AWS re:Invent

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

AIM206

How Bloomberg invested in smarter search with Amazon Kendra

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Machine Learning, Team Lead
Bloomberg Industry Group

Ritesh Vajariya
Principal Solutions Architect
AWS

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Agenda

AWS ML stack

Amazon Kendra introduction

Smarter search

Bloomberg Industry Group

Life before and after Amazon Kendra

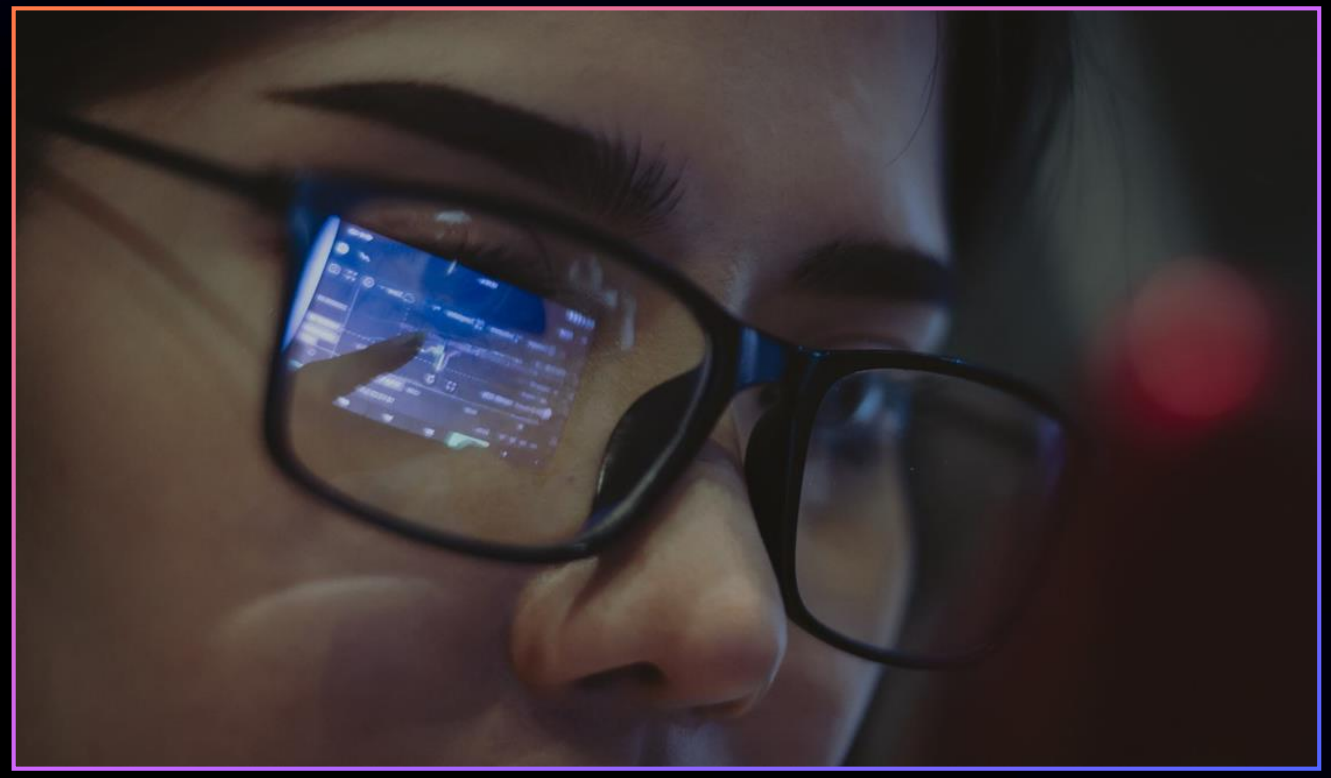
Business benefits

What’s next for Bloomberg Industry Group

How to get started

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Critical information is getting harder to find



Data at the enterprise is proliferating, and it's often scattered and inaccessible

80%

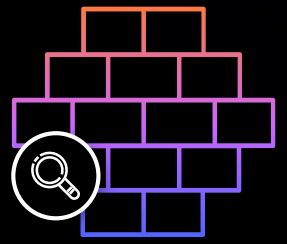
of data at the enterprise will be **unstructured** by 2025

Source: https://www.capgemini.com/2018/08/reorganizing-unstructured-data/

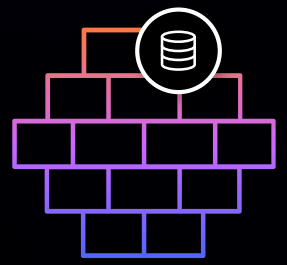
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Cost and complexity barriers when delivering great search

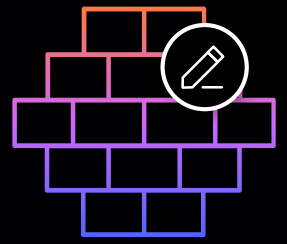
Inaccurate keyword search



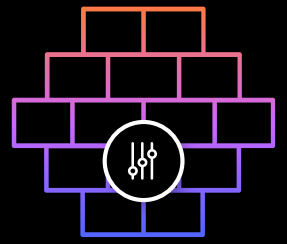
Scattered content repositories



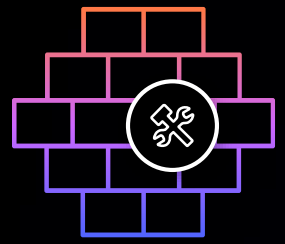
Unstructured data



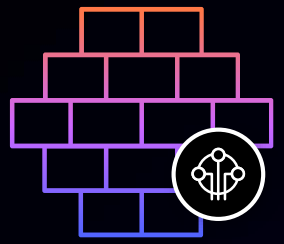
Manual tuning



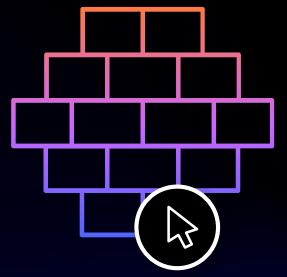
Ongoing maintenance



Keeping content up to date



Suboptimal user experience



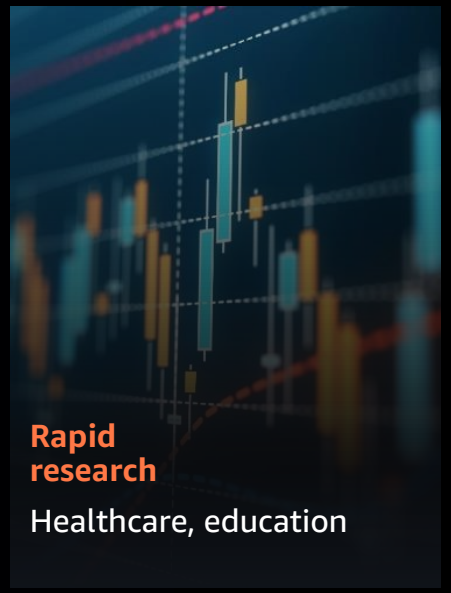
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Smarter search drives better outcomes across every industry



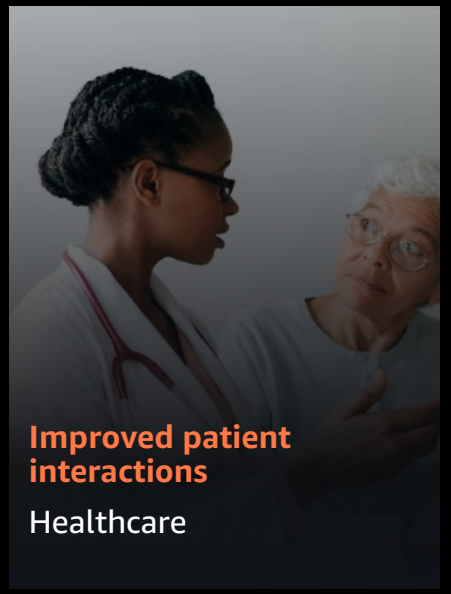
Faster drug development

Pharmaceuticals



Rapid research

Healthcare, education



Improved patient interactions

Healthcare



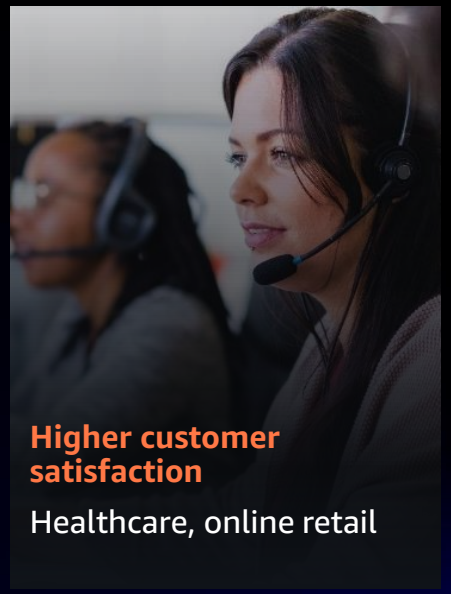
Shorter manufacturing timelines

Industrial, automotive



Enhanced risk governance

Financial services



Higher customer satisfaction

Healthcare, online retail



Richer web experiences

Media and entertainment, online retail

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AWS machine learning



Machine learning in the hands of every developer, data scientist, and business user

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The AWS ML stack

BROADEST AND MOST COMPLETE SET OF MACHINE LEARNING CAPABILITIES

AI SERVICES

Vision
Amazon Rekognition

Chatbots
Amazon Lex

Business tools
Amazon Personalize
Amazon Forecast
Amazon Fraud Detector
Amazon Lookout for Metrics

Search
Amazon Kendra

Healthcare
Amazon HealthLake
Amazon Comprehend Medical
Amazon Transcribe Medical

Speech
Amazon Polly
Amazon Transcribe

Text
Amazon Comprehend
Amazon Translate
Amazon Textract

Contact centers
Contact Lens for Amazon Connect
Amazon Connect Voice ID

Code + DevOps
Amazon CodeGuru
Amazon DevOps Guru

Industrial
AWS Panorama Appliance and SDK
Amazon Monitron
Amazon Lookout for Equipment
Amazon Lookout for Vision

AMAZON SAGEMAKER

Label data

SAGEMAKER STUDIO IDE

Data collection prep | Store features | Detect bias and explain predictions | Visualize in notebooks | Pick algorithm | Train models faster | Tune parameters | Deploy in production | Manage & monitor

CI/CD

Manage edge devices

ML FRAMEWORKS & INFRASTRUCTURE

TensorFlow, PyTorch, Apache MXNet | Deep learning AMIs & containers | GPUs | AWS Inferentia | Amazon Elastic Inference | FPGA

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Amazon Kendra

QUICKLY AND EASILY FIND ACCURATE INFORMATION

EASY TO FIND WHAT YOU ARE LOOKING FOR



Natural language queries

Contextual search in unstructured content



NLU and machine learning core

Reading comprehension

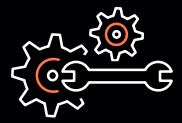
FAQ matching

Document ranking



Broad domain expertise

Pre-trained for 14 domains and industries



Continuous improvement

Incrementally learns from user feedback

QUICK SETUP



Native and partner connectors

Automate ingestion

Find the best answer, wherever it is

SECURE



Secure search

Encrypted in transit and at rest

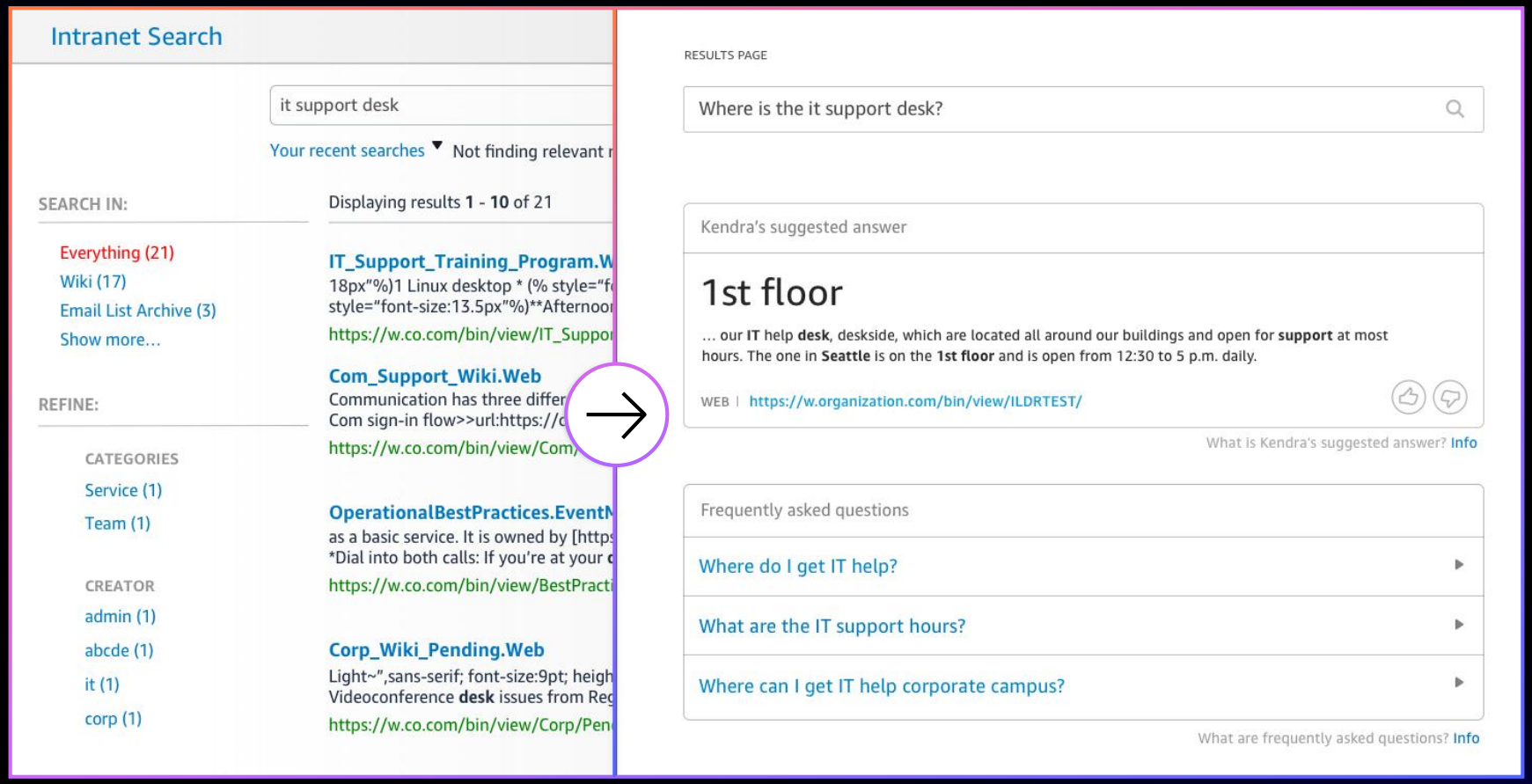
Token-based access control

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Employees and customers want answers, not choices

Traditional search



Intelligent search

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Advantages of intelligent search



Accelerate research and development

Finding relevant information in highly technical research and engineering documents



Minimize regulatory and compliance risks

Enhancing regulatory intelligence, correspondence, and access to up-to-date compliance data



Boost contact center efficiency

Assist call center agents to answer questions quickly and accurately, in call centers and via chatbots (without bot training)



Enhance customer search experiences

Create interactions that delight, and give customers the answers they're looking for, whether it's a product search, return policy details, or a news article



Increase employee productivity

Create a unified search and discovery experience to equip employees with the information they need to do their jobs

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Simple implementation workflow

Getting started



Step 1: Create an index

An index is the place where you add your data sources to make them searchable in Amazon Kendra



Step 2: Add data sources

Add and sync your data from Amazon S3, SharePoint, and other databases to your index



Step 3: Test and deploy

After syncing your data, visit the search console page to test search and to deploy Amazon Kendra in your search application

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Amazon Kendra

NATURAL LANGUAGE QUERIES



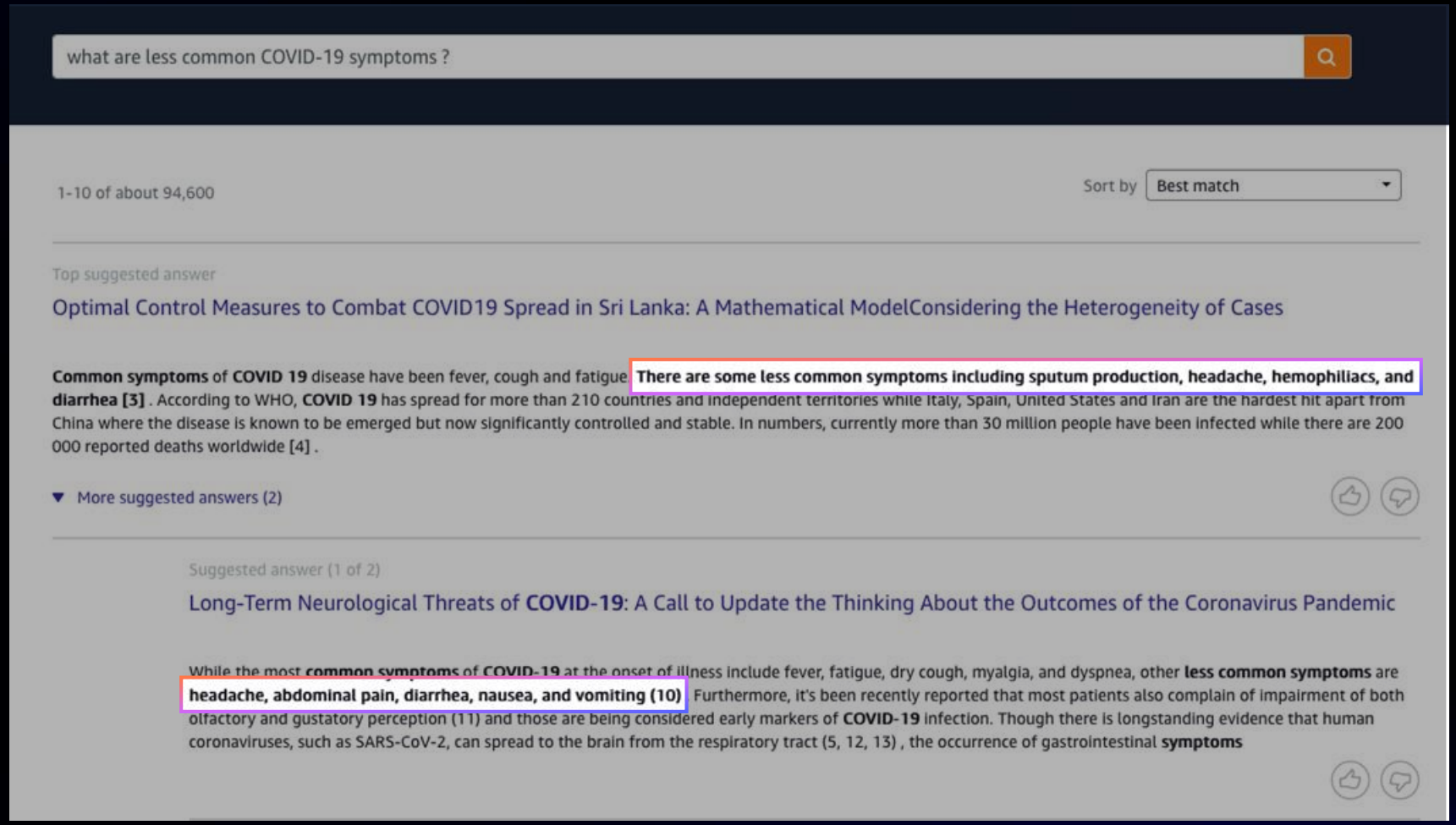
Natural language queries

Natural language queries

“Where is the IT support desk in Kumo?” → “1st floor”

Keyword queries

“Health benefits” or “parking allowance”



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Amazon Kendra

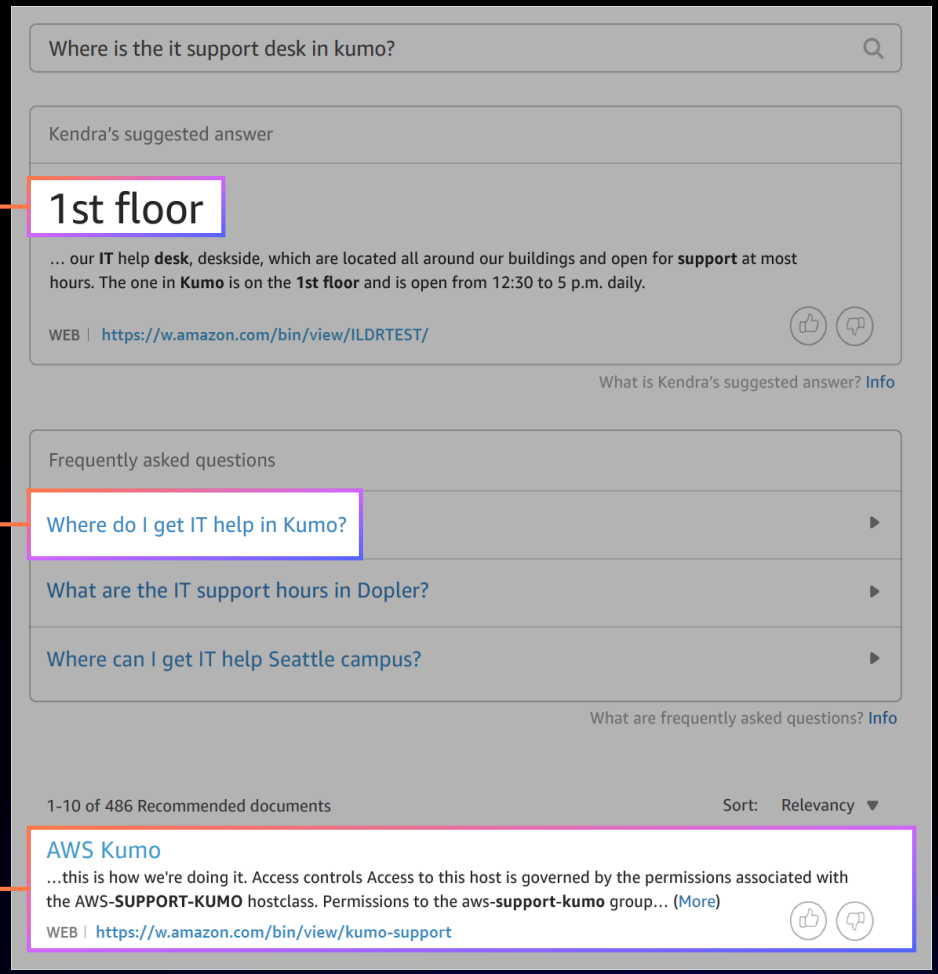
NLU AND ML CORE

Natural language queries

NLU and ML core

Better answers

- Reading comprehension
- FAQ matching
- Document ranking



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Amazon Kendra

DOMAIN EXPERTISE

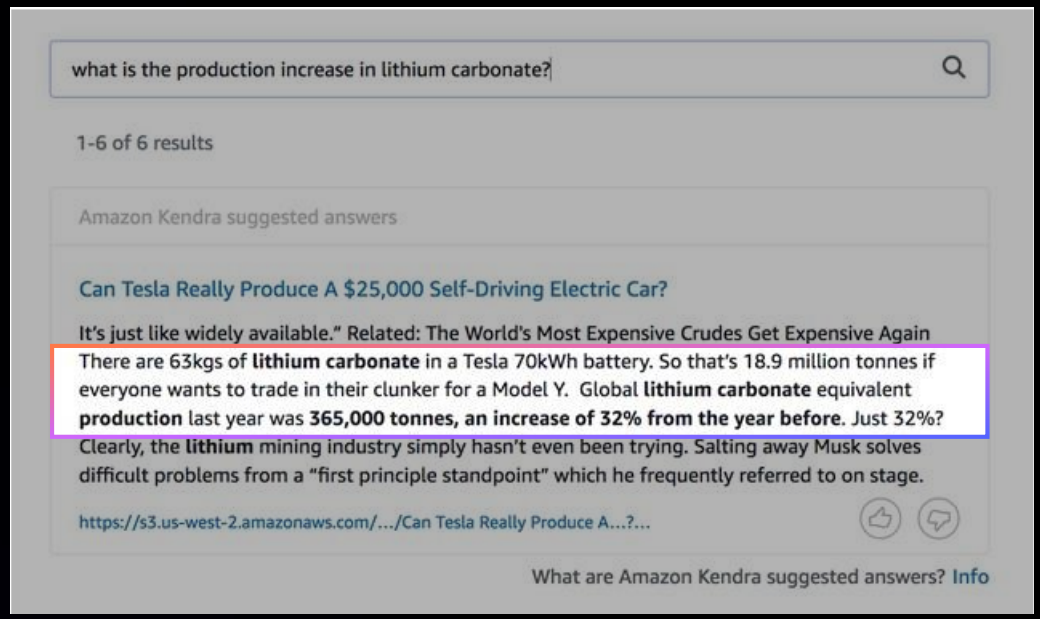
Natural language queries

NLU and ML core

Domain expertise

Optimized for 14 major domains

IT, financial services, insurance, pharma, industrial, energy, legal, media and entertainment, travel and hospitality, health, HR, news, telecommunications, and automotive



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Amazon Kendra

INCREMENTAL LEARNING

Natural language queries

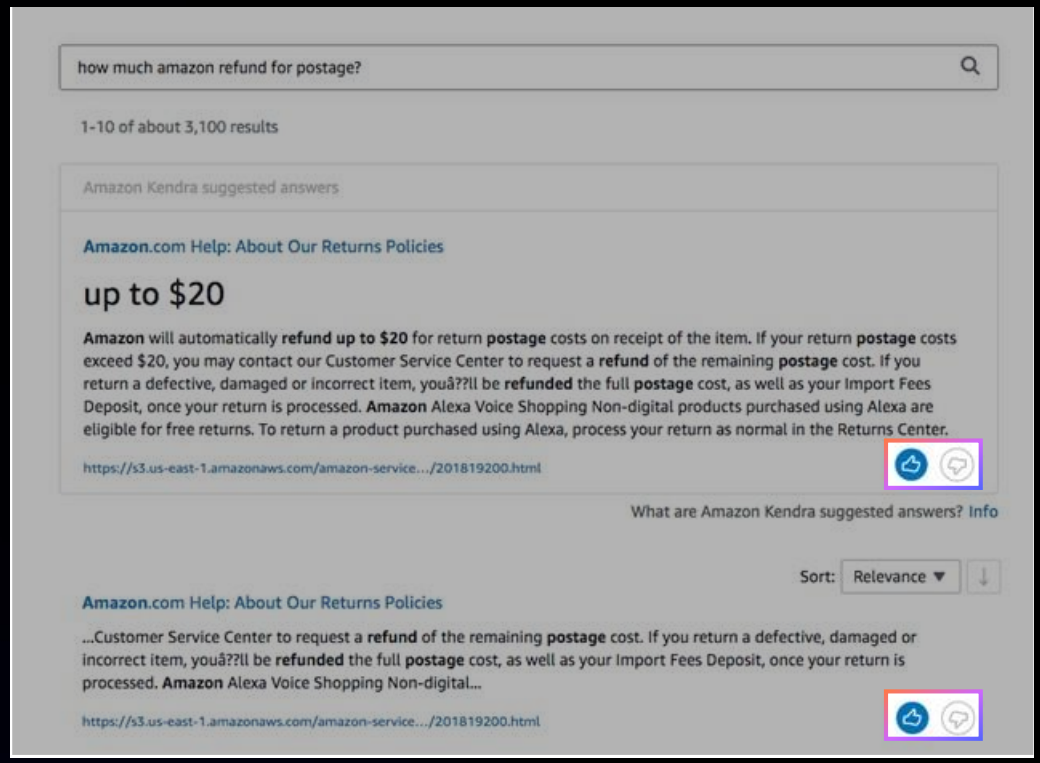
NLU and ML core

Domain expertise

Continuous improvement

Amazon Kendra improves automatically over time

- Captures click-through and user feedback
- Retrains models periodically



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Amazon Kendra

NATIVE CONNECTORS

Natural language queries

NLU and ML core

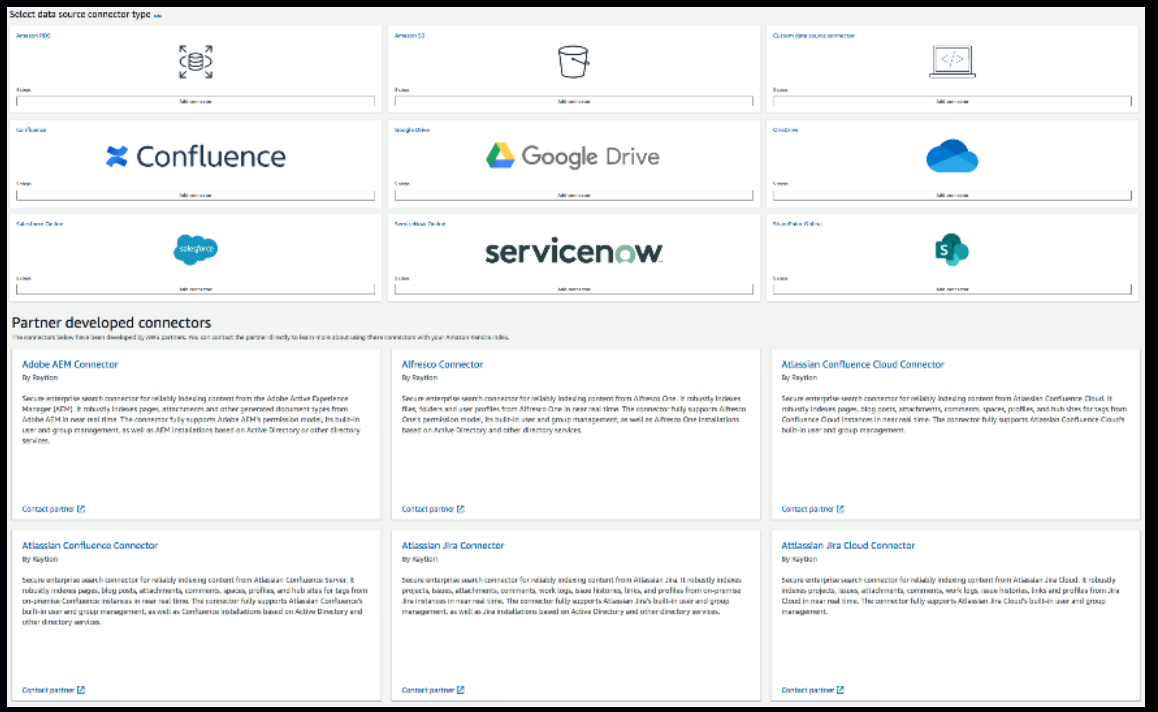
Domain expertise

Continuous improvement

Native and partner connectors

>50 popular data sources including SharePoint, Atlassian Confluence and Jira, Adobe Experience Manager, ServiceNow, and Salesforce

Add credentials, get started quickly



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Amazon Kendra

HIGHLY SECURE

Natural language queries

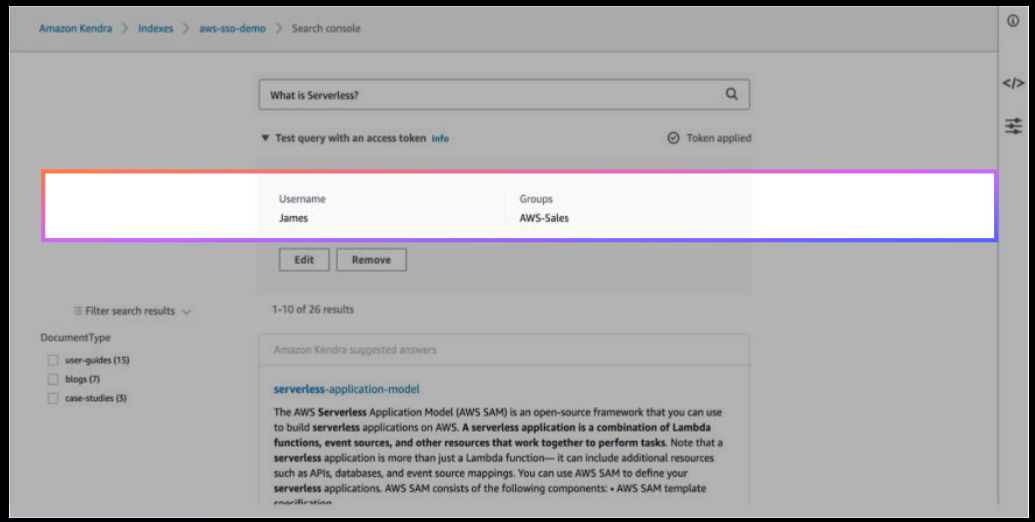
NLU and ML core

Native and partner connectors

Domain expertise

Continuous improvement

Secure search



- Data encrypted in transit and at rest
- Token-based user access control

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Amazon Kendra customers

ORGANIZATIONS SHIFTING TO ML-POWERED INTELLIGENT SEARCH



































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Bloomberg Industry Group and Amazon Kendra

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The company

Bloomberg Industry Group

- We empower professionals in government, law, tax, and accounting with essential data, news, and analysis
- Bloomberg Law, Bloomberg Tax and Accounting, Bloomberg Government
- Petabytes of primary source documents, reference materials, analysis, and news



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The team



Formed in late 2019 to create machine learning solutions to enhance our product platforms



Three-member team of one data scientist and two software engineers



Backlogs full of product aspirations, limited staff, and runway to tackle most of them

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The platform

“One platform, one price, continuous innovation”

Bloomberg Law is trusted by

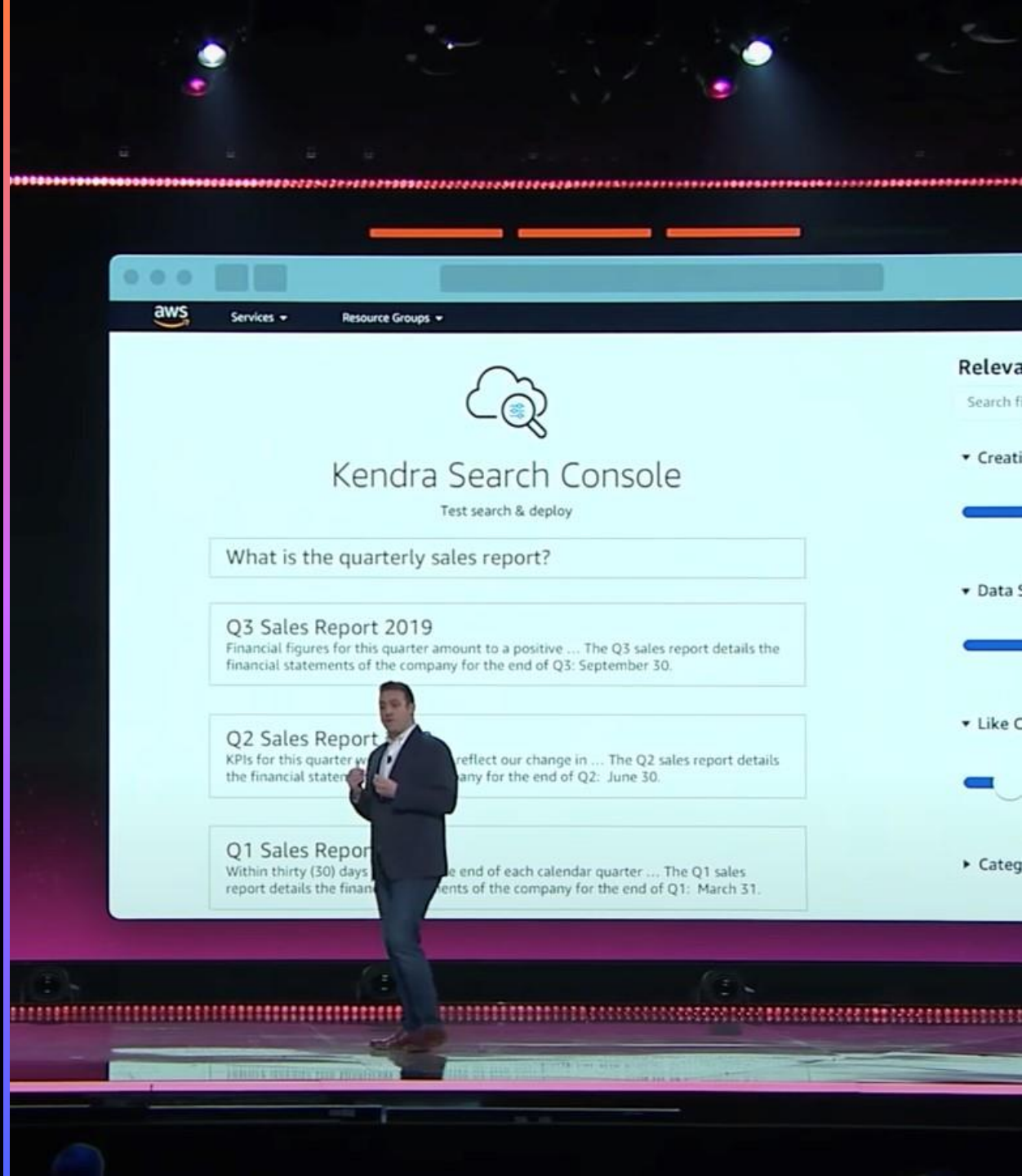
- 95% of Am Law 200 firms
- 48% of Fortune 500 companies



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The intro

- Amazon Kendra debuted at AWS re:Invent 2019
- Our team was tasked with evaluating Amazon Kendra
- Can we use Amazon Kendra to tackle an existing product aspiration?



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The first impression



Amazon Kendra is shockingly easy to deploy and configure



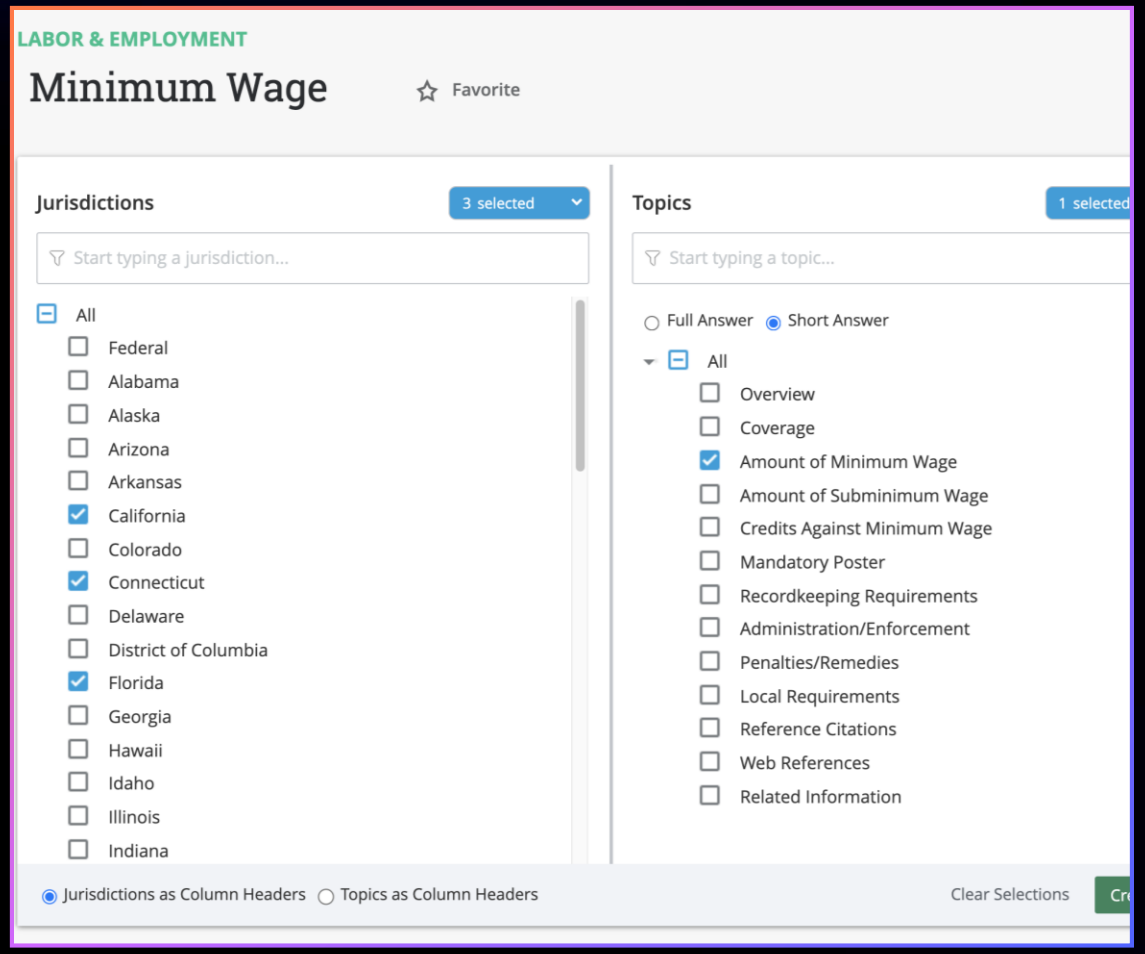
Amazon Kendra out of the box is a full-featured search service

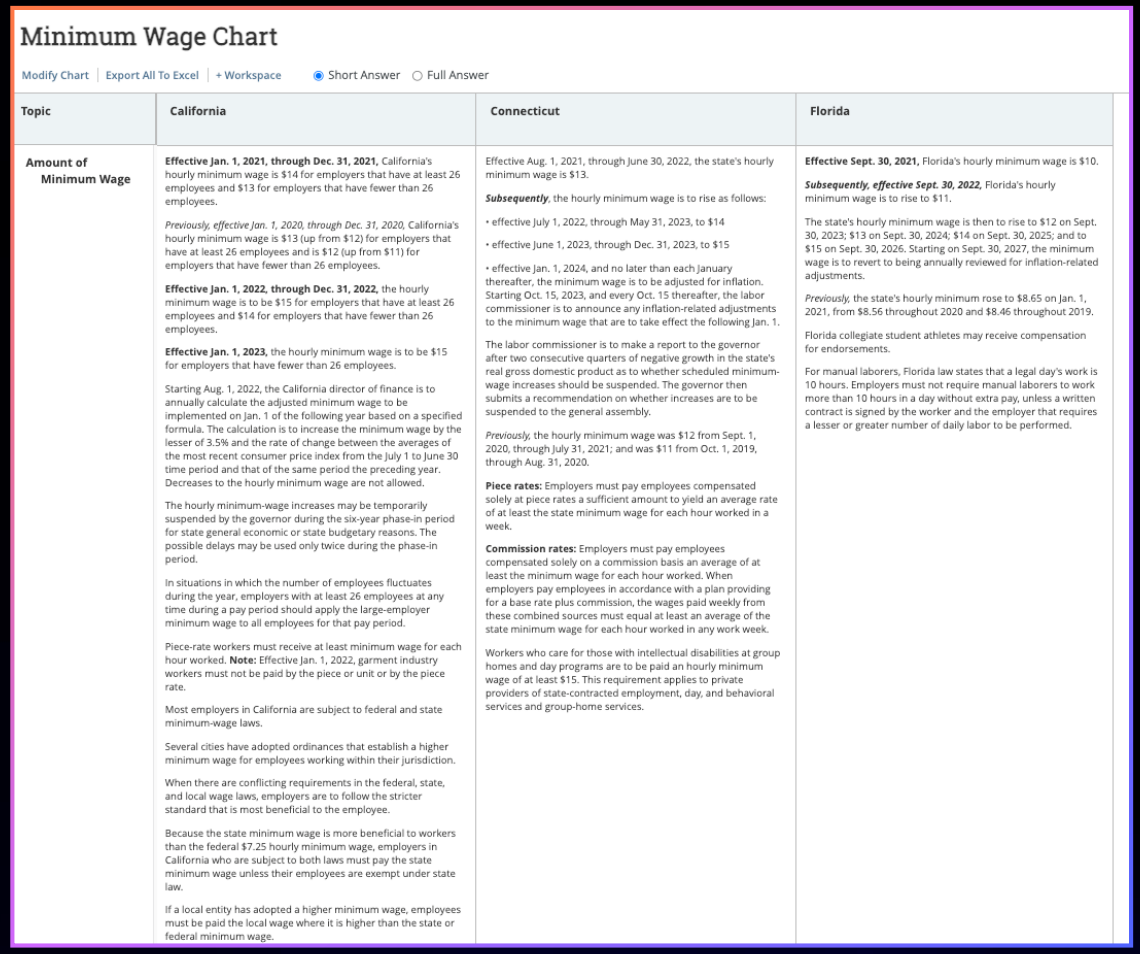


Amazon Kendra performs well retrieving facts

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The existing product: Chart Builders





Minimum Wage Chart

Modify Chart | Export All To Excel | + Workspace | Short Answer | Full Answer

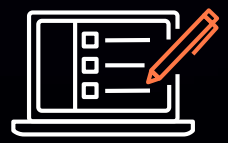
Topic	California	Connecticut	Florida
Amount of Minimum Wage	**Effective Jan. 1, 2021, through Dec. 31, 2021,** California's hourly minimum wage is $14 for employers that have at least 26 employees and $13 for employers that have fewer than 26 employees. *Previously, effective Jan. 1, 2020, through Dec. 31, 2020,* California's hourly minimum wage is $13 (up from $12) for employers that have at least 26 employees and is $12 (up from $11) for employers that have fewer than 26 employees. **Effective Jan. 1, 2022, through Dec. 31, 2022,** the hourly minimum wage is to be $15 for employers that have at least 26 employees and $14 for employers that have fewer than 26 employees. **Effective Jan. 1, 2023,** the hourly minimum wage is to be $15 for employers that have fewer than 26 employees. Starting Aug. 1, 2022, the California director of finance is to annually calculate the adjusted minimum wage to be implemented on Jan. 1 of the following year based on a specified formula. The calculation is to increase the minimum wage by the lesser of 3.5% and the rate of change between the averages of the most recent consumer price index from the July 1 to June 30 time period and that of the same period the preceding year. Decreases to the hourly minimum wage are not allowed. The hourly minimum-wage increases may be temporarily suspended by the governor during the six-year phase-in period for state general economic or state budgetary reasons. The possible delays may be used only twice during the phase-in period. In situations in which the number of employees fluctuates during the year, employers with at least 26 employees at any time during a pay period should apply the large-employer minimum wage to all employees for that pay period. Piece-rate workers must receive at least minimum wage for each hour worked. **Note:** Effective Jan. 1, 2022, garment industry workers must not be paid by the piece or unit or by the piece rate. Most employers in California are subject to federal and state minimum-wage laws. Several cities have adopted ordinances that establish a higher minimum wage for employees working within their jurisdiction. When there are conflicting requirements in the federal, state, and local wage laws, employers are to follow the stricter standard that is most beneficial to the employee. Because the state minimum wage is more beneficial to workers than the federal $7.25 hourly minimum wage, employers in California who are subject to both laws must pay the state minimum wage unless their employees are exempt under state law. If a local entity has adopted a higher minimum wage, employees must be paid the local wage where it is higher than the state or federal minimum wage.	Effective Aug. 1, 2021, through June 30, 2022, the state's hourly minimum wage is $13. ***Subsequently,*** the hourly minimum wage is to rise as follows: • effective July 1, 2022, through May 31, 2023, to $14 • effective June 1, 2023, through Dec. 31, 2023, to $15 • effective Jan. 1, 2024, and no later than each January thereafter, the minimum wage is to be adjusted for inflation. Starting Oct. 15, 2023, and every Oct. 15 thereafter, the labor commissioner is to announce any inflation-related adjustments to the minimum wage that are to take effect the following Jan. 1. The labor commissioner is to make a report to the governor after two consecutive quarters of negative growth in the state's real gross domestic product as to whether scheduled minimum-wage increases should be suspended. The governor then submits a recommendation on whether increases are to be suspended to the general assembly. *Previously,* the hourly minimum wage was $12 from Sept. 1, 2020, through July 31, 2021; and was $11 from Oct. 1, 2019, through Aug. 31, 2020. **Piece rates:** Employers must pay employees compensated solely at piece rates a sufficient amount to yield an average rate of at least the state minimum wage for each hour worked in a week. **Commission rates:** Employers must pay employees compensated solely on a commission basis an average of at least the minimum wage for each hour worked. When employers pay employees in accordance with a plan providing for a base rate plus commission, the wages paid weekly from these combined sources must equal at least an average of the state minimum wage for each hour worked in any work week. Workers who care for those with intellectual disabilities at group homes and day programs are to be paid an hourly minimum wage of at least $15. This requirement applies to private providers of state-contracted employment, day, and behavioral services and group-home services.	**Effective Sept. 30, 2021,** Florida's hourly minimum wage is $10. ***Subsequently, effective Sept. 30, 2022,*** Florida's hourly minimum wage is to rise to $11. The state's hourly minimum wage is then to rise to $12 on Sept. 30, 2023; $13 on Sept. 30, 2024; $14 on Sept. 30, 2025; and to $15 on Sept. 30, 2026. Starting on Sept. 30, 2027, the minimum wage is to revert to being annually reviewed for inflation-related adjustments. *Previously,* the state's hourly minimum rose to $8.65 on Jan. 1, 2021, from $8.56 throughout 2020 and $8.46 throughout 2019. Florida collegiate student athletes may receive compensation for endorsements. For manual laborers, Florida law states that a legal day's work is 10 hours. Employers must not require manual laborers to work more than 10 hours in a day without extra pay, unless a written contract is signed by the worker and the employer that requires a lesser or greater number of daily labor to be performed.

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The existing problems



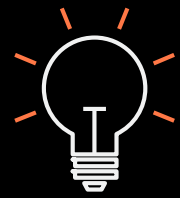
All the information you need in a chart for the effort of 6 to 30 clicks



Modern users expect search to return answers, not documents



The existing search solution returns a document, not an answer



Prior solutions relied too much on user knowledge and experience

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The Amazon Kendra fit



Natural language searching over document sections and paragraphs offers easier access to quick answers



The product question: **But do our users want this solution?**



Most approaches to answering this question are expensive and time-consuming



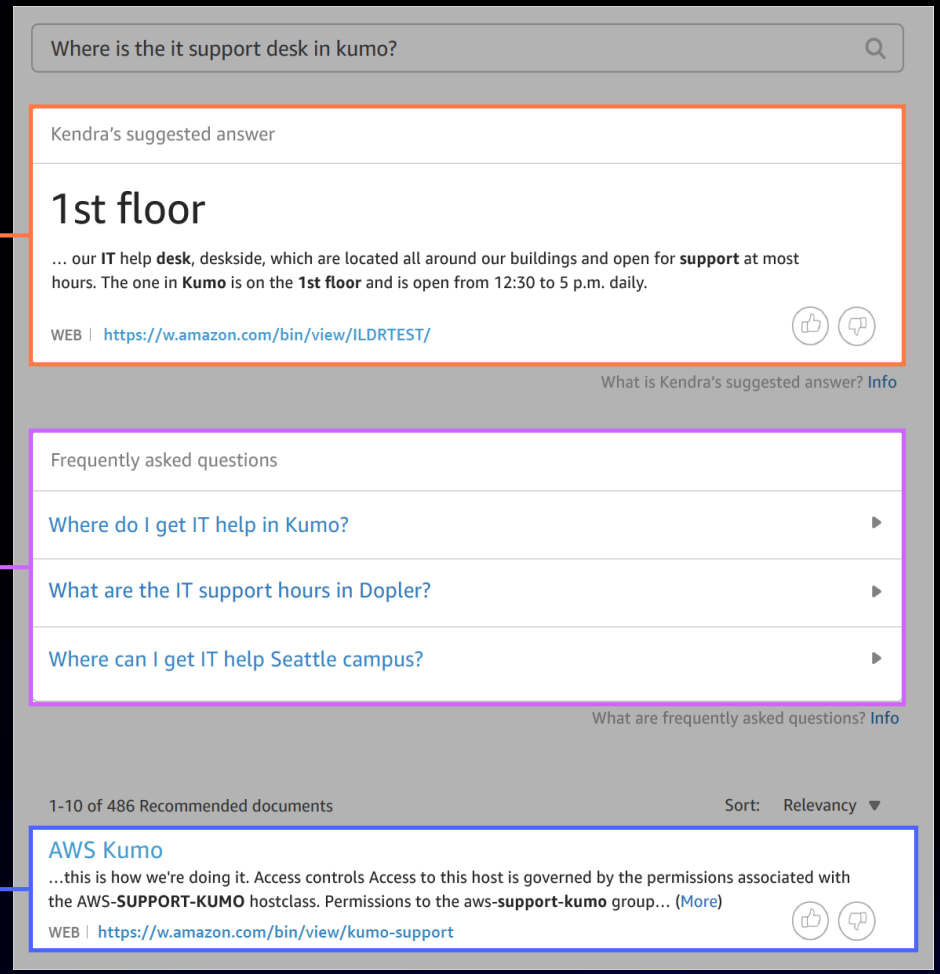
Amazon Kendra allowed our team to focus on testing instead of building

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The components

- Amazon Kendra results come in three components
- Question_Answer or FAQ results are indexed separately from data supporting the answer and document results



Answer

Question_Answer

Document

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The challenges and gaps



Tuning mechanisms targeted only **document** results



Tuning can be effective at the document level

Our use case targeted the section or paragraph level



The language in our data is highly repetitive and boilerplate

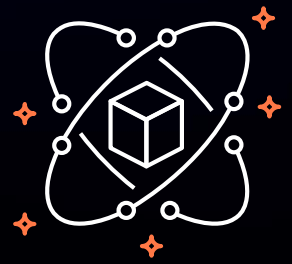


Our content contains many technical terms and specialized language

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The solutions and workarounds

Optimize the underlying data



Store original content in Amazon DynamoDB

Add scaffolding text to Amazon Kendra indexed documents

Add anchor links to each section of Amazon Kendra indexed documents



Implement synonym lists for technical language



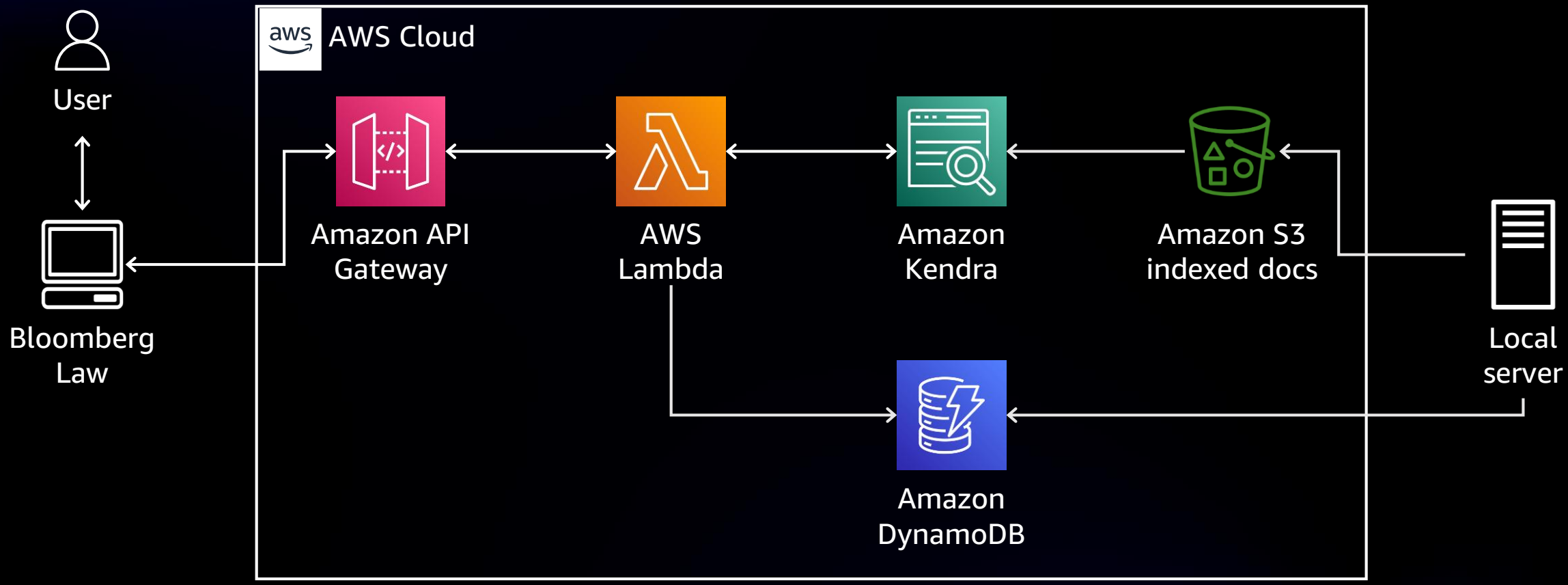
Obsessively extract and create metadata



Automate testing using anchor links

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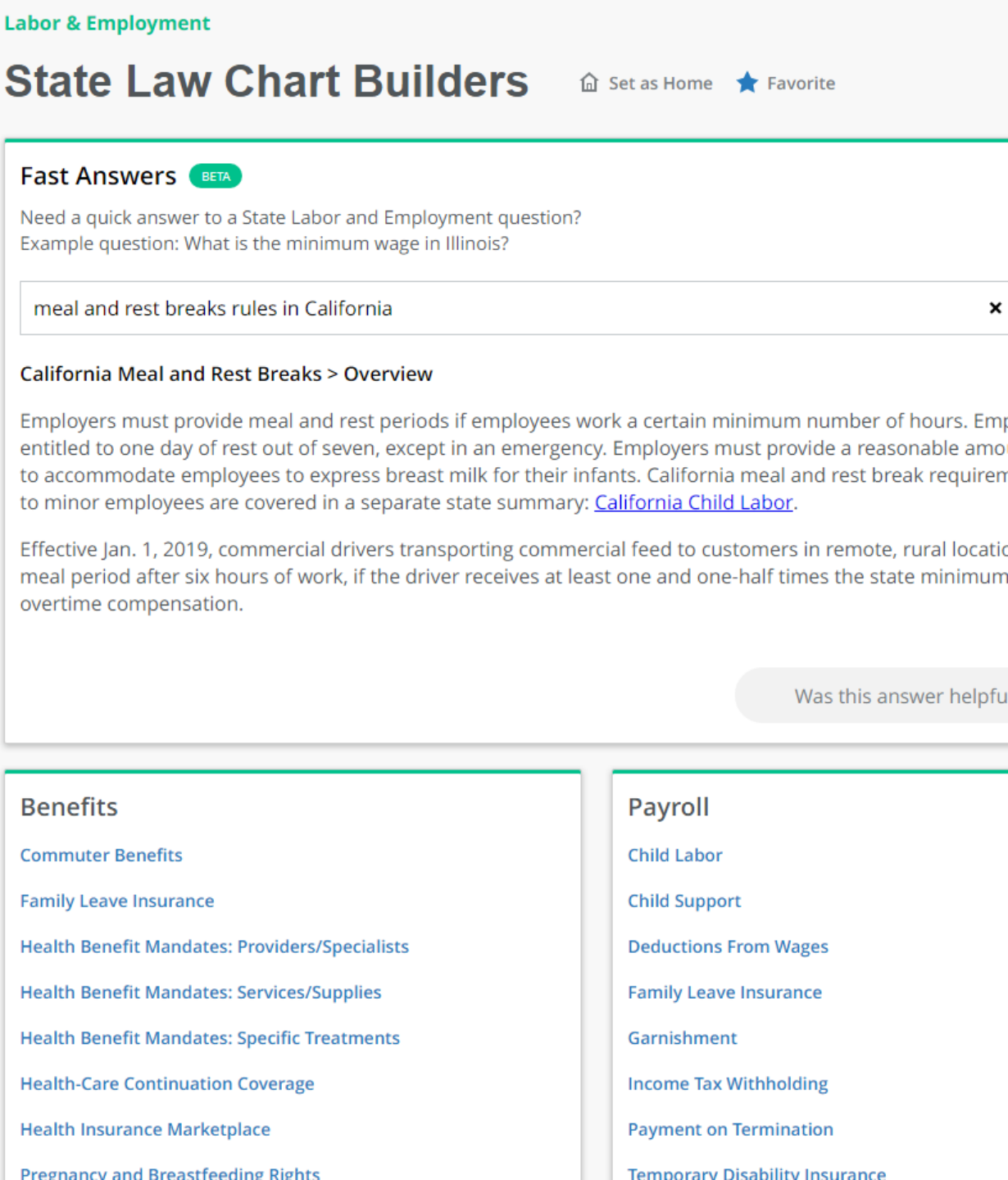
The implementation



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The end result

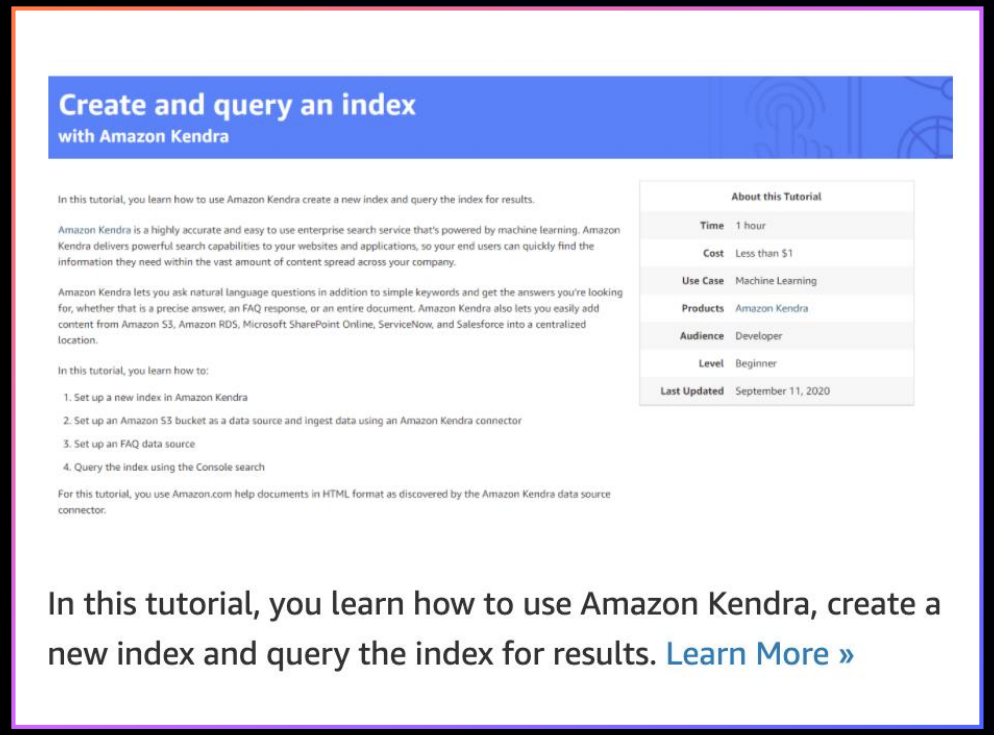
- Our team launched Fast Answers for the State Labor and Employment Chart Builders product in October
- Goals of the beta are to observe how users interact with the tool and identify where we can make improvements
- We are also working to extend Amazon Kendra to other content sets



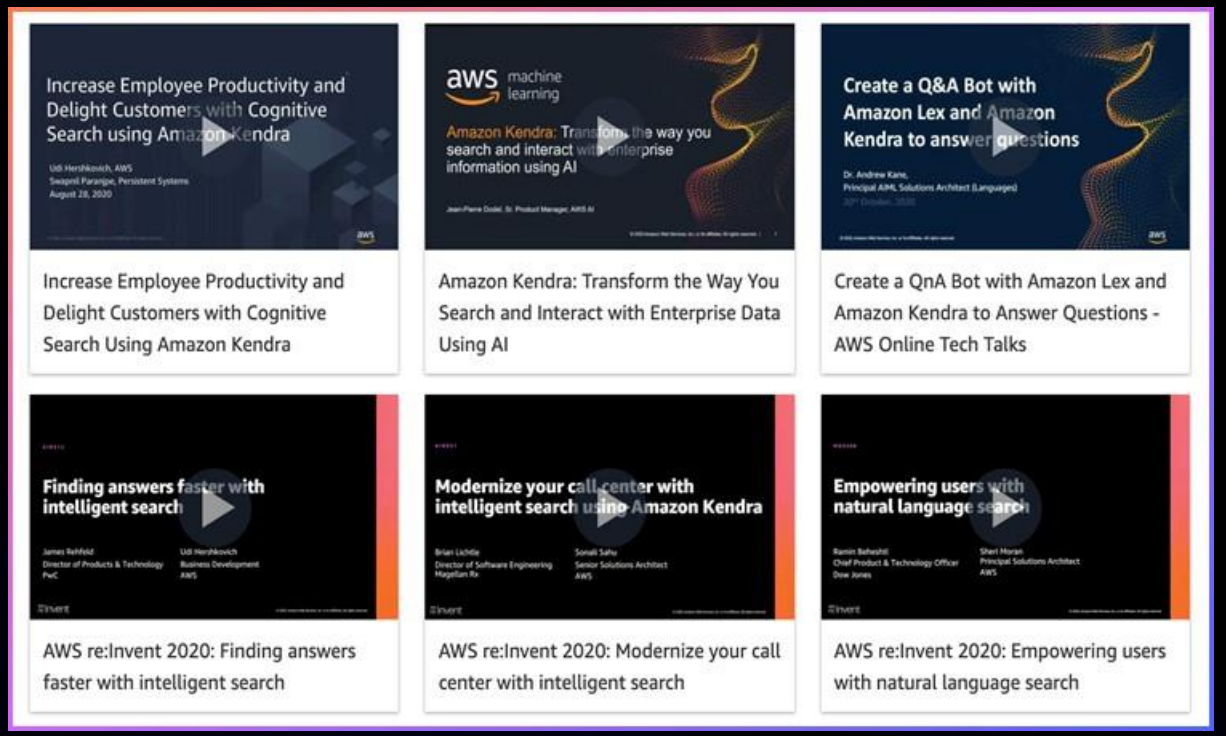
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Getting started with Amazon Kendra

Tutorials



Video libraries



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Thank you!

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Ritesh Vajariya
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