MILLIONS OF TRANSACTIONS PER SECOND ON A SINGLE MACHINE CASE FOR A VIRTUALIZED DATABASE AND SCALE-IN

ROGER JOHANSSON

Who am I?

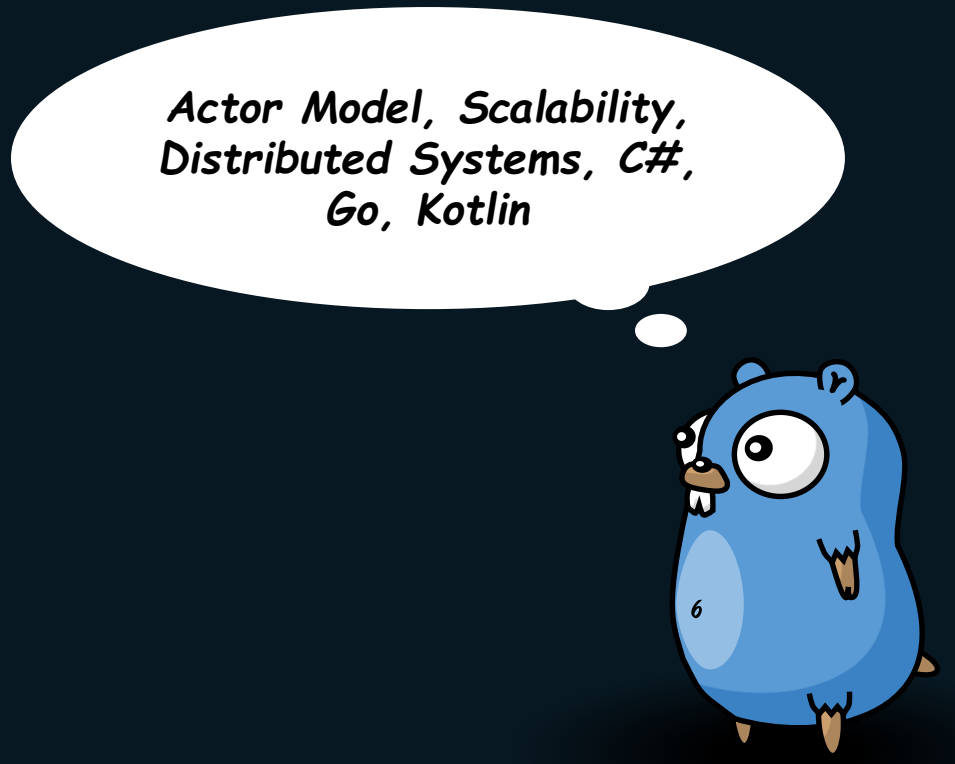
Roger Johansson

Senior Solution Architect – Starcounter
http://StarCounter.io

Akka.NET and Proto.Actor Founder
http://GetAkka.net, http://Proto.Actor

Twitter: @rogeralsing
Github: rogeralsing
Mail: roger@starcounter.com

http://Github.com/rogeralsing/presentations



Agenda

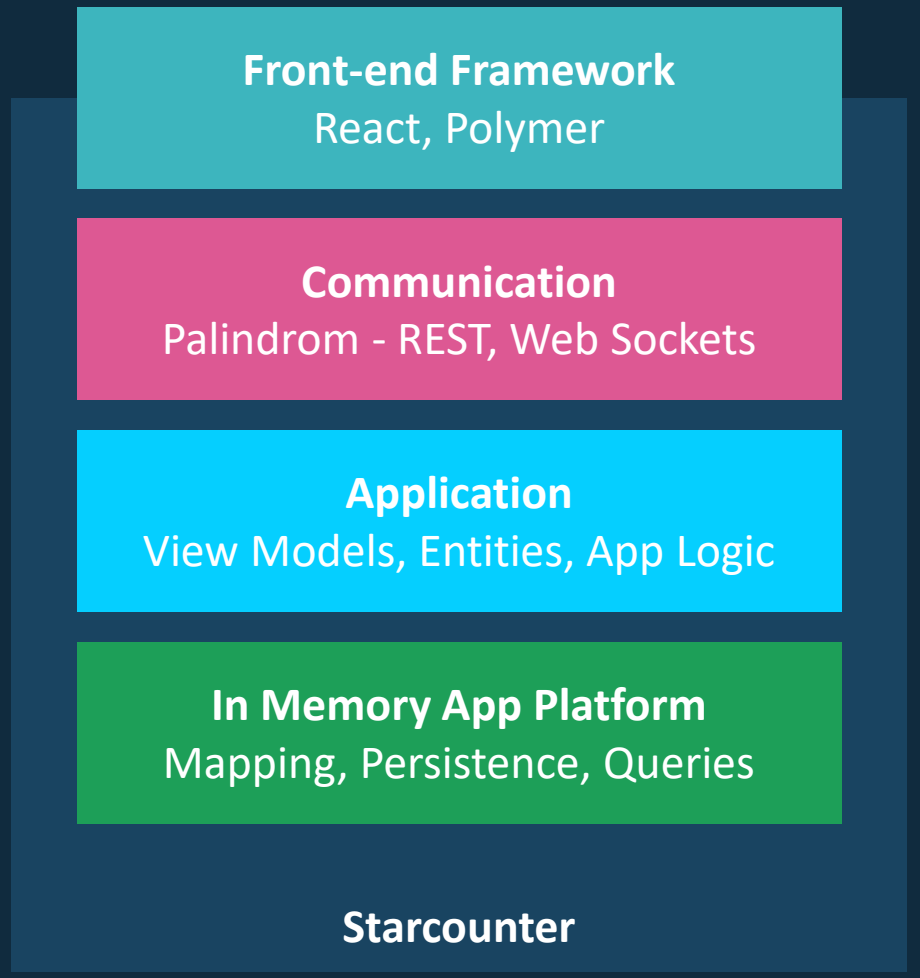
Setting the stage - Why we need in memory computing:

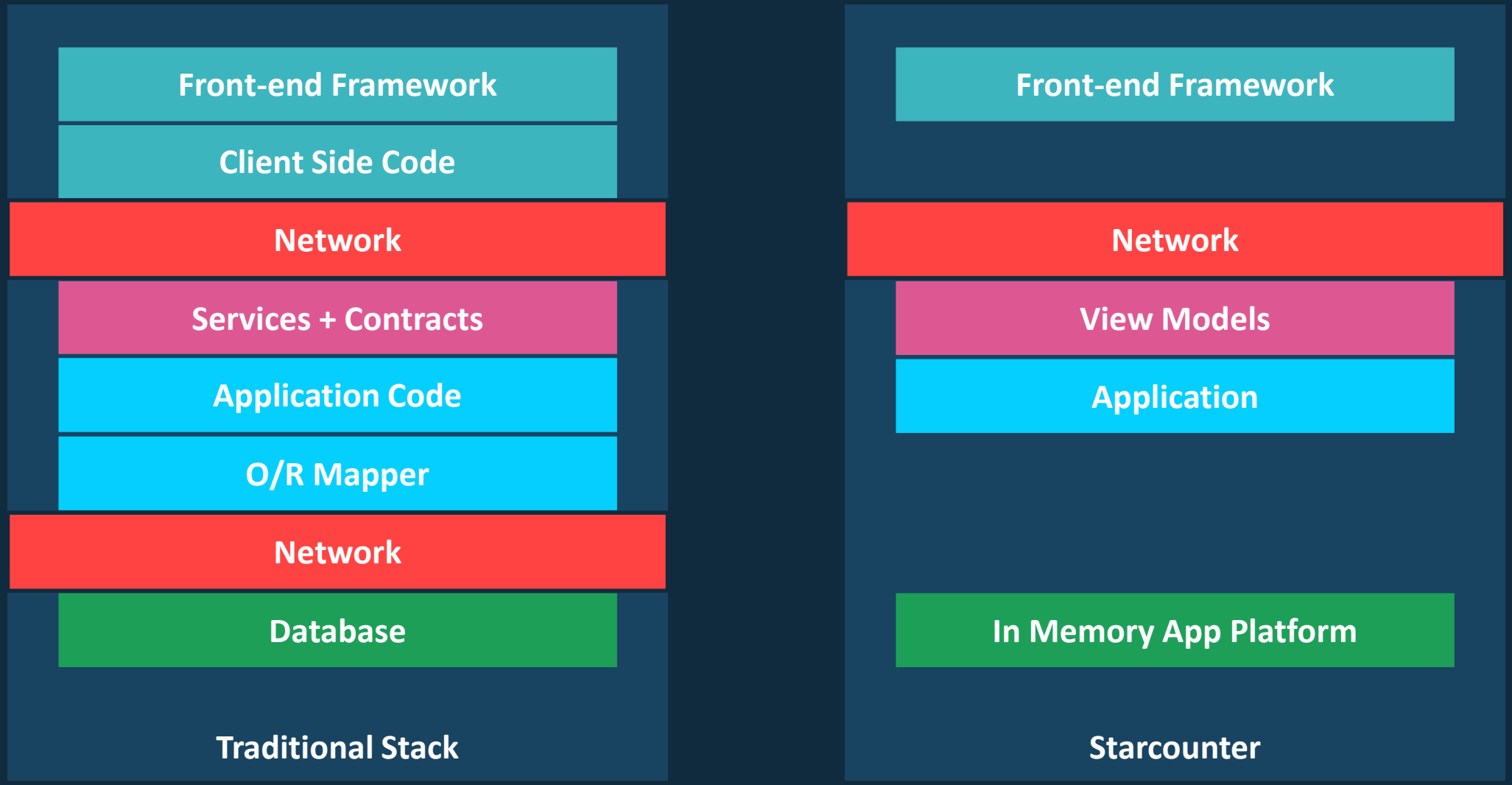
- Application Platform
- Micro-Apps

The Starcounter information operating system:

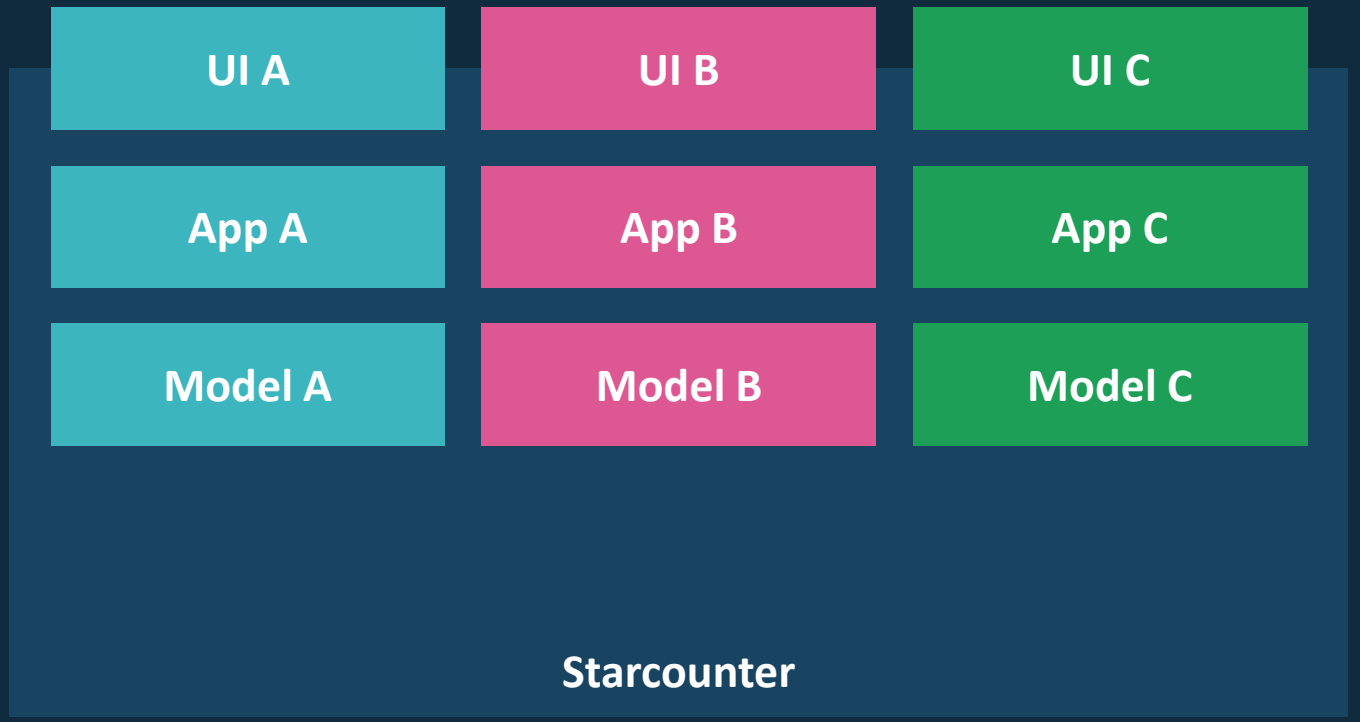
- Our approach to in memory computing
- The future of hardware
- The Mars project

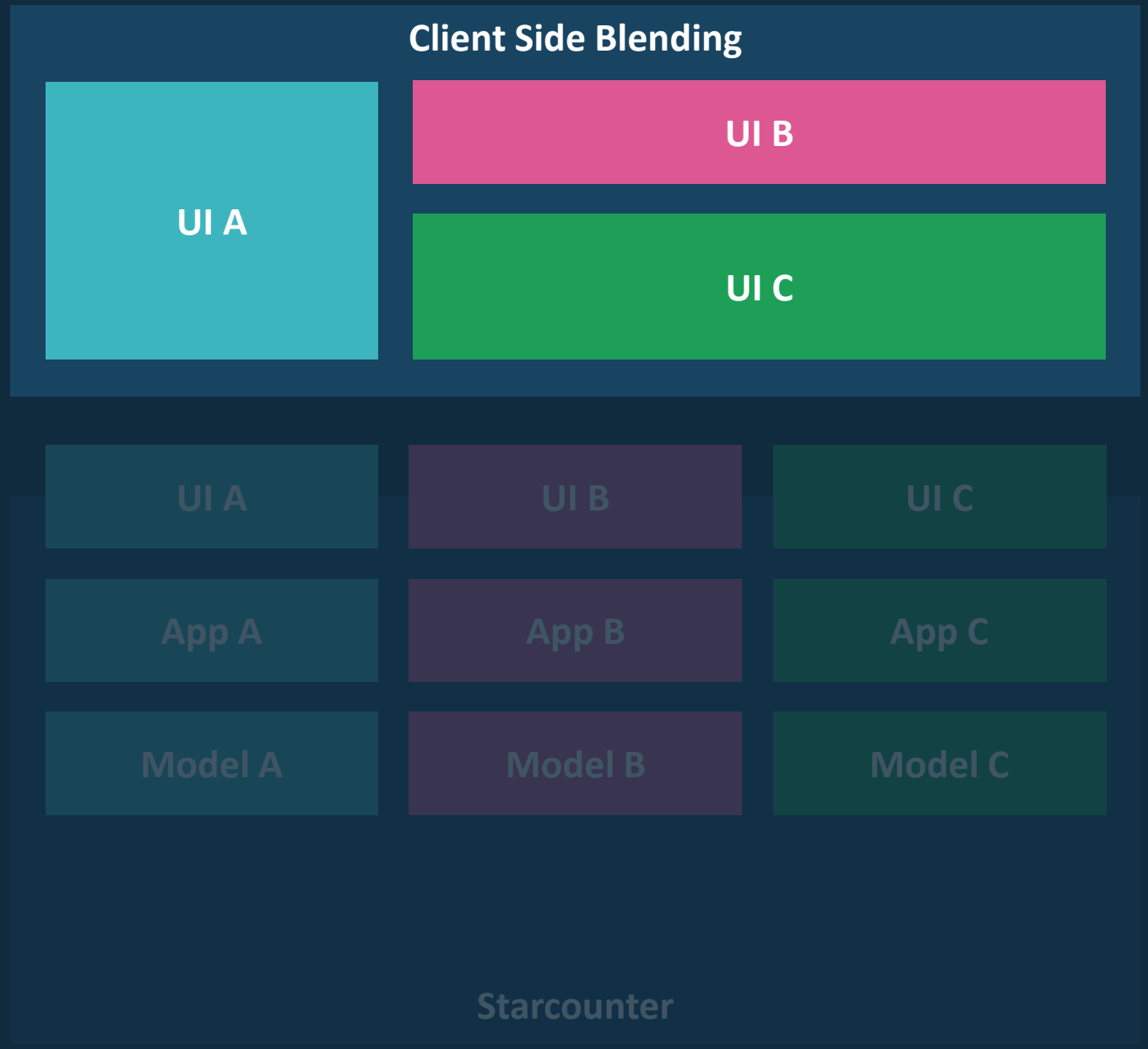
Application Platform


Front-end Framework
React, Polymer
Communication
Palindrom - REST, Web Sockets
Application
View Models, Entities, App Logic
In Memory App Platform
Mapping, Persistence, Queries
Starcounter


Front-end Framework
Client Side Code
Network
Services + Contracts
Application Code
O/R Mapper
Network
Database
Traditional Stack
Front-end Framework
Network
View Models
Application
In Memory App Platform
Starcounter

Micro-Applications


UI A
UI B
UI C
App A
App B
App C
Model A
Model B
Model C
Starcounter


Client Side Blending
UI A
UI B
UI C
UI A
UI B
UI C
App A
App B
App C
Model A
Model B
Model C
Starcounter

Search...

Home Persons Organizations

SAVE CANCEL

Stefan Edqvist

Starcounter AB (Sweden)

ADD EMAIL ADDRESS ADD PHONE NUMBER

First name: Stefan

Last name: Edqvist

Email: Primary — stefan.edqvist@starcounter.com

Phone Number: Mobile — +46 739856748

This person does not have any addresses yet. Click HERE to add some.

Organizations

Starcounter AB (Sweden)

MORE ORGANIZATIONS

Birthday: 11/11/1972

Nationality: Sweden

Tags: C# .Net Core test

ADD TAG

Editable Custom Fields

This person does not have any custom fields yet. Click HERE to add some.

CREATE ALL 0

Stefan Edqvist

Username

stefan

FirstName

Stefan

LastName

Edqvist

Authentication settings

SET NEW PASSWORD RESET PASSWORD

Member in

Name	Action
Admin (System Users)	REMOVE

Add to a system user group

None — ADD TO THE GROUP

SAVE DELETE UNDO CLOSE

Title...

Write Note here...

SAVE

PRIVACY TOGGLE GO TO OWN NOTEBOARD

test

This is a note

Search...

Home Persons Organizations

SAVE CANCEL

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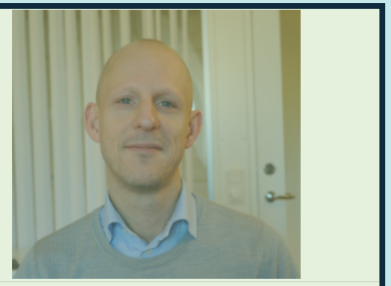
Starcounter AB (Sweden)



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Phone Number: Mobile — +46 739856748

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Profile	
ObjectId	789
FirstName	Stefan
LastName	Edqvist

Organizations: Starcounter AB (Sweden) — MORE ORGANIZATIONS

Birthday: 11/11/1972

Nationality: Sweden

Tags: C# .Net Core test — ADD TAG

Editable Custom Fields

This person does not have any custom fields yet. Click HERE to add some.

Stefan Edqvist

Username: stefan

FirstName: Stefan

LastName: Edqvist

User	
ObjectId	123
FirstName	Stefan
LastName	Edqvist

Authentication settings

SET NEW PASSWORD RESET PASSWORD

Member in

Name	Action
Admin (System Users)	REMOVE

Add to a system user group

None — ADD TO THE GROUP

SAVE DELETE UNDO CLOSE

Title...

Write Note here...

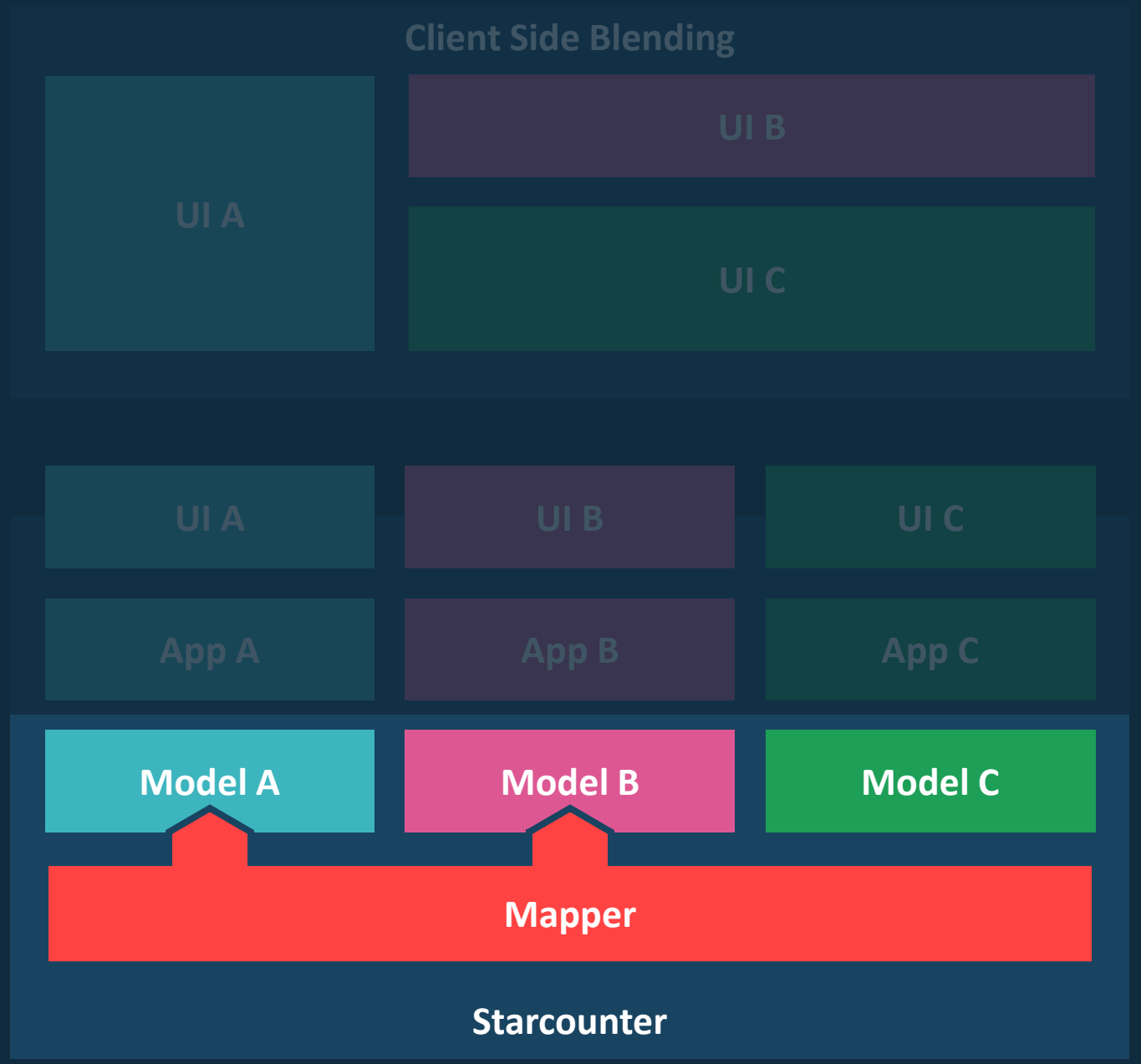
SAVE

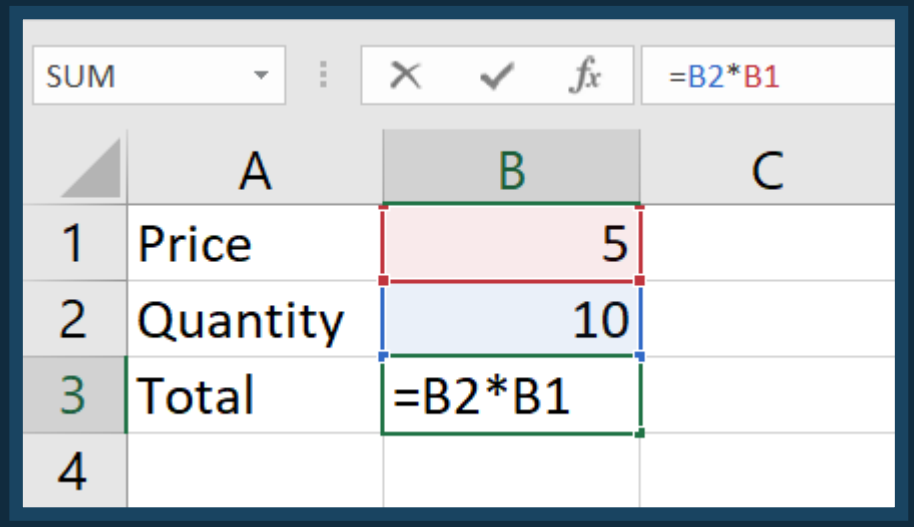
PRIVACY TOGGLE GO TO OWN NOTEBOARD

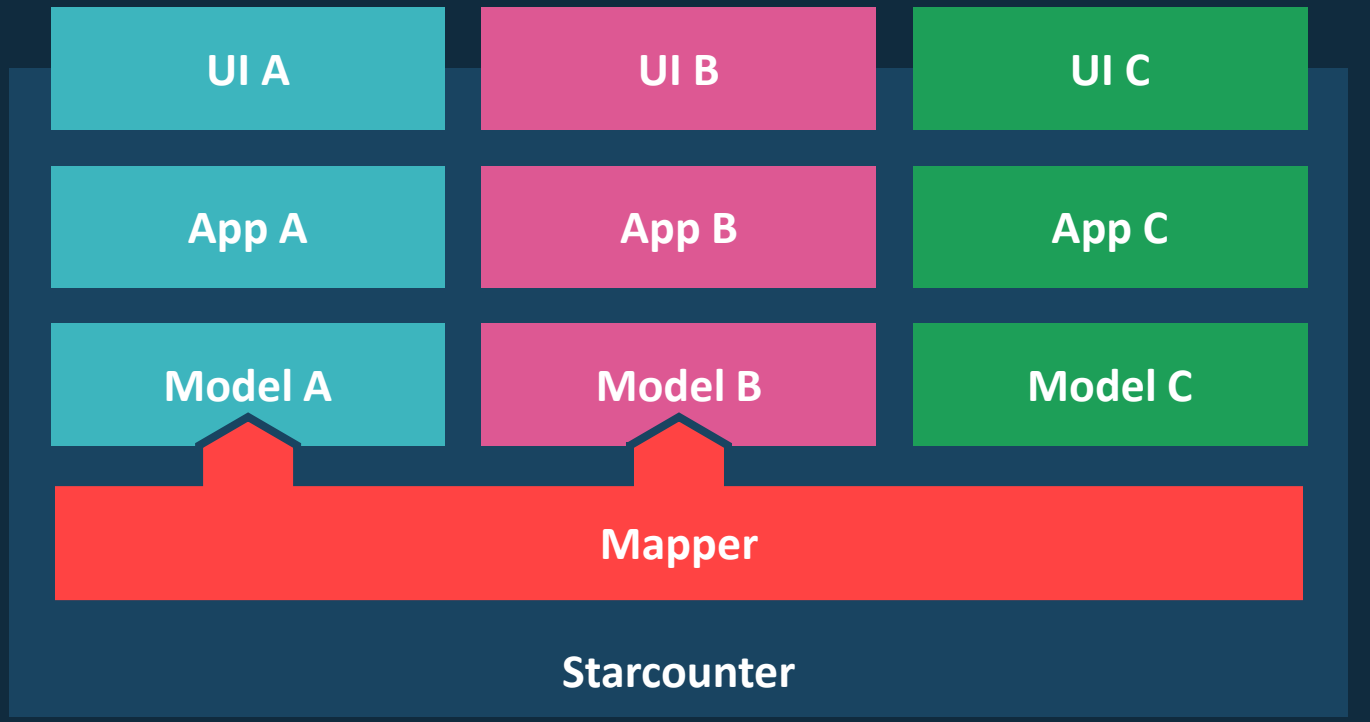
test

This is a note

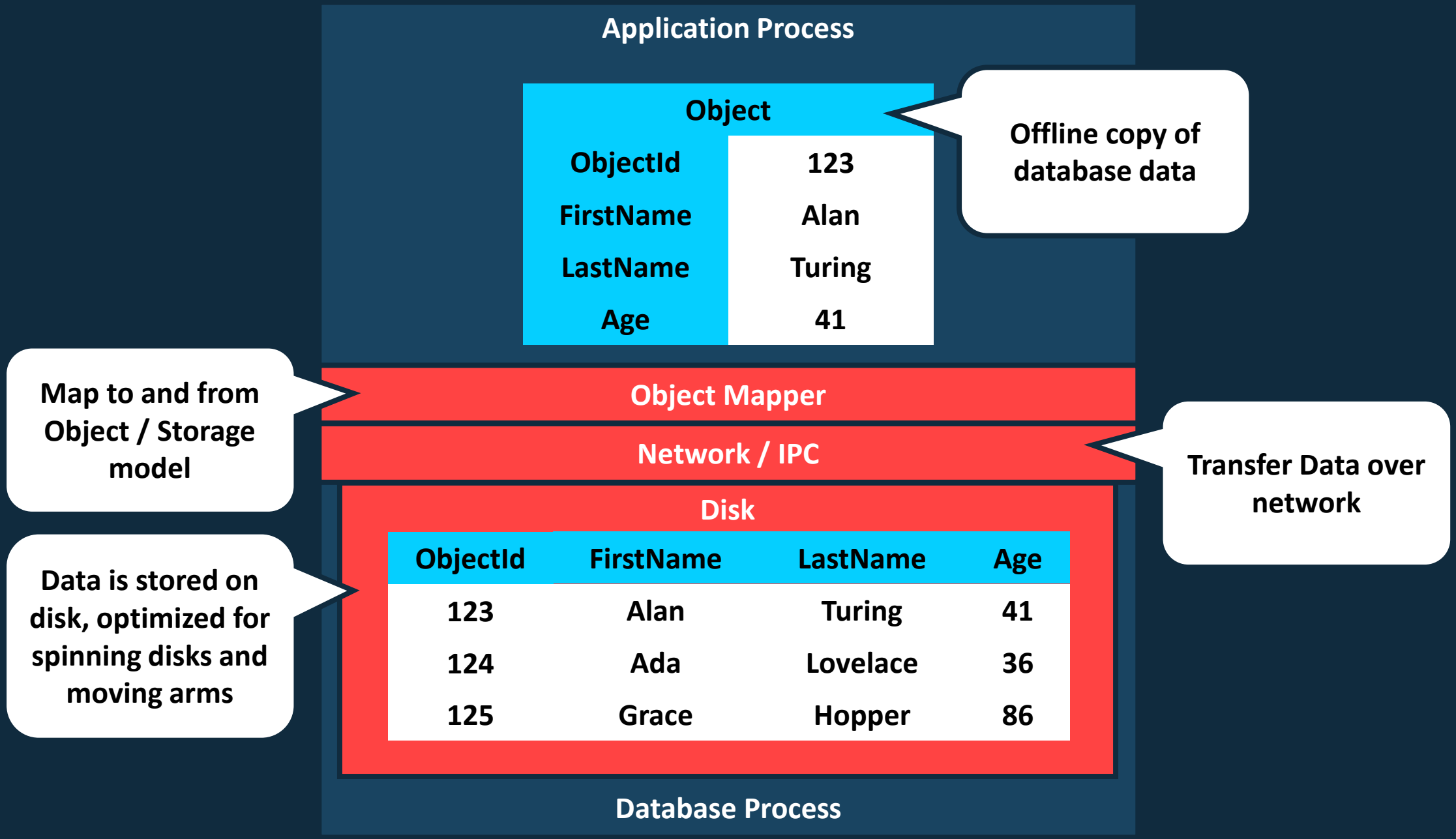
Data Flow Programming

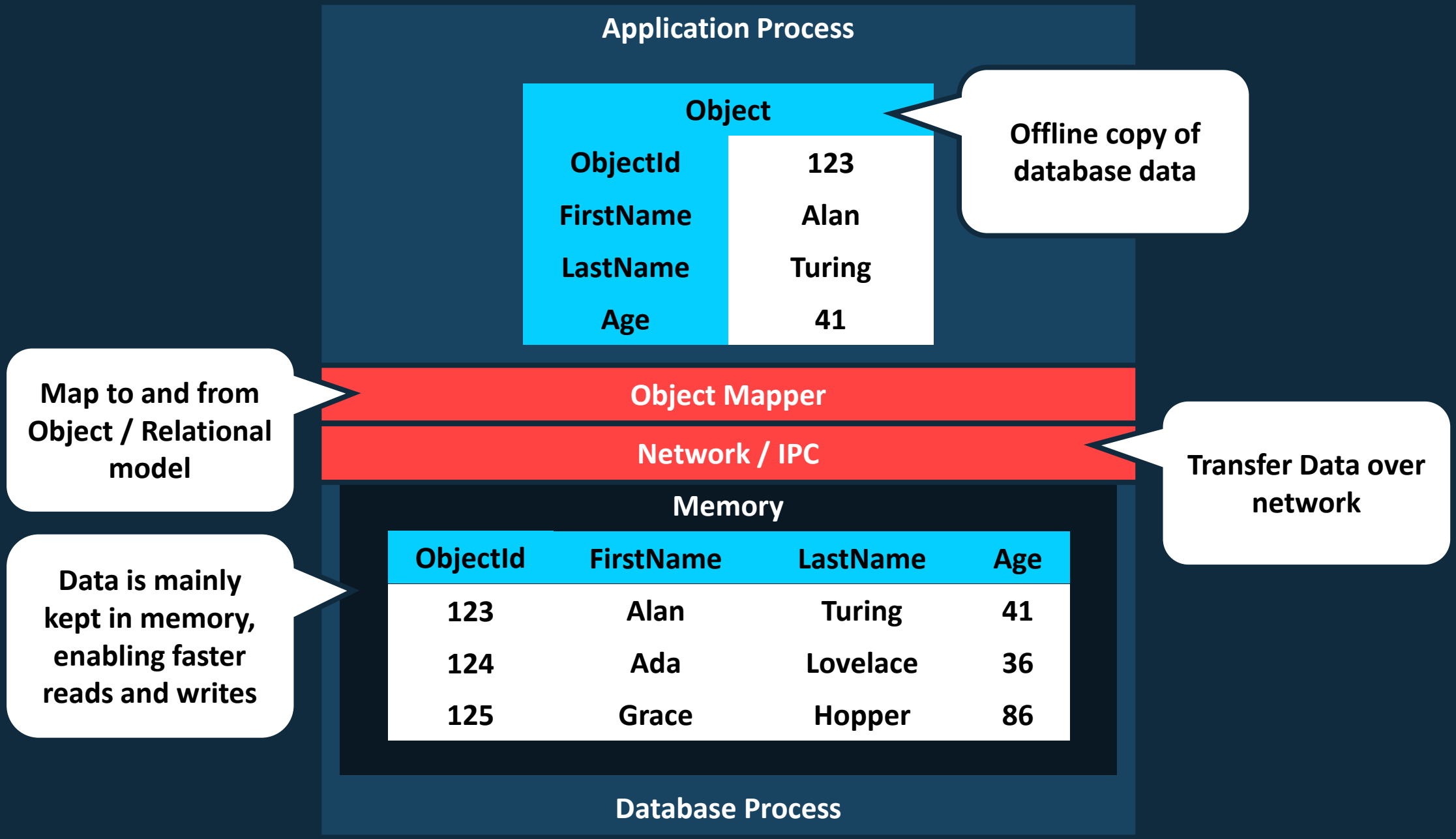

Client Side Blending
UI A
UI B
UI C
UI A
UI B
UI C
App A
App B
App C
Model A
Model B
Model C
Mapper
Starcounter

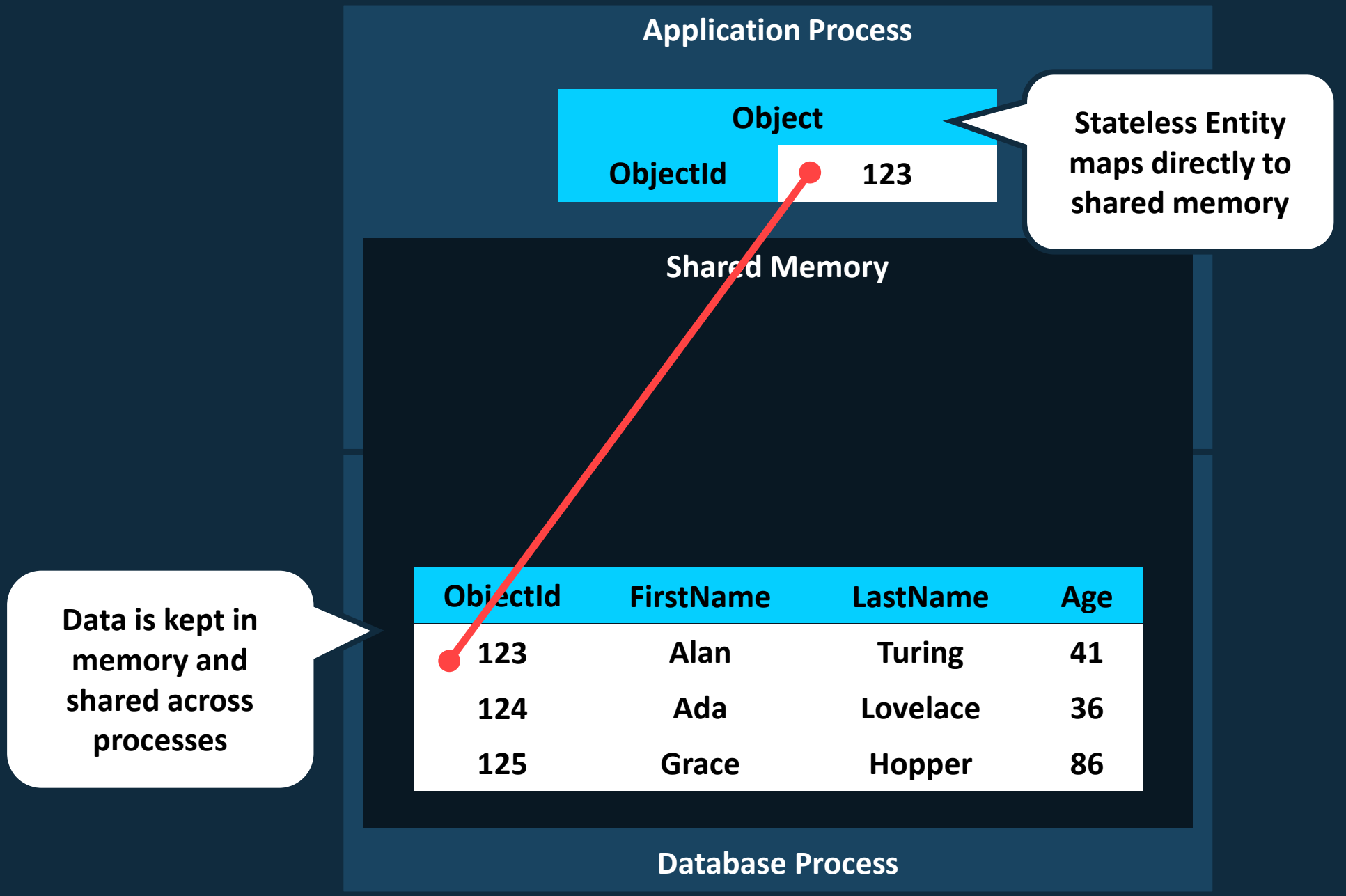

SUM
=B2*B1
A
B
C
1
Price
5
2
Quantity
10
3
Total
=B2*B1
4

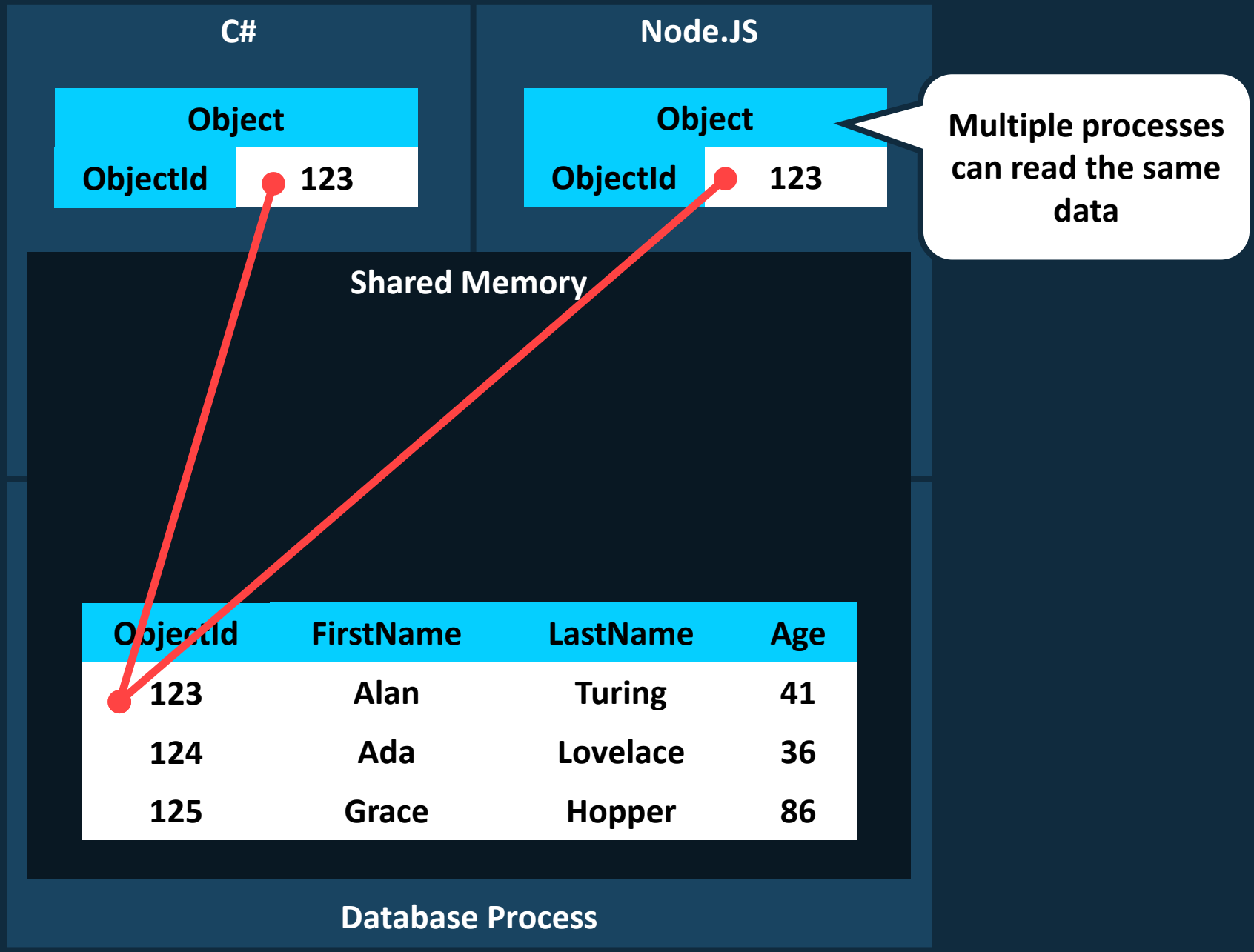

UI A
UI B
UI C
App A
App B
App C
Model A
Model B
Model C
Mapper
Starcounter

In Memory, For Real


Application Process
Object
ObjectId
123
FirstName
Alan
LastName
Turing
Age
41
Offline copy of database data
Map to and from Object / Storage model
Object Mapper
Network / IPC
Transfer Data over network
Disk
ObjectId
FirstName
LastName
Age
123
Alan
Turing
41
124
Ada
Lovelace
36
125
Grace
Hopper
86
Data is stored on disk, optimized for spinning disks and moving arms
Database Process


Application Process
Object
ObjectId
123
FirstName
Alan
LastName
Turing
Age
41
Offline copy of database data
Map to and from Object / Relational model
Object Mapper
Network / IPC
Transfer Data over network
Memory
ObjectId
FirstName
LastName
Age
123
Alan
Turing
41
124
Ada
Lovelace
36
125
Grace
Hopper
86
Data is mainly kept in memory, enabling faster reads and writes
Database Process


Application Process
Object
ObjectId
123
Stateless Entity maps directly to shared memory
Shared Memory
ObjectId
FirstName
LastName
Age
123
Alan
Turing
41
124
Ada
Lovelace
36
125
Grace
Hopper
86
Data is kept in memory and shared across processes
Database Process


C#
Node.JS
Object
ObjectId
123
Object
ObjectId
123
Multiple processes can read the same data
Shared Memory
ObjectId
FirstName
LastName
Age
123
Alan
Turing
41
124
Ada
Lovelace
36
125
Grace
Hopper
86
Database Process

C# Source Code

```
public class Person
{


  public string FirstName
  {
    get;
    set;
  }
```

C# Compiler Output

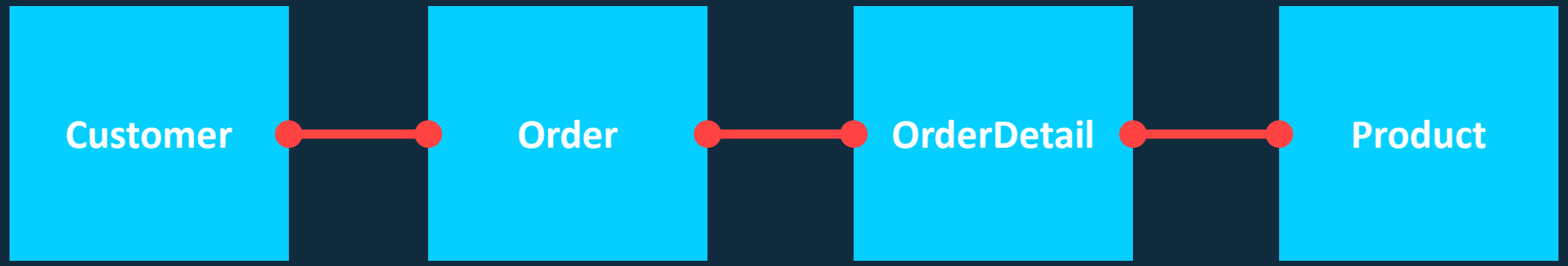
```
public class Person
{
  private string _firstName;

  public string FirstName
  {
    get => _firstName;
    set value => _firstName = value;
  }
```

Starcounter Weaver Output

```
public class Person
{
  private string _firstName;
  private ulong _id;
  public string FirstName
  {
    get => DbState.GetString(_id, FirstNameId);
    set value => DbState.SetString(_id, FirstNameId, value)
  }
```

Millions of operations per second

O/R mapper – Object Graphs



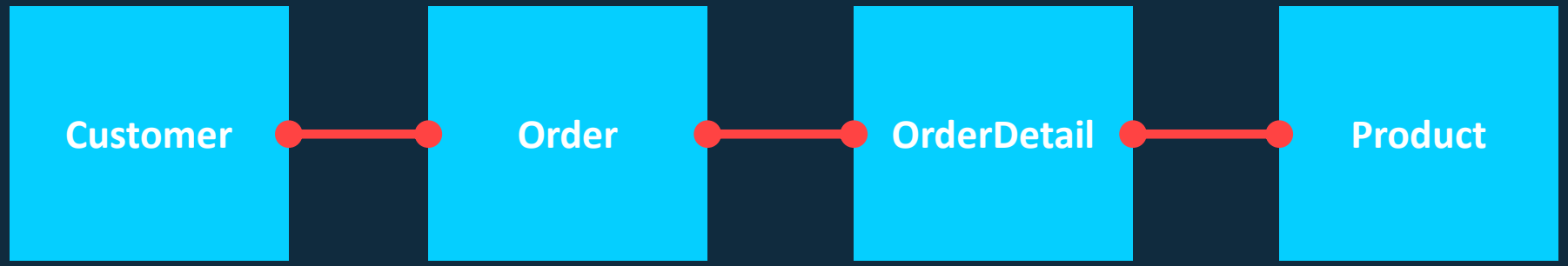
Lazy Load
Execute SQL Query per traversed relation

Ripple load, Hundreds/Thousands of queries per view

Eager Load
Carefully defining load boundaries

Hard to maintain, inefficient joined queries

Starcounter – Object Graphs



Chasing Pointers

Traversing relations are simple pointer traversals

PALMA

Module System
Navigation

Merge
Actions

Admin Admin

- Market Input
- Engineering Input
- Module Concepts
- Product Configuration
- Profitability
- Supply Chain

SCS Supply Chain Structure
VP Volume Planner

- Navigator

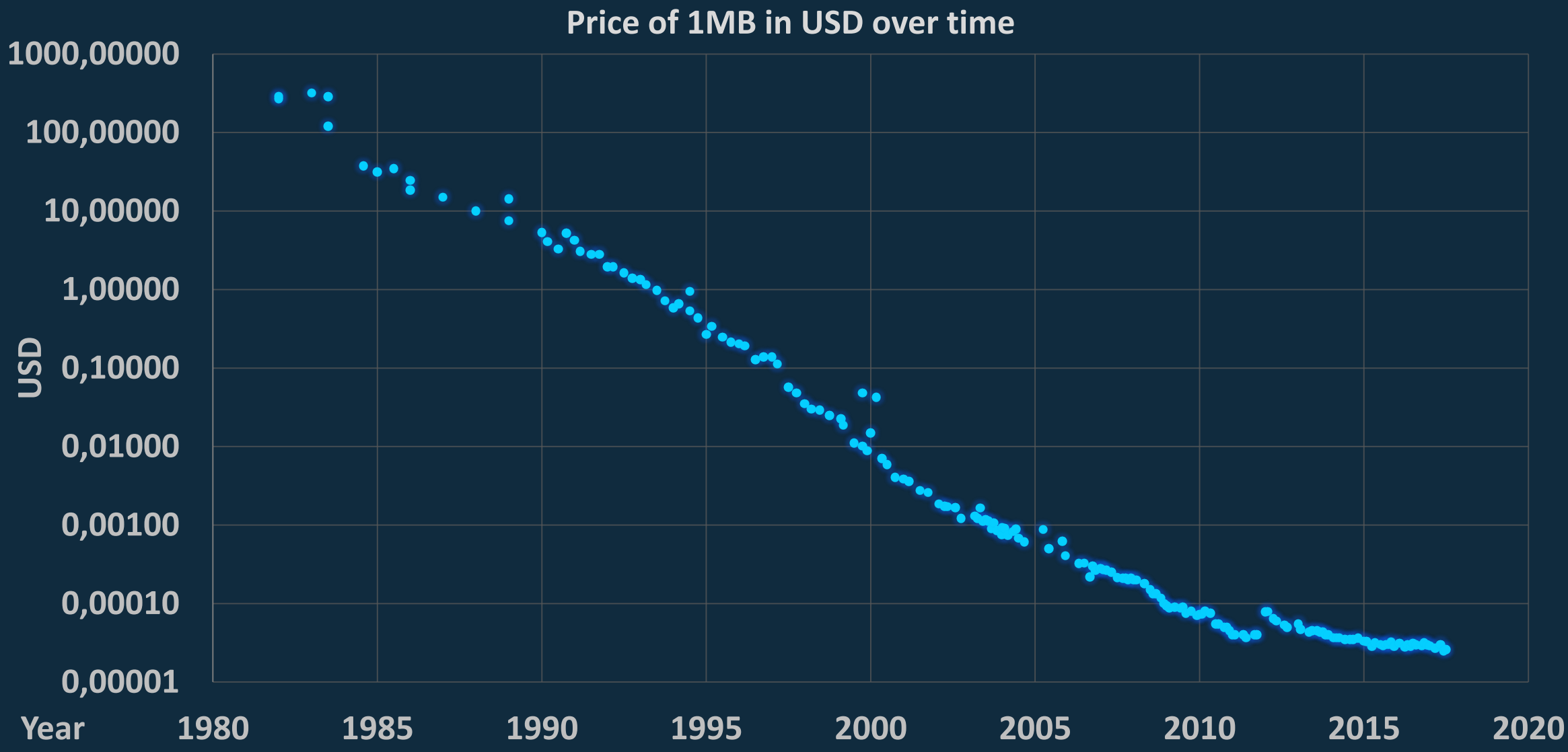
Module Variant

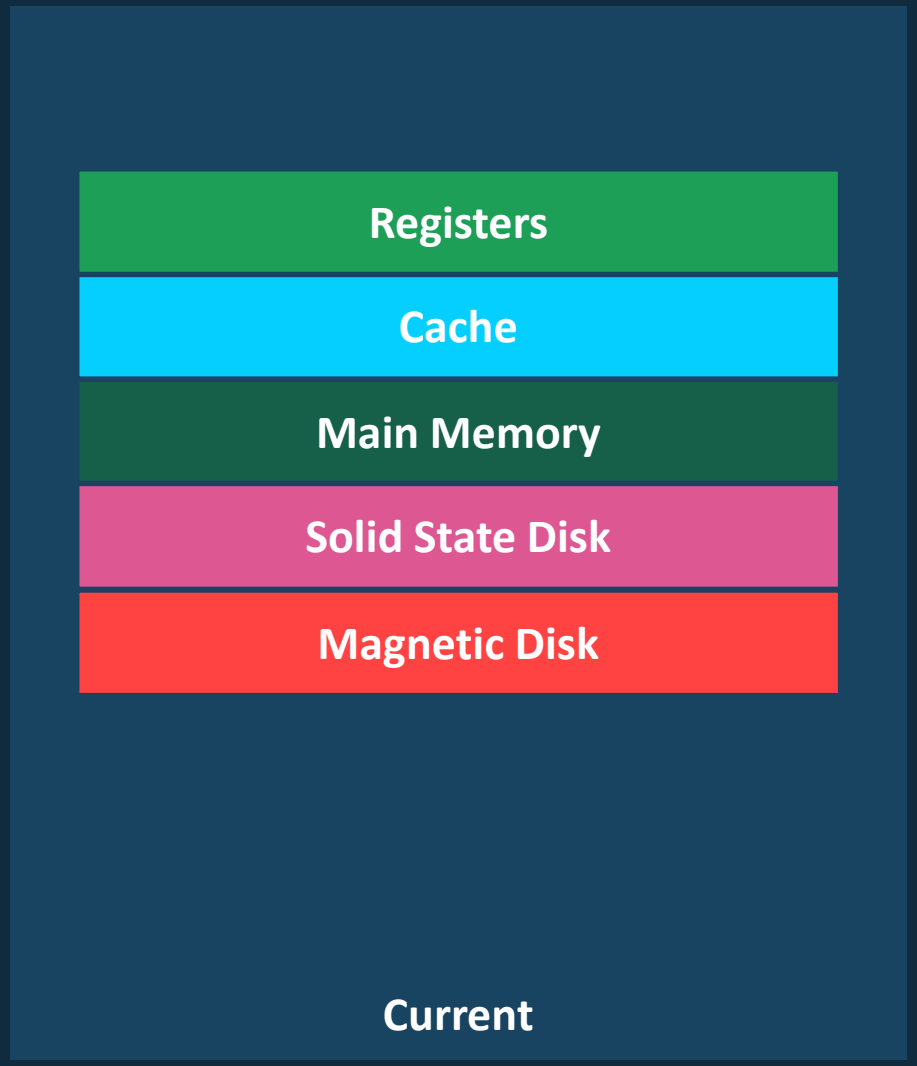
MODULE VARIANTS

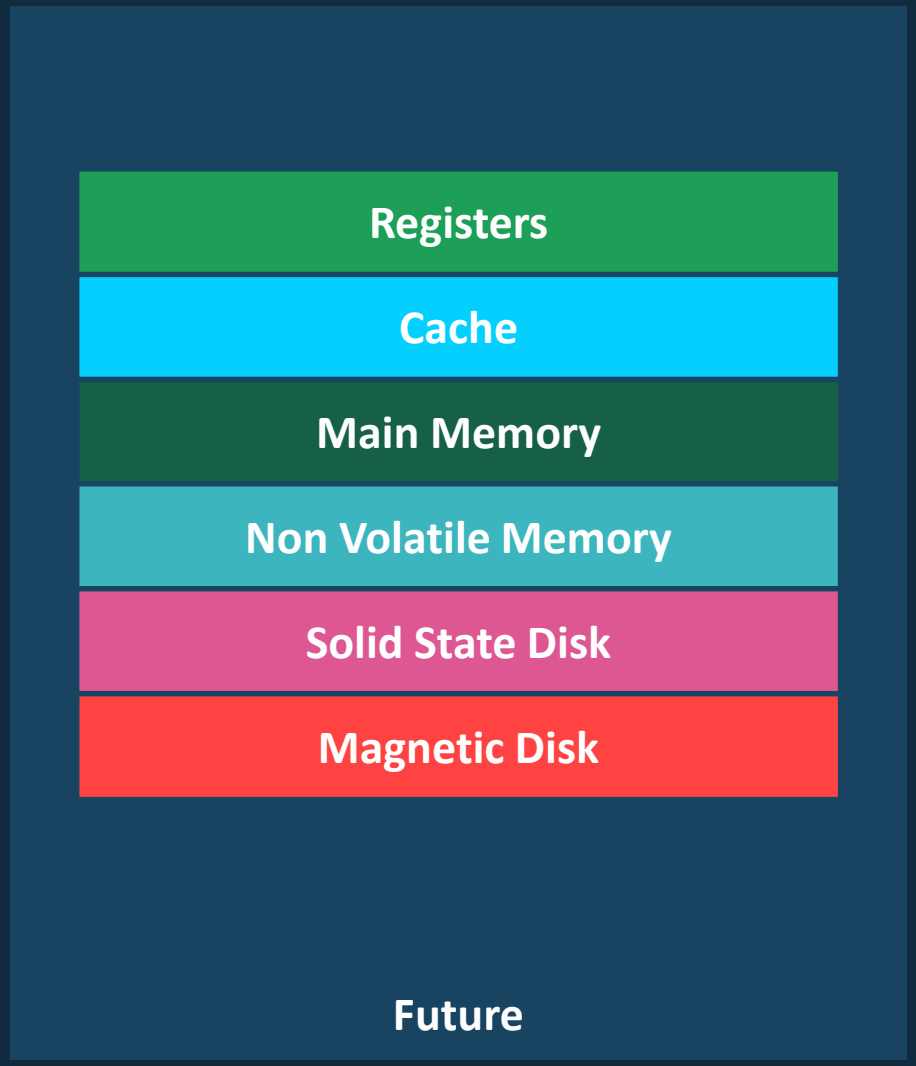
Product Properties	Base Price	Brand	Region	Surface texture	Size of inlet	Styling shape	Air flow
[ ]	USD	-	-	VDI	mm	-	l/min
S	S	S	S	S	S	S	S
C	B	V	V	B	V	E	E
#	1	5	3	1	2	2	6

Modules / Variants	Description	Base Price	Brand	Region	Surface texture	Size of inlet	Styling shape	Air flow	VCP
Shell module	Shell and container Styling						●		6
Shell, Extended	Extended, w "dust wheel"						Base style		
Shell, Short	Short, Compact						Exclusive...		
Shell, Long	Long, Standard						Base style		
Dust flap module	Dust flap One-way-valve							○	1
Dust flap, long life	Long Life, Silicone							120;1	
Dust flap, std	STD, Black rubber							80;90;	
Charger connect m...	Charge plugg and Charge so...								1
Dock module	Wall mounting, Docking Uni...						◒		2.25
PCB module	Printed circut board, electro...								1
Speciality Nozzle m...	Crevice nozzle (detachable)					◒		◒	4.5
Nozzle module	Nozzle (fixed)		●	◒	○	◒		○	7.5
Control module	On/Off switch, Container rel...				○				1.5
Container module	Container for dust collection...				○				3
Handle module	Handle, used for Styling				○				1.5
Charger module	Power Adopter (transformer...								54
Base module	Shell base								1
Filter module	Dust filter(Detachable)								3
Container styling m...					○		●		6

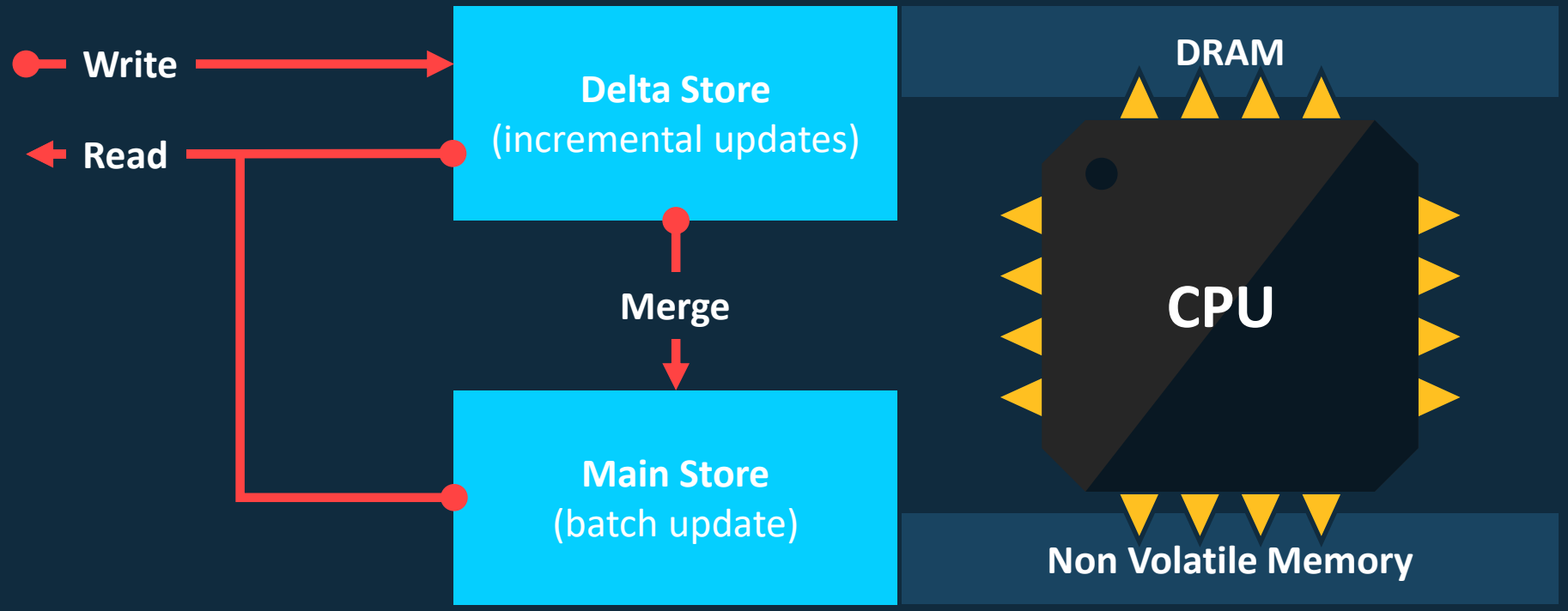
The Future of Hardware


Price of 1MB in USD over time
1000,00000
100,00000
10,00000
1,00000
0,10000
0,01000
0,00100
0,00010
0,00001
USD
Year
1980
1985
1990
1995
2000
2005
2010
2015
2020


Registers
Cache
Main Memory
Solid State Disk
Magnetic Disk
Current


Registers
Cache
Main Memory
Non Volatile Memory
Solid State Disk
Magnetic Disk
Future

Starcounter on the CPUs of 2018



Q & A