



WELCOME

From RDBMS to NoSQL at Enterprise Scale



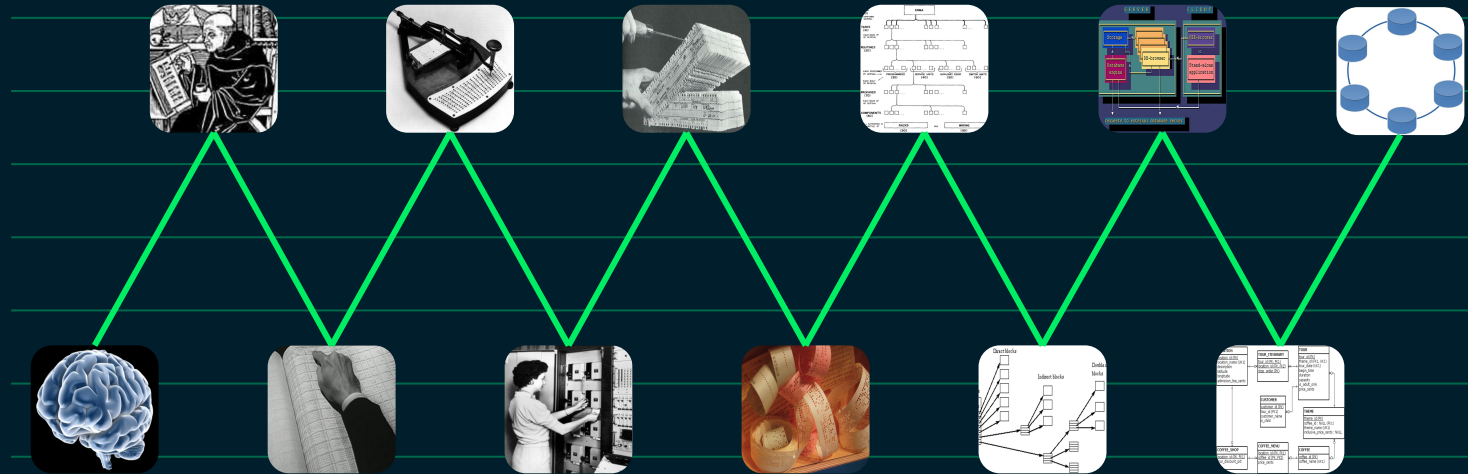
Jan Göbel

Solutions Architect



Timeline of Database Technology

Data Pressure

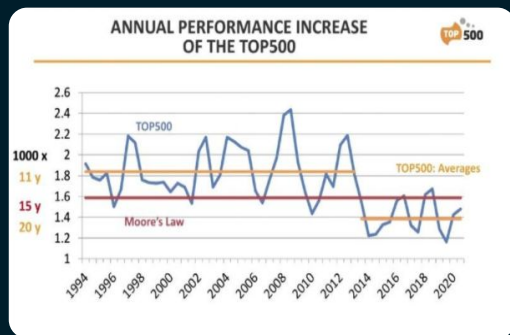
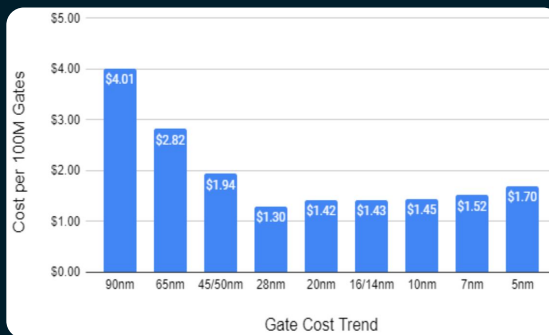
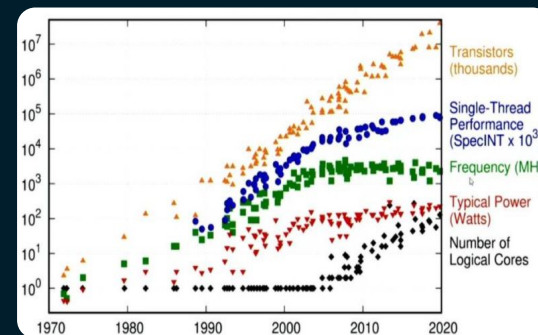




Moore's Law no longer an enabler

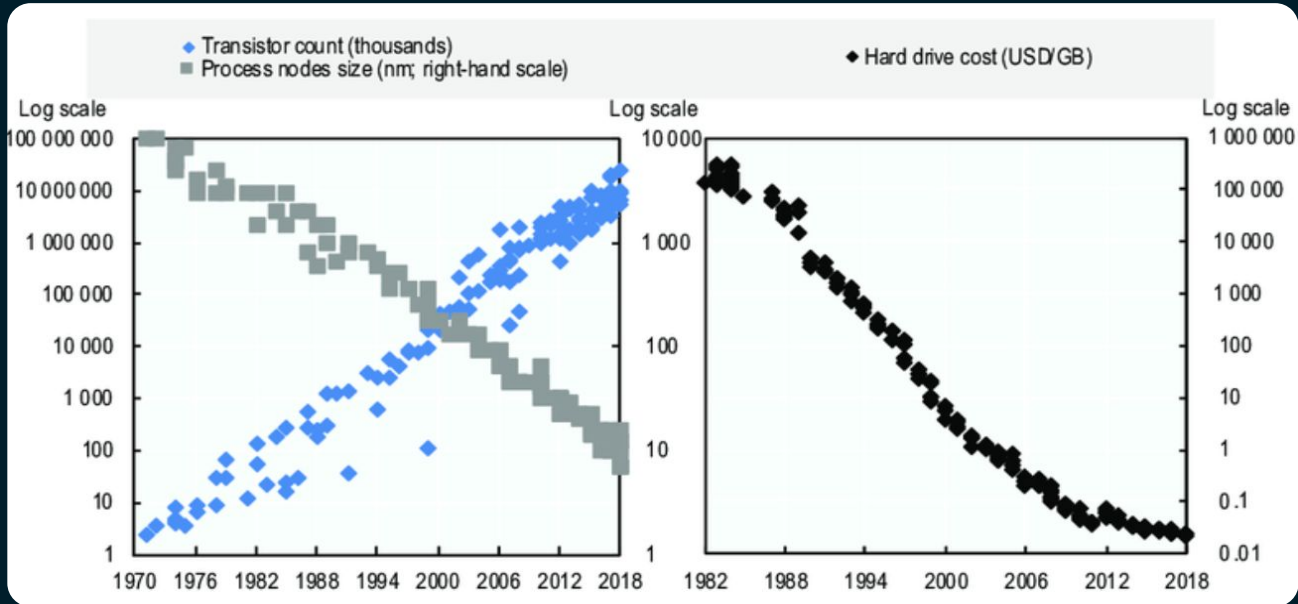
“ the number of transistors on an integrated circuit will double every two years with minimal rise in cost ”

CPU performance is flattening





Cost of storage continues to fall

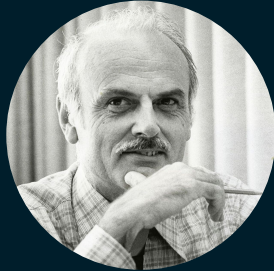




It's not new thinking...

Codd, Edgar F. "A relational model of data for large shared data banks." Communications of the ACM 13.6 (1970): 377-387.

Normalization

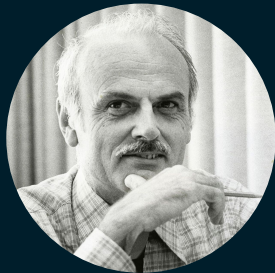


“

The simplicity of the array representation which becomes feasible when all relations are cast in normal form is not only an advantage for storage purposes but also for communication of bulk data between systems which use widely different representations of the data.

Normalization optimizes storage and simplifies different representations of data

Denormalization

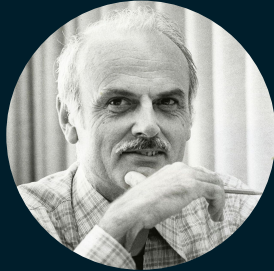


“

If the strong redundancies in the named set are directly reflected in strong redundancies in the stored set (or if other strong redundancies are introduced into the stored set), then, generally speaking, extra storage space and update time are consumed with a potential drop in query time for some queries and in load on the central processing units.

Denormalization requires
more storage but gives
faster queries and lower
CPU loads

ERD Design



“

Ideally, the variety of permitted data representations should be just adequate to cover the spectrum of performance requirements of the total collection of installations. Too great a variety leads to unnecessary overhead in storage and continual reinterpretation of descriptions for the structures currently in effect.”

(De)normalize to meet your requirements

Why the document data model?

SQL

MongoDB

Optimized for storage

Normalized/relational

Optimized for compute

De-normalized/hierarchical

Why the document data model?

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Optimized for storage

Optimized for compute

Normalized/relational

De-normalized/hierarchical

Ad hoc queries

Well-known queries

Why the document data model?

SQL

MongoDB

Optimized for storage	Optimized for compute
Normalized/relational	De-normalized/hierarchical
Ad hoc queries	Well-known queries
Scale vertically	Scale horizontally

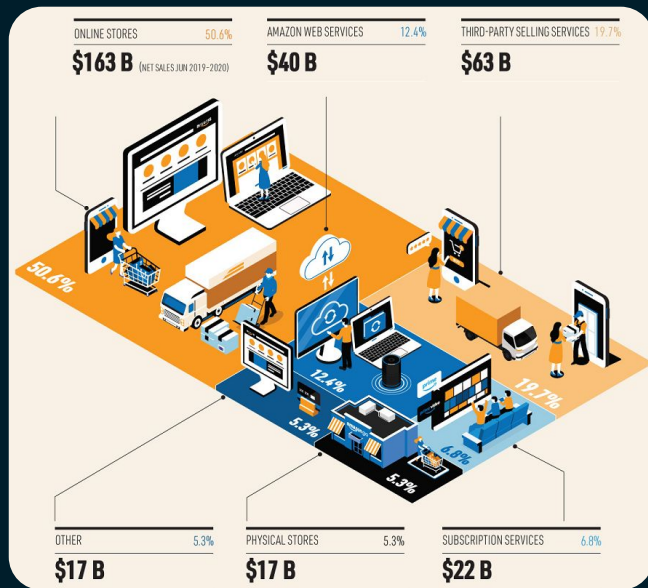
Why the document data model?

SQL

MongoDB

Optimized for storage	Optimized for compute
Normalized/relational	De-normalized/hierarchical
Ad hoc queries	Well-known queries
Scale vertically	Scale horizontally
Good for OLAP	Built for OLTP at scale - but also good at analytics

Not really “Born in the Cloud”...



“Amazon was founded in 1995 & built on monolithic services.

\$5B company when SOA became an internal standard in ‘05.

By 2018 scale was breaking many things

- 3K Oracle instances
- 10K Application Services
- 25K Developers

Cost of RDBMS was a big line item

- Largest Oracle license in the world
- High infrastructure TCO

Maybe a better way?



Access patterns drive cost



- At Amazon in 2017, 70% of queries accessed a single row of data
- 20% more accessed a range of rows from a single table
- Up to 50% of infrastructure supported the last 10%



Making it Work



It's all about relationships



Social
network



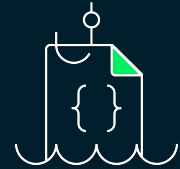
Document
management



Process
control



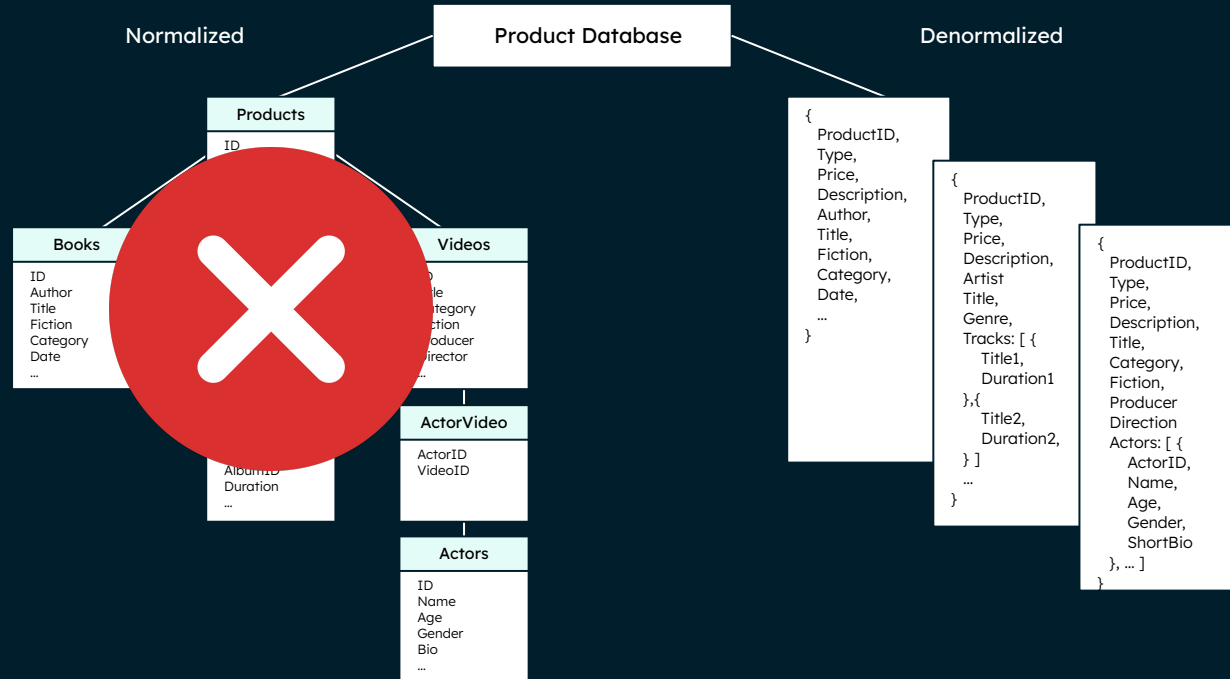
IT monitoring



Data lake



SQL vs. NoSQL design pattern



Ad hoc “joins” in SQL

```
SELECT * FROM PRODUCTS INNER JOIN MOVIES ON
```

```
productId = productId
```

```
WHERE JOIN ACTORS ON productId = actorId
```

```
WHERE JOIN ACTORS ON productId = actorId
```

```
WHERE name = “Movie Title”
```

bookId	productId	author	publisher	ISBN-10
1	1	Mary Shelley	Bantam	553212478
2	4	Charlotte Bronte	Wordsworth	1853260207

albumId	productId	artist	producer	releaseDate
1	2	Dire Straits	Muff Winwood	10/7/78
2	5	Pink Floyd	Pink Floyd	3/1/73

videoId	productId	author	director	releaseDate
1	3	Ann Spielberg	Penny Marshall	6/5/88
2	6	Robert Rodat	Steven Spielberg	7/21/98

actorVideoId	gender	name	birthDate
1	M	Tom Hanks	7/9/56
2	F	Elizabeth Perkins	11/18/60
3	M	Robert Loggia	1/3/30

actorVideoId	videoId	actorId	character
1	1	1	Josh
2	2	1	Captain Miller
3	1	2	Susan
4	1	3	MacMillan

productId	name	type	price
1	Frankenstein	Book	11.99
2	Dire Straits	Album	17.49
3	Big	Video	14.99
4	Jane Eyre	Book	10.99
5	The Dark Side of the Moon	Album	17.49
6	Saving Private Ryan	Video	18.99

trackId	albumId	song	duration
1	1	Down to the Waterline	3:55
2	1	Water of Love	5:23
3	1	Setting Me Up	3:18
4	1	Six Blade Knife	4:10
5	1	Southbound Again	2:58
6	1	Sultans of Swing	5:47
7	1	In the Gallery	6:16
8	1	Wild West End	4:42
9	1	Lions	5:05
10	2	Speak to Me	1:13
11	2	Breathe	2:43
12	2	On the Run	3:36
13	2	Time	4:36
14	2	The Great Gig in the Sky	19:27
15	2	Money	6:23
16	2	Us and Them	7:49
17	2	Any Colour You Like	3:26
18	2	Brain Damage	3:49
19	2	Eclipse	2:03

Time Complexity: $O(\log(N) + N\log(M)) + N\log(M) + N\log(M)$



Modeled “joins” in NoSQL

```
SELECT * WHERE _id = {  
  title: “Frankenstein”  
  type: “book”  
}
```

Time Complexity: $O(\log(N))$

```
{  
  _id: {  
    title: “Frankenstein”,  
    type: “book”  
  },  
  price: 19.50,  
  author: “...”,  
  ...  
}
```



Modeled “joins” in NoSQL

```
SELECT * WHERE _id = {  
  title: “Dire Straits”  
  type: “album”  
}
```

Time Complexity: $O(\log(N))$

```
{  
  _id: {  
    title: “Dire Straits”,  
    type: “album”  
  },  
  price: 21.99,  
  artist: “...”  
  tracks: [  
    {title: “...”, description: “...”},  
    ...  
  ],  
  ...  
}
```



Modeled “joins” in NoSQL

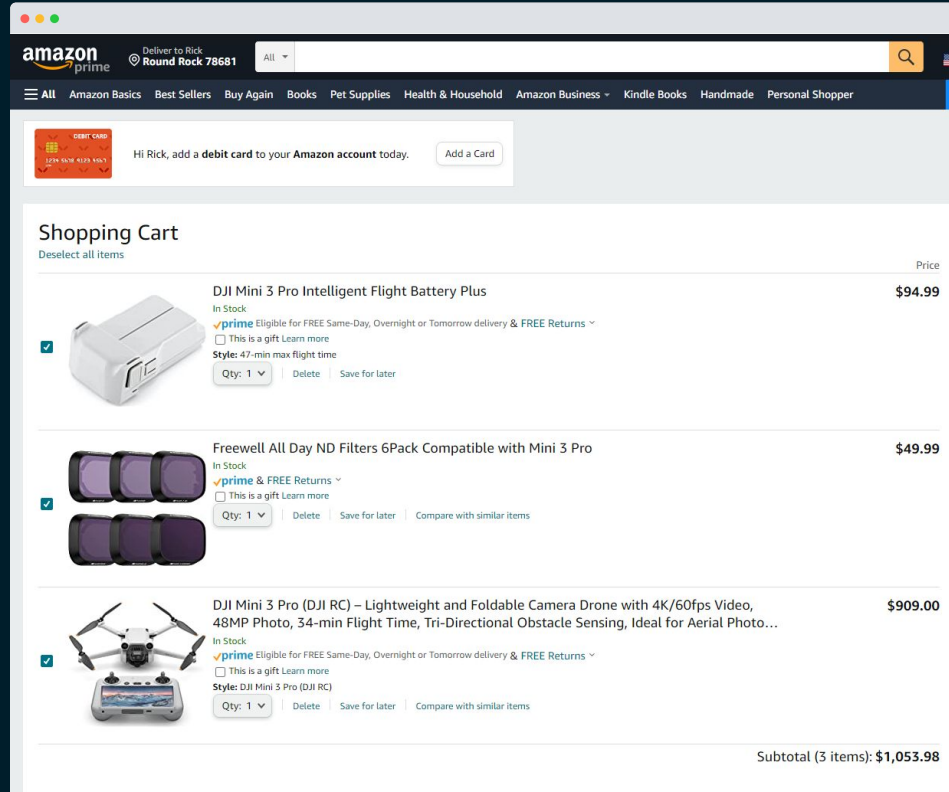
```
SELECT * WHERE _id = {  
  title: “Big”  
  type: “video”  
}
```

Time Complexity: $O(\log(N))$

```
{  
  _id: {  
    title: “Big”,  
    type: “video”  
  },  
  price: 15.40,  
  actors: [  
    {name: “...”, age: “...”, ...},  
    ...  
  ],  
  ...  
}
```



Making the Amazon shopping cart work



```
{
  cartId: "c1111",
  items: [
    {
      sku: "abcd1234",
      ...
    }
  ]
  ...
}
```

amazon prime Deliver to Rick Round Rock 78681 All

Hi Rick, add a debit card to your Amazon account today. Add a Card

Shopping Cart

Deselect all items



DJI Mini 3 Pro Intelligent Flight Battery Plus \$94.99

In Stock
✓prime Eligible for FREE Same-Day, Overnight or Tomorrow delivery & FREE Returns
☐ This is a gift Learn more
Style: 47-min max flight time
Qty: 1 Delete Save for later



Freewell All Day ND Filters 6Pack Compatible with Mini 3 Pro \$49.99

In Stock
✓prime & FREE Returns
☐ This is a gift Learn more
Qty: 1 Delete Save for later Compare with similar items



DJI Mini 3 Pro (DJI RC) - Lightweight and Foldable Camera Drone with 4K/60fps Video, 48MP Photo, 34-min Flight Time, Tri-Directional Obstacle Sensing, Ideal for Aerial Photo... \$909.00

In Stock
✓prime Eligible for FREE Same-Day, Overnight or Tomorrow delivery & FREE Returns
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Style: DJI Mini 3 Pro (DJI RC)
Qty: 1 Delete Save for later Compare with similar items

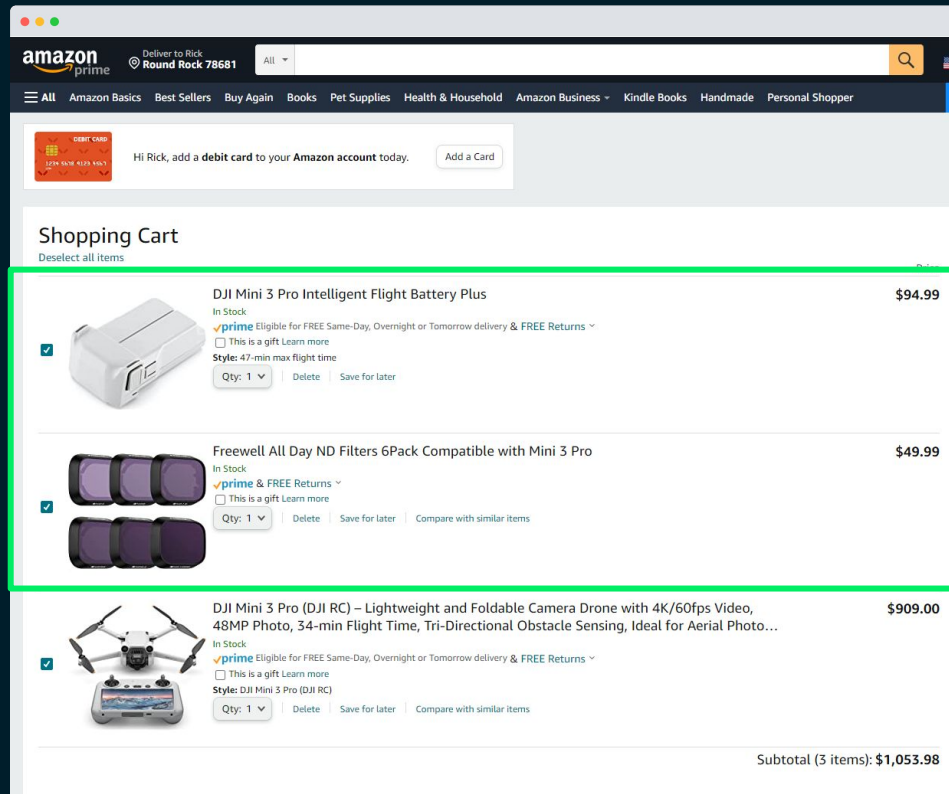
Subtotal (3 items): \$1,053.98



```

{
  cartId: "c1111",
  items: [
    {
      sku: "abcd1234",
      ...
    },
    {
      sku: "bcde2345",
      ...
    }
  ]
  ...
}

```



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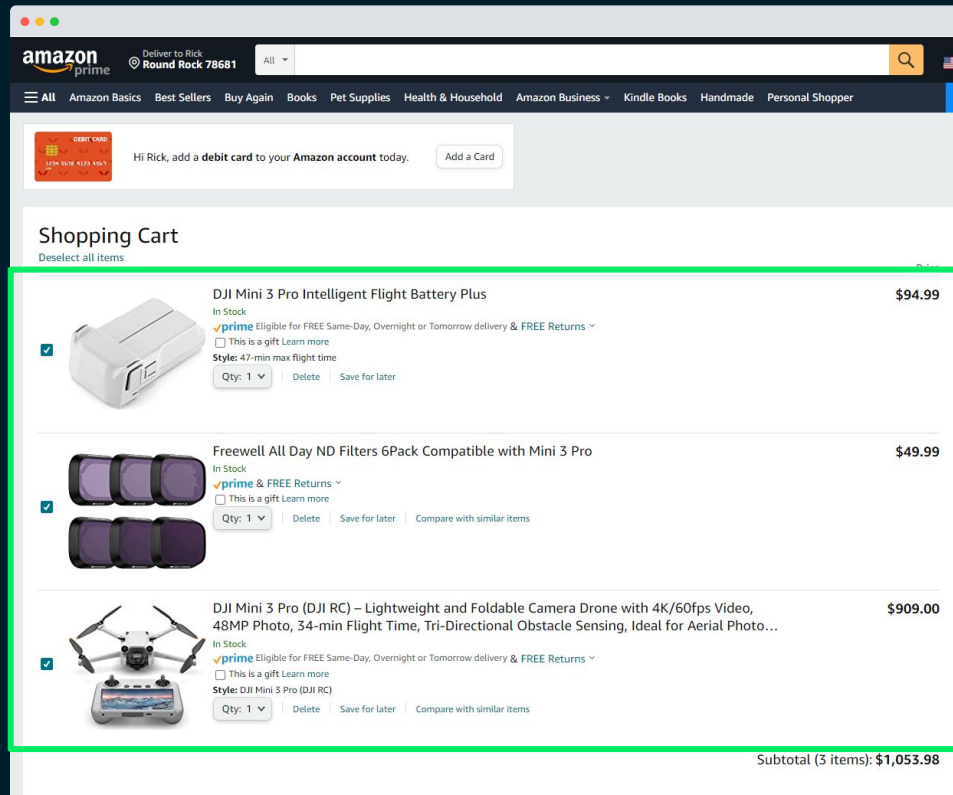
Subtotal (3 items): **\$1,053.98**



```

{
  cartId: "c1111",
  items: [
    {
      sku: "abcd1234",
      ...
    },
    {
      sku: "bcde2345",
      ...
    },
    {
      sku: "cdef3456",
      ...
    }
  ]
  ...
}

```



amazon prime Deliver to Rick Round Rock 78681 All

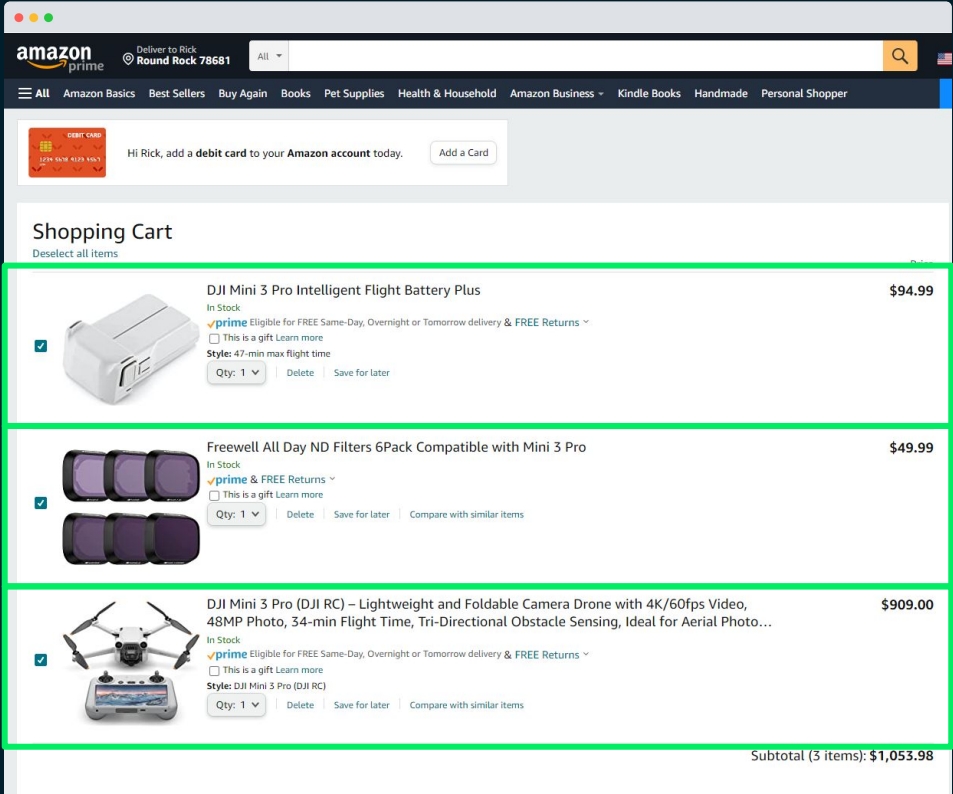
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Subtotal (3 items): \$1,053.98



Use the Right
Technology the Right
Way





Dive Deep on NoSQL at MongoDB Day

TAILORED ENGAGEMENTS TO ACCELERATE PROJECTS

- Detailed exploration of NoSQL Data Modeling
- Breakout content covering specific areas of interest
- Whiteboard sessions with subject matter experts
- Reach out to your Account Rep today



MongoDB Design Reviews: Value



Expertise

Our Developer Relations Team decades of experience benefits teams by preventing common mistakes that can significantly impact cost and performance.



Outcome

Design a data model in real time and leave the session with a documented data model and enough knowledge to iterate and optimise the design on your own.



Conclusions

- NoSQL does not mean non-relational
- The ERD still matters
- RDBMS efficiency is declining
- NoSQL is a great fit for most OLTP workloads
- The MongoDB API supports OLAP just as well



Thank you.