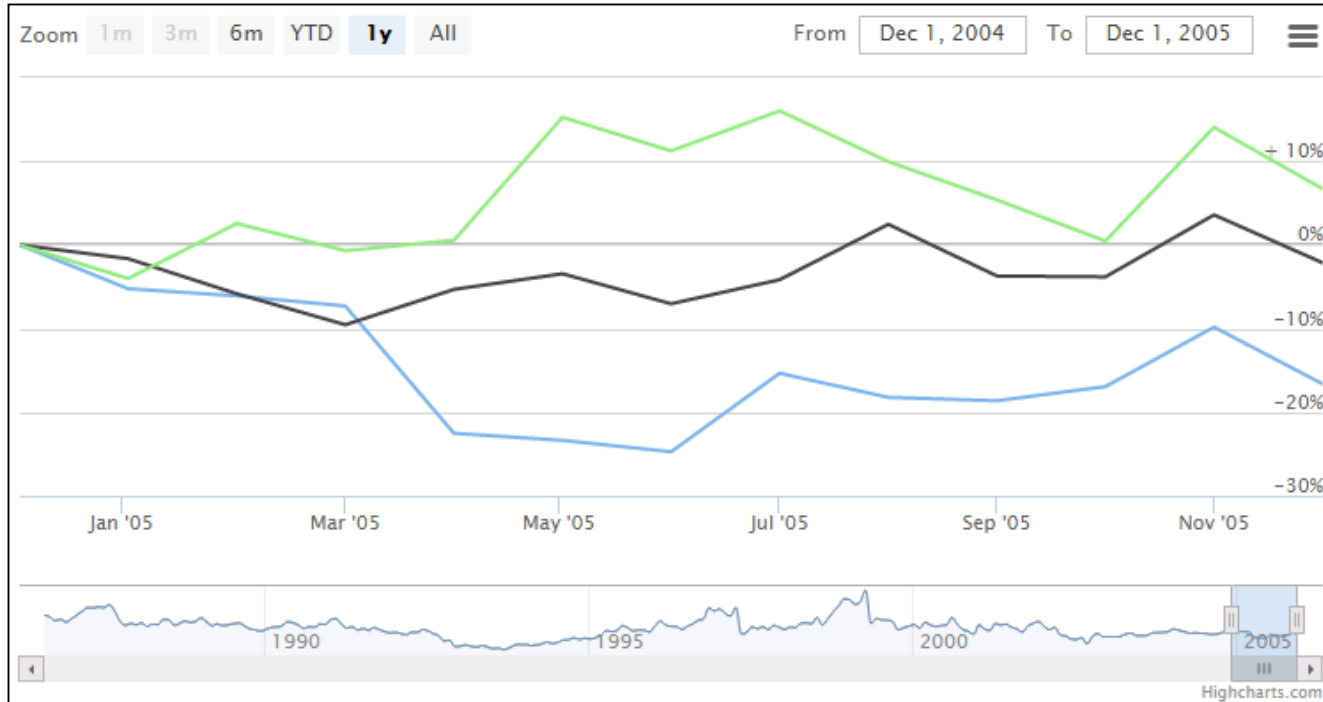
Data visualisation with HighChart or D3

Vasilij Nevlev – Aviva Health

How to get sashelp.stocks from this:

	 Stock	 Date	 Open	 High	 Low	 Close	 Volume	 AdjClose
1	IBM	01DEC05	\$89.15	\$89.92	\$81.56	\$82.20	5,976,252	\$81.37
2	IBM	01NOV05	\$81.85	\$89.94	\$80.64	\$88.90	5,556,471	\$88.01
3	IBM	03OCT05	\$80.22	\$84.60	\$78.70	\$81.88	7,019,666	\$80.86
4	IBM	01SEP05	\$80.16	\$82.11	\$76.93	\$80.22	5,772,280	\$79.22
5	IBM	01AUG05	\$83.00	\$84.20	\$79.87	\$80.62	4,801,386	\$79.62
6	IBM	01JUL05	\$74.30	\$85.11	\$74.16	\$83.46	8,056,590	\$82.23
7	IBM	01JUN05	\$75.57	\$77.73	\$73.45	\$74.20	6,439,536	\$73.10
8	IBM	02MAY05	\$76.88	\$78.11	\$72.50	\$75.55	6,896,904	\$74.43
9	IBM	01APR05	\$91.49	\$91.76	\$71.85	\$76.38	10,709,200	\$75.05
10	IBM	01MAR05	\$92.64	\$93.73	\$89.09	\$91.38	5,025,627	\$89.79
11	IBM	01FEB05	\$93.67	\$94.97	\$91.55	\$92.58	4,455,657	\$90.97
12	IBM	03JAN05	\$98.97	\$99.10	\$91.44	\$93.42	5,960,945	\$91.62
13	IBM	01DEC04	\$94.50	\$99.00	\$94.47	\$98.58	5,043,800	\$96.68
14	IBM	01NOV04	\$89.33	\$96.63	\$89.23	\$94.24	5,754,876	\$92.42
15	IBM	01OCT04	\$85.95	\$90.27	\$84.29	\$89.75	5,839,742	\$87.85
16	IBM	01SEP04	\$84.05	\$87.28	\$83.24	\$85.74	4,719,252	\$83.93
17	IBM	02AUG04	\$86.87	\$87.39	\$81.90	\$84.69	4,298,600	\$82.90

To this in two data steps:



Agenda

- Introduction
- Why to visualise with HighCharts or D3?
- What do you need to have?
- What do you need to know?
- One of many ways of doing it
- Questions

Introduction

- Role: Financial Loss Analyst (Fraud)
- Project: Fraud detection framework
- Tool: Complex web portal build on:
 - SAS Stored Processes
 - JavaScript/HTML/CSS

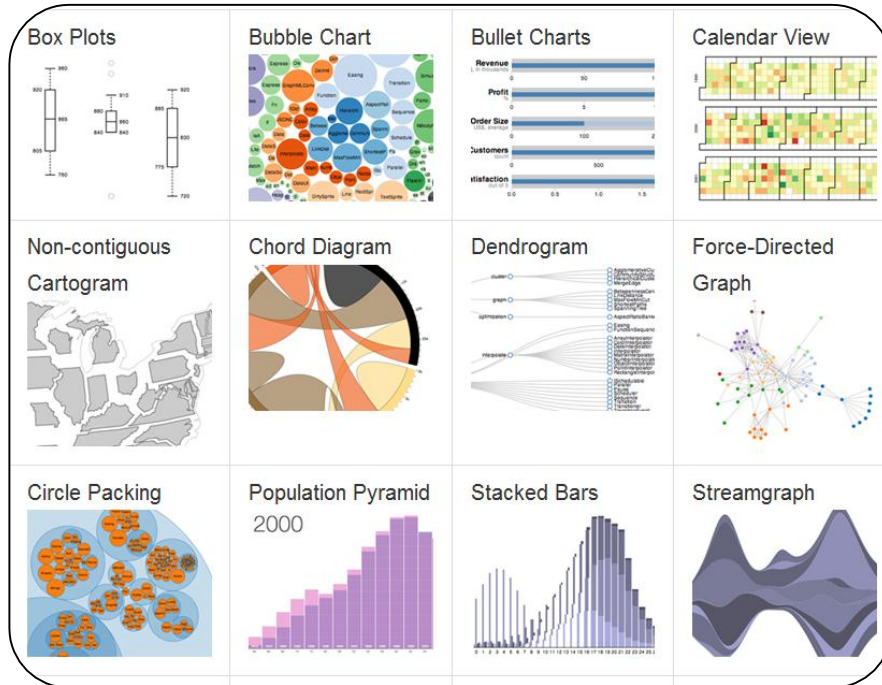
Why to visualise with HighCharts or D3?



Ok, so what exactly is HighCharts or D3?

- Simple, small, but powerful JavaScript Library
- That's it, there is nothing else to it
- And yes, there is a lot of other great libraries

What sort of visualisation can I do with it?



You must experience it.

Didn't I say it was mobile friendly?

Visit:

<https://github.com/mbostock/d3/wiki/Gallery>

<http://www.highcharts.com/demo>

Or Google:

“D3 Demo” or “HighCharts Demo”

Questions so far?



So what do I need to have?

- SAS Base server
- SAS Stored Process web app and server
- Somewhere to store your JS libraries with access over HTTP(S)

What do I need to know?

- SAS Base programming
- How to work with macro variables
- How to design Stored Processes
- Basic understanding of JavaScript/HTML/CSS

Can we start doing it already?

- This example is using sashelp.stocks data table
- We will turn that into stocks visualisation that allows dynamically adjust time periods of the time series data
- The example is based on Model and View principle, so first stored process visualises the data, and another Stored Process provides the actual data on demand.

SAS pseudo-Code for visualisation

```
1. data _null_;
2.     file _webout;
3.     put '<html><head>' /
4.     'JavaScript of your choice'
5.     '1st JavaScript function to transform the "container" into a graph when data is
ready'
6.     '2nd JavaScript function to fetch the data from your SAS server'
7.     '</script>' /
8.     '</head><body>' /
9.     '<div id="container" style="height: 400px; min-width: 310px"></div>' /
10.    '</body></html>';
11. run;
```

```

1. data _null_;
2.   file _webout;
3.   put
4.     '<html><head>' /
5.     '<script src="http://code.jquery.com/jquery-1.11.3.min.js"></script>' /
6.     '<script src="http://code.highcharts.com/stock/highstock.js"></script>' /
7.     '<script src="http://code.highcharts.com/stock/modules/exporting.js"></script>' /
8.     '<script type="text/javascript">' /
9.       '$(function () {var seriesOptions = [],'/
10.        'seriesCounter = 0,'/
11.        'names = ["IBM", "Microsoft", "Intel"],'/
12.        'createChart = function () {'/
13.          '$("#container").highcharts("StockChart", {'/
14.            'rangeSelector: {'/
15.              'selected: 4},'/
16.              'yAxis: {labels: {
17. formatter: function () {return (this.value > 0 ? " + " : "") + this.value + "%";}},'/
18.            'plotLines: [{'/
19.              'value: 0,'/
20.              'width: 2,'/
21.              'color: "silver"}]},'/
22.            'plotOptions: {series: { compare: "percent"}},'/
23.            'series: seriesOptions});};'/
24.          '$.each(names, function (i, name) {'/
25.            '$.ajax({ type: "GET" , url: "/SASStoredProcess/do?_program=/getStockData&Stock=" + name, dataType: "JSON",
26.              success: function (data) {'/
27.                'seriesOptions[i] = data;' /
28.                'seriesCounter += 1;' /
29.                'if (seriesCounter === names.length) {'/
30.                  'createChart();}}});});};'; /
31.          '</script></head><body><div id="container" style="height: 400px; min-width: 310px"></div>' /
32.          '</body></html>'; run;

```

SAS Code to feed the data

```
1.   proc sort data=sashelp.stocks (where=(Stock="&Stock")) out=stocks_sorted;
2.     by date;
3.   run;
4.
5.   data _null_;
6.     set stocks_sorted end = eof;
7.     file _webout lrecl=20480;
8.     format Date BEST16.;
9.     format Close 8.2;
10.    Date = INTCK("days", "01JAN70"d, Date) * 86400000 ;
11.    if _N_ eq 1 then put '{ "name":'""&Stock""', "data": [';
12.    put '[' Date ',' Close']' ;
13.    if eof then put ']}';
14.    else put ',';
15.  run;
```

JSON data format

- JavaScript Object Notation
- Open Standard
- Not dependent on any language, event that it has “JavaScript” in its name
- Here is what sashelp.stocks should look like:
- ```
{ "name": "IBM", "data": [[523238400000,138.75], [526003200000,134.50], [528508800000,123.62], [531360000000,127.12], [533779200000,120.00], [536544000000,128.75], [539222400000,139.50], [541641600000,150.13], [544233600000,160.13], [546825600000,160.00], [549504000000,162.50], [552096000000,161.00], [554947200000,168.38], [557452800000,150.75], [560044800000,122.50], [562809600000,110.75], [565315200000,115.50], [568252800000,112.37], [570672000000,117.50], [573177600000,107.62], [576115200000,113.37], [578534400000,112.50], [581126400000,127.37], [583718400000,125.75], [586396800000,111.50], [589075200000,115.37], [591840000000,122.62], [594345600000,118.50], [596937600000,121.87], [599788800000,130.63], [602294400000,121.50], [604713600000,109.12], [607564800000,114.12], [609984000000,109.62]] }
```



# Important Tips

- You must turn off “Global Stored Process Variables” in SAS EG in order for `_webout fileref` to be available for your data step
- You must set input macro variables in your stored process in order for POST or GET HTTP method to work correctly when passing parameters to your program
- If you create records on SAS server side, ensure you avoid locks by checking for locks in advance, by using SAS/SHARE or SAS SPDS (SAS Scalable Performance Data Server)
- If you are on 9.4, use PROC STREAM, otherwise be mindful when using quotes because syntax conflict between JavaScript, HTML and SAS
- Remember, single quotes and macro variables do not mix
- PUT statement always puts a blank at the end of each variable. It can be controlled by specifying “+(-1)”. This moves the pointer one character back.

# That is it. Questions?





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**Thank you for your attention.**



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# Appendix I – AppendGrid

| My CD Collections                                                                                                                                                   |             |              |      |             |                                     |       |                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------|------|-------------|-------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                     | Album       | Artist       | Year | Origin      | With Poster?                        | Price |                                                                                                                                                                                                                                                                                                                                                 |
| 1                                                                                                                                                                   | Dearest     | Theresa Fu   | abcd | Hong Kong ▼ | <input checked="" type="checkbox"/> | 168.9 |     |
| 2                                                                                                                                                                   | To be Free  |              | 2010 | Japan ▼     | <input checked="" type="checkbox"/> | 152.6 |     |
| 3                                                                                                                                                                   | Count On Me | Show Luo     | 2012 | Taiwan ▼    | <input type="checkbox"/>            | 306.8 |     |
| 4                                                                                                                                                                   |             | Wonder Girls | 200  | Korea ▼     | <input checked="" type="checkbox"/> | 108.6 |     |
| 5                                                                                                                                                                   | Reflection  | Kelly Chen   | 2013 | Hong Kong ▼ | <input type="checkbox"/>            | !     |     |
|   |             |              |      |             |                                     |       |                                                                                                                                                                                                                                                                                                                                                 |

# Appendix II

## jqGrid – Java Script multifunctional tables

|   | ID    | Company Name               | Contact Name       | Phone        | City        |
|---|-------|----------------------------|--------------------|--------------|-------------|
| + | ALFKI | Alfreds Futterkiste        | Maria Anders       | 030-0074321  | Berlin      |
| + | ANATR | Ana Trujillo Emparedados y | Ana Trujillo       | (5) 555-4729 | México D.F. |
| + | ANTON | Antonio Moreno Taquería    | Antonio Moreno     | (5) 555-3932 | México D.F. |
| + | BLAUS | Blauer See Delikatessen    | Hanna Moos         | 0621-08460   | Mannheim    |
| - | BLONP | Blondel père et fils       | Frédérique Citeaux | 88.60.15.31  | Strasbourg  |


| Order ID | Required Date     | Ship Name            | Ship City  | Freight |
|----------|-------------------|----------------------|------------|---------|
| 10826    | 1998-02-09 00:00: | Blondel père et fils | Strasbourg | 7.0900  |
| 10679    | 1997-10-21 00:00: | Blondel père et fils | Strasbourg | 27.9400 |
| 10628    | 1997-09-09 00:00: | Blondel père et fils | Strasbourg | 30.3600 |
| 10584    | 1997-07-28 00:00: | Blondel père et fils | Strasbourg | 50.1400 |

Page 1 of 1

# Appendix III

## Combining multiple stored processes

Vasilij Nevlev



Alerts Search ▾ Cases Portal Help Test Area

Entity Type: Members | Date Filter: Last 30 days | Team: Financial Loss | Alert Model Name: Black List | Sort By: Alert Score | Viewed: OFF | Hypothesis: OFF | Closed: OFF | Page: 1

| Key Entity Type | Key Entity ID | Handling Team  | Alert Owner | Alert Model Name | Alert ID | Alert Issue Date | Business Benefit (£) | Alert Status | Last Viewed | Final Score |
|-----------------|---------------|----------------|-------------|------------------|----------|------------------|----------------------|--------------|-------------|-------------|
| Members         | ██████████    | Financial_Loss |             | Black_list       | BAN_1    | 02/06/2015       | 1400                 | Viewed       | 02/06/2015  | 375         |