HiLabs

APM CASE STUDY 2024

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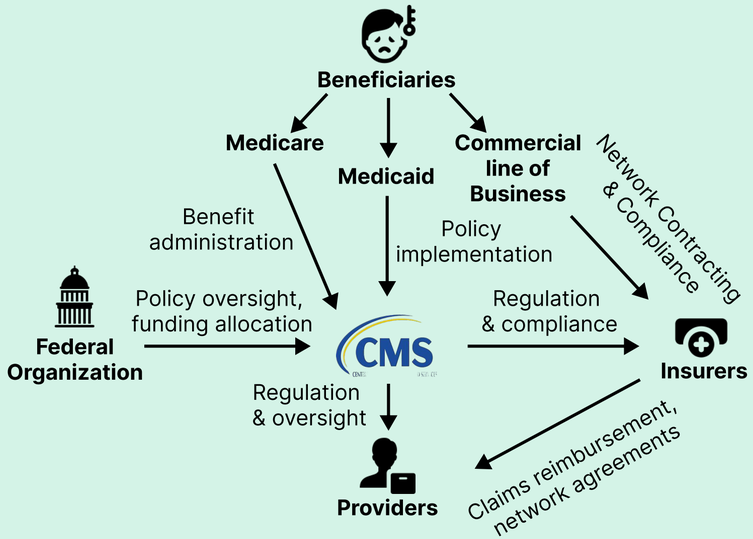
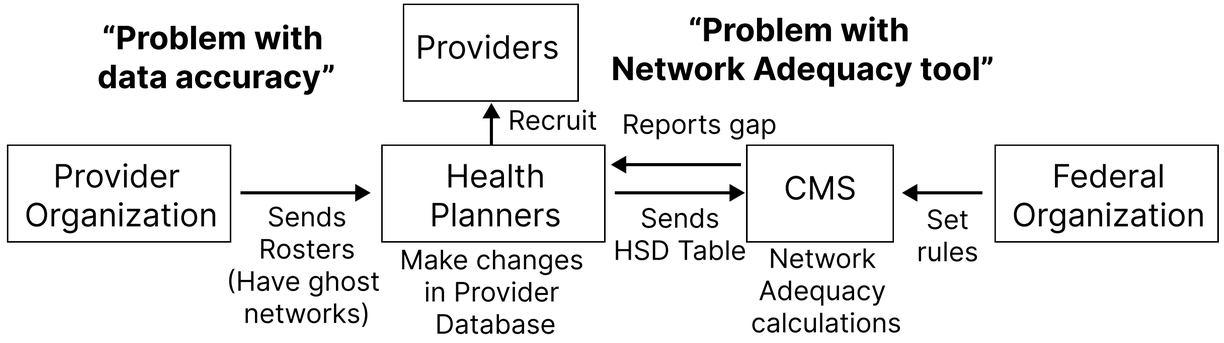
Problem: Health planner's operations are impacted by sudden network gaps identified by CMS triennially. These gaps arise from data inaccuracies in rosters provided by provider organizations and the absence of an in-house Network Adequacy tool

Stakeholder Analysis



- **CMS:** Oversees network adequacy for providers through insurer HSD table data
- **Medicare:** Providers deliver benefits via CMS under federal policies
- **Medicaid:** Benefits are provided through state and federal joint programs, managed by CMS
- **Commercial:** Health plans are offered through private insurers, outside federal programs

Understanding the Current Process



Potential impact of missing providers in the network

Cost and time to recruit new provider[1]:

Entry-level (0-5 years): Average costs $2,167 and 84 days

Mid-level (6-10 years): Average costs $3,581 and 153 days

Senior-level (10+ years): Average costs $5,699 and 207 days

Average: $3,816 and 148 days

Assumption:

Out-of-network expense to the company per unavailable provider is $5,000 per week

Total Loss per provider = Cost to recruit provider ⊕ Cost incurred during the period a provider remains unrecruited

$ 110K **Potential loss per unavailable provider**

" Optimizing the provider network can lead to a **15% reduction** in overall network costs* "

Assumptions

- The solution is being developed by a health plan organization to check their providers
- CMS assesses only quantitative data, not qualitative data
- The health plan has a manual review process for the provider's data
- No exception for regions with small populations; CMS rules on specialist range still apply
- Any beneficiaries migration is being fed on the programs from where the solution extract data

Target Users

- **Network managers** at the health plan company to effectively analyze the results it generates
- **Providers** in case they need to update their location

[1]: Cost and time to recruit provider

* Mentioned in the Case Overview that was provided

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1 Network Adequacy

- Provider-to-member distance within range
- Acceptable wait times
- Sufficient # specialists
- Adequate range of specialties

Requirements

2 Data Accuracy

- Provider's current specialty
- Provider's Precise location
- Wait time metrics
- Data update mechanism

Meet HealthSecure Insurance

Industry: Health Insurance
Headquarters: New Jersey, USA
Target Market: Individuals, families, employers

Pain Points-

Due to lack of network adequacy tool

- Increased delay and costs from urgent provider recruitment to fill network gaps
- Missed opportunities to optimize network size and provider distribution
- Higher member churn, complaints, and negative reviews from network gaps
- Delayed gap identification due to manual/outdated processes

Range of providers:

(57[1] types of specialists in total)

- Primary Care Providers (PCPs)
- Hospitals
- Mental Health Professionals
- Ancillary Services
- Culturally and Linguistically Diverse Providers

The Core Issues

- Despite having a sufficient number of providers, many regions are still unable to offer this range of specialists
- This table has **2023 data** and many regions still face distance and time issues, primarily due to an ineffective network present in plans
- **73%*** of calls to providers listed in network directories are unable to secure appointments
- Changing a provider after CMS identifies a network gap is a significant challenge for health planners
- Poor-quality provider data costs organizations **over $2 billion annually**, affecting efficiency, compliance, profits, care quality, and patient outcomes

Avg. Max. Time and Distance Standards (min./miles) Per County Type[2]

Specialty Area	Large Metro	Metro	Micro	Rural	Extreme access considerations
Primary Care Providers (PCPs)	20/10	36/25	65/48	75/60	108/95
Hospitals	30/12	58/36	90/68	82/68	132/120
Mental Health Professionals	24/12	47/32	78/58	88/72	120/108
Ancillary Services	20/10	20/10	20/10	20/10	20/10

Towards Solutions...

From the analysis our solution should-

1. Identify network gap at a early stage
2. Assess data accuracy on real time basis
3. Evaluate county-specialty pairs to identify gaps based on time, distance, wait time, range
4. Competitively capable of capturing data from all relevant sources to stay ahead in the game

[1]: Types of specialists [2]: Time and Distance Standards * Mentioned in the Case Overview that was provided

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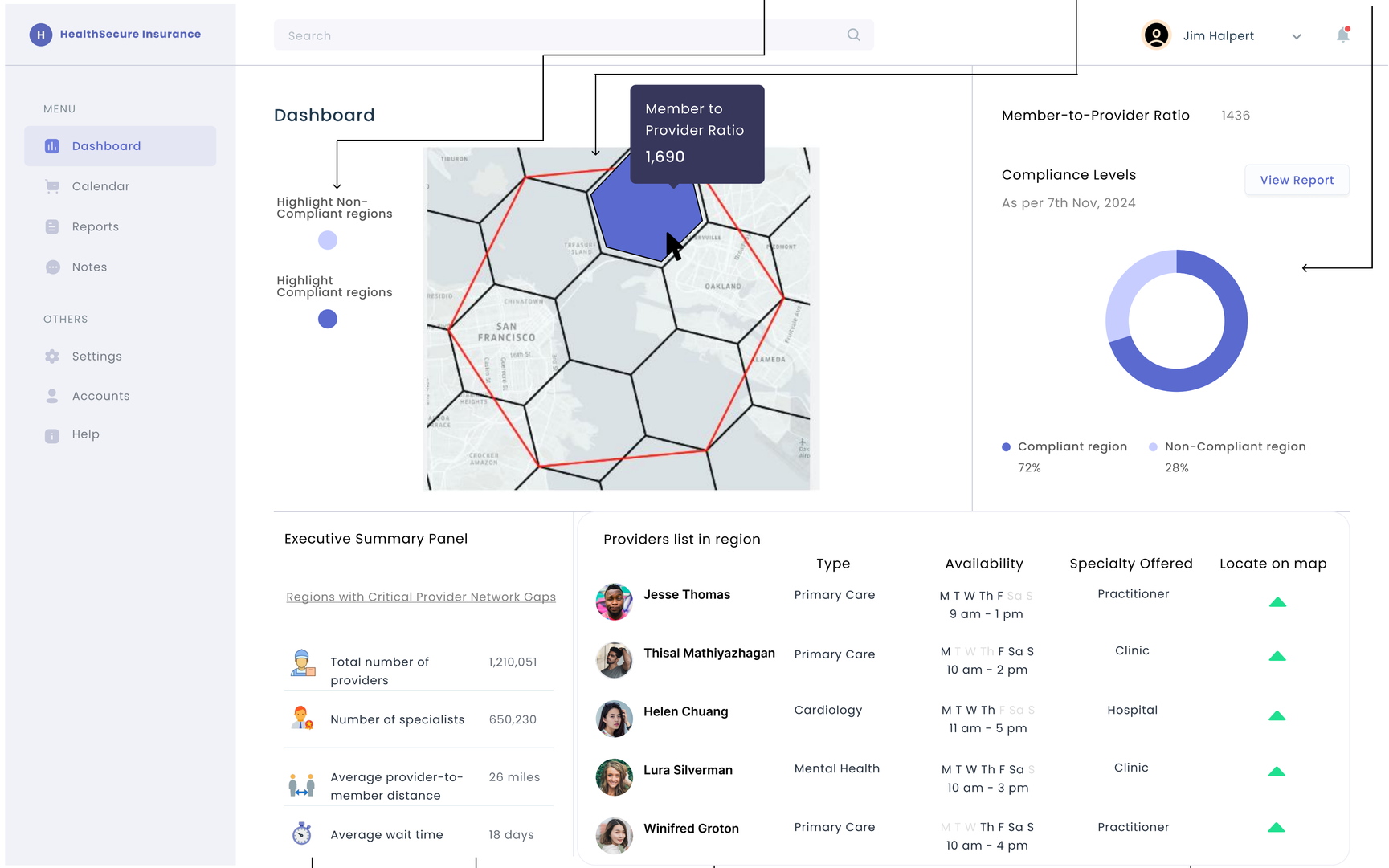
1 Network Adequacy check tool

Click to view the said regions

Division of regions based on CMS criteria and members density

% region that complies with CMS criteria



Important KPI summary with an option to view Regions with Critical Provider Network Gaps

List of providers in the selected region clicked

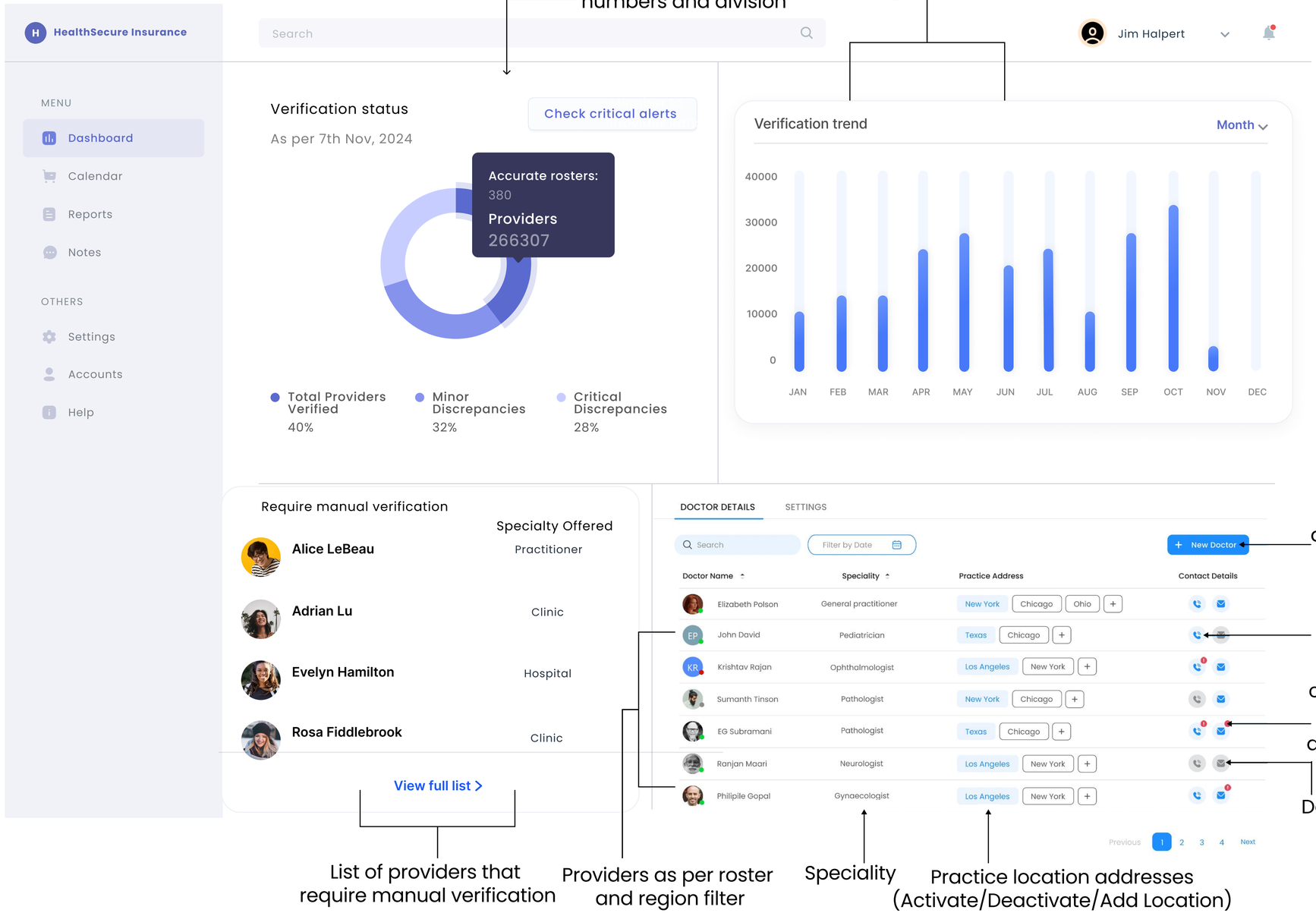
Sequence of Logical Operations

1. The map space will be segmented into **hexagonal regions,** structured around the feasible distance parameters set by CMS and the required range of specialists within each region
2. In densely populated regions, larger hexagons will be **divided into smaller units** to ensure each meets CMS's wait time guidelines and contains the required number of specialists. These subdivisions will also maintain the minimum specialist count necessary for network adequacy compliance
3. Non-compliant large hexagons are **flagged,** allowing users to zoom in and identify the smaller hexagons where specific compliance issues exist

Key value offerings

1. **Precision in Compliance:** Accurate mapping and analysis ensure network adequacy meets CMS regulatory standards
2. **Real-time Monitoring**: Provides alerts and notifications on network adequacy status and emerging gaps
3. **Enhanced Decision-making:** Visual tools and detailed reports support strategic planning and decision-making
4. **Comprehensive Data Integration:** Enables seamless processing of geospatial, provider, and member data for robust verification

2 Data Accuracy managing tool



Sequence of Logical Operations

1. Submitted roster data will be verified by cross-referencing it with data collected through **web crawling and scraping** performed by bots
2. The data collected through web scraping will be stored in a **timeline**, with accuracy checks based on the **reliability** of the source. The most recent, verified data will replace previous provider information, ensuring that only the most accurate and up-to-date details are used
3. The data that cannot be verified will be displayed on the dashboard, allowing us to manually review and verify it
4. Providers also have the option to **update** after creating their account and completing the verification process

Key value offerings

1. **Enhanced Data Accuracy:** Real-time, automated verification for provider data
2. **Operational Efficiency:** Reduced manual work and faster identification of discrepancies
3. **Compliance Assurance:** Supports HIPAA compliance and ensures data protection
4. **Improved User Experience:** Reliable data increases trust and member satisfaction

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1 Network Adequacy check tool

Geospatial Mapping and Region Segmentation

Tech overview	Technology	Purpose	Implementation
Hexagonal Grid System	Uber's H3 geospatial indexing library	To divide geographic space into hexagonal units for better spatial coverage	Integrated into a Python or Node.js backend for processing geospatial data
GIS Platform Integration	Leaflet.js or Mapbox (JavaScript library for interactive maps)	To create an interactive user interface that visualizes provider networks and compliance areas	Custom layers overlaid with data visualization using React.js or Angular for front-end development
Distance Calculation	Haversine formula (Python), Google Maps API	To accurately calculate the distance between members and providers	Embedded into the backend logic with API calls for precise, real-time calculations

Data Integration and Provider Analysis

Tech overview	Technology	Purpose	Implementation
Provider Data Collection	Pandas, APIs for data extraction, database integration (MongoDB)	To pull and structure data from various public and private data sources	ETL (Extract, Transform, Load) pipelines built using Apache Airflow or Apache NiFi
Density Mapping	Python with libraries like Geopandas, Census data API	To analyze population density and adjust the grid segmentation accordingly	Use geospatial analysis scripts to overlay population data on the hex grid
Wait Time Monitoring	Real-time data streaming (RabbitMQ), analytics platforms (Elasticsearch or Datadog)	To monitor and alert when wait times exceed CMS requirements	Data ingested from provider platforms, processed, and displayed on dashboards using Grafana

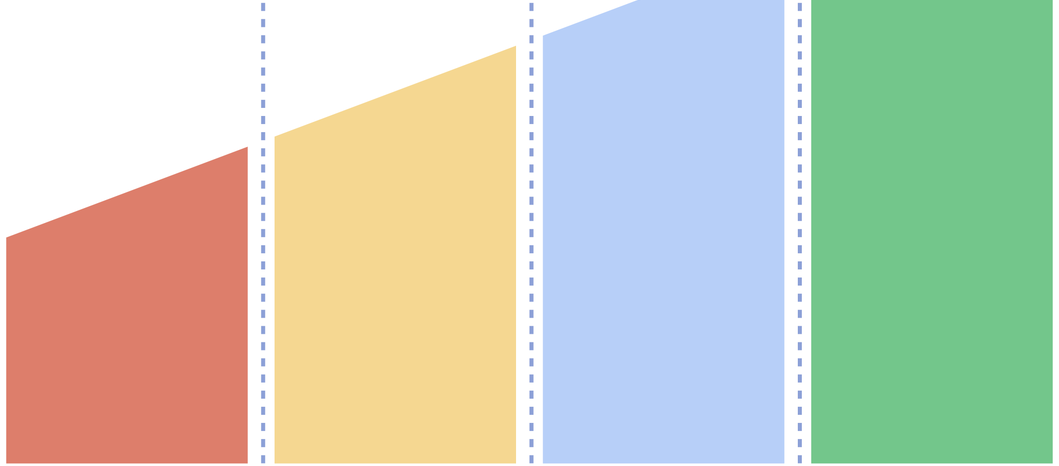
Compliance Check Module

Tech overview	Technology	Purpose	Implementation
Provider and Specialty Review	SQL-based rules, Python scripts (NumPy, Pandas)	To verify the number and specialties of providers within each region	Backend scripts run periodic checks and validations against stored provider data
Real-Time Alerts	Notification services (Twilio), backend support (Node.js)	To alert users about non-compliance in specific hexagonal units	Integrated into the dashboard for real-time push notifications and email alerts
Reporting Engine	Python (Jinja2 for templated reports), PDF generation (ReportLab)	To compile and generate detailed reports on compliance status	Report generation jobs run on-demand or on schedule, accessible via the user dashboard

2 Data Accuracy managing tool

Web Crawling and Scraping	**Tech:** Python (Scrapy), Selenium **Purpose:** Automatically collects provider information (address, phone, specialty) from reliable online sources **Implementation:** Bots crawl government directories, state medical boards, and provider websites, storing data in a secure database
Data Comparison Algorithms	**Tech:** Pandas, NumPy **Purpose:** Cross-checks collected data against the existing database to detect discrepancies. **Implementation:** The system compares new data to existing records, flagging outdated or inconsistent entries for review
Machine Learning Integration	**Tech:** Scikit-learn, TensorFlow/PyTorch **Purpose:** Uses anomaly detection to identify potential errors and improve data accuracy **Implementation:** A machine learning model trains on historical data to predict and flag potential data inaccuracies
Secure Data Handling	**Tech:** AWS/Azure (Cloud), Encryption protocols **Purpose:** Ensures secure storage and handling of sensitive provider data **Implementation:** All data is encrypted and transmitted via HTTPS to meet HIPAA compliance and ensure privacy
User Dashboard & Alerts	**Tech:** React.js (Frontend), Node.js (Backend) **Purpose:** Provides users with a real-time view of data accuracy, discrepancies and manual review options **Implementation:** The dashboard displays data verification status, flagged issues and sends alerts for manual checks

Go to Market Strategy



Leverage Industry Authority	Partnerships with Healthcare Providers	Targeted Outreach and Sales	Subscription-Based SaaS Model
Stage 1	Stage 2	Stage 3	Stage 4
Establish the company as a leader in healthcare compliance by publishing whitepapers, speaking at conferences, and creating educational content like blogs and webinars	Build strategic partnerships with providers, insurers, and government entities, offering pilot programs and case studies to showcase the tool's impact on network adequacy and regulatory compliance	Use data-driven outreach to engage potential customers, tailoring pitches to specific segments (e.g., clinics, hospitals, government) focusing on solving their unique pain points	Offer the solution as a flexible SaaS with scalable pricing, ensuring it's accessible to organizations of all sizes and providing value-added services like support and advanced reporting

Success Metrics

North Star Metric:

1 Network Adequacy check tool

Compliance Coverage Index =

$$\left(\frac{\text{\# Compliant Hexagonal Units}}{\text{Total \# of Hexagonal Units}}\right) \times \left(\frac{\text{\% Regions Meeting Wait Time and Specialty Requirements}}{100}\right)$$

Note: The regions or hexagonal units are present only in areas with human populations that require health coverage

2 Data Accuracy managing tool

Data Accuracy Validation Rate $= \left(\frac{\text{Validated Accurate Provider Records}}{\text{Total provider records}}\right) \times 100$

Network Adequacy check tool	• Provider Accessibility Coverage = (Reachable Population / Total population) x 100 • Real-Time Compliance Alert Rate = (Non-Compliant Areas Flagged in *X* Time / Total non-compliance area detected) x 100
Data Accuracy managing tool	• False Positive Rate = (False Positives Detected / Total discrepancies flagged) x 100 • Data Verification Time = (Total Time for Data Verification / # data points verified) x 100

Risks and Mitigation

Network Adequacy check tool

1. Potential **breaches** or **unauthorized** access to sensitive data like provider details	1. To mitigate data privacy risks, encrypt data at rest and in transit, use secure storage protocols (e.g., AWS, Azure), and comply with privacy laws (HIPAA, GDPR). Implement role-based access control (RBAC) with multi-factor authentication (MFA) to restrict access
2. **Incorrect** provider locations could affect network adequacy calculations	2. To mitigate geospatial data inaccuracies, use reliable APIs (e.g., Google Maps, OpenStreetMap), cross-check with multiple data sources, and perform regular data audits and validations
3. System slowdown due to high data volume or real-time processing needs	3. To improve system performance and scalability, optimize backend code, use caching, leverage scalable cloud solutions (e.g., AWS, Google Cloud), and implement asynchronous processing with database partitioning

Data Accuracy managing tool

1. Handling sensitive data, including provider and patient information, could lead to **privacy violations** and non-compliance with HIPAA standards	1. Implement strong encryption protocols for data at rest and in transit, use secure cloud storage solutions certified for HIPAA compliance, and enforce strict access controls to protect against unauthorized access and data breaches
2. Websites may **block** automated web crawlers, disrupting data collection and limiting the tool's effectiveness	2. Use adaptive web crawling strategies, such as rotating IP addresses and user agents, to mimic human browsing behavior. Implement rate-limiting and adhere to site-specific robots.txt policies
3. Data may come from **outdated or unreliable sources**, resulting in potential inaccuracies in the provider database	3. Incorporate cross-referencing of multiple trusted data sources and assign a confidence score to each source. Regularly review and update the list of data sources to flag and manually review any data discrepancies or low-confidence records

Future Enhancements

Network Adequacy check tool

- **AI-based Predictive Analytics:** Incorporate models to anticipate future provider shortages
- **Enhanced User Customization:** Develop more interactive, tailored dashboard options
- **Integration with Mobile Platforms:** Extend capabilities for on-the-go access and alerts
- **AI-driven Optimization:** Implement ML to further refine grid segmentation and network adequacy

Data Accuracy managing tool

- **AI Enhancements:** Integrate NLP for deeper data insights
- **Expanded Sources:** Broaden data sources to include new, verified channels
- **Predictive Analytics:** Enhance models to predict future inaccuracies proactively
- **Scalable Design:** Adapt for larger datasets and global provider directories.