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Big memory – Scale-in vs. Scale-out

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Simplicity and magic

“The future of computer power is pure simplicity.”

Douglas Adams

“Any sufficiently advanced technology is indistinguishable from magic.”

Arthur C. Clarke

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Today’s topics

History

Database landscape

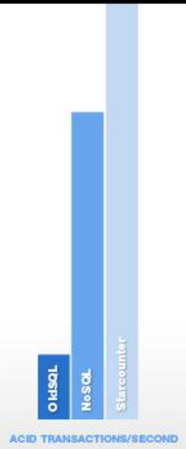
Scale-In instead of Scale-out

Performance everywhere

History

Why do we do what we do today?

(Don’t worry, it’s just 2 slides)



SQL is born

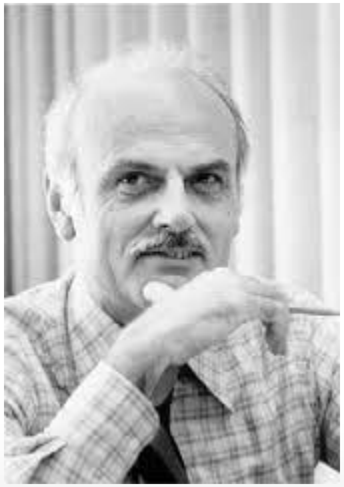
SEQUEL by Dr. Codd in 1970

IBM and Oracle (Relational System) early adopters

First relational database released in 1980

Optimizations in traditional database to optimize for disk access

Extreme memory costs – need to store on disk



Dr Codd invented the relational data model around 1970.
”A Relational Model of Data for Large Shared Data Banks”,
Communications of the ACM 13 (6):377-387, 1970

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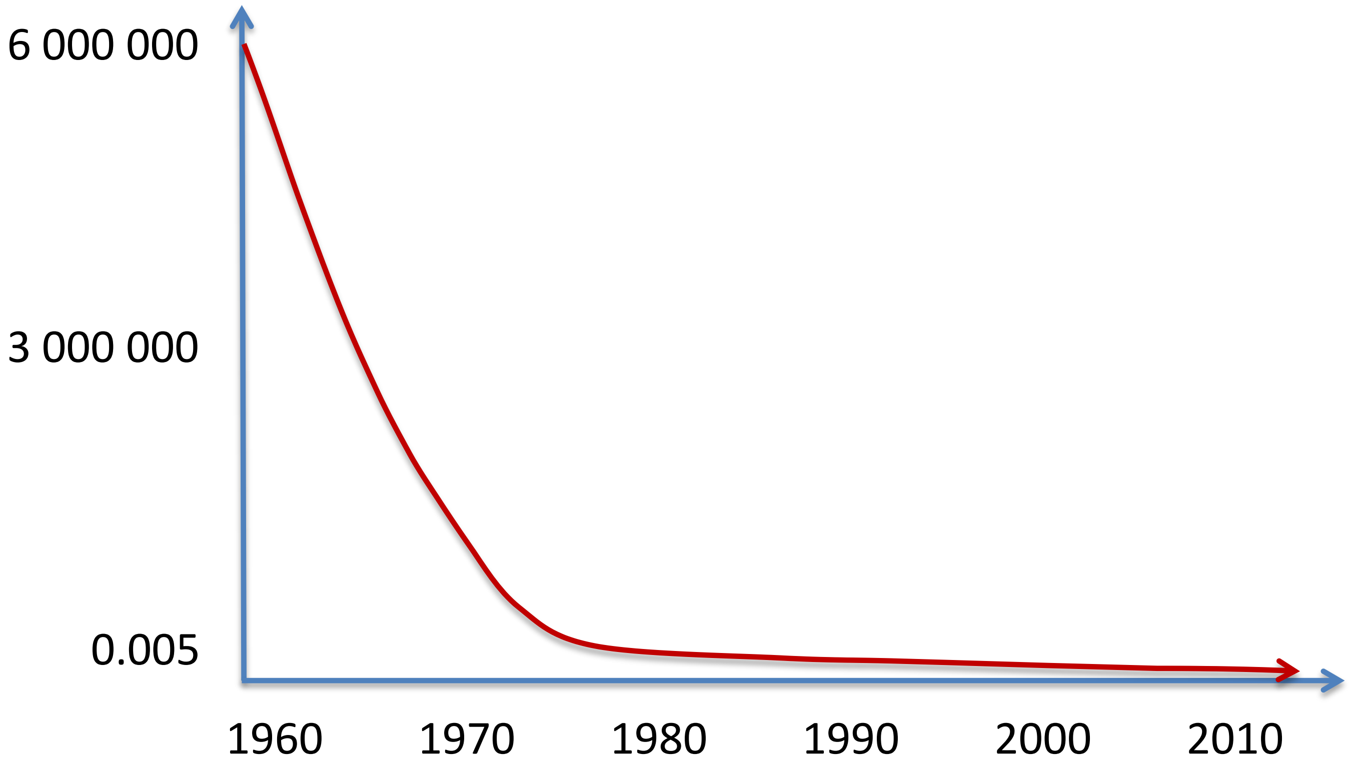
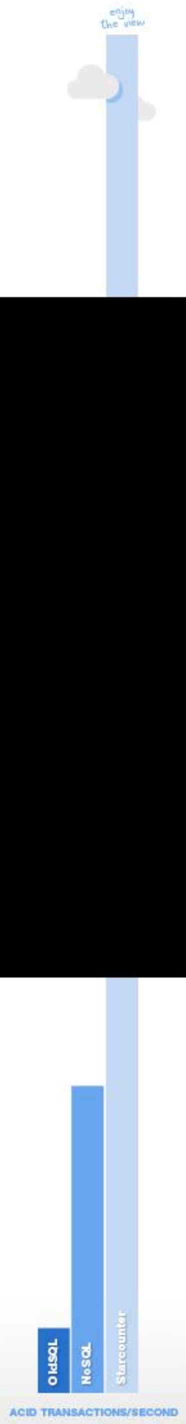
RAM v's history



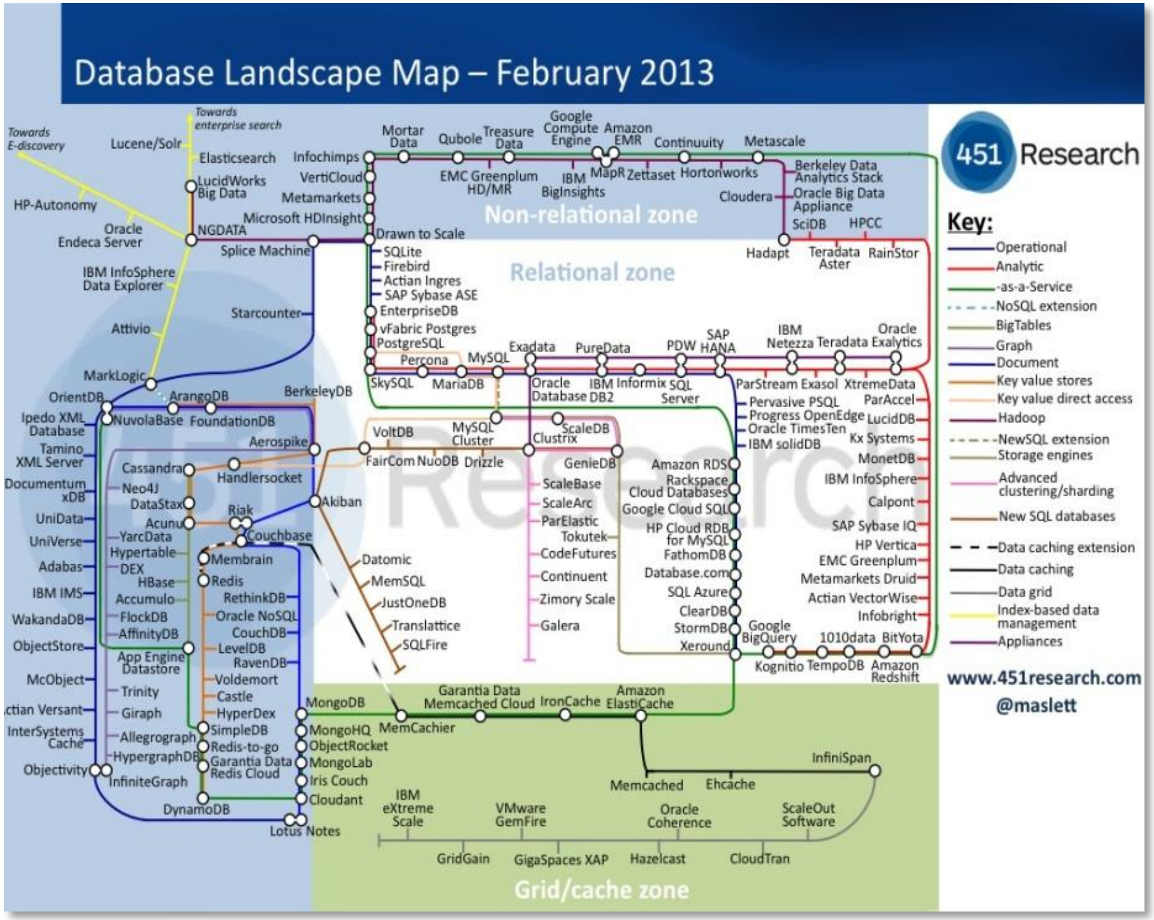
1 MB of RAM was $750,000 in 1970 compared to 0.5 cents today

Today

Where are we today?



Landscape



Matt Aslett – 451 group

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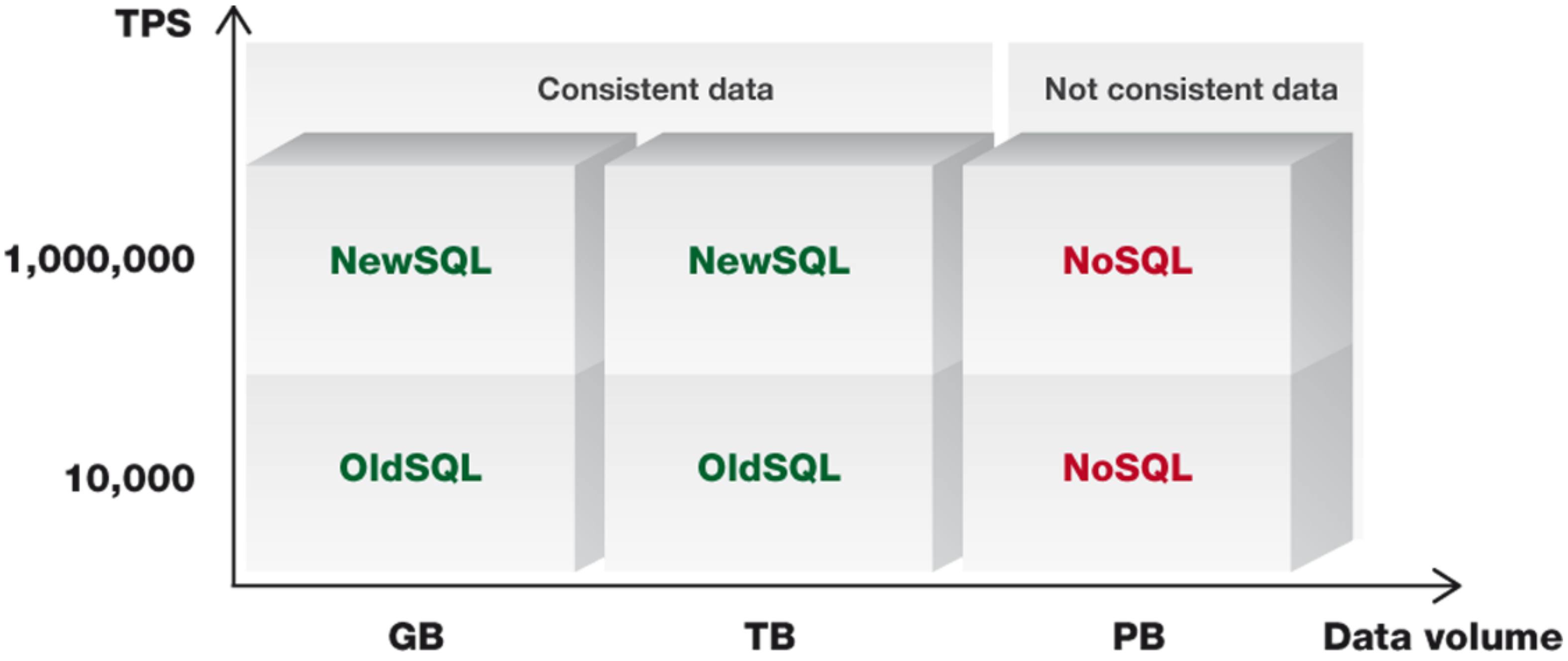
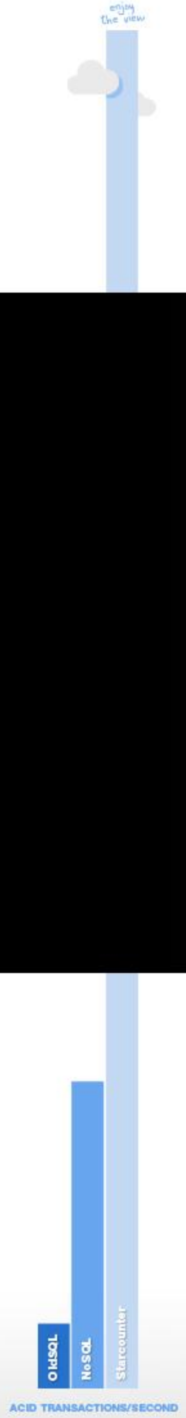
Alternatives today





Utilize the RAM

Scale In - use the RAM

Scale-In instead of out

All data in one set of RAM

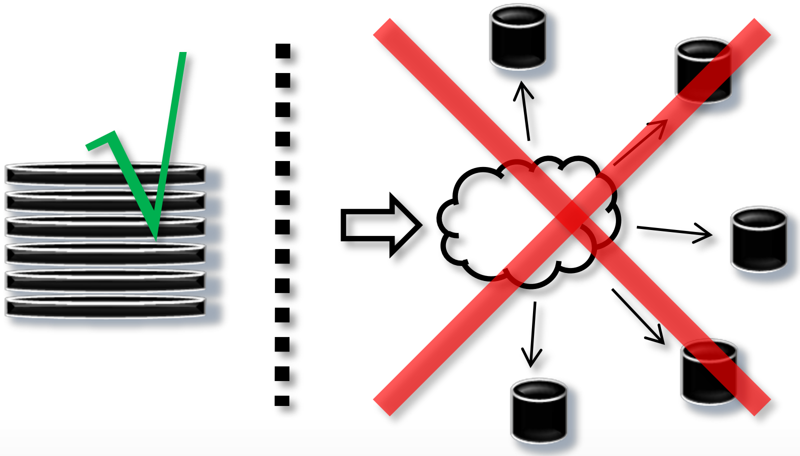
Hardware limit at 2 TB (soon > 10 TB?) of data (64bit)

Compress data about 4 times

Transaction conflicts solved fast

Extreme performance

True ACID

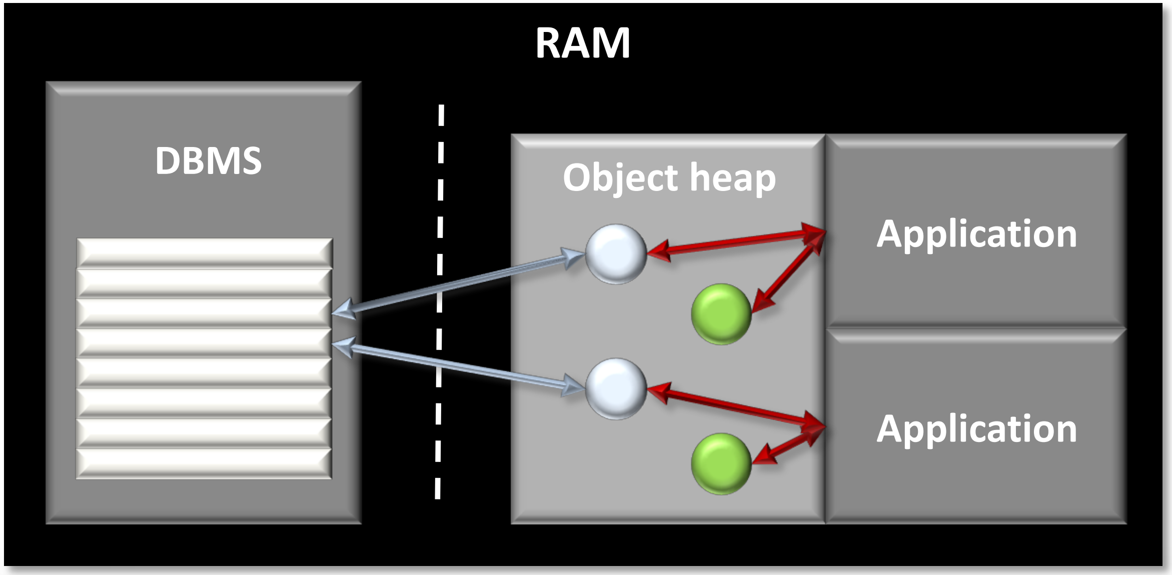


The extra mile

Let’s see what happens if we use the RAM even further

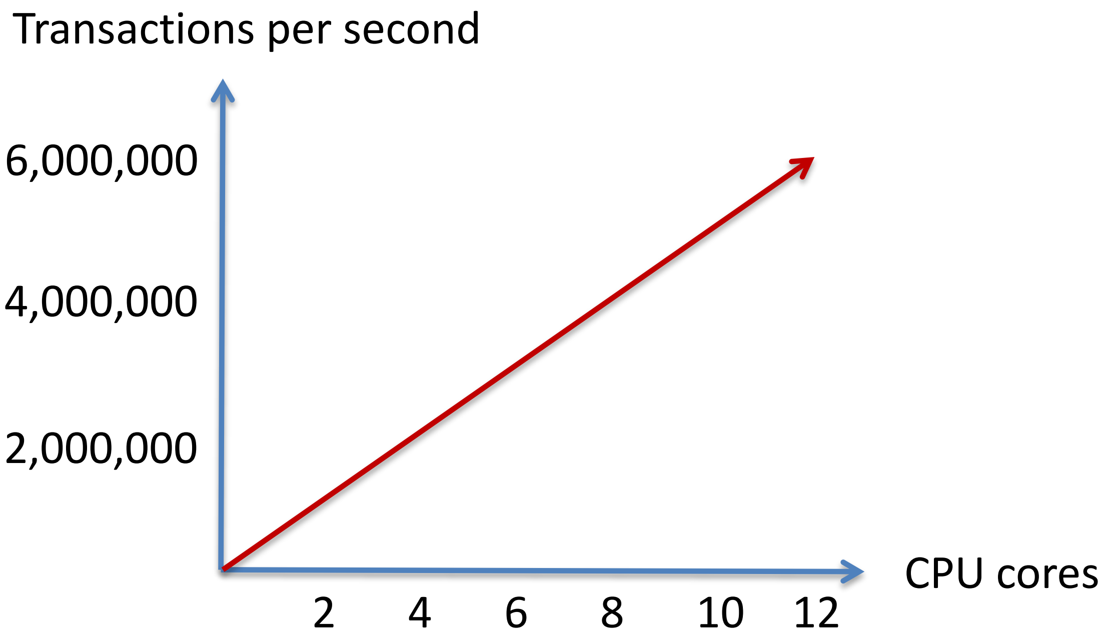
Usually DB objects and App objects in different set of RAM

Share heap between application and database



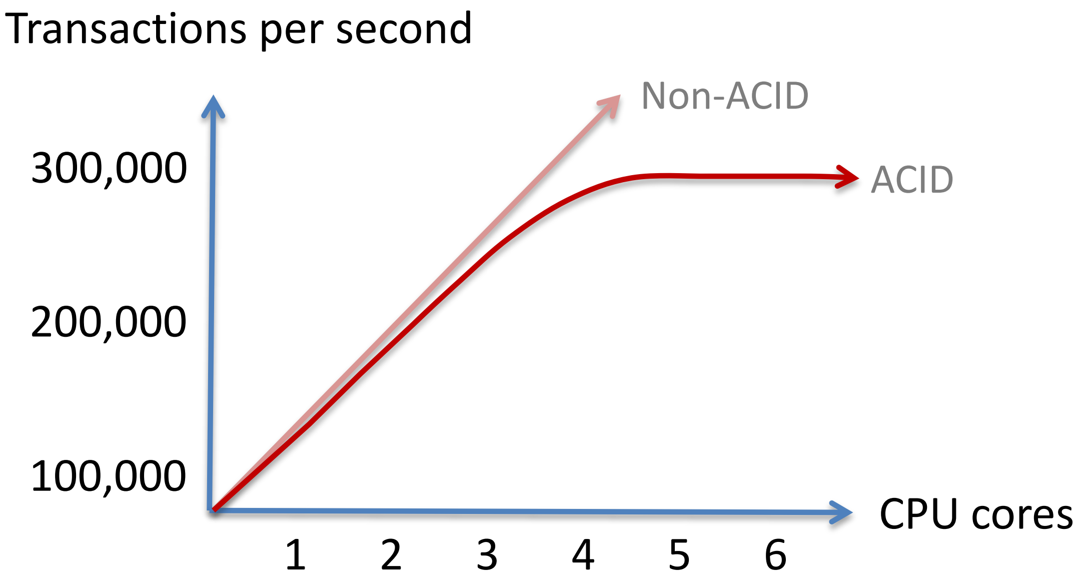
Performance - reading

If used wisely we can scale read transactions linearly over the number of cores



Performance - writing

Depending of the number of transactional conflicts, writes will level out at a certain level (ACID). Still 100 times faster than traditional relational databases.



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Scale-In and ACID

Atomicity

”C” without suffix or prefix

Isolation level like traditional databases

All writes secured on disk upon committed

CAP theorem (no ACID in scaling out)

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Who needs ACID?

Dealing with business-critical data like retail, money transfers and logistics in a multi user environment

Conflicts *will* occur and need to be managed by

Database

Application *(hard for developers)*

End user:
"Sorry we have just sold you a product we already sold to someone else"

New opportunities

No need for separate schema

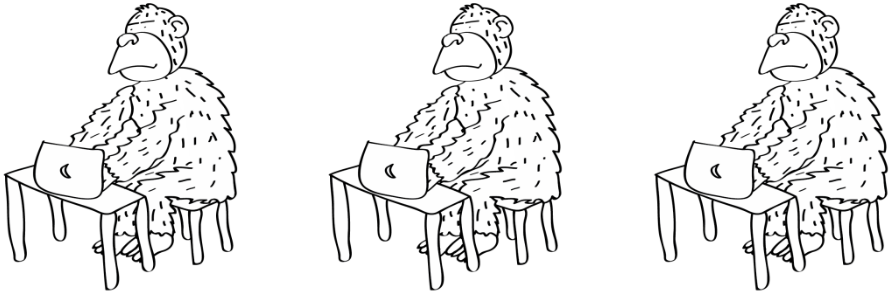
The end of ORMs

Fast and auto solve transactional conflicts

POCO objects are your database

SQL directly on your POCO

We can simplify application development



Application programming

Traditional database	***Modern database***
Database schema (CREATE TABLE)	*Set attribute [Database] on your CLR class*
Create object (INSERT)	*Native new() operator*
Modify object (UPDATE)	*Native assignment operator (=)*
Delete object (DELETE)	*Use method Delete()*
Query objects (SELECT)	*Db.SQL("SQL92")*

Database schema

```
[Database]
public class Employee
{
    public String Name;
    public DateTime? HireDate;
    public decimal Salary;
    public Department Department;
    public DateTime BirthDate;

    public int Age
    {
       get
       {
         return DateTime.Now.Year-BirthDate.Year;
       }
    }
}
```

Create object

```
[Database]
public class Employee
{
    public Employee() { }
}


Employee e = new Employee();
```

Modify object

```
Department d = new Department();
Employee e = new Employee();

e.Name = ”John”;
e.HireDate = null;
e.Salary = 20000;
e.Department = d;
```

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Delete object

```
Department d = new Department();
Employee e = new Employee();
e.Name = ”John”;
e.HireDate = null;
e.Salary = 20000;
e.Department = d;

e.Delete();
```

Transactions

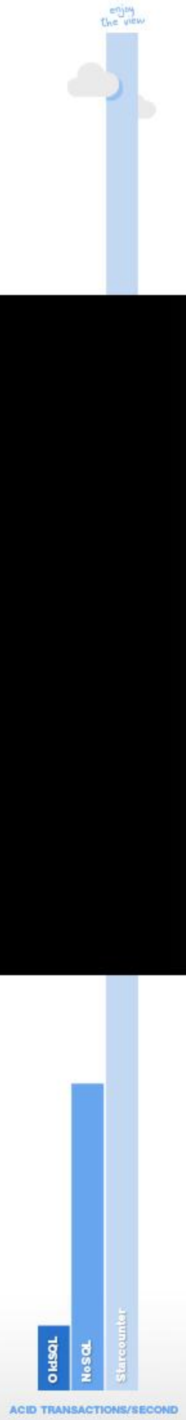
Transaction scopes

```
Db.Transaction(()=>
{
    Person p = new Person();
    p.Name = ”Albert”;
}
```

Long lived transactions

```
Transaction t = new Transaction();
...
t.Commit(); // t. Rollback();
```

Parallel transactions



Next steps

Bring the performance all the way to the clients

What’s next?

Today we have databases with

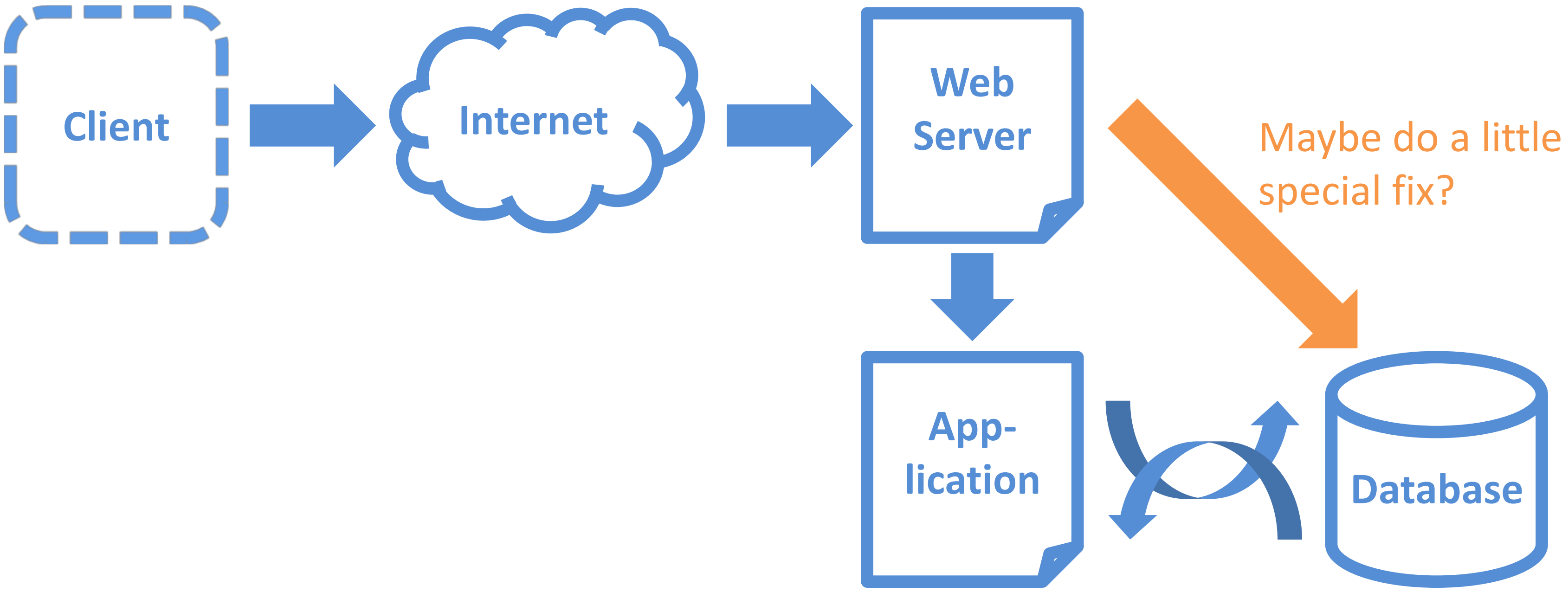
- Extreme performance
- Reliability (ACID)
- Easy to use API:s

Logical next steps

- Easy to use connectivity
- Super fast communication servers
- Easy to use in modern applications

Communication Performance

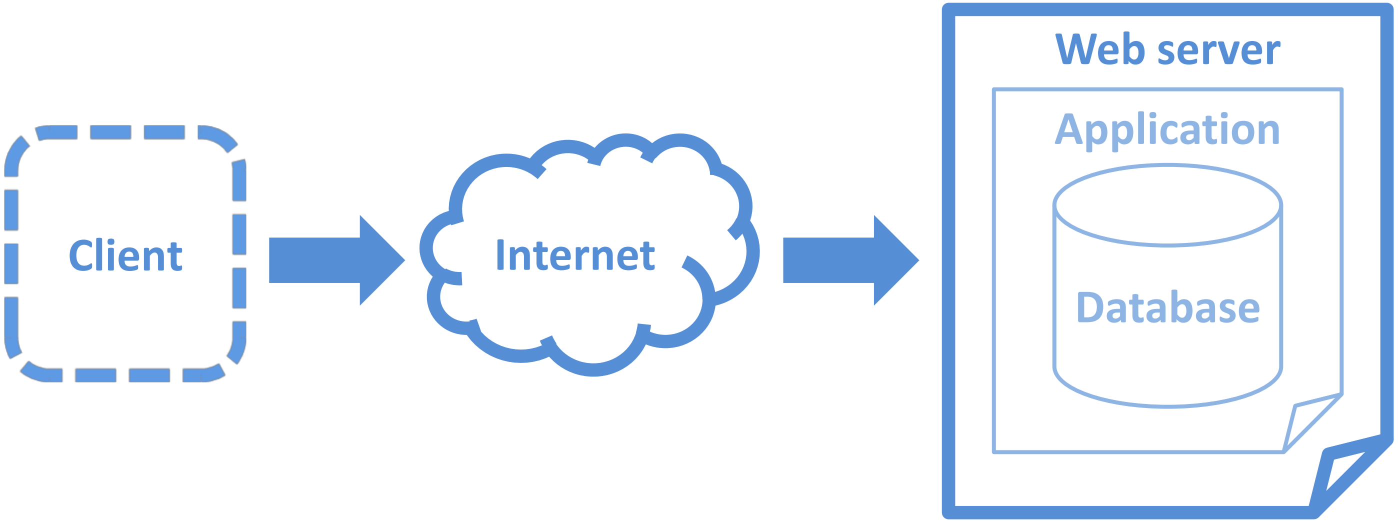
A normal setup for a web based application



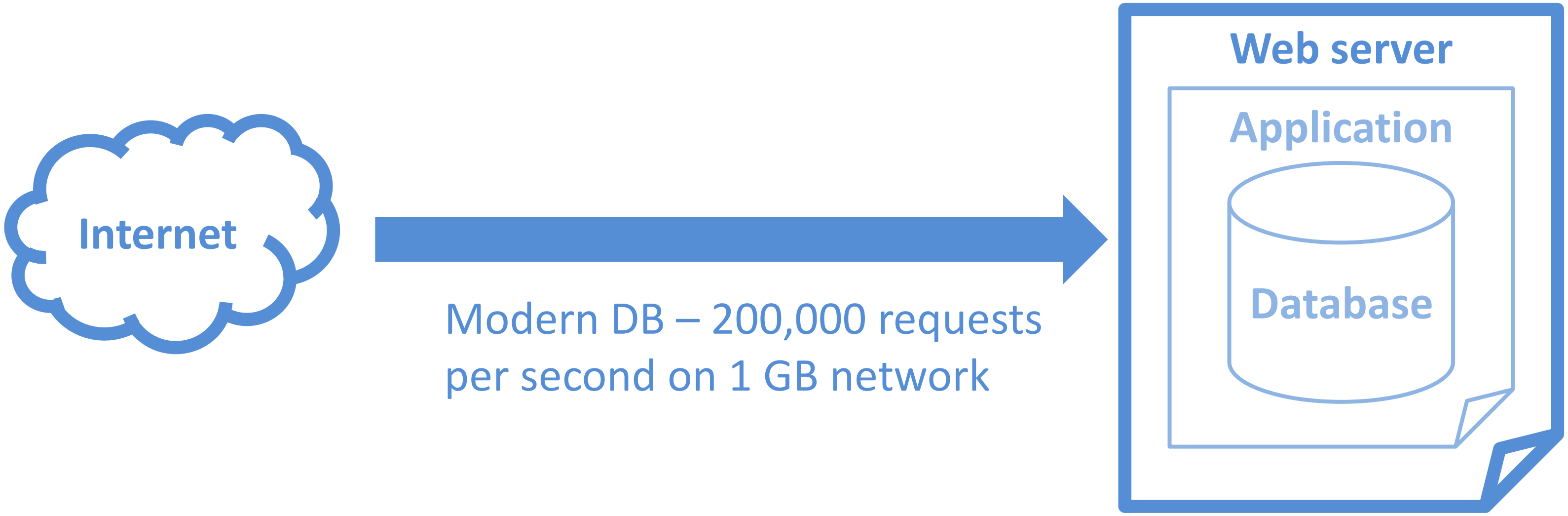
Maybe do a little special fix?

Communication Performance

Tie the web server, application and database closer together

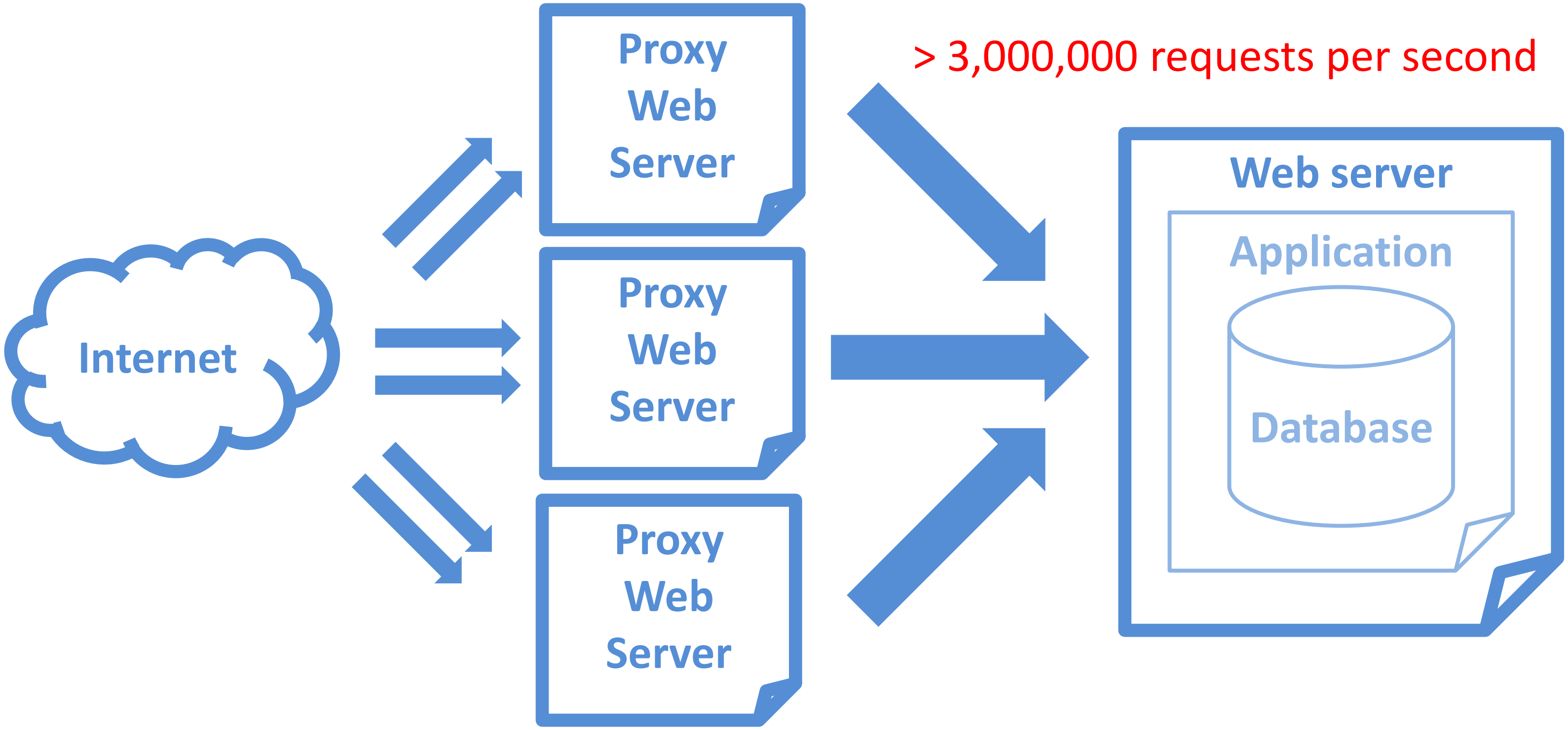


Limitation - Network/OS



Modern DB – 200,000 requests per second on 1 GB network

Solution - Network/OS



> 3,000,000 requests per second

Development performance

Modern applications with web standards

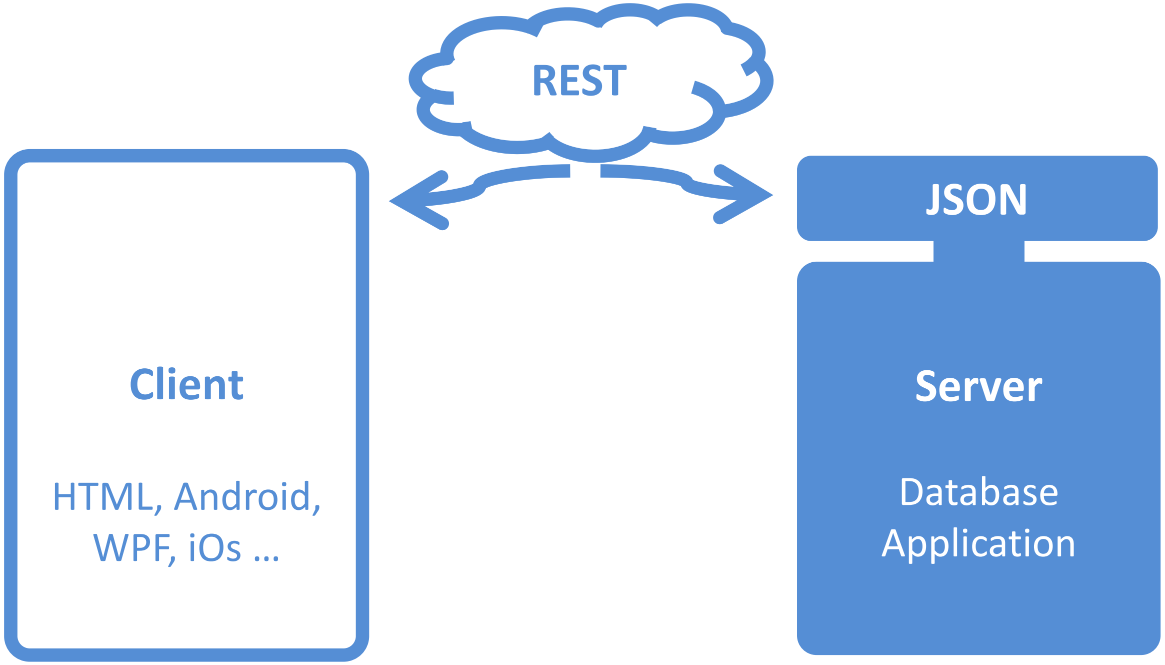
- REST/JSON
- JSON Patch (RFC 6902)

Modern Interactive applications using

- MVVM
- MV*
- WebComponents
- AngularJs

Modern standards

Easy to use REST API



REST

Client

HTML, Android, WPF, iOs …

JSON

Server

Database Application

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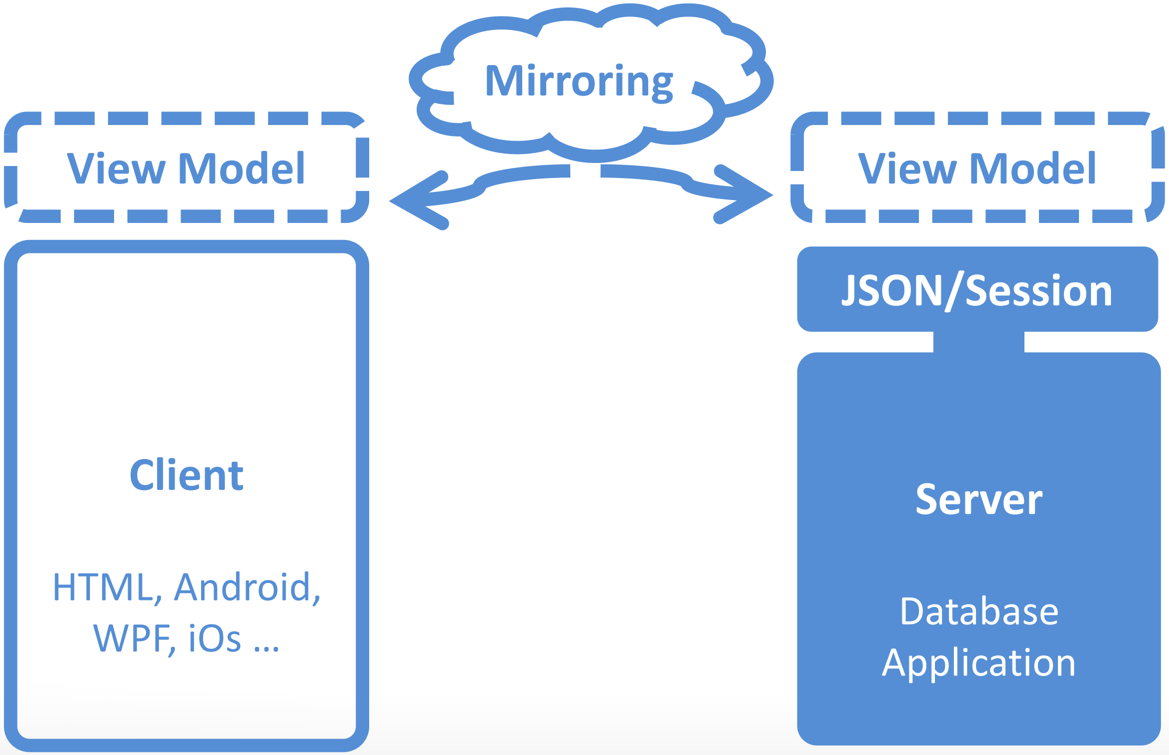
Trends

The trend is that we move away from server side rendering

Data is fetched from server - on the fly or mirrored MVVM



JSON models

Simple JSON model

```
“FirstName$”:"Albert",
“LastName$”:"Einstein",
“Quotes”: [
     { Text:"This is an example" }
]
```

JSON model automatically bound to persistent data

```
PersonModel model = new PersonModel();
model.Data = new Person();
```

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REST verbs

Handle REST verbs server side

```
Handle.GET("/new-person", () =>
{
    PersonModel c = new PersonModel();
    Person p = new Person();
    p.FirstName = ”Albert”;
    p.LastName = ”Einstein”;
    c.Data = p;
    return c;
});
```

REST with body

Complete model in body

```
Handle.POST("/new-person-wModel", (PersonModel model) =>
{
    Person comp = new Person();
    comp.FirstName = model.FirstName;
    comp.LastName = model.LastName;
});
```

Controller

Handle client modifications on the server (optional)

```
class PersonModel : Json {

   void Handle( Input.FirstName input ) {
      if (input.Value == ”Albert”) {
          Message = ”Not accepted value”;
          input.Cancel();
      }
   }
}
```

Binding – server side

Using declarative programming and binding allows automated updates

```
FirstName$:"Albert",
LastName$:"Einstein",
Quotes: [
   { Text:"This is an example" }
]
```

```
[Database]
public class Person {
    public String FirstName;
    public String LastName;
    public IEnumerable<Quote> Quotes {
        get{
            return Db.SQL<Quote>(
                “SELECT q FROM Quote WHERE q.Person=?”, this);
        }
    }
}
```

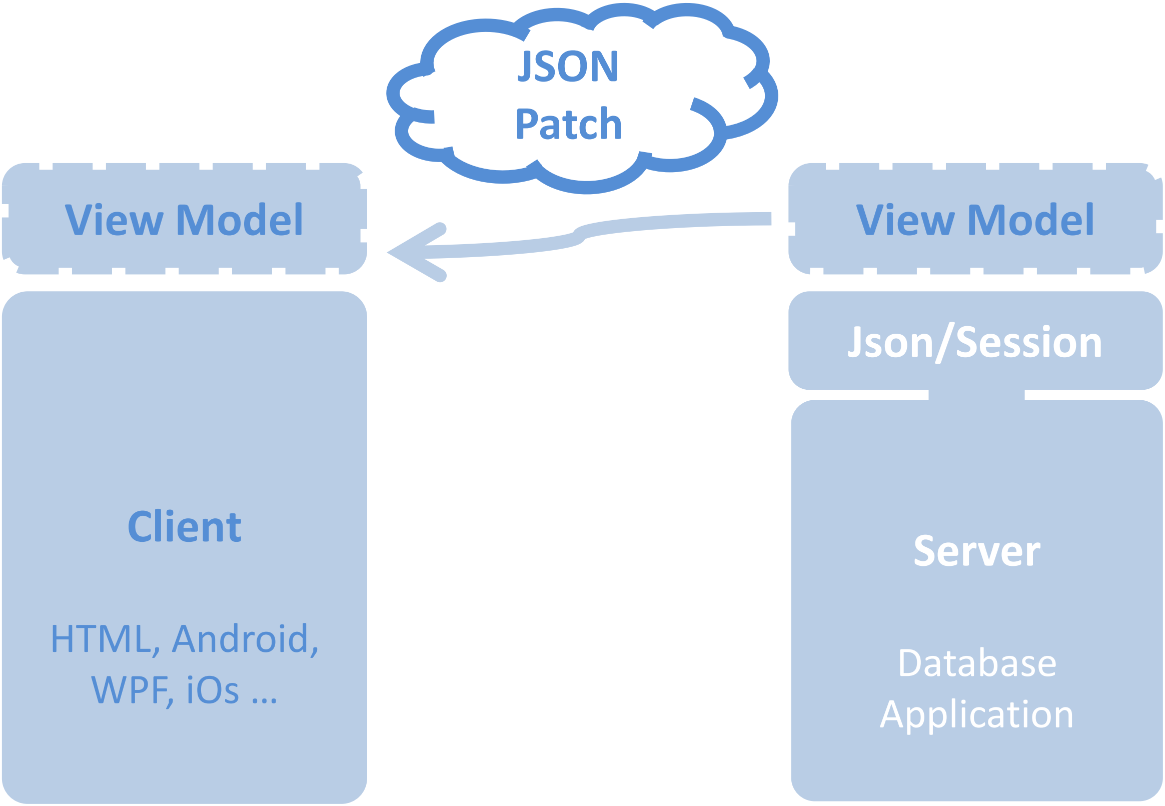
Binding – automatic updates

```
void Handle(Input.Text input) {
    new Quote(){
        Text = input.Value,
        Person = Data
    };
}
```

Controller detects that the ”Quotes” property will change in class Person

```
public IEnumerable<Quote> Quotes
{
    get
    {
        return Db.SQL<Quote>(
            “SELECT q FROM Quote WHERE q.Person=?”, this);
    }
}
```

Delta sent to client



JSON Patch

View Model

View Model

Json/Session

Client

HTML, Android, WPF, iOs …

Server

Database Application

Example setup MVVM

Client

```
<label>
     {{item.FirstName$}}
</label>
```

JSON patch (JSON)

Server

```
{
     “FirstName$”:"Albert",
}
```

Controller

```
void Handle( Input.FirstName input ) {
     if (input.Value == ”John”)
      {
          Message = ”Not accepted value”;
          input.Cancel();
     }
   }
```

DB

```
public class Person{
     public String FirstName;
}
```

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Super fast, super easy

Super fast

Database core

Application

Communication server

Super easy

Database API

Client-Server API

To maintain

Less lines of code

As ABBA would say

Money, money, money

Save money on

- Hardware
- Maintenance
- Fewer developers
- Faster to learn
- Shorter time to market
- Less DBA costs

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Summary

History

Database landscape

Scale-In instead of Scale-out

Performance on all levels

Easy to use

Simplicity and magic!

Thanks for listening!