

AWTDataTable Pivot Support

Design Overview

Craig Federighi

August 25, 2006

Disclaimer:

These slides were the subject of *3 hours* of live presentation and code review. Their value when read alone is unknown (and highly suspect)



ARIBAWEB

Outline

- ▶ Problem Statement / Requirements
 - ▶ vs Analysis
- ▶ Using it – Feature Overview
- ▶ Implementation Details
- ▶ To Do

Domain: Multi-dimensional Data

- ▶ Take a few Items...

Item	ItemDesc	Price	Quantity	ExtendedPrice	Color
2.1	Ball Bearings	45	6	270	Red
2.2	Bolts	1	1120	1120	Red

- ▶ Get Bids from 3 suppliers

Item	ItemDesc	Supplier	Price	Quantity
2.1	Ball Bearings	Apple	45	6
2.1	Ball Bearings	Dell	49	425
2.1	Ball Bearings	Gateway	11	679
2.2	Bolts	Apple	1	1120
2.2	Bolts	Dell	14	52
2.2	Bolts	Gateway	5	142

- ▶ For three Regions...

Item	ItemDesc	Supplier	Region	Price	Quantity	Extended Co
2.1	Ball Bearir	Apple	APAC	45	6	270 Re
2.1	Ball Bearir	Apple	EUR	21	1075	22575 Re
2.1	Ball Bearir	Apple	USA	56	31	1736 Gr
2.1	Ball Bearir	Dell	APAC	49	425	20825 Re
2.1	Ball Bearir	Dell	USA	1	38	38 Re
2.1	Ball Bearir	Dell	USA	9	894	8046 Gr
2.1	Ball Bearir	Gateway	APAC	11	679	7469 Re
2.1	Ball Bearir	Gateway	EUR	104	21	2184 Re
2.1	Ball Bearir	Gateway	USA	82	893	73226 Gr
2.2	Bolts	Apple	APAC	1	1120	1120 Re
2.2	Bolts	Apple	EUR	32	172	5504 Re
2.2	Bolts	Apple	USA	38	112	4256 Gr
2.2	Bolts	Dell	APAC	14	52	728 Gr
2.2	Bolts	Dell	USA	2	176	352 Gr
2.2	Bolts	Gateway	APAC	5	142	710 Re
2.2	Bolts	Gateway	EUR	20	17	340 Re
2.2	Bolts	Gateway	USA	11	142	1562 Gr

- ▶ They for 2 Years * 4 Quarters...

Item	ItemDesc	Supplier	Region	Year	Quarter	Price	Quantity	Extended	Color	Size
2.1	Ball Bearings	Dell	APAC	2006	Q2	49	425	20825	Red	Medium
2.1	Ball Bearings	Dell	APAC	2006	Q3	31	23	713	Green	Large
2.1	Ball Bearings	Dell	APAC	2006	Q4	40	46	1840	Blue	Huge
2.1	Ball Bearings	Dell	USA	2006	Q1	1	38	38	Red	Small
2.1	Ball Bearings	Dell	USA	2006	Q2	9	894	8046	Green	Medium
2.1	Ball Bearings	Dell	USA	2006	Q3	37	255	9435	Blue	Large
2.1	Ball Bearings	Dell	USA	2006	Q4	22	233	5126	Red	Huge
2.1	Ball Bearings	Dell	APAC	2007	Q1	30	330	9900	Green	Small
2.1	Ball Bearings	Dell	APAC	2007	Q2	64	243	15552	Blue	Medium
2.1	Ball Bearings	Dell	APAC	2007	Q3	52	582	30264	Red	Large
2.1	Ball Bearings	Dell	APAC	2007	Q4	26	561	14586	Green	Huge
2.1	Ball Bearings	Dell	USA	2007	Q1	53	311	16483	Blue	Small
2.1	Ball Bearings	Dell	USA	2007	Q2	97	345	33465	Red	Medium
2.1	Ball Bearings	Dell	USA	2007	Q3	12	161	1932	Green	Large
2.1	Ball Bearings	Dell	USA	2007	Q4	29	44	1276	Blue	Huge
2.1	Ball Bearings	Apple	APAC	2006	Q2	45	6	270	Red	Small
2.1	Ball Bearings	Apple	APAC	2006	Q3	23	44	1012	Green	Medium
2.1	Ball Bearings	Apple	APAC	2006	Q4	31	506	15686	Blue	Large
2.1	Ball Bearings	Apple	EUR	2006	Q1	21	1075	22575	Red	Huge
2.1	Ball Bearings	Apple	EUR	2006	Q2	54	1182	63828	Green	Small
2.1	Ball Bearings	Apple	EUR	2006	Q3	47	789	37083	Blue	Medium
2.1	Ball Bearings	Apple	EUR	2006	Q4	22	467	10274	Red	Large
2.1	Ball Bearings	Apple	USA	2006	Q1	56	31	1736	Green	Huge
2.1	Ball Bearings	Apple	USA	2006	Q2	2	1051	2102	Blue	Small
2.1	Ball Bearings	Apple	USA	2006	Q3	98	207	20286	Red	Medium
2.1	Ball Bearings	Apple	USA	2006	Q4	47	204	9588	Green	Large
2.1	Ball Bearings	Apple	APAC	2007	Q1	68	42	2856	Blue	Huge
2.1	Ball Bearings	Apple	APAC	2007	Q2	13	90	1170	Red	Small
2.1	Ball Bearings	Apple	APAC	2007	Q3	24	188	4512	Green	Medium
2.1	Ball Bearings	Apple	APAC	2007	Q4	30	95	2850	Blue	Large
2.1	Ball Bearings	Apple	EUR	2007	Q1	15	133	1995	Red	Huge
2.1	Ball Bearings	Apple	EUR	2007	Q2	22	23	506	Green	Small
2.1	Ball Bearings	Apple	EUR	2007	Q3	15	1326	19890	Blue	Medium
2.1	Ball Bearings	Apple	EUR	2007	Q4	73	172	12556	Red	Large
2.1	Ball Bearings	Apple	USA	2007	Q1	11	84	924	Green	Huge
2.1	Ball Bearings	Apple	USA	2007	Q2	6	688	4128	Blue	Small
2.1	Ball Bearings	Apple	USA	2007	Q3	14	562	7868	Red	Medium
2.1	Ball Bearings	Apple	USA	2007	Q4	6	938	5628	Green	Large
2.1	Ball Bearings	HP	APAC	2006	Q2	64	61	3904	Blue	Huge
2.1	Ball Bearings	HP	APAC	2006	Q3	11	216	2376	Red	Small
2.1	Ball Bearings	HP	APAC	2006	Q4	14	709	9926	Green	Medium
2.1	Ball Bearings	HP	EUR	2006	Q1	94	456	42864	Blue	Large
2.1	Ball Bearings	HP	EUR	2006	Q2	2	244	488	Red	Huge
2.1	Ball Bearings	HP	EUR	2006	Q3	56	155	8680	Green	Small
2.1	Ball Bearings	HP	EUR	2006	Q4	7	6	42	Blue	Medium
2.1	Ball Bearings	HP	USA	2006	Q1	70	39	2730	Red	Large
2.1	Ball Bearings	HP	USA	2006	Q2	63	438	27594	Green	Huge
2.1	Ball Bearings	HP	USA	2006	Q3	52	1059	55068	Blue	Small
2.1	Ball Bearings	HP	APAC	2007	Q1	2	742	1484	Red	Medium
2.1	Ball Bearings	HP	APAC	2007	Q2	13	988	12844	Green	Large
2.1	Ball Bearings	HP	APAC	2007	Q3	8	403	3224	Blue	Huge
2.1	Ball Bearings	HP	APAC	2007	Q4	20	148	2960	Red	Small
2.1	Ball Bearings	HP	EUR	2007	Q1	37	269	9953	Green	Medium
2.1	Ball Bearings	HP	EUR	2007	Q2	128	378	48384	Blue	Large
2.1	Ball Bearings	HP	EUR	2007	Q3	50	581	29050	Red	Huge
2.1	Ball Bearings	HP	EUR	2007	Q4	2	1309	2618	Green	Small
2.1	Ball Bearings	HP	USA	2007	Q1	20	525	10500	Blue	Medium

A flat view doesn't cut it...



ARIBAWEB

Layout: Show Details

Item ↓	Region	Year	Quarter	Supplier	Price	Quantity	E P	Answer	Color	Size
2 Ball Bearings	EUR	2006	Q2	Supplier3	\$2.00	244	\$488.00		Red	Huge
2 Ball Bearings	EUR	2006	Q3	Supplier3	\$56.00	155	\$8,680.00		Green	Small
2 Ball Bearings	EUR	2006	Q4	Supplier3	\$7.00	6	\$42.00		Blue	Medium
2 Ball Bearings	USA	2006	Q1	Supplier3	\$70.00	39	\$2,730.00		Red	Large
2 Ball Bearings	USA	2006	Q2	Supplier3	\$63.00	438	\$27,594.00	*	Green	Huge
2 Ball Bearings	USA	2006	Q3	Supplier3	\$52.00	1059	\$55,068.00	*	Blue	Small
2 Ball Bearings	APAC	2007	Q1	Supplier3	\$2.00	742	\$1,484.00		Red	Medium
2 Ball Bearings	APAC	2007	Q2	Supplier3	\$13.00	988	\$12,844.00		Green	Large
2 Ball Bearings	APAC	2007	Q3	Supplier3	\$8.00	403	\$3,224.00		Blue	Huge
2 Ball Bearings	APAC	2007	Q4	Supplier3	\$20.00	148	\$2,960.00		Red	Small
2 Ball Bearings	EUR	2007	Q1	Supplier3	\$37.00	269	\$9,953.00		Green	Medium
2 Ball Bearings	EUR	2007	Q2	Supplier3	\$128.00	378	\$48,384.00	*	Blue	Large
2 Ball Bearings	EUR	2007	Q3	Supplier3	\$50.00	581	\$29,050.00	*	Red	Huge
2 Ball Bearings	EUR	2007	Q4	Supplier3	\$2.00	1309	\$2,618.00		Green	Small
2 Ball Bearings	USA	2007	Q1	Supplier3	\$20.00	525	\$10,500.00		Blue	Medium
2 Ball Bearings	USA	2007	Q2	Supplier3	\$99.00	97	\$9,603.00		Red	Large
2 Ball Bearings	USA	2007	Q3	Supplier3	\$1.00	709	\$709.00		Green	Huge

We need grouping!

Bid Data!									
		APAC							
		2006							
		Q2		Q3		Q4		Q1	
Item ↓	Supplier	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity
Ball Bearings	Best	\$18.00	707	\$15.00	890	\$33.00	779	\$57.00	2
	Historical	\$70.00	1083	\$142.00	172	\$7.00	538	\$87.00	1162
	Initial	\$43.00	2	\$12.00	271	\$3.00	997	\$89.00	1454
	Supplier1	\$49.00	425	\$31.00	23	\$40.00	46	\$30.00	330
	Supplier2	\$45.00	6	\$23.00	44	\$31.00	506	\$68.00	42
	Supplier3	\$64.00	61	\$11.00	216	\$14.00	709	\$2.00	742
Bolts	Supplier4	\$11.00	679	\$71.00	166	\$85.00	174	\$10.00	82
	Supplier5	\$18.00	188	\$81.00	471	\$3.00	74	\$39.00	310
	Best	\$3.00	83	\$1.00	639	\$14.00	83	\$91.00	67
	Historical	\$17.00	24	\$94.00	30	\$1.00	119	\$40.00	16
	Initial	\$69.00	170	\$8.00	232	\$44.00	378	\$20.00	382
	Supplier1	\$14.00	52	\$21.00	31	\$52.00	435	\$18.00	304
	Supplier2	\$1.00	1120	\$8.00	220	\$22.00	90	\$8.00	890

Or Maybe like this...



Bid Data!											
Item ↓	Year	Quarter	Region	Best		Historical		Initial		Supplier1	
				Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity
Ball Bearings	2006	Q1	EUR	\$34.00	399	\$32.00	131	\$58.00	237		
			USA	\$18.00	635	\$55.00	21	\$18.00	103	\$1.00	38
		Q2	APAC	\$18.00	707	\$70.00	1083	\$43.00	2	\$49.00	425
			EUR	\$24.00	85	\$23.00	92	\$121.00	379		
	Q3	USA	EUR	\$53.00	632	\$16.00	387	\$28.00	768	\$9.00	894
			APAC	\$15.00	890	\$142.00	172	\$12.00	271	\$31.00	23
		EUR	EUR	\$28.00	959	\$12.00	68	\$63.00	461		
			USA	\$1.00	750	\$58.00	1234	\$26.00	863	\$37.00	255
	Q4	APAC	EUR	\$33.00	779	\$7.00	538	\$3.00	997	\$40.00	46
			EUR	\$12.00	821	\$136.00	401	\$9.00	200		
		USA	EUR	\$10.00	327	\$83.00	32	\$67.00	21	\$22.00	233
			APAC	\$57.00	2	\$87.00	1162	\$89.00	1454	\$30.00	330
2007	Q1	EUR	\$3.00	391	\$76.00	92	\$11.00	133			
		USA	EUR	\$36.00	231	\$17.00	41	\$23.00	574	\$53.00	311
			APAC	\$4.00	564	\$17.00	175	\$26.00	366	\$64.00	243
	Q2	EUR	\$28.00	23	\$10.00	773	\$39.00	227			

Additional Requirements

- ▶ Editing!
 - ▶ Custom widgets in every cell
- ▶ Outline (section / item hierarchy)
- ▶ Scroll Faulting
- ▶ Spanning columns (e.g for Questions spanning dimensions)
- ▶ Detail Attributes

Data Table Reivew

▶ AWTColumns

▶ With Custom renderers

```
<AWTDataTable csvPath="BidData-Full.csv" displayGroup="$displayGroup"
  enableScrolling="$true" showOptionsMenu="$true" title="Bid Data!" multiSelect="$false"
  >
```

```
  <AWTColumn key="Item" nowrap>$displayGroup.currentItem.Item</AWTColumn>
  <AWTColumn key="Region"/>
  <AWTColumn key="Year"/>
  <AWTColumn key="Quarter"/>
  <AWTColumn key="Supplier"/>
```

```
  <AWTColumn key="Price">
    <AWTextField value="$displayGroup.currentItem.Price" formatter="$formatters.money" size=9
  style="text-align:right"/>
  </AWTColumn>
```

```
  <AWTColumn key="Quantity" formatter="$formatters.integer" align="right"/>
  <AWTColumn key="ExtendedPrice" label="E P" formatter="$formatters.money" align="right"/>
</AWTDataTable>
```

Pivots

▶ What if I did this?

```
<AWTDataTable csvPath="BidData-Full.csv" displayGroup="$displayGroup"  
  enableScrolling="$true" showOptionsMenu="$true" title="Bid Data!" multiSelect="$false"  
  pivotLayout="$true" rowFields="$(Item, Region, Supplier)" columnFields="$(Year, Quarter)"  
  columnAttributes="$(Price, Quantity)"  
>
```

```
<AWTColumn key="Item" nowrap>$displayGroup.currentItem.Item</AWTColumn>
```

```
<AWTColumn key="Region"/>
```

```
<AWTColumn key="Year"/>
```

```
<AWTColumn key="Quarter"/>
```

```
<AWTColumn key="Supplier"/>
```

```
<AWTColumn key="Price">
```

```
  <AWTextField value="$displayGroup.currentItem.Price" formatter="$formatters.money" size=9  
  style="text-align:right"/>
```

```
</AWTColumn>
```

```
<AWTColumn key="Quantity" formatter="$formatters.integer" align="right"/>
```

```
<AWTColumn key="ExtendedPrice" label="E P" formatter="$formatters.money" align="right"/>
```

```
</AWTDataTable>
```

“rowFields” and “columnFields” specify columns used to group and render labels on the pivot edges. “columnAttributes” specify columns used to render *data* in the table body.

Details

- ▶ OverrideAttribute
- ▶ RowAttributes
- ▶ Custom SortOrderings
- ▶ Selection

Implementation

- ▶ PivotState
 - ▶ rowFields, columnFields
 - ▶ columnAttributeFields & PivotAttributesColumn
- ▶ PivotGroup
- ▶ EdgeCell tree
 - ▶ CellVisitor
- ▶ PivotEdgeColumn
- ▶ RowAttributes

Flat View – Rows and Columns

Objects

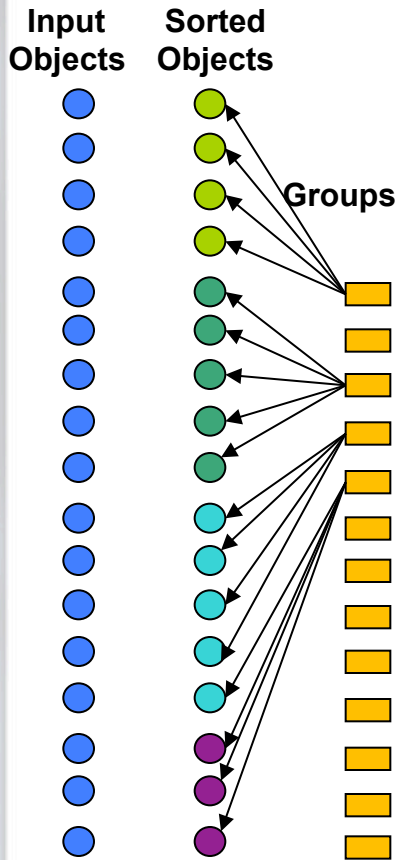
AWTColumns

Item ↓	Region	Year	Quarter	Supplier	Price	Quantity	E P	Answer	Color	Size
2 Ball Bearings	EUR	2006	Q2	Supplier3	\$2.00	244	\$488.00		Red	Huge
2 Ball Bearings	EUR	2006	Q3	Supplier3	\$56.00	155	\$8,680.00		Green	Small
2 Ball Bearings	EUR	2006	Q4	Supplier3	\$7.00	6	\$42.00		Blue	Medium
2 Ball Bearings	USA	2006	Q1	Supplier3	\$70.00	39	\$2,730.00		Red	Large
2 Ball Bearings	USA	2006	Q2	Supplier3	\$63.00	438	\$27,594.00	*	Green	Huge
2 Ball Bearings	USA	2006	Q3	Supplier3	\$52.00	1059	\$55,068.00	*	Blue	Small
2 Ball Bearings	APAC	2007	Q1	Supplier3	\$2.00	742	\$1,484.00		Red	Medium
2 Ball Bearings	APAC	2007	Q2	Supplier3	\$13.00	988	\$12,844.00		Green	Large
2 Ball Bearings	APAC	2007	Q3	Supplier3	\$8.00	403	\$3,224.00		Blue	Huge
2 Ball Bearings	APAC	2007	Q4	Supplier3	\$20.00	148	\$2,960.00		Red	Small
2 Ball Bearings	EUR	2007	Q1	Supplier3	\$37.00	269	\$9,953.00		Green	Medium
2 Ball Bearings	EUR	2007	Q2	Supplier3	\$128.00	378	\$48,384.00	*	Blue	Large
2 Ball Bearings	EUR	2007	Q3	Supplier3	\$50.00	581	\$29,050.00	*	Red	Huge
2 Ball Bearings	EUR	2007	Q4	Supplier3	\$2.00	1309	\$2,618.00		Green	Small
2 Ball Bearings	USA	2007	Q1	Supplier3	\$20.00	525	\$10,500.00		Blue	Medium
2 Ball Bearings	USA	2007	Q2	Supplier3	\$99.00	97	\$9,603.00		Red	Large
2 Ball Bearings	USA	2007	Q3	Supplier3	\$1.00	709	\$709.00		Green	Huge

One Object → One Row

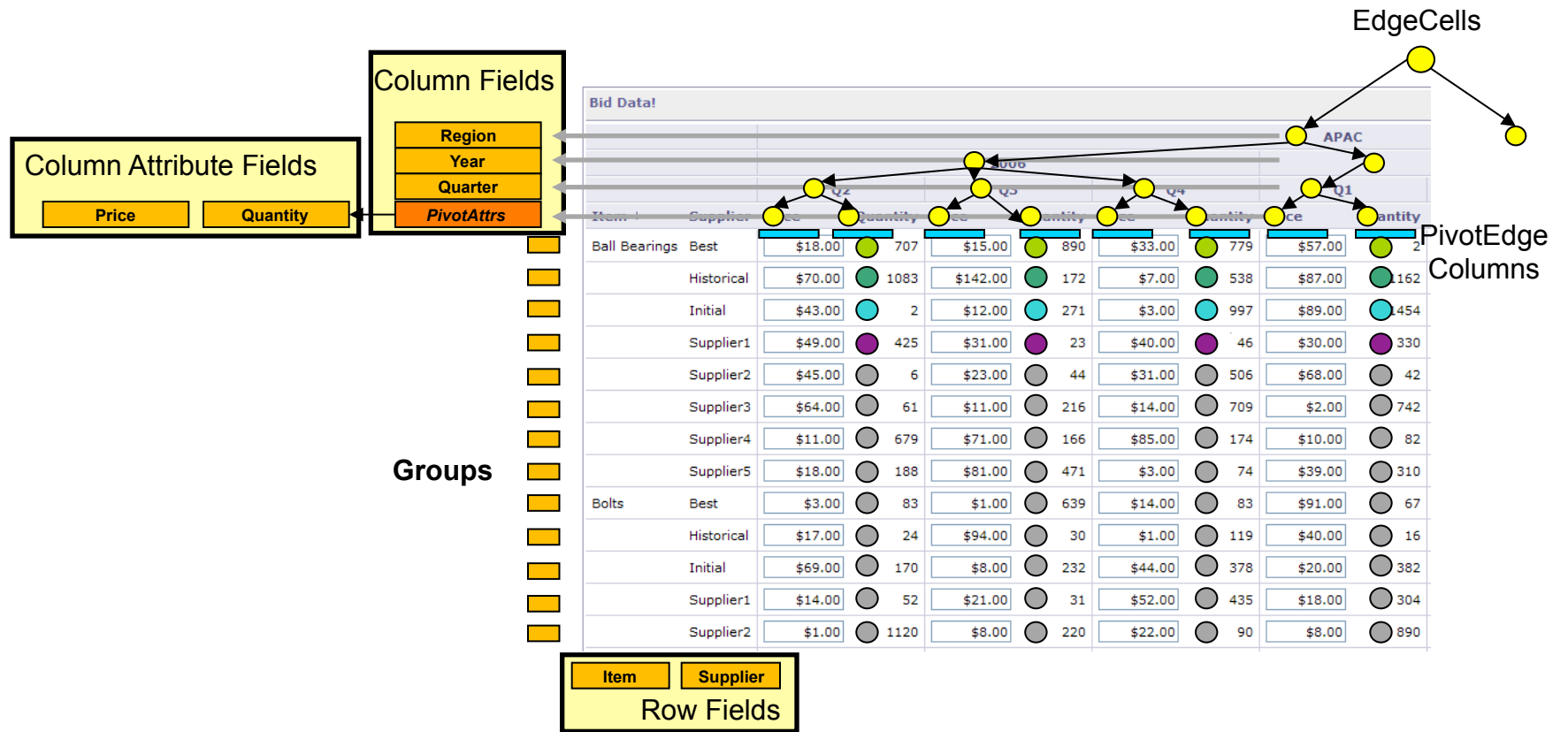
Flat View – Rows and Columns

AWTColumns



Bid Data!										
				2006				APAC		
				Q2	Q3	Q4	Q1			
Item ↓	Supplier	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	
Ball Bearings	Best	\$18.00	707	\$15.00	890	\$33.00	779	\$57.00	2	
	Historical	\$70.00	1083	\$142.00	172	\$7.00	538	\$87.00	1162	
	Initial	\$43.00	2	\$12.00	271	\$3.00	997	\$89.00	1454	
	Supplier1	\$49.00	425	\$31.00	23	\$40.00	46	\$30.00	330	
	Supplier2	\$45.00	6	\$23.00	44	\$31.00	506	\$68.00	42	
Bolts	Supplier3	\$64.00	61	\$11.00	216	\$14.00	709	\$2.00	742	
	Supplier4	\$11.00	679	\$71.00	166	\$85.00	174	\$10.00	82	
	Supplier5	\$18.00	188	\$81.00	471	\$3.00	74	\$39.00	310	
	Best	\$3.00	83	\$1.00	639	\$14.00	83	\$91.00	67	
	Historical	\$17.00	24	\$94.00	30	\$1.00	119	\$40.00	16	
Supplier1	Initial	\$69.00	170	\$8.00	232	\$44.00	378	\$20.00	382	
	Supplier1	\$14.00	52	\$21.00	31	\$52.00	435	\$18.00	304	
	Supplier2	\$1.00	1120	\$8.00	220	\$22.00	90	\$8.00	890	

Key Classes in Context...



Use Cases

- ▶ Grouping, Building the Column Edge
- ▶ Rendering
 - ▶ Nested Column Heading
 - Rendering “data” as label
 - ▶ Indenting row grouping, rendering detail fields
 - `substituteForCurrentColumn()`
 - ▶ Rendering ColumnAttributes
 - `PivotEdgeColumn prepareAndReplace()`
 - ▶ Slots, and Missing Objects
 - ▶ `OverrideColumn`
- ▶ Outline support