

AWS
re:Invent

CMY304

Data modeling with Amazon DynamoDB

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Agenda

What is Amazon DynamoDB?

Key concepts

Data modeling strategies

Alex DeBrie

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DynamoDBGuide.com

DynamoDBBook.com

@alexdebrie

alexdebrie.com



Related breakouts

DAT301-R: Data modeling with Amazon DynamoDB in 60 minutes

DAT325: Amazon DynamoDB: Under the hood of a hyperscale database

DAT403-R: Amazon DynamoDB deep dive: Advanced design patterns

What is DynamoDB?

What is DynamoDB?

NoSQL database

Fully managed by AWS

HTTPS with AWS Identity and Access Management auth

Fast, consistent performance as it scales

Hyperscale



Hyper-ephemeral compute



AWS Lambda



AWS AppSync

Key concepts

Concepts

- Table
- Item
- Primary key
- Attributes

Primary Key	Attributes		
SessionId	Username	CreatedAt	ExpiresAt
01c1093b-7e54-4864-8d43-703e0fc1686b	blackwidow	2019-05-02T22:09:08	2019-05-03T22:09:09
54ba2c29-d533-43f0-b7a6-114bcf2f003f	thanos	2019-05-06T06:15:54	2019-05-07T06:15:54
f01fc912-5292-4ba1-821d-a1e05b42cdf9	ironman	2019-04-26T20:38:18	2019-04-27T20:38:18
ed7d2e9e-699e-4f21-a8b4-96c607740d98	blackpanther	2019-05-11T19:15:59	2019-05-12T19:15:59

Table

Primary Key	Attributes		
SessionId	Username	CreatedAt	ExpiresAt
01c1093b-7e54-4864-8d43-703e0fc1686b	blackwidow	2019-05-02T22:09:08	2019-05-03T22:09:09
54ba2c29-d533-43f0-b7a6-114bcf2f003f	thanos	2019-05-06T06:15:54	2019-05-07T06:15:54
f01fc912-5292-4ba1-821d-a1e05b42cdf9	ironman	2019-04-26T20:38:18	2019-04-27T20:38:18
ed7d2e9e-699e-4f21-a8b4-96c607740d98	blackpanther	2019-05-11T19:15:59	2019-05-12T19:15:59

Item

Primary Key	Attributes		
SessionId	Username	CreatedAt	ExpiresAt
01c1093b-7e54-4864-8d43-703e0fc1686b	blackwidow	2019-05-02T22:09:08	2019-05-03T22:09:09
54ba2c29-d533-43f0-b7a6-114bcf2f003f	thanos	2019-05-06T06:15:54	2019-05-07T06:15:54
f01fc912-5292-4ba1-821d-a1e05b42cdf9	ironman	2019-04-26T20:38:18	2019-04-27T20:38:18
ed7d2e9e-699e-4f21-a8b4-96c607740d98	blackpanther	2019-05-11T19:15:59	2019-05-12T19:15:59

Primary key

Primary Key	Attributes		
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01c1093b-7e54-4864-8d43-703e0fc1686b	blackwidow	2019-05-02T22:09:08	2019-05-03T22:09:09
54ba2c29-d533-43f0-b7a6-114bcf2f003f	thanos	2019-05-06T06:15:54	2019-05-07T06:15:54
f01fc912-5292-4ba1-821d-a1e05b42cdf9	ironman	2019-04-26T20:38:18	2019-04-27T20:38:18
ed7d2e9e-699e-4f21-a8b4-96c607740d98	blackpanther	2019-05-11T19:15:59	2019-05-12T19:15:59

Attributes

Primary Key	Attributes		
SessionId	Username	CreatedAt	ExpiresAt
01c1093b-7e54-4864-8d43-703e0fc1686b	blackwidow	2019-05-02T22:09:08	2019-05-03T22:09:09
54ba2c29-d533-43f0-b7a6-114bcf2f003f	thanos	2019-05-06T06:15:54	2019-05-07T06:15:54
f01fc912-5292-4ba1-821d-a1e05b42cdf9	ironman	2019-04-26T20:38:18	2019-04-27T20:38:18
ed7d2e9e-699e-4f21-a8b4-96c607740d98	blackpanther	2019-05-11T19:15:59	2019-05-12T19:15:59

Primary key

- Simple primary key (partition key)
- Composite primary key (partition key + sort key)

Simple primary key

Primary Key	Attributes		
SessionId	Username	CreatedAt	ExpiresAt
01c1093b-7e54-4864-8d43-703e0fc1686b	blackwidow	2019-05-02T22:09:08	2019-05-03T22:09:09
54ba2c29-d533-43f0-b7a6-114bcf2f003f	thanos	2019-05-06T06:15:54	2019-05-07T06:15:54
f01fc912-5292-4ba1-821d-a1e05b42cdf9	ironman	2019-04-26T20:38:18	2019-04-27T20:38:18
ed7d2e9e-699e-4f21-a8b4-96c607740d98	blackpanther	2019-05-11T19:15:59	2019-05-12T19:15:59

Composite primary key

Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)	Role	Year	Genre
Tom Hanks	Cast Away	Chuck Noland	2000	Drama
Tom Hanks	Toy Story	Woody	1995	Children's
Tim Allen	Toy Story	Buzz Lightyear	1995	Children's
Natalie Portman	Black Swan	Nina Sayers	2010	Drama

API actions

- **Item-based actions**

Item-based actions—writing, updating, deleting

Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)			
Tom Hanks	Cast Away	Role	Year	Genre
		Chuck Noland	2000	Drama
Tom Hanks	Toy Story	Role	Year	Genre
		Woody	1995	Children's
Tim Allen	Toy Story	Role	Year	Genre
		Buzz Lightyear	1995	Children's
Natalie Portman	Black Swan	Role	Year	Genre
		Nina Sayers	2010	Drama

Item-based actions—writing, updating, deleting

Must provide entire primary key



Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)			
Tom Hanks	Cast Away	Role	Year	Genre
		Chuck Noland	2000	Drama
Tom Hanks	Toy Story	Role	Year	Genre
		Woody	1995	Children's
Tim Allen	Toy Story	Role	Year	Genre
		Buzz Lightyear	1995	Children's
Natalie Portman	Black Swan	Role	Year	Genre
		Nina Sayers	2010	Drama

API actions

- Item-based actions
- **Query**

Query

Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)			
Tom Hanks	Cast Away	Role	Year	Genre
		Chuck Noland	2000	Drama
Tom Hanks	Toy Story	Role	Year	Genre
		Woody	1995	Children's
Tim Allen	Toy Story	Role	Year	Genre
		Buzz Lightyear	1995	Children's
Natalie Portman	Black Swan	Role	Year	Genre
		Nina Sayers	2010	Drama

Query

Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)	Role	Year	Genre
Tom Hanks	Cast Away	Chuck Noland	2000	Drama
Tom Hanks	Toy Story	Woody	1995	Children's
Tim Allen	Toy Story	Buzz Lightyear	1995	Children's
Natalie Portman	Black Swan	Nina Sayers	2010	Drama

Must provide partition key



May provide sort key conditions

API actions

- Item-based actions
- Query
- **Scan**

Scan

Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)	Role	Year	Genre
Tom Hanks	Cast Away	Chuck Noland	2000	Drama
Tom Hanks	Toy Story	Woody	1995	Children's
Tim Allen	Toy Story	Buzz Lightyear	1995	Children's
Natalie Portman	Black Swan	Nina Sayers	2010	Drama

Scan

Avoid!
Expensive
at scale

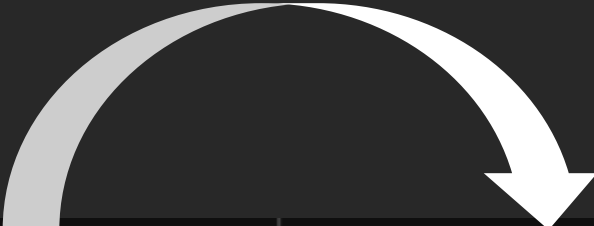
Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)			
Tom Hanks	Cast Away	Role	Year	Genre
		Chuck Noland	2000	Drama
Tom Hanks	Toy Story	Role	Year	Genre
		Woody	1995	Children's
Tim Allen	Toy Story	Role	Year	Genre
		Buzz Lightyear	1995	Children's
Natalie Portman	Black Swan	Role	Year	Genre
		Nina Sayers	2010	Drama

Secondary indexes

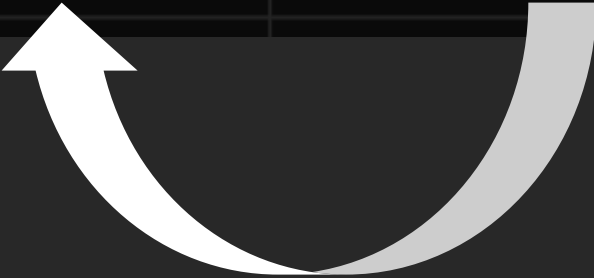
Secondary indexes

Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)	Role	Year	Genre
Tom Hanks	Cast Away	Chuck Noland	2000	Drama
		Woody	1995	Children's
Tom Hanks	Toy Story	Buzz Lightyear	1995	Children's
		Nina Sayers	2010	Drama
Tim Allen	Toy Story			
Natalie Portman	Black Swan			

Secondary indexes



Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)	Role	Year	Genre
Tom Hanks	Cast Away	Chuck Noland	2000	Drama
Tom Hanks	Toy Story	Woody	1995	Children's
Tim Allen	Toy Story	Buzz Lightyear	1995	Children's
Natalie Portman	Black Swan	Nina Sayers	2010	Drama



Secondary indexes

GSI (MoviesActorsIndex)		Attributes		
Movie (PARTITION)	Actor (SORT)			
Cast Away	Tom Hanks	Role	Year	Genre
		Chuck Noland	2000	Drama
Toy Story	Tom Hanks	Role	Year	Genre
		Woody	1995	Children's
Toy Story	Tim Allen	Role	Year	Genre
		Buzz Lightyear	1995	Children's
Black Swan	Natalie Portman	Role	Year	Genre
		Nina Sayers	2010	Drama

Secondary indexes

GSI (MoviesActorsIndex)		Attributes		
Movie (PARTITION)	Actor (SORT)			
Cast Away	Tom Hanks	Role	Year	Genre
		Chuck Noland	2000	Drama
Toy Story	Tom Hanks	Role	Year	Genre
		Woody	1995	Children's
Toy Story	Tim Allen	Role	Year	Genre
		Buzz Lightyear	1995	Children's
Black Swan	Natalie Portman	Role	Year	Genre
		Nina Sayers	2010	Drama

Data modeling example

Basics

1. Start with an ERD
2. Define your access patterns
3. Design your primary key & secondary indexes

Forget your relational experience

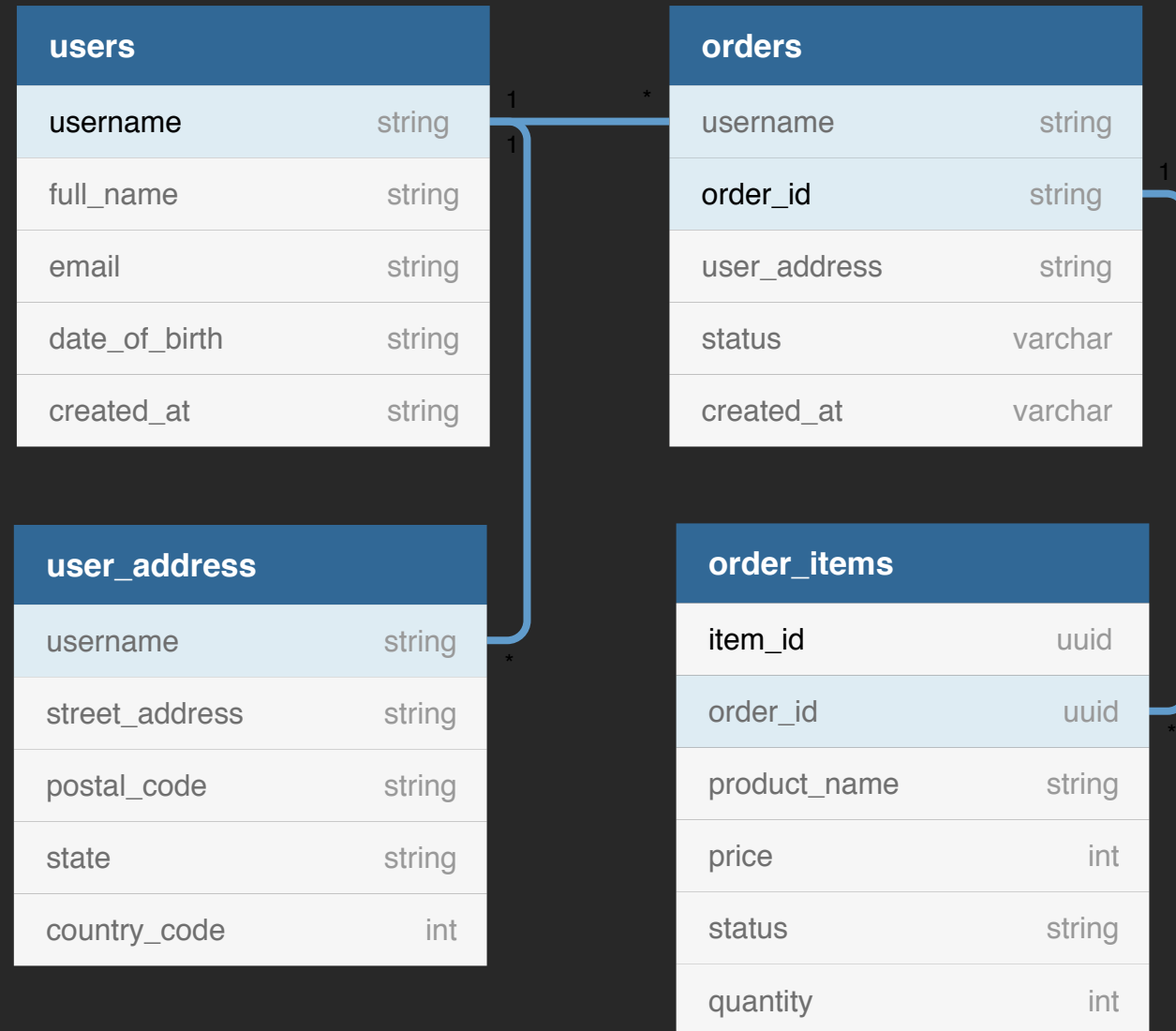
- Normalization
- JOINS
- One entity type per table

Setup

- E-commerce store
- Users make orders
- An order may have many items

1. Create your ERD

E-commerce store



2. Define your access patterns

Identify access patterns

1. Get user profile
2. Get orders for user
3. Get single order and order items
4. Get orders for user by status
5. Get open orders

3. Design your primary keys & secondary indexes

Primary Key		Attributes			
PK	SK				
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27

Primary Key		Attributes			
PK	SK				
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27

Primary Key		Attributes			
PK	SK				
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27

Entities

	PK	SK
User	USER#<username>	#PROFILE#<username>
User Address		
Order		
Order Item		

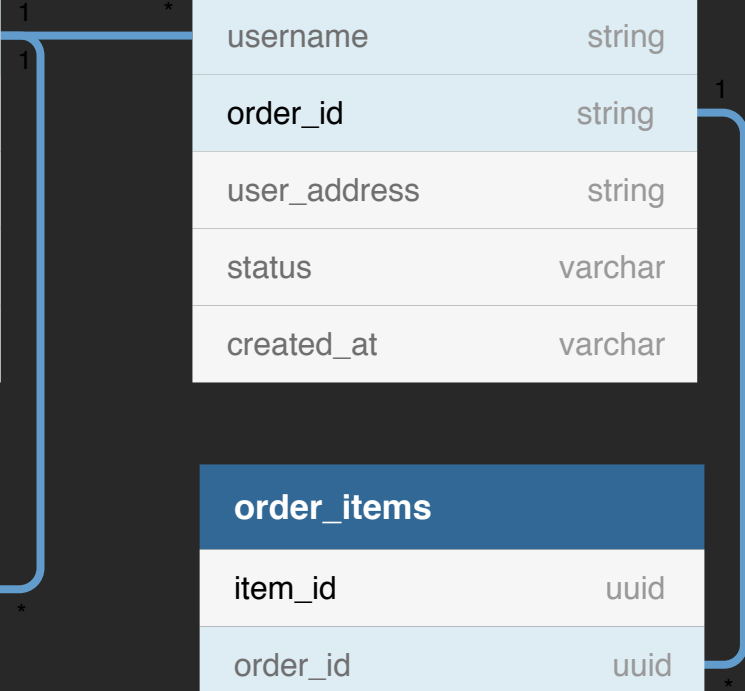
One-to-many relationships

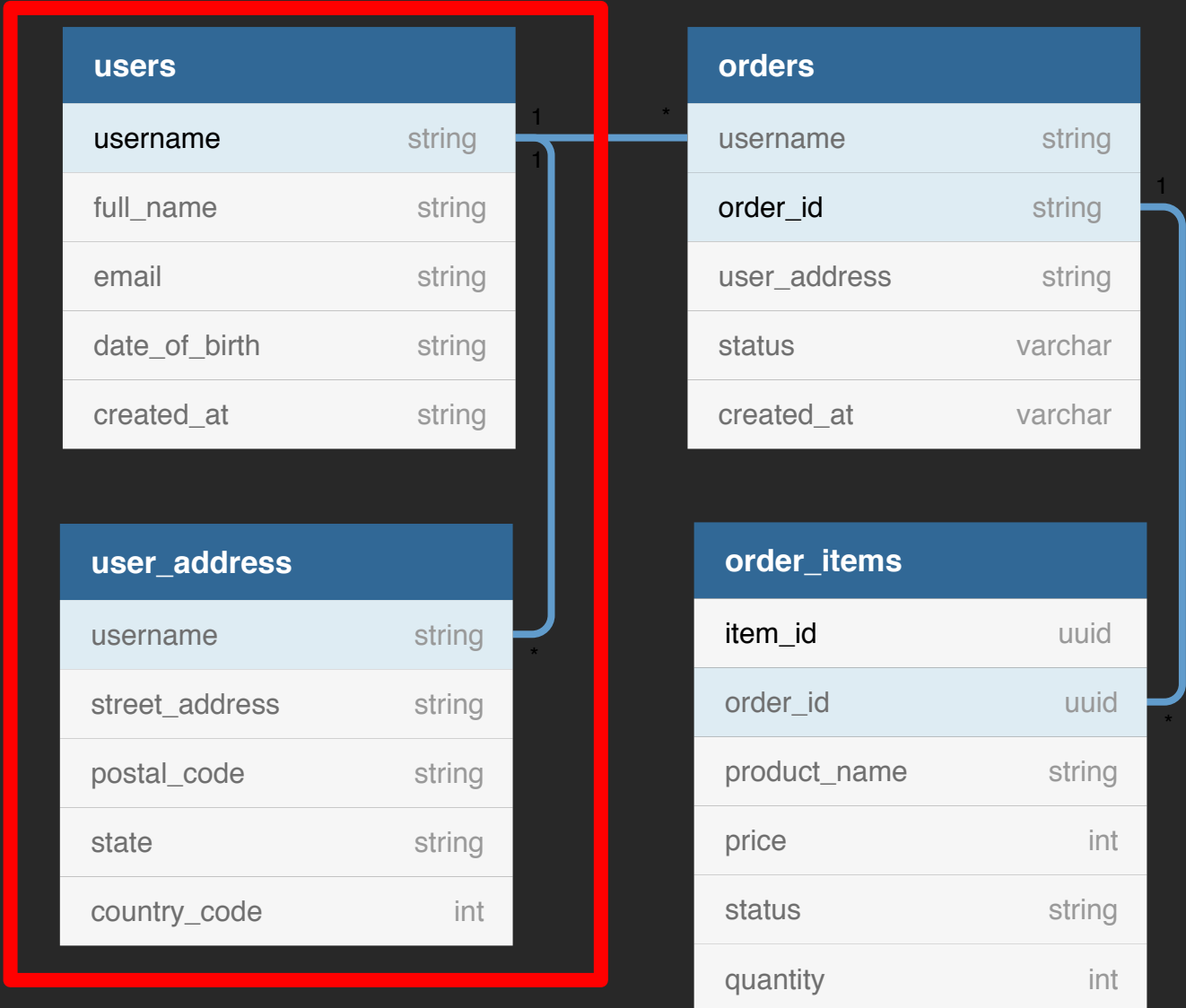
users	
username	string
full_name	string
email	string
date_of_birth	string
created_at	string

orders	
username	string
order_id	string
user_address	string
status	varchar
created_at	varchar

user_address	
username	string
street_address	string
postal_code	string
state	string
country_code	int

order_items	
item_id	uuid
order_id	uuid
product_name	string
price	int
status	string
quantity	int



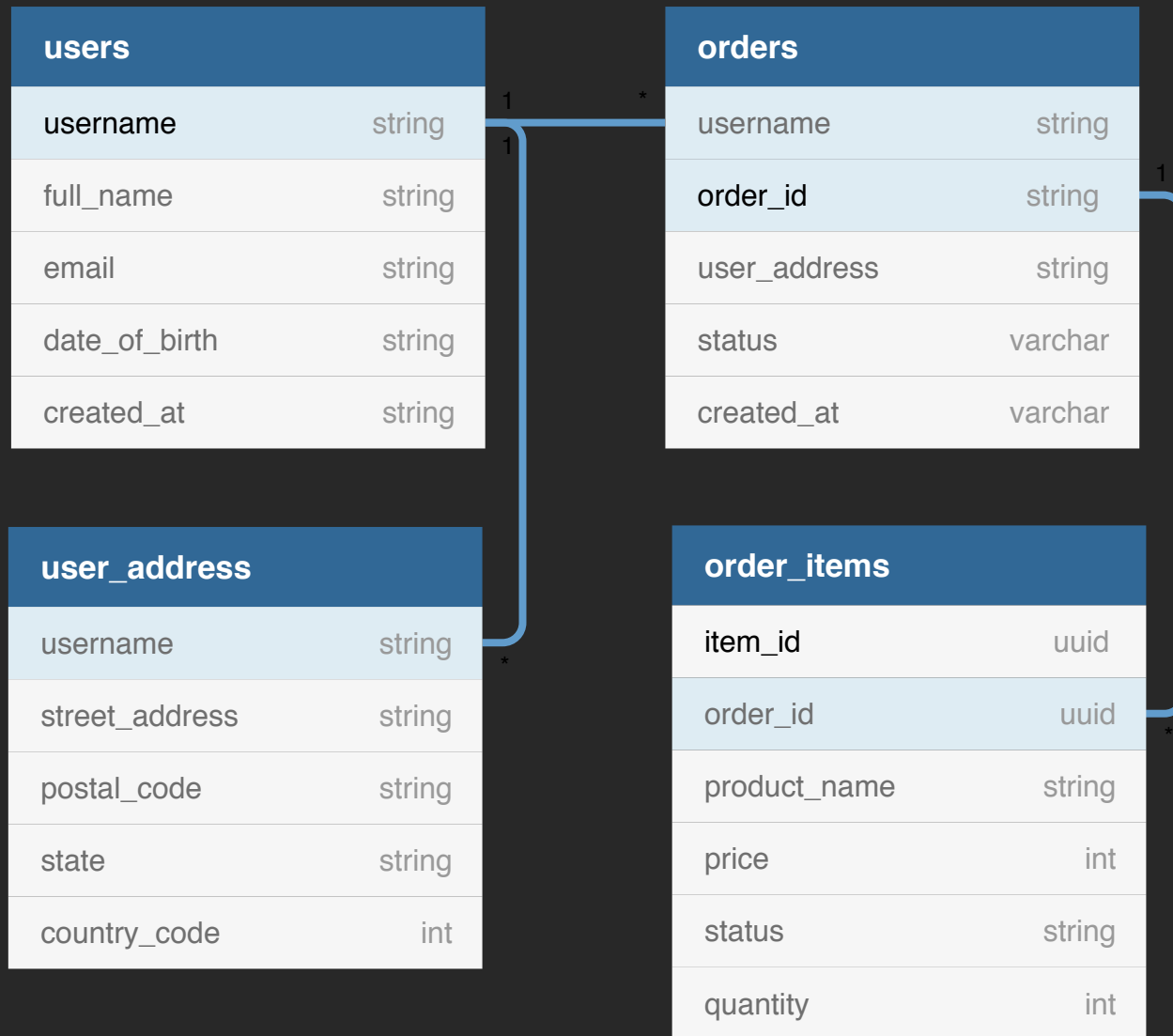


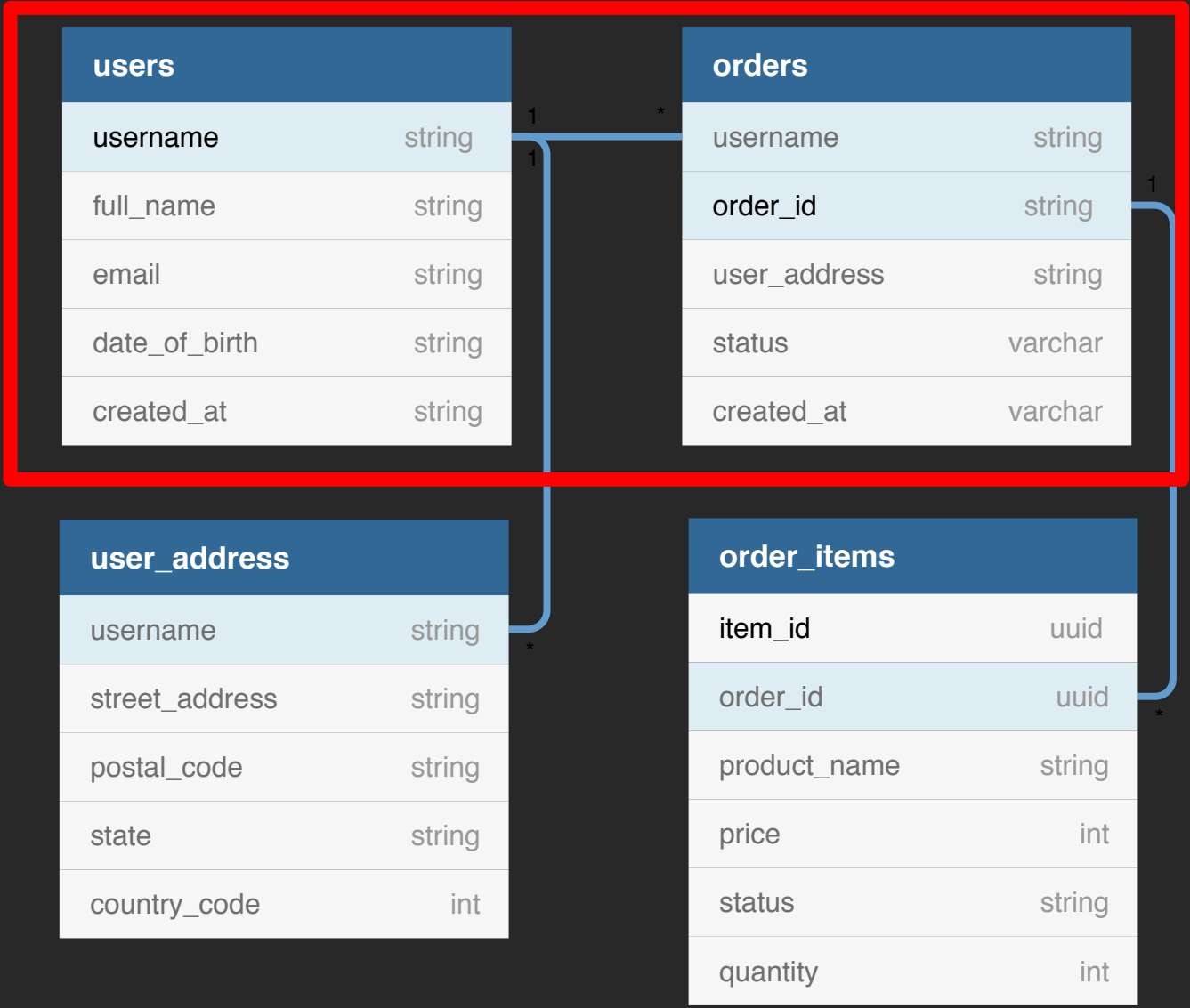
Denormalization + document types

Primary Key		Attributes				
PK	SK	Username	FullName	Email	CreatedAt	Addresses
USER#alexdebrie	#PROFILE#alexdebrie	alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	<pre>{ "Home": { "StreetAddress": "1111 1st St", "State": "Nebraska", "Country": "USA" } }</pre>
USER#nedstark	#PROFILE#nedstark	nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	<pre>{ "Home": { "StreetAddress": "1234 2nd Ave", "City": "Winterfell", "Country": "Westeros" }, "Business": { "StreetAddress": "Suite 200, Red Keep", "City": "King's Landing", "Country": "Westeros" } }</pre>

Entities

	PK	SK
User	USER#<username>	#PROFILE#<username>
User Address	N/A	N/A
Order		
Order Item		





One-to-many: Sort keys


Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	2019-04-21	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	2019-04-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
USER#nedstark	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	2019-01-15	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
ORDER#f4f80a91	Username	OrderId	Status	CreatedAt	Address	
		nedstark	f4f80a91	PLACED	2019-05-12	{"StreetAddress":"Suite 200, Red Keep","City":"King's L

Entities

	PK	SK
User	USER#<username>	#PROFILE#<username>
User Address	N/A	N/A
Order	USER#<username>	ORDER#<orderId>
Order Item		

Entities

	PK	SK
User	USER#<username>	#PROFILE#<username>
User Address	N/A	N/A
Order	USER#<username>	ORDER#<orderId>
Order Item		



Query:

```
“PK = USER#a1exdebrie AND BEGINS_WITH(SK, ‘ORDER#’)”
```

One-to-many: Sort keys

“PK = USER#a1exdebrie AND BEGINS_WITH(SK, ‘ORDER#’)”

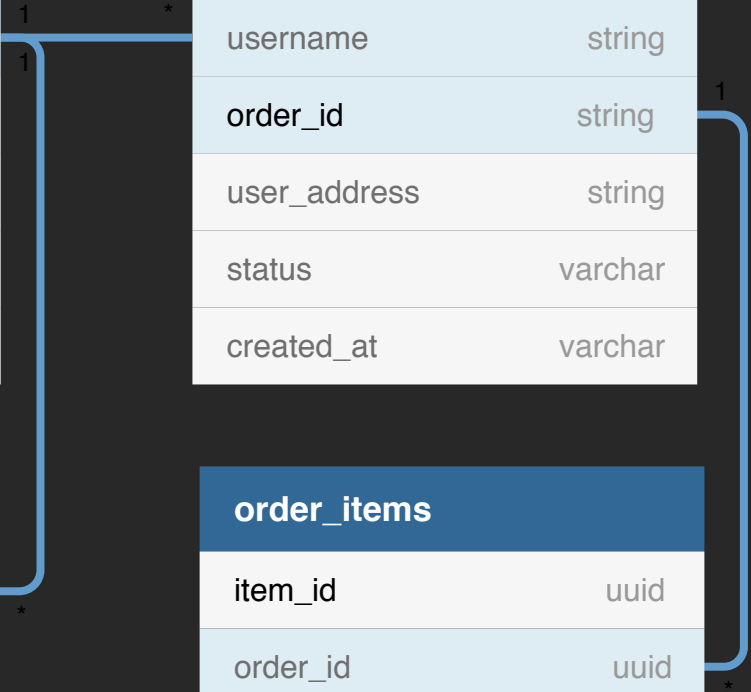
Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	2019-04-21	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	2019-04-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	2019-01-15	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
	ORDER#f4f80a91	Username	OrderId	Status	CreatedAt	Address
		nedstark	f4f80a91	PLACED	2019-05-12	{"StreetAddress":"Suite 200, Red Keep","City":"King's L

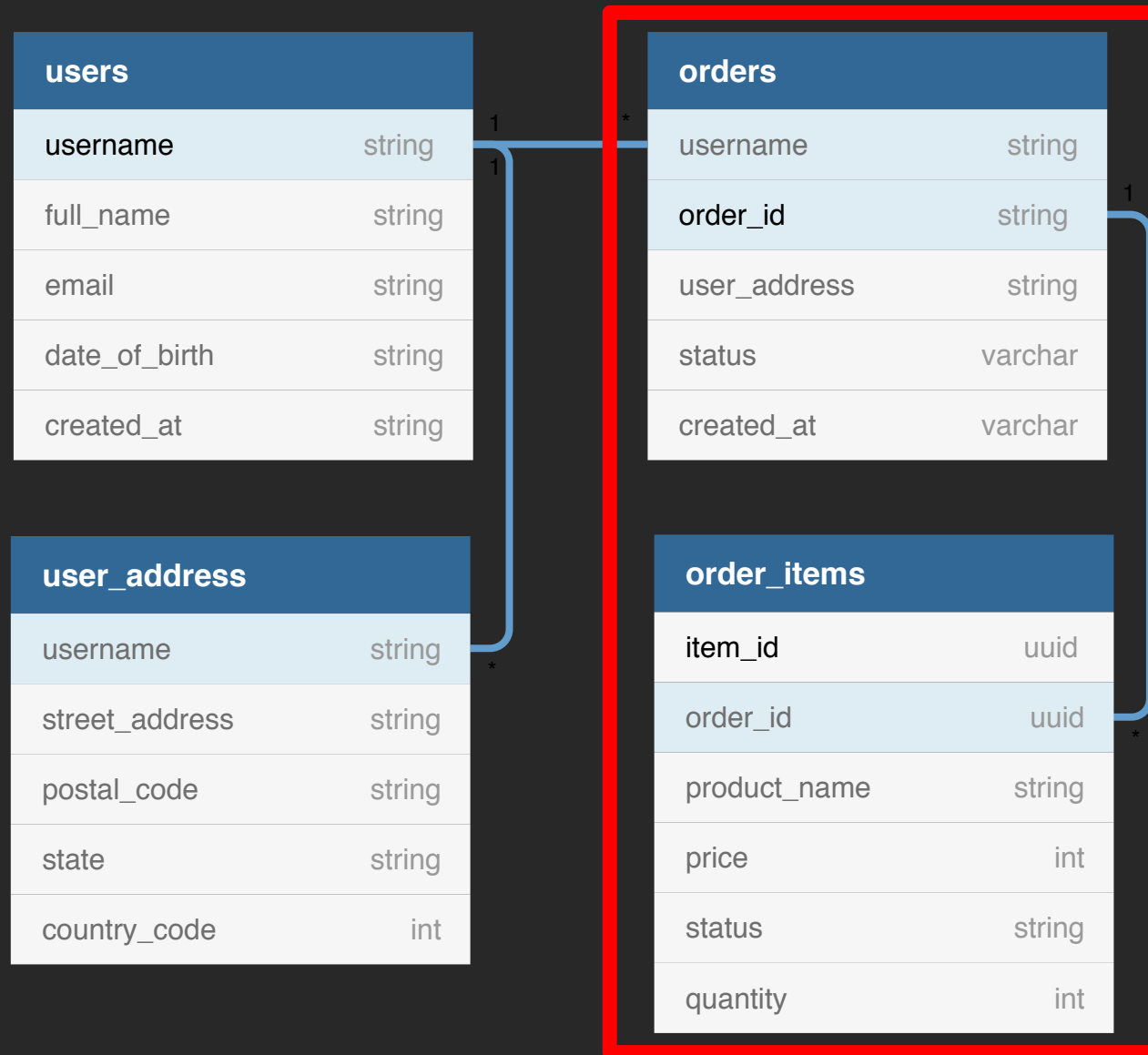
users	
username	string
full_name	string
email	string
date_of_birth	string
created_at	string

orders	
username	string
order_id	string
user_address	string
status	varchar
created_at	varchar

user_address	
username	string
street_address	string
postal_code	string
state	string
country_code	int

order_items	
item_id	uuid
order_id	uuid
product_name	string
price	int
status	string
quantity	int





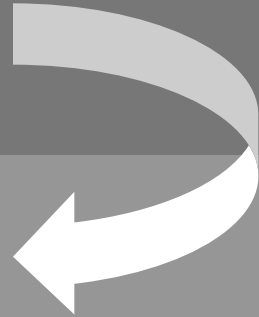
Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	2019-04-21	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	2019-04-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	Address	
	alexdebrie	2e7abecc	SHIPPED	2018-12-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co	
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	2019-01-15	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
ITEM#ab070628	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		ab070628	5e7272b7	Amazon Echo	59.99	FILLED
ITEM#4cc734ec	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		4cc734ec	5e7272b7	Macbook Pro	1399.99	FILLED
ITEM#e16f4906	ORDER#2eae1dee	ItemId	OrderId	ProductName	Price	Status
		e16f4906	2eae1dee	Duct tape	5.99	FILLED

Entities

	PK	SK
User	USER#<username>	#PROFILE#<username>
User Address	N/A	N/A
Order	USER#<username>	ORDER#<orderId>
Order Item	ITEM#<itemId>	ORDER#<orderId>

Entities

	PK	SK
User	USER#<username>	#PROFILE#<username>
User Address	N/A	N/A
Order	USER#<username>	ORDER#<orderId>
Order Item	ITEM#<itemId>	ORDER#<orderId>



Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	2019-04-21	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	2019-04-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
USER#nedstark	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
ITEM#ab070628	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	2019-01-15	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
ITEM#4cc734ec	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		ab070628	5e7272b7	Amazon Echo	59.99	FILLED
ITEM#e16f4906	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		4cc734ec	5e7272b7	Macbook Pro	1399.99	FILLED
ITEM#e16f4906	ORDER#2eae1dee	ItemId	OrderId	ProductName	Price	Status
		e16f4906	2eae1dee	Duct tape	5.99	FILLED

Inverted index

Inverted index

GSI1 (Inverted Index)		Attributes				
SK	PK					
#PROFILE#alexdebrie	USER#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
#PROFILE#nedstark	USER#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
ORDER#2e7abecc	USER#alexdebrie	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
ORDER#2eae1dee	USER#nedstark	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	2019-01-15	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
ORDER#2eae1dee	ITEM#e16f4906	ItemId	OrderId	ProductName	Price	Status
		e16f4906	2eae1dee	Duct tape	5.99	FILLED
ORDER#42ef295e	USER#alexdebrie	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	2019-04-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
ORDER#5e7272b7	USER#alexdebrie	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	2019-04-21	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ITEM#ab070628	ItemId	OrderId	ProductName	Price	Status
		ab070628	5e7272b7	Amazon Echo	59.99	FILLED
	ITEM#4cc734ec	ItemId	OrderId	ProductName	Price	Status
		4cc734ec	5e7272b7	Macbook Pro	1399.99	FILLED

Inverted index

GSI1 (Inverted Index)		Attributes				
SK	PK					
#PROFILE#alexdebrie	USER#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
#PROFILE#nedstark	USER#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
ORDER#2e7abecc	USER#alexdebrie	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
ORDER#2eae1dee	USER#nedstark	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	2019-01-15	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
	ITEM#e16f4906	ItemId	OrderId	ProductName	Price	Status
		e16f4906	2eae1dee	Duct tape	5.99	FILLED
ORDER#42ef295e	USER#alexdebrie	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	2019-04-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
ORDER#5e7272b7	USER#alexdebrie	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	2019-04-21	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ITEM#ab070628	ItemId	OrderId	ProductName	Price	Status
		ab070628	5e7272b7	Amazon Echo	59.99	FILLED
ITEM#4cc734ec	ItemId	OrderId	ProductName	Price	Status	
4cc734ec	5e7272b7	Macbook Pro	1399.99	FILLED		

One-to-many relationship patterns

1. Attribute (list or map)
2. Primary key + query
3. Secondary index + query

Filtering

Filtering

```
SELECT * FROM ORDERS
```

```
WHERE USERNAME = 'alexdebrie'
```

```
AND ORDERDATE > GETDATE() - 14
```

Filter expressions

Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	2019-04-21	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	2019-04-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	Address	
	alexdebrie	2e7abecc	SHIPPED	2018-12-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co	
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	2019-01-15	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
ITEM#ab070628	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		ab070628	5e7272b7	Amazon Echo	59.99	FILLED
ITEM#4cc734ec	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		4cc734ec	5e7272b7	Macbook Pro	1399.99	FILLED
ITEM#e16f4906	ORDER#2eae1dee	ItemId	OrderId	ProductName	Price	Status
		e16f4906	2eae1dee	Duct tape	5.99	FILLED

Filter expressions

Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	2019-04-21	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	2019-04-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
USER#nedstark	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
ITEM#ab070628	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	2019-01-15	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
ITEM#ab070628	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		ab070628	5e7272b7	Amazon Echo	59.99	FILLED
ITEM#4cc734ec	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		4cc734ec	5e7272b7	Macbook Pro	1399.99	FILLED
ITEM#e16f4906	ORDER#2eae1dee	ItemId	OrderId	ProductName	Price	Status
		e16f4906	2eae1dee	Duct tape	5.99	FILLED

Filter expressions



```
import boto3

client = boto3.client('dynamodb')

resp = client.query(
    TableName='UsersAndOrdersTable',
    FilterExpression="Status = SHIPPED"
)
```

Filter expressions



```
import boto3

client = boto3.client('dynamodb')

resp = client.query(
    TableName='UsersAndOrdersTable',
    FilterExpression="Status = SHIPPED"
)
```

Query

Primary Key		Attributes		
Actor (PARTITION)	Movie (SORT)	Role	Year	Genre
Tom Hanks	Cast Away	Chuck Noland	2000	Drama
Tom Hanks	Toy Story	Woody	1995	Children's
Tim Allen	Toy Story	Buzz Lightyear	1995	Children's
Natalie Portman	Black Swan	Nina Sayers	2010	Drama

Must provide partition key



May provide sort key conditions

Filter expressions

Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	2019-04-21	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
USER#nedstark	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	2019-04-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
ITEM#ab070628	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	2019-01-15	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
ITEM#4cc734ec	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		ab070628	5e7272b7	Amazon Echo	59.99	FILLED
ITEM#e16f4906	ORDER#5e7272b7	ItemId	OrderId	ProductName	Price	Status
		4cc734ec	5e7272b7	Macbook Pro	1399.99	FILLED
ITEM#e16f4906	ORDER#2eae1dee	ItemId	OrderId	ProductName	Price	Status
		e16f4906	2eae1dee	Duct tape	5.99	FILLED

Filter expressions



```
import boto3
```

```
client = boto3.client('dynamodb')
```

```
resp = client.query(
```

```
    TableName='UsersAndOrdersTable',
```

```
    FilterExpression="Status = SHIPPED"
```

```
)
```

Filter expressions



```
import boto3

client = boto3.client('dynamodb')

resp = client.scan(
    TableName='UsersAndOrdersTable',
    FilterExpression="Status = SHIPPED"
)
```

Filter expressions

1. Read items
from table

Filter expressions

1. Read items
from table



2. If *FilterExpression*,
filter out items that
don't match

Filter expressions

1. Read items
from table

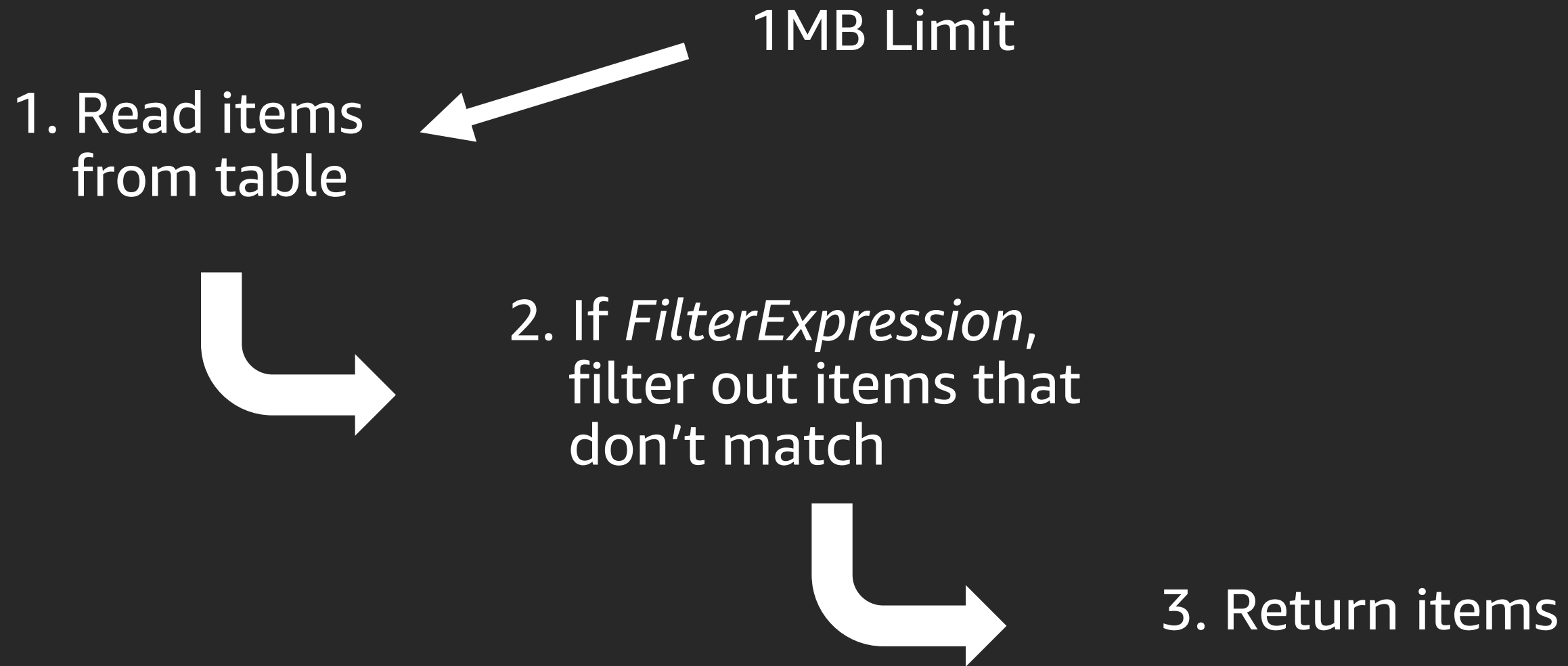


2. If *FilterExpression*,
filter out items that
don't match



3. Return items

Filter expressions



Filtering access patterns

1. Get orders for user
2. Get orders by status for user
3. Get open orders

Filtering access patterns

- 1. Get orders for user**
2. Get orders by status for user
3. Get open orders

Filtering access patterns

1. **Get orders for user**

```
SELECT * FROM ORDERS
```

```
WHERE USERNAME = 'alexdebrie'
```

2. Get orders by status for user

3. Get open orders

Filtering access patterns

```
“PK = USER#alexdebrie AND BEGINS_WITH(SK, ‘ORDER#’)”
```

Filtering patterns: Primary key

“PK = USER#a1exdebrie AND BEGINS_WITH(SK, ‘ORDER#’)”

Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	03/23/2018	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	04/21/2019	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	04/25/2019	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	2e7abecc	SHIPPED	12/25/2018	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	02/27/2016	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	Address
		nedstark	2eae1dee	SHIPPED	01/15/2019	{"StreetAddress":"Suite 200, Red Keep","City":"King's L
	ORDER#f4f80a91	Username	OrderId	Status	CreatedAt	Address
		nedstark	f4f80a91	PLACED	05/12/2019	{"StreetAddress":"Suite 200, Red Keep","City":"King's L

Filtering access patterns

1. Get orders for user
2. **Get orders by status for user**
3. Get open orders

Filtering access patterns

1. Get orders for user

```
SELECT * FROM ORDERS
```

2. Get orders by status for user

```
WHERE USERNAME = 'alexdebrie'
```

```
AND STATUS = 'SHIPPED'
```

3. Get open orders

Filtering access pattern

Primary Key		Attributes			
PK	SK				
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt
		alexdebrie	Alex DeBrie	alexdebrie1@c	2018-03-23
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt
		alexdebrie	5e7272b7	PLACED	2019-04-21
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt
		alexdebrie	42ef295e	PLACED	2019-04-25
USER#nedstark	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt
		alexdebrie	2e7abecc	SHIPPED	2018-12-25
	#PROFILE#nedstark	Username	FullName	Email	CreatedAt
		nedstark	Eddard Stark	lord@winterfel	2016-02-27
	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt
	nedstark	2eae1dee	SHIPPED	2019-01-15	

Filtering access pattern

Status	CreatedAt		OrderStatusDate
PLACED	2019-04-21	➔	PLACED#2019-04-21
Status	CreatedAt		OrderStatusDate
PLACED	2019-04-25	➔	PLACED#2019-04-25
Status	CreatedAt		OrderStatusDate
SHIPPED	2018-12-25	➔	SHIPPED#2018-12-25

Filtering access pattern

Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@c	2018-03-23	{"Home":{"StreetAddress":"1111 1st St" "State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	5e7272b7	PLACED	2019-04-21	PLACED#2019-04-21
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	42ef295e	PLACED	2019-04-25	PLACED#2019-04-25
USER#nedstark	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	SHIPPED#2018-12-25
	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfel	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	OrderStatusDate
	nedstark	2eae1dee	SHIPPED	2019-01-15	SHIPPED#2019-01-15	

Filtering patterns: Composite sort key

GS2 (OrderStatusDate)		Attributes				
PK	OrderStatusDate					
USER#alexdebrie	PLACED#2019-04-21	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	5e7272b7	PLACED	2019-04-21	PLACED#2019-04-21
	PLACED#2019-04-25	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	42ef295e	PLACED	2019-04-25	PLACED#2019-04-25
USER#nedstark	SHIPPED#2018-12-25	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	SHIPPED#2018-12-25
	SHIPPED#2019-01-15	Username	OrderId	Status	CreatedAt	OrderStatusDate
		nedstark	2eae1dee	SHIPPED	2019-01-15	SHIPPED#2019-01-15

Filtering access patterns

1. Get orders for user

```
SELECT * FROM ORDERS
```

2. Get orders by status for user

```
WHERE USERNAME = 'alexdebrie'
```

```
AND STATUS = 'SHIPPED'
```

3. Get open orders

Filtering patterns: Composite sort key

```
“PK = USER#a1exdebrie AND BEGINS_WITH(OrderStatusDate, ‘SHIPPED#’)”
```

Filtering patterns: Composite sort key

GS2 (OrderStatusDate)		Attributes				
PK	OrderStatusDate					
USER#alexdebrie	PLACED#2019-04-21	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	5e7272b7	PLACED	2019-04-21	PLACED#2019-04-21
	PLACED#2019-04-25	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	42ef295e	PLACED	2019-04-25	PLACED#2019-04-25
USER#nedstark	SHIPPED#2018-12-25	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	SHIPPED#2018-12-25
	SHIPPED#2019-01-15	Username	OrderId	Status	CreatedAt	OrderStatusDate
		nedstark	2eae1dee	SHIPPED	2019-01-15	SHIPPED#2019-01-15

Filtering patterns: Composite sort key

“PK = USER#alexdebrie AND BEGINS_WITH(OrderStatusDate, ‘SHIPPED#’)”

GS2 (OrderStatusDate)		Attributes				
PK	OrderStatusDate					
USER#alexdebrie	PLACED#2019-04-21	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	5e7272b7	PLACED	2019-04-21	PLACED#2019-04-21
	PLACED#2019-04-25	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	42ef295e	PLACED	2019-04-25	PLACED#2019-04-25
USER#alexdebrie	SHIPPED#2018-12-25	Username	OrderId	Status	CreatedAt	OrderStatusDate
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	SHIPPED#2018-12-25
USER#nedstark	SHIPPED#2019-01-15	Username	OrderId	Status	CreatedAt	OrderStatusDate
		nedstark	2eae1dee	SHIPPED	2019-01-15	SHIPPED#2019-01-15

Filtering access patterns

1. Get orders for user
2. Get orders by status for user
3. Get open orders

Filtering access patterns

1. Get orders for user
2. Get orders by status for user
- 3. Get open orders**

Filtering access patterns

1. Get orders for user

```
SELECT * FROM ORDERS
```

2. Get orders by status for user

```
WHERE STATUS = 'PLACED'
```

3. Get open orders

Filtering access patterns: Sparse index

Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	03/23/2018	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	5e7272b7	PLACED	04/21/2019	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
USER#alexdebrie	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	Address
		alexdebrie	42ef295e	PLACED	04/25/2019	{"StreetAddress":"1111 1st St","State":"Nebraska","Co
	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	Address
	alexdebrie	2e7abecc	SHIPPED	12/25/2018	{"StreetAddress":"1111 1st St","State":"Nebraska","Co	
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	02/27/2016	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	Address
	nedstark	2eae1dee	SHIPPED	01/15/2019	{"StreetAddress":"Suite 200, Red Keep","City":"King's L	
USER#nedstark	ORDER#f4f80a91	Username	OrderId	Status	CreatedAt	Address
		nedstark	f4f80a91	PLACED	05/12/2019	{"StreetAddress":"Suite 200, Red Keep","City":"King's L

Filtering access patterns: Sparse index

Primary Key		Attributes				
PK	SK					
USER#alexdebrie	#PROFILE#alexdebrie	Username	FullName	Email	CreatedAt	Addresses
		alexdebrie	Alex DeBrie	alexdebrie1@gmail.com	2018-03-23	{"Home":{"StreetAddress":"1111 1st St","State":"Nebr
	ORDER#5e7272b7	Username	OrderId	Status	CreatedAt	PlacedId
		alexdebrie	5e7272b7	PLACED	2019-04-2	fb7f
	ORDER#42ef295e	Username	OrderId	Status	CreatedAt	PlacedId
		alexdebrie	42ef295e	PLACED	2019-04-2	c81c
	ORDER#2e7abecc	Username	OrderId	Status	CreatedAt	
		alexdebrie	2e7abecc	SHIPPED	2018-12-25	
USER#nedstark	#PROFILE#nedstark	Username	FullName	Email	CreatedAt	Addresses
		nedstark	Eddard Stark	lord@winterfell.com	2016-02-27	{"Home":{"StreetAddress":"1234 2nd Ave","City":"Wir
	ORDER#2eae1dee	Username	OrderId	Status	CreatedAt	
		nedstark	2eae1dee	SHIPPED	2019-01-15	
	ORDER#f4f80a91	Username	OrderId	Status	CreatedAt	PlacedId
		nedstark	f4f80a91	PLACED	2019-05-1	ac40

Filtering access patterns: Sparse index

GSI (PlacedId)		Attributes			
PlacedId	Username	OrderId	Status	CreatedAt	PlacedId
fb7f	alexdebrie	5e7272b7	PLACED	2019-04-21	fb7f
c81c	alexdebrie	42ef295e	PLACED	2019-04-25	c81c
ac40	nedstark	f4f80a91	PLACED	2019-05-12	ac40

Filtering patterns

1. Primary key
2. Composite sort key
3. Sparse index

Thank you!

Alex DeBrie

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dynamodbbook.com



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