



Dennis van der Stelt

Mission Impossible: Dealing with eventual consistency

A cinematic still from the TV series Game of Thrones. The scene is set in a winter forest, heavily covered in snow. A large, ancient tree with thick, gnarled branches dominates the right side of the frame. The tree's leaves are a vibrant red, contrasting with the otherwise monochromatic blue and white palette. Two characters are seated on the snow at the base of the tree, their forms partially obscured by the white. The overall atmosphere is cold and somber.

GAME OF
THRONES™



DE FINALE VAN GAME OF THRONES BIJ PATHÉ

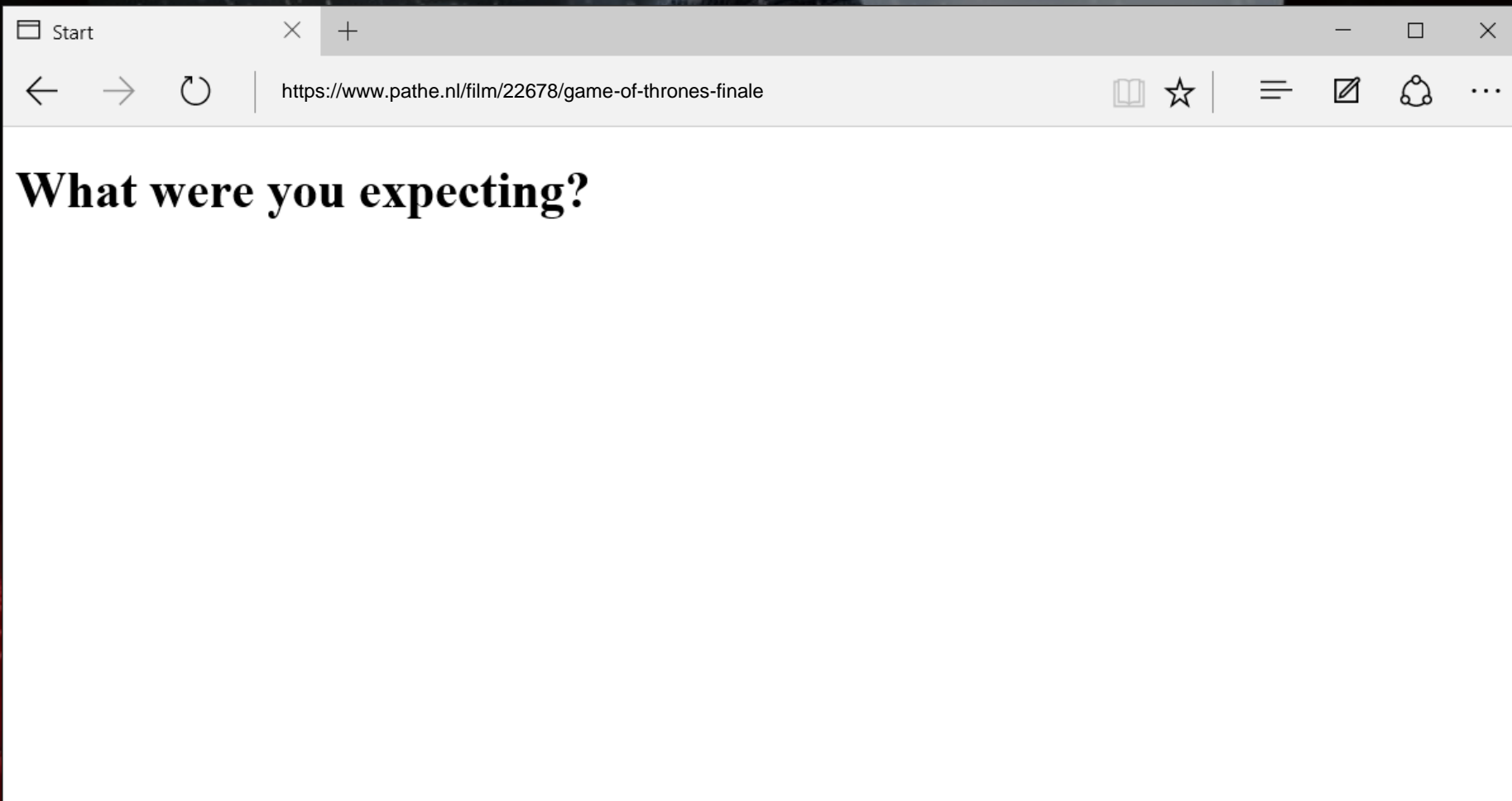
Op vrijdagmorgen 10 mei kan iedereen een poging doen om tickets te bestellen voor de vertoning van Game of Thrones op 20 mei. Deze allerlaatste aflevering vertonen we in samenwerking met Ziggo in 19 bioscopen door het hele land!

Je kunt de gratis tickets bestellen via onze app en website: pathe.nl;

We kunnen niet het tijdstip communiceren waarop het ook echt mogelijk is om tickets te bestellen. Alleen een dagdeel. Zo proberen we te voorkomen dat onze website crasht!

niet helemaal zoals je had verwacht, probeer dan een beetje lief voor ons te blijven! Je kunt ons altijd een privébericht sturen met je vragen en/of opmerkingen.





Start × +

← → ↻ | <https://www.pathe.nl/film/22678/game-of-thrones-finale> | 📖 ☆ | ☰ ✎ 🔔 ⋮

What were you expecting?

The screenshot shows a web browser window with a single tab titled "Start". The address bar contains the URL "https://www.pathe.nl/film/22678/game-of-thrones-finale". The page content features a large, bold heading "What were you expecting?". The background of the page is a dark, atmospheric image of a Game of Thrones character, likely Jon Snow, looking out over a snowy landscape. The browser interface includes standard navigation icons (back, forward, refresh) and utility icons (bookmarks, star, menu, share, print, notifications, and more options). The browser window is overlaid on a background image of a cinema interior with rows of red seats and glowing light fixtures.

BESTELLING GESLAAGD!

VEEL PLEZIER BIJ HET ZIEN VAN GAME OF THRONES FINALE

WAAR?



PATHÉ SCHOUWBURGPLEIN

WANNEER?



MA 20 MEI



19:30 TOT 21:05

ZET IN MIJN AGENDA



WAT DOEN WIJ?

We sturen een bevestigingsmail naar dvdstelt@gmail.com. Met de QR-code in die mail hoef je niet meer je ticket via de machine op te halen en mag je direct doorlopen!



MELD JE NU AAN OM STARS TE SPAREN

[Wat is Pathé All Stars? >](#)

JA LEUK, IK DOE MEE!



DEEL DIT OP FACEBOOK



Pathé  @Pathe · May 7

Tienduizenden klanten van Ziggo proberen nu tickets te bestellen voor Game of Thrones. Daar heeft onze site het een beetje moeilijk mee! Ondanks dat we meer serverruimte hebben ingezet dan nodig was voor Avengers: Endgame! Onze excuses voor het ongemak.

 Translate Tweet

 179

 6

 58



Dennis van der Stelt

@dvdstelt

Replying to @Pathe

Daar zijn technische oplossingen voor! Nu kan geen enkele klant iets op jullie website. Als je dat opgelost wilt hebben, mag je altijd contact opnemen. Dit soort oplossingen en gedistribueerde systemen bouwen zijn mijn specialiteit! Stuur maar een DM.

 Translate Tweet

10:14 AM - 7 May 2019

WE WERE EXPECTING SNOW
BUT WE GOT A
BLIZZARD



BEST BUY

BLACK FRIDAY DEALS
Preview Now

Our site is incredibly busy!
Please be patient while we shovel you a path.

Careers For Our Investors Community Relations Conditions of Use Legal Notices Privacy Policy

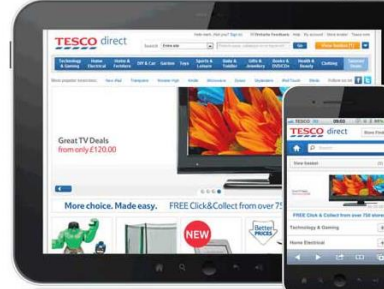
TESCO direct

Sorry for making you wait

Lots of people are shopping with us at the moment and we need to ask you wait briefly. Don't worry, we'll redirect you to the website as quickly as we can.

Thank you for choosing Tesco Direct.

retrying in **24** seconds



takealot .com

Sorry, our store is full right now.

There are so many customers shopping, we can't squeeze everyone in.

Please be patient and come back in a few minutes.

If you already have items in your cart, you can go straight to checkout.

CHECKOUT NOW

the magic of
macy's

temporary shopping jam!

2

Sorry, shoppers! We're currently experiencing heavier traffic than normal. To make sure everyone gets the best shopping experience possible, we're asking new shoppers to wait approximately **10** seconds, and then we'll refresh your browser and welcome you in.

Thanks for your patience!

If you'd like to order by phone or to speak with one of our Customer Service representatives, please call 1-800-BUY-MACYS (1-800-289-6229).

[find a store near you](#)

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Macys.com, Inc., 680 Folsom Street, San Francisco, CA 94107.

DEBENHAMS



We're very popular right now!

Sorry, we're getting a high amount of visitors to our site. We've placed you in a queue so please leave this page open and we'll get you shopping again as soon as possible.

Page will refresh in: **00:00:26 seconds**

U kunt deze pagina verlaten zonder uw plaats in de wachlijn te verliezen

de Bijenkorf

Webshop Portier


U bent nu in de wachlijn geplaatst. Het kan in onze webshop soms spectaculair druk zijn, daarom hebben we een portier ingeschakeld. De portier zal ervoor zorgen dat iedereen zonder problemen kan winkelen. Als u daardoor niet meteen naar binnen kunt, vragen we u vriendelijk om even geduld te hebben. Voor u het weet, wordt u verder gelaten.
Wat is dit?

Aantal wachtenden voor u: berekenen...
Verwachte tijd berekenen...
Dat is over: berekenen...

Als deze tekst niet binnen 2 minuten verandert, vernieuw dan uw browser om handmatig te updaten.

Status: 21/25
Het is vandaag erg druk in de webshop en daarom hebben we besloten dat de Membervouchers ook morgen nog te verkrijgen zijn, maar alleen online.
Tijdens het wachten kunt u hier de boekjes bekijken.

Vraag de Bijenkorf Card aan | Facebook | Twitter





let's check history

**how did we get to
those issues?**

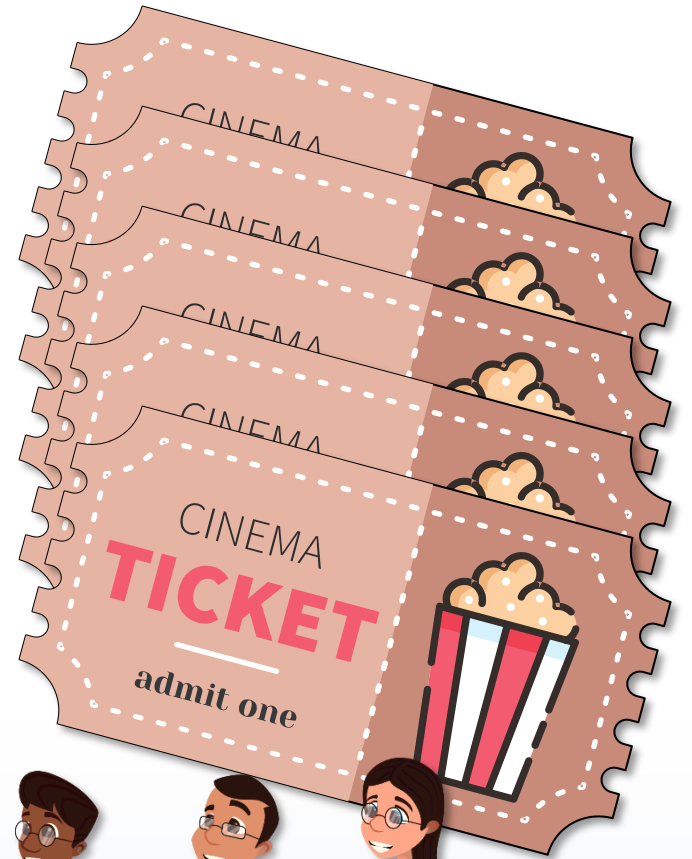
SELLING TICKETS

And when we are too successful for our own good

I'd like to order tickets to the finale of Game of Thrones.
I have no friends, so I'll be alone. Just one ticket, please.



Hi, how can I help you?
Sure, no problem. How many would you like?



WHEN BUSINESS IS BOOMING

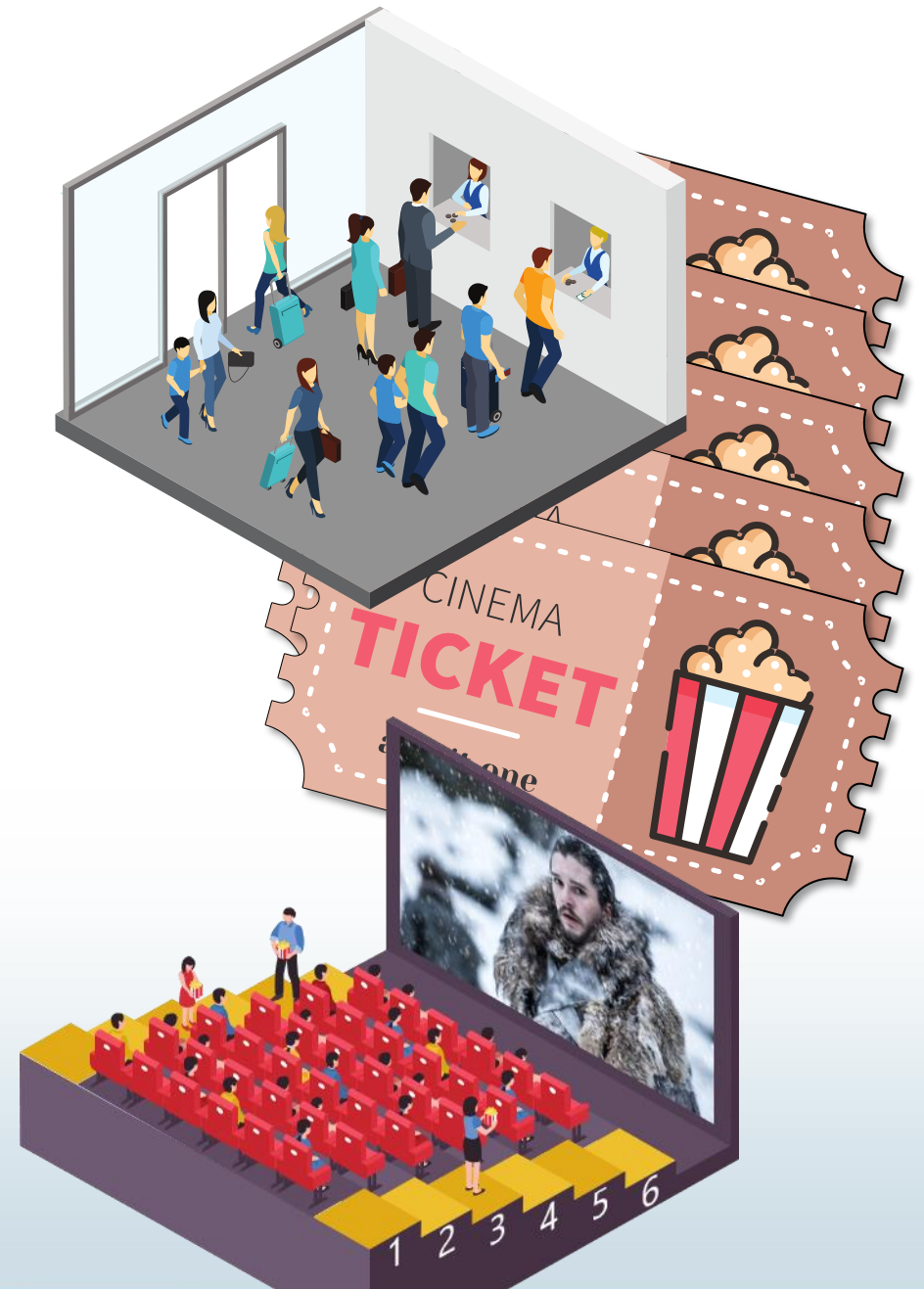
We need to scale out



Hi, how can I help you?
Game of Thrones finale,
4 tickets. You've got them.



Hi, how can I help you?
Game of Thrones finale,
3 tickets. You've got them.





and then...

the internet happened

DIGITIZING COMMERCE

The birth of eCommerce



DEALING WITH STRONG CONSISTENCY

How every solution starts as a very, very small problem

Movies table

Id	Name	TheaterId	Price	Quantity
42	Star Wars Rise of Skywalker	1	\$ 15.00	400
1337	Game of Thrones	2	\$ 0.00	100

```
begin transaction
    var quantity = select Quantity from Movies
                    where Id = @MovieId
    if (quantity >= amountOfTicketsCustomerWants)
        update Movies
        set Quantity = quantity - amountOfTicketsCustomerWants
        where Id = @MovieId
commit transaction
```

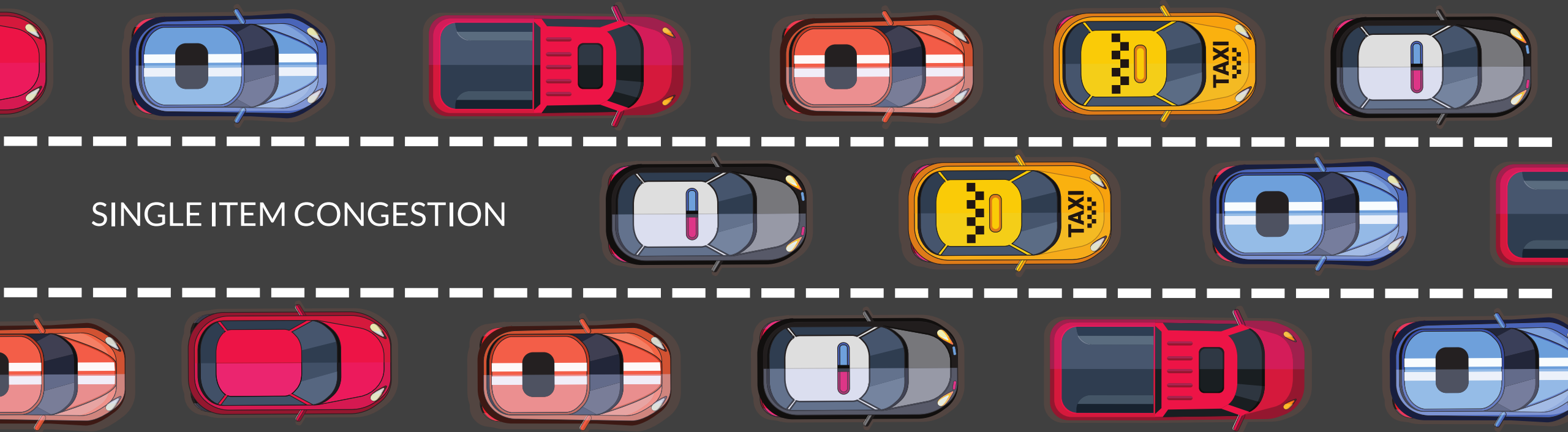


DEALING WITH STRONG CONSISTENCY

How every solution starts as a very, very small problem

Movies table

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1337	Game of Thrones	2	\$ 0.00	100



DIGITIZING COMMERCE

The birth of eCommerce







LET'S DIG A LITTLE BIT DEEPER

Relational Database

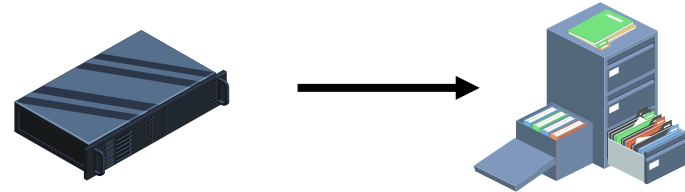


ALTERNATIVE SOLUTIONS

Relational Database



Document Database

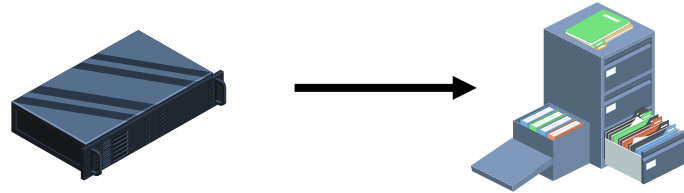


ALTERNATIVE SOLUTIONS

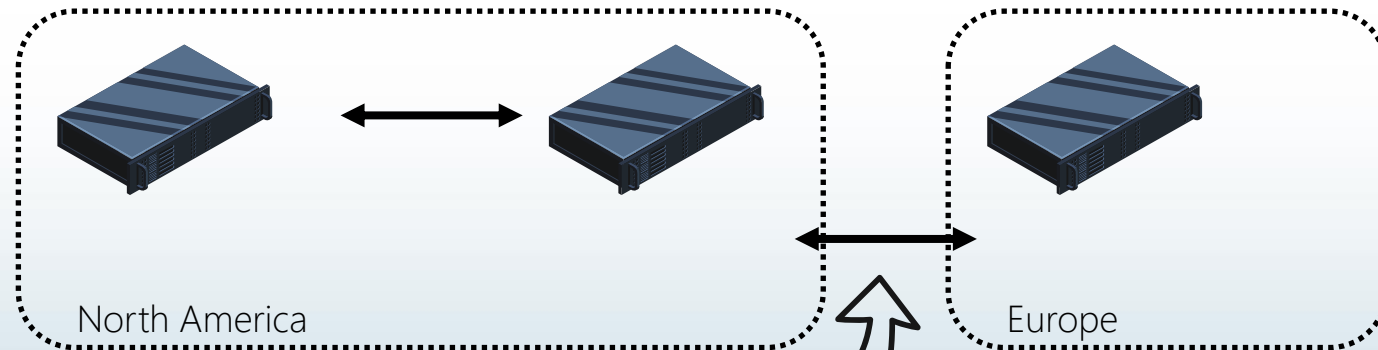
Relational Database



Document Database



Datacenters

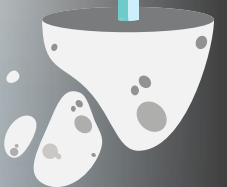


data travels only at the speed of light

Speed Limit

Speed of Light

300,000
km/s

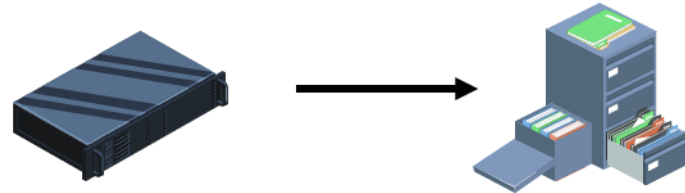


ALTERNATIVE SOLUTIONS

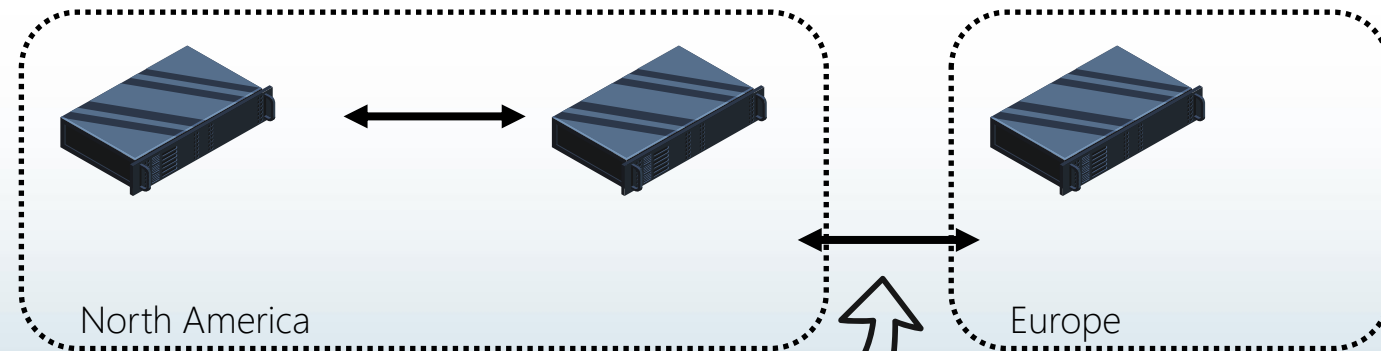
Relational Database



Document Database



Datacenters

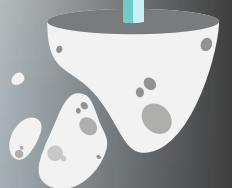


data travels only at the speed of light

Speed Limit

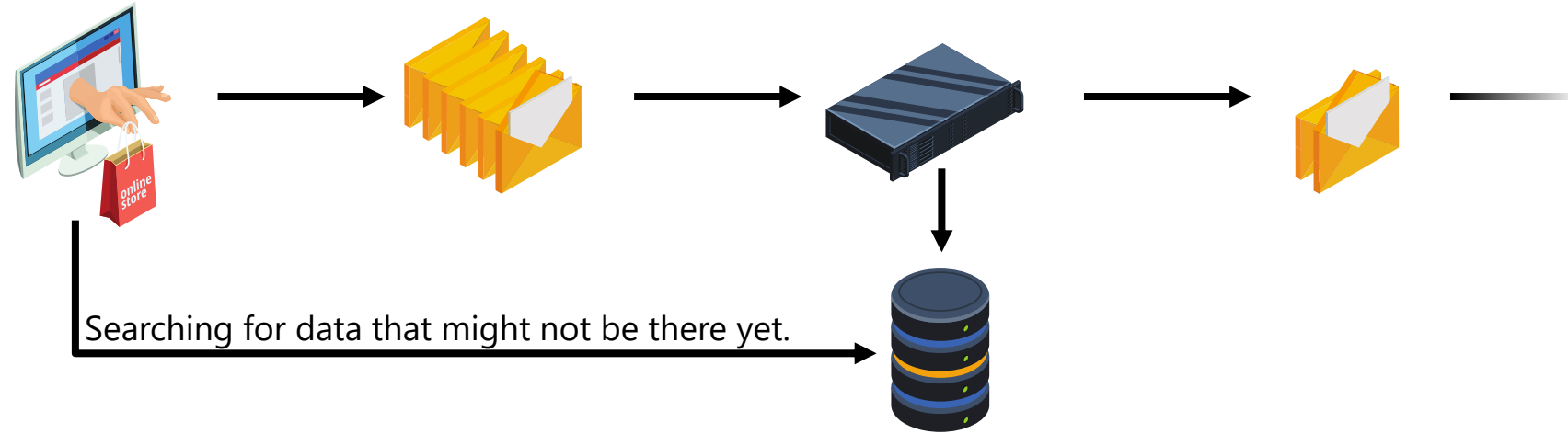
Speed of Light

300,000
km/s

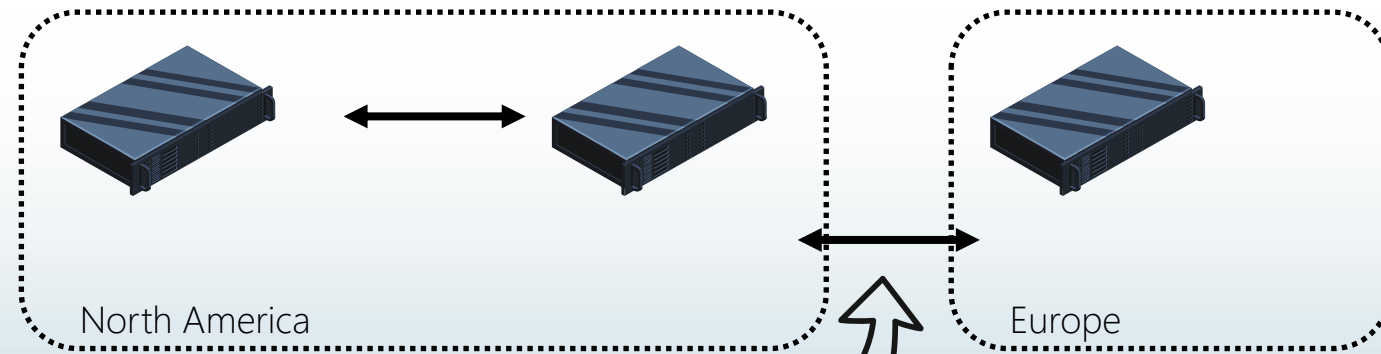


ALTERNATIVE SOLUTIONS

Messaging



Datacenters

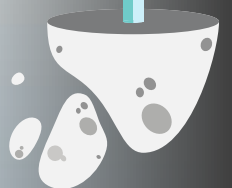


data travels only at the speed of light

Speed Limit

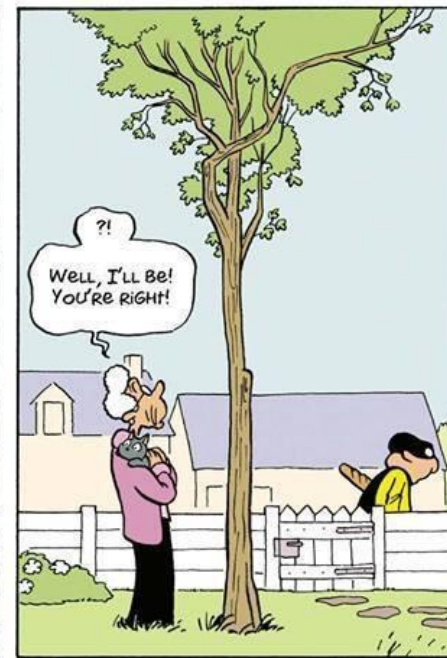
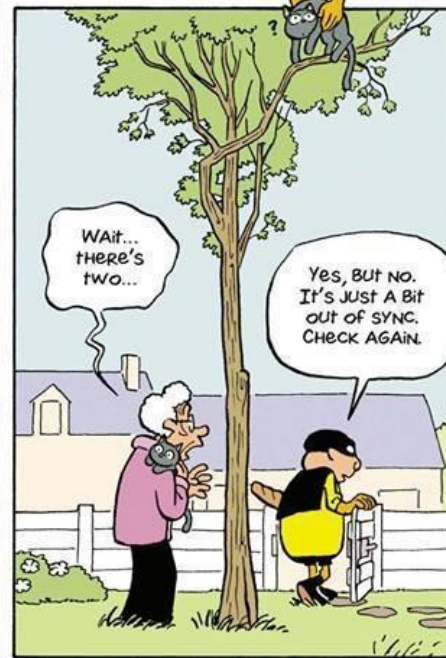
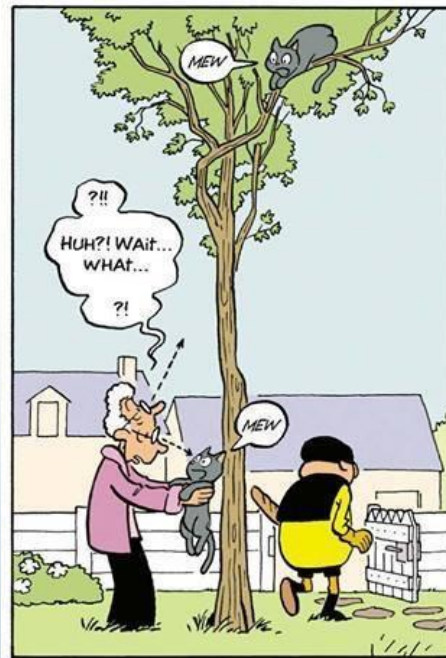
Speed of Light

300,000
km/s





asynchronous communication



How to deal with it?

Do we really need strong consistency?

READING what you are WRITING



DEALING WITH EVENTUAL CONSISTENCY

Reading what you're writing

https://movies.com/subscription/edit/

Home Movies Theaters

Get a subscription

Enter your details

Full Name:

Subscription type:

Address:

Payment type:

City:

Country:

[Get subscription](#)



https://movies.com/subscription/details/

Home Movies Theaters

Subscription

Your subscription details

Full Name : Dennis van der Stelt

Address : Van Zandvlietplein 1

City : Rotterdam

Country : The Netherlands

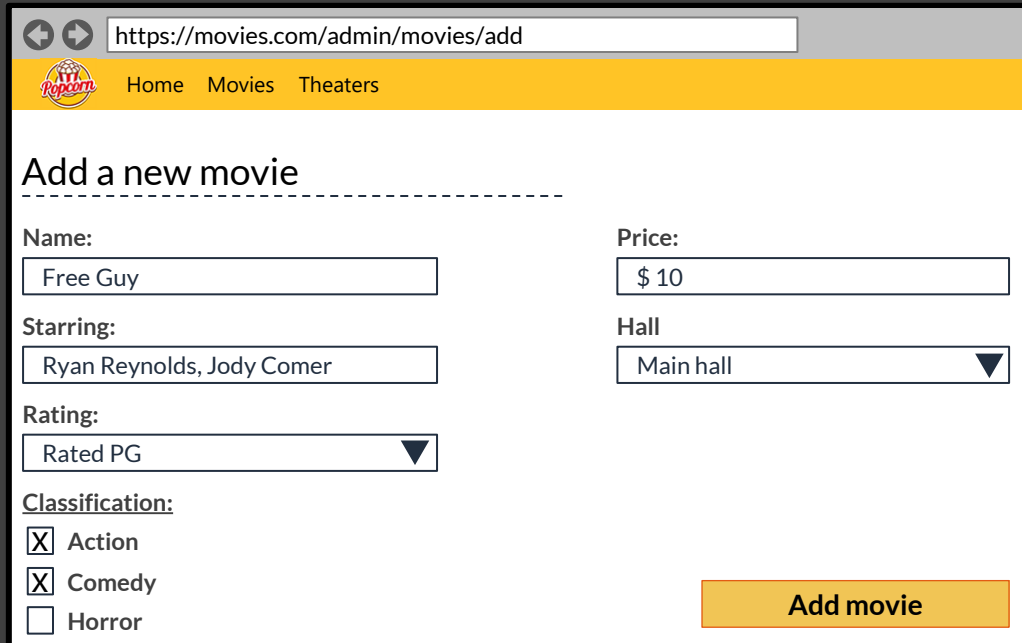
Subscription type Premium

Payment type Monthly payment

[Edit subscription](#)

DEALING WITH EVENTUAL CONSISTENCY

When you're not reading your own writes...



https://movies.com/admin/movies/add

Home Movies Theaters

Add a new movie

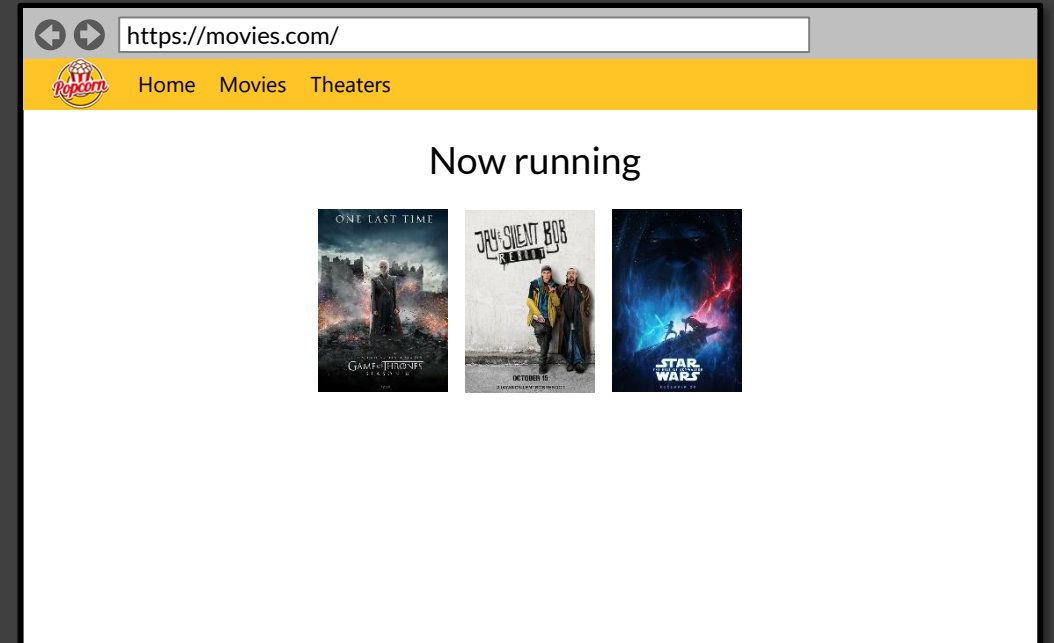
Name: Price:

Starring: Hall:

Rating:

Classification:

Action
 Comedy
 Horror



https://movies.com/

Home Movies Theaters

Now running

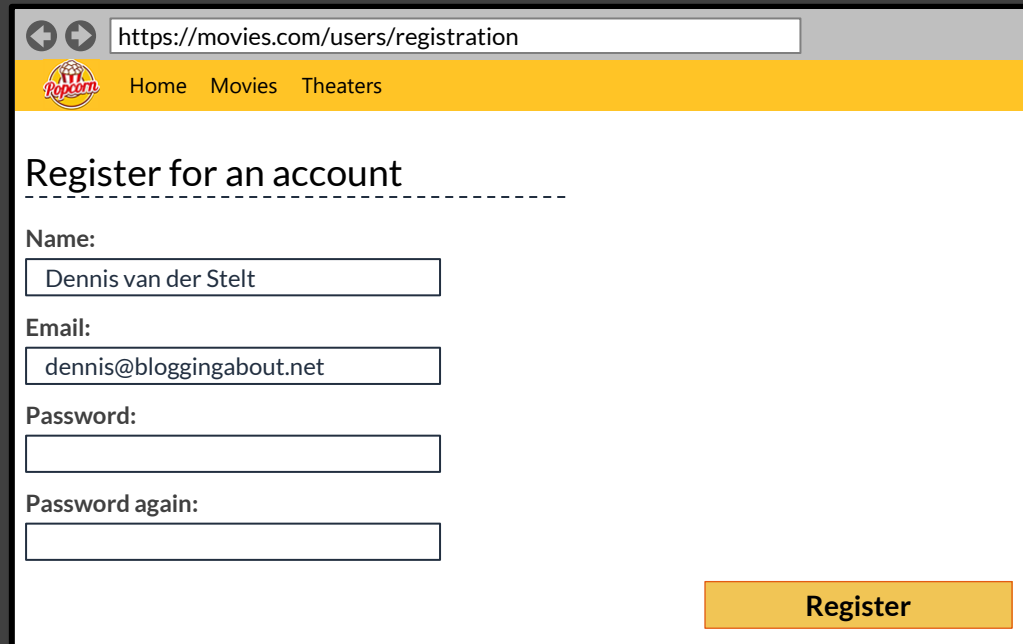
ONE LAST TIME
GAME OF THRONES SEASON 8

JOBY SILENT BOB
OCTOBER 15

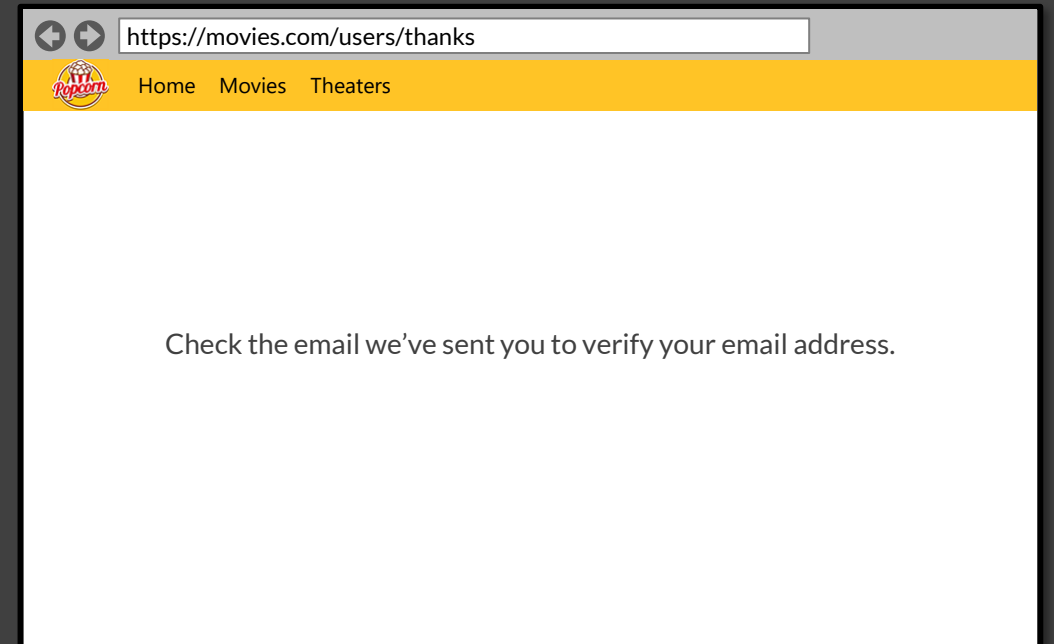
STAR WARS
THE FORCE AWAKENS

DEALING WITH EVENTUAL CONSISTENCY

When you're not reading your own writes...



A screenshot of a web browser showing the registration page for movies.com. The address bar contains 'https://movies.com/users/registration'. The page has a yellow navigation bar with 'Home', 'Movies', and 'Theaters' links. Below the navigation bar is a heading 'Register for an account' followed by a dashed line. There are four input fields: 'Name' with 'Dennis van der Stelt', 'Email' with 'dennis@bloggingabout.net', 'Password', and 'Password again'. A yellow 'Register' button is at the bottom right.



A screenshot of a web browser showing the confirmation page for movies.com. The address bar contains 'https://movies.com/users/thanks'. The page has a yellow navigation bar with 'Home', 'Movies', and 'Theaters' links. The main content area contains the text: 'Check the email we've sent you to verify your email address.'

DEALING WITH EVENTUAL CONSISTENCY

When you are reading your own writes

https://movies.com/subscription/edit/

Home Movies Theaters

Get a subscription

Enter your details

Full Name:

Address:

City:

Country:

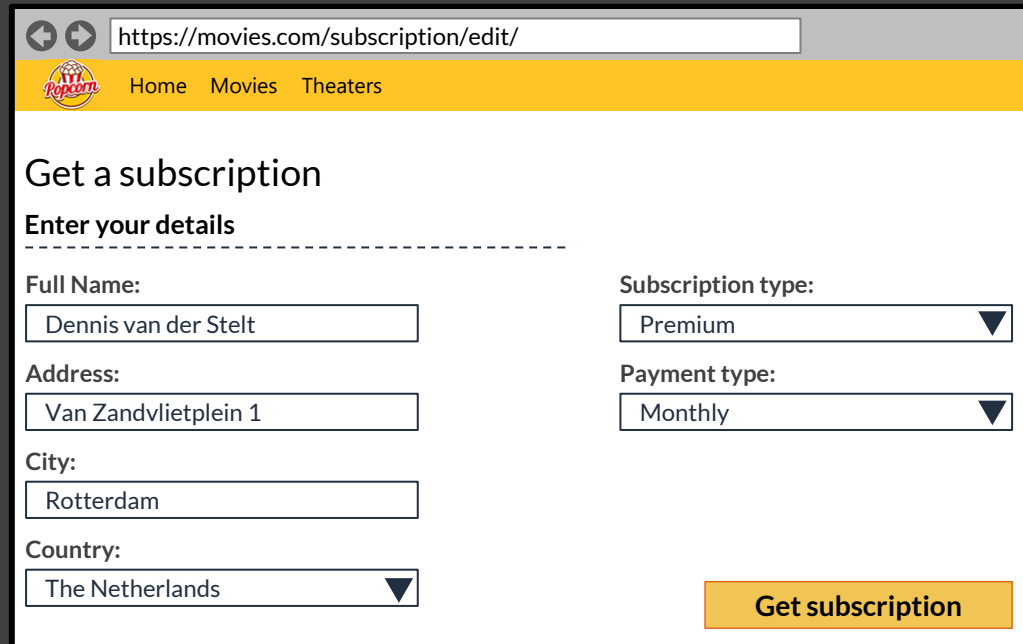
Subscription type:

Payment type:

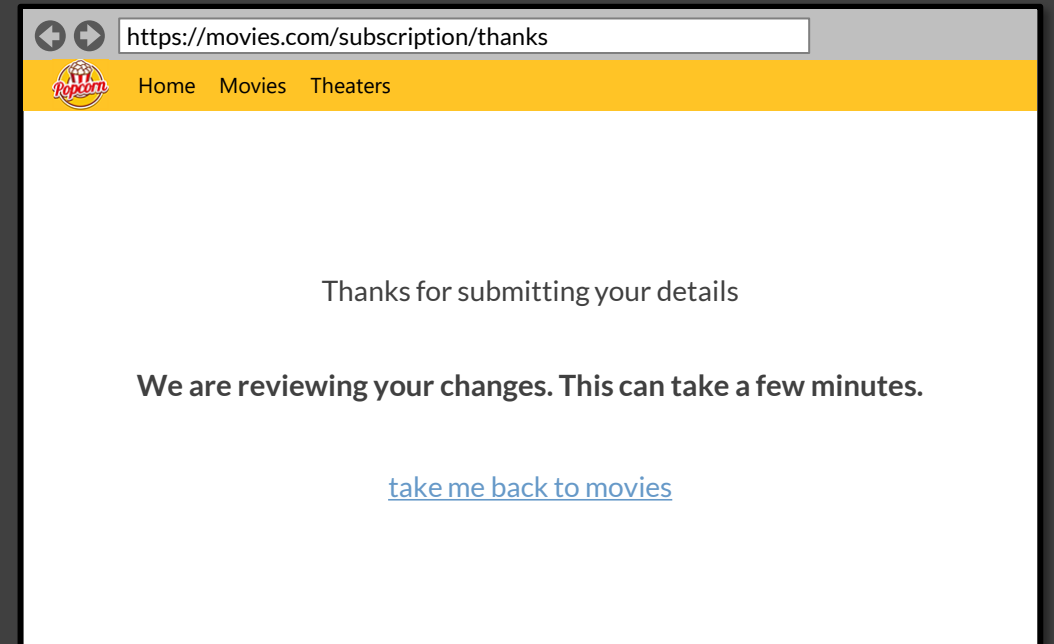


DEALING WITH EVENTUAL CONSISTENCY

Reading your own writes – the simplest solution



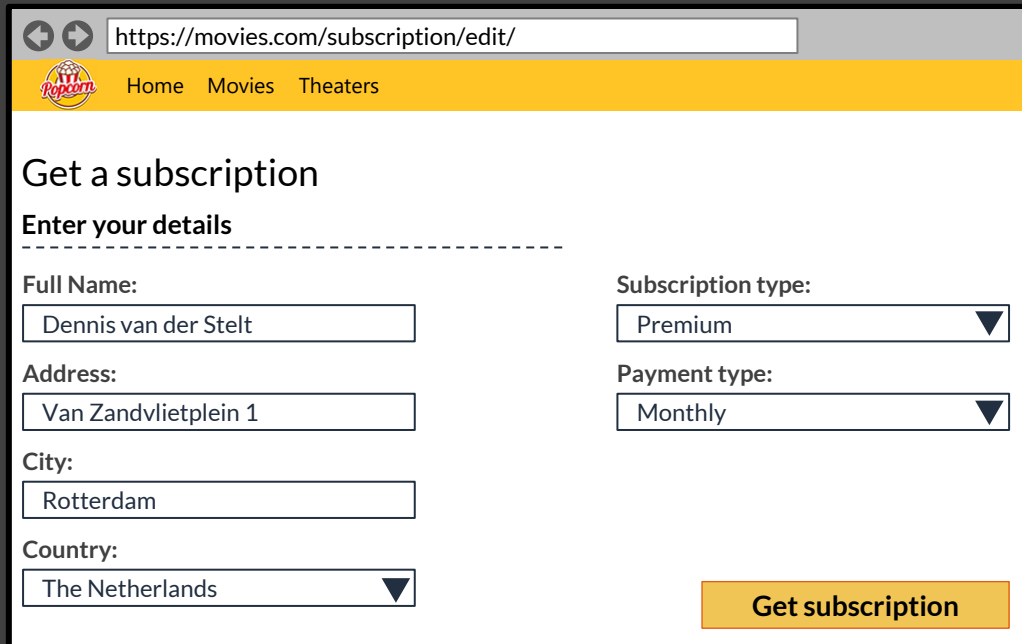
A screenshot of a web browser showing the URL `https://movies.com/subscription/edit/`. The page features a yellow navigation bar with the 'Popcorn' logo and links for 'Home', 'Movies', and 'Theaters'. The main content area is titled 'Get a subscription' and 'Enter your details'. It contains several input fields: 'Full Name' (Dennis van der Stelt), 'Address' (Van Zandvlietplein 1), 'City' (Rotterdam), and 'Country' (The Netherlands). There are also two dropdown menus: 'Subscription type' (Premium) and 'Payment type' (Monthly). A yellow 'Get subscription' button is located at the bottom right of the form.



A screenshot of a web browser showing the URL `https://movies.com/subscription/thanks`. The page features the same yellow navigation bar as the previous screenshot. The main content area displays a message: 'Thanks for submitting your details' followed by 'We are reviewing your changes. This can take a few minutes.' Below this message is a blue link that says 'take me back to movies'.

DEALING WITH EVENTUAL CONSISTENCY

Reading your own writes – another simple solution



https://movies.com/subscription/edit/

Home Movies Theaters

Get a subscription

Enter your details

Full Name:

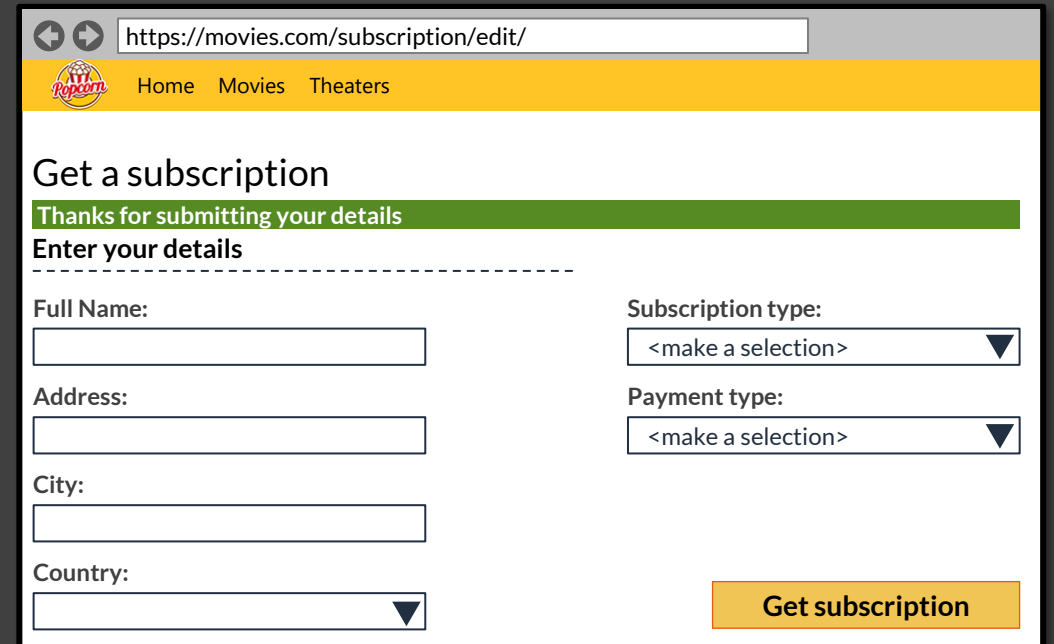
Subscription type:

Address:

Payment type:

City:

Country:



https://movies.com/subscription/edit/

Home Movies Theaters

Get a subscription

Thanks for submitting your details

Enter your details

Full Name:

Subscription type:

Address:

Payment type:

City:

Country:

DEALING WITH EVENTUAL CONSISTENCY

Reading your own writes – providing the best user experience, but for who?

The screenshot shows a Stack Overflow question page. The question is 'Eventual consistency in plain English', asked 7 years, 6 months ago. It has 108 votes and 7 answers. A red arrow points to a comment box containing the text 'Yeah, I'd like to know as well! Thanks for asking!'. The comment box also has an 'Add Comment' button and a character count of 350 characters left.

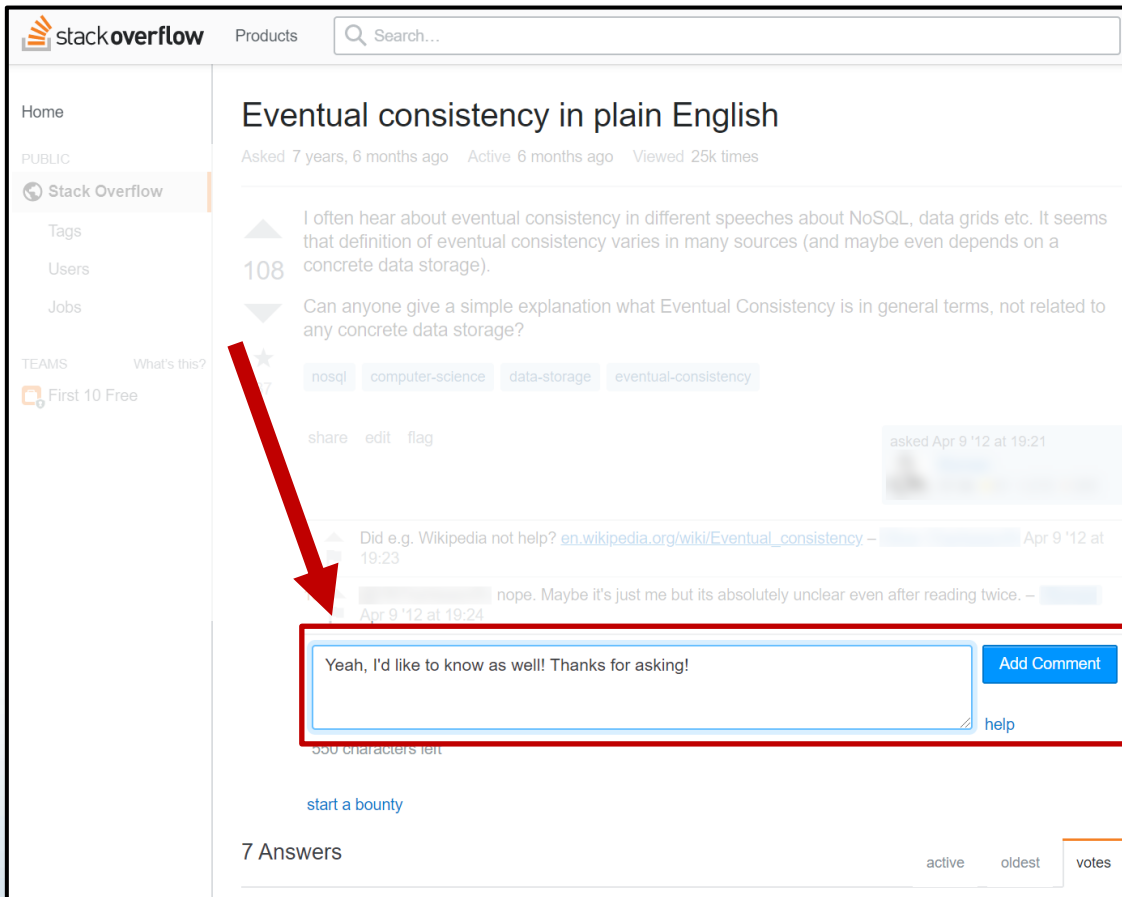
```
<div class="visible">
  <textarea name="comment" />
  <button type="submit">
    Add comment
  </button>
</div>
```



```
<div class="invisible">
  <span class="comment-copy"></div>
  <a href="/users/1337">Name</a>
</div>
```

DEALING WITH EVENTUAL CONSISTENCY

Reading your own writes – providing the best user experience, but for who?



The screenshot shows a Stack Overflow question titled "Eventual consistency in plain English". The question text is: "I often hear about eventual consistency in different speeches about NoSQL, data grids etc. It seems that definition of eventual consistency varies in many sources (and maybe even depends on a concrete data storage). Can anyone give a simple explanation what Eventual Consistency is in general terms, not related to any concrete data storage?". The question has 108 votes and was asked 7 years, 6 months ago. A red arrow points to a comment input field at the bottom of the question, which contains the text "Yeah, I'd like to know as well! Thanks for asking!". The input field has an "Add Comment" button and a "help" link. Below the input field, it says "350 characters left". At the bottom of the question, there is a "start a bounty" link and "7 Answers" with sorting options: "active", "oldest", and "votes".

```
var comments = repository.GetComments();
foreach (var comment in comments)
{
    // display comments
}

var comments = localStorage.GetItem("com
foreach (var comment in comments)
{
    if (!commentWasDisplayedAlready)
        // display localStorage comment
}
```

Demo

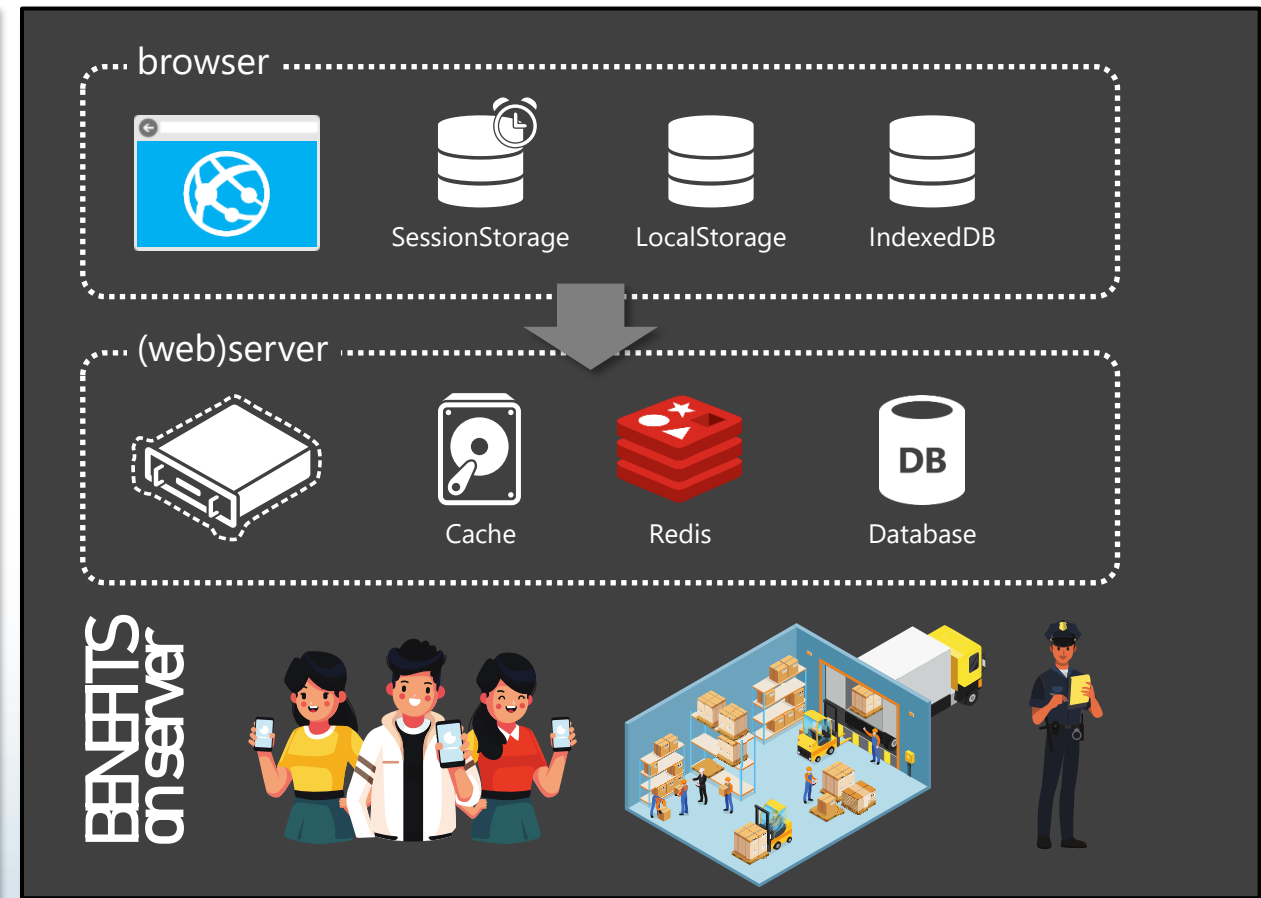
Using LocalStorage to mimic fast response times.

```
$('#submitReviewButton').click(function(e) {  
  
    var comment = $('#comment').val();  
  
    var newReview = {  
        Identifier: guid,  
        ReviewedAt: new Date(),  
        Description: comment  
    };  
  
    localStorage.setItem('popcornStoredReviews', JSON.stringify(newReview));  
  
    $('#comment').val('');  
  
    $('#reviews').append('<li>').append(  
        $('#<div>').attr('class', 'comment').text(newReview)  
    );  
});
```

DEALING WITH EVENTUAL CONSISTENCY

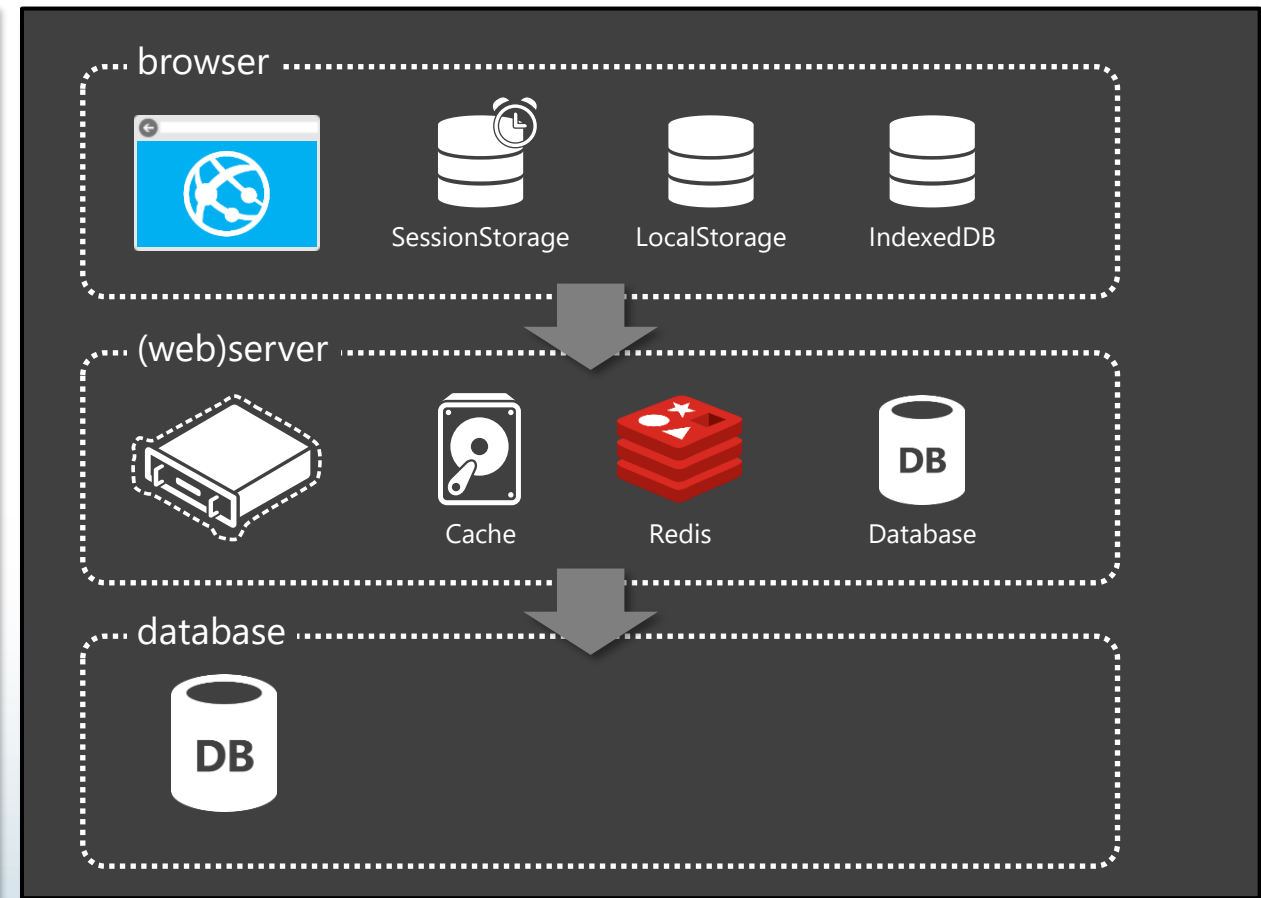
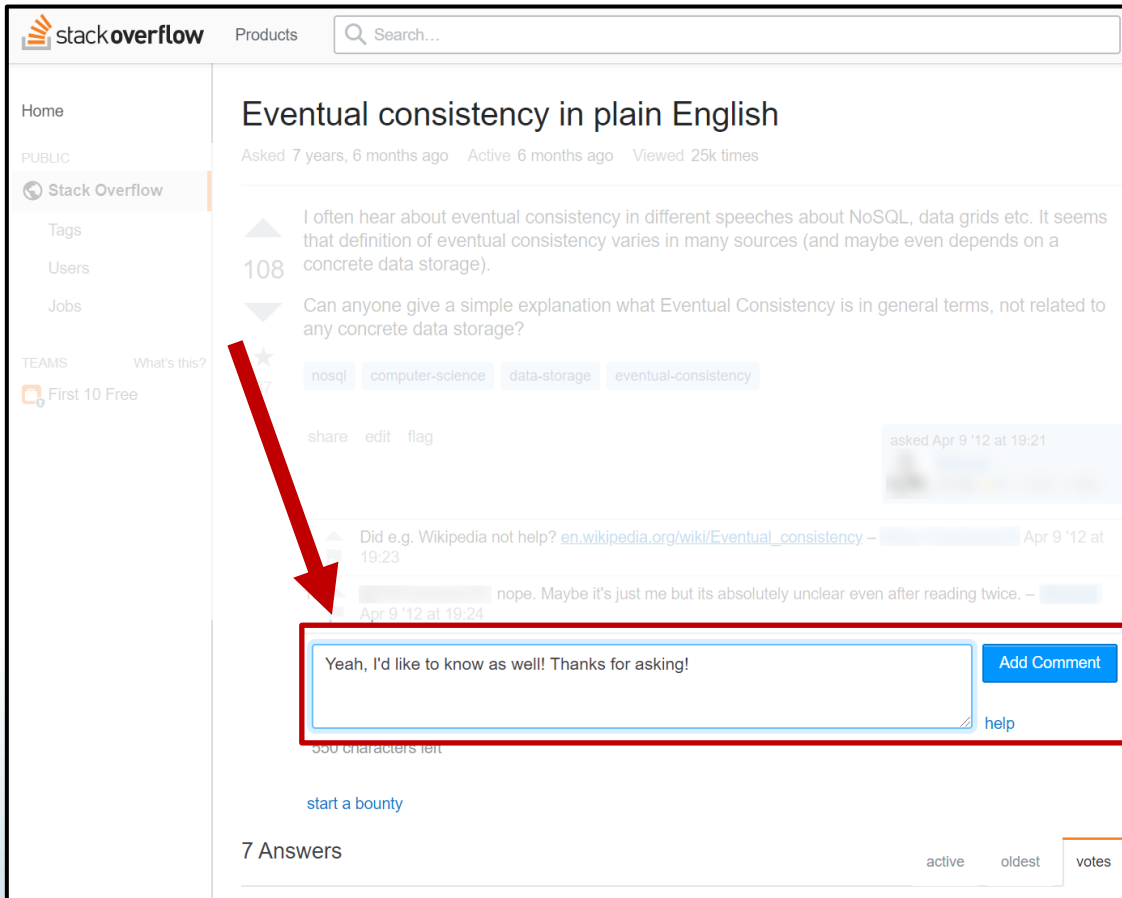
Reading your own writes – providing the best user experience, but for who?

The screenshot shows a Stack Overflow question titled "Eventual consistency in plain English". The question asks for a simple explanation of Eventual Consistency. A red arrow points to a comment that says "Yeah, I'd like to know as well! Thanks for asking!". The comment is highlighted with a red box. The question has 108 votes and 7 answers.



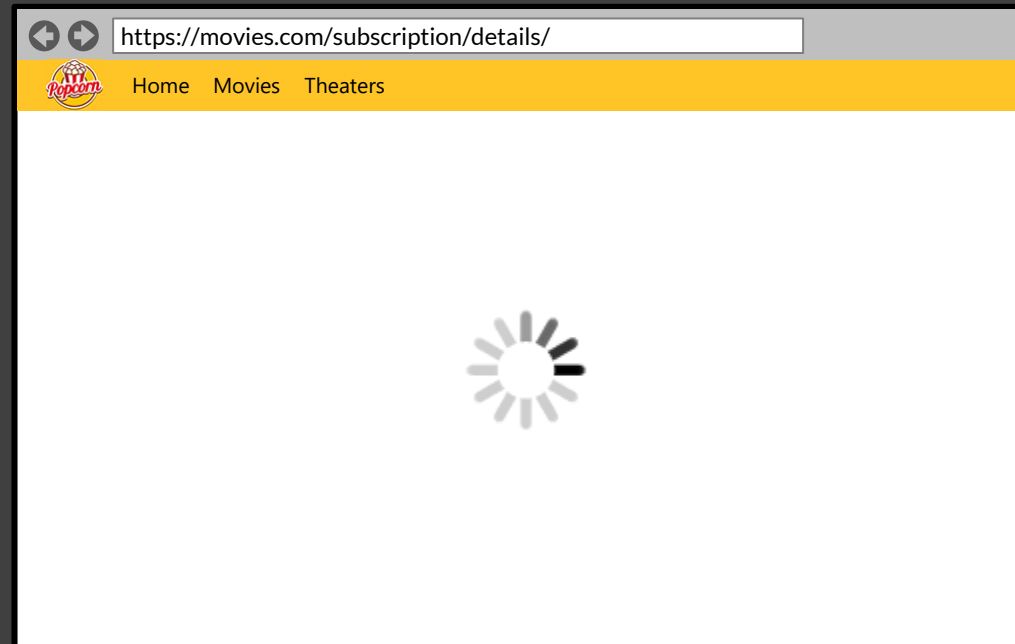
DEALING WITH EVENTUAL CONSISTENCY

Reading your own writes – providing the best user experience, but for who?



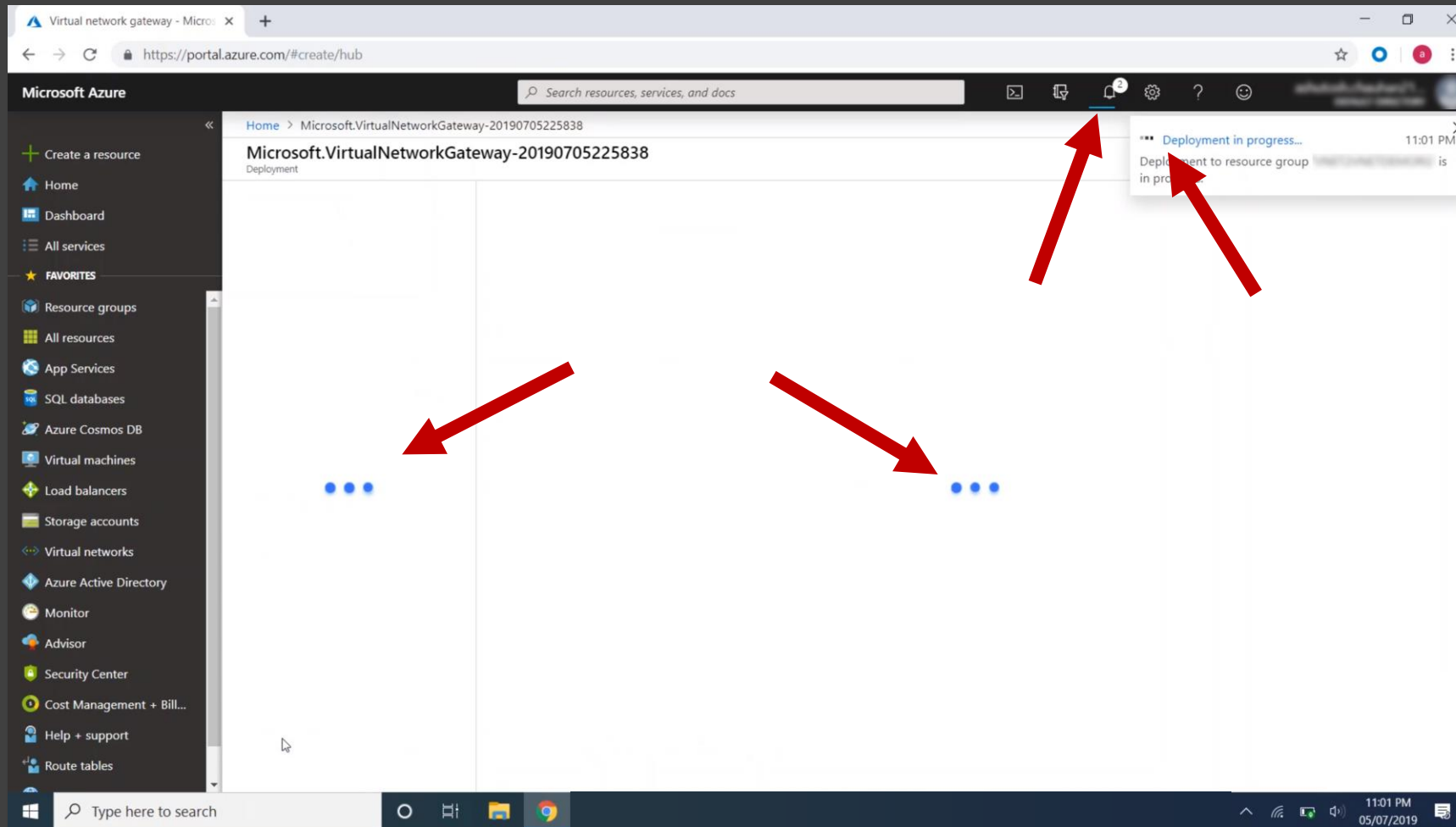
DEALING WITH EVENTUAL CONSISTENCY

Another simple solution – waiting for something happening in the background



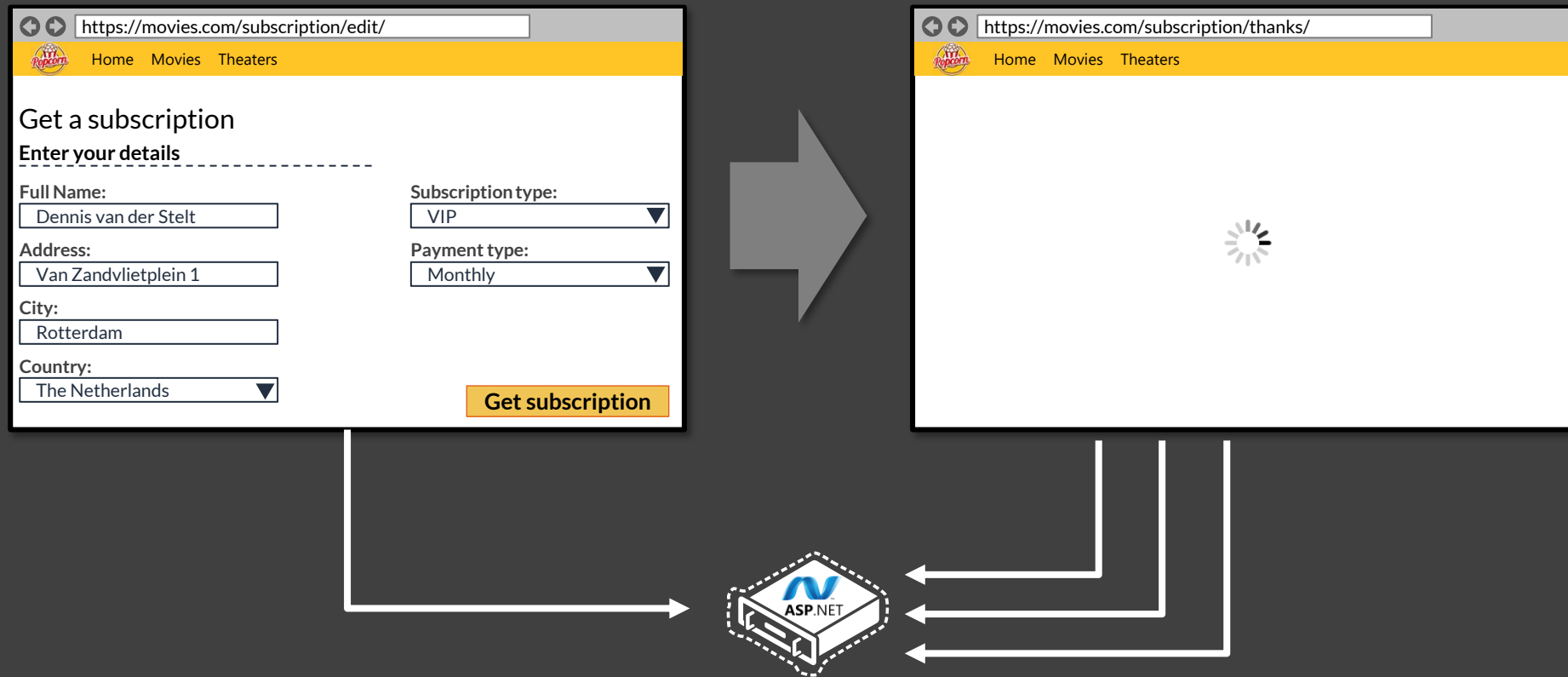
DEALING WITH EVENTUAL CONSISTENCY

Another simple solution – waiting for something happening in the background



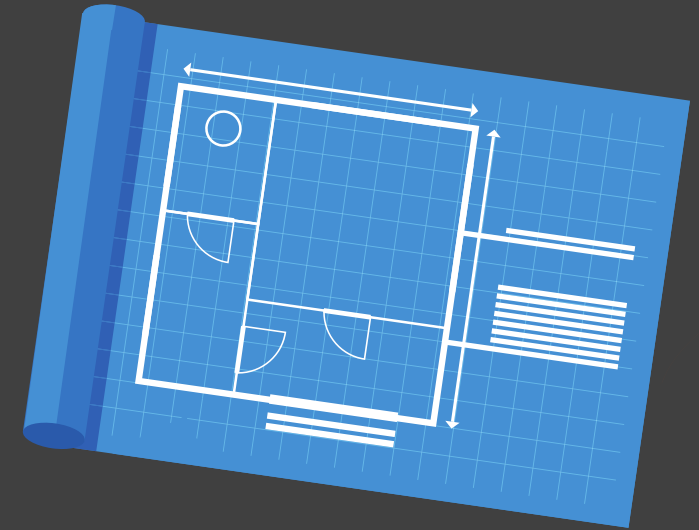
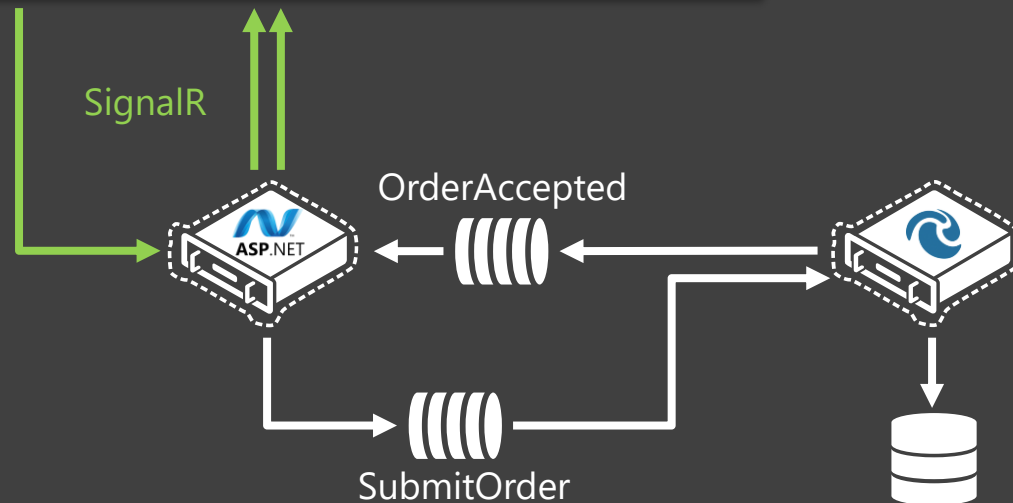
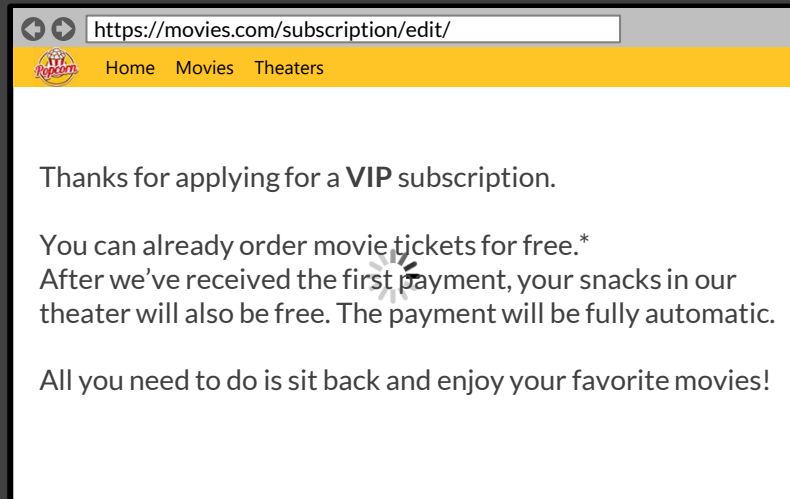
ASYNCHRONOUS EXECUTION

Keeps a callback thread open on the client and frequently polls the server



ASYNCHRONOUS COMMUNICATION

Using asynchronous messaging and SignalR



Demo

Ordering movie tickets using NServiceBus & SignalR

ASYNCHRONOUSLY SUBMITTING A FORM

Set up a SignalR connection and submit the form to the backend

```
$('#submit_button').click(function (e) {  
  
    var connection = new  
        signalR.HubConnectionBuilder().withUrl('/ticketHub').build();  
  
    connection.on('OrderSubmission', function (message) {  
        $('#acknowledgement').html(message);  
    });  
  
    var order = $('#ticketOrderingForm').serialize();  
  
    connection.invoke("SubmitOrder", order);  
});
```

ASYNCHRONOUSLY SUBMITTING A FORM

Accept SignalR message and use NServiceBus to send message to queue

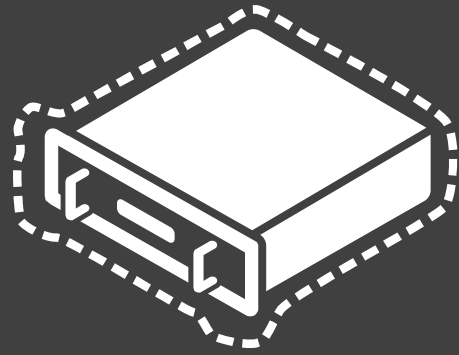
```
public class TicketHub : Hub
{
    IMessageSession messageSession;

    public TicketHub(IMessageSession messageSession) {
        this.messageSession = messageSession;
    }

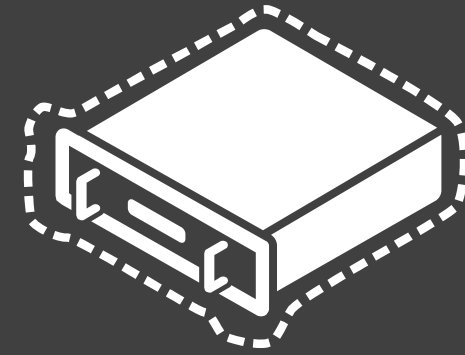
    public async Task SubmitOrder(var order)
    {
        await messageSession.Send(new SubmitOrder(order));
        await this.ReplyToSenderIfLottery(order);
    }
}
```

ASYNCHRONOUSLY SUBMITTING A FORM

The message is now in the queue



Website / SignalR Hub



Server Process

ASYNCHRONOUSLY SUBMITTING A FORM

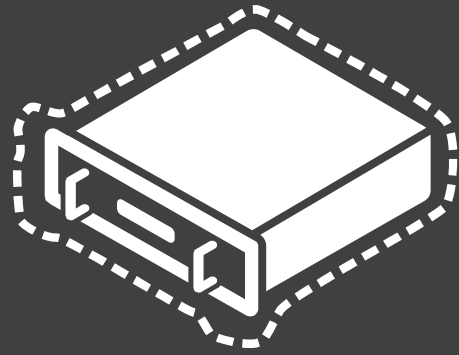
NServiceBus handler processing message and replying with answer.

```
public class SubmitOrderHandler : IHandleMessages<SubmitOrder>
{
    public async Task Handle(SubmitOrder message, IMessageHandlerContext context)
    {
        var result = await RegisterOrder(message);

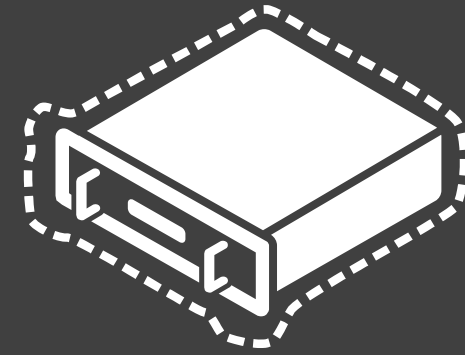
        return await context.Reply(new OrderSubmission(result));
    }
}
```


ASYNCHRONOUSLY REPLYING BACK TO WEBSITE

Another message is now in the receiving queue for the website



Website / SignalR Hub



Server Process

ASYNCHRONOUSLY SUBMITTING A FORM

NServiceBus handler [in website](#) using SignalR to reply to browser

```
public class OrderSubmissionHandler : IHandleMessages<OrderSubmission>
{
    IHubContext<TicketHub> ticketHubContext;

    public OrderSubmissionHandler(IHubContext<TicketHub> ticketHubContext) {
        this.ticketHubContext = ticketHubContext;
    }

    public Task Handle(OrderSubmission message, IMessageHandlerContext context)
    {
        return ticketHubContext.Clients.User(user).SendAsync("OrderSubmission",
                                                                ticket);
    }
}
```

What about the business?

Dealing with eventual consistency in the business



HOW THE BUSINESS DEALS WITH EVENTUAL CONSISTENCY

Eventual consistency is baked into the business

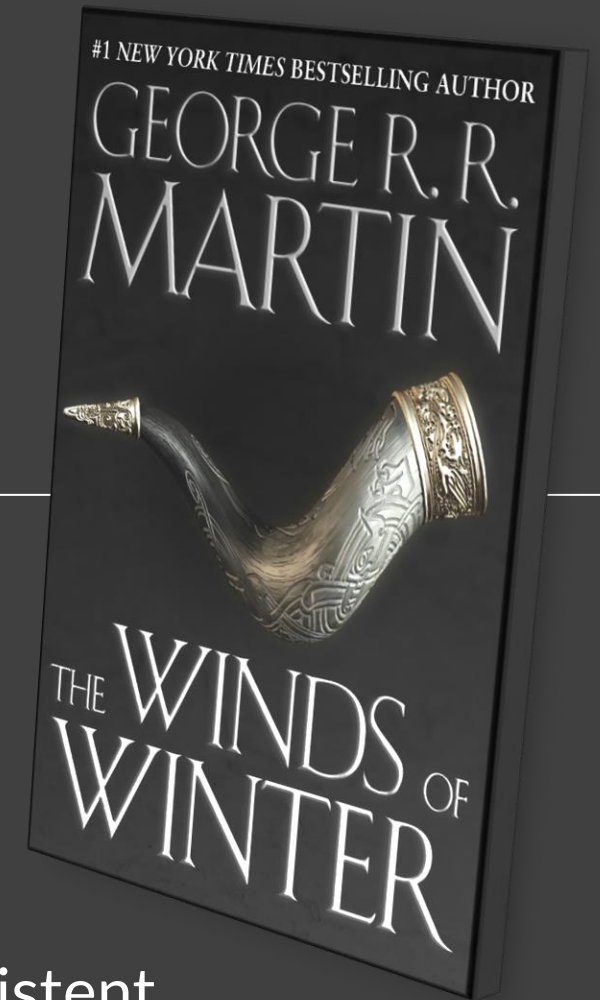
Inventory table

Id	Name	Price	Quantity
42	i can has cheezburger?	\$ 15.00	10
1337	The Winds of Winter	\$ 25.00	1000

Inventory table

ProductId	Delta	Timestamp
1337	-5	09:03:22 17-1-2016
1337	-3	09:03:24 17-1-2016
1337	-4	09:03:25 17-1-2016
1337	-1	09:03:27 17-1-2016
1337	+250	09:03:28 17-1-2016
1337	-4	09:03:30 17-1-2016

- ⌚ EventSourcing done simple
- ⌚ No locking, append only
- ⌚ Inventory is eventually consistent
No transactional lock to discover the current inventory left





Hello,

Due to a technical issue during our recent sale, we mistakenly took more orders for the Steam Controller than we were able to fulfill, including yours.

Currently there are no plans to produce more of this product, so we are unable to send you a Steam Controller and have prompted a full refund of your purchase.

Please note some payment methods may take several business days to show the refunded amount has returned to your account.

We sincerely apologize for the confusion and inconvenience.

If you have any further questions, please feel free to contact [Steam Support](#).



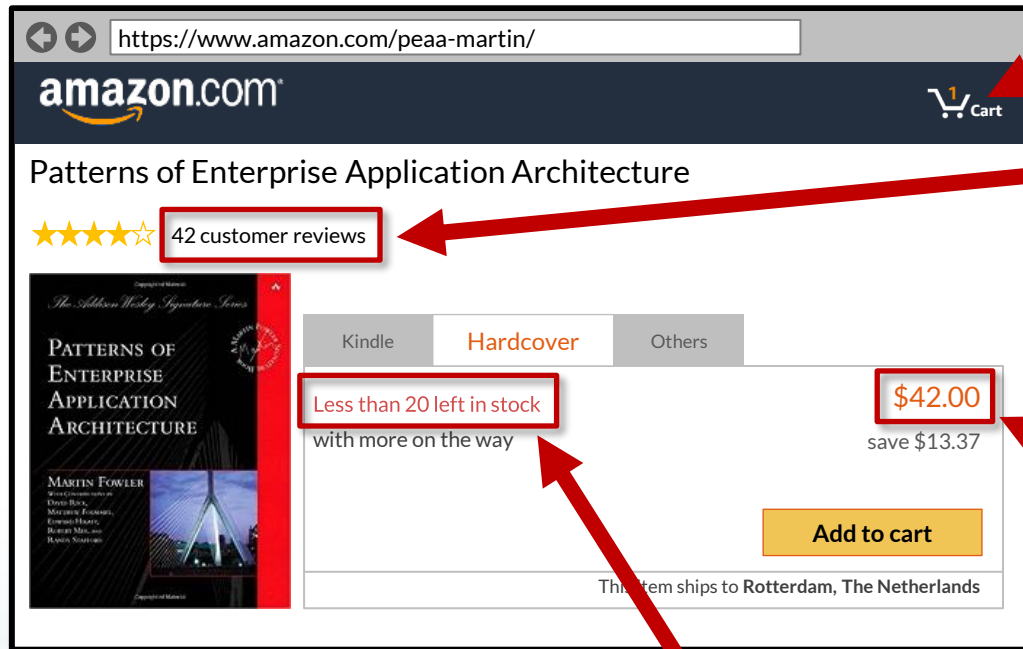
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STEAM
CONTROLLER

HOW THE BUSINESS DEALS WITH EVENTUAL CONSISTENCY

Fake consistency in the user interface



how important is it

**that all numbers
are 100% accurate?**

HOW THE BUSINESS DEALS WITH EVENTUAL CONSISTENCY

When you're faking it, please do it well...

The screenshot shows the OneTravel website interface for reviewing a flight. At the top, the OneTravel logo is on the left, and the text 'Book Online Now and Get 24/7 Toll-Free Customer Support 1-888-571-4078' is on the right. Below the logo, the text 'Price displayed in: USD \$' is visible. The main heading is 'Review Trip Details and Book' with the subtext 'Just one final step, then you're on your way to lasi!'. A 'Go back' button is on the left. A yellow banner says 'Book Now: Only 1 ticket left at \$261.20 per person!'. The 'Flight Summary' section shows a green banner: 'You saved \$357.40 by selecting this nearby airport'. Below this, a green checkmark indicates 'Good Choice! This deal is backed by our Price Match Promise.' and another green checkmark indicates '24 hour cancellation'. The flight details are as follows:

Carrier	Day	Time	Origin	Duration	Stop	Destination	Time
TAROM	Tue Feb 25	11:40a	AMS	10h 15m	1 stop	IAS	10:55p
TAROM	Sat Feb 29	05:45a	IAS	5h 55m	1 stop	AMS	10:40a

Both flights are in 'Cabin: Coach' and have a 'Nearby airport' label. A red arrow points from the '37 people are looking at this flight.' notification to the flight details. The right sidebar contains a 'Book now before tickets run out!' section with a timer showing '19:55' (19 min 55 sec) and a 'Secure SSL Booking' section with McAfee and Norton logos.

HOW THE BUSINESS DEALS WITH EVENTUAL CONSISTENCY

When you're faking it, please do it well...

The image shows a browser window displaying a flight booking website. The website has a dark header with "Customer Support 1-888-571-4078" and a price display. A notification bubble says "37 people are looking at this flight." Below this is a "Book now before tickets run out!" section with a 17:04 timer. Further down are security logos for McAfee and Norton. The browser's developer tool is open on the right, showing the HTML structure. A red box highlights the following code snippet:

```
<span class="view_notification_random">37</span> == $0  
  " people"  
</b>  
  " are looking at this flight."  
  ::after  
</span>
```


HOW THE BUSINESS DEALS WITH EVENTUAL CONSISTENCY

When you're faking it, please do it well...

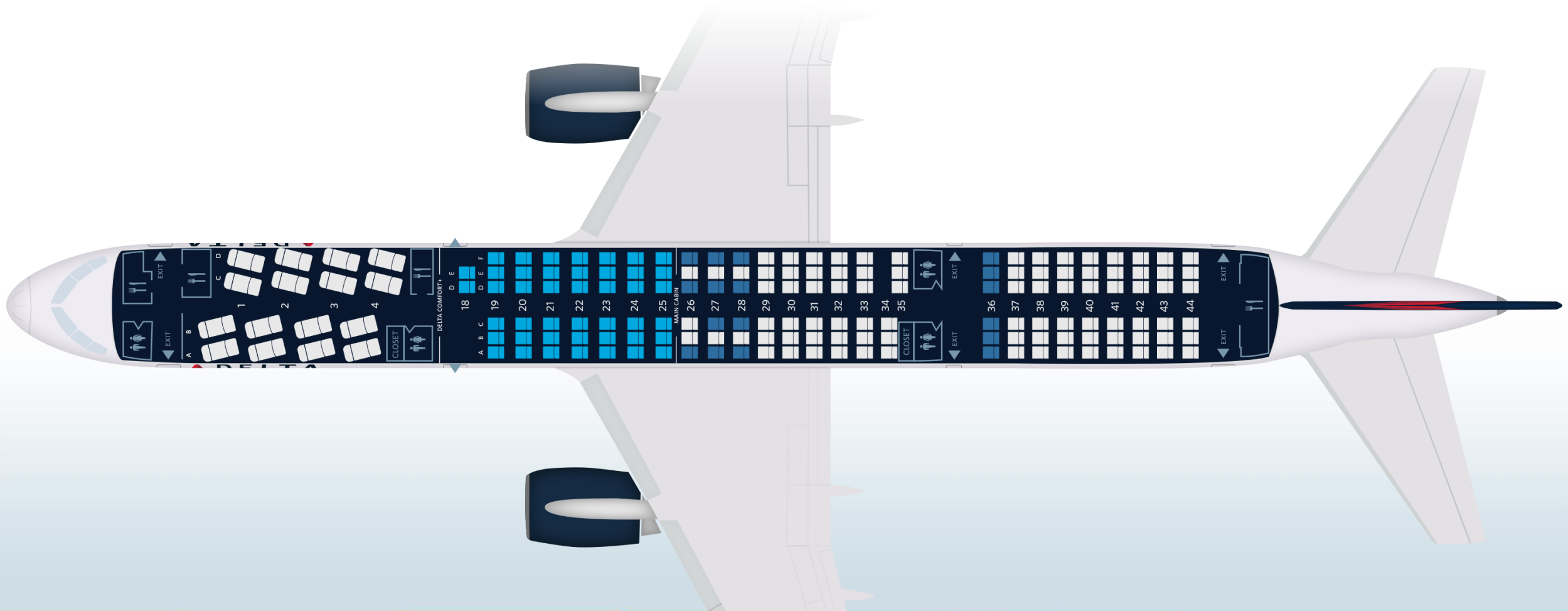
The screenshot shows a flight booking interface with a green notification bubble stating "37 people are looking at this flight." Below this, there's a "Book now before tickets run out!" section with a large "13:04" timer. Further down, there's a "Secure SSL Booking" section with McAfee and Norton logos. The browser's developer console is open, displaying a file explorer on the left and JavaScript code on the right. A red box highlights a specific JavaScript function in the console that simulates a notification:

```
var u = 28
, c = Math.floor(Math.random() * (45 - u)) + u;
for ($("#view_notification_random").text(c),
$("#payment-page-errors_inner").find(".validation-s
```

The code in the console includes various jQuery and JavaScript snippets, such as `$("#cardHolderName_1 input").val($("#PaymentList_0_...)` and `$("#is--phone-number input").attr("placeholder", "");`. The highlighted code is a function that generates a random number between 0 and 45 (excluding 28) and updates the text of a notification element.

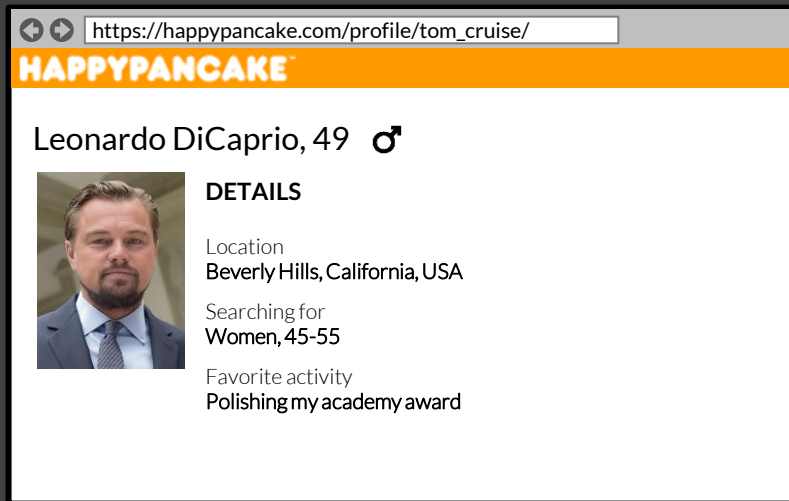
HOW THE BUSINESS DEALS WITH EVENTUAL CONSISTENCY

A hybrid solution, optimized for customer satisfaction and consistency



HOW THE BUSINESS DEALS WITH EVENTUAL CONSISTENCY


Putting good user experience before occasional money loss



Browser address bar: https://happypancake.com/profile/tom_cruise/

HAPPYPANCAKE™

Leonardo DiCaprio, 49 ♂

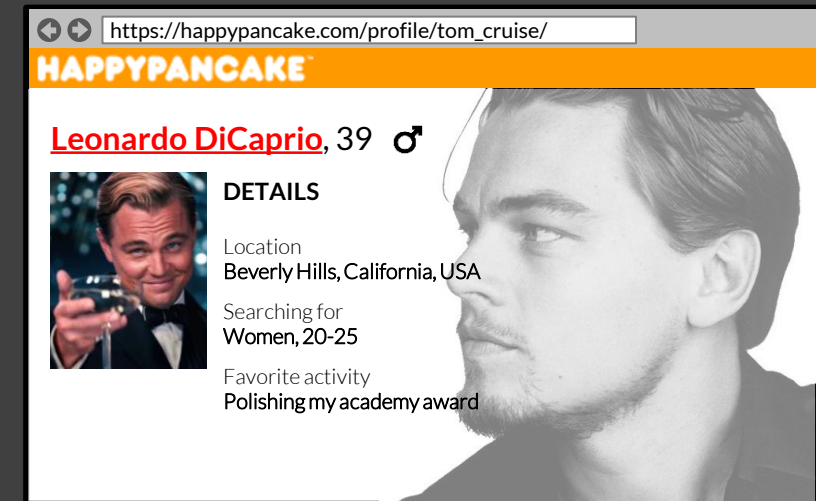


DETAILS

Location
Beverly Hills, California, USA

Searching for
Women, 45-55

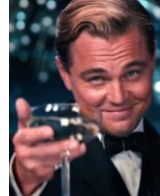
Favorite activity
Polishing my academy award



Browser address bar: https://happypancake.com/profile/tom_cruise/

HAPPYPANCAKE™

Leonardo DiCaprio, 39 ♂



DETAILS

Location
Beverly Hills, California, USA

Searching for
Women, 20-25

Favorite activity
Polishing my academy award

strong consistency VS user experience

WHAT PROBLEM ARE WE TRYING TO SOLVE

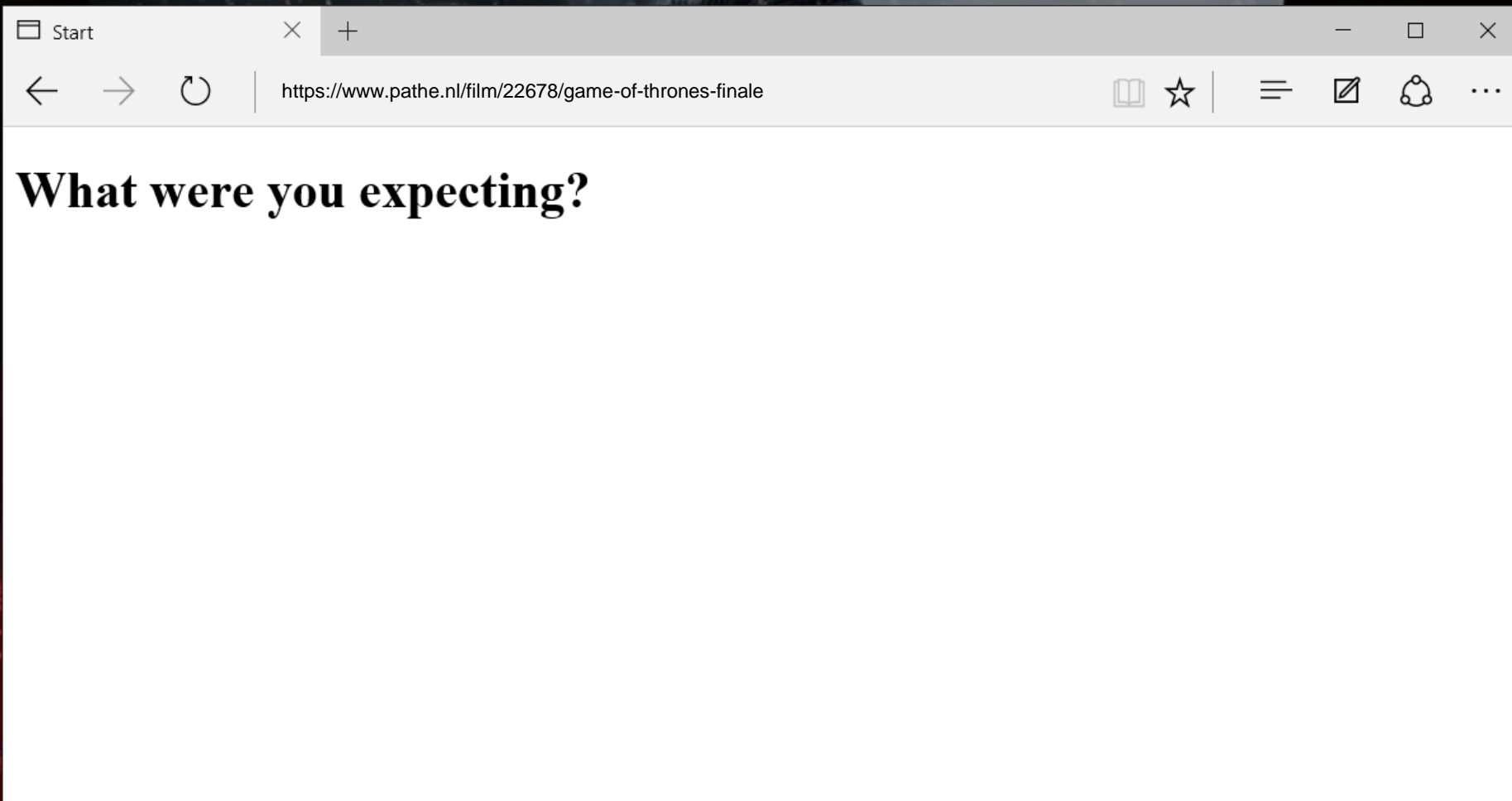
Eventual Consistency is not scary!



WHAT PROBLEM ARE WE SOLVING?

Strive for high customer satisfaction, and talk to the business





Start × +

← → ↻ | <https://www.pathe.nl/film/22678/game-of-thrones-finale> | 📖 ☆ | ☰ ✎ 🔔 ⋮

What were you expecting?



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Solution Architect specialized in distributed systems.

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 calendly.com/dvdstelt 

 <https://go.particular.net/warsaw24>