Migration and Developer Productivity Solutions

PostgreSQL and REST API’s The Easy Way

Charles Finley, Transformix Computer Corporation
http://modernization.xformix.com/resources/articles/
Speaker: Charles Finley

- Specialization: Legacy Application Migration and Modernization
- Replatforming
- Database migrations
- Language conversions
- System Integration
- Web and Mobile Development
- Oracle, IBM DB2, MSSQL, Postrgresql, MySQL
- OS: Linux, UNIX and Windows
- Minimally Invasive
- 40+ years in IT

http://modernization.xformix.com/resources/articles/
https://www.socallinuxexpo.org/scale/16x/presentations/postgresql-and-rest-apis-easy-way

http://modernization.xformix.com/resources/articles/
Application Evolution – 5 Levels

Monolithic
Early-Mid 80s

Client Server
Late 80s-Mid 90s

Internet Enabled
Mid 90s

Composite/Services Based
Mid 00s-

- Mainframe apps
- Dumb terminals

- Static-state applications

- GUI driven applications

- Connected applications

- Internet Connected Applications

- Services Based Applications

- Composite/Services Based

- Loosely coupled web architectures
- REST, SOAP, XML, ESB
- Devices, form factors

- Rich UI
- Connected to suppliers & customers
- Internet enabled

- Enhanced GUI
- Integrated toolsets
- LOB apps connected within the company (ERP, CRM, etc.)

- Spreadsheets
- Word processors
- Standalone apps

- Mainframe apps
- Dumb terminals
Database-Centric Application

- Database **applications** consists of forms, formatted reports, queries, programs, etc.
- Database Management Systems (**DBMS**) process database tables for applications

http://modernization.xformix.com/resources/articles/
## Example Applications

<table>
<thead>
<tr>
<th>Application/Database</th>
<th>Source Application</th>
<th>Database</th>
<th>Database Modernization Solution</th>
<th>Application Modernization Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>COBOL, TurboIMAGE</td>
<td>COBOL, Screen Handler, Report Writer</td>
<td>TurboIMAGE</td>
<td>PostgreSQL, Transformix TurboIMAGE call library and migration tools</td>
<td>CUBA-Platform and TransformixTools</td>
</tr>
<tr>
<td>MS Access (Application, Jet Database)</td>
<td>MS Access Jet Database</td>
<td>MS Access Jet Database</td>
<td>PostgreSQL, Transformix MS Access Migration Toolkit</td>
<td>CUBA-Platform and TransformixTools</td>
</tr>
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</tr>
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<td>XBASE –ISAM (clipper, dBASE II, Foxpro, etc.)</td>
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<td>CUBA-Platform and TransformixTools</td>
</tr>
</tbody>
</table>

http://modernization.xformix.com/resources/articles/
Migrating and Modernizing Existing Database Applications

- **DBMS** – convert to PostgreSQL
- **Applications** (forms, reports, logic) – Use the original, modernize or both
- Modernizing – web, mobile, APIs

http://modernization.xformix.com/resources/articles/
Session Overview

- Two Case Studies
  - Case 1: Single table application one done without a Web Application Framework and one with the CUBA-Platform
  - Case 2: MS Access Database Application migrated to JAVA with CUBA-Platform
  - Building web applications for web and mobile with an integrated toolset based on REST API and that is able to consume and produce REST APIs.

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Modernization InPlace Approach
Our Development Approach

- PostgreSQL
- REST APIs
- CUBA-Platform Web Application Development Framework
- TransformixTools

http://modernization.xformix.com/resources/articles/
Why PostgreSQL?

Storing data - the model, structures, types and size limits

- Data model
  - User Defined Types
  - Complex data structures
  - Multi-dimensional arrays
  - ACID for referential and transactional integrity
- Data size –
  - Max table size 32 TB, etc.
  - Max database size – unlimited
  - Max indexes per table - unlimited

Data manipulation and retrieval

- Indexing
  - Partial indexes
  - Expression indexes
  - GIST (Generalized Search Tree)
  - FTS (Full Text Search)
- Query Capabilities
  - Combining queries
  - Lateral subqueries
- Functions (create own operator)

https://www.compose.com/articles/what-postgresql-has-over-other-open-source-sql-databases/
Why REST API?

- Interoperability
- Commonly used interface
- Actually HTTP and REST APIs

http://modernization.xformix.com/resources/articles/
Interoperability

Migration  Transformation  Database  Interface  Mobile

REST API

- Mobile Applications
- Cloud-Based Services
- Partner Applications
- Cloud Resources
- Legacy Applications
- Application Servers
- Data
REST API Basics

HTTP

GET /allUsers

HTTP POST /newUser

HTTP PATCH /updateUser

Our Clients, send HTTP Requests and wait for responses

Typical HTTP Verbs:
GET -> Read from Database
PUT -> Update/Replace row in Database
PATCH -> Update/Modify row in Database
POST -> Create a new record in the database
DELETE -> Delete from the database

Database

Rest API
Recieves HTTP requests from Clients and does whatever request needs. i.e create users

Our Rest API queries the database for what it needs

Response: When the Rest API has what it needs, it sends back a response to the clients. This would typically be in JSON or XML format.
What Do We Need From REST and HTTP API Web Services?

- Consuming REST Web Services using PostgreSQL and CUBA-Platform
  - Web browser
  - Mobile device
  - Google Maps
  - Yelp
  - Payment gateways
  - Vendors
  - Customers

- Providing REST Web Services
  - Database
  - Services
    - Applications
    - Programs
  - IoT
Why High Level Full Stack Framework?

**Spring MVC**
- 1 hour after prerequisites
- Coding
- Requires an understanding of JAVA, etc.

**CUBA Studio**
- 5 minutes after prerequisites
- No coding
- Does not require a programmer

Case 1: Basic REST Application
## REST API

**Entities**: CRUD entities operations

<table>
<thead>
<tr>
<th>Method</th>
<th>URL</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GET</td>
<td>/entities/{entityName}</td>
<td>Get a list of entities</td>
</tr>
<tr>
<td>POST</td>
<td>/entities/{entityName}</td>
<td>Create new entity</td>
</tr>
<tr>
<td>DELETE</td>
<td>/entities/{entityName}/{entityId}</td>
<td>Delete the entity</td>
</tr>
<tr>
<td>GET</td>
<td>/entities/{entityName}/{entityId}</td>
<td>Get a single entity by id</td>
</tr>
<tr>
<td>PUT</td>
<td>/entities/{entityName}/{entityId}</td>
<td>Update the entity</td>
</tr>
</tbody>
</table>
Who Are The Application Developers?

- No-code LoB Developer (Citizen Developer)
  - OO Frameworks
  - Declarative/ 4GL
  - Scripting
  - Productivity/Desktop DB
- Low-code Developer (BU IT or Central IT)
  - JAVA
  - .NET
  - CUBA–Platform, CUBA Studio, Vaadin
- Pro-developer (Central IT)
  - Groovy
  - Access
  - Excel
High-level Full-stack Frameworks

**Low(no)-code Frameworks**
- Mendix
- OutSystems
- PowerApps
- Wordpress
- Drupal

**High-level Full-stack Frameworks**
- Ruby on Rails
- Grails
- Django
- CUBA Platform

**Code Generators / Aggregators**
- Spring Boot
- JHipster

**Narrow-focused Frameworks**
- .NET
- Spring Framework
- Java EE
- Angular
- React
- Vaadin
- Hibernate
- EclipseLink
- Entity Framework

**“No Frameworks” Approach**
- Java
- C++
- Python

**Development Speed & Flexibility**
- Migration
- Transformation
- Database
- Interface
- Mobile

**Range of Applicability**
- Development from scratch
- Huge codebase
- Steep learning curve
- High total cost of ownership

- Low(no) management of a project / source code
- Problems with collaborative development
- Low(no) flexibility for non-standard requirements
- Customization beyond predefined points is impossible
- Fastest way to configure simple applications

- Well-integrated narrow-focused frameworks
- Shorter learning curve
- Ready to use functionality for standard requirements
- Faster development (RAD)
- Lower flexibility / customization issues

- Application is a set of lower-level frameworks
- Give no advantage after bootstrap

- Laborious integration with each other
- Different vendors
- Hard updates to major versions
The Target Environment – CUBA-Platform, PostgreSQL, IDE
Database Powered Application Builders

The Microsoft Access Model

- Relational Microsoft Jet Database Engine
- Graphical user interface
- Software-development tools
- One person can build and deploy database, forms, reports, queries and do some amount of coding (scripting) from a single toolset
Overview of Access IDE

• Main Database Window
  • Shows available tools
  • Many object types can be created and maintained
Example provided by techonthenet.com

```vba
Sub CheckIfFileExists()
    Dim LRow As Integer
    Dim LPath As String
    Dim LExtension As String
    Dim LContinue As Boolean

    'Initialize variables
    LContinue = True
    LRow = 2
    LPath = "R:\Symbols\"
    LExtension = ".sym"

    'Loop through all column A values until a blank
    While LContinue
        'Found a blank cell, do not continue
        If Len(Range("A" & CStr(LRow)).Value) = 0 Then
            LContinue = False
        Else
            'Check if file exists for part number
            If LPath & Range("A" & CStr(LRow)).Value <> "No" Then
                Dim LFile As Object
                Set LFile = CreateObject("Scripting.FileSystemObject")

                If Not LFile.FileExists(LPath & Range("A" & CStr(LRow)).Value & LExtension) Then
                    LContinue = False
                Else
                    'Place "Yes" in column B if the file does
                    Range("B" & CStr(LRow)).Value = "Yes"
                End If
            End If
        End If
        LRow = LRow + 1
    WEnd
```

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## MS Access Advantages vs. Disadvantages

<table>
<thead>
<tr>
<th>Microsoft Access advantages (partial list)</th>
<th>Microsoft Access Disadvantages (partial list)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to install and use</td>
<td>Windows Only</td>
</tr>
<tr>
<td>Ease to integrate</td>
<td>Finite</td>
</tr>
<tr>
<td>Widely popular</td>
<td></td>
</tr>
<tr>
<td>Saves you money</td>
<td></td>
</tr>
<tr>
<td>Multi-user support</td>
<td></td>
</tr>
<tr>
<td>Importing data</td>
<td></td>
</tr>
</tbody>
</table>
Database Powered Application Builders – A Modernized Version

- The main three tools are
  - PostgreSQL ORDBMS,
  - CUBA-platform RAD Web application framework and an
  - IDE (Eclipse).
Modernized Database Powered Application Builder

<table>
<thead>
<tr>
<th>Microsoft Access Tools</th>
<th>PostgreSQL, CUBA-platform, IDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database</td>
<td>PostgreSQL</td>
</tr>
<tr>
<td>Database Modernization</td>
<td>Dbeaver</td>
</tr>
<tr>
<td>Graphical User Interface</td>
<td>CUBA-platform, CUBA Studio and IDE</td>
</tr>
<tr>
<td>Code development</td>
<td>IDE – Eclipse</td>
</tr>
</tbody>
</table>
CUBA Studio
Development Environment
CUBA Studio and IDE (Eclipse)
CUBA-platform REST API

- CUBA’s REST API: CRUD via a HTTP API with exactly zero effort.
- The universal REST API provides the following functionality:
  - CRUD operations on entities.
  - Execution of predefined JPQL queries.
  - Execution of service methods.
  - Getting metadata (entities, views, enumerations, and datatypes).
  - Getting current user permissions (access to entities, attributes, specific permissions).
  - Getting current user information (name, language, time zone, etc.).
  - Uploading and downloading files.
  - REST API uses the OAuth2 protocol for authentication and supports anonymous access.
How Applications Have Evolved

ModernizationInPlace™ Application Evolution with Transport and CUBA-Platform

1. Split MS Access database
2. Add CUBA-Platform application features and RDBMS
3. Supplement MS Access application with CUBA applications
4. Replace all legacy modules with CUBA-Platform modules

Rich UI
Connected to suppliers & customers
Internet enabled

Web, Mobile, Touch Screen

Loosely Coupled web architectures
REST, SOAP, XML, ESB
Devices, form factors

Internet Connected Applications

Services Based Applications

GUI driven applications

1. Like for Like
   CUBA-Platform
   PostgreSQL
   Transport

2. Web Front-end
   CUBA-Platform
   VPSM

3. CUBA-Platform Enhanced
   ModernizationInPlace
   Hybrid application components
   Some all CUBA-application components

4. Only Modern components
Case 2:
Source: MS Access Northwind

## Split MS Access

### MS Access Database Components

<table>
<thead>
<tr>
<th>Component</th>
<th>MS Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tables</td>
<td>MS Access</td>
</tr>
<tr>
<td>References</td>
<td>MS Access</td>
</tr>
<tr>
<td>Relations</td>
<td>MS Access</td>
</tr>
<tr>
<td>Queries</td>
<td>MS Access</td>
</tr>
<tr>
<td>Forms</td>
<td>MS Access</td>
</tr>
<tr>
<td>Reports</td>
<td>MS Access</td>
</tr>
<tr>
<td>Pages</td>
<td>MS Access</td>
</tr>
<tr>
<td>Macros</td>
<td>MS Access</td>
</tr>
<tr>
<td>Modules</td>
<td>MS Access</td>
</tr>
</tbody>
</table>

### Other Features

- **WAN**: NO
- **REST API**: NO
- **Mobile**: NO
- **Desktop**: NO
- **Web**: NO
- **Internet Access**: NO
- **Number of Users**: 5-10
- **Data Integrity**: Poor
- **Cloud Ready**: NO
- **OS**: Windows Only
Target: Dual Clients, MS Access, CUBA-Platform (JAVA), Postgresql
## Dual Client

### Migration

<table>
<thead>
<tr>
<th>Client</th>
<th>MS Access</th>
<th>CUBA Client</th>
</tr>
</thead>
</table>

### Transformation

| Database | PostgreSQL | PostgreSQL |
| Tables   | PostgreSQL | PostgreSQL |
| References | PostgreSQL | PostgreSQL |
| Relations | PostgreSQL | PostgreSQL |

| Queries | MS Access | PostgreSQL |
| Forms   | MS Access | CUBA-JAVA |
| Reports | MS Access | CUBA-JAVA |
| Pages   | MS Access | CUBA-JAVA |
| Macros  | MS Access | CUBA-JAVA |
| Modules | MS Access | CUBA-JAVA |

### Interface

| WAN       | NO | YES |
| REST API  | NO | YES |
| Mobile    | NO | YES |
| Desktop   | NO | YES |
| Web       | NO | YES |

### Mobile

| Internet Access | NO | YES |
| Number of Users | 5-10 | Any |
| Data Integrity | Poor | High |
| Cloud Ready    | Partially - Database can be in the cloud | YES |

### OS

| Windows Only | Windows, Linux, UNIX, MAC |
CUBA-Platform Clients

Client tier
- Polymer Client
- Web Client
- Web Portal
- Desktop Client

Middle tier
- Middleware

Database tier
- Database
CUBA-platform Clients
CUBA-platform Clients

Migration | Transformation | Database | Interface | Mobile

1. Access MDB to IIF Engine
2. edb
3. edb
4. JCDBC
CUBA-platform Clients

1. Split MS Access database
2. MS Access client with RDMBS backend
3. Dual clients with RDMBS backend – MS Access client and Modern Web Application Framework clients (Web browser, Mobile, Desktop, REST API)
   - Database entities are exposed as REST APIs
   - CUBA-Application can now consume external REST API web services
4. RDMBS backend – MS Access client and Modern Web Application Framework clients (Web browser, Mobile, Desktop, REST API)
CUBA-platform Clients
**REST API Impacts**

- **REST APIs**
- Modernized Northwind Application and Database
- Consume
  - External – currency rates, google maps, payment gateways
- Provide
  - Web browser
  - Mobile
  - Database
  - Reports (Moulton)
Modernization In Place App Interfaces

**Migration**
- Desktop integrated GUI application
- Rich client processing
- Enhanced UI widgets

**Transformation**
- No footprint
- Web 2.0 interface including HTML5, AJAX, etc.
- Use any leading browser including Chrome, Internet Explorer, Firefox, Safari

**Database**
- Integration on the device
- Blend applications from different sources

**Interface**
- Access host applications from mobile devices
- Access host applications from mobile devices
- Android, iPad, iPhone, etc.
- REST/JSON integration

**Mobile**
- Provide web services to host applications
- Access external web services from any client
- REST APIs part of application architectures

**Web Services**
- Non-invasive integration with host applications
- Low cost: No change to existing applications
- Low risk: Leverage open source, industry standard platforms and technologies
- Integration of host applications and process with data and external web applications and services
- Quick ROI: Fast deployment
- RAD development Web Application Development Framework – CUBA-Platform
Case 2: Northwind CUBA
Case 2: Northwind CUBA Eclipse
Non Cuba REST

<table>
<thead>
<tr>
<th>Company</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfreds Futterkiste</td>
<td>Germany</td>
</tr>
<tr>
<td>Ana Trujillo Emparedados y</td>
<td>Mexico</td>
</tr>
<tr>
<td>helados</td>
<td></td>
</tr>
<tr>
<td>Antonio Moreno Taqueria</td>
<td>Mexico</td>
</tr>
<tr>
<td>Around the Horn</td>
<td>UK</td>
</tr>
<tr>
<td>Berglund's snabbshop</td>
<td>Sweden</td>
</tr>
<tr>
<td>Blauer See Delikatessen</td>
<td>Germany</td>
</tr>
<tr>
<td>Blondel père et fils</td>
<td>France</td>
</tr>
<tr>
<td>Bóvido Comidas preparadas</td>
<td>Spain</td>
</tr>
<tr>
<td>Bon app</td>
<td>France</td>
</tr>
<tr>
<td>Bottom Dollar Markets</td>
<td>Canada</td>
</tr>
<tr>
<td>B's Beverages</td>
<td>UK</td>
</tr>
<tr>
<td>Cactus Comidas para llavar</td>
<td>Argentina</td>
</tr>
<tr>
<td>Centro comercial Móctezuma</td>
<td>Mexico</td>
</tr>
<tr>
<td>Chop-suey Chinese</td>
<td>Switzerland</td>
</tr>
<tr>
<td>Comércio Mineiro</td>
<td>Brazil</td>
</tr>
<tr>
<td>Consolidated Holdings</td>
<td>UK</td>
</tr>
<tr>
<td>Drachenblut Delikatessen</td>
<td>Germany</td>
</tr>
<tr>
<td>Du monde en international</td>
<td>France</td>
</tr>
<tr>
<td>Eastern Connection</td>
<td>UK</td>
</tr>
<tr>
<td>Ernst Handel</td>
<td>Austria</td>
</tr>
<tr>
<td>Familia Arquibaldo</td>
<td>Brazil</td>
</tr>
</tbody>
</table>
## CUBA-Generated Products

### Products

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Supplier</th>
<th>Category</th>
<th>Quantity/Unit</th>
<th>Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chai</td>
<td>Exotic Liquids</td>
<td>Beverages</td>
<td>10 boxes x 20 bags</td>
<td>$18</td>
</tr>
<tr>
<td>Chiang</td>
<td>Exotic Liquids</td>
<td>Beverages</td>
<td>24 - 12 oz bottles</td>
<td>$19</td>
</tr>
<tr>
<td>Chief Anton's Cajun Seasoning</td>
<td>New Orleans Cajun Delights</td>
<td>Beverages</td>
<td>48 - 6 oz jars</td>
<td>$22</td>
</tr>
<tr>
<td>Chief Anton's Gumbo Mix</td>
<td>New Orleans Cajun Delights</td>
<td>Beverages</td>
<td>36 boxes</td>
<td>$21.35</td>
</tr>
<tr>
<td>Grandma's Boysenberry Spread</td>
<td>Grandma Kelly's Homestead</td>
<td>Condiments</td>
<td>12 - 8 oz jars</td>
<td>$25</td>
</tr>
<tr>
<td>Uncle Bob's Organic Dried Peas</td>
<td>Grandma Kelly's Homestead</td>
<td>Produce</td>
<td>12 - 1 lb bags,</td>
<td>$30</td>
</tr>
<tr>
<td>Northwoods Cranberry Sauce</td>
<td>Grandma Kelly's Homestead</td>
<td>Condiments</td>
<td>12 - 12 oz jars</td>
<td>$40</td>
</tr>
<tr>
<td>Mishl Kobe Niku</td>
<td>Tokyo Traders</td>
<td>Meat/Poultry</td>
<td>15 - 500 g pkgs</td>
<td>$97</td>
</tr>
<tr>
<td>Ikura</td>
<td>Tokyo Traders</td>
<td>Seafood</td>
<td>12 - 200 ml jars</td>
<td>$31</td>
</tr>
<tr>
<td>Queso Cabrillo</td>
<td>Cooperative de Quesos Las Cabrill</td>
<td>Dairy Products</td>
<td>1 kg pkg.</td>
<td>$21</td>
</tr>
<tr>
<td>Queso Manchego La Pastor</td>
<td>Cooperative de Quesos Las Cabrill</td>
<td>Dairy Products</td>
<td>10 - 500 g pkgs</td>
<td>$88</td>
</tr>
<tr>
<td>Kombu</td>
<td>Mayumi's</td>
<td>Seafood</td>
<td>2 kg box</td>
<td>$6</td>
</tr>
<tr>
<td>Tofu</td>
<td>Mayumi's</td>
<td>Product</td>
<td>40 - 250 ml pkgs</td>
<td>$23.25</td>
</tr>
<tr>
<td>Genen Shoyu</td>
<td>Mayumi's</td>
<td>Condiments</td>
<td>24 - 250 ml bottles</td>
<td>$15.5</td>
</tr>
<tr>
<td>Pavlova</td>
<td>Pavlova, Ltd.</td>
<td>Confections</td>
<td>32 - 500 g boxes</td>
<td>$17.48</td>
</tr>
<tr>
<td>Alice Mutton</td>
<td>Pavlova, Ltd.</td>
<td>Meat/Poultry</td>
<td>20 - 1 kg tins</td>
<td>$39</td>
</tr>
<tr>
<td>Carnavon Tigers</td>
<td>Pavlova, Ltd.</td>
<td>Seafood</td>
<td>16 kg pkg.</td>
<td>$62.5</td>
</tr>
<tr>
<td>Teatime Chocolate Biscuits</td>
<td>Specialty Biscuits, Ltd.</td>
<td>Confections</td>
<td>10 boxes x 12 pieces</td>
<td>$9.2</td>
</tr>
</tbody>
</table>
Currency Service

Northwinds Application

Currency From: United States Dollar

<table>
<thead>
<tr>
<th>Currency To</th>
<th>Conversion Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Dollar</td>
<td>1.28</td>
</tr>
<tr>
<td>Bulgarian Lev</td>
<td>1.59</td>
</tr>
<tr>
<td>Great Britain Pound</td>
<td>0.72</td>
</tr>
<tr>
<td>Russian Ruble</td>
<td>55.93</td>
</tr>
<tr>
<td>Euro</td>
<td>0.81</td>
</tr>
<tr>
<td>Brazilian Real</td>
<td>3.24</td>
</tr>
<tr>
<td>Romanian Lion</td>
<td>3.79</td>
</tr>
</tbody>
</table>
Add Currency to Existing Screen

Northwinds Application

Reports
- Application
- Currency screen
- Forms: Quarterly Orders
  - Forms: Quarterly Orders 2
- Forms: Suppliers
- Forms: Customer Phone List
- Forms: Customer Orders
- Forms: Products
- Forms: Orders
- Forms: Categories
- Forms: Customers
- Forms: Employees

Forms: Employee Sales...
- Reports: Customer Labels
- Reports: Catalog
- Reports: Summary of Sales...
- Reports: Sales by Category
- Reports: Sales Total by A...

Select Currency
- United States Dollar
  - Great Britain Pound
  - Russian Ruble
  - Romanian Leu
  - Australian Dollar
  - Bulgarian Lev
  - Brazilian Real

Customer List
- Company Name
- City
- Toulouse

Product List
- Product Name
- Qtr 1
- Qtr 2
- Qtr 3
- Qtr 4

Country
- Mexico
- Mexico D.F.
- Puebla

Grand Total for 1997: EUR 4,295,799

Scale16x
Summary and Conclusions

What users expect from their applications has changed and is changing. Yet applications have been and must be written with existing tools. When these applications are valuable it is usually impractical to replace them with the latest and greatest thing. REST APIs, PostgreSQL and a full stack web application development framework like the CUBA-Platform with a few added tools from Transformix and others can be used to extend the long-term usefulness of these applications. This paper shows how this can be done in small steps using an approach called ModernizationInPlace™.
Thank You

Questions?