

CSE 6242 A / CS 4803 DVA

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Time Series

Visualization and Application

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Some lectures are partly based on materials by
Professors Guy Lebanon, Jeffrey Heer, John Stasko, Christos Faloutsos, Le Song

Last Time

Similarity search

- Euclidean distance
- Time-warping

Linear Forecasting

- AR (Auto Regression) methodology
- RLS (Recursive Least Square)
= fast, incremental least square

Non-linear forecasting

- Lag-plots + k-NN

This Time

Time Series Visualization + Applications

Apple Inc. (NASDAQ:AAPL)

Add to portfolio

428.43

-3.56 (-0.82%)

Real-time: 12:51PM EDT
NASDAQ real-time data - Disclaimer
Currency in USD

Range	425.25 - 435.00	Div/yield	2.65/2.47
52 week	419.00 - 705.07	EPS	44.10
Open	433.76	Shares	939.06M
Vol / Avg.	8.11M/16.07M	Beta	1.04
Mkt cap	402.55B	Inst. own	64%
P/E	9.72		

+1 7k



Why Time Series Visualization?

Time series is the **most common data type**

- But why is **time series** so common?

How to build time series visualization?

Easy way: use existing tools, libraries

- **Google Public Data Explorer (Gapminder)**

<http://goo.gl/HmrH>

- **Google acquired Gapminder**

<http://goo.gl/43avY>

(seen Hans Rosling's **TED talk**? <http://goo.gl/tKV7>)

- **Google Annotated Time Line**

<http://goo.gl/Upm5W>

- **Timeline**, from MIT's SIMILE project

<http://simile-widgets.org/timeline/>

- **Timeplot**, also from SIMILE

<http://simile-widgets.org/timeplot/>

- **Excel**, of course

How to build time series visualization?

The harder way:

- R (ggplot2)
- Matlab
- gnuplot
- ...

The even harder way:

- D3, for web
- JFreeChart (Java)
- ...

Time Series Visualization

Why is it useful?

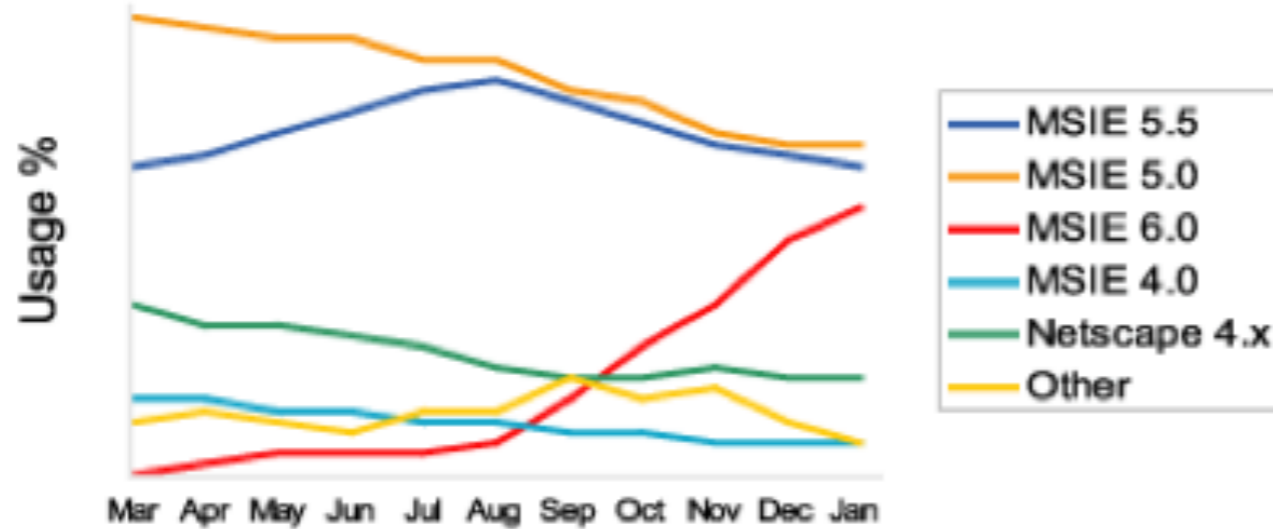
When is visualization useful?

(Why not automate everything? Like using the forecasting techniques you learned last time.)

Time Series User Tasks

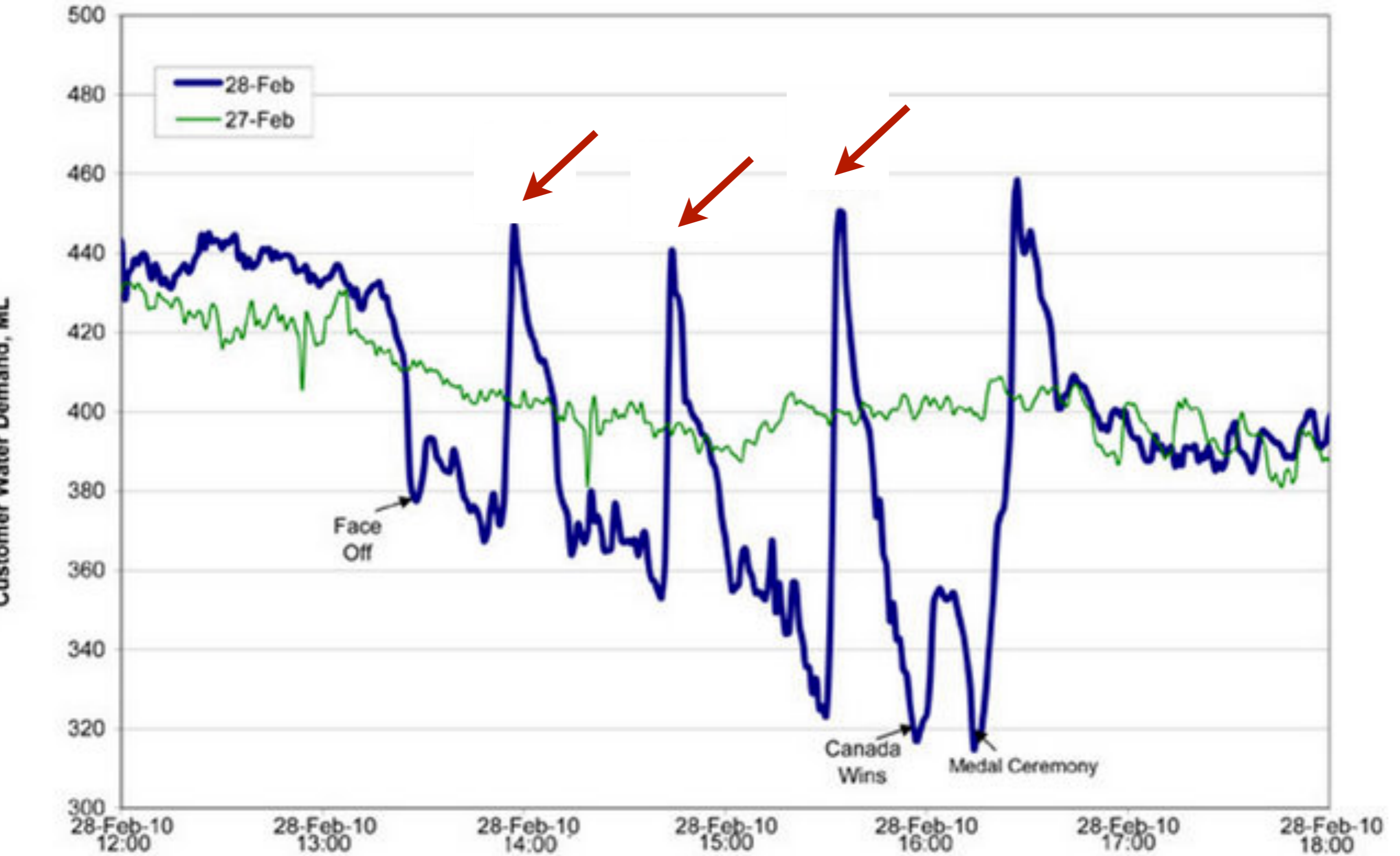
- When was something greatest/least?
- Is there a pattern?
- Are two series similar?
- Do any of the series match a pattern?
- Provide simpler, faster access to the series
- Does data element exist at time t ?
- When does a data element exist?
- How long does a data element exist?
- How often does a data element occur?
- How fast are data elements changing?
- In what order do data elements appear?
- Do data elements exist together?

Classic Views

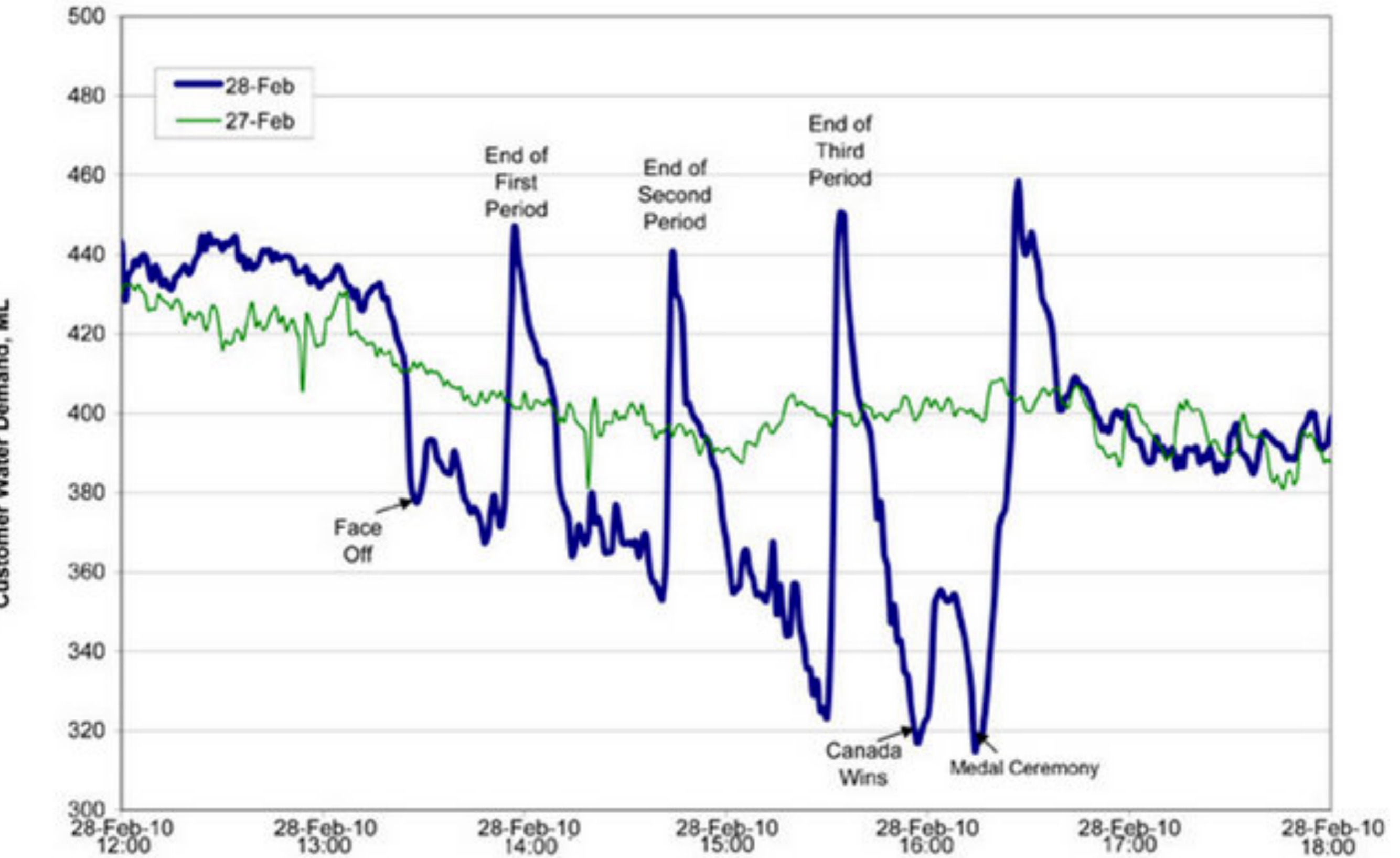


horizontal axis is time

Water Consumption in Edmonton During Olympic Gold Medal Hockey Game

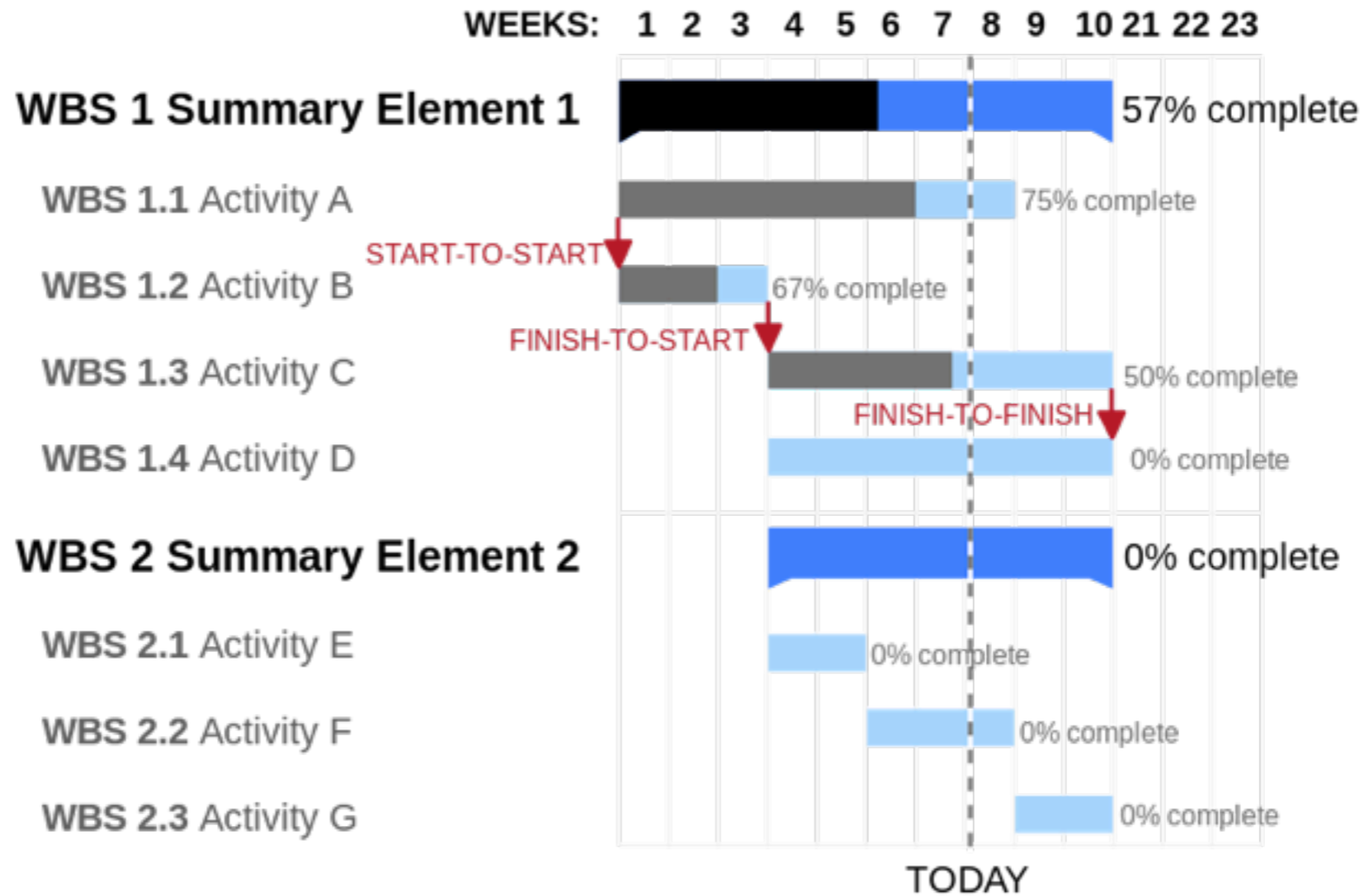


Water Consumption in Edmonton During Olympic Gold Medal Hockey Game



Gantt Chart

Useful for project



How to create in Excel:

<http://www.youtube.com/watch?v=sA67g6zaKOE>

ThemeRiver

Stacked graph

Streamgraph

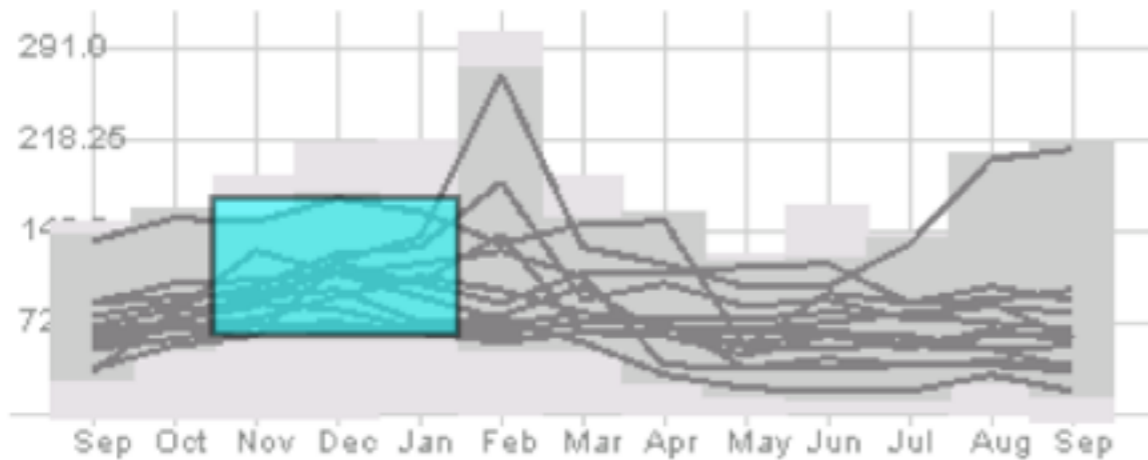
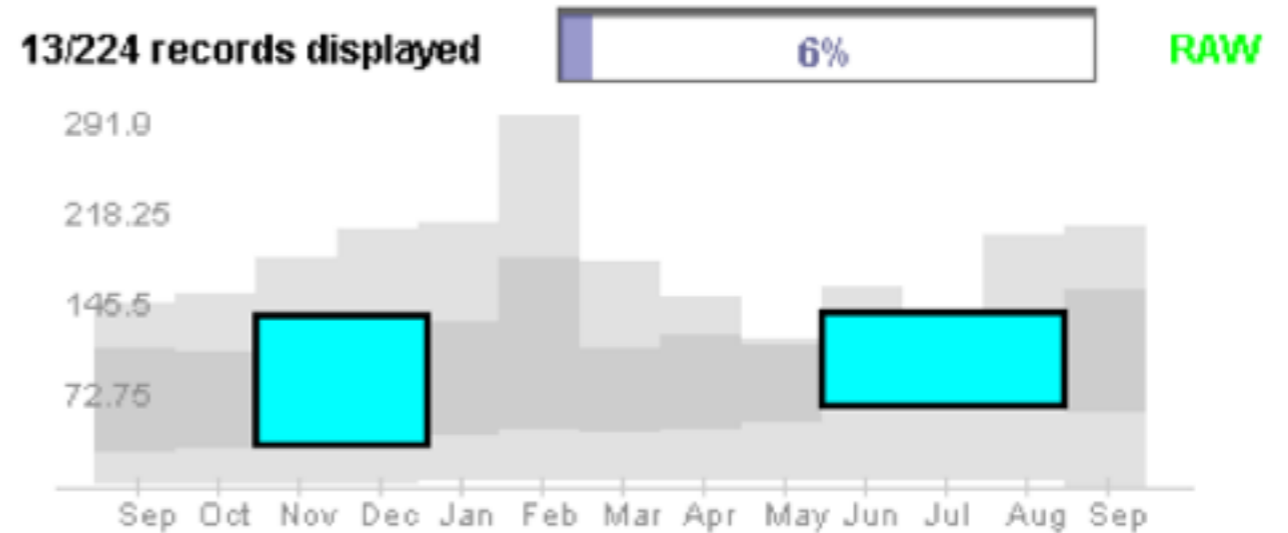
http://www.nytimes.com/interactive/2008/02/23/movies/20080223_REVENUE_GRAPHIC.html

<http://bl.ocks.org/mbostock/3943967>

TimeSearcher

support queries

Can create rectangles that function as matching regions



Light gray is all data's extent

Darker grayed region is data envelope that shows extreme values of queries matching criteria

Multiple boxes are "anded"

Hochheiser & Shneiderman
Proc. Discovery Science '01

GeoTime

<http://www.youtube.com/watch?v=inkF86QJBdA>