# Building a Customer 360 Graph Application on Amazon Neptune

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# Agenda

- What is a Customer 360 Graph?
- Why a Graph Database and Amazon Neptune?
- Customer examples and how to get started

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# What is a Customer 360 Graph?

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# What is a Graph?

- Graph databases are optimized to store and query relationships
- Nodes represent real-world objects
- Edges store relationships between objects
- Properties and Labels can be added to both Nodes and Edges

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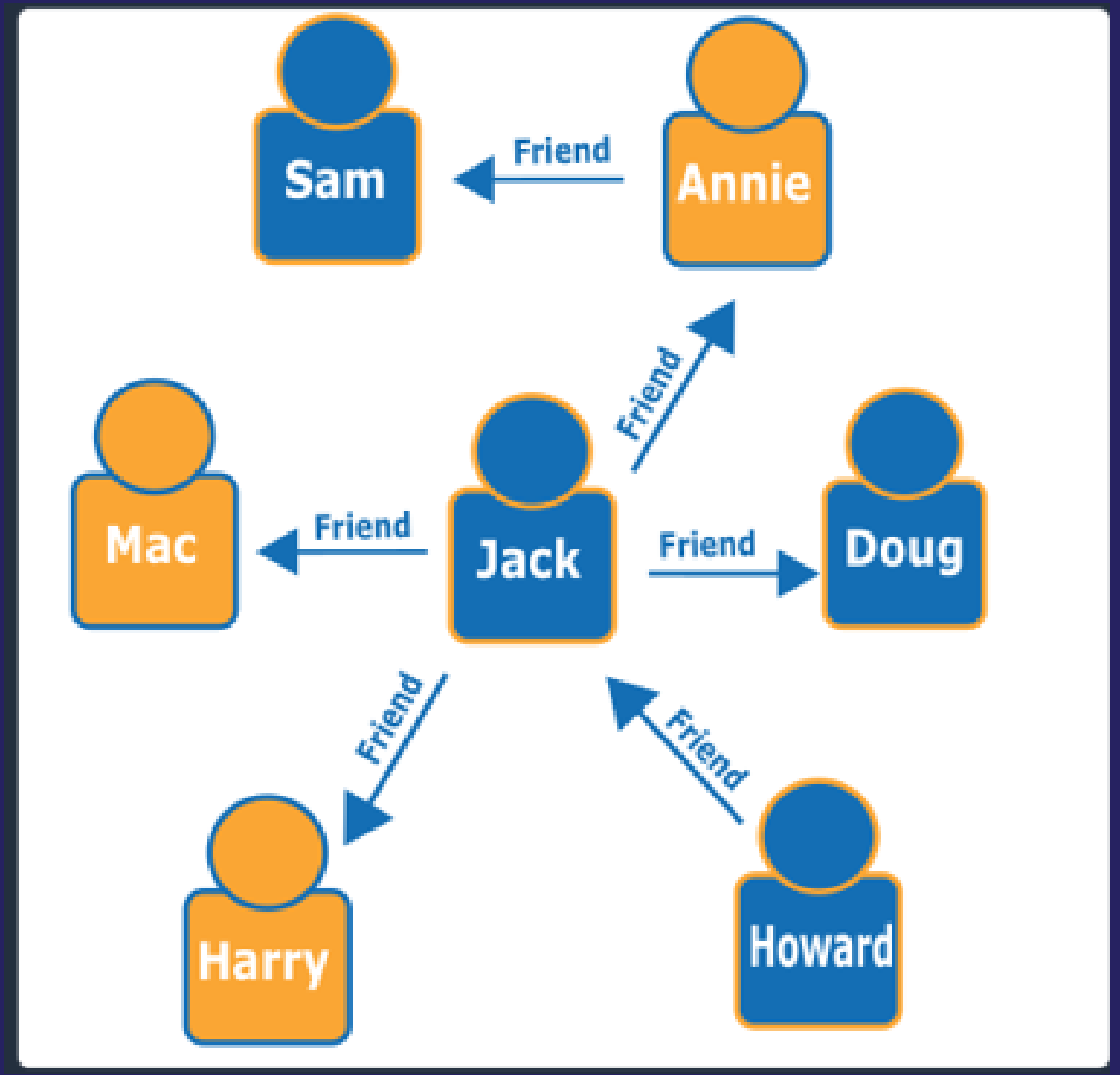
# A Social Network is a Graph

- Nodes: People
- Edges: Friend Relationships
- Edges can have direction

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# Consumer 360 Graph – Unified view across channels and devices

**Customers interact** with brands and products across multiple channels, devices, and identifiers

**Lack of a common identifier** linking customer interactions across devices and platforms

**Consumer 360** enables capture and linking of identities, devices, interests and behaviors to develop  a unified

**Marketers** use Consumer 360 to personalize content, products, offers and advertising

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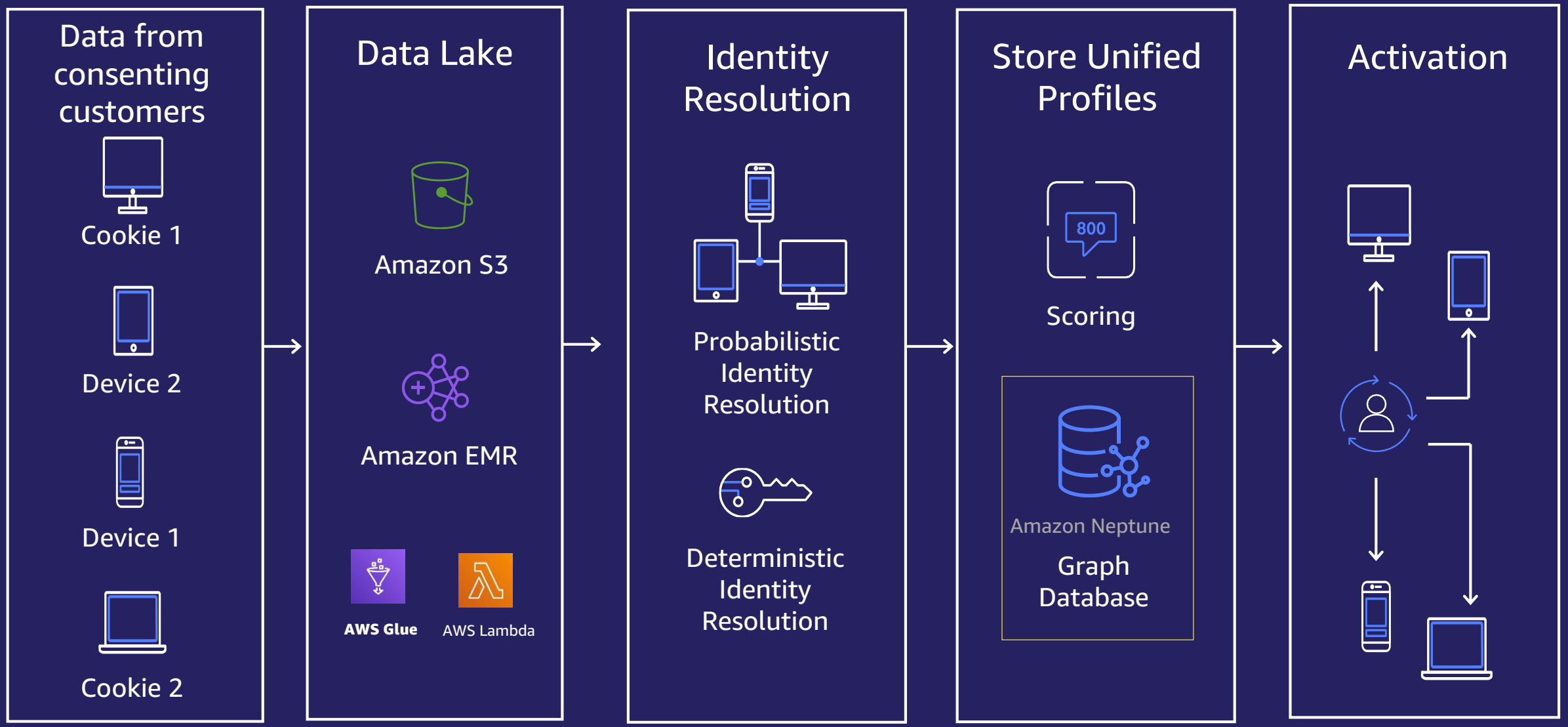
# Logical Flow — Customer 360 Graph

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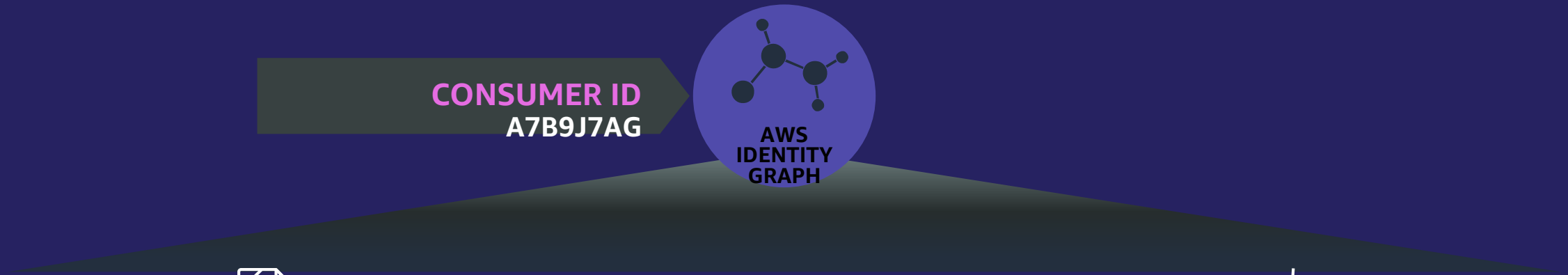
# Cox Automotive - connected consumer journey

## A connected consumer journey, combined with machine learning, resulting in reliable predictive insights

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# Identity resolution to power personalization

"We have addressed the immediate goals of reducing dependence on third-party cookies and building a 360-degree view of the consumer household."

– **Carlos Rendon,** Principal Technical Architect, Cox

Amazon Neptune
Amazon EMR
Amazon S3

## Challenge

- Loss of third-party cookie expected to highly impact ability to personalize website content
- Build a 360-degree view of households that can be utilized across business units, many of which were the result of M&A

## Solution

- Simplified data modeling that will support new use cases using a graph database
- Created an Identity Graph to define identify and combine shoppers or prospects of a "household" and leads
- Graph consists of approximately 0.5 billion edges and 0.4 billion vertices running on a Neptune cluster

## Results

- Yielded twice as much browsing history per household compared to using individual cookies resulting in higher engagement, better click through rates, and higher email open rates
- Able to integrate with downstream applications (ad segmentation and vehicle recommendations)
- 180% increase average online interactions per consumer
- 380% increase average cookies per customer
- Six use cases that benefit from identity graph today

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# Audible scales up for business customers with help from Amazon Neptune

## Challenge:

Audible for Business needed to enable its enterprise customers' administrators to maintain their own sets of end users and required a database that would scale to seamlessly manage the complex network of relationships.

## Solution:

The company used Amazon Neptune, a managed graph database, to provide automated reporting and an increased self-service experience that could scale to support hundreds of thousands of end users.

## Results:

- Scalable to thousands of customers
- 5K transactions per second
- 4 million edges and vertices total
- A single-source solution

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# Why a Graph Database?

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# Technical Challenges with Customer 360

## Traditional Databases

- Relational databases are not built to capture and store relationships between billions of interconnected entities
- Challenging to deliver low latency required for real-time cross-device advertising targeting, personalization and other customer experience use-cases

## Other Graph Solutions

- Other graph options are often expensive, inflexible, and may be difficult to optimize and scale globally
- Require hardware management, provisioning, manual scaling for open-source models

## Identity Resolution & Privacy

- Identity resolution is an ongoing process due to growth of devices and new digital touchpoints—presenting challenges with schema changes, indexing and scaling
- Challenging to support privacy requirement with audit trail

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# Graph vs. RDBMS

| | | |
|---|---|---|
| Easy to model for highly connected data | ⟷ | Complex models |
| Relationships are first class citizens | ⟷ | Relationships are represented by Foreign Keys |
| Imperative Gremlin | ⟷ | Declarative SQL |
| Graphs are flexible | ⟷ | Rigid Schema |
| Graph Traversal Performance | ⟷ | SQL Query Performance |

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# Why Amazon Neptune

***Build and run graph applications with highly connected datasets***

Cost-effective

No hardware management

Instant provisioning

Scaling

Security & compliance

- Optimized to store and map hundreds of billions of relationships between customer profiles, identifiers, cookies, devices, products and channels
- Enables real-time personalization, ad targeting  with millisecond query response time
- Deploy high performance graph applications with popular open-source APIs such as openCypher, Gremlin, SPARQL, and easily migrate applications

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# Neptune Customers

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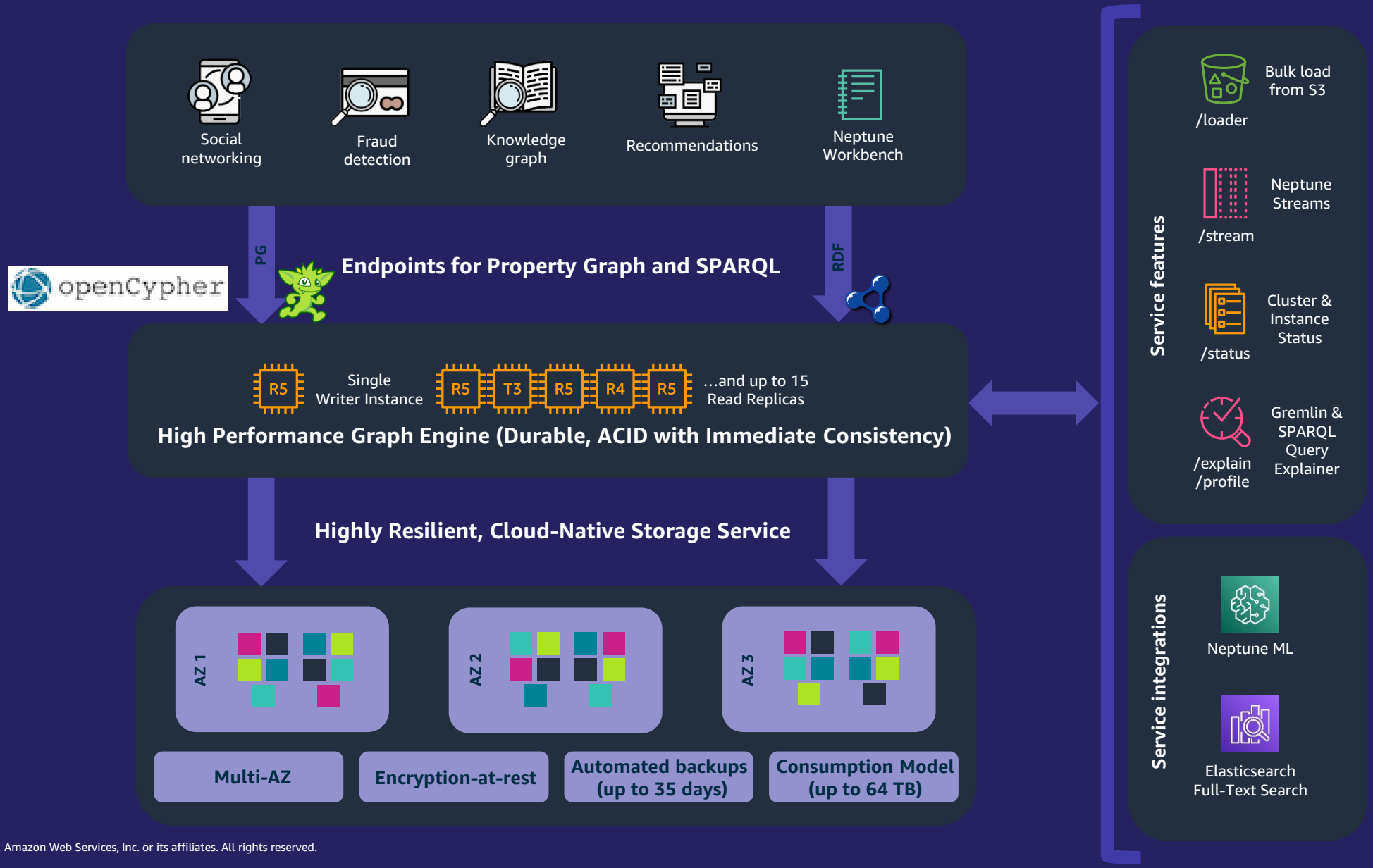
# Amazon Neptune High Level Architecture

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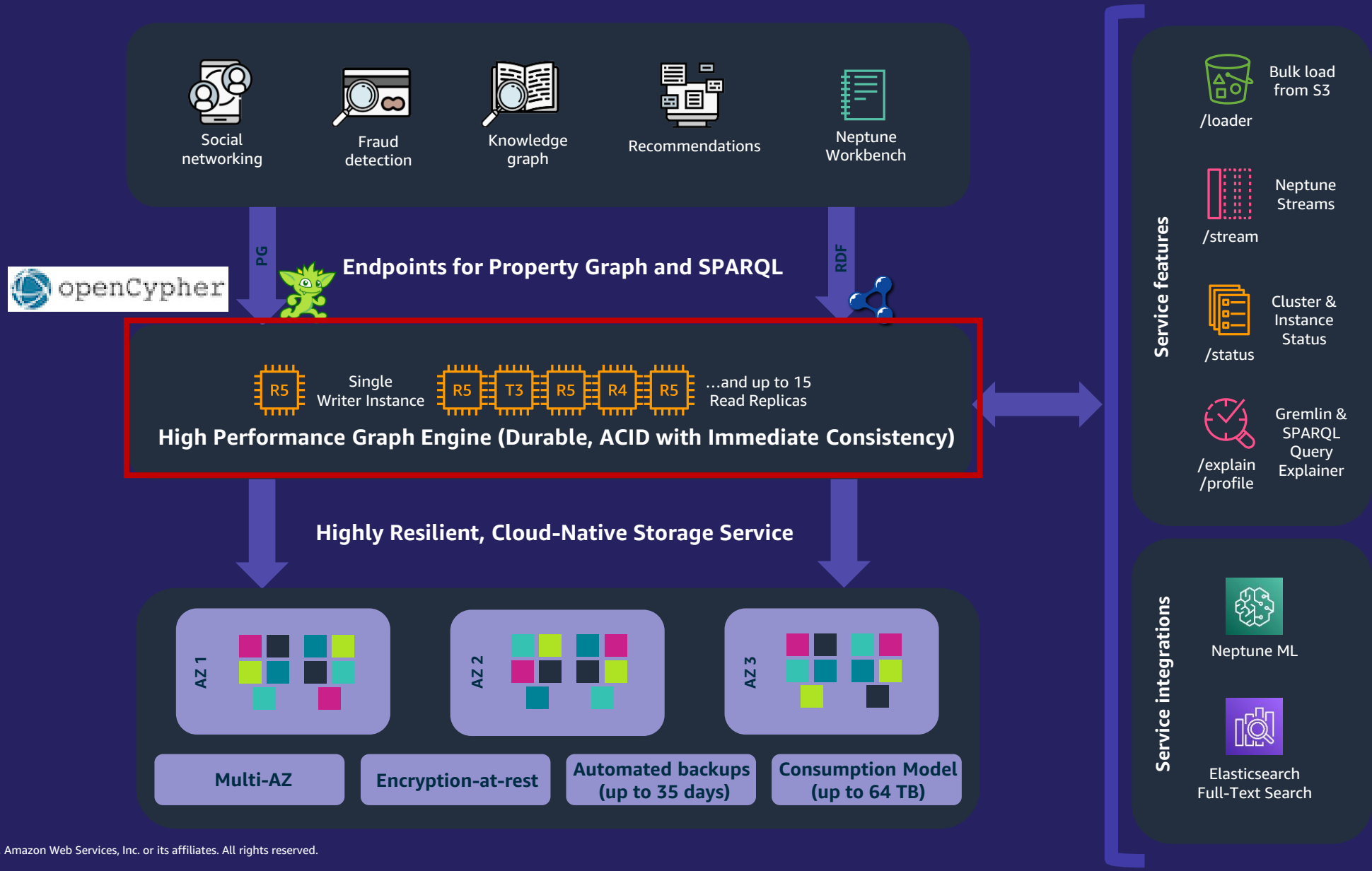
# High Performance Graph Engine

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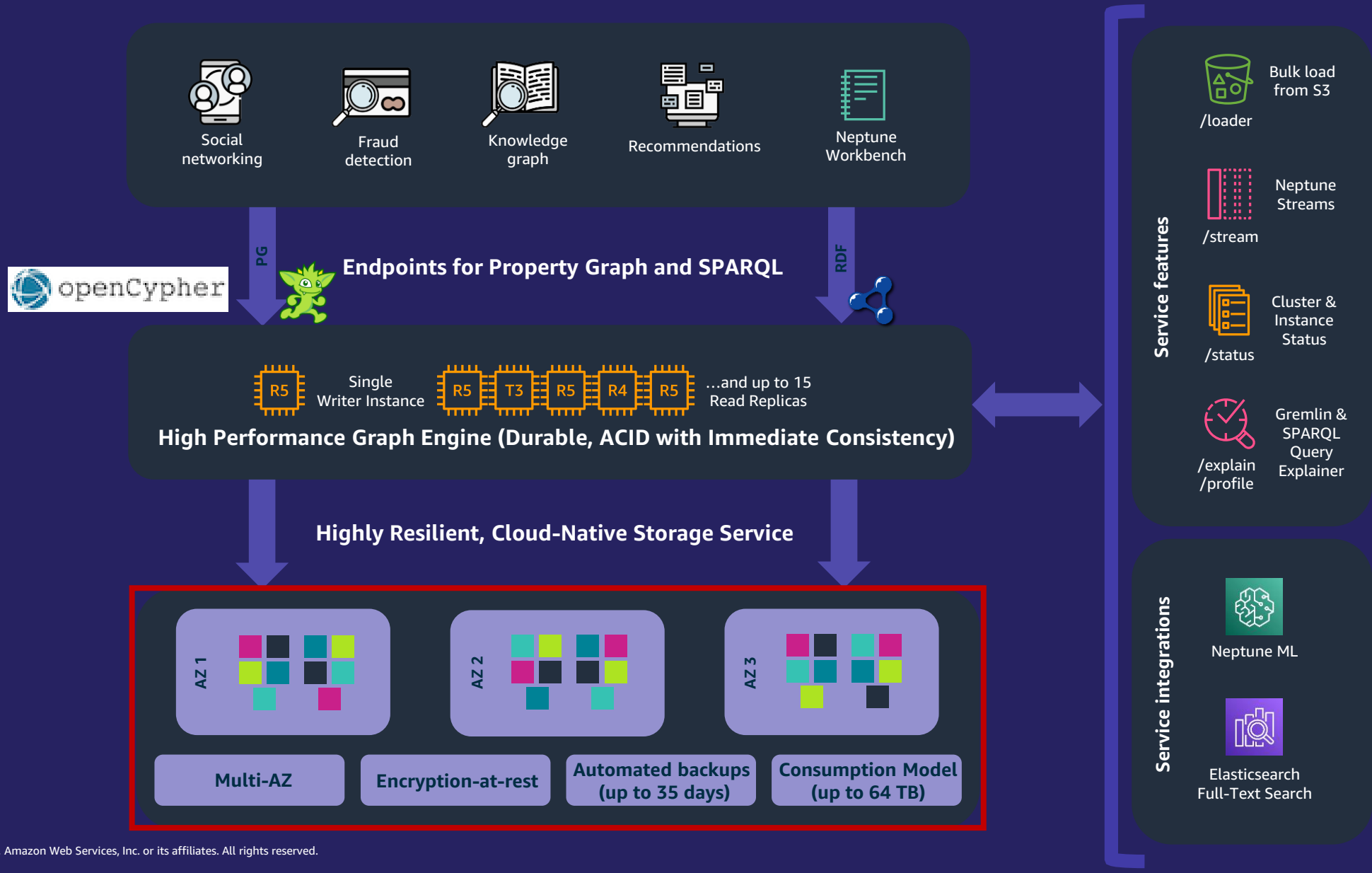
# Cloud-Native Storage Service – Multi AZ up to 128TiB

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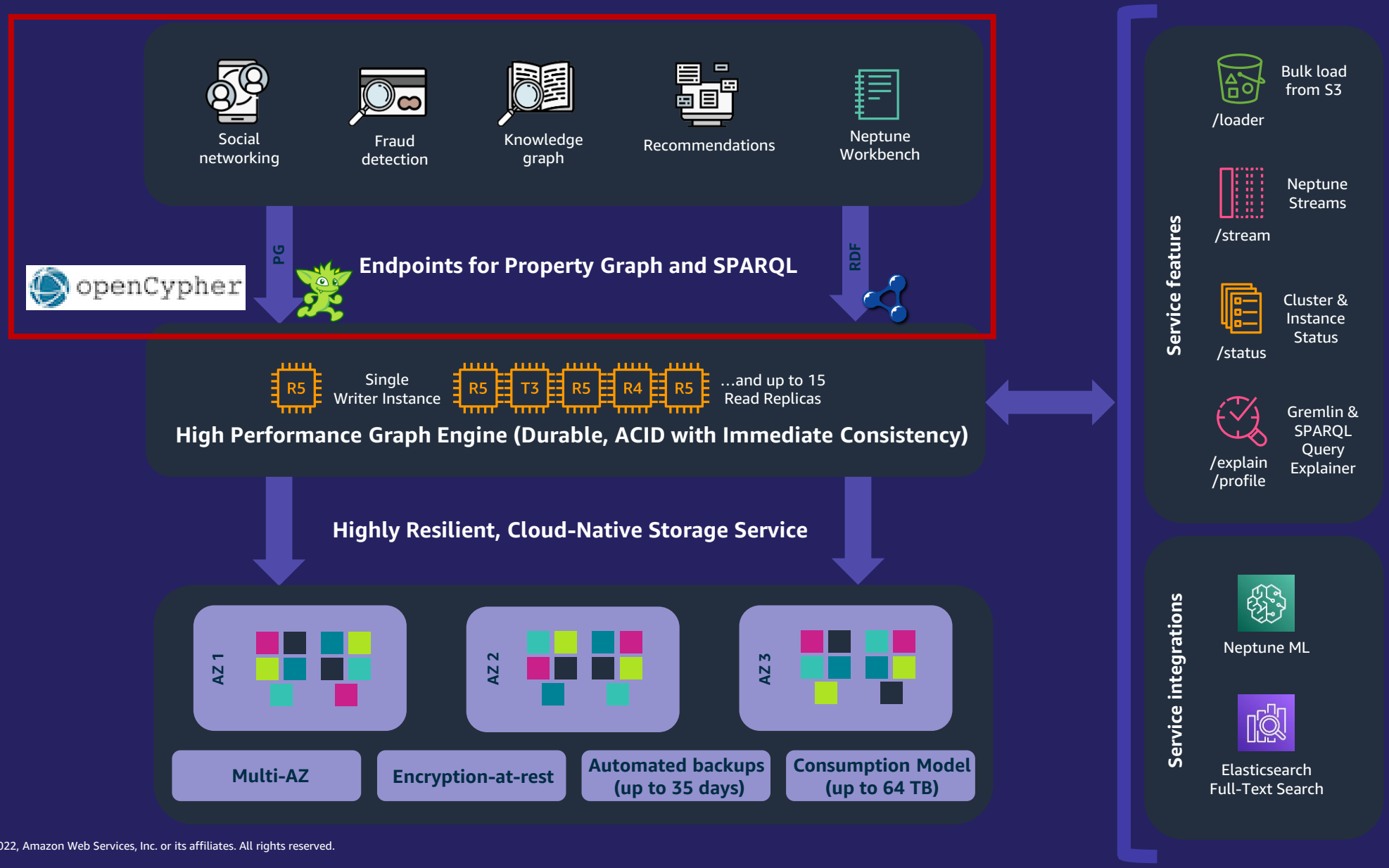
# Graph Models and Query Languages

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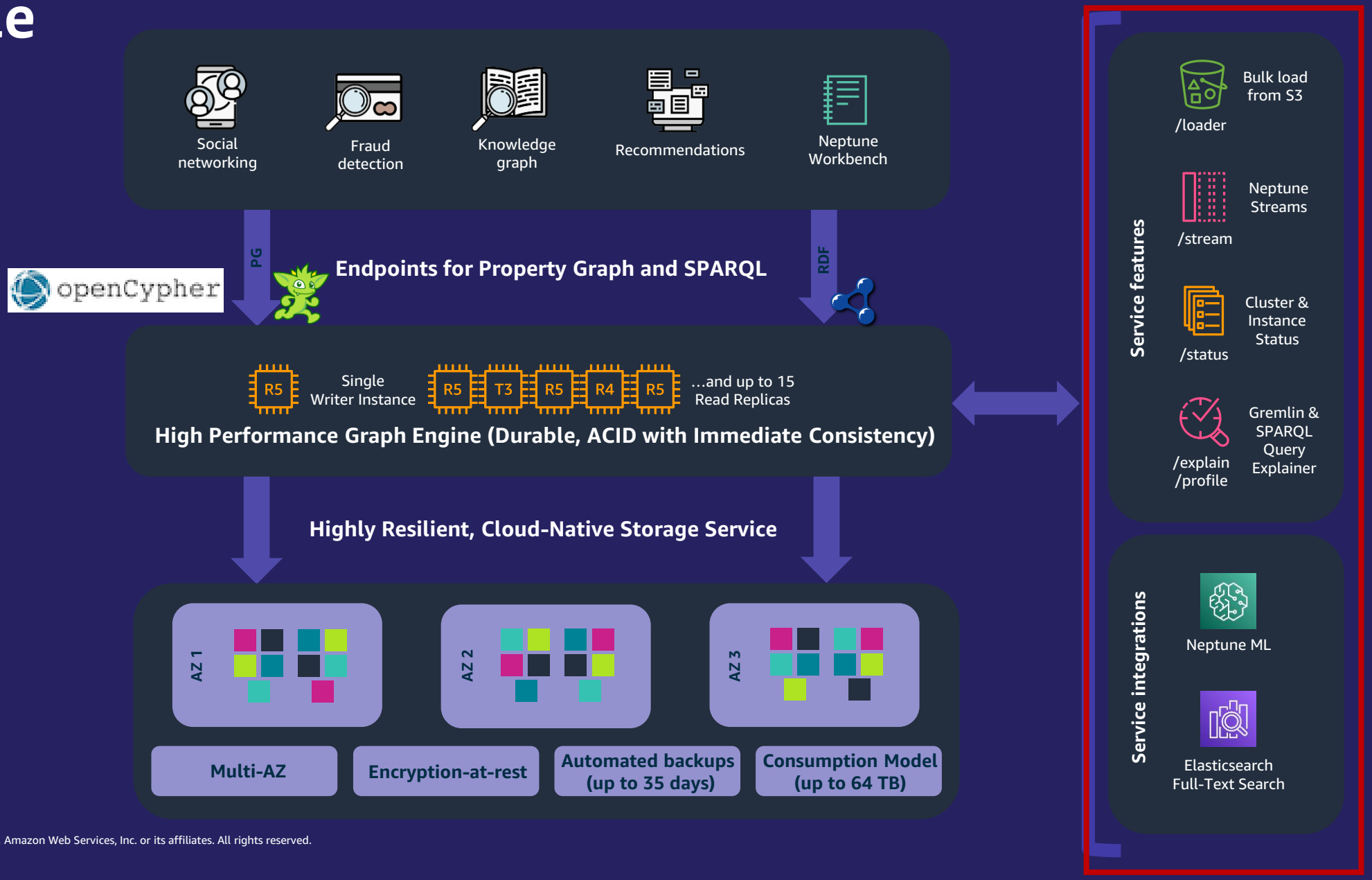
# APIs for Load, Streams, ML, Search, Status, Explain, Profile

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# Demo

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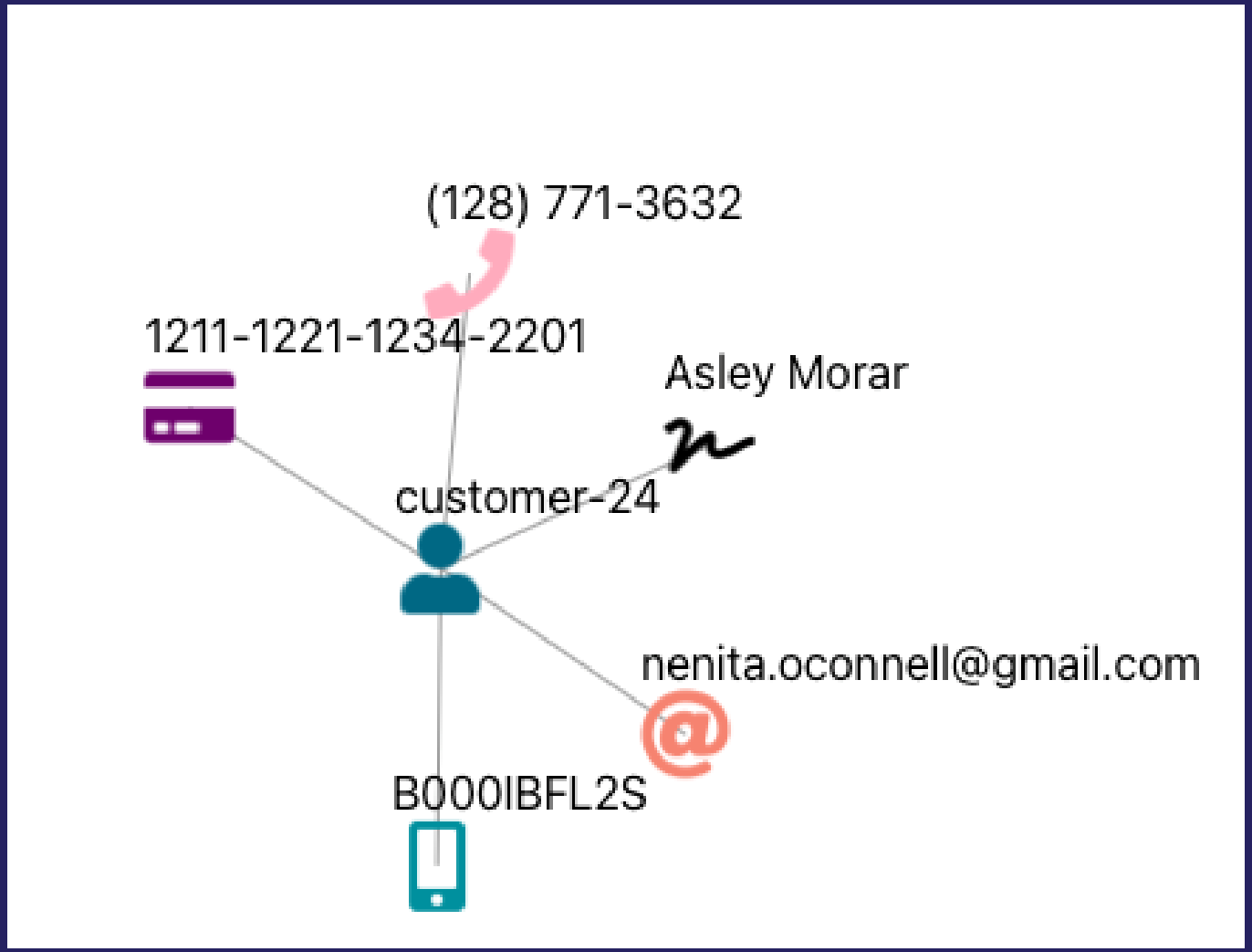
# Customer 360 Demo

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# Customer 360 Demo

## Connected Identity Results

| Number | Customer 1 | Customer 2 | Shared Attributes |
|---|---|---|---|
| 1 | customer-24 | customer-92 | phone-210 device-105 email-143 |
| 2 | customer-92 | customer-24 | phone-210 device-105 email-143 |
| 3 | customer-28 | customer-100 | phone-225 name-163 token-184 |
| 4 | customer-100 | customer-28 | phone-225 name-163 token-184 |
| 5 | customer-6 | customer-59 | phone-201 email-140 token-191 |
| 6 | customer-59 | customer-6 | phone-201 email-140 token-191 |
| 7 | customer-10 | customer-91 | device-115 token-182 |
| 8 | customer-14 | customer-30 | phone-209 device-110 |
| 9 | customer-15 | customer-77 | device-118 token-184 |
| 10 | customer-16 | customer-71 | device-107 email-132 |

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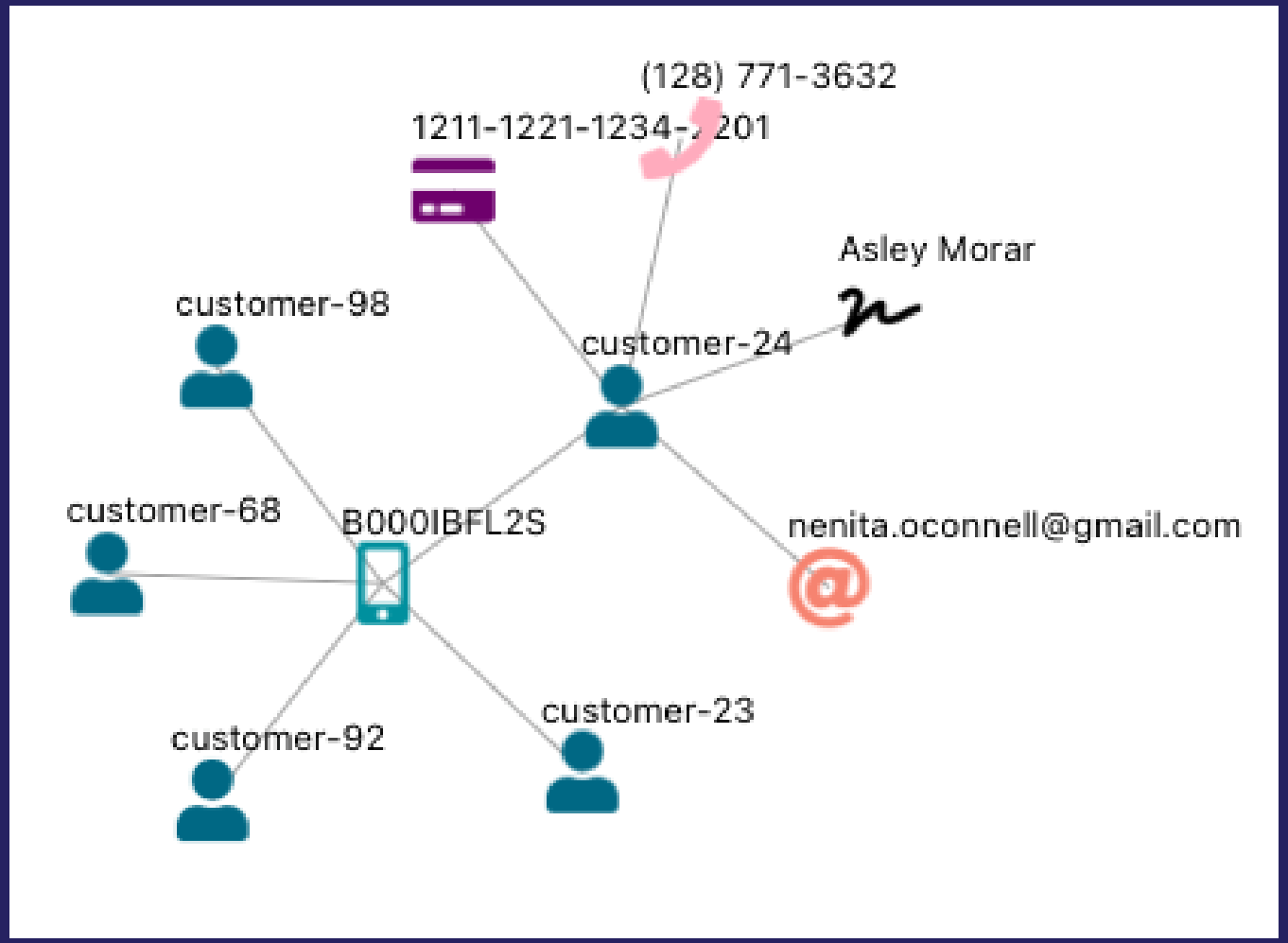
# Customer 360 Demo

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| 10 | customer-16 | customer-71 | device-107 email-132 |

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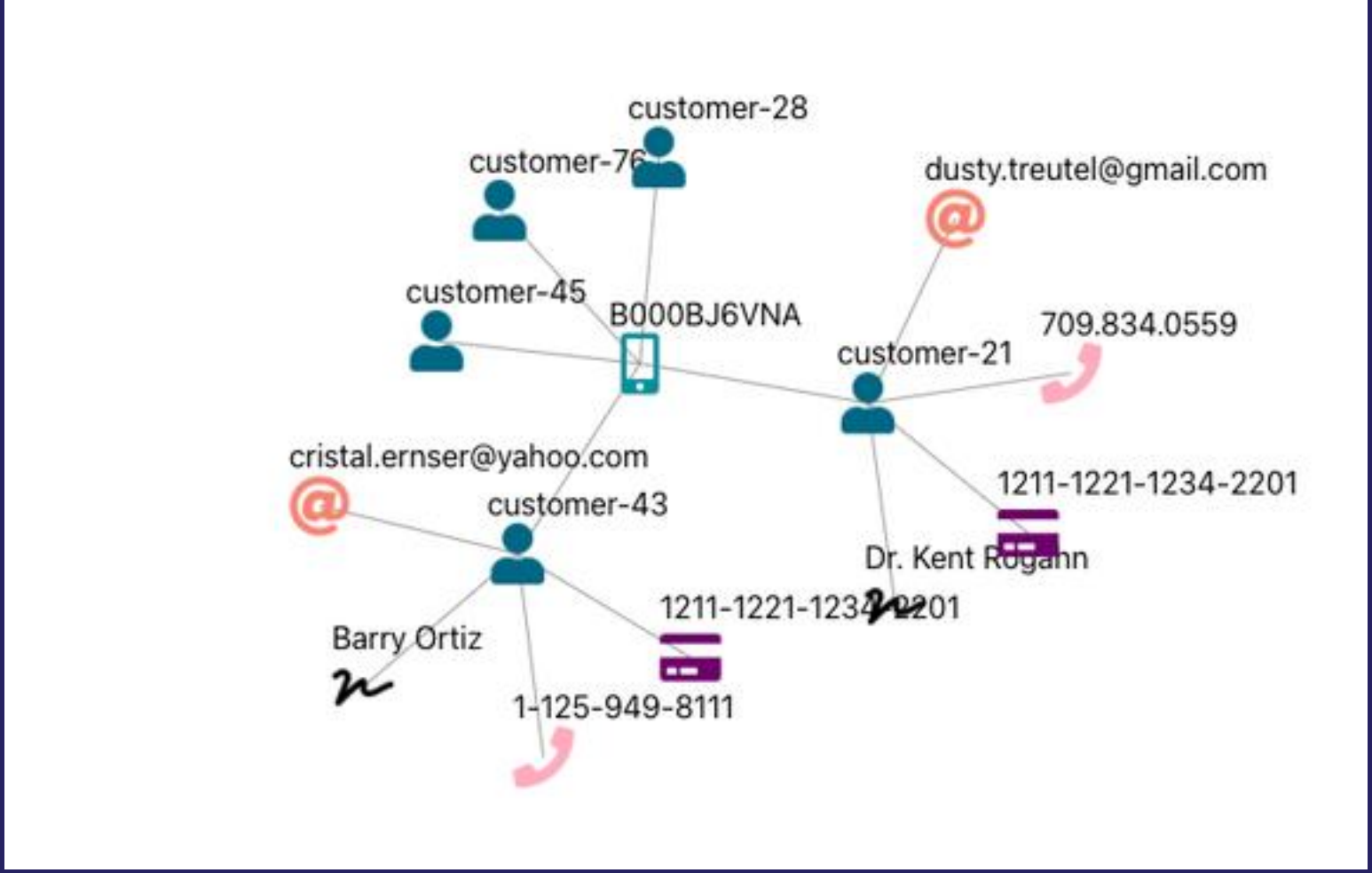
# Customer 360 Demo - Householding

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# Resources for Next Steps

- Neptune Best Practices, Training, and Developer Resources
  https://aws.amazon.com/neptune/developer-resources/

- Neptune Reference Architectures
  https://github.com/aws-samples/aws-dbs-refarch-graph

- Neptune Graph Notebook & Sample Applications
  https://github.com/aws/graph-notebook/

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# Summary

- AWS customers are building Customer 360 Graphs
- The benefits of a Graph Database and Amazon Neptune
- Customer examples and how to get started

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# Thank you!

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