INFRAGISTICS

DESIGN / DEVELOP / EXPERIENCE

WPF Performance Tuning

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XAML Applications Performance

Application Resources

- Use shared resource definitions on the Window/Application level
- Use static resources rather than dynamic ones
- Set Opacity on Brushes rather than Elements to prevent the generation of a temporary surface for the element

Layouts & Templates

- Reduce the number of visuals (more to follow)
- Use virtualized containers with element recycling
- Refrain from using BitmapEffects
- Set the neutral culture using NeutralResourcesLanguageAttribute to prevent lookup of satellite assemblies

Data Binding

- Fix binding errors to prevent expensive binding path resolutions
- Bind to IList rather than IEnumerable, because the CLR generates an IList to wrap it
- For adding/removing data from data sources, bind to ObservableCollection<T> rather than IList

Convertor vs DataTemplateSelector

- Use Convertors instead of DataTemplateSelectors
- For virtualized control, the convertors will be invoked for each cell coming into view
- Apply processing in code-behind and bind to transformed/formatted data

Convertor Limitations

- For virtualized item controls, the conversion logic will be invoked for each cell coming into view
- Avoid unbound columns and convertors - apply processing in code-behind and bind to transformed data

So…XamDataGrid is the most sophisticated control we use. How do we speed it up?

The smaller the number of UI elements visible, the better performance

Default Templates

- XamDataGrid uses editors for editing and formatting:
  - Currencies – 12 elements
  - Numbers – 12 elements
  - DateTime – 20 elements

Use lean templates for read-only columns

Read-only Templates

- XamDataGrid uses editors for editing and formatting:
  - Currencies – 3 elements
  - Numbers – 3 elements
  - DateTime – 3 elements

Using Read-only Templates

- Download the read-only templates here:

  http://bit.ly/16eW3K7

- Set the AllowCellVirtualization and ForceCellVirtualization properties to true (on each field where the read-only templates are applied

ForceCellVirtualization property

- If you're using your own CellValuePresenter with no editor inside, XDG instantiates the cells in the column when not visible horizontally
- AllowCellVirtualization and ForceCellVirtualization (true) tell the grid that these cells won't impact row height and can be virtualized

Demo – Optimized Templates

Symbc	Side	Filled	Ren	Typ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR
5 (5 items)																						
PPWC	B	8	5	L AGGR	331.90	390.46	5.57	72.04	-170.71	-73.09	19.09	-90.70	148.88	-1.30	235.50	79.61	-10.86	67.10	-129.88	122.75	124.88	230.25
BZQM	B	1	5	L AGGR	-14.57	276.42	280.97	274.77	315.65	27.61	131.22	-9.45	183.04	150.07	193.76	212.97	-104.69	308.83	37.95	-137.74	59.92	165.98
HKLL	B	6	5	L AGGR	-254.59	281.95	-119.13	68.62	-30.60	9.06	165.56	-15.87	-88.48	353.12	11.41	-64.83	-48.43	186.67	-157.51	86.23	60.88	9.76
XILO	B	8	5	L AGGR	208.97	12.59	-33.55	-17.31	87.76	298.40	165.69	45.20	88.37	85.65	-104.46	118.23	38.99	84.82	401.45	145.05	26.62	-36.06
TSRB	B	7	5	L AGGR	69.61	-201.30	-341.21	195.98	68.43	72.21	177.25	-119.59	197.35	-46.94	345.90	13.40	65.59	58.88	132.41	67.56	4.33	230.95
4 (6 items)																						
AHSB	B	6	4	L AGGR	29.79	277.10	146.43	162.13	117.65	-167.86	-3.72	-28.15	79.15	-93.93	289.38	225.83	-177.54	336.12	160.47	14.87	-210.13	145.22
JJNJ	B	0	4	L AGGR	-29.62	114.96	-99.69	189.65	12.58	21.03	448.84	64.32	-121.04	-49.32	42.03	23.40	241.54	386.87	244.88	-178.56	41.85	111.52
OQMH	B	8	4	L AGGR	8.53	95.49	135.78	-221.47	58.71	-42.99	-86.93	-128.21	55.82	-50.48	-43.75	-4.62	-157.51	21.26	-135.52	-179.81	167.13	-195.06
GDHS	B	9	4	L AGGR	148.51	-187.62	141.13	77.35	127.85	67.10	-75.30	-4.85	-180.88	109.17	-113.36	221.93	-182.04	-7.85	174.14	3.48	-33.57	17.80
QDKI	B	3	4	L AGGR	-162.17	213.25	-243.38	3.02	-119.73	77.24	166.98	-102.39	42.42	35.63	95.88	258.62	126.79	282.26	-135.50	-393.88	302.31	-71.17
IPEY	B	8	4	L AGGR	383.55	188.17	-44.92	398.55	113.42	47.40	498.66	83.79	-39.37	288.77	82.44	400.70	148.89	42.75	383.91	37.52	151.94	81.10
3 (6 items)																						
GAAO	B	9	3	L AGGR	99.85	96.44	171.53	164.26	32.58	-9.62	250.14	46.83	-184.39	-32.06	128.88	202.55	205.21	20.41	1.84	210.87	-53.41	75.07
KMHR	B	2	3	L AGGR	226.06	47.50	26.81	207.33	71.95	238.92	188.91	304.53	112.22	221.24	-59.90	274.51	149.38	158.63	-54.31	-154.04	-80.58	27.38
UXTV	B	1	3	L AGGR	94.49	-37.14	304.87	355.17	-75.23	-49.59	185.92	-134.83	214.55	285.69	373.33	205.11	150.17	39.20	119.99	-20.36	324.86	89.53
UNTB	B	6	3	L AGGR	87.90	224.99	157.28	123.33	-53.38	432.62	-57.43	124.05	285.94	96.04	257.68	204.33	-89.56	11.63	62.80	115.43	201.87	-156.76
KUQQ	B	9	3	L AGGR	268.15	15.25	-17.04	-39.64	-14.62	-147.45	-281.90	291.75	40.68	254.63	129.59	262.42	193.23	-72.74	-3.57	68.86	-2.07	112.14
NVJP	B	0	3	L AGGR	-107.72	219.21	105.57	23.16	126.36	74.82	112.60	-18.12	-60.83	290.41	96.46	25.63	-4.79	266.48	52.47	391.20	19.00	66.08
2 (3 items)																						
FUUP	B	9	2	L AGGR	-111.55	-91.17	553.40	102.29	-102.48	309.79	31.65	-87.89	-40.81	287.82	118.12	-248.06	123.51	180.85	-134.30	53.72	157.31	-95.10
PDZF	B	7	2	L AGGR	22.30	51.09	-88.59	-134.15	150.06	62.96	43.48	17.98	94.54	48.35	258.19	125.61	85.90	-9.48	207.74	181.55	216.66	-128.65
YQAF	B	2	2	L AGGR	-76.45	120.67	271.65	-90.22	-88.83	64.31	232.70	-49.35	-89.88	-144.15	18.38	-165.07	-28.96	161.94	118.27	-85.63	139.39	337.66
1 (7 items)																						
JOPY	B	7	1	L AGGR	88.51	91.95	112.35	105.24	121.24	-37.79	-20.43	-3.41	229.85	-9.63	-2.29	111.17	327.05	-315.66	277.03	-145.82	63.92	-253.01
NJNU	B	2	1	L AGGR	-27.98	64.32	60.85	92.13	78.10	182.53	117.17	-48.86	152.03	97.62	-63.48	-34.33	12.45	-66.62	-136.88	-97.32	-281.28	-163.62
LOXZ	B	4	1	L AGGR	58.51	-69.97	-101.04	-11.26	144.65	36.36	152.99	-121.38	15.41	37.88	340.90	273.04	46.16	192.52	130.78	227.99	319.71	118.18

Process data as far as possible from the UI

Avoid the default UI Thread sorts

- Default XamDataGrid does filtering, sorting, grouping on UI thread
- Requires loading of ALL records not currently visible
  - Memory footprint
  - Initial loading delay

Avoid the default UI Thread sorts

12.1 XamDataGrid added API to enable sorting/grouping/filtering on the ListCollectionView and manually

Enables you to create a middle tier of your application to handle data processing

New API Introduced in 12.1

- SortEvaluationMode
- GroupByEvaluationMode
- FilterEvaluationMode
  - Auto
  - UseCollectionView
  - Manual (use RecordFilterChanging/ed)

New API Introduced in 12.1

- SummaryEvaluationMode
  - Auto
  - Manual
  - UseLinq

Demo – External Sorting

Symbo	Side	Filled	Ren	Typ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR
5 (5 items)																						
PPWC	B	8	5	L AGGR	331.90	390.46	5.57	72.04	-170.71	-73.09	19.09	-90.70	148.88	-1.30	235.50	79.61	-10.86	67.10	-129.88	122.75	124.88	230.25
BZQM	B	1	5	L AGGR	-14.57	276.42	280.97	274.77	315.65	27.61	131.22	-9.45	183.04	150.07	193.76	212.97	-104.69	308.83	37.95	-137.74	59.92	165.98
HKLL	B	6	5	L AGGR	-254.59	281.95	-119.13	68.62	-30.60	9.06	165.56	-15.87	-88.48	353.12	11.41	-64.83	-48.43	186.67	-157.51	86.23	60.88	9.76
XILO	B	8	5	L AGGR	208.97	12.59	-33.55	-17.31	87.76	298.40	165.69	45.20	88.37	85.65	-104.46	118.23	38.99	84.82	401.45	145.05	26.62	-36.06
TSRB	B	7	5	L AGGR	69.61	-201.30	-341.21	195.98	68.43	72.21	177.25	-119.59	197.35	-46.94	345.90	13.40	65.59	58.88	132.41	67.56	4.33	230.95
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JJNJ	B	0	4	L AGGR	-29.62	114.96	-99.69	189.65	12.58	21.03	448.84	64.32	-121.04	-49.32	42.03	23.40	241.54	386.87	244.88	-178.56	41.85	111.52
OQMH	B	8	4	L AGGR	8.53	95.49	135.78	-221.47	58.71	-42.99	-86.93	-128.21	55.82	-50.48	-43.75	-4.62	-157.51	21.26	-135.52	-179.81	167.13	-195.06
GDHS	B	9	4	L AGGR	148.51	-187.62	141.13	77.35	127.85	67.10	-75.30	-4.85	-180.88	109.17	-113.36	221.93	-182.04	-7.85	174.14	3.48	-33.57	17.80
QDKI	B	3	4	L AGGR	-162.17	213.25	-243.38	3.02	-119.73	77.24	166.98	-102.39	42.42	35.63	95.88	258.62	126.79	282.26	-135.50	-393.88	302.31	-71.17
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YQAF	B	2	2	L AGGR	-76.45	120.67	271.65	-90.22	-88.83	64.31	232.70	-49.35	-89.88	-144.15	18.38	-165.07	-28.96	161.94	118.27	-85.63	139.39	337.66
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NJNU	B	2	1	L AGGR	-27.98	64.32	60.85	92.13	78.10	182.53	117.17	-48.86	152.03	97.62	-63.48	-34.33	12.45	-66.62	-136.88	-97.32	-281.28	-163.62
LOXZ	B	4	1	L AGGR	58.51	-69.97	-101.04	-11.26	144.65	36.36	152.99	-121.38	15.41	37.88	340.90	273.04	46.16	192.52	130.78	227.99	319.71	118.18

Sorting real-time data

- In 12.1 we've added an optimization to substantially improve on sorting real-time data

- Invoke the re-sort only when sorted field is changed, instead of any field on record

Demo – Real-Time Sorting

Symb	Side	Filled	Ren	Typ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR
5 (5 items)																						
PPWC	B	8	5	L AGGR	331.90	390.46	5.57	72.04	-170.71	-73.09	19.09	-90.70	148.88	-1.30	235.50	79.61	-10.86	67.10	-129.88	122.75	124.88	230.25
BZQM	B	1	5	L AGGR	-14.57	276.42	280.97	274.77	315.65	27.61	131.22	-9.45	183.04	150.07	193.76	212.97	-104.69	308.83	37.95	-137.74	59.92	165.98
HKLL	B	6	5	L AGGR	-254.59	281.95	-119.13	68.62	-30.60	9.06	165.56	-15.87	-88.48	353.12	11.41	-64.83	-48.43	186.67	-157.51	86.23	60.88	9.76
XILO	B	8	5	L AGGR	208.97	12.59	-33.55	-17.31	87.76	298.40	165.69	45.20	88.37	85.65	-104.46	118.23	38.99	84.82	401.45	145.05	26.62	-36.06
TSRB	B	7	5	L AGGR	69.61	-201.30	-341.21	195.98	68.43	72.21	177.25	-119.59	197.35	-46.94	345.90	13.40	65.59	58.88	132.41	67.56	4.33	230.95
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JJNJ	B	0	4	L AGGR	-29.62	114.96	-99.69	189.65	12.58	21.03	448.84	64.32	-121.04	-49.32	42.03	23.40	241.54	386.87	244.88	-178.56	41.85	111.52
OQMH	B	8	4	L AGGR	8.53	95.49	135.78	-221.47	58.71	-42.99	-86.93	-128.21	55.82	-50.48	-43.75	-4.62	-157.51	21.26	-135.52	-179.81	167.13	-195.06
GDHS	B	9	4	L AGGR	148.51	-187.62	141.13	77.35	127.85	67.10	-75.30	-4.85	-180.88	109.17	-113.36	221.93	-182.04	-7.85	174.14	3.48	-33.57	17.80
QDKI	B	3	4	L AGGR	-162.17	213.25	-243.38	3.02	-119.73	77.24	166.98	-102.39	42.42	35.63	95.88	258.62	126.79	282.26	-135.50	-393.88	302.31	-71.17
IPEY	B	8	4	L AGGR	383.55	188.17	-44.92	398.55	113.42	47.40	498.66	83.79	-39.37	288.77	82.44	400.70	148.89	42.75	383.91	37.52	151.94	81.10
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KMHR	B	2	3	L AGGR	226.06	47.50	26.81	207.33	71.95	238.92	188.91	304.53	112.22	221.24	-59.90	274.51	149.38	158.63	-54.31	-154.04	-80.58	27.38
UXTV	B	1	3	L AGGR	94.49	-37.14	304.87	355.17	-75.23	-49.59	185.92	-134.83	214.55	285.69	373.33	205.11	150.17	39.20	119.99	-20.36	324.86	89.53
UNTB	B	6	3	L AGGR	87.90	224.99	157.28	123.33	-53.38	432.62	-57.43	124.05	285.94	96.04	257.68	204.33	-89.56	11.63	62.80	115.43	201.87	-156.76
KUQQ	B	9	3	L AGGR	268.15	15.25	-17.04	-39.64	-14.62	-147.45	-281.90	291.75	40.68	254.63	129.59	262.42	193.23	-72.74	-3.57	68.86	-2.07	112.14
NVJP	B	0	3	L AGGR	-107.72	219.21	105.57	23.16	126.36	74.82	112.60	-18.12	-60.83	290.41	96.46	25.63	-4.79	266.48	52.47	391.20	19.00	66.08
2 (3 items)																						
FUUP	B	9	2	L AGGR	-111.55	-91.17	553.40	102.29	-102.48	309.79	31.65	-87.89	-40.81	287.82	118.12	-248.06	123.51	180.85	-134.30	53.72	157.31	-95.10
PDZF	B	7	2	L AGGR	22.30	51.09	-88.59	-134.15	150.06	62.96	43.48	17.98	94.54	48.35	258.19	125.61	85.90	-9.48	207.74	181.55	216.66	-128.65
YQAF	B	2	2	L AGGR	-76.45	120.67	271.65	-90.22	-88.83	64.31	232.70	-49.35	-89.88	-144.15	18.38	-165.07	-28.96	161.94	118.27	-85.63	139.39	337.66
1 (7 items)																						
JOPY	B	7	1	L AGGR	88.51	91.95	112.35	105.24	121.24	-37.79	-20.43	-3.41	229.85	-9.63	-2.29	111.17	327.05	-315.66	277.03	-145.82	63.92	-253.01
NJNU	B	2	1	L AGGR	-27.98	64.32	60.85	92.13	78.10	182.53	117.17	-48.86	152.03	97.62	-63.48	-34.33	12.45	-66.62	-136.88	-97.32	-281.28	-163.62
LOXZ	B	4	1	L AGGR	58.51	-69.97	-101.04	-11.26	144.65	36.36	152.99	-121.38	15.41	37.88	340.90	273.04	46.16	192.52	130.78	227.99	319.71	118.18

Perform formatting away from the UI

Data Formatting

- Format data in the application layer and bind to formatted values
- Converters are evaluated for each cell scrolled into view on the UI layer, which should be avoided

Styling

- Instead of Triggers, use a binding to a brush which is evaluated in the view model to evaluate the conditions and set brushes before data is bound to the view

Styling – an Example

```
<Style x:Key="myStateCellStyle" TargetType="{x:Type igDP:CellValuePresenter}"
       BasedOn="{StaticResource cvpStyle}">
    <!--binding on the brush evaluated only once per cell-->
    <Setter Property="Background" Value="{Binding DataItem.RowBackgroundColour}"/>
    <Setter Property="Foreground" Value="White"/>
</Style>

<Style x:Key="myStatusCellStyle" TargetType="{x:Type igDP:CellValuePresenter}"
       BasedOn="{StaticResource cvpStyle}">
    <Style.Triggers>
        <!--bindings on the data item evaluated twice per cell -->
        <DataTrigger Binding="{Binding Path=DataItem.IsYes,FallbackValue=false}" Value="True">
            <Setter Property="Background" Value="{Binding Path=DataItem.YesColor}" />
            <Setter Property="Foreground" Value="White"/>
        </DataTrigger>
        <DataTrigger Binding="{Binding Path=DataItem.IsNo,FallbackValue=false}" Value="True">
            <Setter Property="Background" Value="{Binding Path=DataItem.NoColor}" />
            <Setter Property="Foreground" Value="White"/>
        </DataTrigger>
    </Style.Triggers>
</Style>
```

Preload UI Controls to ensure fast loading times

Preloading

- Preload controls (IG XamDataGrid) in a window not shown to user during initialization
- Causes the controls to be JIT-ted before they're used

- Ensures fast first-time loading

Preload - Health and Safety Warning

- Requires a change in application initialization logic
- Document well

References & Materials

- External operations demo - http://bit.ly/QNPmUF
- Simplified templates demo - http://bit.ly/LIo6Wh
- Sorting update demo - http://bit.ly/SPxk6s
- Preloading demo - http://bit.ly/14sjLEm

XAML Performance – Q & A

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