



THE CUSTOMER SUCCESS PLATFORM
SALES SERVICE MARKETING COMMUNITY ANALYTICS APPS

Salesforce.com's Multitenant Architecture

How we do the magic we do...

Safe Harbor

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Doug Merrett

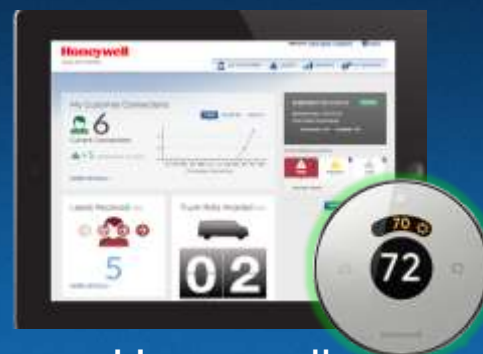
Principal Architect – Northern Europe

In the Internet of Customers, Apps Connect Everything





Academy of Art
STUDENT SCHEDULING APP



Honeywell
CONTRACTOR
APP



Trunk Club
CONSUMER FASHION APP

salesforce¹ Platform

Build Next Gen Apps. Lead Next Gen IT.



Time Warner
Cable
FIELD SALES APP



Virgin America
EMPLOYEE INTRANET APP



Zimmer
PRODUCT CATALOG APP

The World's #1 Cloud Platform

salesforce[®] 1 Platform

The Fastest Path From Idea To App



salesforce[®] 1 Platform

dreamforce[®]

salesforce

Salesforce1: A New Customer Platform for the Future



At The Core Of The Customer Success Platform

Multitenant Cloud Computing



Enterprise
Cloud Computing



Fast

No Hardware
No Software
Faster ROI



Innovative

Automatic Upgrades
Continuous Improvement
Flexible



Open

Any Device
API First
Data Portability



Easy

Real-time Customizations
AppExchange
Scalable



Trusted

Transparent
Secure
Performance at Scale

What Salesforce.com does for you

We do **Infrastructure** Services



Network
Storage
Operating System
Database
App Server
Web Server
Data Center

We do **Application** Services



Security
Sharing
Integration
Customization
Web Services
API
Multi-Language

We do **Operations** Services



Authentication
Availability
Monitoring
Patch Mgmt
Upgrades
Backup
NOC

YOU get to focus on **innovation**



Customize your CRM
Build your data model
Build your business logic
Build your user interface

Multitenancy

One Cloud with Many Customers

Shared Elastic Services

One Primary Data Store per Production Instance

8K+ Customers per Instance

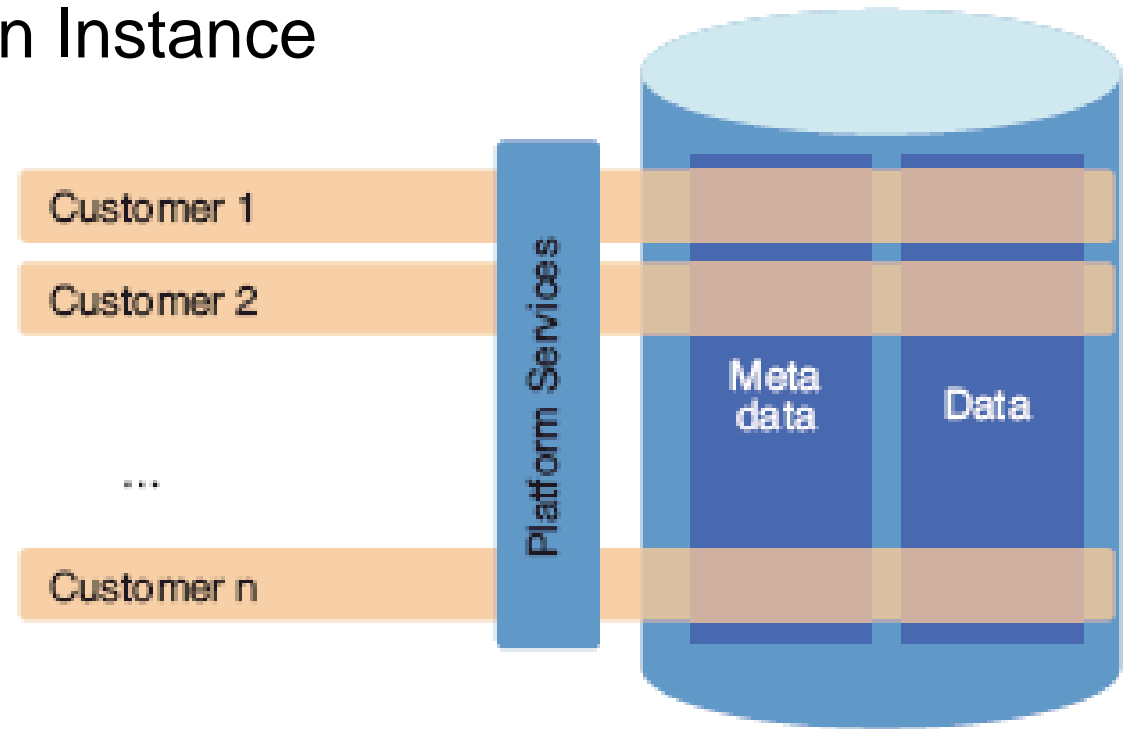
50+ Production Instances

All data segregated by customer

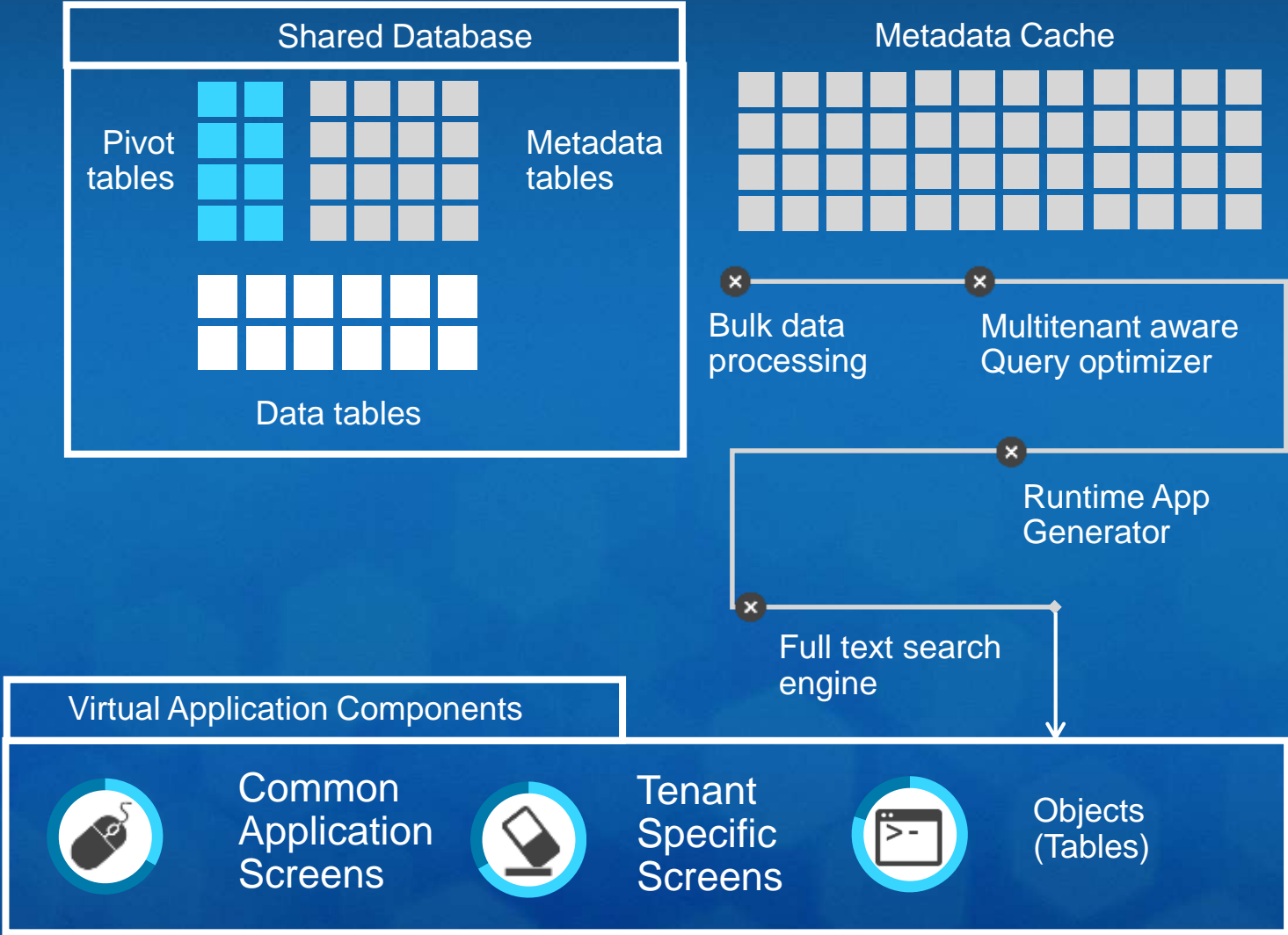
All operations include Org ID

Disaster Recovery

Per Org encryption keys



What is in an Instance



What Multitenancy means for Salesforce.com R&D



One Version

No Legacy Teams
Bugs fixed for everyone

What Multitenancy means for Salesforce.com R&D



One Version

No Legacy Teams
Bugs fixed for everyone



Automation

260K+ of our Tests
Run your tests as well

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Instance Architecture

Staggered Releases
Scalability across all sizes

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Instance Architecture

Staggered Releases
Scalability across all sizes



Predictability

Three major releases per year
Bug fixes every week

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Instance Architecture

Staggered Releases
Scalability across all sizes



Predictability

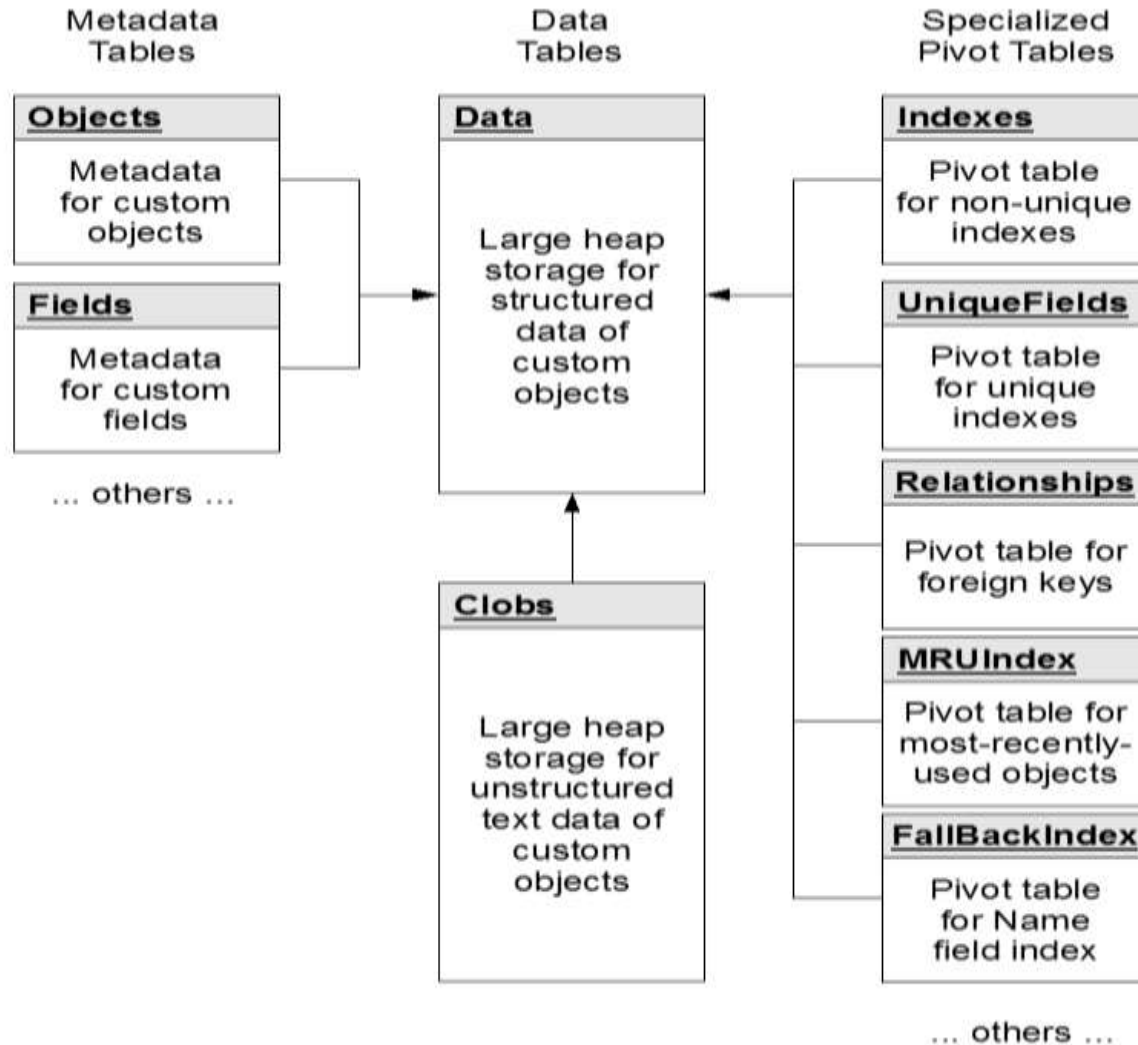
Three major releases per year
Bug fixes every week



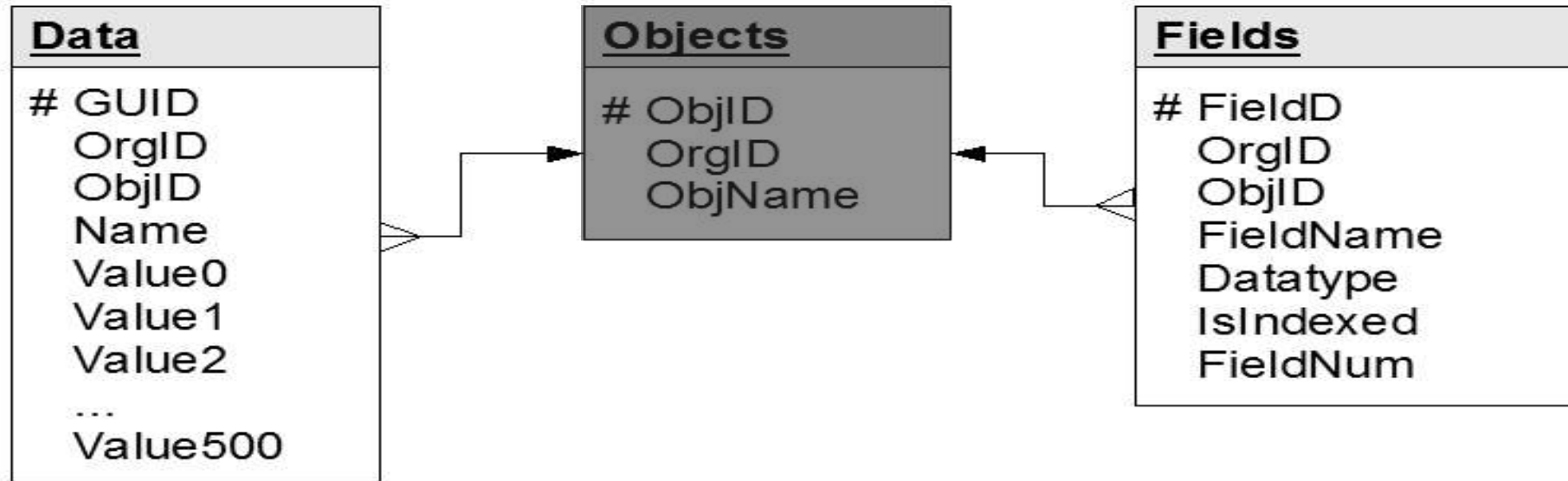
Key Architectural Principles

- Stateless Appservers
- Database system of record
- No Database Definition Language (DDL) at Runtime
- All tables partitioned by OrgId
- Smart Primary Keys, Polymorphic Foreign Keys
- Creative de-normalization and pivoting
- Use every RDBMS feature & optimization

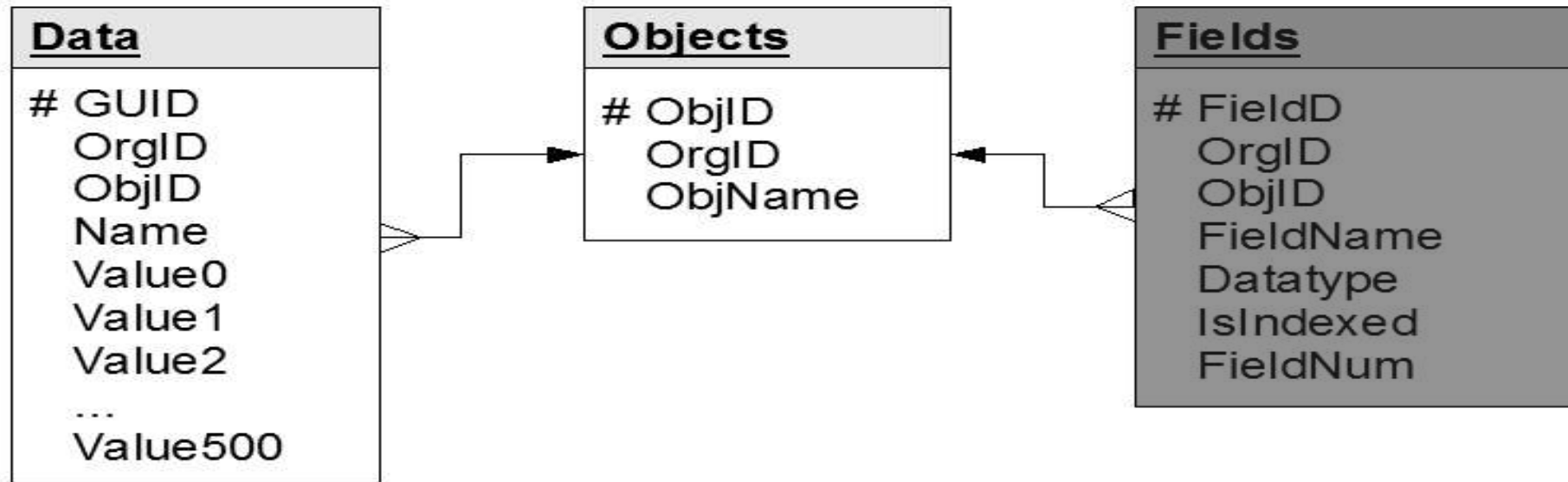
Metadata, data, and pivot table structures store data corresponding to virtual data structures



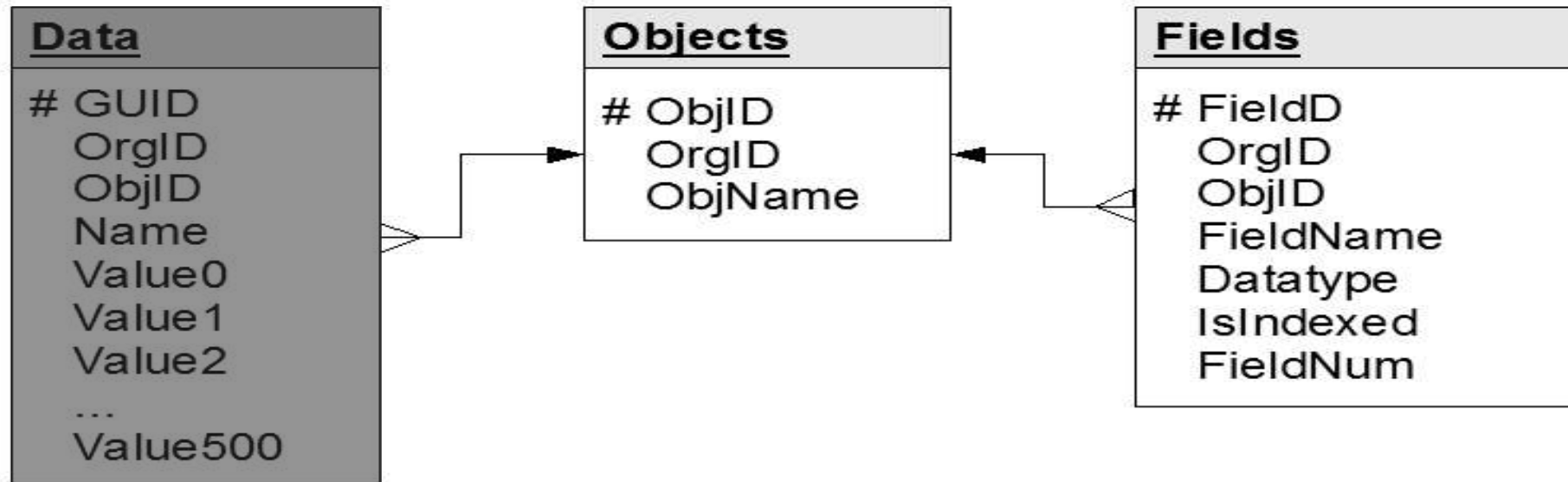
The Objects table stores metadata about custom objects (tables)



The Fields table stores metadata about custom fields (columns)



The Data heap table stores all structured data corresponding to custom objects

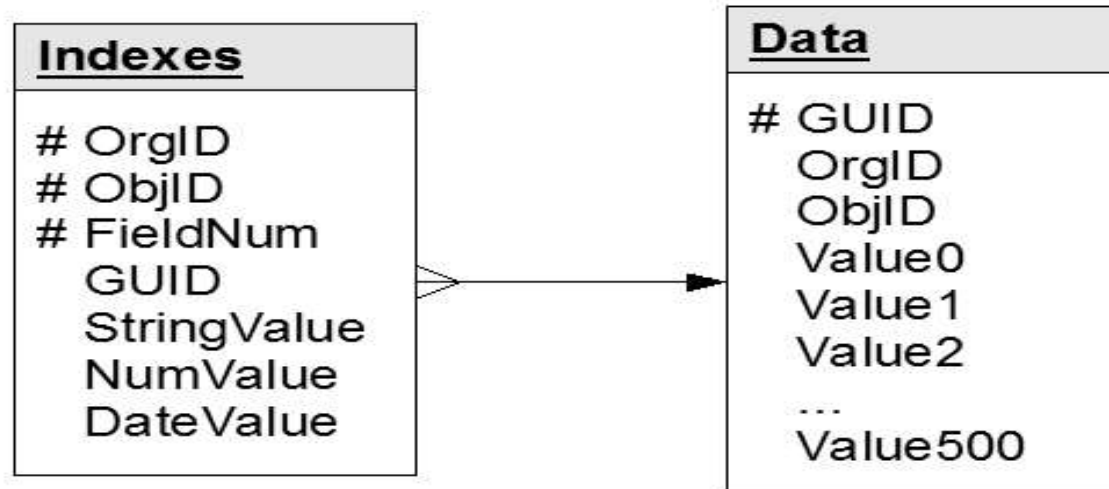


A single slot can store various types of data that originate from different objects

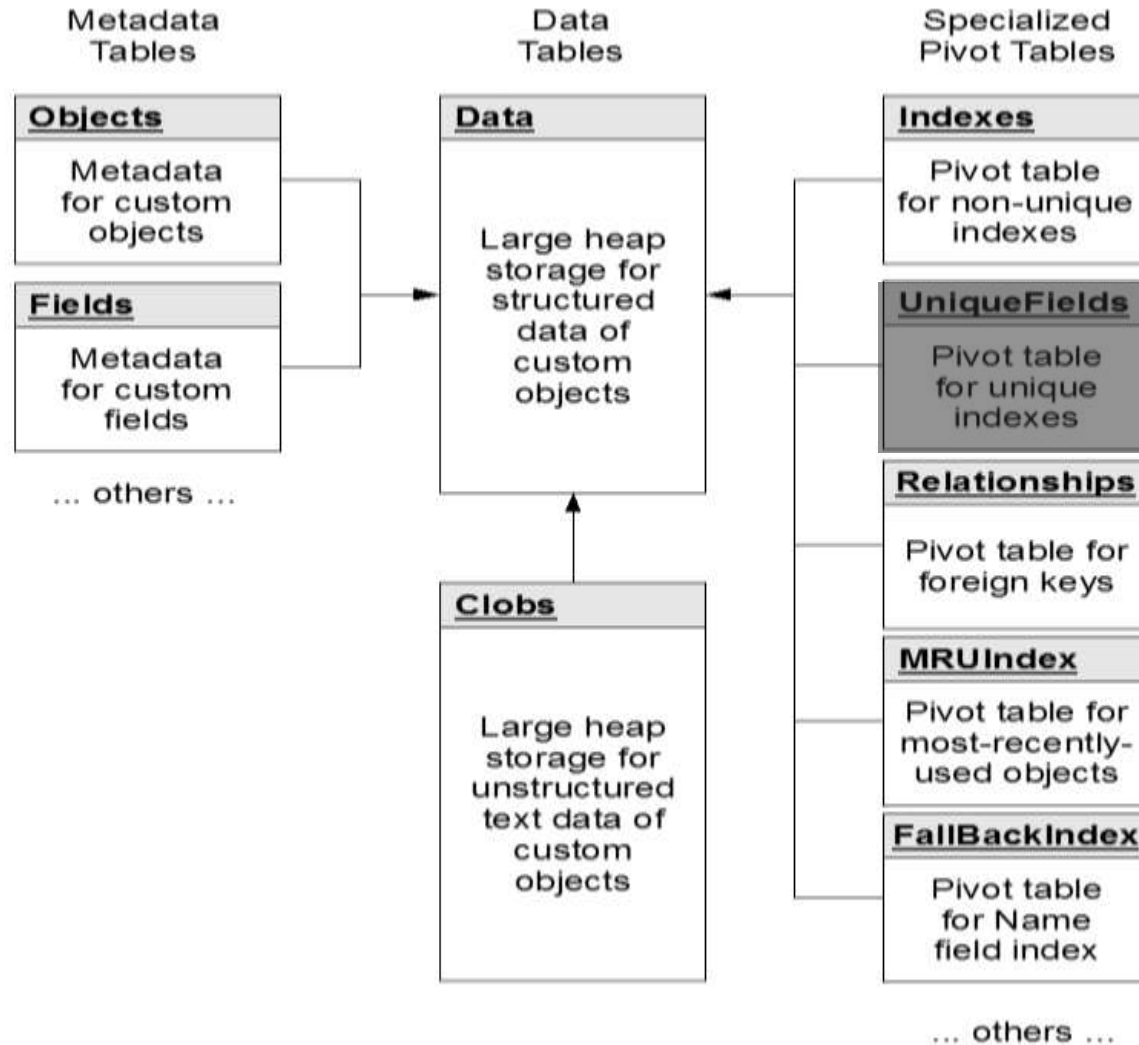
Data

GUID	OrgID	ObjID	...	Val0
a01...1	org1	a01	...	Up
a01...2	org1	a01	...	Flat
a02...1	org1	a02	...	20080129
a02...2	org1	a02	...	20080214
a03...1	org1	a03	...	41.23
a03...2	org1	a03	...	-10.3

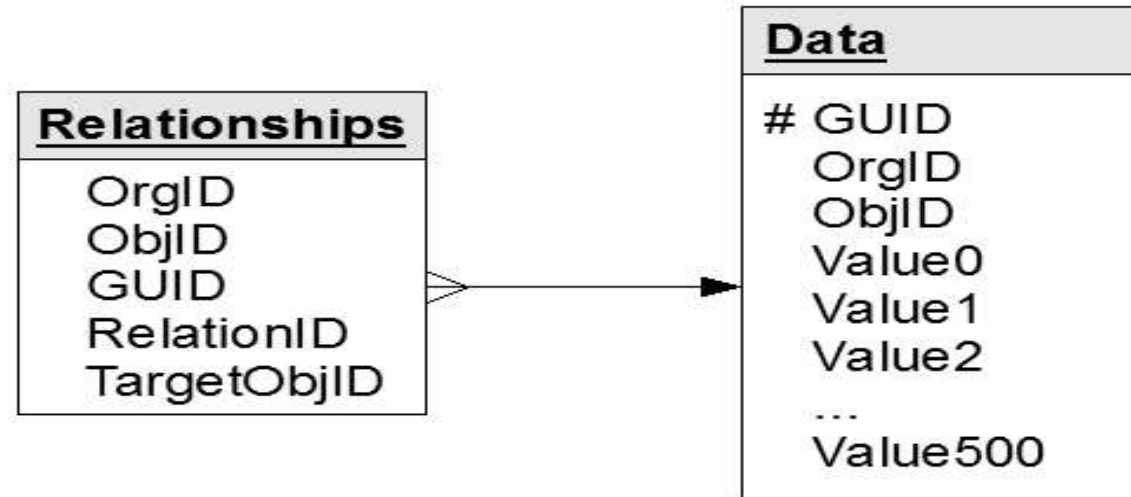
The Indexes pivot table manages tenant-specific selective indexes



The UniqueFields pivot table facilitates uniqueness for custom fields



The Relationships pivot table facilitates referential integrity and optimizes joins



All data & metadata structures are partitioned to improve performance and manageability

- Tables hash partitioned by OrgId
- Separate connection pools point to physical hosts
- App tier is also dynamically partitioned by OrgId
- Distributed metadata cache with transactional invalidation

Application Framework: a whole lot for free

- Native Declarative features
- Bulk Processing
- The Recycle Bin
- Full Text Search
- Smart Bulk Data Manipulation Language (DML)
- Web Services APIs

Force.com's native Application Framework provides declarative development, no coding

Edit Custom Object Help for this Page

Invoice Statement

Custom Object Definition Edit Save Save & New Cancel

Custom Object Information I = Required Information

The singular and plural labels are used in tabs, page layouts, and reports.
Be careful when changing the name or label as it may affect existing integrations and merge templates.

Label I Invoice Statement Example: Account

Plural Label I Invoice Statements Example: Accounts

Starts with vowel sound ☒

The Object Name is used when referencing the object via the API.

Object Name I Invoice_Statement Example: Account

Description

Context-Sensitive Help Setting
☒ Open the standard Salesforce.com Help & Training window
☐ Open a window using a Visualforce page

Content Name --None--

Enter Record Name Label and Format

The Record Name appears in page layouts, key lists, related lists, lookups, and search results. For example, the Record Name for Account is "Account Name" and for Case it is "Case Number". Note that the Record Name field is always called "Name" when referenced via the API.

Record Name I Invoice Number Example: Account Name

Data Type I Auto Number

Display Format I INV-{0000} Example: A-{0000} [What Is This?](#)

Optional Features

☒ Allow Reports
☐ Allow Activities
☐ Track Field History

Invoice Statement Field History Help for this Page

This page allows you to select the fields you want to track on the Invoice Statement History related list. Whenever a user modifies any of the fields selected below, the old and new field values are added to the History related list as well as the date, time, nature of the change, and user making the change. Note that multi-select picklist and large text field values are tracked as edited; their old and new field values are not recorded.

Save Cancel

[Deselect all fields](#)

Track old and new values

Description	<input checked="" type="checkbox"/>	Invoice Number	<input checked="" type="checkbox"/>
Owner	<input type="checkbox"/>	Status	<input checked="" type="checkbox"/>

Save Cancel

Validation rules and simple formulas: Business analysts can “code” these

Validation Rule Edit

Save

Save & New

Cancel

Rule Name

Only_Order_Positive_Amounts

Active

☒

Description

Quick Tips

- Getting Started
- Operators & Functions

Error Condition Formula

= Required Information

Example:

Discount_Percent__c > 0.30

More Examples ...

Display an error if Discount is more than 30%

If this formula expression is **true**, display the text defined in the Error Message area

Insert Field

Insert Operator

Units_Sold__c < 1

Check Syntax

Functions

-- All Function Categories --

ABS

AND

BEGINS

BLANKVALUE

BR

CASE

Insert Selected Function

ABS(number)

Returns the absolute value of a number, a number without a sign.

Help on this function

Error Message

Example:

Discount percent cannot exceed 30%

This message will appear when Error Condition formula is **true**

Error Message

You must sell at least one!

This error message can either appear at the top of the page or below a specific field on the page

Error Location

☐ Top of Page

☒ Field

Units Sold

i

Simple Formula

Advanced Formula

Select Field Type

Line Item

Insert Field

-- Insert Merge Field --

Insert Operator

Value (Currency) =

Unit_Price__c * Units_Sold__c

Not so simple: Rollup-summary fields provide for easy cross-object summaries

Edit Invoice Statement Custom Field
Invoice Value [Help for this Page](#)

Custom Field Definition
Edit [Save](#) [Cancel](#)

Field Information Required Information

Field Label

Field Name

Description

Help Text

Roll-Up Summary Options

Data Type: Roll-Up Summary

Calculation Options: ☒ Automatic calculation (Recommended)
☐ Force a mass recalculation of this field

Select Object to Summarize

Master Object: Invoice Statement
Summarized Object: Line Items

Select Roll-Up Type

☐ COUNT

☒ SUM Field to Aggregate: Value

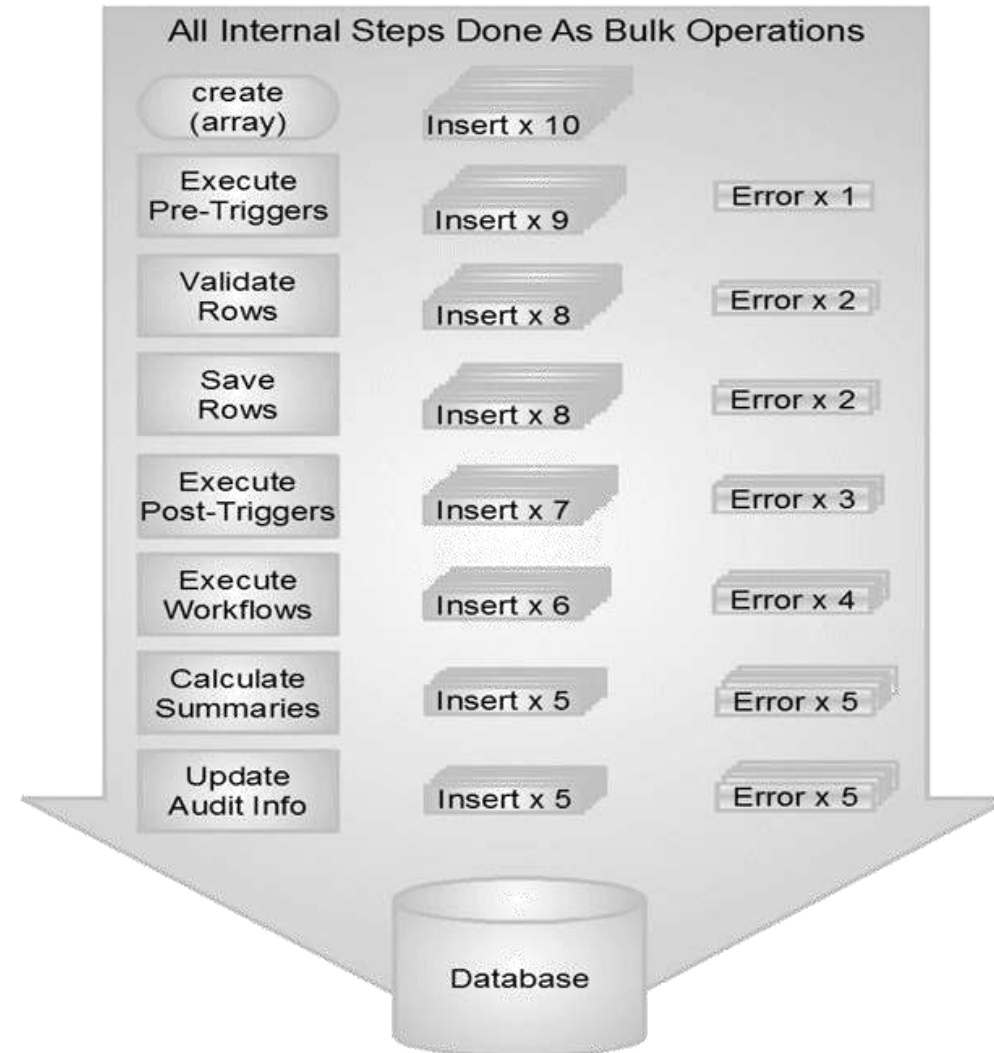
☐ MIN

☐ MAX

Filter Criteria

☒ All records should be included in the calculation
☐ Only records meeting certain criteria should be included in the calculation

Force.com's bulk processing optimizations reduce overhead for data loads

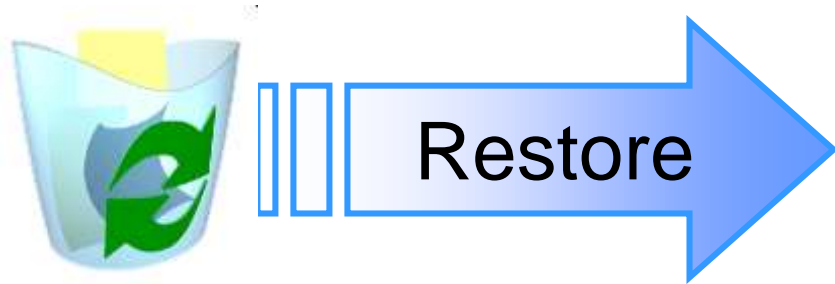


Data definition processing is optimized to avoid performance hits or concurrency limits

Examples:

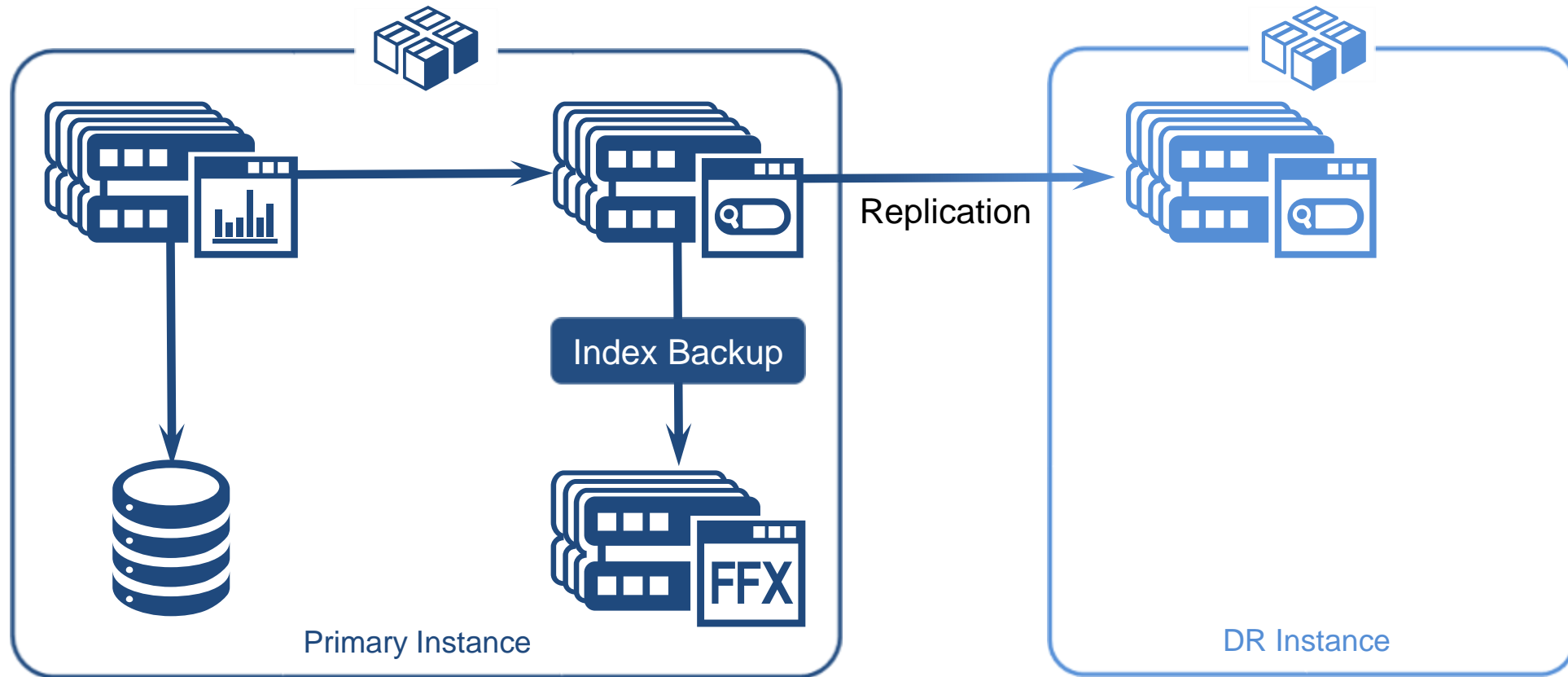
- Sort all records by primary key before attempting DML
- Operate on tables in deterministic order
- Slot reallocation for field datatype change
- Deferred calculation for new rollup-summary field
- Background processing of mass changes

The Recycle Bin: Smart Undeletes



- Individual object instances (records)
- Related object instances (parent/child records)
- Entire fields and objects (dropped columns and tables)

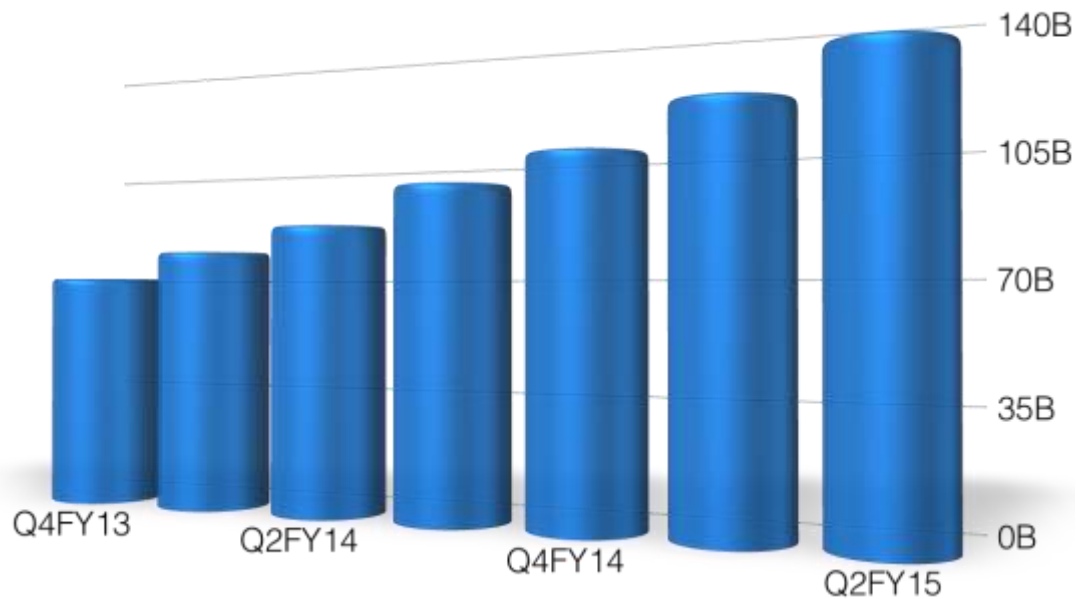
Multitenant Search, anything but simple



Multitenancy delivers Blazing Performance

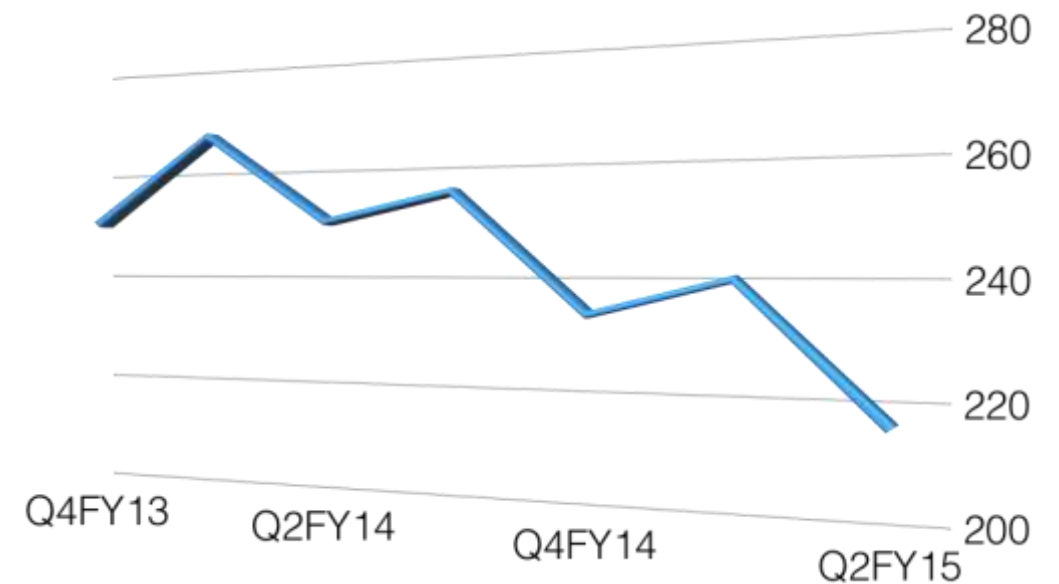
Transactions Per Quarter

131B Transactions in Q2FY15
51% YOY Growth

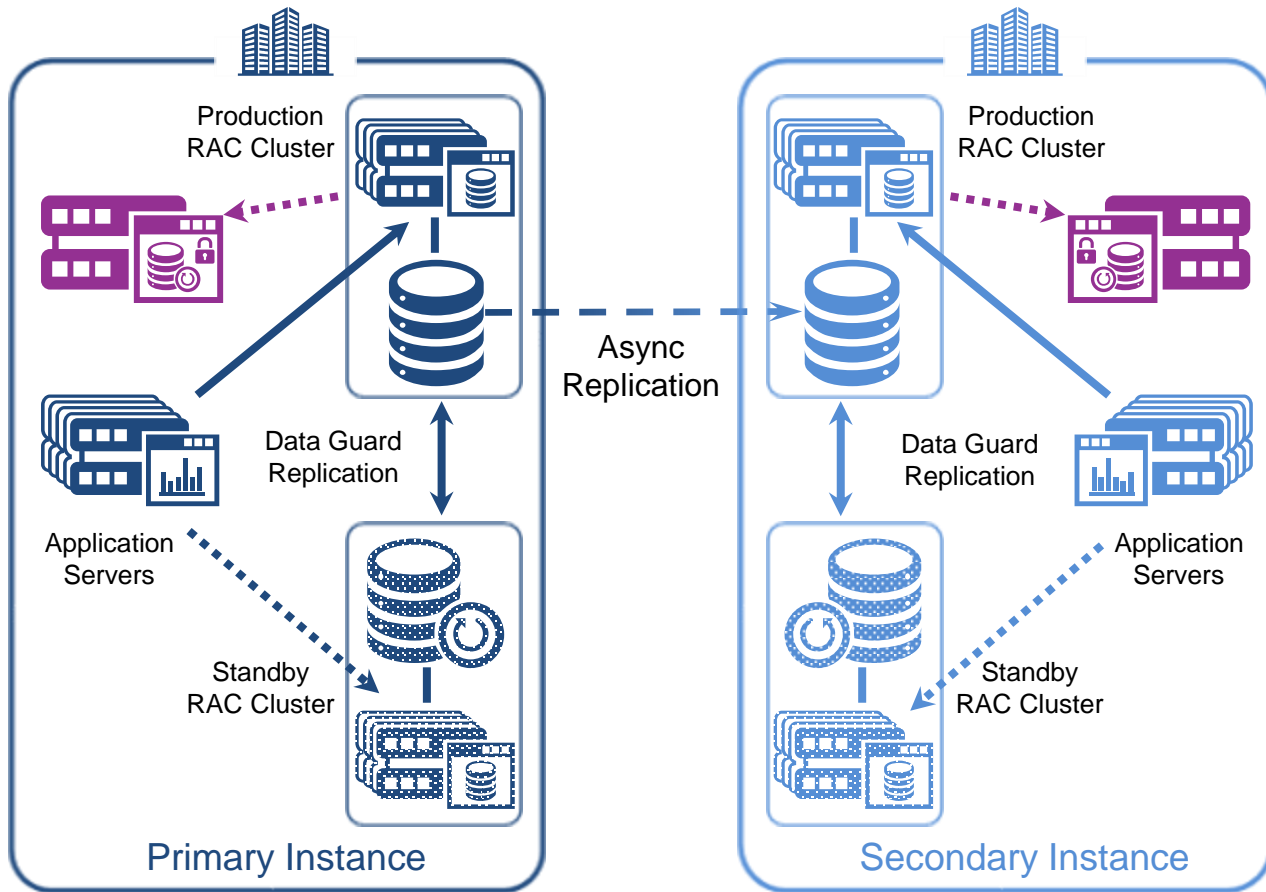


Average Page Time

217ms Latency in Q2FY15
13% YOY Improvement



Multitenant Core Data Storage

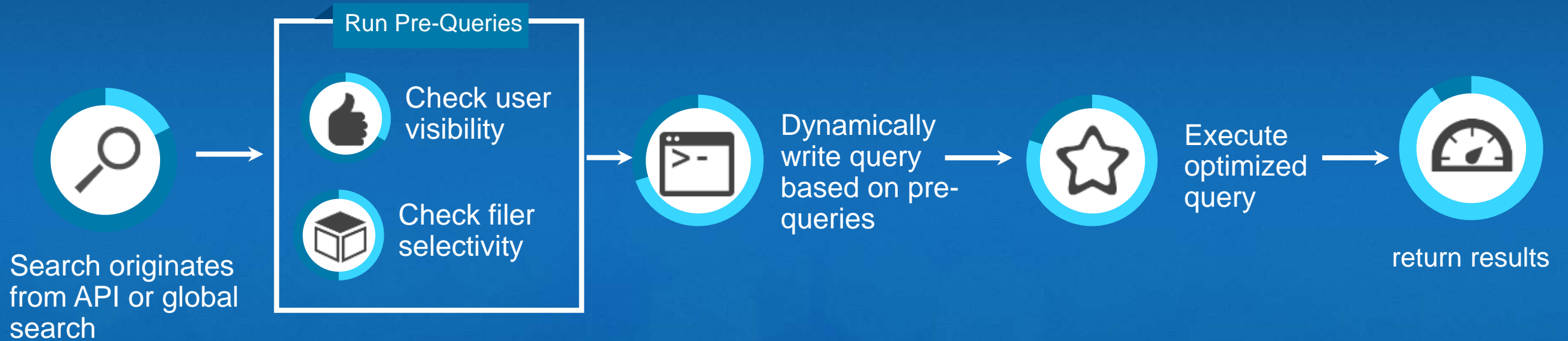


- 4 Online copies of database
- 2 Online backup copies

Multitenant Query Optimization Principles

- Consistent SQL generation across the application
- Deep awareness of pivot table structure
 - Flex schema does impose a cost
- Tenant, user, object, fields statistics are crucial
- No runaway queries allowed
- Deep integration with the sharing model

Multitenant Query Optimizer



user visibility = number of rows user can access

filter selectivity = index corresponding to filter column

The optimizer considers pre-query selectivity measurements when writing a query

Pre-Query Selectivity Measurements		Write final database access query, forcing ...
User	Filter	
Low	Low	... nested loops join; drive using view of rows that the user can see.
Low	High	... use of index related to filter.
High	Low	... ordered hash join; drive using Data table.
High	High	... use of index related to filter.

Apex: Force.com's procedural frontier

Variable
Declaration

```
Integer NUM = 10;  
Account[] accs;
```

SOQL
Query

Commit
Transaction

```
// Clean up old data  
accs = [select id from account where name like 'test%'];  
delete accs;  
commit;
```

Control
Structure

```
accs = new Account[NUM];  
for (Integer i = 0; i < NUM; i++)  
{  
    accs[i] = new Account(name='test ' + i, outstandingshares__c=i);  
}  
insert accs;
```

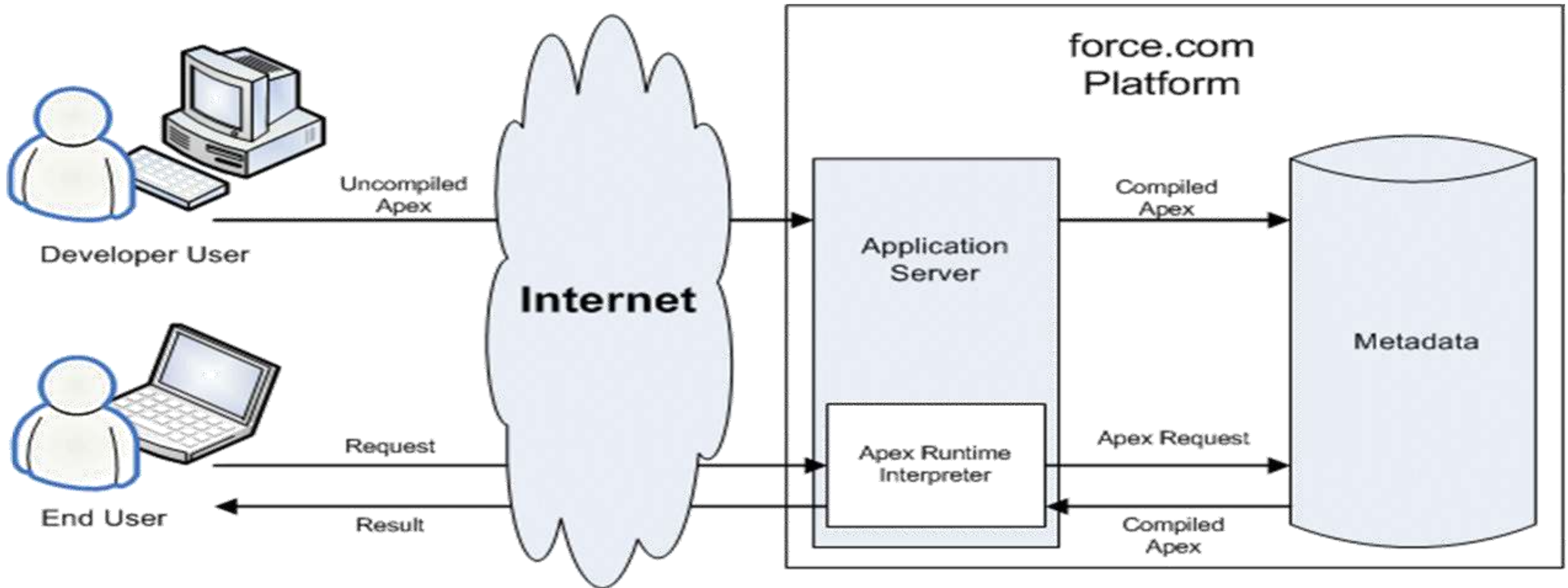
Array

```
Contact[] cons = new Contact [0];
```

Data
Operation

```
for (Account acc : accs)  
{  
    cons.add(new Contact(lastName=acc.name + '1', accountId=acc.id));  
    cons.add(new Contact(lastName=acc.name + '2', accountId=acc.id));  
}  
insert cons;
```

Apex code is stored as metadata, interpreted at runtime, and cached for scalability



Apex is deeply integrated with platform features

- Bulk DML
- Email and messaging
- Asynchronous processing (Futures)
- XmlStream / HTTP (RESTful) services classes
- Declarative exposure as new Web Services

What Makes Us Different?

Customer Success Platform Powered by Multitenancy

Social



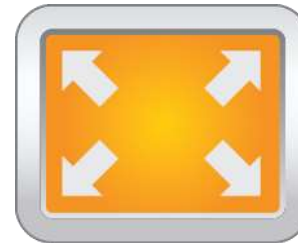
Feeds
Profiles
Files
Social Graph

Mobile



Right Experience
Any Device
Customizable

Open



Open Standards
Open Technologies
Open Interfaces
Open Languages

Real-time



Real-time notifications
Real-time workflow
Real-time feeds

Where to go for more information...

- <http://developer.force.com/architect>
- <http://developer.force.com/security>

- Other Sessions

Session	Day	Time	Location
External Network Monitoring and ThousandEyes	Monday	10:00 – 10:40 am	Marriott Marquis – Foothill F
Access Options: Direct Network Capability with AT&T Netbond and Salesforce.com	Monday	11:00 – 11:40 am	Marriott Marquis – Foothill F
PaaS vs. IaaS: What Should I Do?	Monday	1:00 – 1:40 pm	InterContinental SF – Grand Ballroom AB
Scaling at Salesforce: Scaling the Most Trusted Enterprise Cloud	Monday	4:00 – 4:40 pm	Marriott Marquis – Foothill F

Where to go for more information... (cont)

- Other Sessions

Session	Day	Time	Location
High Availability and Business Continuity Roadmap	Tuesday	4:30 – 5:10 pm	Marriott Marquis – Foothill F
Performance Infrastructure: How Salesforce Delivers Optimal Performance	Wednesday	10:00 – 10:40 am	Marriott Marquis – Foothill F
Continually Improving Availability	Wednesday	1:00 – 1:40 pm	Marriott Marquis – Foothill F
Data Center Information Management with the Salesforce Platform	Wednesday	2:00 – 2:40 pm	Marriott Marquis – Foothill F

BUILD APPS FAST. BUILD BUSINESS FASTER.

Don't miss the Salesforce1 Platform Keynote with



Mike Rosenbaum
EVP, Salesforce1 Platform



Toby Lester
VP, Technology Architecture
And Innovation, **Brown-Forman**



Mike Meadows
VP, Chief Technology Officer
Eli Lilly and Company



Tod Nielsen
CEO, Heroku

Wednesday, October 15, 2 p.m.
Moscone South, Main Keynote Hall

Q & A

Please fill out your survey in Dreamforce App



Thank You