


**MAX 2006** **Beyond Boundaries**

## Building an Enterprise Reporting Framework Using Adobe Flex

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**Presentation Outline** MAX

- Customer Challenges – 2 min
- Challenges of the current process
- Requirement for the solution
- Technical Solution – 45 min
- How we meet the requirement – 2 min
- Architecture of the solution - 3 min
- DaoFlex Solution technical overview and demo -15 min
- Reporting Framework technical overview and demo - 25 min
- Q&A – 7 min



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**Customer Challenges** MAX

- IFS/StateStreet accountants are processing about 10,000 back-office generated reports on a daily basis
- Links to PDF of selected reports which pass accounting verification are exposed to the customers – Fortune 100 financial corporations
- IFS customers are not able to manipulate the report data themselves, i.e: add/remove columns, filter/sort accounts, drilldown/rollup etc.
- IFS accountants are not able to manipulate the data either. All requests for adding computed fields, modifications of groupings, filtering, aggregation, pivoting etc. fall back to IFS IT
- IFS/StateStreet plans to introduce a new service – Web-based user-driven reporting solution, allowing end-users and in-house accountants to manipulate the existing report data as well as build and persist the report structure for later reuse on personal and shared level

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**Requirements for the Solution** MAX

- Web-based Report Delivery
- Data Location
  - Due to the volatile nature of the data, manipulation should be done on the client desktop, i.e. inside the browser as oppose to hitting the datastore again
- Intuitive User Interface to allow report manipulation :
  - Adding/removing columns;
  - Support of computed fields;
  - Support dynamic grouping with group and cross-group computations;
  - Support custom filtering and sorting
  - Support bi-directional link with Excel
- Support of business quality client-side printing w/out server side trip (PDF generation, etc.)

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**Requirements for the Solution (continued)** MAX

- Performance, look-and-feel, cross-browser
- Development and deployment has to be highly automated, currently labor intensive parts streamlined or eliminated
- Power users should be able to customize templates either via UI or directly – but without low-level coding
- Customization has to be available on all levels independently, no "black box" integration
- Initial metadata has to automatically derive from SQL or stored procedure defined for a base report

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**How Farata Systems meets the requirement** MAX

- FlexBI – Flex-based business intelligence solution
  - SuperGrid control, a natural extension of standard DataGrid
  - Custom MXML tags to support arbitrary groupings and computations
  - Metadata as MXML
  - Database as persistent storage of metadata and pre-compiled reports
  - Dynamic visual modification of report MXML by the end-user
  - Web-tier compilation, support of add-hoc expressions: filtering, sorting, formulas
  - Printing, Excel Link
- DaoFlex – XSL Template-based design-time code generator
  - SQL statements as Java doclet annotations; mix and match pure Java and "SQL" methods
  - Java code: DAO - both Remoting and DataServices flavors; data transfer objects; JARs
  - Test MXML UI, ActionScript and Java data transfer objects
  - Initial report Metadata
  - Deployment descriptors, etc

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## Session Agenda

- Introductions
- DaoFlex – MXML/ActionScript/Java code generator
- Generated code review (live demo)
- SuperGrid Control
- Saving base reports as templates
- FlexBI – flexible end-user driven reporting tool
- WebTier compilation engine for business formulas, expressions and complete design
- Database-based deployment of the reports

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## Introductions

- Who we are
  - Mentoring consultants
  - Software Engineers
  - Educators
- What we do
  - Mentoring
  - Consulting
  - Training
- Publications
  - Books
  - Articles
  - Blogs
  - Adobe Exchange
- Open Source Projects
  - DaoFlex
  - FlexBI
  - fAnt
  - log4F

Brief Introduction  
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## DaoFlex: RAD approach to Data Access in Flex

### PRODUCTIVITY


- Eliminate the need for manual Java coding of data access tasks
- Eliminate the need of manual synchronization of data transfer classes on Java and ActionScript side
- Eliminate the need of manual synchronization of DataGridColumn definitions with ActionScript classes.
- And more...

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## DaoFlex At A Glance

```

package com.theriabook.datasource;
/**
 * @daoFlex:webservice
 * pool=jdbc/theriabook
 */
public abstract class Employee {
/**
 * @daoFlex:sql
 * sql= select * from employee where start_date < :startDate
 * transferType=EmployeeDTO[]
 * keyColumns=emp_id
 */
public abstract List getEmployees(Date startDate);
}
  
```



- Code generation solution that completely automates manual Java coding for CRUD (create, retrieve, update, delete) tasks
- Integrates with Eclipse or works standalone as Ant task
- Goes all the way from simple annotated Java class to deployed JARs in the WEB-INF/lib
- Generates all required Java, ActionScript, MXML, XML

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## DaoFlex Input: Annotated Abstract Class

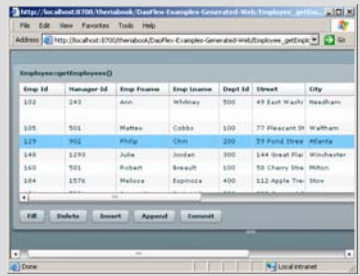
```

package com.theriabook.datasource;
/**
 * @daoFlex:webservice
 * pool=jdbc/theriabook
 */
public abstract class Employee {
/**
 * @daoFlex:sql
 * sql= select * from employee where start_date < :startDate
 * transferType=EmployeeDTO[]
 * keyColumns=emp_id
 */
public abstract List getEmployees(Date startDate);
}
  
```

[The complete source code of the Employee class is here](#)

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## Application Completely Built by DaoFlex



[The finished sample application is here](#)

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### DaoFlex At A Glance

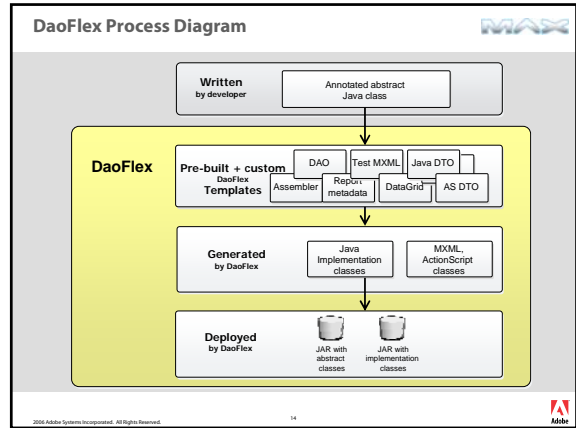
```

package com.theriabook.datasource;
/* @doFlexReference
 * pool=jdbc/theriabook
 */
public abstract class Employee {
    /* @doFlexSQL
     * sql=select * from employee where start_date < :startDate
     * handlerType=EmployeeDTO
     * keyColumns=emp_id
     */
    public abstract List getEmployees(Date startDate);
}

```

Physical data source pointed by pool=jdbc/theriabook

- Code-generation of all required Java, ActionScript, MXML, configuration files is based on the pre-written customizable XSL templates
- Code generation includes connecting to the database and obtaining result set metadata
- XSL Templates are processing combined metadata extracted from DB with info extracted from the Doclet tags



### DaoFlex Directory Structure

### ANT Process Based on DaoFlex

```

[INFO] Processing "com.theriabook.datasource.Employee" class...
[INFO] ---->Save DTO
[INFO] ---->ActionScript DTO
[INFO] Warning[1]: Using already created "com.theriabook.datasource.dto.EmployeeDTO" bean type.
[INFO] Warning[2]: Using already created "com.theriabook.datasource.dto.EmployeeDTO" bean type.
[INFO] ---->RemotingDAO
[INFO] ---->DataServiceDao
[INFO] ---->Assembler
[INFO] ---->TestApplication (Grid/DataService)
[INFO] ---->data-management-config.xml
[INFO] ---->remoting-config.xml
[INFO] ---->TestApplication (Grid/Remoting)
[INFO] Done. 0 errors, 2 warnings.
BUILD SUCCESSFUL
Total time: 7 seconds

```

### Generated Java DAO: Fill Method

```

public final List getEmployees(java.util.Date startDate) {
    String sql = "select * from employee where start_date < ? or start_date=?"; ...
    conn = JDBCConnection.getConnection("jdbc/theriabook");
    stmt = conn.prepareStatement(sql);
    stmt.setDate(1, DateTimeConversion.toSqlDate(startDate));
    rs = stmt.executeQuery();
    while( rs.next() ) {
        EmployeeDTO dto = new EmployeeDTO();
        dto.EMP_FNAME = rs.getString("EMP_FNAME");
        dto.SALARY = rs.getDouble("SALARY");
        dto.START_DATE = DateTimeConversion.toUtilDate(rs.getDate("START_DATE"));
        list.add(dto);
    }
    return list; // ... catch ... finally
}

```

### Generated Java DAO: doUpdate

```

private void doUpdate_getEmployees(Connection conn, ChangeObject co) ... {
    StringBuffer sql = new StringBuffer("UPDATE EMPLOYEE SET ");
    String [] names = co.getChangedPropertyNames();
    for (int ii=0; ii < names.length; ii++) {
        sql.append((ii=0? ", ":"") + names[ii] + " = ? ");
    }
    sql.append(" WHERE (EMP_ID=?)");
    stmt = conn.prepareStatement(sql.toString());
    Map values = co.getChangedValues();
    int ii=0;
    for (ii=0; ii < names.length; ii++) {
        stmt.setObject( ii+1, values.get(names[ii]));
    }
    ii++;
    stmt.setObject(ii++, co.getPreviousValue("EMP_ID"));
    if (stmt.executeUpdate()==0) throw new DataSyncException(co);
}

```

### Generated Java DAO: doCreate

```
private ChangeObject doCreate_getEmployees(Connection conn, ChangeObject co) throws ... {
    PreparedStatement stmt = null;
    String sql = "INSERT INTO EMPLOYEE * + "(EMP_ID, ... SALARY, START_DATE)" +
    values (?,...?,?)";
    stmt = conn.prepareStatement(sql);
    EmployeeDTO item = (EmployeeDTO) co.getNewVersion();
    stmt.setInt(1, item.EMP_ID);
    stmt.setString(12, item.SS_NUMBER);
    if (Double.isNaN(item.SALARY))
        stmt.setNull(13, Types.DOUBLE);
    else
        stmt.setDouble(13, item.SALARY);
    stmt.setDate(14, DateTimeConversion.toSqlDate(item.START_DATE));
    if (stmt.executeUpdate()==0) throw new DAOException("Failed inserting.");
    co.setNewVersion(item);
    return co;
}
```

[The full source of the generated JavaDAO can be seen here](#)

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### Generated Java DAO: Sync Method

```
public final List searchEmployees_sync(List items) {
    Connection conn = null;
    ChangeObject co = null;
    try {
        conn = JDBCConnection.getPooledConnection("jdbc:/theriobook");
        Iterator iterator = items.iterator();
        while (iterator.hasNext()) { // Do all deletes first
            co = (ChangeObject)iterator.next();
            if (co.isDelete()) doDelete_searchEmployees(conn, co);
        }
        iterator = items.iterator();
        while (iterator.hasNext()) { // Proceed to all updates next ...
            iterator = items.iterator();
            while (iterator.hasNext()) { // Finish with inserts ...
            }
        }
    } catch ...
    } finally {
        if (conn!=null) JDBCConnection.releasePooledConnection(conn);
    }
    return items;
}
```

[The full source of the generated JavaDAO can be seen here](#)

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### Generated Java DTO

```
/* Generated by DAO FLEX Utility (JavaDTO.xml) */
package com.theriobook.datasourcedto;

public class EmployeeDTO implements Serializable{
    private static final long serialVersionUID = 1L;

    public int EMP_ID;
    public String EMP_FNAME;
    public double SALARY; ...
    public java.util.Date START_DATE;

    private String _uid;
    public EmployeeDTO() { _uid = UUIDGen.getUUID(); }
    public String getUid() { return _uid; }
    public void setUid(String value) { _uid = value; }
}
```

[The full source of the generated JavaDAO can be seen here](#)

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### Generated ActionScript DTO

```
/* Generated by DAO FLEX Utility (ActionScriptDTO.xml) */
package com.theriobook.datasourcedto {
[Managed]
[RemoteClass(alias="com.theriobook.datasourcedto.EmployeeDTO")]
public dynamic class EmployeeDTO {
    public var EMP_ID : Number;
    public var EMP_FNAME : String; ...
    public var SALARY : Number;
    public var START_DATE : Date; ...

    private var _uid:String;
    public function get uid():String { return _uid; }
    public function set uid(value:String);void [_ uid = value; ]

    public function EmployeeDTO() [_ uid = UIDUtil.createUID(); ]
} //EmployeeDTO
```

[The full source of the generated ActionScriptDTO can be seen here](#)

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### Generated Test MXML Application


```
<mx:Application xmlns:mx="http://www.adobe.com/2006/mxml" creationComplete="onCreationComplete()">
<mx:DataService id="ds" destination="Employee" . . . />
<mx:Panel title="Employee-getEmployees()" >
<mx:DataGrid id="dg" dataProvider="{collection}" editable="true" height="100%">
<mx:columns><mx:Array>
<mx:DataGridColumn dataField="EMP_FNAME" headerText="Emp Fname" />...
<mx:DataGridColumn dataField="SALARY" headerText="Salary"
itemEditor="{numberEditor}" labelFunction="numberLabelFunction"/>
</mx:Array></mx:columns>
</mx:DataGrid>
<mx:ControlBar><mx:Button label="Fill" click="fill_onClick"/><mx:Button label="Delete" click="delete_onClick"/>
...
<mx:Button label="Commit" click="commit_onClick" enabled="{ds.commitRequired}"/>
</mx:ControlBar>
</mx:Panel>
</mx:Application>
```

[The full source of the generated Test MXML application can be seen here](#)


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### DaoFlex in Action

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**Wait, There is More...** 


- Java Assembler
- Remoting DAO classes
- Configuration XML files
- Report metadata for FlexBI
- Forms and Master/Detail
- Project specific templates

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**Controlling DaoFlex** 


- Rebuild DaoFlex from the source code: daoflex-runtime.jar & daoflex-generator.jar
- DaoFlex runtime - a tiny (13 Kb) JAR with a handful of simple classes
- DaoFlex Generator's templates - external XSL files
- Customize existing templates and/or add your own to generate as per your project organization
- Extend standard metadata with custom tags

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**Employing DaoFlex in Reporting Systems** 


- RAD Approach:
  - Provide visual development tools with full editing capabilities including, but not limited to drag-n-drop
  - Put the end-user in the driver's seat to extend the system
- Cut and Paste Approach (works for data entry as well):
  - Copy generated code to the application
  - Add business functionality on top
  - Development cycle: standard incremental process of design, test, deployment

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**FlexBI – Business Intelligence Tool** 

**COST OF OWNERSHIP**

- Native Flex approach for reporting solutions
- Eliminate the need to integrate and customize 3<sup>rd</sup> party BI packages
- Control performance and security issues
- Simplify deployment
- Support report personalization by the end user


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**FlexBI – Business Intelligence Tool**

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**Key Ingredients of FlexBI**

- SuperGrid control, a natural extension of standard DataGrid
- Run-time use of MXML for VISUAL editing by the end-user

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### SuperGrid In Action

Employee Name

EMP_FNAME	SS_NUMBER	SALARY	BIRTH_DATE	PHONE
Department: 200				
State: Massachusetts				
Siegan, Kevin	075-67-9377	\$37,900.00	04/13/1953	(617) 555-3788
Freston, Mark	027-66-3454	\$37,800.00	09/14/1967	(617) 555-5962
Singer, Samuel	011-34-9786	\$34,892.00	04/07/1960	(508) 555-3255
Chas, Shih Lin	046-97-3741	\$33,690.00	12/12/1970	(617) 555-5921
Sub-total:		\$155,690.00		
State: Texas				
Hobbs, James	034-28-1032	\$49,500.00	11/09/1953	(713) 555-9627
Garcia, Mary	042-70-6188	\$39,800.00	01/23/1964	(713) 555-3431
Sub-total:		\$89,300.00		
Sub-Total:		\$980,129.00		
Department: 300				
State: California				
Overby, Rubin	025-49-7133	\$39,300.00	03/15/1965	(510) 555-7255
Sub-total:		\$39,300.00		
State: Massachusetts				
Etha, Mary Anne	019-64-1485	\$38,949.00	05/13/1956	(617) 555-4836
Letting, John	079-37-2285	\$75,490.00	04/27/1940	(617) 555-1167

### SuperGrid: Business Domain MXML

- New functionality: header/footer bands; formulas
- Automation of routine tasks: formatting

```

<fx:columns><mx:Array>
  <fx:SuperGridColumn colId="LNAME" dataField="LNAME" headerText="Name" /> ...
  <fx:SuperGridColumn colId="SALARY" dataField="SALARY" format="currency" />
  <fx:SuperGridColumn colId="BIRTH_DATE" dataField="BIRTH_DATE" format="shortdate" />
  ...
</mx:Array></fx:columns>
<fx:bandColumns><mx:Array> ....
  <fx:SuperGridColumn bandName="Header1" colId="h1" headerText="Department:" />
  <fx:SuperGridColumn bandName="Header1" colId="D1" dataField="DEPT_ID"
    fontWeight="bold"/>
  <fx:SuperGridColumn bandName="Trailer1" colId="st1" headerText="Sub-Total:" />
  <fx:SuperGridColumn bandName="Trailer1" colId="S_T1" dataField="SALARY"
    boundTo="SALARY" format="currency" formula="SUM(SALARY for CURRENT)"/>....
</mx:Array></fx:bandColumns>
  
```

### FlexBI Report Metadata - MXML

- Def: MXML of the Report persisted in the database
- Initially produced by DaoFlex as SQL INSERT statement
- Iteratively and interactively edited via FlexBI Designer
- Regular MXML: can be edited and standalone tested
- MXML-to-components serialization/de-serialization allows ad-hoc modification of the report by the end user (column list, grouping, sorting, formulas, etc.)

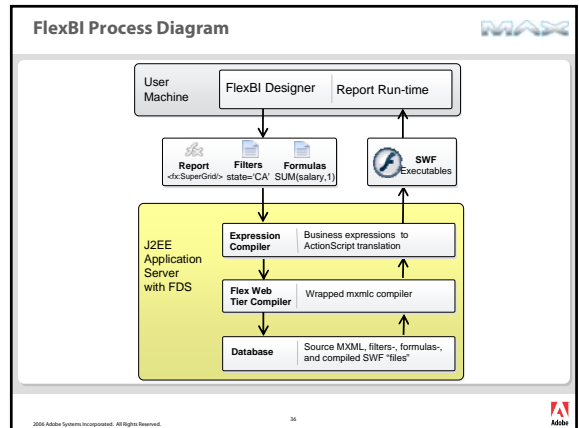
insert into COMPOSITIONLIST (description, columns, arguments, method, classname) values ( 'Template for Employee::getDepartments', '<fx:columns><mx:Array><fx:SuperGridColumn dataField="DEPT\_ID" headerText="Dept Id" /></mx:Array>...</fx:columns>', null, 'getDepartments', 'com.theriabook.composition.Employee' );

### FlexBI Reports Deployment: Publishing

- Are we going to have build for each additional report?
- Are we going to update server with each additional destination?
- Are we going to stop/start server after adding each additional report?
- How are we going to maintain security of the reports?

### FlexBI Reports Performance

- For each report composition there is appropriate "editable" MXML stored in the database
- The end-user can interactively change layout, grouping, formulas, formatting, etc.
- The changes are applied as modifications to the original MXML and are stored in the database for future sessions
- There is also a set of SWF files to be used for high-performance "view"



### Grouping with SuperGrid

```

<fx:groups><mx:Array>
  <fx:GroupSort level="1">
    <fx:fields><mx:Array>
      <mx:SortField name="DEPT_ID" descending="false" numeric="true"/>
    </fx:fields></fx:GroupSort>
  <fx:GroupSort level="2"><fx:fields><mx:Array>
    <mx:SortField caseInsensitive="true" name="STATE" descending="false" />
  </fx:fields></fx:GroupSort>
</mx:Array></fx:groups>
</fx:sort> ... /fx:sort>

```

- Grouping as natural progression of standard Flex sorting
- Seamless integration of the concept in the underlying platform

### Grouping with SuperGrid Continued

```

<fx:groups>...<fx:groups>
<fx:sort>
  <mx:Sort>
    <mx:fields><mx:Array>
      <mx:SortField caseInsensitive="true" name="EMP_LNAME" descending="false" />
      <mx:SortField caseInsensitive="true" name="EMP_FNAME" descending="false" />
    </mx:fields>
  </mx:Sort>
</fx:sort>

```

- "Inner" Sorting

### Data Driven Programming

- The MXML in the previous slides can be either compiled or interpreted on the client
- Interpreting subset of MXML on the client is relatively inexpensive due to E4X support in the player
- Once MXML is processed, fully functional report is instantiated
- The end-user can interactively change layout, grouping, formulas, formatting, etc. The changes are applied as modifications to the original MXML and are saved to Database for reuse in the future sessions
- Application objects become "data" and are available for modification through the application life cycle

### Real-world scenario – Reporting Application


- Business Analysts need high-level widgets understanding business functionality / no low-level coding
- Has to be customizable and extensible in almost real-time
- Has to support standard office integration and functions
- Developers (like us) want it to be:
  - Easy to develop
  - Easy to deploy
  - Easy to maintain
  - Should require very little testing
  - Should be easy to turn to operations
- Providing developers and business analyst with common markup widgets to assemble applications
- Separate and hide programming implementation of common tasks, make them data driven
- Engage end-user in the application customization and personalization

### Customizable Report Designer


- Base Interface for creating, extending and running dynamic reports
- Customizable set of painters and utility functions for reporting
- Built-in personalization layer


### Layout Designer




**FlexBI Benefits** 

- No builds for each additional report
- No need to change config files with extra remoting destinations
- No server stop/start after adding an additional report
- No large SWF files, no hundreds of small SWFs
- Complete personalization of reports by the end-user
- Complete control of the default enterprise formatting by the business analyst
- Complete automation of development and testing environments for developer

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**Q & A** 

- **Links**
  - Introduction into DaoFlex
  - Introduction into fxReporter
  - Demo of
- **Downloads**
  - DaoFlex
  - fAnt – Flex Ant Automation
  - XPanel – tracing/debugging console
  - PojoFacade for remoting
- **Contact Information**
  - [vrasputnis@faratasystems.com](mailto:vrasputnis@faratasystems.com)
  - [atartakovsky@faratasystems.com](mailto:atartakovsky@faratasystems.com)
  - <http://www.faratasystems.com>
- **Q & A**

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