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Project Heal

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Contents

Project Heal: A Path to MLP (Minimum Lovable Product)

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About this Document

This document aims to help ease the pathway from idea to production implementation of a Minimum Lovable Product (MLP) for Project Heal. The discussion points within this document have been shaped from the outputs of a series of workshops which helped refine the vision of Project Heal as well as define success criteria.

This document explores a variety of technical considerations and approaches that can be utilized to help during development.

Problem Background

Around the world, public health administrators are overwhelmed by false medical information and its impacts to their communities. Community members persuaded by untrue medical information present resistance to sound diagnosis and treatment paths. This may lead to impacts

in health and recovery and in extreme cases loss of life. Currently, public health administrators do not have the ability to rapidly identify and respond to these false medical information trends.

The Spectrum of False Medical Information

False medical information can fall into three primary large classification types:

- Misinformation: False information that spreads regardless of intent to mislead others.
- Disinformation: Deliberately created to harm, manipulate, or mislead.
- Malinformation: Based on fact but taken out of context to mislead, harm, or manipulate.

Each type of false medical information has unique response strategies that can be utilized by public health administrators to effectively combat the threat.

Proposed Solution

Project Heal is an open source toolkit that can be easily deployed on Amazon Web Services by interested entities across the globe.

Developed by a partnership of several research institutions, the launched toolkit uses cloud-based AI services that allows public health administrators worldwide to rapidly be informed of emerging false medical information threats, obtain insights, and generate tailored response communications for impacted communities.

Persona in Scope during Designs

During solutioning, designs were anchored to the persona of a Public Health Administrator, Mary. Mary's persona profile can be seen in the image below.

Figure 1: Selected Persona

Storyboard

The following eight image panels convey the basic premise of Project Heal. The storyboard tells the story of a child who is sick with “Stomach Virus X” in the hospital; the parents of the child tried to treat them with bleach based on false medical information they had believed. In parallel, we see a Public Health Administrator, Mary, overwhelmed with the efforts to understand how this piece of misinformation is spreading. She is introduced to Project Heal, allowing her to dive deep into misinformation associated with “Stomach Virus X”. Ultimately, Project Heal allows her to get ahead of a new threat, “Stomach Virus Z”. Mary’s proactive approach helped prevent the parents of the same child from believing Motor Oil was an appropriate treatment of “Stomach Virus Z”.

Figure 2: Storyboard Frame 1

Figure 3: Storyboard Frame 2

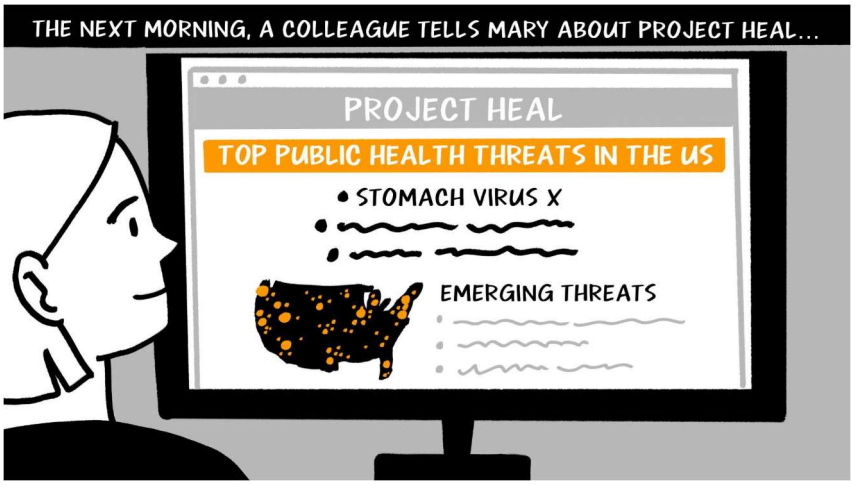

Figure 4: Storyboard Frame 3

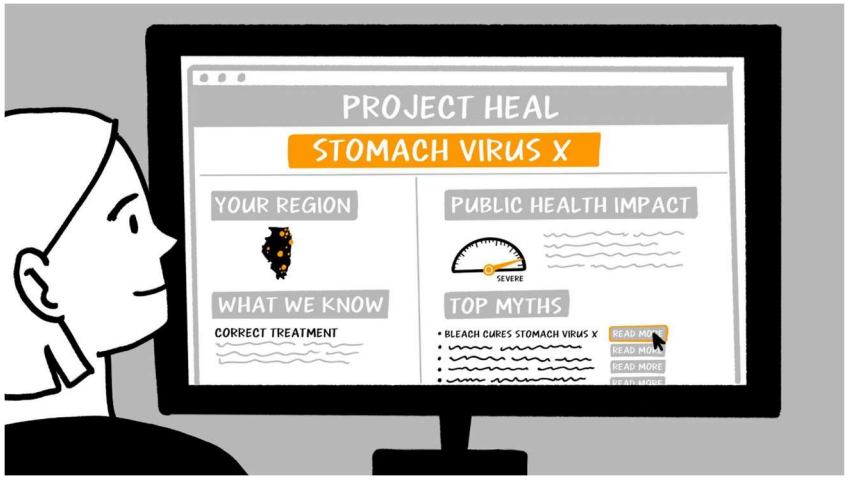

Figure 5: Storyboard Frame 4

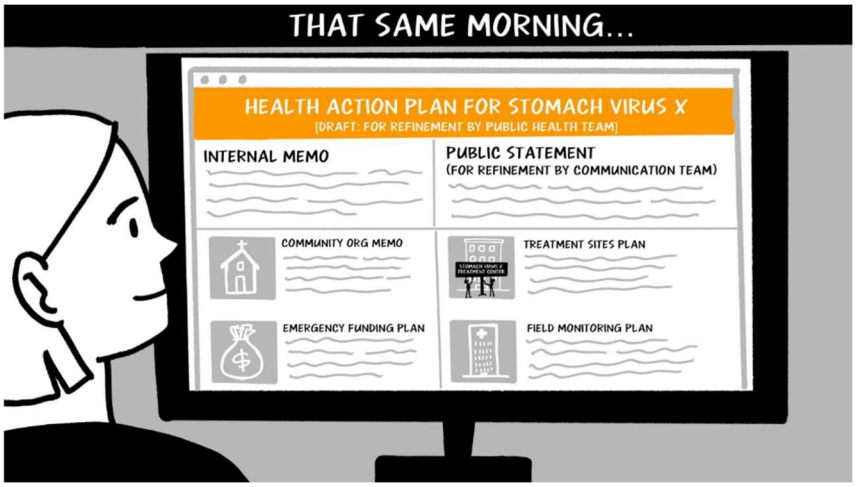

Figure 6: Storyboard Frame 5

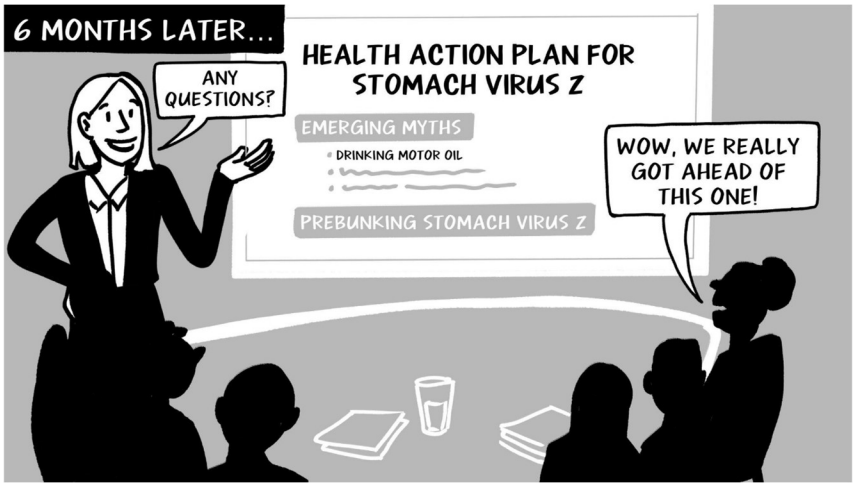

Figure 7: Storyboard Frame 6

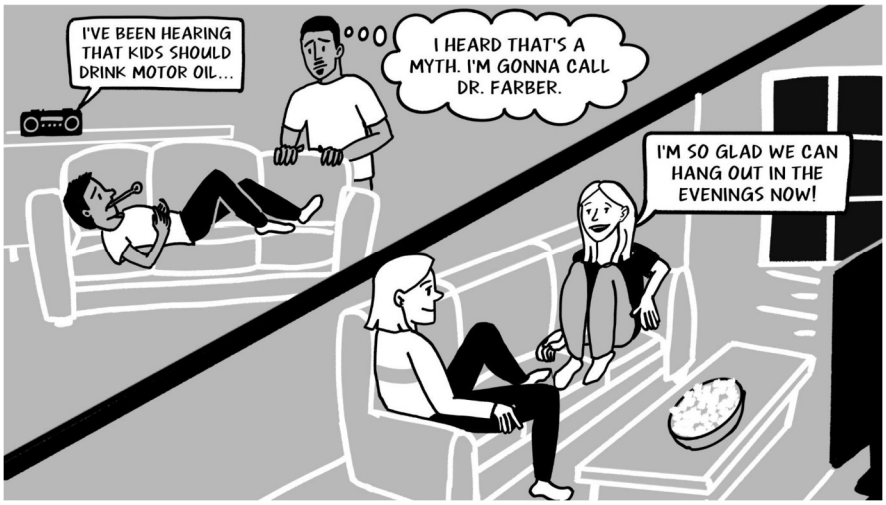

Figure 8: Storyboard Frame 7

Aligning on Language

Alignment on typology/taxonomy of health misinformation is an important first step for customers to consider before diving into development of a Project Heal. Below is a table of definitions and terminologies that can be evaluated and incorporated into the Project Heal platform.

Source: *EU Disinfo Lab Disinformation Glossary of Terms (https://www.disinfo.eu/publications/disinformation-glossary-150-terms-to-understand-the-information-disorder/)* *By Maria Giovanna Sessa, EU DisinfoLab* *The author would like to thank Francesco Poldi, Rita Jonušaitė, Nicolas Hénin, Raquel Miguel Serrano and Ana Romero Vicente for their contributions to some of the definitions.*	
Misinformation	Information that is false, but believed to be true by those disseminating it. It differs from disinformation in the absence of an intention to mislead or harm.
Disinformation	Information that is false and is disseminated intentionally to cause harm.
Malinformation	Information that is based on reality but is used to harm or threaten a person, an organization, or a country (e.g., see "doxing").
Clickbait	The practice of writing sensationalized, misleading, or false headlines in order to attract clicks on a piece of content and therefore encourage traffic.
Deepfake	An image or footage that has been convincingly altered and manipulated through some form of machine learning (differently from cheapfakes) to misrepresent someone as doing or saying something that was not actually done or said.
Rumor	A tall tale of explanations of events circulating from person to person and pertaining to an object, event, or issue in public concern.
Satire/Parody	These may incur in disinformation when the receiver of the message does not understand the transmitters' ironic intent and takes the message for authentic. Therefore, it has no

	intention to cause harm but has the potential to fool, as our research unveils. This is also part of First Draft's typology to classify mis- and disinformation.
Fake/False News	False or misleading information presented as news. Although it can be inaccurately used as a synonym of disinformation, the term has been popularized by Donald Trump, who exploited it to cast doubt upon credible news.
Hoax	A deception or falsehood, which we use in general terms to indicate a single piece of mis- or disinformation.
Myth	A widely held but false belief or idea.
Misconception	A view or opinion that is incorrect because based on faulty thinking or understanding.
Logical fallacy	The use of invalid or otherwise faulty reasoning in the construction of an argument, which may appear to be a well-reasoned argument if unnoticed.
Coordinated Inauthentic Behavior (CIB)	A term coined by Facebook to describe the use of multiple actors engaging in violations of the platform's community standards, e.g., misrepresenting themselves through the creation of fake accounts or artificially boosting the popularity of content.
Digital Humans	A conversational type of AI, created using state-of-the-art computer-generating imagery and designed by teams of expert animators and visual effects specialists. Among them, there are virtual influencers, such as Lil Miquela and Imma.
Firehosing	A propaganda technique by which many messages are broadcast rapidly, repetitively, and continuously over multiple online channels without considering truthfulness or consistency.
Denialism	The refusal to admit the truth of a concept or an event that is supported by the majority of scientific or historical evidence, such as the existence of a pandemic or a war. We extensively wrote about COVID-19, monkeypox, Ukraine war, and climate change denial. Historically, one of the best-known cases is the Holocaust denial (see definition).
Microtargeting	A marketing strategy that employs users' data (i.e., collected via cookies) to segment them into groups for content targeting. It has been used for malicious purposes, especially during elections to target voters with personalized political advertisements. In 2010, Cambridge Analytica targeted Black youth voters in Trinidad with a campaign that discouraged them from voting.
Anti-Vaccination or Anti-Vax	Opposed to vaccination
Hate Speech	Discourse that expresses hate or encourages violence towards a person or group based on inherited characteristics such as race, religion, sex, or sexual orientation.
Dangerous Speech	Dangerous speech is any form of expression (e.g., speech, text, or images) that can increase the risk that its audience will condone or commit violence against members of another group. Online disinformation and hate speech constitute dangerous speech when they include elements that can lead to offline discrimination and brutality.
Phishing	A fraudulent practice, which is usually part of a hacking attempt, consisting of sending messages – usually emails and direct messages – purporting to be from reputable companies in order to induce individuals to reveal personal details, such as financial information.
Propaganda	True or false information spread to persuade an audience, which is often politically connoted. In detail, white propaganda uses accurate, albeit selectively presented, information and identified sources.
Scam	A fraudulent or deceptive act or operation, usually via email or private message. A popular variant is the so-called "Nigerian scam", which involves promising the victim a share in a large sum of money or a payment in return for a small up-front payment, allegedly used to obtain the large sum.
Sock-Puppet	A fictitious online identity created specifically to deceive, i.e., a fake persona. Sock puppet accounts differ from catfishing as the former are short-lasting, not very detailed, and not necessarily conceived for malign intent.
Synthetic Media	Also known as "AI-generated media". It is a catch-all term for the artificial production, manipulation, and modification of data and media by automated means, especially using artificial intelligence algorithms, such as for the purpose of misleading people or changing an original meaning (e.g., deepfakes).
Troll	A user who intentionally antagonizes others online by posting inflammatory, insulting, or disruptive content to get attention, upset, or provoke.
Vishing	A combination of 'voice' and 'phishing', it indicates a phone scam that uses social engineering tactics to persuade victims to provide personal information, typically with the goal of accessing financial accounts. Users are often tricked into believing that their bank account was compromised or that they received an unmissable offer.
Bot Alt Tech	The term is referred to social media platforms and Internet service providers that found popularity among the alt-right, far-right, and others sharing extreme or fringe opinions, due to their actual, or perceived, laxity in moderating content compared with mainstream Internet service providers.
Astro-turfing	The attempt to create an impression of widespread spontaneous support for a policy, individual, or product. In reality, it is initiated and controlled by a concealed group.
Doppelganger	A Russia-based influence operation network that has been operating in Europe since at least May 2022. It uses multiple "clones" of authentic media that operate through different yet similar Internet domains, reproduce the same designs, and target users with fake articles, videos, and polls.
Bot	A software program that performs automated, repetitive, pre-defined tasks, typically imitating or replacing human behavior. In this regard, Bot Sentinel is an interesting platform developed to detect and track troll-bots and untrustworthy Twitter accounts.
Source: *Understanding the Infodemic and Misinformation in the fight against COVID-19 (https://iris.paho.org/handle/10665.2/52052)* *Pan American Health Organization, 2020. Some rights reserved. This work is available under license CC BY-NC-SA 3.0 IGO.*	
Paper Conspiracy Theory	The belief that a small group of powerful people are making secret arrangements to advance their personal interests, consequently causing harm to society. Pseudo-science: a collection of beliefs or practices mistakenly regarded as being based on scientific method.
Misunderstood Science	(No formal definition in this context)
Misapplicatin of Science	(No formal definition in this context)
Threat	(No formal definition in this context)
Source: *Fake news. It's complicated. Claire Wardle (https://firstdraftnews.org/articles/fake-news-complicated/)*	
Satire/Parody	Information that has no intention to cause harm but has potential to fool the user
Misleading Content	Information that intentionally misleads users in order to frame an issue or individual Imposter Content: Information that falsely impersonates a genuine source of content
Fabricated Content	Totally new content that is 100% false, and is designed to deceive and do harm

False Connection Content	Headlines, visuals, or captions that don't support their primary content. Manipulated Content: Genuine information

Table 1: Common Terminology

Customers can utilize above terms to form mappings of similar terms (IE groupings). Examples of groupings can be:

- Types of incorrect information
- Actions to Harm
- Topics with high levels of misinformation
- Malinformation
- Disinformation
- Misinformation
- Technology utilized for bad information
- Sources
- Impact
- Topic/Subject
- Intent
- Domain
- Computerized Approaches
- Hate-driven
- Deceptive
- Opinions
- Monetary Driven

Grouping terminology helps customers understand if there is duplicate terminology, or if a hierarchical structure for terms should be utilized within Project Heal. A possible approach that was utilized during mockup development was to view terms in a flat hierarchical structure. At the highest level, a topic, metadata would be associated with it forming a “tagging” concept on pieces of data. The following image demonstrates a “napkin sketch” of the concept.

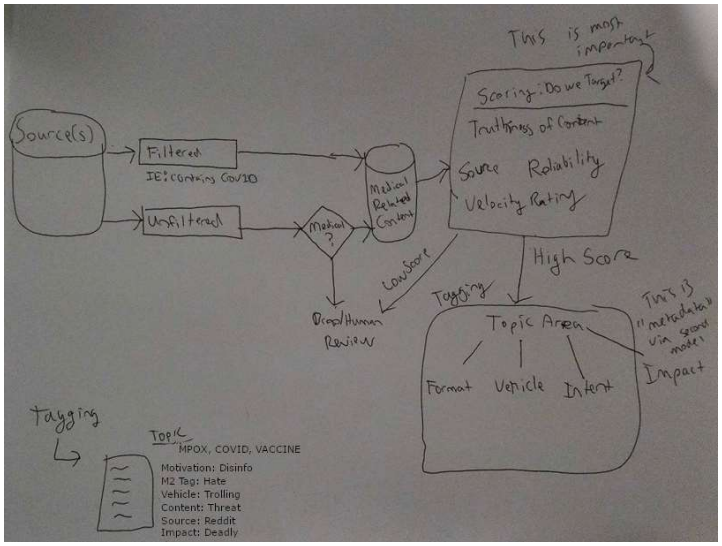

Figure 9: Napkin sketch

User Experience for Project Heal

Project Heal has an ambitious vision. UI mockups were developed to help demonstrate core functionality of the system to allow customers to have a north star for development. The mockups are tailored towards the Public Health Administrator experience on the platform. Prioritization and having a clear roadmap for development will be critical for customers to create prior to development phases of Project Heal. Please see document/link for full mockup content.

The following sections describe areas of the developed mockup where customers should further dive into prior to development.

False Medical Claim Insights

The main page for users presents information on which false medical claims (FMC) are scored as the most dangerous (IE drinking bleach is more dangerous than using mineral oil on skin), FMC's with the current highest velocity detected by the system, and top FMC topic areas (such as MPOX, Covid, etc.).

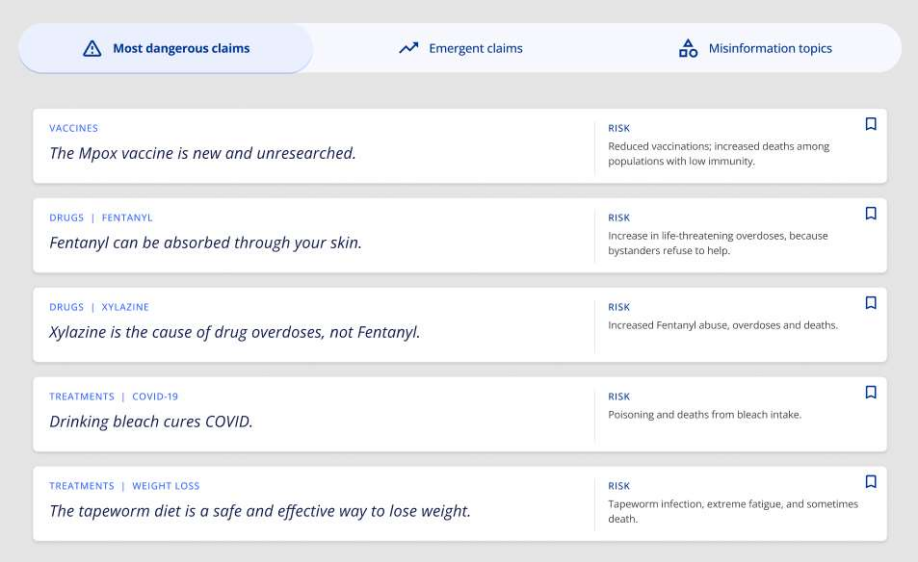

Figure 10: Top Threats

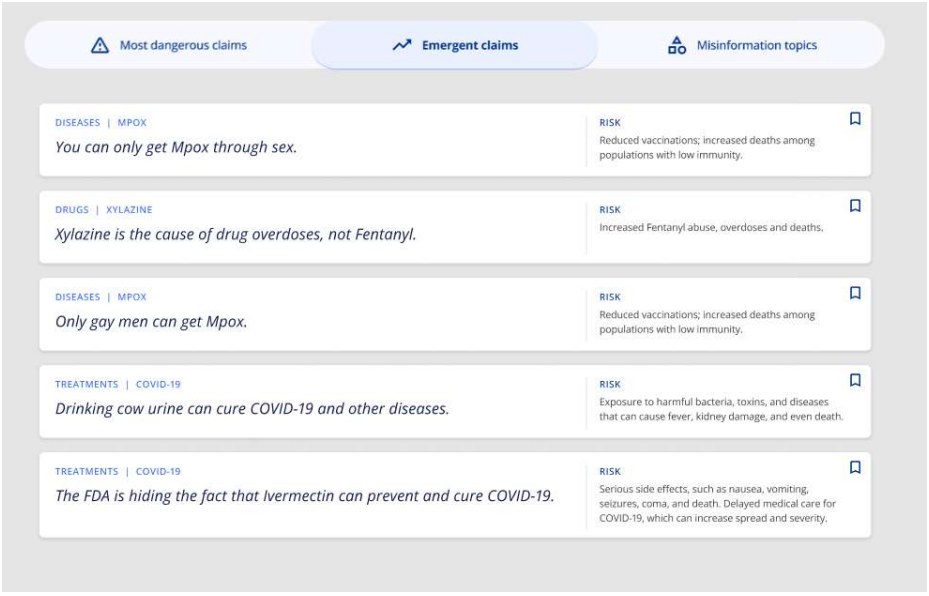

Figure 11: Emergent Claims

Most Dangerous Claims: Technical/Implementation Considerations

The “Most Dangerous Claims” tab requires both a scoring system and a “summarization” system to be developed for content read by Project Heal.

A FMC can be stated in several ways with slight variations of language, for example:

- Drinking bleach cures COVID
- Hey folks, use bleach shots to treat COVID
- I don’t get why people are scared of COVID, just eliminate it by drinking bleach
- Bleach, it does the body good when you have COVID

All of these FMC's can be categorized as the same FMC. A summarization line for all four of these could be "Drinking bleach cures COVID". This allows for the system to efficiently roll up FMC's so that the system may produce meaningful reports & metrics.

A technical approach to achieving this that can be explored is to pass content through NLP services such as Amazon Comprehend/Amazon Comprehend Medical to help with entity recognition & key phrase extraction. These entities can then be flowed into a LLM to generate a tagline for those entities.

The second area to explore for customers is Project Heal's scoring system. For accurate scores of threats, Project Heal may need the capability to track medical outcomes. This could require the need for a dedicated team that help define healthcare outcomes or potentially an integration with a database of clinical outcomes. Scoring will require factoring in many dimensions and these scoring factors will need to be made transparent to users.

Communication Generation

Project Heal allows for tailored messaging to be generated. The screen below demonstrates a possible generated communication.

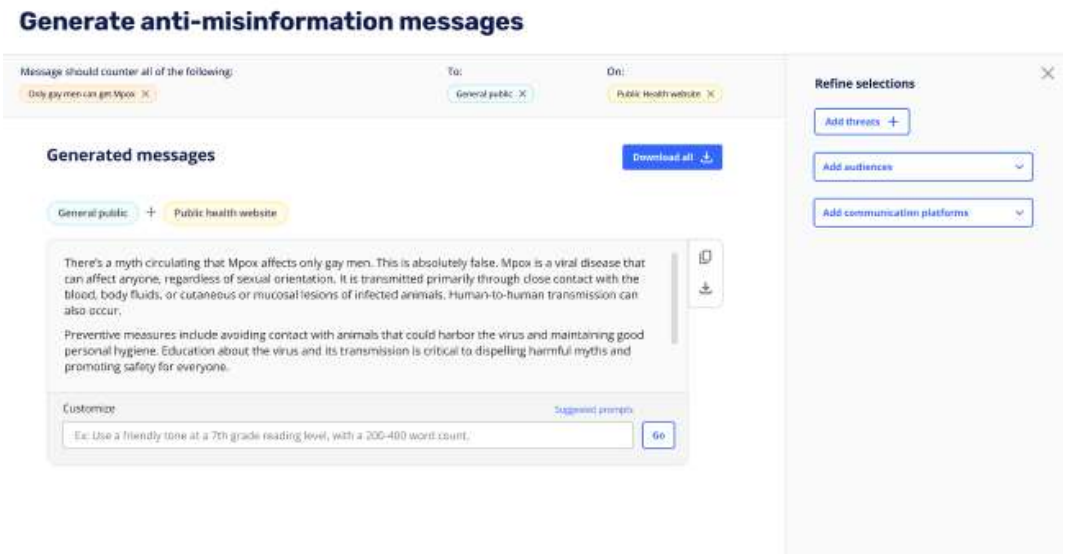

Figure 12: Generated Communication

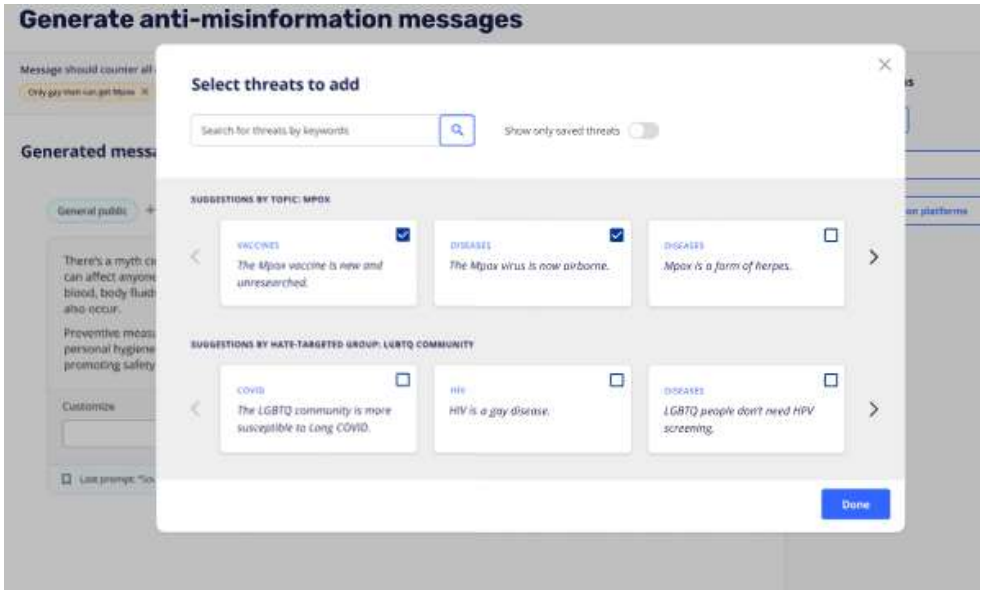

Figure 13: Customize Generated Communication

A technical approach to achieve above would be to utilize generative AI. The backend of the system should utilize dynamic prompt engineering based on user selections. As generative AI is a newer field, customers should consider adding appropriate disclaimers on outputted messages or even a workflow to allow for both approvals of messages before export or supporting the enhancement of outputs.

Project Heal design has opted to avoid presenting rich text editing to users to keep focus on message output. Users are capable of interacting with the generated message and submitting additional prompts to help fine tune output (user driven prompt engineering). Through system use, metrics can be collected on user prompts and outputs to present users with common modification prompts.

Scoring

As noted in the “False Medical Claim Insights” section, customers will need to designate an algorithm to define how threats are rated from a severity perspective. Explore how clinical outcomes, velocity of the misinformation, and other factors that denote urgency and provide a score.

Figure 14: Scoring

Building a Community of Experts

UI mockups make use of visual views of misinformation locations and can be seen below.

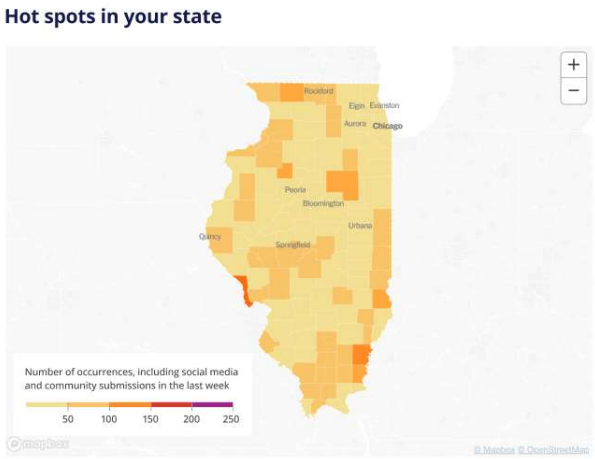

Figure 15: Map View

A major consideration and research point for customers attempting to implement Project Heal is how this mapping capability can be achieved. Data sources that are potential candidates for Project Heal ingestion often lack reliable geolocation data.

Customers could potentially consider utilizing similar approaches to that of advertising agencies to infer user location; however, this would likely still pose many gaps in the system.

A more viable approach could be to utilize a community of trusted health experts that are supporting Project Heal in a fashion similar to Wikipedia. This trusted community would help provide additional data points for Project Heal based off of on the ground information.

The question remains, however, what volume of submissions would be coming into the system, as well as what "zoom level" could be utilized (IE state view versus county view).

User Testing Feedback of Mockups

User testing was performed with five separate users to validate core concepts of mockups. These users represented a broad group of potential users of Project Heal including Public Health Communicators, Public Health Administrators, Public Health Nurses, and an international user representing Latin America.

All five users validated the benefits of the core concept of Project Heal. The two most highlighted features that stood out to the user test group was the ability to generate communications and the core capability of tracking misinformation trends.

A common improvement area that came out of user testing was the ability to subscribe and configure to a newsletter style report of trends within the system to allow for quick and easy consumption for users. Additionally, users could potentially set seasonal alerting to remind them of trending diseases such as flu and Lyme disease.

The user test group stated that they would trust an external group providing submissions to the platform as long as that external group was vetted and appropriate controls were in place to prevent malicious use.

Map based functionality was of interest for multiple users, but it did pose the question of how to best implement it from a technical & operational perspective. Granularity at scale would be a difficult feature to implement.

Users stated that equitable access and scalability of the platform could be achieved by incorporating more languages; however, implementors of Project Heal should consider the technical implications of this. Initial AI models that the system utilizes will be trained on English content. Detection algorithms as well as communication generation is a nuanced area for additional languages. A simple English to alternate language such as Spanish translation of content will not necessarily provide accurate information and lose context. This could decrease trust of the system for non-English speakers.

Ultimately, user testing highlighted excitement for the potential of Project Heal and its feature set. Testing has helped confirm desirability and initial viability to use the platform, as well as supported key design decisions. The largest area of exploration which was exposed by user testing is understanding what the best mechanisms for incorporating community contributions into the platform are. These mechanisms are crucial to explore for functional mapping capabilities at the desired "zoom" level.

Key Insights

- 5 of 5 users validated the concept as a valuable tool they would regularly use to simplify and accelerate their workload

- 5 of 5 users would find a subscription style newsletter beneficial
- 5 of 5 users had hesitancies in regards to mapping and how it would be made feasible
- 5 of 5 users had no issues with trusting the system
- 4 of 5 users had hesitancies in regards to their departments and associated staff reporting threats to the system due to time constraints, but overall were receptive to allowing reports from a larger community of trained threat reporters
- 3 of 5 users found communication generation as one of the top features
- 3 of 5 users found that the map view would either not be a useful feature for them or not essential
- 3 of 5 user found that map would be more useful at a national level
- 2 of 5 users found the aggregation of content across social media platforms as the most useful feature
- 1 of 5 users mentioned the benefit of additional languages

Key Improvements

- Add appropriate disclaimers to areas such as communication generation
- Add ability to prioritize alerts
- Add ability to set default search filter options
- Add ability to create custom and default audiences to message generation
- Add ability to subscribe and tailor a newsletter from the platform

Deprioritize

- Map functionality

Next Steps

- Creation of in-depth mockups & user tests for community contributions
- Develop a rollout strategy to operationalize the platform
- Explore additional personas that will be required for the system such administrators, department leads, etc.
- Continue refining prototypes and testing/validating with users

Selected User Feedback Quotes

- "Going about my day, if an alert pops up, I'd pop in and be all over Project Heal. I would be looking at everything"
- "I go out and do a lot of presentations and interfacing with communities; communication generation would be very useful."
- “This platform would be like having an additional entire team of employees working for us.”
- "This is a great idea, that would have a lot of utility"

- "Nurses are left to their own means to message appropriately to patients; helping them with a starting point would be great."
- “This would change my behavior based on the sites features. Our team would use it weekly and incorporate it into our regular cadence of team meetings.”

Project Heal Technical Overview

Project Heal needs to encompass a variety of elements in order to become a successful platform. The following image helps demonstrate some of the foundational elements that Project Heal would need to include during development phases:

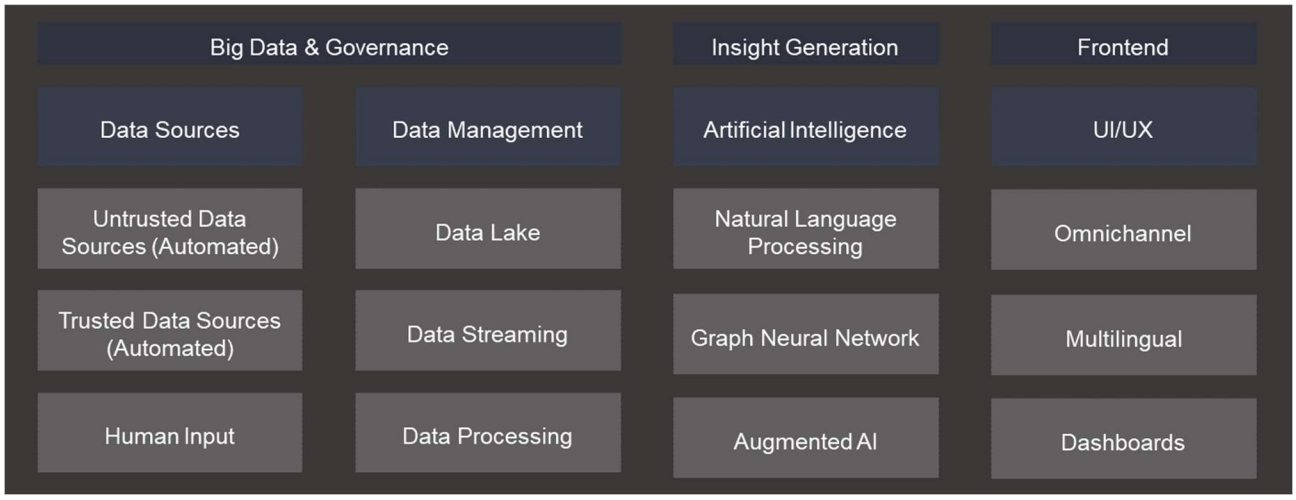

Figure 16: System Overview

Big Data & Governance

Project Heal will only be successful with access to sufficient data. For this platform, data sources can be viewed as one of two category types:

1) Untrusted Data Sources: These data sources have been designated as potential vehicles that can spread false medical information. Examples of this could include Reddit or Twitter.
2) Trusted Data Sources: Data sources that have been designated as sources of truth. Examples of this can include PubMed.

In addition to data consumed automatically from various technology platforms, users of Project Heal act as a crucial driver of information for the system. Public Health Administrators, their associated staff, and a trusted community of medical experts will have critical on-the-ground information that can support system insights.

Due to the large scale of data the system will store and process, proper implementation of a data lake and associated data controls will be necessary. Customers implementing a MLP should consider managed services such as AWS Lake Formation to support data governance and Amazon Kinesis to support streaming data needs.

Insight Generation

Designing and implementing a proper data strategy for data collection, storage, cataloging, and serving supports Project Heal's ability to evolve its artificial intelligence capabilities.

Easily accessible data will support iterative training of models which determine if pieces of information are truthful medical information or untruthful medical information. This "truthiness" detection engine can be built utilizing a graph neural network (GNN) and machine learning capabilities. A large, scalable, fully managed graph databases such as Amazon Neptune can be utilized to support storing and forming billions of relationships which Deep Graph Library (DGL) can be utilized to build and train GNNs, including Relational Graph Convolutional Networks (R-GCNs) for tasks such as node classification, node regression, link prediction, or edge classification.

Additionally, technologies such as Amazon Comprehend and Amazon Comprehend Medical can help support evaluation of data and extract keywords and entities to support Project Heal's tagging system. These automated extractions can help support tagging elements such as:

- Type of mis/disinformation
- Why content is being spread
- Where has the content been seen
- How the content is being spread
- How long the content has been around

The final piece which supports insight generation is model improvement through an augmented artificial intelligence workforce (humans). Services such as Amazon A2I help support human validation workflows for inferences made by Project Heal models that do not meet designated confidence levels.

Frontend

Customers should strive to deliver a pleasant and intuitive user experience through Project Heal's user interface. The user interface should allow Public Health Administrators to both proactively detect threats as well as support their ability to research threats. Additional user testing and validation should be performed prior to development of the system.

Conceptual Technical Architecture

The following conceptual technical architecture has been proposed to support the development of Project Heal. This architecture focuses primarily on the ability to evaluate whether a piece of information is truthful medical information or false medical information. Additional design will be required for building out elements of Project Heal such as tagging capabilities, generative AI functionality, and various UI features.

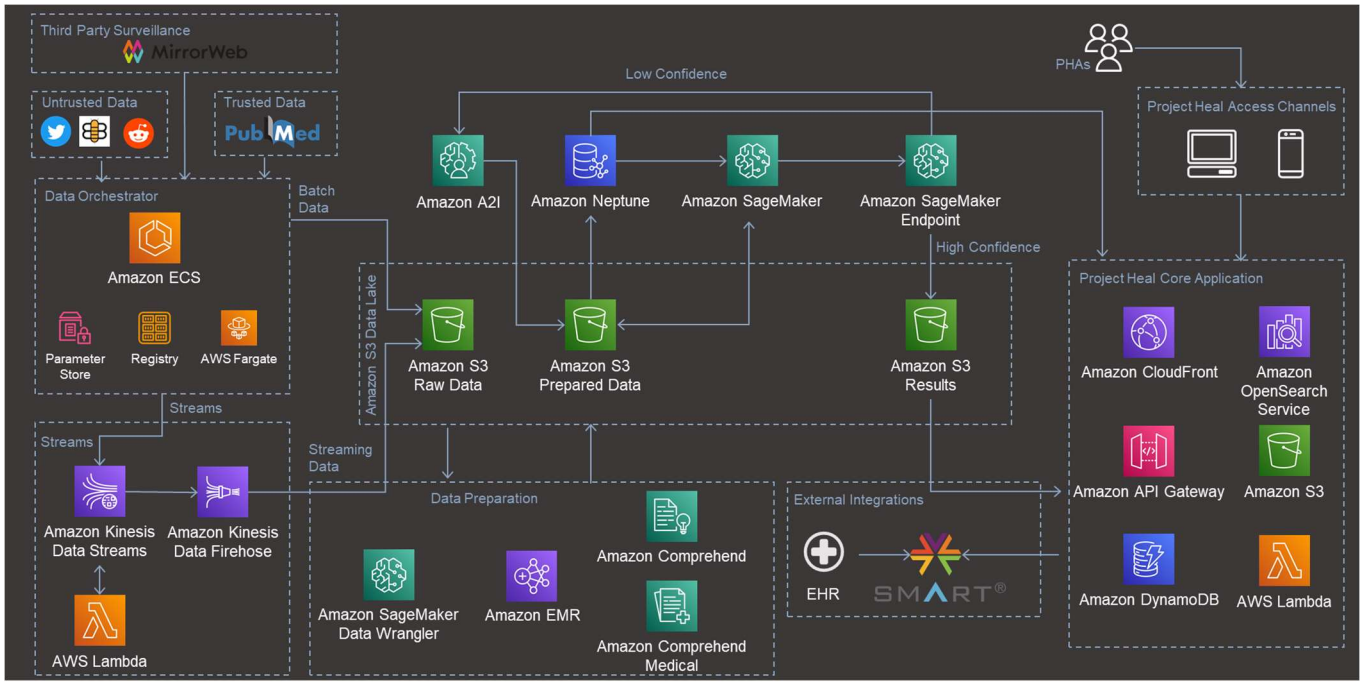

Figure 17: Conceptual Architecture

Data Sources

For MLP buildout, customers should consider limiting the amount of data sources selected for untrusted and trusted content. The following is a possible selection of data sources for the MLP:

1) Untrusted Sources: Twitter, Reddit, Babylon Bee
2) Trusted Sources: PubMed

As the deployment of Project Heal matures, third party services, such as MirrorWeb (a communication surveillance platform), can provide Project Heal with additional sources of data to evaluate.

Additionally, as customers are developing and validating their "truth" detection model, consideration should be taken in selection of datasets to help train the initial version of the model. A variety of datasets exist on the web that could be utilized to help train the initial model. Some examples include:

- https://arxiv.org/abs/2204.12294
- https://github.com/kinit-sk/medical-misinformation-dataset
- https://www.kaggle.com/datasets/arashnic/covid19-fake-news
- https://data.mendeley.com/datasets/242whtdt3m/1

Customers will need to think through limitations that may arise when utilizing above data sets, such as API rate limitations and missing original content if performing rehydration processes.

External Integrations

The platform has the opportunity to integrate with additional third-party integrations, such as SMART: Cumulus, a platform that can help provide aggregate information from EHR systems. This likely would not be included in an MLP, but design considerations should be taken to allow for integrations in future iterations of Project Heal.

Security Considerations

System design and deployment in a production environment should align to NIST 800-53 controls. Control Tower can help accelerate the deployment of a landing zone and provide overarching governance to the deployment necessary to meet these guidelines. In the case that Project Heal additionally integrates with Health Systems and deals with HIPAA protected data, appropriate controls must be in place to meet HIPAA compliance.

Areas to Explore for Build

Project Heal is a large-scale system that requires many components to make a production implementation successful. The following sections cover some areas of consideration and exploration for customers as they move towards their production journey.

Structuring Your Landing Zone

Building out a secure multi-account environment aligned to the AWS Well-Architected Framework will be critical to provide the appropriate governance for Project Heal workloads (which may include rules for security, operations, and Customer's internal requirements). Additionally, a properly structured landing zone will allow ease of integration to customer's existing IT infrastructure.

Customer's should explore and develop requirements related to organization structure, account structure, operations, security, governance, and compliance as well as integrations needed for networking purposes of existing IT infrastructure.

Designing and implementing a scalable Landing Zone for Project Heal can be achieved leveraging AWS Control Tower, designed to address the following needs:

- Scalable and integrated with Customer's existing ecosystem
- Secured with Customer-defined policies and requirements
- Defined AWS Organizations organizational unit (OU) structure and AWS Account Vending Machine
- Domain name system (DNS) setup, including setup for name resolution for Internet, on-premises, and cloud hosted DNS zones
- Network setup with routes defined for Internet, inter-account, and cloud to on-premises (and vice versa) routing
- Secure and operational account access integrated with Customer's existing identity provider solution
- Automated creation of predefined AWS Identity and Access Management (IAM) users and roles with required permissions

- Automated detective and preventative guardrail rules in AWS Control Tower for every new account that is created
- Automation setup of deploying Customer's defined resources in every new account for the following AWS Services: Amazon Virtual Private Cloud (Amazon VPC), Route 53, Amazon Simple Notification Service (Amazon SNS) topics, Amazon Simple Storage Service (Amazon S3) buckets, and IAM roles
- Established AWS Service Catalog for publishing products centrally

Model Development & Feasibility

A core piece of Project Heal's functionality is its capability to evaluate whether a piece of medical information is truthful or not truthful. It would be beneficial to focus on model development & feasibility prior to the creation of automated data ingestion processes.

This effort would help support:

- Ramp up efforts to increase familiarity and understanding of Amazon Machine Learning (Amazon ML) within the organization
- Lay the groundwork to implement best practices for implementation
- Research, select, and augment initial datasets that could be viable for training purposes of a model
- Building of trained Amazon ML model(s) utilizing selected data to test viability utilizing services such as
    - Amazon SageMaker
    - Amazon Neptune
- Creation of necessary endpoints for real-time inference

Building an Augmented AI Workflow

Project Heal's model should be supplemented by a human workforce for both audit review of predictions as well as workflows to label low confidence predictions. Services such as Amazon A2I can be utilized to help support the development of these workflows for improved model precision.

Customers can develop this integration after model feasibility and development phases have concluded. Additional areas customers should explore are designing the appropriate workflows to support MLOps.

Building Your Data Lake

Project Heal will process a multitude of data – whether that is automatically ingested by the system from various data sources, or provided by a trusted health community. Building a reusable framework for data collection, data storage, data catalog and data serving that increase speed to which information is curated, added, and secure access is provided will be a key step for customers implementing Project Heal.

Data Lake: Design and Architecture

- Implementing Amazon Virtual Private Cloud (Amazon VPC), account, Amazon Simple Storage Service (Amazon S3) bucket strategy and capture impact for introducing critical data for a data lake.
- Provide an environment for consumption and utilization of data coming from either batch or streaming sources

- Define detailed data architecture including raw data, conformed, structured, enriched, and aggregated
- Aligning to general best practices in building production quality data pipeline for ingestion, transformation and consumption to downstream applications through a serving layer
- Define details to data catalog and data serving layer through application program interfaces (APIs)
- Optimize Amazon S3 data storage approach
- Selection & utilization of AWS Services that support compliance requirements
- Develop governance for managing user created data and integration into catalog

Data Lake: Ingestion

- Design and build robust data ingestion solutions using monitoring, logging and alerting servicing with retry capabilities
- Aim to utilize server-less approaches where if applicable for the ingestion
- Develop mechanism supporting auto registering data in a metadata catalogue
- Align to the general best practice for managing data updates to data stored in objects on Amazon S3

Data Lake: Orchestration

- Utilize AWS services such as Amazon Kinesis, Amazon EMR, AWS Lambda, AWS Glue, AWS Step Functions, AWS Batch, AWS Data Pipeline, or other AWS native orchestration tooling
- Build out the orchestration and state management processes to ensure data is processed without data loss and exception and error handling is identified
- Build orchestration tooling that will provide operational feedback to the support organizations in the event of a failure

Data Lake: Storage and Catalog

- Develop a data landing zone including data stored in Amazon S3 unchanged from the source compared to different data derivative options including format transformations and business logic data manipulation
- Utilize appropriate services to support data storage including buckets, prefixes, encryption, file types, partitioning
- Support automated data partition strategy
- Develop Amazon S3 Bucket policies, logging and monitoring methods
- Design & implement an efficient data lifecycle strategy
- Utilize cross region replication for increase durability
- Create data definition language (DDLs) for the data catalogue
- Create a searchable data catalogue
- Align to security compliance requirements.

UI Development

Modern design principals should be taken for UI development. Project Heal should be a responsive website accessible by a variety of devices including mobile, tablet, and desktop. UI

wireframes that have been developed can be leveraged as foundational guidance for sprint planning of development.

Exploring Generative AI for Communication Generation

Tailored communication generation is a core component of Project Heal. Customers should explore services such as Amazon SageMaker to deploy foundational models or Amazon Bedrock which is a fully managed service that makes FMs from leading AI startups and Amazon available via an API. Utilizing these services, customers can experiment with the development of an initial communication generator for Project heal. The following are some targeted areas customers can explore for an initial feasibility assessment:

- Development of a prototype utilizing tuned generative AI capabilities to produce communications targeted for Twitter
- Development of a prototype which demonstrates fine tuning a foundational model to allow for generated text to be differentiated based on tuning parameters
- Development of a prototype utilizing generative AI capabilities to show how differences can be spotted between a source of truth and a piece of information that contains non-truths.

Additional Personas and Screens to Develop

Project Heal has touched upon only a primary persona to develop some of the foundational components for the system. As customers build iterations of Project Heal, various other personas and screens will need to be explored including, but not limited to:

- Administrator & administrative functionality
- Community health experts & contribution functionality
- External researchers & “view” only mode

Potential Approach to MLP

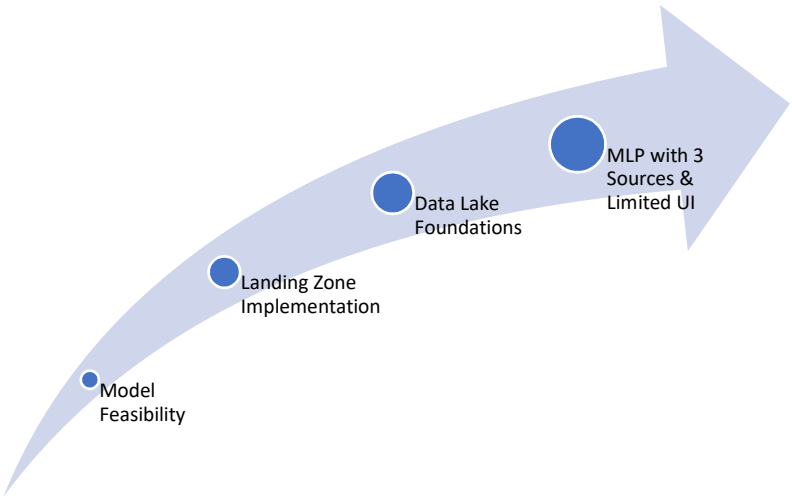

Figure 18: Possible Approach

An approach to reach a production MLP is shown above. This pathway lays the foundation of iterative expansion of features after implementation of the MLP.

After deployment of initial MLP, areas to explore & plan for include but are not limited to:

- Generative AI Communications
- Additional Data Sources
- Augmented Workforce to improve AI Model
- Development of additional persona functionality such as admin
- Community of experts design, feature planning, and integrations

Accelerating your build with the right partner

Adopting the AWS Cloud can provide you with sustainable business advantages. Supplementing your team with specialized skills and experience can help you achieve those results. The AWS Professional Services organization is a global team of experts that can help you realize your desired business outcomes when using the AWS Cloud. AWS Professional Services work together with your team and your chosen member of the AWS Partner Network (APN) to execute your enterprise cloud computing initiatives.

AWS Professional Services provides assistance through a collection of offerings which help you achieve specific outcomes related to enterprise cloud adoption. AWS Professional Services also deliver focused guidance through our global specialty practices, which cover a variety of solutions, technologies, and industries.

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