AWS re:Invent

NOV. 29 – DEC. 3, 2021 | LAS VEGAS, NV

DAT204

Which NoSQL database is right for you?

Deepak Thakral
Vice President
McAfee

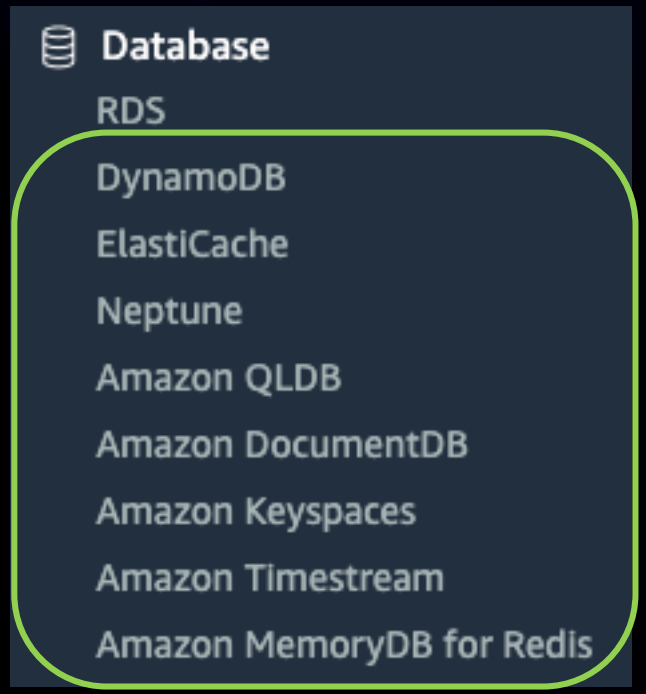
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AWS

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Sr. Technical Advocate
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SQL vs. NoSQL

RELATIONAL VS. NON-RELATIONAL



Normalized vs. denormalized data

Strong vs. eventual consistency

Vertical vs. horizontal scaling

Entity/relationship-based vs. access-based modeling

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NoSQL database types



Type	Key-Value	Wide-Column	Document	In-Memory	Graph	Time-Series	Ledger
Strengths	Low-latency retrieval, extremely high performance	Query column data, high throughput	Complex / nested data, query any attribute including nested	Microseconds latency, specialized data structures	Creating and navigating data relations easily and quickly	Analytics over time-series data	Immutable, sequenced, verifiable history of changes
Use Cases	Media metadata, inventory tracking	Trade monitoring, fleet management	Content management, gaming	Leaderboards, caching	Fraud detection, social networking	IoT, health and usage metrics	Supply chain tracking, financial records



More General Purpose **More Specialized**

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Fully-managed NoSQL databases

Document



Amazon DocumentDB (with MongoDB compatibility)

Wide-Column



Amazon Keyspaces (for Apache Cassandra)

Key-Value



Amazon DynamoDB

Secure, highly available, durable , fully managed database services

- Multi-AZ deployments
- Encryption-at-rest
- Point-in-time recovery (PITR)
- Automated backups

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Amazon DocumentDB (with MongoDB Compatibility)

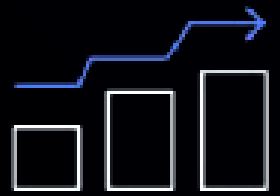
Fast, scalable, fully managed MongoDB-compatible database service

Fast



Millions of requests per second with millisecond latency

Scalable



Separation of compute and storage scales both independently; scale out to 15 read replicas in minutes

Fully managed



Managed by AWS: no hardware provisioning; auto patching, quick setup, secure, and automatic backups

MongoDB-compatible



Compatible with MongoDB 3.6/4.0; use the same SDKs, tools, and applications with Amazon DocumentDB

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DocumentDB data model

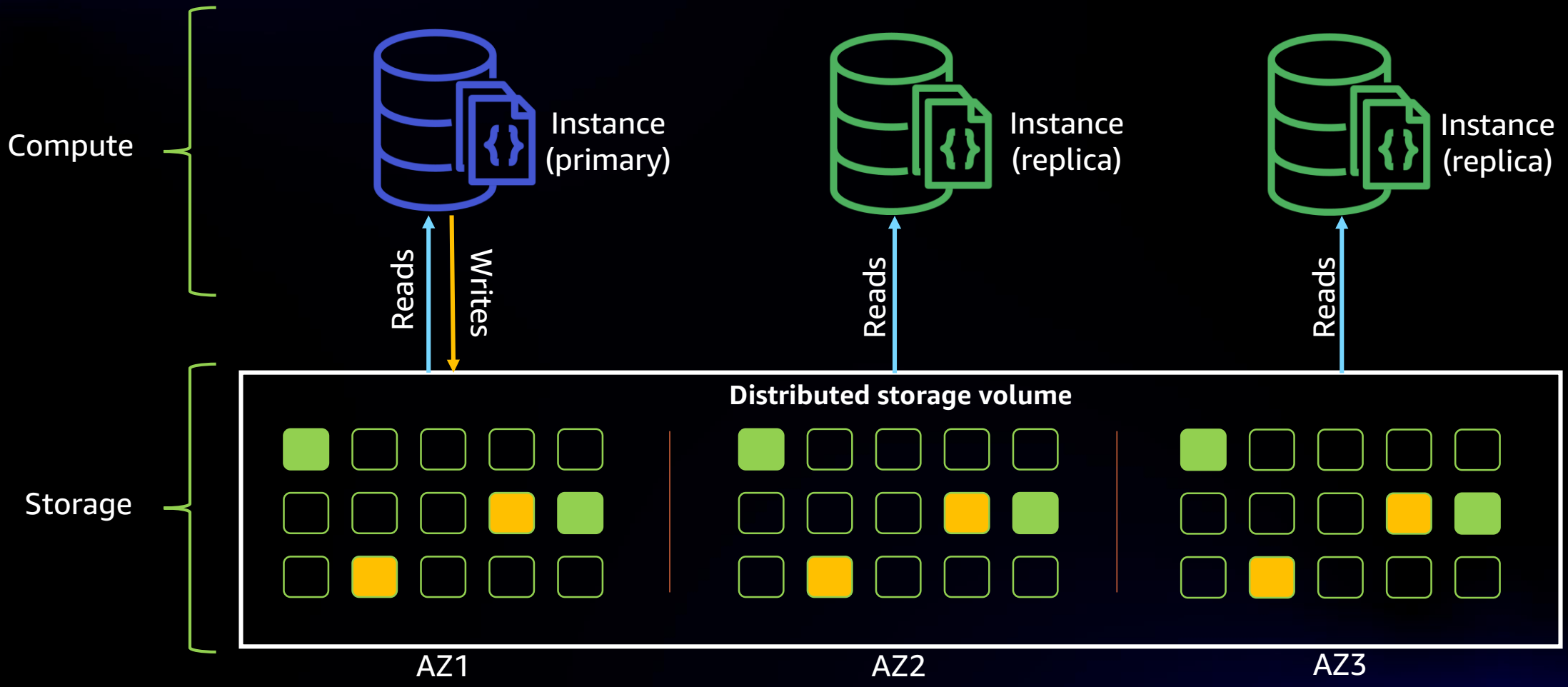
- JSON-like documents with field:value pairs
- Documents are saved in a collection (analogous to a table)
- Rich data types (Timestamp, Boolean, etc.)
- Supports nested data structures
- Query on any attribute
- Index on any attribute(s)

```
{
  userid: 181276,
  username: "sue1942",
  name: {first: "Susan",
         last: "Benoit"},
  Game1: {
    hi_score: 3185400,
    global_rank: 5139,
    bonus_levels: true
  }
}
```

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Amazon DocumentDB architecture



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Querying DocumentDB

```
{
  userid: 181276,
  username: "sue1942",
  name: {first: "Susan",
                last:
"Benoit"},
  shellGame: {
       hi_score: 3185400,
       global_rank: 5139,
       bonus_levels: true
       }
}
```

```
db.players.find({"shellGame.bonus_levels": true})
```

Read consistency options

- Read-your-writes consistency from primary
- Eventual consistency from replica

Transactions supported

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Amazon Keyspaces (for Apache Cassandra)

Compatible with Apache Cassandra



No servers to manage



Performance at scale



Highly available and secure



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Amazon Keyspaces data model

- Data stored in rows of columns (up to 1 MB)
- Rows are stored in tables
- Related tables are grouped into keyspaces
- Basic data types (int, Boolean, blob, etc.)
- Supports nested data types (list, map, set, etc.)
- Row must have partition key, can be multiple columns
- May have optional clustering columns (size constrained)

```
CREATE TABLE IF NOT EXISTS
tracker.blogs (
        publish_date date,
        shard int,
        title string,
        description int,
 PRIMARY KEY (publish_date, shard));
```

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Querying Amazon Keyspaces

- Uses Cassandra Query Language (CQL)
- Predicates via WHERE clause
- ORDER BY on clustering columns, can sort in multiple directions

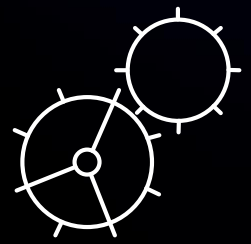
```
SELECT title, description
FROM ”tracker".blogs
WHERE publish_date = “2020-10-31”
ALLOW FILTERING;
```

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Amazon DynamoDB

FAST AND FLEXIBLE NOSQL DATABASE SERVICE FOR ANY SCALE



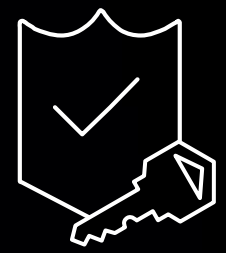
Performance at any scale

- Handles millions of requests per second
- Delivers single-digit-millisecond latency
- Automated global replication



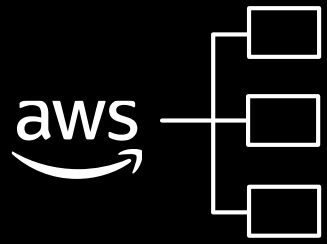
Serverless

- Maintenance free
- Auto scaling
- On-demand capacity mode



Enterprise ready

- ACID transactions
- Encryption at rest
- NoSQL Workbench
- PartiQL support



Built-in integration with other AWS services

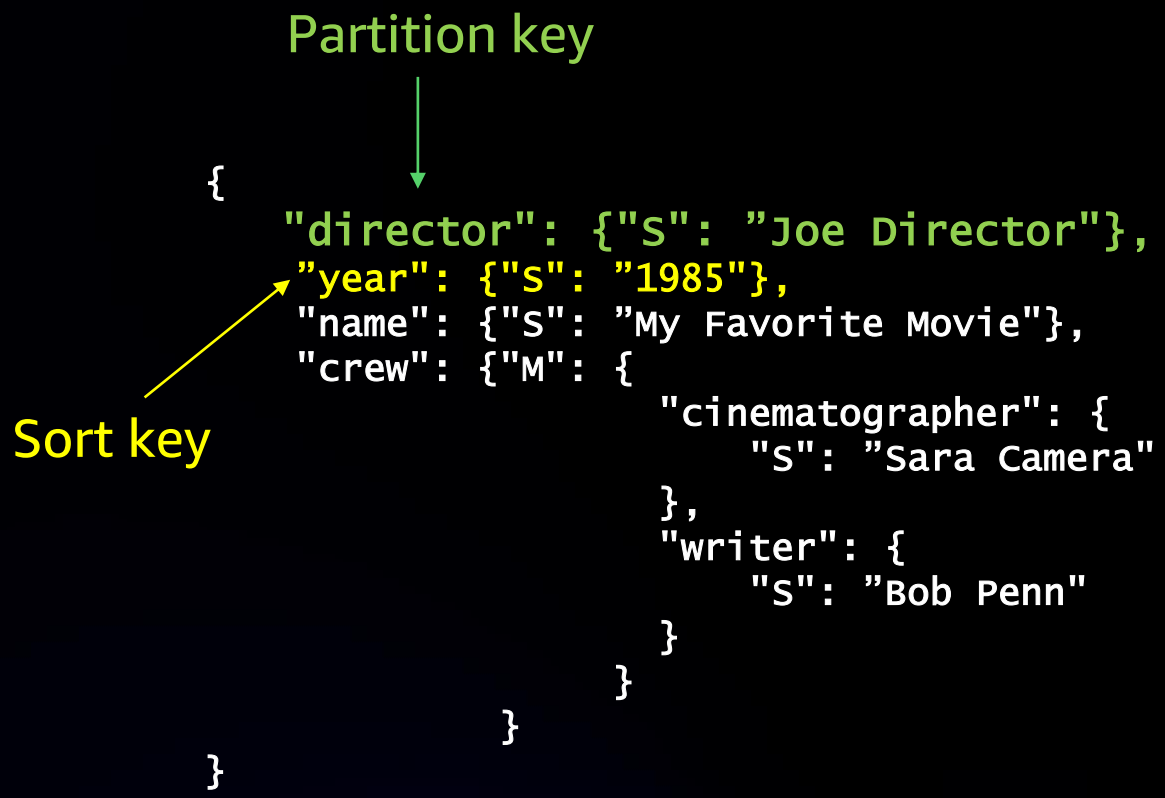
- Advanced streaming with Amazon Kinesis Data Streams
- Monitor traffic trends with Amazon CloudWatch Contributor Insights

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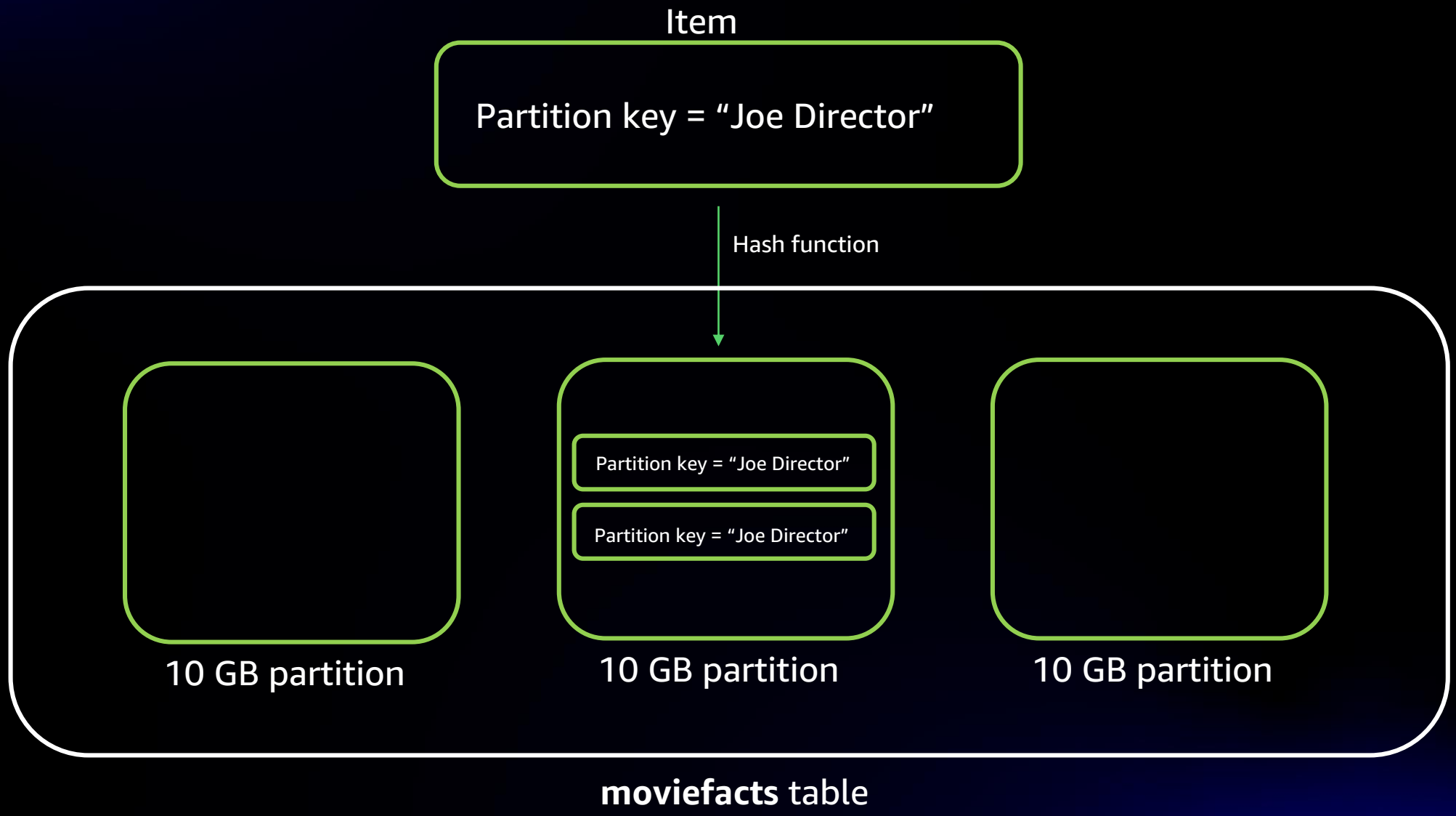
DynamoDB data model

- Items contain attributes (up to 400 kb)
- Items are stored in a table
- Basic data types (String, Number, Boolean, Binary, Null)
- Supports nested data types (List, Map)
- Item must have partition key
- Optional sort key allows for ranged queries
- Global Secondary Indexes (GSIs) enable different PK



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DynamoDB architecture



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Querying DynamoDB

Three methods of data access

- **GetItem –** Retrieve single item
- **Query –** Retrieve multiple items with same partition key, condition filter by sort key
- **Scan –** Retrieve all items in a table

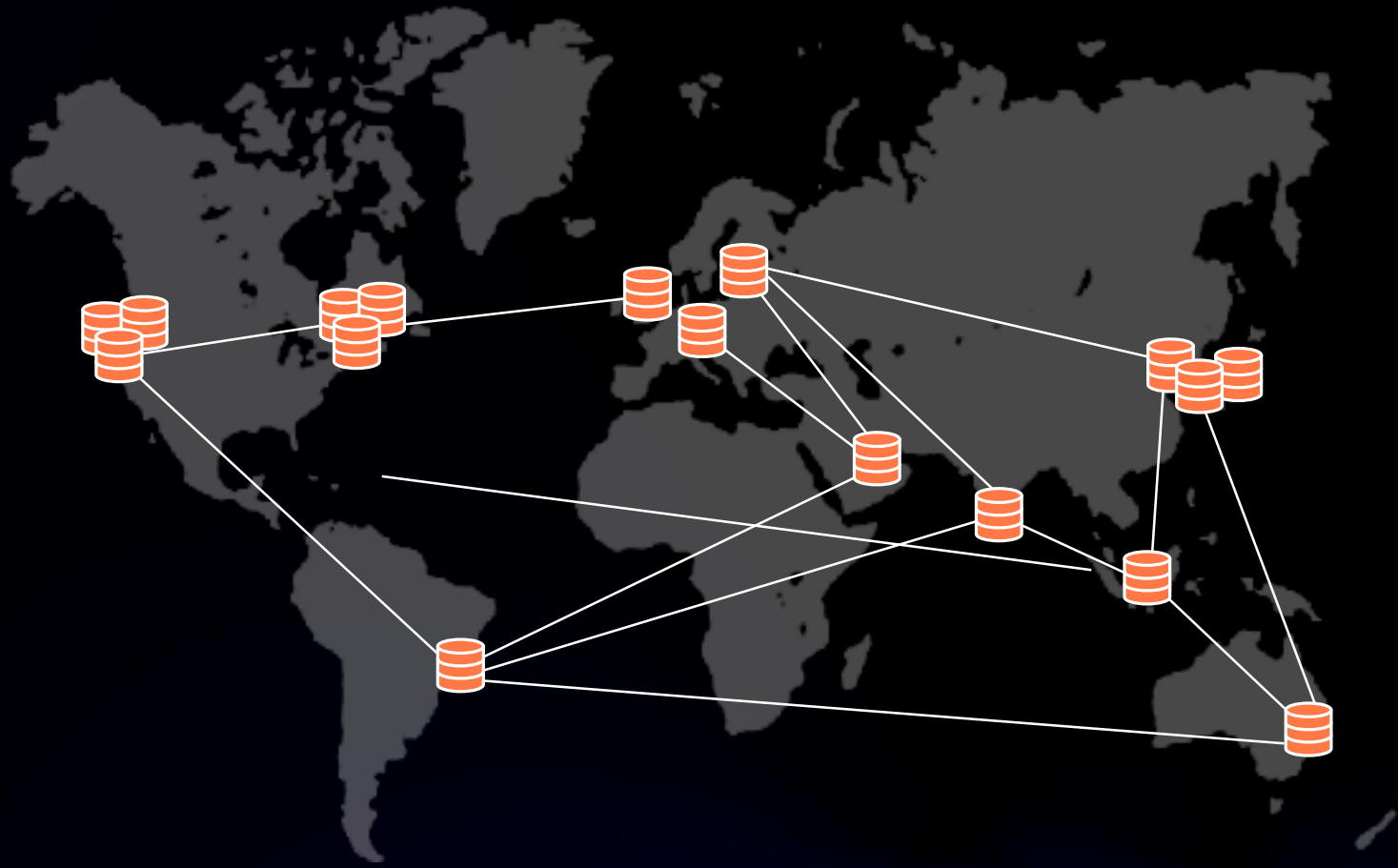
```
aws dynamodb query \
    --table-name moviefacts \
    --key-condition-expression ”director = :dir" \
    --expression-attribute-values ‘{“:dir":{"S":”Joe Director"}}'
```

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Notable DynamoDB features

- Global tables
- Change Data Capture for Kinesis
- DynamoDB Streams
- DynamoDB Accelerator (DAX)
- Export to S3



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DocumentDB indicators



- MongoDB-compatibility
- Maximum data model flexibility
- The ability to query nested data
- Read-heavy workloads that can tolerate eventual consistency
- Workloads up to 64 TB of data

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Keyspaces indicators



- Cassandra compatibility
- Schema validation
- Multiple independent sorts in a query
- Rows up to 1 MB

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DynamoDB indicators



- Workloads with well-defined query patterns
- Single-digit millisecond latency
- Infinite scalability
- Mature, rich feature set
- Tight integration with AWS services

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Customer use case: McAfee

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NGM – Modernization with Amazon DynamoDB

Next-Generation Messaging (NGM)

- Provides personalized messaging and measures campaign performance
- Reaches >30M subscribers

Modernized on DynamoDB

Scalability

- Adjacency lists, GSIs, and GSI overloading

Cost

- Application autoscaling, storage scaling

Performance

- DAX, DDB VPC endpoints

Operational Efficiency

- Global tables, continuous backups

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McAfee ecommerce

Subscription Management

- Direct to consumer
- Drive new customer acquisitions
- Enable renewals
- Provide new payment methods
- Drive search engine optimizations

Ecommerce Transformation

- Cloud scale website
- Ecommerce cart
- Marketing tech
- Content management and personalization
- Microservices design

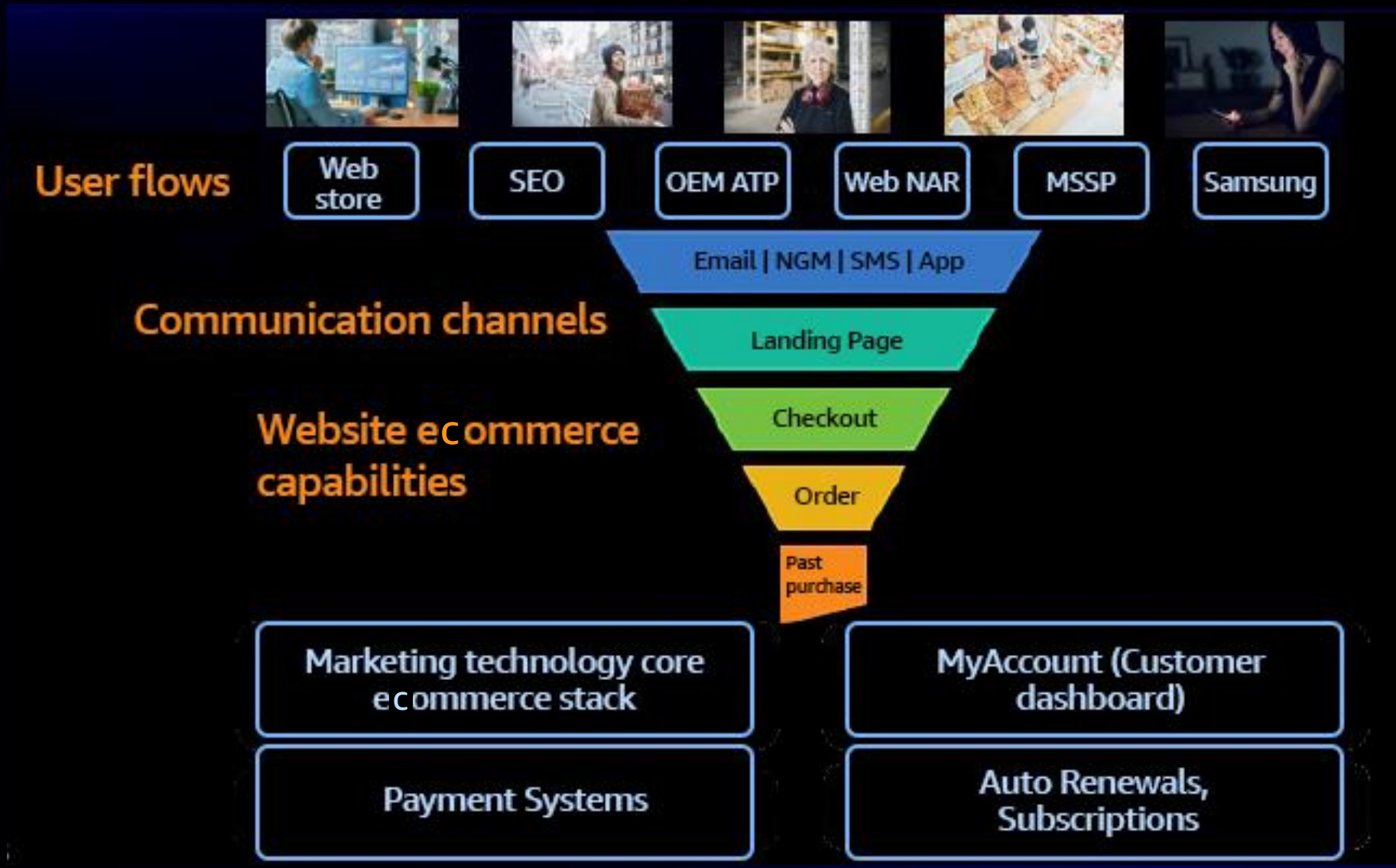
Partner Enablement

- Partner registration portal
- Personalization
- Device-centric personal protection

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Ecommerce powers McAfee's platform

McAfee's online protection, acquisition & retention platform



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Transforming ecommerce at McAfee

FROM

- Monolith application hosted on-prem data centers in US
- 99.9% uptimes resulting in 8 hours of outages impacting revenue, brand reputation, and stakeholder credibility
- Time to market limited by monthly release cycles, quality issues 80%+ manual QA effort
- Data platforms are siloed, audience segments limited to country and PC manufacturer, rule-driven messaging orchestration

TO

- Ecommerce stack that is cloud-native, microservices-based
- 99.99% uptime that drives higher NPS internally and externally
- Faster time to market with 100% test automation
- Unified profiles in customer data platforms, ML-driven audience segmentation and message orchestration

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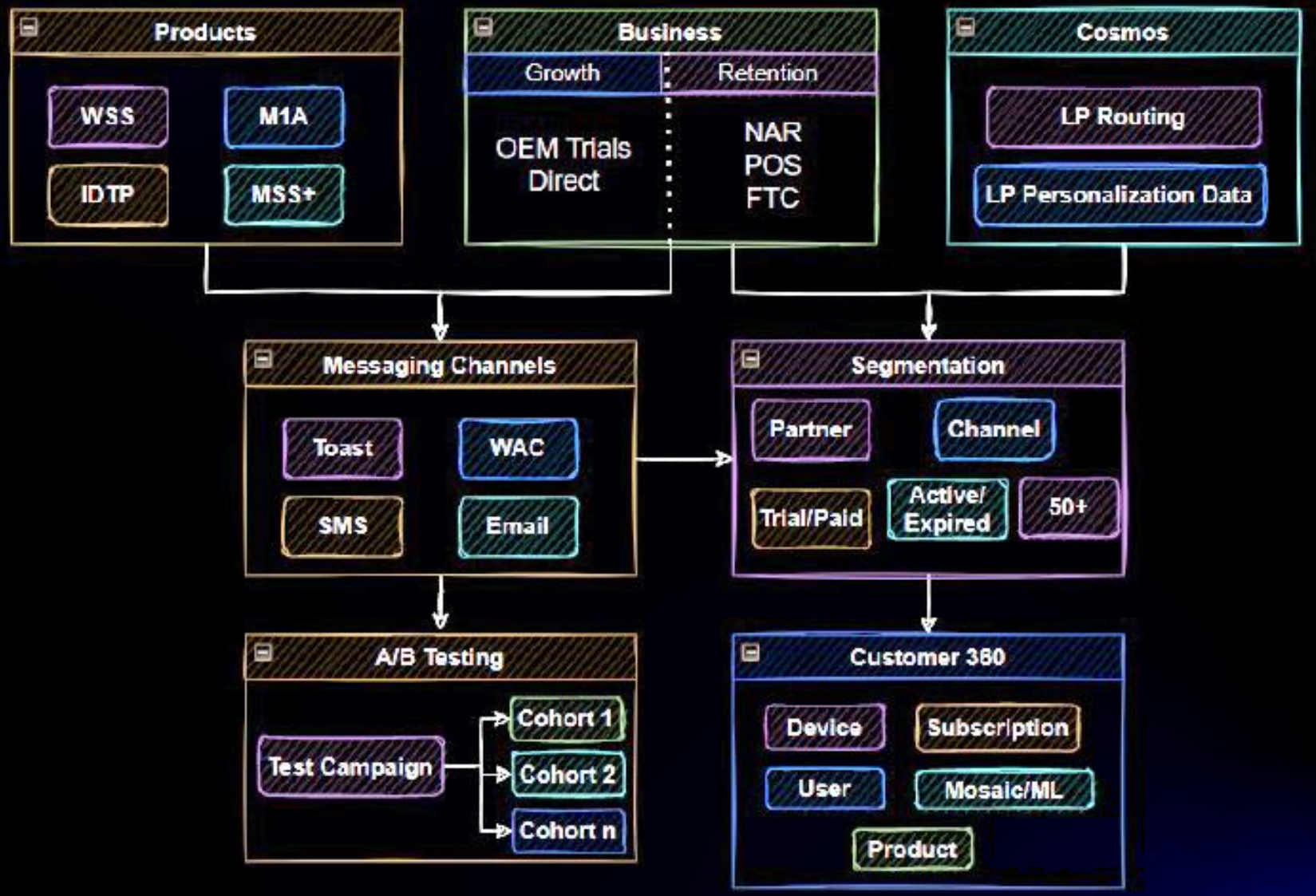
Next-generation messaging (NGM)

Marketing Automation

- Provide dynamic content and personalization to drive message delivery to hundreds of millions of impressions each month
- Calculate KPI including deliverability, open rates, click-to-open rates, conversion rates, opt-out rates, and revenue
- Marketing message campaigns that reach >30M+ subscribers with YOY growth >15%

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NGM architecture



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NGM – Prior solution

Composed of 3 core databases that utilized Microsoft SQL Server on Amazon EC2

- ❑ >1B write operations per month
- ❑ Store message history, device details, user profile, and subscription context for consumers

Challenges

- ❑ Cost
- ❑ Performance
- ❑ Scale
- ❑ Operational complexity

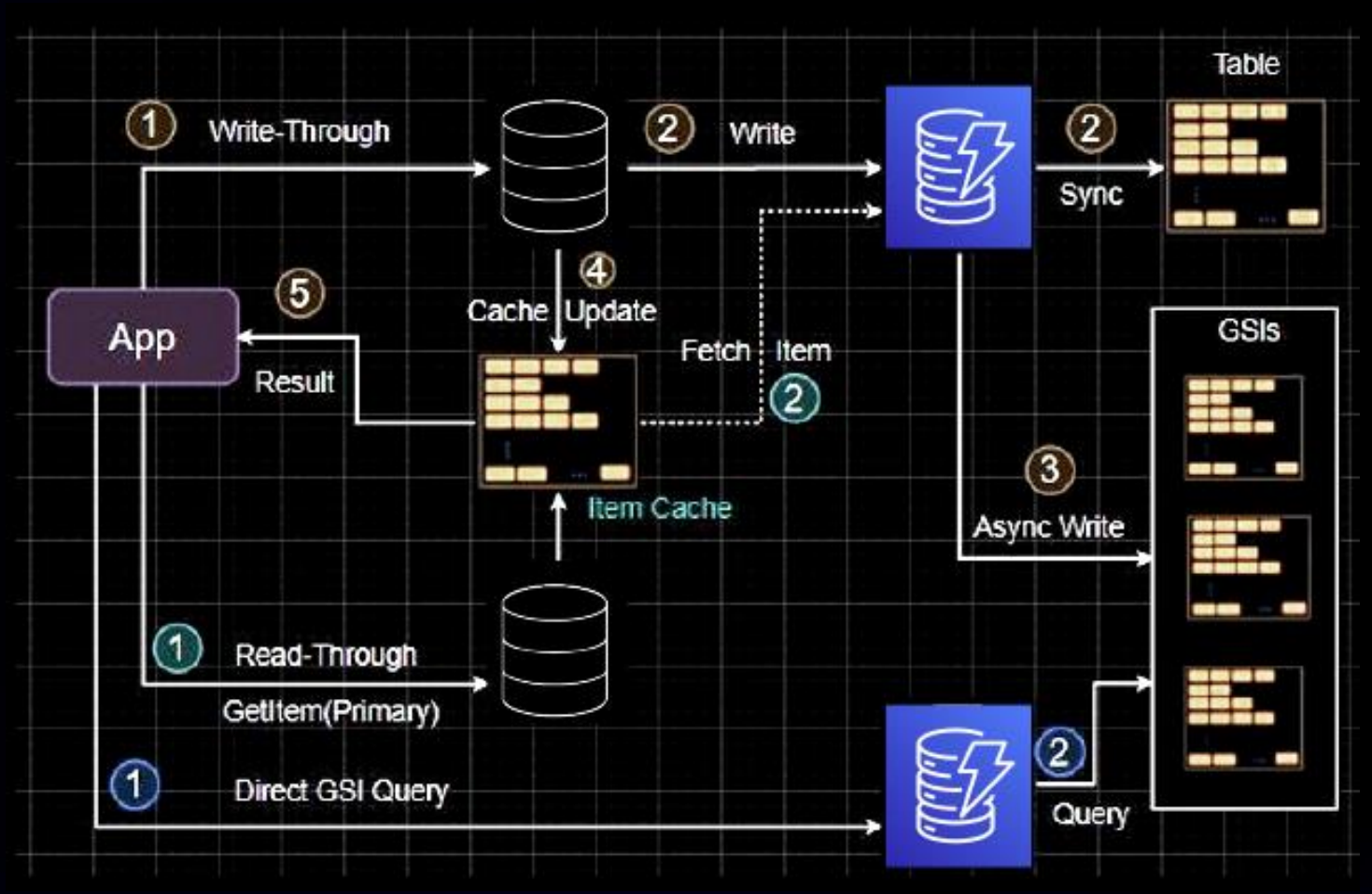


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NGM – Results

Migrating to DynamoDB has enabled NGM to save annual infrastructure costs significantly, in addition to providing low latency and operational reliability

- ❑ Monthly infrastructure costs down >40%
- ❑ Millisecond response times
- ❑ >3B write operations per month and >8B read operations per month with 20% YOY growth
- ❑ Continuous backups; global replication



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Ecommerce roadmap

- NGM first application in ecommerce stack to move to cloud-native stack
- McAfee global payments platform moves to AWS in late Q4 to provide higher uptime and global scale
- McAfee customer dashboard (MyAccount) moves to AWS early Q1 – faster-loading pages
- In Q1 2022, we are moving our web store, shopping cart, and payment services to AWS to achieve low latency and global scale for our ecommerce operations

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