Batching, Sorting and Filtering with ABL

Query and UltraWinGrid in OERA

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Premises

- This presentation assumes an architecture where presentation layer data requests are passed thru the layers to the data access
- This presentation discusses how batching can be used to allow users to work on large data amounts
- There are both simpler and more sophisticated alternatives to these approaches

Agenda

- Managing Large Data Amounts
- Data Request Requirements
- Data Access Requirements
- Filter, Sorting and Batching with UltraGrid
- Sample Implementation
- Demo
- Questions

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Managing Large Data Amounts

- Resolved by user
  - Limit amount
    - Filter or error
  - Paging
    - User selects a page of data to navigate on client
- Transparent batching
  - Forward batching
    - Append more data to client when navigating forward
  - Two-way batching (bidirectional)
    - Position anywhere and append when navigating in any direction

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Managing Large Data Amounts
Limit Amount

- User Interface
  - Filter first
    - Remember Last Query
    - Stored Queries
    - Pseudo Query (A,B,C,D)
  - Error on too much data
    - Max number of records and timeout
- Performance not an issue

Managing Large Data Amounts
Paging

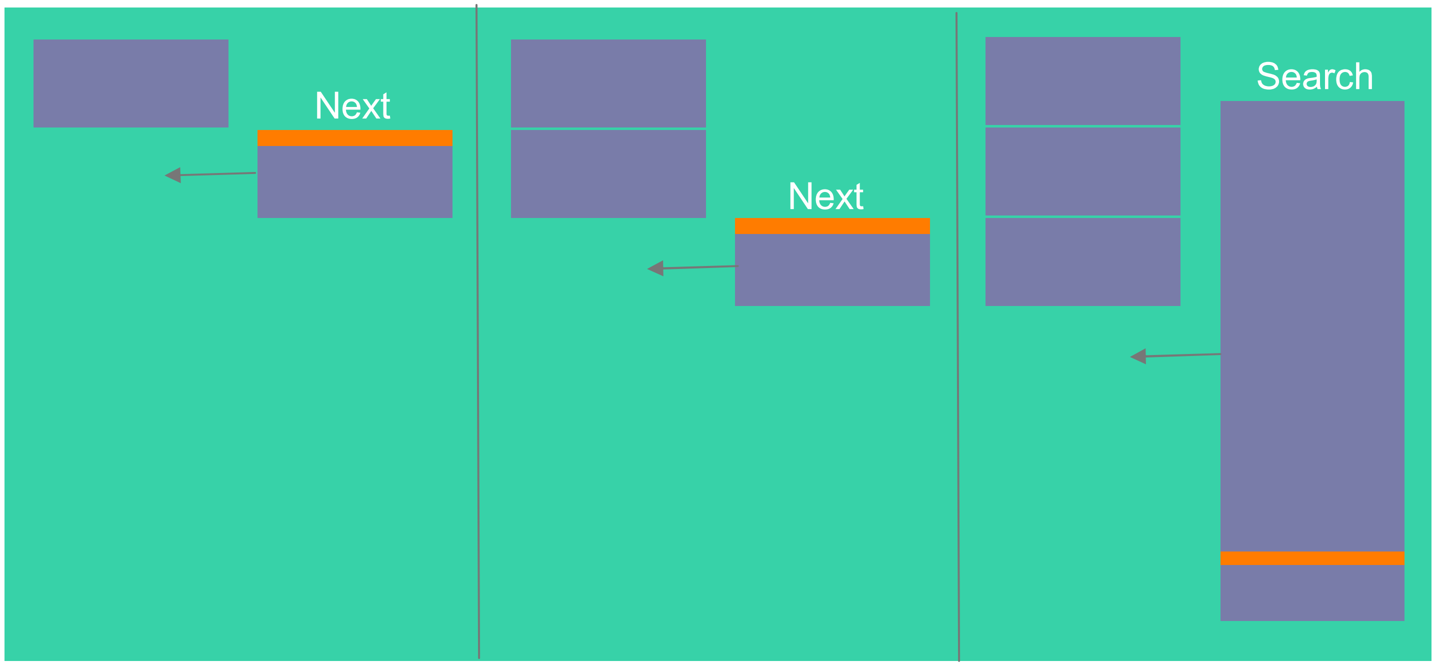
- User Interface
  - 1 – 100, 101 – 200, 201 – 300
  - 1,2,3,4,5
- Performance
  - No benefit from INDEXED-REPOSITION
    - Uses REPOSITION-TO-ROW
  - Very fast on cached data (PRESELECT)
- Easy to adapt and implement

Managing Large Data Amounts
Transparent Batching

- User Interface
  - Almost Transparent
  - Jumping or fixed scrollbar
  - Total number of records unknown
- Performance
  - Benefits from INDEXED-REPOSITION
    - Use set START-ROWID

Managing Large Data Amounts
Forward Batching

- Usability issues
  - Search, Find and Last need special attention
  - Resort and Refresh must start on first



Managing Large Data Amounts
Two-way batching

- Performance
  - Extra query open for Search, Find, Last and Previous
    - Return “look back” information
- Challenging to implement

Summary

- Batching is used to manage large data amounts
- Two way batching
  - Position anywhere
  - Can use indexed reposition
- Paging
  - Industry standard
  - More efficient with data cache on server
  - Relatively easy to add on two way batching

Batch Context Information

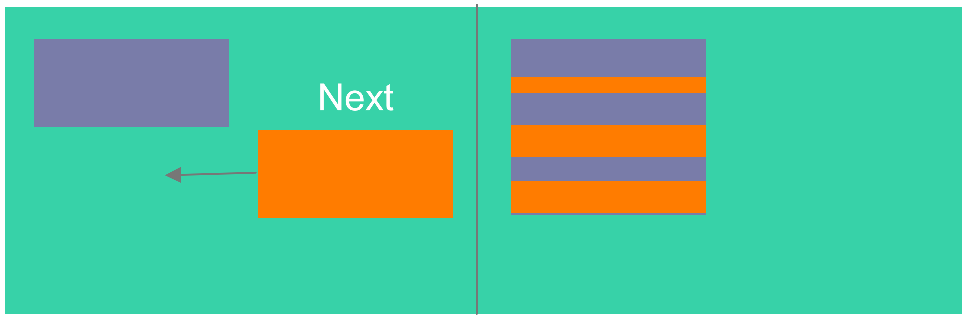
- Query Expression
  - Must be exactly the same for each request
  - Tables, Filter and Sort
- Transparent batching position context
  - Prev position for two-way batching
  - Next position
- Paging context
  - Start position
  - Total num records

Batching Updatable Data

- Batching should only be used on read only data
  - Practice is different
- Updates on server can cause
  - Same record in next batch
  - Record already exists
    - Appending batch with unique index on client

Appending Batches and Sorting

- Sort on non unique index
  - Different sort on client
    - Add KeyFields to sort



Batching Requirements

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Batching Requirements	Sample
Two-way batching	**Yes**
Paging	**?**
Deal with record collision	**No**
Add key sort to non-unique sort	**Yes**

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Data Request Requirements
Request Granularity

- Multiple Entities (datasets)
  - Particularly important at start up
  - Separate receive from request
- Table oriented requests
  - Most requests after start up are table oriented
  - Keep lookup tables on subsequent requests
  - Use relation definitions
    - Empty (unless appending batch) and retrieve child tables
    - Keep tables that have a reposition relation

Data Request Requirements
Query Requests

- Open
  - Apply filter and sort
  - Could position to key
- Refresh
  - Position query to current key
  - Should return with batch size
- Resort
  - Done locally if not batching (or all batches)
  - Position query to current key
  - Should return with rows before and after

Data Request Types
Record Position Requests

- Search (find first)
  - Can search on client if first record available
  - Position query to first where
  - Should return with rows before and after
- Find (unique)
  - Can look on client first if unique index (or info)
  - Position query to key
  - Use batch size 1 for single row requests

Data Service Position Requirements

- Position to
  - Key (find unique)
    - Resort, Refresh, Find
  - Where (find first)
    - Search
  - Last
- Keep find unique and find first separate
  - No open necessary for key as order is irrelevant

Data Service Position Options

- Ordinal Positioning
  - Return rows before and after positioned row
    - Improve user experience with two way batching
  - Low cost - only when “look back” is already done
- Fill Batch
  - Always return enough rows to fill batch
    - When Search or Find positions to end of batch
    - Necessary for ABL GUI Browser scrollbars

Data Request Requirements

Query (filter and sort) and batch size are implied

Data Request Requirements	Sample
Multiple datasets in one request	**Not shown – prepared APIs**
Table oriented requests	**Yes**
Position to key	**Yes**
Position to where	**Yes**
Ordinal position	**Yes – hard coded**
Fill batch	**Yes**

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Query Transformation

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- Use data source field mapping
  - for each eOrder where eOrder.OrderNum > “20”
  - for each order where order.order-num > “20”
- Data source child query uses temp-table parent
  - for each eOrderLine where eOrderLine.OrderNum = eOrder.OrderNum
  - for each order-line where orderline.ordernum = eOrder.OrderNum

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Query Join Optimization

- Data source query table order may vary
  - for each eOrder where eOrder.OrderNum = “22”
  - for each order where order.order-num = “22”

  - for each eOrder,
    ```
    each eSalesRep
                where  eSalesRep.Salesrep = eOrder.Salesrep
                and     eSalesrep.SalesRep = “BBB”
    ```

  - for each salesrep where salesrep.salesrep = “BBB”,
    ```
    each order  where order.salesrep = salesrep.salesrep
    ```

Internationalization

- Values in a query is interpreted according to session settings for date and numeric values
  - Use quotes (quoter)
    - Must use same setting when executed
  - Pass native data types

Data Access Query Requirements

Data Access Requirements	Sample
Query transformation	Yes
Variable table order in query	Yes
Base Query	Yes
Internationalization	No

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Retrieving Data in UltraGrid Events

- Grid keeps ordinal row Selected
  - Turn off before and set back to same row after
- Open query activates first row
  - Set flag to turn off next AfterRowActivate (or Before)
    - DisplayLayout.Override.ActiveRowAppearance.Reset() ???

Sorting in UltraGrid

- Turn off default sort in DisplayLayout:Override
  - HeaderClickAction:ExternalSortMulti (-Single)
  - Improves performance for local sort also
- AfterSortChange event (or Before)
  - Band:SortedColumns
  - Let the Presenter/Model decide active row

Column Filtering in UltraGrid

- Filter UI is set in DisplayLayout:Override
  - Set FilterUIType = FilterUIType:FilterRow
- Population of drop down values from data (fires off end)
  - Use BeforeRowFilterDropDownPopulate event (e:Handled=true)
- Filter operators can be set per column
  - Set FilterOperatorDropDownItems to ABL friendly values
  - Set FilterOperatorDefaultValue to ABL friendly value
- Filter evaluation is controlled in DisplayLayout:Override
  - Set FilterEvaluationTrigger=FilterEvaluationTrigger:OnEnterKey
- Filters are evaluated per column (also on enter)
  - Cancel the BeforeRowFilterChanged event (e:Cancel = true)
  - Manage apply of filters to external source manually

Column Filtering in UltraGrid
Managing Filters for external data source

- Define local variables
  - mChangedFilterColumns as ArrayList – Not applied changed columns
  - mColumnFilters as SortedList – Applied column filters
  - mRemovedFilterColumn as logical – Flag if any filter was blanked
- Keep track of changes in FilterCellValueChanged
  - If non blank cell add column to mChangedFilterColumns
    else remove it from both lists and set mRemovedfilterColumn true
  - Clear filters if no filters remain (needs improvement)
- Manage filters in BeforeRowFilterChanged
  - Add e:NewFilter to mColumnFilters
  - Remove e:NewFilter:Column from mChangedFilterColumns
  - Apply filters if mChangedFilterColumns became empty
    or mChangedFilterColumns was empty and mRemovedFilterColumn
- Take over the dialog in BeforeCustomRowFilterDialog
  - filter = mColumnfilters:Item[..] or new ColumnFilter().
  - wait-for e:CustomRowFiltersDialog:ShowDialog(filter,?).
  - e:Cancel = true.
  - If dialog is ok apply filters.

Managing Filters for external data source

- Define local variables
  - Define a SortedList to track applied filters
  - Define an ArrayList to track columns with filter changes
  - Define a flag to set if **any** filter was blanked
- Keep track of changes in FilterCellValueChanged
  - Maintain the list of columns with changes
  - Also empty the applied list and set the flag when a cell is blanked
- Manage filters in BeforeRowFilterChanged
  - Add e:NewFilter to the SortedList and remove ref from ArrayList
  - Apply the SortedList If the ArrayList became empty
  - If there were no filters but any blanked apply the SortedList
- Take over the dialog in BeforeCustomRowFilterDialog
  - Give it a filter from the SortedList or create a new
  - Wait and apply filters if ok

Retrieving Data in a Batching UltraGrid

- OffEnd fires (as it is supposed to)
- Off home events fires (not always as it is supposed to)
- Events fires sequentially
  - Difficult to block batching during retrieval
  - KeyDown and KeyUp is helpful
- Events fires asynchronously (?)
  - Message statements does not always stop other events

Batching in UltraGrid

- Forward batching
  - Binding source OffEnd event
- Backward batching
  - Fetch prev batch in BeforeRowRegionScroll
    - If e:NewState:ScrollPosition = 1
  - Keep first row out of viewport when more batches exist
    - Control in AfterSortChanged (other data read events?)
    - Require service that can return rows before current on resort
  - On KeyDown
    - fetch batch on Home, End and Cursor events

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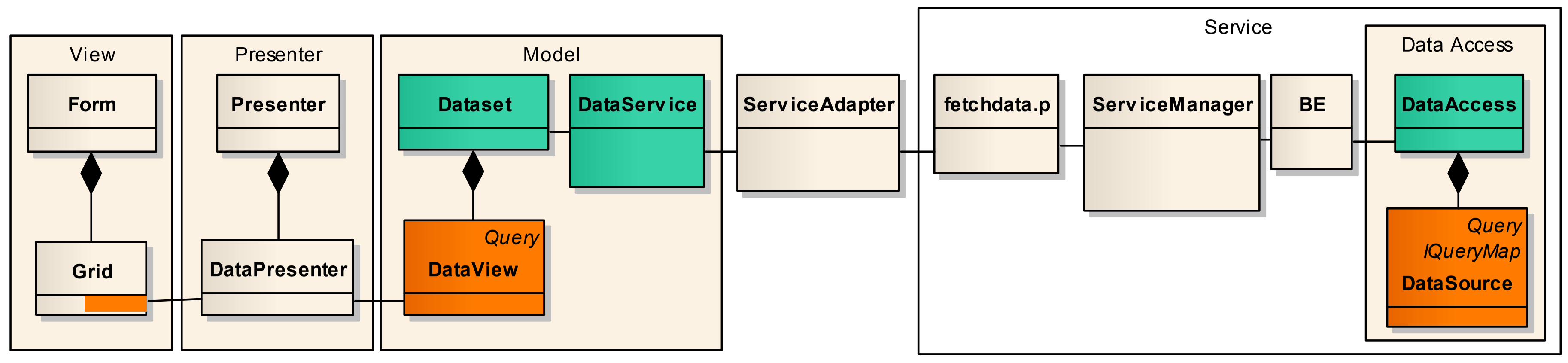
Sample Components
Query management with ABL in OERA



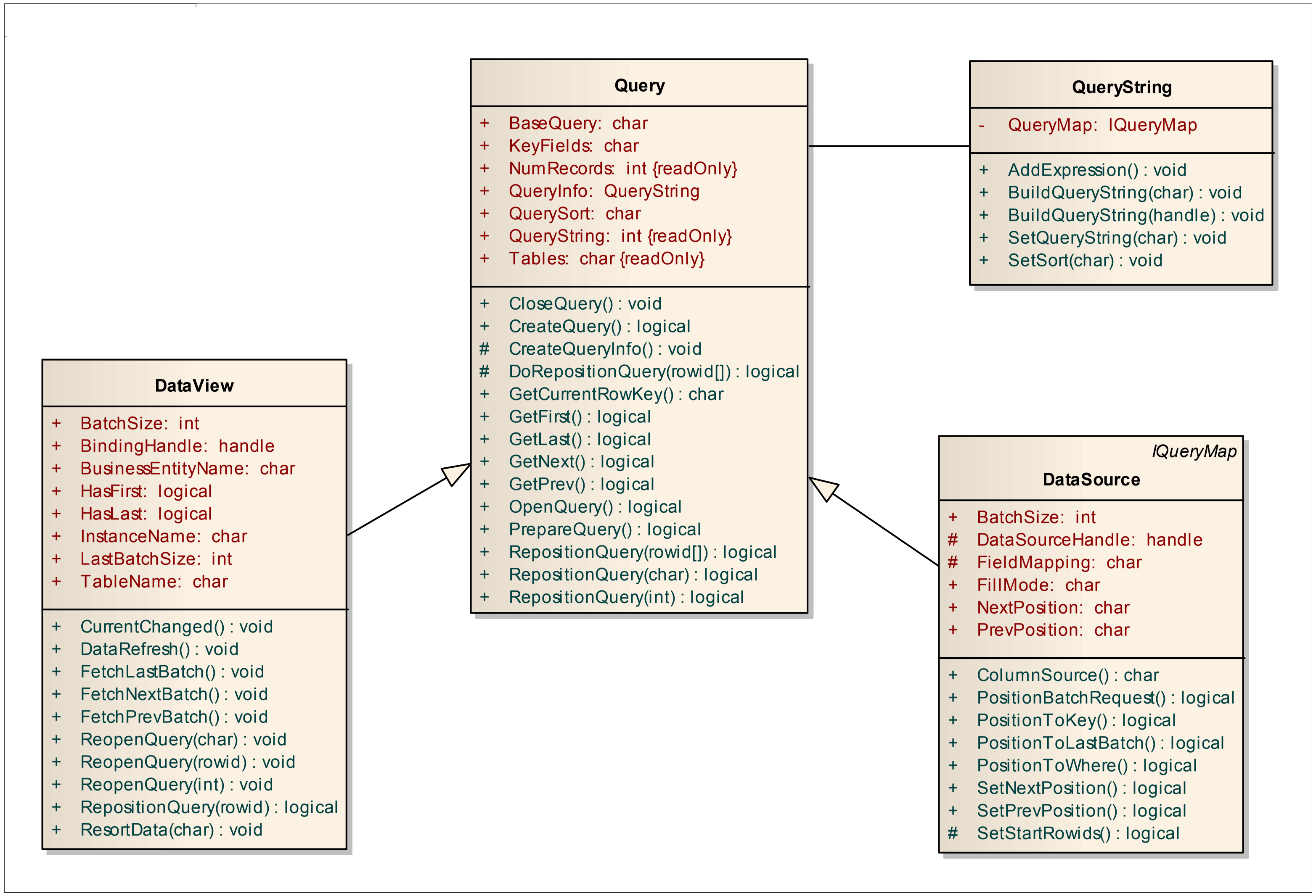
🟧 Query sorting, filtering and batching

🟩 Dataset and request management

⬜ Working simulations

No update methods

Sample Classes
Query classes with QueryString class



Query
+ BaseQuery: char
+ KeyFields: char
+ NumRecords: int {readOnly}
+ QueryInfo: QueryString
+ QuerySort: char
+ QueryString: int {readOnly}
+ Tables: char {readOnly}
+ CloseQuery() : void
+ CreateQuery() : logical
# CreateQueryInfo() : void
# DoRepositionQuery(rowid[]) : logical
+ GetCurrentRowKey() : char
+ GetFirst() : logical
+ GetLast() : logical
+ GetNext() : logical
+ GetPrev() : logical
+ OpenQuery() : logical
+ PrepareQuery() : logical
+ RepositionQuery(rowid[]) : logical
+ RepositionQuery(char) : logical
+ RepositionQuery(int) : logical
QueryString
- QueryMap: IQueryMap
+ AddExpression() : void
+ BuildQueryString(char) : void
+ BuildQueryString(handle) : void
+ SetQueryString(char) : void
+ SetSort(char) : void
DataView
+ BatchSize: int
+ BindingHandle: handle
+ BusinessEntityName: char
+ HasFirst: logical
+ HasLast: logical
+ InstanceName: char
+ LastBatchSize: int
+ TableName: char
+ CurrentChanged() : void
+ DataRefresh() : void
+ FetchLastBatch() : void
+ FetchNextBatch() : void
+ FetchPrevBatch() : void
+ ReopenQuery(char) : void
+ ReopenQuery(rowid) : void
+ ReopenQuery(int) : void
+ RepositionQuery(rowid) : logical
+ ResortData(char) : void
IQueryMap
DataSource
+ BatchSize: int
# DataSourceHandle: handle
# FieldMapping: char
+ FillMode: char
+ NextPosition: char
+ PrevPosition: char
+ ColumnSource() : char
+ PositionBatchRequest() : logical
+ PositionToKey() : logical
+ PositionToLastBatch() : logical
+ PositionToWhere() : logical
+ SetNextPosition() : logical
+ SetPrevPosition() : logical
# SetStartRowids() : logical

THANK YOU

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