



# PROMOTING HEALTH THROUGH LEVERAGING CLINICAL AND CLAIMS DATA

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# HEALTH INSURANCE CLAIMS & TRIPLE AIM

- Improving Population Health
  - Standardization of Structured/Unstructured & Proprietary Data (Office of Assistant Secretary for Planning and Evaluation, 2000)
  - Enrichment of Clinical & Claims Data
- Reducing Healthcare Costs
  - Automation of Care
  - Appropriation of Treatment
- Quality and Satisfaction of Care
  - Reduction of Care Fragmentation
  - Promotion Consumer Education



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# STAKEHOLDERS

- Patients
  - Value-Based Care
  - Analytically Informed Care Decisions
- Providers
  - Service Reimbursement
  - Matching Services with Consumer Care Needs
- Payers
  - Decreased Costs from Unfragmented Care
  - Cost-Benefit of Preventative Care



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# STANDARDIZATION APPROACHES

- SmileCDR
  - Uninterrupted ETL of Data to import FHIR into CDR (Rivkin & IDC, 2020)
  - Costly for Smaller Service Providers
  - Integrate with EHRs (Rivkin & IDC, 2020)
- OSCAR
  - Personalized Member and Provider Driven Analytics Through AWS (Barr, 2015)
  - Reduction in Fragmentation Across Care Continuum
  - Provides Members with Right Treatment from Appropriate Provider (Barr, 2015)

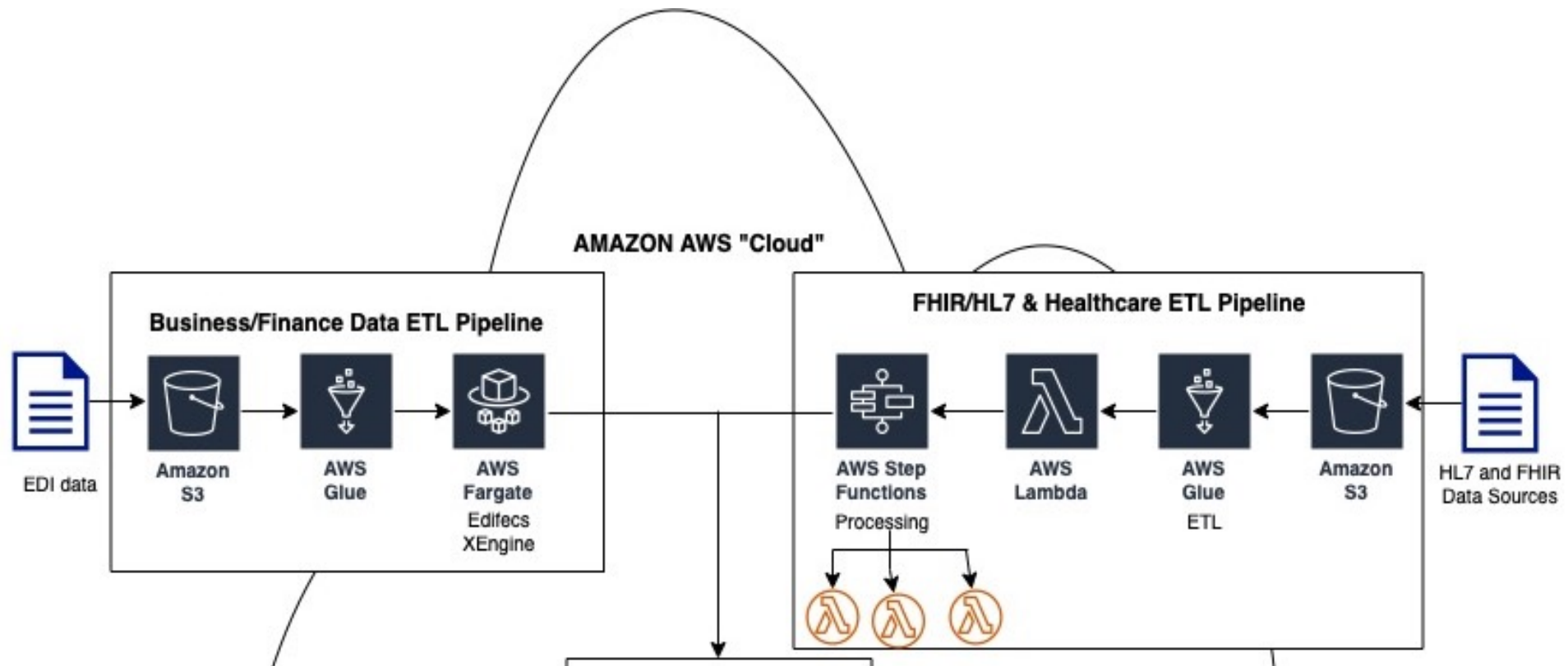


# ARCHITECTURE PROMOTING TRIPLE AIM

- Align Clinical (HL7 and FHIR) & Claims Data
- Data Extraction/Transform/Load (ETL)
- Leveraging Analytical Data for Value-Based Care
- HEDIS Measures Promoting Care Continuum



# ETL PIPELINE



# HEALTH INSURANCE BUSINESS ETL

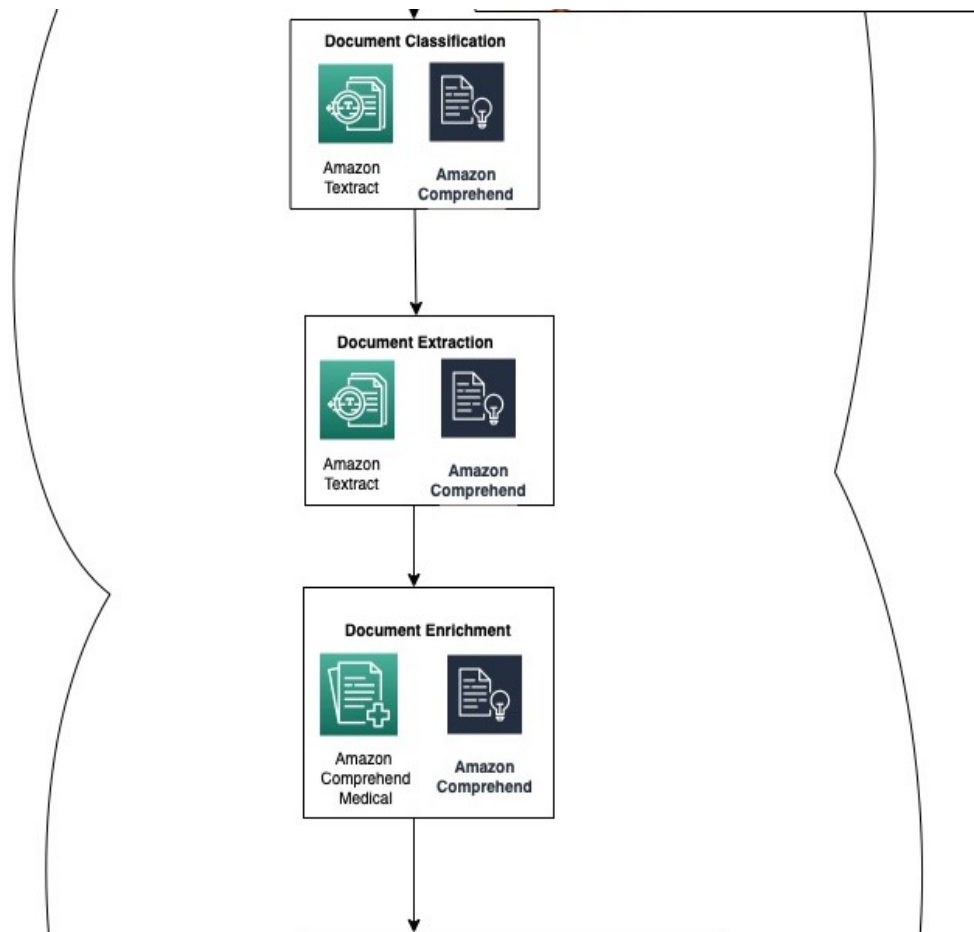
- Amazon S3 Organizes Claims Forms, Insurance Identification and Invoices (Condello et al., 2022)
- AWS Glue Orchestrates ETL Operations for Query
- AWS Fargate Edifecs X-Engine Validates and Classifies (Condello et al., 2022)

# HL7/FHIR HEALTHCARE ETL

- Amazon S3 Processes & Organizes HL7/FHIR Server Coding from EHR (Condello et al., 2022)
- AWS Glue (ETL) Analytics for Machine Learning (ML) (Condello et al., 2022)
- AWS Lambda Classifies Structured & Unstructured Data (Condello et al., 2022)
- AWS Step Function Extracts Unstructured Data for Application (Condello et al., 2022)



# CLAIMS & CLINICAL DATA PROCESSING



# DOCUMENT CLASSIFICATION

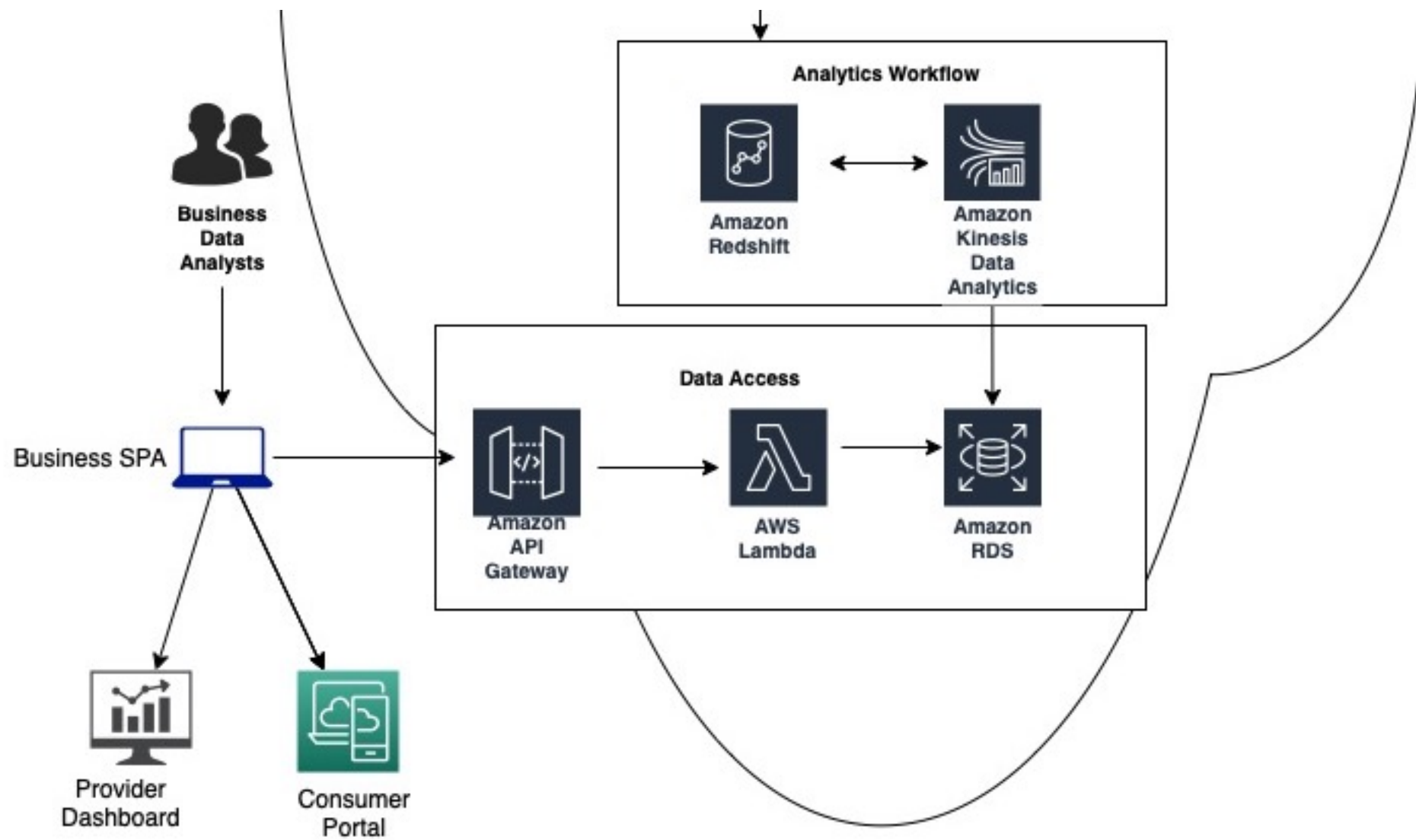
- Amazon Textract (ML) automation
  - Processes Documents for Classification (Condello et al., 2022)
- Amazon Comprehend (NLP) allocates data
  - Classifies with Confidence Percentage Scores (Condello et al., 2022)

# DOCUMENTATION EXTRACTION

- Amazon Textract
  - Process Data for Analytical Insights
- Amazon Comprehend
  - Extracts Data from Textract Effectively and Efficiently
  - Transcribe to JSON Format Universal to APIs (Application Programming Interfaces) (Condello et al., 2022)

# DOCUMENT ENRICHMENT

- Comprehend
  - Redact PII, PHI to Conform to HIPAA
  - Ensures compliance to data access after analytical insights (Narayanan et al., 2022)
- Comprehend Medical
  - NLP utilizes ML to extract data (Narayanan et al., 2022)
    - Medical Data & Claims (e.g. medical text, prescriptions, diagnosis etc.)
    - Medical Ontologies (e.g. ICD-10, RxNorm, SNOMED CT codes)





# ANALYTICS WORKFLOW

- Amazon Redshift Data Warehouse
  - Stores Enrichment Data Prior to Analytical Measures (Narayanan et al., 2022)
- Amazon Kinesis Analytics
  - Prescriptive & Predictive Analytics for Meaningful Use (Narayanan et al., 2022)
  - Relational Trends in Clinical & Claims Data
    - Promoting Continuum of Care
    - Meeting HEDIS Measures

# DATA ACCESS

- Amazon RDS Database
  - Scalable Storage of Relational Data
- Application Programming Interface (API) with Software Programming Application (SPA)
  - Interactive Provider Dashboard
  - Consumer Care Metrics Portal



# HEDIS MEASURES & CLINICAL APPLICATIONS

- **Diabetes Mellitus 2** (ICD-E11 codes)
  - Hemoglobin A1C <8% (HCPCS G8016, LOINC 96070-8) (National Committee for Quality Assurance, n.d.-b)
  - Eye Exam (ICD-10 E10.39, E11.39) (National Committee for Quality Assurance, n.d.-b)
  - Blood Pressure (HCPCS G8024) (National Committee for Quality Assurance, n.d.-b)
  - Nephropathy (ICD-10 E10.21, E11.21) (National Committee for Quality Assurance, n.d.-b)
  - Glucometer/Lancets (HCPCS A4259)
  - Medical Treatment (RxNorm Metformin:: 151827)
  - Nutritionists (CPT 97802, 97803, S9470)
  - Provider Follow Up Appointment (CPT 99204, 99396)
  - Identify Prediabetic (ICD-10 R73.09)



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# HEDIS MEASURES & CLINICAL APPLICATIONS

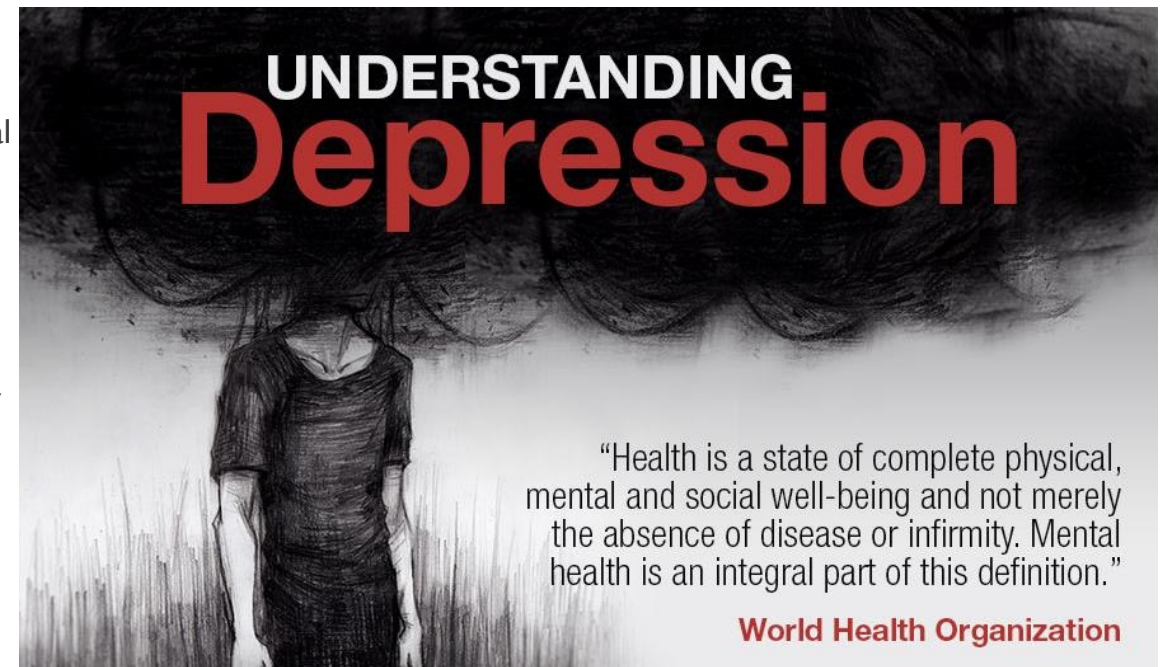
- **Acute Myocardial Infarction (ICD-10 I21)**
  - Beta Blockers (RxNorm Lopressor: 203344; Sotalol: 224909)
  - Claims Tracking Refills 6 Months Post-Discharge (National Committee for Quality Assurance, n.d.-d)
  - Electrocardiogram (CPT 93229, 93010, 93005)
  - Cardiology Consult (CPT G0406, G0407, G0408, G9968; ICD Z71)



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# HEDIS MEASURES & CLINICAL APPLICATIONS

- **Major Depressive Disorder (ICD-10 F32)**
  - Depression Screening (HCPCS G0444)
  - Claims Data Provider Follow Up
    - Within 7 days & 30 days Post-Discharge (CPT 90791, 90792) (National Committee for Quality Assurance, n.d.-c)
  - Medication Compliance
    - Acute Adherence 12 weeks Claims Data (National Committee for Quality Assurance, n.d.-q)
    - Continuation 6 Months Claims Data (National Committee for Quality Assurance, n.d.-a)
    - Refill Claims and RxNorm (Fluoxetine/Prozac 58827)
    - Minimize Side Effects (ICD-10 T43)



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# ARCHITECTURAL OUTCOME ADVANTAGES

- Data Classification, Extraction and Enrichment
  - Aggregates Consumer Clinical and Claims (Structured/Unstructured) Data
  - Classification of Clinical and Claims Data with Confidence Scores
  - Transcribes Data to JSON Format for Interoperability
- Amazon Redshift Data Warehouse
  - Stores Aggregated Consumer Clinical and Claims Data
- Amazon Kinesis Analytics
  - Analytical Insights Performed on Clinical and Claims Data
  - Missing/Unrepresented Data based HEDIS Measures Algorithms sent to Provider Dashboard & Consumer Portal (See Previous Slides)
- SPA
  - Automated Data sent to Dashboard/Portal
  - Manual Review of Data by Analysts for Algorithmic Confidence Purposes
- Provider Dashboard/Patient Portal APP
  - Real-time/Near Real-time Education Provided Addressing Gap(s) in Treatment via HEDIS Measures (e.g. lab work, devices, diagnostics, medication, appointments, etc.).
  - Aligning Consumer with Appropriate Provider based on Diagnostic Codes.

# CONCLUSION

- Dashboard and Patient Portal App
  - Leverages Clinical & Claims Data
  - Preventative & Continuation of Care
    - Reduces 30-Day Readmissions & Lapses in Treatment
  - Decreased Healthcare Costs
    - Addresses Population Risk Factors through Personalized Solutions
    - Provides Health Education
    - Aligns Consumers with Appropriate Service Providers

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